

# PHILIPPINE ENERGY PLAN 2018-2040



**Department of Energy**  
**Republic of the Philippines**

## MESSAGE OF THE SECRETARY



The **2018-2040 Philippine Energy Plan (PEP)** is the second energy plan in support of the government's **AmBisyon Natin 2040** platform. The Plan seeks to uplift the well-being of all Filipinos by securing access to reliable and affordable energy services and technologies. It also looks at enforceable policies and feasible programs to support the government's goal of achieving inclusive growth for all.

Energy and power have become an indispensable need in our modern world. Advances in technological innovations have made demand for energy more compelling. And to meet that basic need, the DOE is tasked to deliver its mandate of ensuring that energy is readily available to make lives comfortable and our businesses competitive. However, the complex energy challenges facing us today require long-term strategies, strong collaboration, and firm decision-making to achieve realistic and long-term solutions to the increasing energy demands of the country.

Thus, this PEP outlines the energy priorities that are innovative, sustainable, and clean. Through this Plan, we hope to advance initiatives on the smart use of renewable energy, natural gas and other emerging technologies, as well as the promotion and deployment of alternative fuels and technologies.

Moreover, we look forward to an energy efficient economy with the signing of Republic Act 11285 or the National Energy Efficiency and Conservation Act of 2019. This policy will make energy efficiency and conservation a national way of life for all stakeholders.

In all these undertakings, we seek to promote the sustainable production and consumption of energy resources to achieve the country's overall economic development goals, reduce poverty, strengthen competitiveness and reduce environmental costs.

**But above everything else, this Plan seeks to enhance our stakeholders' greater understanding of the DOE's key policies, programs, and developments with the goal of engaging them in building a stronger energy system for the country.**

With these initiatives in place, a brighter energy future awaits us all!

  
**ALFONSO G. CUSI**  
Secretary  
Department of Energy

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# OVERVIEW AND EXECUTIVE SUMMARY

Secretary Alfonso G. Cusi, during the turnover ceremony as the new Chief of the Department of Energy (DOE) in July 2016, highlighted the Department’s mission of improving the lives of Filipinos. To achieve this call, the DOE Secretary directed the energy sector to concentrate on specific areas that promote a **“consumer first” perspective, provide a level playing field for all stakeholders, and bring about change**, which should start at the very core of government service.

President Rodrigo R. Duterte signed Executive Order (EO) 5 in October 2016 adopting a 25-year long-term vision known as the **AmBisyon Natin 2040**, which sees the Philippines as a “prosperous, predominantly middle-class society by 2040.” The EO required all plans of the government agencies, offices and instrumentalities, including government-owned or -controlled corporations (GOCC) and LGUs shall be consistent with the said vision.

The government’s long-term vision packaged under the **AmBisyon Natin 2040** expects that by 2040, Filipinos will have a strongly rooted, comfortable and secure life. To realize this vision, the DOE responded with the formulation of the **Philippine Energy Plan (PEP) 2018-2040** that embodies a clear set of objectives, namely:

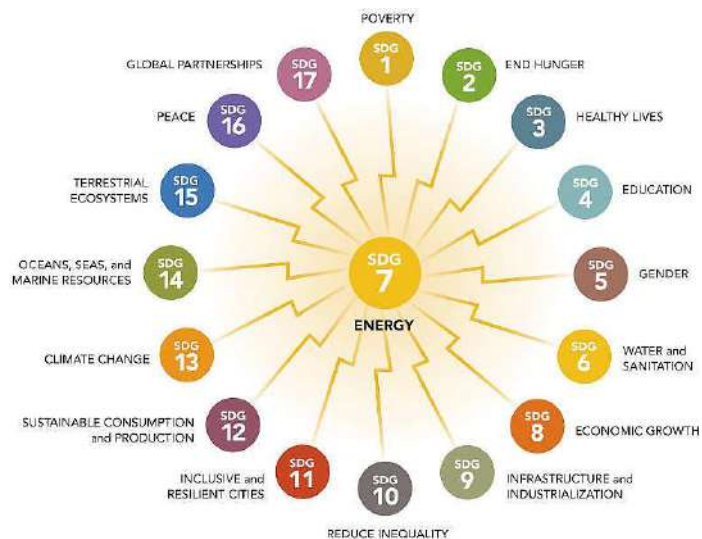
- a) Increase the production of clean and indigenous sources of energy to meet the growing economic development of the country;
- b) Decrease the wasteful utilization of energy through the use of energy efficiency tools and strategies; and
- c) Ensure the balance between the provision of reliable and reasonably priced energy services, support for economic growth, and protection of the environment.

And just like **AmBisyon Natin 2040**, the PEP lays down the foundation to ensure that Filipinos gain from the deliverables set forth in the energy roadmaps by 2040, specifically covering the following areas:

- I. Ensuring Energy Services 24/7;
- II. Creating Wealth for Filipinos;
- III. Consumer Empowerment; and,
- IV. Philippine Agenda with the International Community.

The PEP likewise embodies the policies and laws that support the United Nations Sustainable Development Goal (SDG) of affordable and clean energy, such as the Renewable Energy Act, Energy Efficiency Act, and the policy on Resiliency of Energy System and Infrastructure. These are integrated in the energy demand and supply scenarios of the PEP as briefly explained in the succeeding discussions below on energy outlook and presented in *Chapter II* of this plan.

The SDG 7 on energy intends to correct the imbalances through access to affordable, reliable, and modern energy services by 2030. Energy is at the core of the SDGs being the “Golden Thread” that connects and supports the others goals like addressing poverty and ending hunger, economic growth, infrastructure and industrialization, reduce inequality, inclusive and resilient cities, and climate change. Energy is critical as there is no development without fueling the engine of growth, which is access to sustainable energy.



## I. ENSURING ENERGY SERVICES 24/7

### A. 2018 ENERGY SITUATIONER

#### 1. LONG-TERM ENERGY STRATEGIC DIRECTION

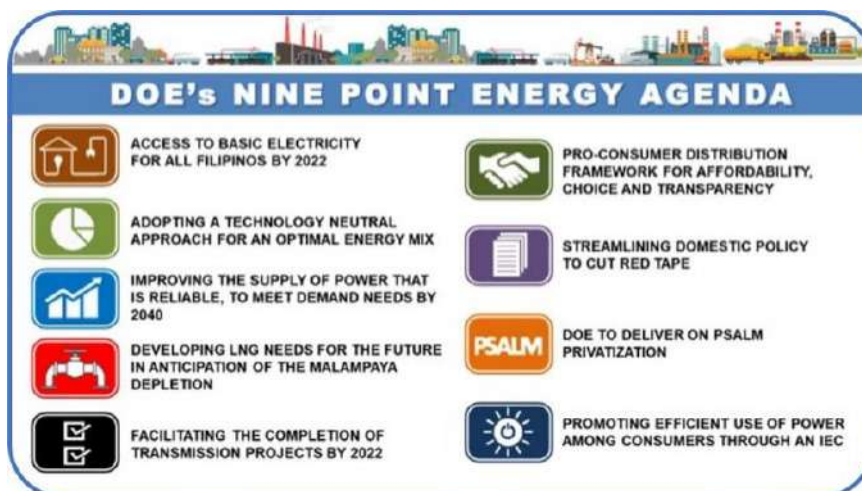
In support of the **AmBisyon Natin 2040** and in pursuit of responsive delivery of public service, the DOE has been guided by the eight (8) **Energy Sector Strategic Directions**, which are envisioned to be implemented progressively during the planning period. These strategies encompass the government’s call towards inclusive growth, high trust society and a globally competitive knowledge economy.



In the medium-term, the DOE focuses on the **Nine-Point Energy Agenda** with priorities on **consumer-first policies, reliability of energy supply and affordability**. And central to the energy agenda are:

<sup>1</sup> As mentioned by Former Secretary-General of United Nations, Ban Ki-moon.

- **Access to Basic Electricity for All Filipinos by 2022.** Achieve a 100.0 percent electrification level by 2022 based on 2015 Census, especially in Mindanao and off-grid areas, by improving electricity supplies and upgrading the transmission and distribution network.



- **Adopting a Technology Neutral Approach for an Optimal Energy Mix.** A priority toward a reliable, sustainable and affordable energy mix to meet the domestic energy requirements.
- **Improving the Supply of Power that is Reliable to Meet Demand Needs by 2040.** Ensure that committed power generation projects are operational as needed to include the adoption of a 25.0 percent reserve capacity requirement for system reliability.
- **Developing Liquefied Natural Gas (LNG) needs for the future in anticipation of the Malampaya Field's depletion.** Accelerate the implementation of LNG projects for natural gas supply security once the Malampaya gas resource is exhausted in 2024.
- **Facilitating the Completion of Transmission Projects by 2022.** Fast-track the completion of the Mindanao-Visayas Interconnection Project by 2021 and other potential small island interconnections, such as Mindoro-Batangas, Semirara-Occidental Mindoro, and Sulu-Basilan (*please see Annex 28*).
- **Pro-Consumer Distribution Framework for Affordability, Choice and Transparency.** Policy implementation of the Retail Competition and Open Access (RCOA) and the Green Energy Option (GEOP) provides the consumers with power to choose their energy sources.
- **Streamlining Domestic Policy to Cut Red Tape.** The promulgation of the *Energy Virtual One Stop Shop (EVOSS) under Republic Act (RA) 11234 or EVOSS Act of 2019* and the *EO 30* signed by President Duterte in June 2017 streamlined the process and harmonized the regulatory frameworks of the government agencies (including local government units/LGUs) in the issuance of permits/licenses for energy projects. These policies support the *Ease of Doing Business and the Efficient Government Service Delivery Act of 2018 (RA 11032)*, which aims to simplify current systems and procedures of government services. The recently issued Administrative Order (AO) 23 on 27 February 2020 by the President intends to eradicate overregulation and improve the government system in delivering services to the people.

From these platforms, development and completion of energy projects will then be speed up and integrated in the energy systems as scheduled, thus providing continuous, stable and reliable energy supply.

- **Deliver on PSALM privatization.** In compliance with the Electric Power Industry Act (EPIRA), the privatization of the remaining PSALM assets will have to be accelerated to meet its mandated goals prior to the end of its corporate life in 2026.
- **Promoting Efficient Use of Power among Consumers through an Information, Education and Communication (IEC) campaign.** Continue to promote efficient use of electricity among consumers through the implementation of the Energy Efficiency and Conservation Act (EE&C) or RA 11285 signed on 12 April 2019. The Act establishes a framework for introducing and institutionalizing fundamental policies on energy efficiency and conservation, promotion of efficient and judicious utilization of energy, and increased use of energy-efficiency technologies that will result in reduced dependence on imported fuel.

A sectoral roadmap has been crafted for each energy subsector containing long-term objectives, deliverables and targets consistent with the Strategic Directions and the Nine-Point Agenda as mentioned above. The following are some of the deliverables and targets over the planning period:

- **Ensure Quality, Reliable, Affordable and Secure Supply, Expanding Electricity Access, and Ensuring a Transparent and Fair Playing Field in the Power Industry.** Focusing on full restructuring and reforms in the power sector, the roadmaps (power industry subsectors) highlight the sector's priorities for more efficient delivery of electricity services from generation, transmission and distribution networks, down to the end-users, and ensuring that all have equitable access to electricity.
- **Improve Policies in the Downstream Oil Industry for Continuous Supply of High Quality and Right Quantity of Petroleum Products.** The continuous development and updating of fuel quality standards and code of safety practices, as well as amending or revising the governing policies to address the industry challenges form part of the sector's roadmap. The DOE's advocacy in the sector is the establishment of a strategic oil stockpiling program to minimize the impact on the economy of rising oil prices in the world market.
- **Establish a World-Class, Investment Driven and Efficient Natural Gas Industry.** An urgent deliverable of the sector's roadmap is the formulation of policies and legislative framework to support the development of the downstream natural gas industry and expand its market reach. The DOE envisions the Philippines to be a liquefied natural gas (LNG) trading and trans-shipment hub in the Asia-Pacific Region.
- **Secure and Stable Energy Supply through a Technology- Responsive Energy Sector.** The Alternative Fuels and Energy Technology (AFET) roadmap targets the identification of AFET for implementation, as well as the preparation of regulatory and infrastructure requirements for mainstreaming in the transportation sector. Priority technologies for promotion are electric vehicles (EVs), hybrid electric vehicles (HEVs), liquefied petroleum gas vehicles (Auto LPG), and compressed natural gas (CNG) vehicles.
- **Pursue Significant Initiatives after the passage of the EE&C Act.** After enactment into law, priority initiatives of the roadmap focus on the integration and mainstreaming of EE&C at the LGU level as a continuing program. The LGUs will have to develop and implement the Local Energy Efficiency and Conservation Plan (LEECP) to be incorporated in the local development plan. Likewise, EE&C will be included in the learning and education system. With the strategies identified in the roadmap, the overall objective is to reduce energy intensity of the country.

## 2. ENERGY DEVELOPMENT OVER THE YEARS

The Philippines is only blessed with modest amount of indigenous energy resources, specifically fossil fuels, thus importing fuel has been an option to augment energy supply for domestic requirement. If the rate of economic development is faster than the development of indigenous energy, heavy reliance on imported energy persists. However, there are energy resources that remain untapped, and harnessing these improves the energy sufficiency level of the country.

Previous administrations attempted to achieve the ideal scenario of having enough indigenous fuels for domestic consumption. During President Ferdinand Marcos regime, where the major focus was infrastructure development, the energy agenda enticed the administration to set its priorities on indigenous energy development. It was in this era that geothermal energy started to be developed, upstream coal exploration was banned, and energy diversification, through the non-conventional resources, was introduced.

The Bataan Nuclear Power Plant (BNPP) was constructed during Marcos period. Initial discussions on nuclear energy development were tabled at the time of President Ramon Magsaysay, but later facilitated and expedited by President Marcos. However, President Corazon Aquino, decided to mothball the BNPP<sup>2</sup> due to alleged safety and social issues.

Succeeding administrations in the recent decades recognized self-sufficiency and energy independence as major elements of energy security. Such led to a paradigm shift from being heavily dependent on the use of conventional energy to greater integration of renewable resources and alternative fuels. To complement the competitive use of different fuels and subsequently reduce wasteful energy consumption, the EE&C Act was finally enacted under President Duterte after being shelved for more than a decade before the legislative and executive bodies finally recognized its importance.

## 3. TOTAL FINAL ENERGY CONSUMPTION

The country's Total Final Energy Consumption (TFEC) in 2018 increased by 1.3 percent from previous year's level of 33.9 million tons of oil equivalent (MTOE) to 34.3 MTOE. The transport, household and service sectors registered an increase in their energy uses, while the industry and agriculture sectors recorded a decline during the same period.

### By Sector

The transport sector remained the most energy-intensive sector, accounting for more than a third (35.7 percent) of the TFEC. Its aggregate energy demand reached 12.2 MTOE, 3.5 percent higher than its 2017 level due to increased utilization of gasoline and diesel for road transport, as well as aviation turbo for domestic air transport.

Household energy consumption was 27.5 percent of the demand mix, as it posted an increase of 2.6 percent in 2018, reaching 9.4 MTOE during the period. The industry's energy consumption dropped by 5.1 percent, from 7.9 MTOE in 2017 to 7.5 MTOE in 2018, translated to a 21.9 percent share of the TFEC. The decreased was attributed to the slowdown in production output from the

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<sup>2</sup> To date, the BNPP has not been operated.

industrial sector, particularly in energy-intensive manufacturing subsectors, such as non-metallic (including cement) minerals, chemical products and basic metal industries.

The service sector's energy consumption rose by 6.0 percent or 4.7 MTOE from the 2017 level of 4.4 MTOE, equivalent to a 13.6 percent share of the TFEC. This was largely driven by the resilient performance of the services sector, particularly hotels and restaurants. The production cuts in the agriculture sector caused its energy use to fall by as much as 14.8 percent in 2018, recorded at 439.6 thousand tons of oil equivalent (kTOE), about 1.0 percent of the TFEC.

### **By Fuel**

Oil products accounted for almost half of the TFEC, with consumption increased by 3.4 percent from last year's level to 16.9 MTOE in 2018. Notwithstanding the fluctuations in domestic pump prices during most parts of 2018, coupled with the implementation of the excise tax provision under the Tax Reform for Acceleration and Inclusion (TRAIN) Act, consumption of gasoline and diesel used primarily for road transport went up by 3.0 percent and 3.5 percent, respectively. The combined share of these fuels was nearly 80.0 percent of the total petroleum consumption.

The consumption of biomass<sup>3</sup> for end-use applications contributed a 21.3 percent to the TFEC 2018, albeit a measly 0.5 percent growth during the period. Of the 7.3 MTOE of biomass consumed in 2018, households accounted for the bulk at 78.8 percent, while the remaining share was utilized by the service and manufacturing sectors, particularly for sugar and food processing.

Electricity was 20.7 percent of the TFEC with its consumption up by 6.2 percent, reaching 7.1 MTOE in 2018 from its year-ago level of 6.7 MTOE. Both the industrial and household sectors registered close to one-third share of the total electricity consumption, while 29.1 percent was used by the commercial sector.

Coal consumption for end-use applications registered a decline of 19.8 percent from the 2017 level of 3.0 MTOE to 2.4 MTOE in 2018 due to merging of two (2) local cement producers and the surged in imported cement that contributed to the reduction in local cement production during the year. Meanwhile, despite meager share of 0.2 percent of the TFEC, natural gas for end-use applications rose by 13.1 percent in 2018 caused by high off-take of the Pilipinas Shell Petroleum Corporation (PSPC).

Biofuels utilization of coco methyl ester (CME) and ethanol went up by 2.9 percent with combined levels reaching 524.0 kTOE in 2018 as a result of compliance to biofuel blend rate as mandated under the Biofuels Law of 2006 or RA 9367.

## **4. POWER GENERATION**

Power generation output posted an increase of 5.7 percent from the 2017 level to 99.8 terawatt-hour (TWh) in 2018. Coal provided about half of the country's power generation requirement, while natural gas contributed 21.4 percent and geothermal with 10.5 percent share of the total power generation. The combined renewable share of total power generation was down to 23.4 percent in 2018 from 25.4 percent a year ago.

Total fuel inputs for power generation went up to 29.7 MTOE in 2018, a 5.5 percent increase from previous year's level. Fossil fuels accounted for 60.0 percent as coal increased its share of the total power generation to cover for the reduced hydropower output. Consequently, the

<sup>3</sup> Includes charcoal, fuelwood, rice hull, bagasse, agriculture and animal waste

combined input of renewable energy to power generation only grew by 0.6 percent. The increase in natural gas generation required 3.3 MTOE of fuel input, while oil with a decrease of 16.2 percent in its power generation, resulted in a 24.6 percent reduction in fuel input.

## **5. TOTAL PRIMARY ENERGY SUPPLY**

The country's total primary energy supply (TPES) reached 59.7 MTOE in 2018, a growth of 2.9 percent from its 2017 level of 58.0 MTOE. The self-sufficiency level, expressed as the ratio of total indigenous energy to total primary supply, was registered at 50.2 percent in 2018, lower by 0.7 percentage points from 50.9 percent in 2017. Net energy imports posted a 4.6 percent hike from 28.4 MTOE in 2017 to 29.7 MTOE in 2018 due to sluggish growth in aggregate indigenous energy production of 1.4 percent growth from contraction in oil, coal and hydro production.

Oil has been the major source of energy supply, which accounted for about a third (33.5 percent) of the TPES, followed by coal with 27.4 percent and geothermal with 15.0 percent share of the TPES. Natural gas supply exhibited the fastest growth at 11.6 percent, while coal supply rose by 5.7 percent from increased importation.

The aggregate supply of renewable energy went up by 0.6 percent to 19.7 MTOE, 34.1 percent of the TPES, with notable contributions from wind and solar, biofuels and geothermal.

## **6. GREENHOUSE GAS EMISSION**

Total greenhouse gas (GHG) emissions from energy-related activities increased by 4.1 percent, or 123.3 million tons of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>e) in 2018 from 118.5 MtCO<sub>2</sub>e the previous year. All sectors contributed to the rise in GHG, specifically from power generation and transport. The power generation contributed more than half (51.7 percent) of the total GHG emissions in 2018, while the transport sector 27.9 percent. The considerable growth in GHG emissions is mainly due to utilization of coal for power generation and oil in the transport sector.

## **7. ENERGY, ECONOMY AND ENVIRONMENT INDICATORS**

Economy-wide energy intensity declined by 3.4 percent, which registered at 6.4 tons of oil equivalent per million pesos of real GDP (TOE/MPhP) in 2018, from improvement of energy efficiency efforts across all economic sectors.

The energy-to-GDP elasticity was reported at 0.4, while oil supply to GDP elasticity recorded at 0.1 in 2018. These values indicate that the overall volume of energy, as well as that of oil, utilized as fuel remained steady despite increased economic output. Meanwhile, electricity had higher elasticity at 0.9, indicating more electricity was utilized with respect to economic output.

Energy per capita level went up by 1.0 percent to 0.56 TOE/person in 2018, from last year's 0.55 TOE/person. Electricity per capita posted a 4.1 percent growth from the previous year's level to reach 936 kWh/person, while oil per capita stood at 1.46 barrel/person. Improved energy and electricity per capita levels in 2018 reflected increased access to energy services from extensive efforts of the government and stakeholders in the energy sector.

Total GHG emissions for every PhP 100,000 of the economic output (measured in terms of real GDP) stood at 1.34 tons of CO<sub>2</sub> equivalent (tCO<sub>2</sub>e), 2.0 percent lower than the previous year's level of 1.37 tCO<sub>2</sub>e.



## 8. LEAST COST TO CONSUMERS

### *Assessment of basic energy services*

Gasoline, diesel and electricity were the most utilized fuels in 2018, representing shares of 13.2 percent, 26.0 percent and 19.9 percent, respectively, of the TFEC. In June 2018, domestic pump prices of gasoline and diesel went up by as much as PhP 11.92/liter and PhP 14.91/liter, respectively, due to the imposition of first tranche of additional excise taxes mandated under the TRAIN Law. Similarly, electricity prices registered average increments of PhP0.92/kWh for residential, PhP 0.89/kWh for commercial and PhP1.03/kWh for industrial customers. Despite price hikes, consumption levels of these fuels also increased in 2018 from its year-ago levels reflecting the price inelasticity attribute of basic energy services.

On the average, the cost components of the pump prices of gasoline and diesel show that fuel costs (imports and biofuel costs) account for the bulk share at around 50-60 percent of the prevailing domestic pump prices. For electricity prices, generation charge gets the biggest chunk from 50.0 to more than 60.0 percent of each customer type classification rate.

### *Policy towards Unbundling*

Electricity rates are already unbundled as mandated under Section 36 of the EPIRA. It paved the way for transparency in the cost components for each customer classification, thus allowing consumers the freedom to make informed decisions towards the least-cost consumption of electricity.

Despite the oil industry being deregulated (much similar to the current structure of the power industry), pump prices have remained unbundled. The DOE sees the need to unbundle pump prices for greater transparency and avoid anti-competitive behavior among the players.

### *Job Creation in the Power Sector*

The power sector provided the economy with a total of 5,050 additional jobs in 2018, out of which, 910 jobs were for operations and maintenance of power plants and 4,139 jobs during construction period. Coal-fired power plants were the most labor-intensive, followed by geothermal and hydropower.

## **B. ENERGY SUPPLY AND DEMAND OUTLOOK 2018-2040**

The Energy Outlook presents two scenarios – the Reference Scenario (REF) or the Business-as-Usual (BAU) and the Clean Energy Scenario (CES) as an alternative. The Outlook likewise incorporates the Asia-Pacific Economic Cooperation’s (APEC) aspirational target to reduce aggregate energy intensity by 25.0 percent in 2030 to 45.0 percent in 2035 (2005 as the base year period), and the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 target reduction in energy intensity of 20.0 percent in 2020 and 30.0 percent by 2025 with a revised target of 32.0-35.0 percent under the APAEC Phase II 2021-2025. *For the assumptions used in the scenarios, please refer to Chapter II of the PEP.*

## 1. REFERENCE SCENARIO (REF) VS. CLEAN ENERGY SCENARIO (CES)

### *Total Final Energy Consumption*

The CES results in a slower growth of the TFEC at 4.4 percent a year requiring 87.7 MTOE in 2040, which is 9.3 percent lower than the REF. The transport sector contributes the largest share in energy demand reduction with 63.7 percent of the 9.0 MTOE decrease in the CES.

The decline in the transport energy demand significantly pushes down the oil consumption, which reaches 43.9 MTOE in the CES by 2040 vis-à-vis 51.5 MTOE under the REF. The factors attributed to such is the fuel diversification, improvement of vehicle efficiency standards in the transport sector, as well as the expected energy savings from the consumption of petroleum products under the CES. This also leads to a drop in oil share to 50.0 percent under the CES from 53.2 percent in the REF.

As electricity displaces some amount of oil consumption in the transport sector under the CES, its share expands to 32.3 percent of the TFEC from 30.5 percent in the REF. However, the aggregate level is 4.0 percent lower than in the REF due to electricity savings from other end-use sectors. The increasing penetration of EVs and the transport modal shift through full operation of the expanded and modernized railway systems contribute to the drop in oil consumption in the CES.

### *Power Sector*

#### **Total Electricity Consumption**

Under the REF, total electricity consumption increases by four-fold from 2018 level of 82,602 gigawatt-hour (GWh) to 343,516 GWh in 2040 under the REF. The target electricity savings in the CES reduces consumption by 4.0 percent equivalent to 329,786 GWh.

With higher EV penetration and the expanded mass and light railway system, electricity consumption of the transport sector increases by two times the level in the REF. The transport sector share of the total electricity consumption improves from 0.1 percent in 2018 to about 9.0 percent in 2040. Bulk of electricity demand comes from the industry and residential sectors over the planning period.

#### **Peak Demand and Capacity Requirements**

Under the CES, the projected peak demand stands at 57,303 megawatts (MW), a 4.5 percent lower than the REF with 60,034 MW. To meet the peak demand, the CES requires more total installed power generating capacity of 93,482 MW, or an additional dependable capacity of 75,325 MW by 2040 to satisfy a lower peak demand, as compared with 90,584 MW installed capacity to provide a dependable capacity of 71,817 MW under the REF. The high requirement for additional capacity in the CES is attributed to having more renewables in the system, specifically solar and wind that are considered variable capacity. Aside from renewables, the CES takes up additional capacities from natural gas and other low carbon and highly efficient technologies.

The Luzon grid's peak demand rises to 39,987 MW by 2040, four (4) times higher than the 2018 level. The demand growth necessitates a total additional capacity of 45,740 MW by end of the planning period comprising 15,220 MW of baseload capacity, 8,400 MW of intermediate capacity, 18,500 of variable capacity, 3,200 MW of flexible capacity, and 420 MW of peaking capacity.

The Visayas grid's peak demand increases by more than four-fold from its 2018 level, which stands at 9,774 MW in 2040. This requires 8,564 MW of additional capacity – 5,000 MW of baseload capacity, 700 MW of intermediate capacity, 1,324 MW of variable capacity, 1,340 MW of flexible capacity, and 200 MW of peaking capacity.

In Mindanao grid, its peak demand expands by about five (5) times, reaching 10,273 MW in 2040. A total 13,041 MW is needed by the end of 2040 to meet the demand growth, broken down as 6,553 MW of baseload capacity, 200 MW of intermediate capacity, 5,148 MW of variable capacity, 1,100 MW of flexible capacity, and 40 MW of peaking capacity.

### **Gross Power Generation and Fuel Inputs**

Total gross generation increases by 6.5 percent a year, from 99.8 TWh in 2018 to 394.5 TWh in 2040 in the REF. Coal contributes more than half of the total power generation requirement, while renewables provide an aggregate average share of 27.5 percent and natural gas with 13.7 percent. Total fuel input requirement for power generation rises by 5.3 percent over the planning period, which stands at 93.5 MTOE in 2040 from 29.7 MTOE in 2018. Fossil fuel accounts for nearly three-fourth of the fuel input mix by end of the planning period due to increased share of coal.

In the CES, generation output registers a slower growth rate at 6.3 percent annually reaching 378.8 TWh in 2040. In this scenario, generation changes significantly as the share of coal drops to 33.4 percent with greater contributions from renewables, natural gas and other clean energy technologies. Gross generation from clean energy sources expands by almost six-fold, from 44.7 TWh in 2017 to 251.2 TWh in 2040. Aggregate share of clean energy improves to 66.3 percent of the total generation by 2040.

With the entry of more efficient coal technologies in the CES, its share of the fuel input mix decelerates to 38.8 percent as compared with 61.9 percent under the REF.

### **Total Primary Energy Supply**

The TPES under the REF escalates at an average rate of 4.6 percent a year reaching 160.7 MTOE in 2040 from 59.7 MTOE in 2018. Coal and oil remain as the dominate fuel in the supply mix with more than a quarter share of the TPES for each fuel. Aggregate contribution from renewables stands at 27.2 percent, while natural gas accounts for remaining 4.4 percent average share over the planning period.

In the CES, the TPES only grows at 4.1 percent a year equivalent to 145.7 MTOE, which is 9.3 percent lower than the REF. Combined share of coal and oil reduce by 4.4 percentage points (64.1 percent in the CES and 68.5 percent in the REF), on average. The decrease is due to expanding use of alternatives in transport, greater use of renewables and highly efficient technologies.

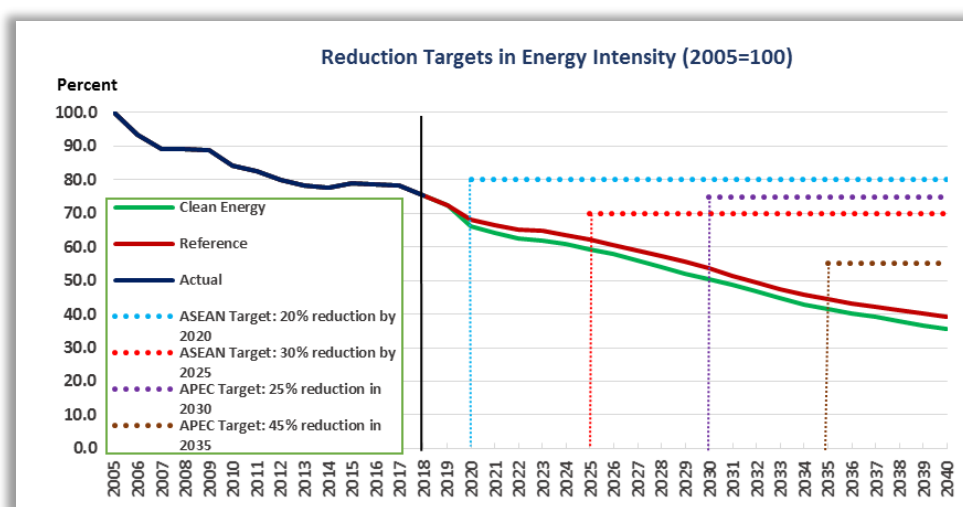
Renewables aggregate supply rises to 44.3 MTOE, and diffusion of other technologies in the CES contributes 1.6 MTOE to the TPES by 2040. The country's energy self-sufficiency level in the CES improves to 64.1 percent in 2040 as compared with 58.0 percent under the REF.

## Scenario Implications

### Energy Intensity Reduction

Energy intensity level declines by 48.1 percent in the REF, translated to 3.3 TOE/MPhP in 2040 from 6.4 TOE/MPhP in 2018. Larger reduction in energy intensity is achieved in the CES with 53.0 percent drop from 2018 level (3.0 TOE/MPhP). In terms of APEC and ASEAN targets on energy intensity reduction, both scenarios satisfy such with the following reduction levels based on 2005:

- 2020 - 32.0 percent (REF) and 34.0 percent (CES)
- 2025 - 38.0 percent (REF) and 41.0 percent (CES)
- 2030 - 46.0 percent (REF) and 50.0 percent (CES)
- 2035 - 56.0 percent (REF) and 58.0 percent (CES)
- 2040 - 61.0 percent (REF) and 64.0 percent (CES)



### Renewable Energy Share

The target increase in renewable capacity of at least 20,000 MW based on 2010 level in the REF expands the share of RE to almost 50.0 percent of the total capacity mix in 2040. However, this falls short to the aspirational target of 35.0 percent share under the Renewable Portfolio Standards (RPS) for on-grid. In the REF, the aggregate share of renewables only reaches 33.0 percent of the total generation mix in 2040.

The said target is achieved in the CES with 37.3 percent contribution to the power generation mix with corresponding 54.0 percent share of the capacity mix.

### Investment

The required build cost for the additional generating capacity under the REF amounts to USD 104.7 billion of investment. With more capacity requirements in the CES, investment jumps to USD 124.0 billion, up by 18.4 percent from the REF or an average of around USD 6.2 billion investment per year. More than 60.0 percent of the CES investment is allocated for the 44,761 MW of new renewable capacity from 2020-2040.

System Cost is not estimated as part of the investment, which covers the costs on reliability and transmission line reinforcement, among others. This cost shall be included in the next PEP update together with the cost estimates on other mitigation actions and adaptation strategies to come up with the total investment cost for the energy sector's Nationally Determined Contribution (NDC)

### **Greenhouse Gas Emission**

Total GHG emission from fossil fuels (oil, coal and natural gas) increases at 6.0 percent per year under the REF, from 123.3 MtCO<sub>2e</sub> in 2018 to 444.5 MtCO<sub>2e</sub> in 2040. Coal accounts for half (56.9 percent) of the total GHG emission, while oil provides a share of 39.1 percent, and natural gas with a 4.0 percent. Under the CES, GHG emission falls by 26.0 percent from the REF level, registering 329.1 MtCO<sub>2e</sub> in 2040. This results from cleaner and more efficient fuels for transport, increased share of renewables, along with highly-efficient coal and natural gas technologies.

## **II. CREATING WEALTH FOR THE FILIPINO**

In compliance with the **AmBisyon Natin 2040**, the PEP 2018-2040 has been formulated to support the government's goal of promoting inclusive growth, one in which the benefits of economic expansion trickles down to more Filipinos, especially those in the marginalized sector. And what better way is there to promote inclusive growth than through the generation of investments and employment opportunities for all.

The energy sector plays an important role not only in providing uninterrupted 24/7 energy supply, but in creating a conducive environment for long-term investments and quality jobs for Filipinos. As the Philippine economy reels from the crippling effect of the health pandemic, the DOE is forward planning by synergizing economic recovery plans with sustainable energy goals.

With the diversity of the country's energy mix, the DOE works towards a much stronger environment for business investments and employment generation in terms of new, clean and efficient energy technologies, as well as from conventional energy sources. Realizing said aspiration is made possible through an innovative partnership between the government and the private sectors.

Summarized below are the major contributions of various energy sectors to help the country realize *AmBisyon Natin 2040* through valuable investments and employment opportunities.

### **A. CLEAN ENERGY FUELS AND TECHNOLOGIES**

#### **1. RENEWABLE ENERGY**

The signs of climate change remain and continue to be alarming. Thus, the DOE emphasizes its commitment to further accelerate RE positioning in the energy mix. As the country's transition toward clean energy fuels and technologies, the sector is packed with opportunities to create "green energy investments and jobs." As of end-2018, a total of 277 Renewable Energy Service Contracts (RESCs) were awarded with potential capacity of more than 15,109 MW. This requires an estimated investment of about PhP 2,062 billion, potentially creating about 10,616 green jobs during the planning horizon. Major contributors to the investments are from hydropower (PhP 2,040 billion), geothermal (PhP 16.7 billion), and solar (PhP 5.2 billion). The geothermal energy sector generates the most employment opportunities at 7,000 jobs for its pre-development stage.

The **Competitive Renewable Energy Zones (CREZ)** is another investment-generating program that intends to upgrade and expand transmission facilities for the optimal use of the indigenous renewable resources of the country. The research study conducted by the DOE and the United States–National Renewable Energy Laboratory (NREL), with funding support from the United States Agency for International Development (USAID), shows that there are identified **25 candidate RE zones (REZ)** estimated to have gross capacity of 807 GW of RE technologies.

## 2. ENERGY EFFICIENCY AND CONSERVATION

With the EE&C Roadmap pointing to its target of annual reduction in energy intensity and consumption, priority initiatives and strategies were identified for the planning horizon. These programs include appropriate mechanisms on energy efficiency and resilience of the power distribution systems and facilities, implementation of the Philippine Energy Labeling Program (PELP), mainstreaming of EE&C at the LGU level, and Demand Side Management, among others. Further, the enactment of the EE&C Act, together with the approval of its Implementing Rules and Regulations (IRR), provides the appropriate catalyst to make EE&C a *Way of Life* in the Philippines

In addition to reducing energy use, EE&C measures can generate investments and create jobs that will foster economic growth. It may either come from the design, installation and maintenance of efficient energy technologies (e.g. such as the hiring of Energy Service Companies or ESCOs), from the manufacture and distribution of energy efficient products, as well as from the training and certification of energy conservation officers and managers. Currently, the country now has 23 active ESCOs, which provide energy efficiency upgrades for various facilities/infrastructures.

In particular, the implementation of the EE&C Act requires the hiring of Certified Energy Conservation Officers (CECO) for Type 1 Designated Establishments, Certified Energy Managers (CEM) for Type 2 Designated Establishments and Energy Auditors. Both the CECO and CEM may either be chosen from within the organization or through external recruitment. The certification system of the CECO and CEM, to be implemented by the DOE-accredited institutions necessitates the services of technical training specialists to conduct the training modules.

With all policies and strategies now in place on EE&C, it may not take long for it to be considered as an energy resource that is equally important as other existing supply resources.

## 3. ALTERNATIVE FUELS AND TECHNOLOGIES

The AFETs play a critical role in the country’s quest for a low emission target especially for the transport sector. In fact, the use of AFETs is a critical strategy identified in the country’s NDC to the Paris Agreement.

As opportunities flourish in this sector, the Alternative Fuels and Technologies Roadmap was crafted to ensure a secured and stable supply of energy through a technology-responsive energy sector. The said roadmap prioritizes the use of EVs, HEVs, auto-LPG vehicles and CNG-fed vehicles. Other initiatives involve the development of solar-powered motorized boats, government vehicle re-fleeting using “Next Generation Vehicles,” prototyping of Original Engine Manufacture for Auto-LPG jeepneys and the mainstreaming of Alternative Fuels Vehicle in the transport sector.

With its broad portfolio for potential innovations in the transport sector, the AFETs sector can generate investments and employment opportunities to boost the growth of the Philippine economy. It is also the sector with the biggest opportunity for research and development.

The DOE's Market Transformation through Introduction of Energy Efficient Electric Vehicles (E-Trike) Project was able to gain the support of 14 investors engaged in the business of electric vehicle manufacturing, assemblers and importers with a corresponding investment of PhP562 Million (USD 11.3 Million @ forex rate of US=PhP49.55) and generating about 1,050 direct jobs from EV companies to support the creation of an electric vehicle industry in the country.

Policies providing incentives to interested investors in the AFET sector are now in place to include the following:

- **EO 226 or the “Omnibus Investments Code of 1987”** offers Income Tax Holiday of six years to a maximum of eight years for new registered pioneering firms that will engage in the business of EVs, Alternative Fuels Vehicles, charging stations and environment/climate change-related projects as well as Duty Free importation of capital equipment, spare parts and supplies;
- **EO 488 (s. 2006)** modifies the rates of import duty on components, parts and accessories for the assembly of hybrid, electric, flexible fuel and CNG motor vehicles to zero rate, thereby allowing electric vehicle manufacturers to import components at a more affordable price; and,
- **TRAIN Act** provides tax incentives for pure EVs and hybrid vehicles

## B. CONVENTIONAL ENERGY

### 1. OIL AND GAS

The DOE is steering its efforts towards the development of an optimal energy mix to meet its agenda on energy security. Specifically, the optimal energy mix requires the use of all available energy resources to meet the country's energy requirements.

The Upstream Oil and Gas Roadmap is bent on increasing local petroleum reserves to 57.1 MMB of oil and 5.87 TCF of gas, as well as production of 114.4 MMB of oil and 4.0 TCF of gas by 2040. The Malampaya Deep Water Gas-to- Power Project is still the biggest source of natural gas in the country. It was developed and currently operated by Shell Philippines Exploration B.V. (SPEX) with joint venture partners, Chevron Malampaya LLC and the Philippine National Oil Company-Exploration Corporation (PNOC-EC). It is also one of the largest and significant endeavors in the Philippine energy sector. For the period January 2002 to June 2018, royalties collected from the project reached PhP 263 billion.

The DOE continues to offer oil and gas prospects through the *Philippine Conventional Energy Contracting Program (PCECP)*. This program has two modes of awarding Service Contracts – through the nomination process and application in pre-determined areas (PDA). As a result, the country may look forward to USD48.6 million once the two service contracts (SCs) recommended for approval under PCECP are signed by the President. Likewise, potential investment of USD 43.7 million may come from the approval of applications received under Nominated Areas 1 and 5, and PDAs 6 and 7.

### 2. COAL

Coal remains as a reliable and affordable source of energy, producing electricity that can power up manufacturing and industrial plants and even residential homes.

The Upstream Coal Roadmap expects that by 2040, local coal reserves reaches 766 MMT, while local coal production is estimated at 282 MMT. The projected coal production alone entails about PhP 609.3 billion. To achieve these targets and attract investor interest, the DOE continues to conduct Information, Education and Communication (IEC) campaigns and promotional activities

Currently, there are two coal projects certified as Energy Projects of National Significance (EPNS) (per EO 30) which can potentially generate investments of about PhP 143 million.

The PNOC-EC, the energy exploration arm of the government, operates Coal Operating Contract (COC) 41 located in Zamboanga Sibugay, which may generate PhP 4.0 billion worth of investments, as well as create 1,000 opportunities for employment.

### **C. DOWNSTREAM OIL INDUSTRY**

Investment opportunities in the downstream oil industry come from business prospects on fuel bulk and retail marketing, LPG refilling and marketing, petroleum transport, terminalling and bunkering. In 2018, there are 325 industry participants with total accumulated investments of PhP180.8 Billion (since 1998).

In 2019, various industry players invested an additional of PhP 8,374.1 million estimated to have employed 753 people. Moreover, the first half of 2020 brought in PhP 1,673 million of investments and providing jobs to about 224 people. These were achieved through activities, such as the construction of new import terminal, depots and distribution/hauling of petroleum products.

On the retail marketing business, the country now has 9,381 industry players in the liquid petroleum product (LPP) and 297 refilling plants for the LPG industry. For 2019 alone, construction of new facilities employed 460 individuals contributing to the economic and social development in the areas where the facilities operate.

For the first quarter of 2020, two additional LPP and LPG facilities were constructed with an investment cost of more than PhP 50 million and provide employment to 15 individuals.

### **D. DOWNSTREAM NATURAL GAS**

The country is transitioning to cleaner energy sources such as natural gas. This resource is also efficient in producing energy to meet the country's energy needs. The DOE crafted the Natural Gas Roadmap with the intent of establishing a world-class, investment-driven and efficient natural gas industry to make it the preferred fuel for end-use subsectors. Also, the DOE envisions the country as an LNG hub, which can distribute LNG not only across the country, but for export to other countries as well.

On the development of LNG terminals, the DOE has approved the permits of four LNG Regasification Terminal Projects targeted for operation from 2022 to 2025. These projects require investments of PhP 64,632 million and create employment for more than 4,000 people during the construction stage and 325 during operation stage of the project (with preference for local experts in the sector). More investments are expected for other necessary natural gas infrastructure like satellite terminals, transmission and distribution pipelines, and refueling stations when demand for natural gas ramps up in the near future.



## E. POWER DEVELOPMENT SECTOR

Private financing and private sector participation are key drivers to push forward developments in the power sector. The restructuring of the power sector called for by the EPIRA has the sole intent of realizing a competitive and market-driven electricity sector. To support the EPIRA, Power Sector Roadmaps (one each per subsector) have been developed covering the business of power generation, transmission, distribution, missionary electrification, total electrification program, and the reforms in the power market.

Implementation of these roadmaps is highly dependent on secured investments. To build new power generation plants brings in investments of about USD 104.7 billion as required under the Reference Scenario. The Clean Energy Scenario, which involves higher share of renewables, necessitates around USD 124.0 billion.

To accommodate new power generation capacities, the transmission network needs a total investment amounting to USD 17.9 billion for the upgrading and expansion plan to include island interconnection projects. Meanwhile, the distribution development projects demand about USD 16.4 billion of investments to increase network efficiency and improve performance of distribution utilities (DUs). Half of the amount is allotted for electrification projects, while 40.0 percent is earmarked for new substations and sub-transmission facilities, and the upgrading/rehabilitation of existing distribution system. The remaining investment is for non-network projects like property acquisition, equipment, vehicles and others.

The potential employment opportunities associated with power generation projects is estimated to be around 515, 881 jobs under the Reference Scenario, and 626,073 jobs in the Clean Energy Scenario.

## III. CONSUMER EMPOWERMENT

As one of DOE's strategic directions, *strengthening consumer welfare and promotion* underscores the important role of consumers in the energy value chain. It asserts that every Filipino is **"first"** when it comes to the delivery of energy goods and services. As a commitment, the DOE recognizes that consumer empowerment can be realized by having a transparent, competitive, and rules-based energy market. Mindful of energy's critical role as a basic need of consumers, the DOE engages in the formulation of policies and programs aimed at empowering and promoting consumer welfare.



*In the country's pursuit for energy independence which started in the 70's to veer away from oil dependence, consumers were always in the Government's foresight. Directions and policies were articulated in a manner that Government looked at the considerable impact of prices, subsidies, and taxes in the bid of meeting energy needs.*

## A. RENEWABLE ENERGY SECTOR

The government's cognizance of the country as being affluent with indigenous renewable resources prompted actions for the aggressive push of their development and utilization. These actions support the energy sector's agenda of attaining supply security in the long-term. Moreover, the passage of the Renewable Energy Act of 2008 (RA 9513), including the formulation of corresponding policy mechanisms, encouraged greater competition and promoted consumer welfare.

The following RE policy mechanisms are seen to have an impact on consumers:

**Renewable Portfolio Standards (RPS).** The policy requires electric power industry participants or load-serving entities to source or produce a specified portion of their electricity requirements from eligible renewable resources. The DOE issued two Department Circulars (DC) related to the RPS - DC 2018-08-0024 (*RPS for Off-grid Areas, promulgated on 14 September 2018*) and DC 2017-12-0015 (*RPS for On-grid Areas promulgated on 30 December 2017*).

**Green Energy Option Program (GEOP).** The GEOP provides end-users or consumers with the option of choosing RE resources as their source of energy. This is clearly defined in DC 2018-07-0019 issued on 7 August 2018, which set the rules and procedures for proper guidance of end-users, RE suppliers and network service providers (NSP).

**Green Energy Auction Program (GEAP).** As one of the recent policy issuances through DC 2020-07-0017 signed on 14 July 2020, GEAP sets the framework for which the DOE shall facilitate the procurement of supply from renewable projects by the mandated participants. Under the RPS on-grid rules, such procurement shall be through a competitive process for compliance of the mandated participants with the RPS and as applicable for their long-term power supply requirements.

**Net Metering.** A consumer-based RE incentive scheme wherein the electric power generated by an end-user from an eligible on-site renewable generating facility and delivered to the local distribution grid may be used to offset electricity provided by the DUs to the end-user during the applicable period. The program's purpose is to encourage end-users to participate in RE generation for own use.<sup>4</sup>

Serving as legal basis for its implementation is the Energy Regulatory Commission's (ERC) Resolution No. 9, Series of 2013 – *A Resolution Adopting the Rules Enabling the Net-Metering Program for Renewable Energy* – approved on 27 May 2013 and became effective on 24 July 2013.

Net metering is an enabler for a consumer to freely exercise the choice of having renewable-based electricity generation for own-use.

### A Shift on RE Perspective

The National Renewable Energy Program (NREP) 2020-2040 is set to adopt a paradigm shift on renewables. It categorizes the RE systems into three (3) main baskets and moves to a consumer-centered use from the then grid-centered approach.

**Consumer + RE Systems.** This basket encourages renewable development as consumers will use it in agriculture, fisheries, health, and education. This also looks at the integration of battery and

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<sup>4</sup> Section 7 of DC 2009-05-0008

other energy storage systems, as well as the use of information and communications technology (ICT).

**Consumer + RE Systems + DU.** The objective is to promote investments in the Net Metering Program, demand-side participation schemes and distributed energy systems through innovative, technical, and commercial approaches.

**Consumer + RE Systems + DU + System and Market Operations.** The basket aims to facilitate and improve compliance to the RPS, GEAP, RE Rules, GEOP and smart grid policy, among the other systems and policies.

## B. POWER SECTOR

**Uniform Bill Format (DC 2018-09-0026).** Electricity is one of the fuels that consumers have an interface with. The usage of such is reflected in the electricity bill, a document providing information on the monthly electricity consumption including the corresponding fee to be settled. The unbundling of electricity rates under Section 36 of the EPIRA provides for greater transparency and enabled consumers to be more aware of how much they are paying, specifically the *fees that go to the DUs and fees considered as “pass through” charges collected by DUs for the government and power generating firms.*

The DOE’s promulgation of DC 2018-09-0026 titled “Adopting Framework for Uniform Monthly Electricity Bill Format” on 14 September 2018 furthers the promotion of consumer welfare as they are affected by rates and services of the DUs and electricity supply providers. The policy covers all entities issuing electricity bills and includes private-investor owned utilities (PIOUs), electric cooperatives (ECs), local government owned utilities (LGOU), entities authorized to operate within Economic Zones, and other entities authorized by law to distribute and/or supply electricity to end-users, such as Qualified Third Parties (QTPs) and retail electricity suppliers (RES). These entities are directed to use a uniform bill format that reflects all corresponding charges to end-users.

**The Murang Kuryente Act of 2019 or RA 11371.** The President’s signing of the *Murang Kuryente Act* on 8 August 2019 denotes the provision of an additional relief to Filipino consumers. The corresponding IRR was subsequently approved on 25 March 2020.

The law allows for the use of Government share from the Malampaya Natural Gas Project<sup>5</sup> as payment for the *stranded contract cost (SCC)*<sup>6</sup> and *stranded debts (SD)*<sup>7</sup> of the National Power Corporation (NPC). Prior to implementation, the SCC, and SD of NPC formed part of the *universal charge (UC)*<sup>8</sup> that is passed on to consumers.

For every consumer paying the passed-on charges, the ERC-approved rates for the UC-SCC and UC-SD as of December 2019 were at PhP 0.1938/kWh and PhP 0.0265/kWh, respectively. With the law taking effect, only the UC for *Missionary Electrification (ME)* at PhP 0.1561/kWh and *Environment and Watershed Rehabilitation and Management (EWRM)* at PhP 0.0025/kWh are being collected from

<sup>5</sup> Service Contract (SC) No. 38 operating in offshore Palawan

<sup>6</sup> Refers to the excess of the contracted cost of electricity under eligible Independent Power Producer contracts over the actual selling price of the contracted energy output of such contracts in the market.

<sup>7</sup> Refers to any unpaid financial obligations of the NPC which have not been liquidated by the proceeds from the sales and privatization of NPC assets.

<sup>8</sup> Refers to a non-bypassable charge which shall be passed on and collected from all end-users monthly by the DU. As stated in Section 34 of RA 9136, it is imposed on electricity consumers for the purposes of missionary electrification, payment of SCC and SD, environmental charge for watershed rehabilitation and management, equalization of taxes and royalties applied to indigenous RE sources of energy vis-à-vis imported energy fuels and a charge to account for all forms of cross-subsidies. It is collected monthly by NGCP and the DU based on the approval of ERC.

consumers. The total ERC-approved UC rates collected in every consumer amount to PhP 0.3789/kWh.<sup>9</sup>

**Suspension of the Collection of UC-Environmental Charge (EC).** The temporary suspension of the collection of the UC-EC (PhP 0.0025/kWh) is an added benefit that consumers get to enjoy. The ERC in its advisory last 22 May 2020 stated the *suspension of UC-EC's collection until further notice*.<sup>10</sup> This move comes in an opportune time as the Filipino people are currently facing an ongoing pandemic brought about by the coronavirus disease 2019 (COVID-19). Suspending the collection is one of the initiatives in the energy sector that aims to ease the burden shouldered by consumers. Apart from this, the energy sector called for the deferment of payments of electricity bills (covered during the imposition of community quarantine in the country).

**Competitive Selection Process (CSP).** The engagement of the DUs in providing the least-cost electricity supply significantly impacts every consumer. In 2015, the DOE issued DC 2015-06-0008 “Mandating All Utilities to Undergo Competitive Selection Process in Securing Power Supply Agreements (PSA).” This required all the DUs to conduct a CSP through a Third Party in the procurement of PSAs for their captive market.

A need was pinpointed for a more specific CSP Policy covering all the DUs in order to have a clear, transparent and fair supply procurement process that promotes competition and greater private sector participation in the provision of least-cost, reliable and adequate supply of electricity. Given this thrust, the DC 2018-02-0003 on “Adopting and Prescribing for the Competitive Selection Process in the Procurement by the Distribution Utilities of Power Supply Agreement for the Captive Market” was issued on 1 February 2018. The policy covers the power supply contracting of all the DUs serving both grid and off-grid areas in the country. It also specifies the establishment of a Third-Party Bids and Awards Committee (TPBAC) to spearhead and manage the CSP. In addition, a Joint TPBAC may also be established in the case of aggregated DUs. The DUs also have the option of engaging a Third-Party Auctioneer in lieu of the TPBAC or Joint TPBAC to conduct and manage their CSP. It should be noted that selection process of the TPBAC or Joint TPBAC captive customer representatives must be submitted to the DOE for approval.

**Retail Competition and Open Access (RCOA).** Compliance to the conditions set in EPIRA instigated the move for RCOA. It is a policy that empowers consumers to choose their electricity supplier thereby aiding in the reduction of electricity costs and expanding transparency in the electricity industry.

Its introduction on 26 June 2013 allowed electricity end-users of 1.0 MW and above to choose their electricity suppliers. The end-users or customers are categorized as *contestable customers* and are permitted to source their supply from RES. It also allows the use of transmission and distribution systems and the associated facilities subject to the payment of distribution wheeling charges duly approved by the ERC. There was voluntary participation at first, but by December 2016 it eventually transitioned to mandatory participation for customers with 1.0 MW of demand and above.

Participation of customers reverted to voluntary after the Supreme Court (SC) issued a Temporary Restraining Order (TRO) in February 2017. This also covered the lowering of the contestable customers' threshold from 750 kW to 1 MW. In December 2018, the RCOA's threshold was reduced to 500 kW to further its implementation. Further, the retail aggregation<sup>11</sup> was intended to start last December 2018 subject to the issuance of relevant guidelines.

<sup>9</sup> Source: <https://www.psaln.gov.ph/universal/administrationofUC>

<sup>10</sup> Source: <https://www.erc.gov.ph/ContentPage/61976>

<sup>11</sup> Allows customers in a contiguous area whose aggregate demand is not less than 500 kW to source their electricity supply requirement on a group basis from a licensed supplier.

## C. DOWNSTREAM OIL INDUSTRY

Petroleum products (e.g. gasoline, diesel, kerosene, LPG, etc.) are energy fuels that affect everyday life of consumers as these are primarily used in the transport sector for mobility of people, goods, and services, as well as the residential sector

**Fuel Cost Unbundling (DC 2019-05-0008).** The DOE deems fuel cost unbundling as a measure to promote consumer welfare and increase transparency in the downstream oil industry. This view led to the issuance of DC 2019-05-0008 on the “*Revised Guidelines for the Monitoring of Prices on the Sale of Petroleum Products by the Downstream Oil Industry in the Philippines,*” which was signed by Secretary Cusi on 28 May 2019 and promulgated on 14 June 2019. The DC basically requires oil firms to submit reports on its disaggregated price components including details on profit margin.

The policy enforcement did not materialize as the oil firms filed a TRO. The DOE’s action was to refer the TRO to the Office of the Solicitor General (OSG).

**Fuel Quantity and Facility and Process Standards Development.** The DOE is unwavering in its efforts on developing and formulating standards on petroleum fuels and related products along with oil facilities. These standards adhere and comply with the Philippine National Standards (PNS)<sup>12</sup> which are also in accordance with the *Philippine Clean Air Act of 1999* (RA 8749). The Clean Air Act is an air quality management policy and program that aims to achieve and maintain a healthy air for every Filipino. The action to constantly develop fuel quality and infrastructure standards is a testament of ensuring consumer welfare by making available quality fuels including safe and clean technologies in the downstream oil market.

**DOI Legislative Agenda.** The DOE’s pending bills that will advance consumer welfare are Senate Bills Nos. 853 and 413. The former seeks to amend RA 8479 or the *Downstream Oil Industry Act of 1998* to ensure transparency in the pricing of petroleum products by oil industry players and determine computations or assumptions used in price adjustments to avoid unwarranted profiteering and safeguard consumers. The latter focuses on the monitoring and supervision of business operations of the LPG industry to ensure safety of the consuming public and protect consumer welfare.

## D. ENERGY EFFICIENCY AND CONSERVATION

Consumers or end-users have a responsibility when it comes to energy efficiency and conservation as highlighted in Section 8 of the EE&C Act. It states that “*all energy end-users shall use every available energy resource efficiently and promote the development and utilization of new and alternative energy efficient technologies and systems including RE technologies and systems across sectors.*”

The DOE is also mandated to develop the minimum energy performance (MEP) for the commercial, industrial and transport sectors in consultation with relevant stakeholders and guided by a cost-benefit analysis, which will be done by DOE with the assistance of the National Economic and Development Authority (NEDA).<sup>13</sup> The energy labeling for products will continue to be implemented and the DOE shall include all energy consuming products, devices, and equipment.<sup>14</sup> Currently, the household appliances covered by the program are *window-type air-conditioning units, household refrigerators and lighting products (e.g. CFL, LFL, FCL and ballast)*. The labeling

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<sup>12</sup> PNS are standards developed and promulgated by the Department of Trade and Industry – Bureau of Product Standards (DTI-BPS).

<sup>13</sup> Section 14 of RA 11285

<sup>14</sup> Section 15 of RA 11285

program is currently characterized by the *yellow label* indicating the energy efficiency ratio (EER) and easily distinguished by the consumers when buying the specified household appliances. A new design for the energy labels is being proposed using “energy stars” as indicator of energy efficiency ratings.

## E. ENVIRONMENTAL MANAGEMENT

The production and utilization of energy must be complemented with sustainable practices to minimize the impacts to the environment. A clean and healthy environment benefits all the populace. The DOE for its part is involved in ensuring that environmental standards are met with the operation of energy projects and facilities. This aligns to the sector’s strategic directions of promoting consumer welfare and having a low carbon future.

Stakeholders are embodied by the Multi-Partite Monitoring Team (MMT) of energy projects and facilities that are considered environmentally critical projects under the Philippine Environmental Impact Statement System (PEISS). The DOE conducts regular environmental compliance monitoring of energy projects and facilities to ensure social and environmental safeguards are in place and applied. This is carried out through the DOE’s representation in the MMT. The MMT has the objective of encouraging public and/or stakeholder’s participation and providing appropriate check and balance mechanisms in monitoring the development and implementation of projects.

## F. ENERGY RESILIENCY

One of the energy sector’s identified priorities is having a system that is resilient from risks and vulnerabilities resulting from natural and human-induced disasters. The sector’s responsiveness alleviates integrity of energy infrastructures and facilities, which in turn aid in improvement in the delivery of services to the people or consumers.

**Energy Resiliency Policy (DC 2018-01-0001).** As a response to the promulgation of the *Philippine Disaster Risk Reduction and Management Act of 2010* (RA 10121), the DOE initiated the formulation of the Energy Resiliency Policy (ERP). The ERP serves as a guide of adopting measures that will enhance and ensure reliability and security of the energy system.

The DOE issued DC 2018-01-0001 on “*Adoption of Energy Resiliency in the Planning and Programming of the Energy Sector to Mitigate Potential Impacts of Disasters*” on 17 January 2018. The energy resiliency program’s guiding principles are: a) strengthen existing energy infrastructure; b) implement the *build back better* principle in terms of reconstruction and rehabilitations of damaged infrastructure; c) improve existing operational, maintenance and practices to ensure continuous operations and energy supply; and d) develop resiliency standards that will be used as basis in future construction of energy facilities.

The Task Force on Energy Resiliency (TFER) was also created through the DC and is headed by the DOE Undersecretary. The TFER is automatically activated if the country faces disasters.

In 2019, the National Energy Contingency Plan (NECP) was updated with the DOE actively working with the Philippine Disaster Resilience Foundation Inc. (PDRF). The NECP was formulated to address supply disruption in both oil and power. It is directed with the prioritization in the restoration of electricity service for installations vital to national security, allocation of petroleum products for critical and strategic activities and considerations of associated effects on domestic socio-political stability that shall be addressed immediately by concerned agencies.

## G. ROLE OF LGUs

The autonomy of LGUs and its role of delivering basic services is a result of the *Local Government Code of 1991* (RA 7160). In energy development, the LGUs are partners as they have the reach to the locals, which are the beneficiaries of energy projects and services. In a move to hasten the process of energy project implementation at the local level, the DOE executed a Joint Memorandum Circular with the Department of Interior and Local Government (DILG), known as the *LGU Energy Code*.

**LGU Energy Code.** The DOE and DILG's Joint Memorandum Circular 2020-01 titled "*Guidelines for LGUs to Facilitate the Implementation of Energy Projects*" intends to attain the following: a) to establish, strengthen and integrate the national energy plans, programs, policies and mechanisms into the local development plans; b) harmonize and fast-track the implementation of EVOSS Act, EODB Act, EO 30 and AO 23 with the establishment of a unified and streamline permitting process; c) maximize benefits from energy projects to host communities; and d) implement other necessary energy programs and projects to spur the total development of the LGUs.

Implementation will be through the local development committee (LDC), which needs to be activated by the LGUs. Correspondingly, there is a *spatial aspect* given that energy programs, policies and projects must be incorporated in the LGU's spatial plan. In addition, consultations must be done by cities and municipalities with concerned stakeholders to identify upstream conventional and/or renewable energy resources present in their jurisdiction.

## H. CONSUMER WELFARE

The DOE's dedicated consumer welfare and promotion office (CWPO) is mandated to formulate and implement policies, plans and programs relative to consumer information, welfare promotion, empowerment, and protection.

Given that energy policies rightly put Filipino consumers first, it is imperative that consumer offices in the energy sector are synchronized. A Memorandum of Understanding (MOU) entered into by the DOE with the ERC on 16 October 2019 for collaborative undertakings between the DOE-CWPO and ERC's Consumer Affairs Service (CAS). These include: a) data and information sharing; b) consumer behavior survey, studies and other researches; c) modernization and improvements; d) training and development; e) technological and best practices exchange; f) policy recommendations/formulation; g) monitoring and evaluation; and, h) harmonization of plans and programs.

The EPIRA is also clear on the promotion of consumer interests as specified in Section 41. It states that the *ERC shall handle consumer complaints and the adequate promotion of consumer interests*. The ERC has promulgated the *Magna Carta for Residential Consumers* as adopted in its Resolution on 9 June 2004.<sup>15</sup> The basic rights of all consumers are defined in Article 4, while Article 5 specifies the basic obligations of the consumer.

If a situation arises wherein the consumer has qualms on the DU's bill or service, the consumer has every right to file a complaint with the DU (Article 13). The DU for its part must record and promptly investigate the complaint filed. Moreover, a written report on the actions taken by the DU will be furnished to the consumer within 15 days from the receipt of complaint. If there is still disagreement between the consumer and the DU, the former may file a complaint with the ERC.

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<sup>15</sup> Amended in 2010 through ERC Resolution No. 28 Series of 2010

The consumer may file with the ERC provided that this has been consulted/discussed with the DU's Consumer Welfare Desk (CWD) and no settlement was reached (Section 27). The ERC observes a procedure for the filing of consumer complaints and it is the CAS (including the Visayas and Mindanao field offices) that handles this.<sup>16</sup> The ERC also has an online customer complaint procedure, which includes downloading and filling up of forms – *consumer complaints and the verification and certification of non-forum shopping* – and submitting these to the CAS.<sup>17</sup>

As a way forward, advancing consumer empowerment requires the DOE to look into the recommendations raised by energy stakeholders. Among them is the DOE's active stance in all energy rate-making processes, institutionalizing consumer representation in the energy sector specifically on the agencies concerned, implementing price freeze that is synchronous with calamities/pandemic, and strengthening the DOE's role in local price coordination councils.

#### **IV. PHILIPPINE AGENDA WITH THE INTERNATIONAL COMMUNITY**

Strengthening our ties with other countries and international and regional groupings is an option to achieve the economic and energy goals. The country's energy agenda as put forward in the international community can gain support through sharing of best practices, technical collaboration and joint undertaking, and pursuing priorities for inclusive growths and even funding assistance for programs and projects that need to be implemented for further improvement of the domestic energy landscape.

The DOE has been active in multilateral, regional and bilateral energy cooperation where national interests can be set forth in the agreements and collective commitments to be reached in these fora. Five (5) fora are highly recognized and prioritized, namely:

1. Asia Pacific Economic Cooperation (APEC);
2. Association of South East Asian Nations (ASEAN);
3. Brunei-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA);
4. United Nations Framework Convention on Climate Change (UNFCCC), and
5. Free Trade Agreements (regional and bilateral) with various countries.

These fora serve as platforms for significant discourses on collaborative efforts, policy issues and concerns that effect both regional and national growth. The Philippines, together with other economies or member states, was able to spearhead projects or co-sponsored projects or initiatives based on APAEC and the Energy Security Initiatives (ESI) under APEC-Energy Working Group's short and long-term Plan. In October 2015, the Philippines hosting of the 12<sup>th</sup> APEC Energy Ministerial Meeting (EMM) held in Cebu led to the adoption of the forum's theme "*Towards an Energy Resilient APEC Community*," that discussed the importance of energy systems and infrastructure to withstand extreme natural and man-made disasters, recover and return to normalcy in a timely and efficient manner and to build back better. The 12<sup>th</sup> EMM resulted in the creation of the Energy Resiliency Task Force (ERTF), which the Philippines co-chairs with the United States.

Exchanges of best practices, policies and programs, as well as researches and studies are the most tangible benefits of the regional and international cooperation including addressing emerging issues at the regional and international levels. For decades now, these fora have been part of

<sup>16</sup> Source: <https://www.erc.gov.ph/ContentPage/111>

<sup>17</sup> Source: <https://www.erc.gov.ph/ContentPage/307>



strategic directions of various countries globally with the end-goal of achieving greater energy security and sustainability.

The DOE has been continuously collaborating with development partners like the United Nations Development Programme (UNDP), World Bank, European Union (EU), Global Environment Facility (GEF) and the United States Agency for International Development (USAID). As manifestations of success, the following are the key accomplishments:

**Access to Sustainable Energy Programme (ASEP).** The ASEP project of EU completed a feasibility study (FS) on rural electrification, and installed 10,000 units Solar Homes System (SHS) and contracted seven (7) projects in various stages of capacity building, procurement and arrangements with counterpart institutions and the LGUs. It also supported the formulation of the IRR for the EE&C Act.

**Development for Renewable Energy Applications Mainstreaming and Market Sustainability (DREAMS).** The DREAMS project under UNDP and GEF supported the development and passage of six (6) renewable policies and guidelines and established the Philippine Renewable Energy Market System (PREMS) to be used by the RE Registrar.

**Building Low Emission Alternatives to Develop Economic Resilience and Sustainability (B-LEADERS).**

The B-LEADERS program of USAID implemented two complementary tasks:

- Conduct in-country capacity building on low emission development; and,
- Increase investment in clean energy projects.



# Chapter I.

## ENERGY SITUATIONER

Energy goes through a series of streams or stages before it is consumed in final form by the end-users. Stages. As presented in *Figure 1*, the Sankey diagram<sup>1</sup> depicts the Philippines' energy flow from the primary resources to the final use. The leftmost side of the diagram shows the **primary energy supply** comprises of available energy resources – *fossil fuels* (oil, coal and natural gas) and *renewable energy* (geothermal, hydro, wind, solar, biomass and biofuels), which are either domestically produced (indigenous) or imported. Some of the indigenous coal, crude and condensate are being exported (*represented as negative values*). The remaining volume of primary energy resources undergoes transformation processes (i.e., oil refining and power generation) to produce **secondary energy** products, petroleum fuels and electricity.

In the power transformation process, coal, oil and natural gas are burned producing heat to run the turbine that generates electricity. The heat from solar and geothermal steam are directly used to run the turbine, while the mechanical energy from hydropower and wind produces heat. The electricity produced then passes through transmission and distribution lines to reach end-users for final use.

The transformation flow of oil involves the refining process where crude oil is transformed to petroleum products (as secondary oil products), such as gasoline, diesel, liquefied petroleum product (LPG), fuel oil and others that are readily used by consumers. A portion of the volume produced from refinery is exported or consumed for international navigation or aviation (*represented as negative values*), and stored as stocks for future use.

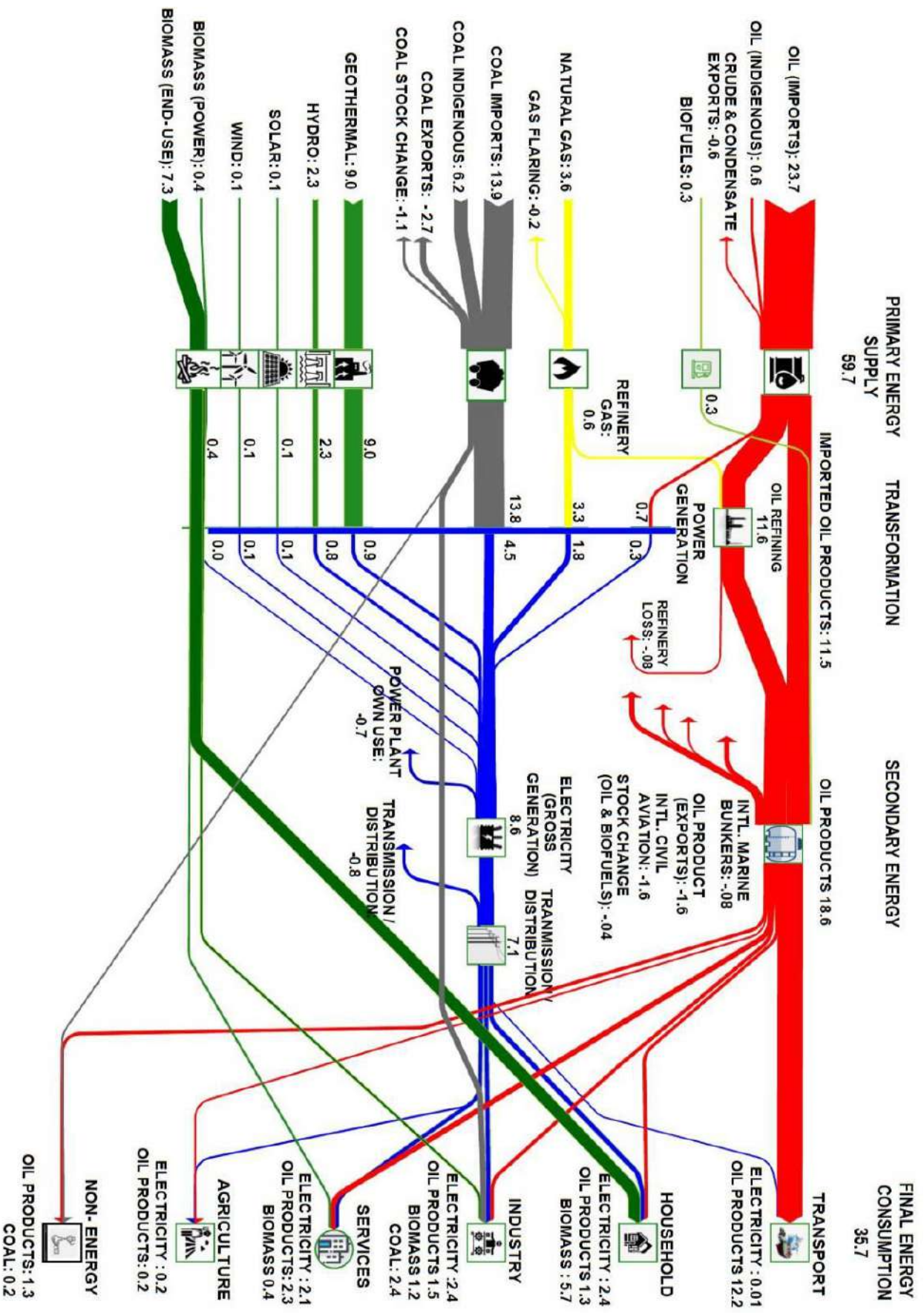
Energy losses are incurred during the transformation process in power generation and oil refining, and during the transmission and distribution for the delivery of electricity supply to the end-users. Power plants and refineries also have their energy own-use. The losses and plant own-use are represented as negative values.

Towards the right side of the diagram is energy commodities for **final consumption** of different economic sectors namely, Household, Transport, Industrial, Services, and Agriculture, and the raw materials for production processes considered as non-energy use.

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<sup>1</sup> Designed using the e!Sankey 4 Pro application developed by ifu hamburg, with offices in Germany.

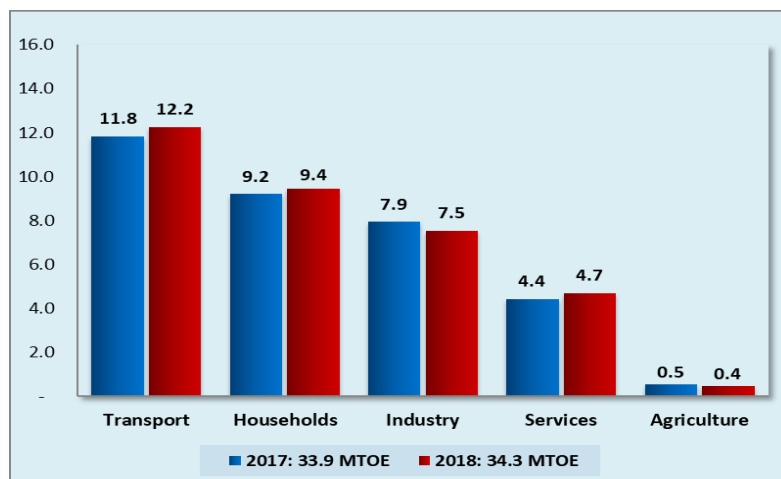
Figure 1. PHILIPPINE ENERGY FLOW, Million Tons of Oil Equivalent (MTOE), 2018



## A. TOTAL FINAL ENERGY CONSUMPTION

The country's Total Final Energy Consumption (TFEC) in 2018 reached 34.3 million tons of oil equivalent (MTOE), up by 1.3 percent from its 2017 level of 33.9 MTOE (Figure 2). Energy use in the transport, households and services<sup>2</sup> sectors increased against the declines registered for the industry and agriculture sectors during the period.

Figure 2. TOTAL FINAL ENERGY CONSUMPTION, By Sector ( MTOE), 2017 vs. 2018

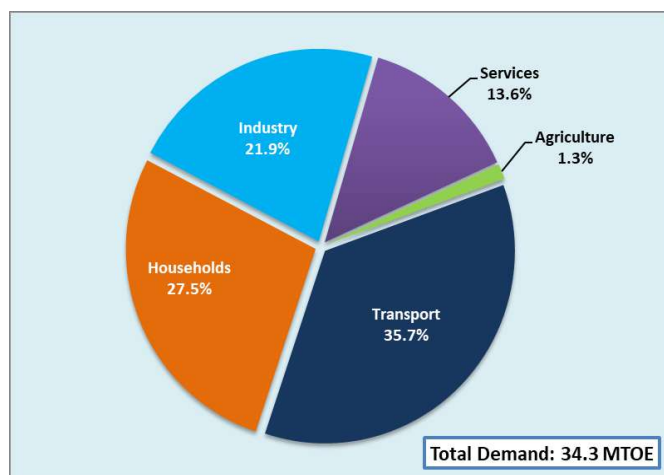


Transport remains the most energy-intensive sector, accounting for more than one-third (35.7 percent) of total energy consumption. Its aggregate energy demand reached 12.2 MTOE, 3.5 percent higher than its last year's level (Figure 3) due to increased utilization of gasoline and diesel for road transport, as well as aviation turbo for domestic air transport.

Household energy consumption contributed 27.5 percent share of the demand mix, as it posted an increase of 2.6 percent to 9.4 MTOE during the period. On the other hand, the slowdown in production output from the industrial sector, particularly from energy-intensive manufacturing sub sectors, such as non-metallic (including cement) minerals, chemical products and basic metal industries, resulted in a 5.1 percent drop in the sector's energy requirements to 7.5 MTOE in 2018, corresponding to a 21.9 percent share in the TFEC. The resilient performance of the services sector, particularly hotels and restaurants, translated to a 6.0 percent hike as its energy consumption reached 4.7 MTOE from its 2017 level of 4.4 MTOE, and contributing a 13.6 percent share to the 2018 demand mix. On the other hand, the registered production cuts in the agriculture sector caused its energy use to fall by as much as 14.8 percent to 439.6 thousand tons of oil equivalent (kTOE) in 2018.

Household energy consumption

Figure 3. TOTAL FINAL ENERGY CONSUMPTION, By Sector Shares (Percent), 2018



Oil products accounted for 49.3 percent share of the country's TFEC, as its consumption went up by 3.4 percent, from last year's level of 16.3 MTOE to 16.9 MTOE in 2018 (Figure 4). Notwithstanding the significant fluctuations in prices of oil products during most parts of 2018 brought about by the implementation of the excise tax provision under the Tax Reform for Acceleration and Inclusion (TRAIN) Act, consumption of gasoline and diesel, primarily for road transport, went up by 3.0

<sup>2</sup> Excluding transport

percent and 3.5 percent, respectively. The combined share of the said fuels was nearly 80.0 percent of the total oil consumption.

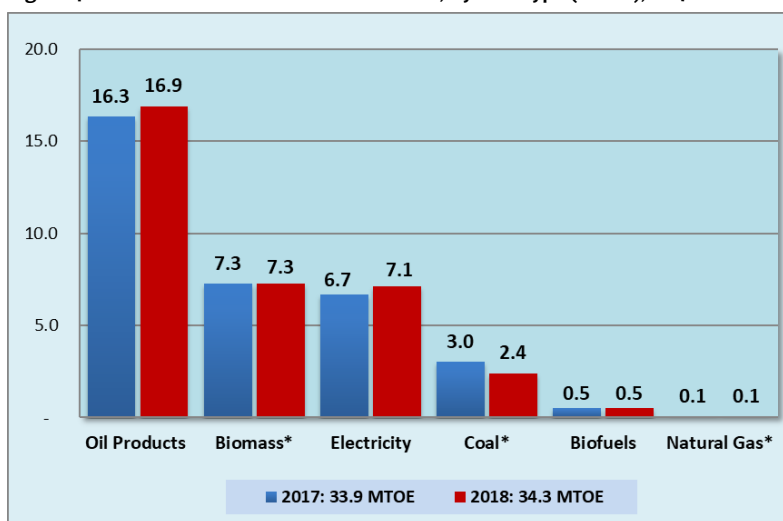
Close to **two-thirds (63.2 percent)** of the country's energy consumption in 2018 was for the **movement of goods or people, and for use in our homes.**

Electricity came in third after oil and biomass and contributed a 20.7 percent share of the TFE in 2018 (Figure 5). Its consumption increased by 6.2 percent to reach 7.1 MTOE from last year's 6.7 MTOE. Both the industrial and household sectors registered close to one-third shares of the total electricity consumption, while 29.1 percent was used in the services sector.

The consumption of coal for end-use applications registered a decline of 19.8 percent from its previous year's level of 3.0 MTOE to 2.4 MTOE in 2018. This was brought about by merger of the two (2) firms' local cement producers, Lafarge Republic Inc. and Holcim Philippines Inc., and the surged in imported cement that contributed to the reduction in local cement production during the year.

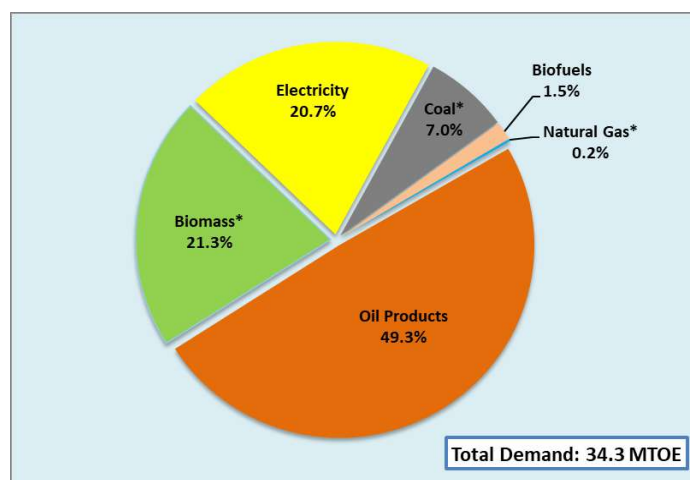
Consumption of biomass<sup>3</sup> for end-use applications garnered a 21.3 percent share of the total demand in 2018, albeit a measly 0.5 percent growth in its consumption during the period. Of the 7.3 MTOE biomass consumed in 2018, households accounted for bulk at 78.8 percent, while the remaining was utilized in the services and manufacturing sectors, particularly for sugar and food processing.

Figure 4. TOTAL FINAL ENERGY CONSUMPTION, By Fuel Type (MTOE), 2017 vs. 2018



\*end-use applications

Figure 5. TOTAL FINAL ENERGY CONSUMPTION, By Fuel Shares (Percent), 2018



\*end-use applications

The utilization of biofuels, coco methyl ester (CME) and ethanol, went up by 2.9 percent with combined levels reached 524.0 kTOE in 2018, from 509.2 kTOE in 2017. The increasing trend in biofuels consumption is attributed to compliance of oil companies with the biofuel blend rate as mandated under the Biofuels Law of 2006 or Republic Act (RA) 9367.

**Oil accounts for the biggest share (49.3 percent) to energy consumption - increasing by 3.4 percent from its 2017 level.**

<sup>3</sup> Includes charcoal, fuelwood, ricehull, bagasse, agriculture and animal waste

Natural gas use for end-use applications jumped by as much as 13.1 percent in 2018, despite its meager share of 0.2 percent of the TFEC. The recorded increase was due to Pilipinas Shell Petroleum Corporation (PSPC)'s high gas off-take on top of using LPG to fuel its turbine and furnaces throughout the year.

## Total Final Energy Consumption, by Sector

### 1. TRANSPORT

The transport sector remained the major user of energy in 2018 with a total share of 35.7 percent in the final energy demand. Its consumption reached 12.2 MTOE during the period, 3.5 percent higher than its year-ago level of 11.8 MTOE.

The energy utilized for road transport went up by 4.1 percent as the number of registered vehicles stood at 11.6 million (as of December 2018), up by 11.4 percent from 10.4 million in the previous year.<sup>4</sup> The high volume of motor vehicles vis-à-vis other transport modes likewise contributed to the 87.9 percent share of the road transport to the sector's aggregate consumption (Figure 6).

The fuel consumption for water transport decreased by 23.6 percent from 265.4 kTOE in 2017 to 202.8 kTOE in 2018 and contributed 1.7 percent share of the total transport demand. Domestic air transport, owning a 4.8 percent share in the sector's energy demand, went up by 14.0 percent to 583.6 kTOE in 2018 from the previous year's 511.9 kTOE. The renewed development and promotion of local tourism and cheaper fare offerings by the Philippine Airlines and the Cebu Pacific and other local airlines contributed to the increase.

Figure 6. TRANSPORT FINAL ENERGY CONSUMPTION, By Sub-sector Shares (Percent), 2018

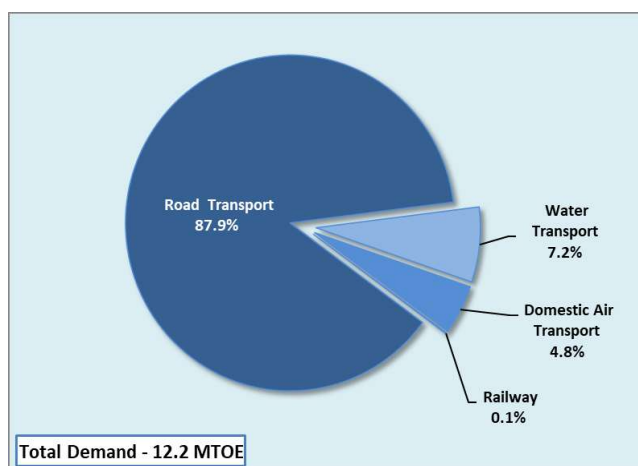
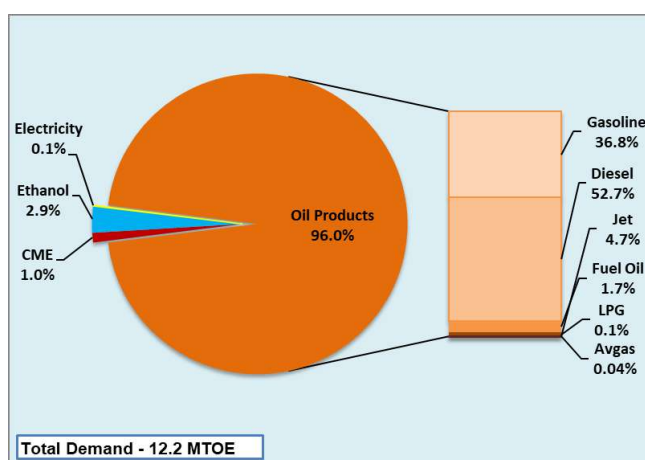


Figure 7. TRANSPORT FINAL ENERGY CONSUMPTION, By Fuel Shares (Percent), 2018



Energy consumption for rail transport decreased by 8.4 percent in 2018 from the 2017 level of 11.8 kTOE. Such decline was a result of reduction in operating hours and running stock of the Metro Rail Transit Line 3 (MRT3) caused by maintenance checks, as well as glitches and breakdowns recorded by the Department of Transportation (DOTr) for this period. Oil products continued to be the sector's primary fuel, representing a bulk share of 96.0 percent to the total energy demand of the sector during the period (Figure 7).

<sup>4</sup> Land Transportation Office (LTO) Annual Reports for 2017 and 2018

Diesel and gasoline, mainly utilized for road transport, registered an aggregate share of 89.5 percent of the sector’s overall demand mix. In terms of growth rate, gasoline and diesel increased by 3.1 percent and 4.2 percent, respectively. Following the same trend, the usage of bioethanol and biodiesel went up by 3.1 percent and 3.2 percent, respectively. Fuel oil consumption decreased by 23.6 percent during the period, mostly consumed for water transport. The declining number of auto-LPG taxi units contributed to the 3.6 percent reduction in the sector’s LPG consumption.

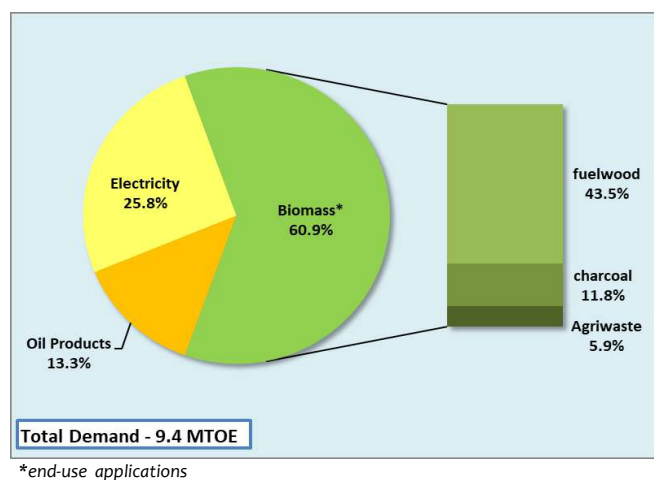
The **increasing** number of motor vehicles contributes to **nearly 90.0 percent** of transport energy consumption.

## 2. HOUSEHOLDS

Aggregate energy consumption of the households posted a sluggish 2.6 percent growth from its 2017 level of 9.2 MTOE to 9.4 MTOE in 2018.

Consumption of biomass for end-use applications accounted for two-thirds (60.9 percent) of the sector’s energy demand mix, as households in most rural areas still prefer fuelwood and charcoal for cooking and heating purposes, owing to its abundance, accessibility and affordability (Figure 8). Despite its share, consumption of biomass posted a measly 0.3 percent growth from its year-ago level of 5.7 MTOE.

Figure 8. HOUSEHOLD FINAL ENERGY CONSUMPTION, By Fuel Shares (Percent), 2018



Household electricity consumption, which accounted for 25.8 percent share of the sector’s energy demand, increased to 2.4 MTOE in 2018 from 2.3 MTOE in 2017. With 95.3 percent household electrification level<sup>5</sup> and an increase in household income<sup>6</sup> due to lower income tax rates as provided under the TRAIN Law in 2018, electricity demand increased by 5.5 percent during the period. Also, the relatively stable LPG prices and the convenience associated with its use as cooking and heating fuel vis-a-vis traditional biomass contributed to the 8.6 percent increase in household LPG consumption during the period

## 3. INDUSTRY

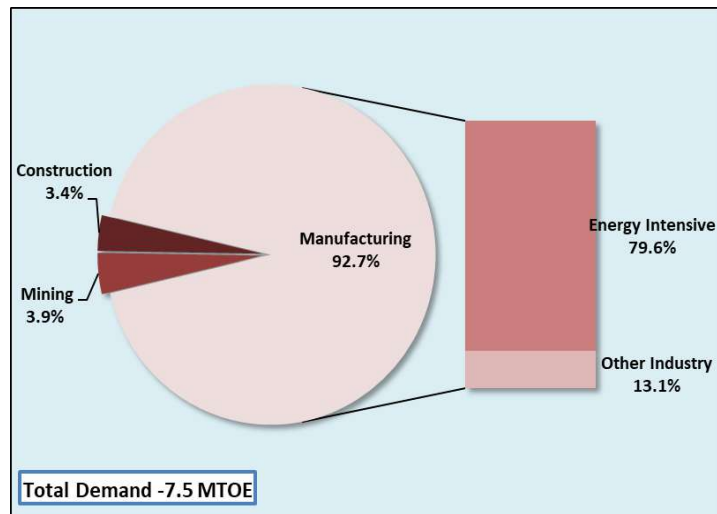
The Industry sector, the third largest energy consumer after the transport and household sectors, posted an energy demand level of 7.5 MTOE in 2018, down by 5.1 percent than a year-ago level of 7.9 MTOE.

<sup>5</sup> As December 2018, around 21.9 million households have access to electricity: DOE Energy Sector Accomplishment Report (ESAR), 2018

<sup>6</sup> Improves the capacity of households to acquire power intensive appliances and equipment, communication gadgets and other technologies

The decline stemmed from the 5.0 percent reduction in aggregate energy consumption of all manufacturing sectors as production output of energy-intensive sectors, particularly chemical and cement, slowed down in 2018. The manufacturing sub sector accounted for the biggest share of 92.7 percent (Figure 9), out of which energy-intensive<sup>7</sup> industries took 79.6 percent of the subsector's total energy demand. With a share of 3.9 percent, the mining subsector's energy consumption fell by 10.9 percent in 2018 as the majority of mineral commodities, particularly nickel, reported declining output from closure of several mining pits<sup>8</sup>, as well as the doubling of excise taxes imposed on mining firms<sup>9</sup>. Similarly, the construction sub sector posted a 0.2 percent drop in its energy consumption due to efficient energy use by companies during the period.

Figure 9. INDUSTRY FINAL ENERGY CONSUMPTION, By Sub-Sector Shares (Percent), 2018

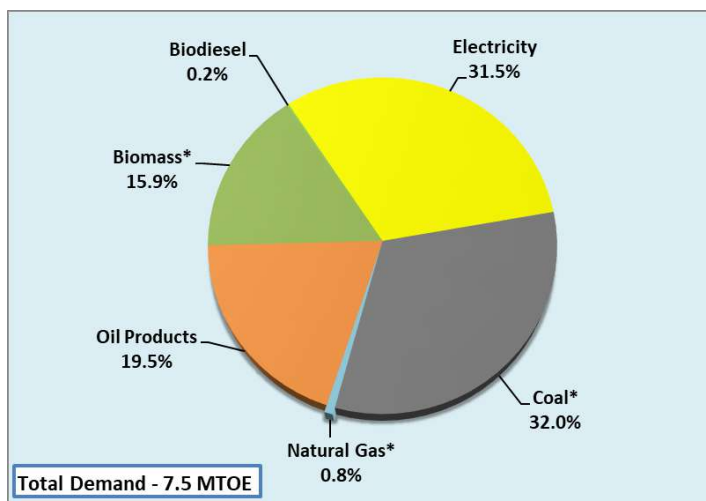


*Industries* relied heavily on **electricity and coal**, as both fuels represent **two-thirds (63.5 percent)** of the energy consumption of the sector.

Coal, electricity, oil products and biomass<sup>10</sup> are the major fuels for industrial processes (Figure 10). As coal garnered a 32.0 percent share of the demand mix of the sector, the 19.8 percent decrease in its consumption was the major contributor to the drop in the industry sector's energy use in 2018. The decline in coal utilization was brought by slowdown in domestic

production of cement due to increased importation, as well as the merger of two local cement plants (Lafarge and Holcim) and the closure of one of Holcim's cement plant in Mabini, Batangas.

Figure 10. INDUSTRY FINAL ENERGY CONSUMPTION, By Fuel Shares (Percent), 2018



\*end-use applications

Electricity, as the second most important fuel of the sector, accounted for 31.5 percent share of the total sector's demand with a utilization level of 2.4 MTOE, an increase of 7.9 percent from 2017 to 2018.

Aggregate consumption of oil products reached 1.5 MTOE, equivalent to 19.5 percent share of the industry's energy demand in 2018. Diesel and LPG were the most consumed among oil products, with a combined growth rate of 6.4 percent. Biomass<sup>11</sup> for end-use application as used extensively in food processing

<sup>7</sup> food processing, cement production, paper production and printing, chemicals, basic metals and machineries

<sup>8</sup> <https://business.mb.com.ph/2019/02/27/phs-mining-sector-earns-higher-at-p122-b-even-with-lower-output/>

<sup>9</sup> <https://business.inquirer.net/262749/denr-sees-better-year-for-mining-in-2019>

<sup>10</sup> Includes charcoal, fuelwood, bagasse, ricehull, agriculture and animal waste

<sup>11</sup> Includes charcoal, fuelwood, bagasse, ricehull, agriculture and animal waste



and sugar production accounted for a 15.9 percent share of the total demand recorded at 1.2 MTOE, 1.5 percent higher than a year-ago level. On the other hand, a minimal demand for natural gas (59.4 kTOE) for non-power applications and biodiesel (13.4 kTOE) was likewise recorded during the period and contributed a combined share of 1.0 percent in the demand mix of the sector.

#### 4. SERVICES<sup>12</sup>

As the major contributor to the country's GDP growth in 2018, the services/commercial (trade and services) sector's 6.0 percent increase in economic output was translated to 4.7 MTOE of energy consumed during the same year. The sector exhibited upward trend of 6.0 percent from its 2017 level of 4.4 MTOE (Figure 11).

Oil products accounted for close to half of the sector's total energy demand, as the consumption went up by 7.2 percent reaching 2.2 MTOE in 2018 from the previous year's level of 2.1 MTOE. Diesel registered consumption level of 1.6 MTOE, 12.3 percent more than its 2017 level of 1.4 MTOE while accounting for 33.6 percent share of the sector's demand mix. Biodiesel usage exhibited the same growth trend as that of diesel, as it posted a double-digit hike of 10.2 percent to reach 30.4 kTOE during the same period. Consumption of LPG, primarily used as cooking fuel in restaurants and other establishments engaged in the food services business, was 4.7 percent lower in 2018 as compared with its 2017 level of 531.7 kTOE. The sector's demand for fuel oil improved by 1.4 percent from its 2017 level of 145.9 kTOE to 147.9 kTOE in 2018.

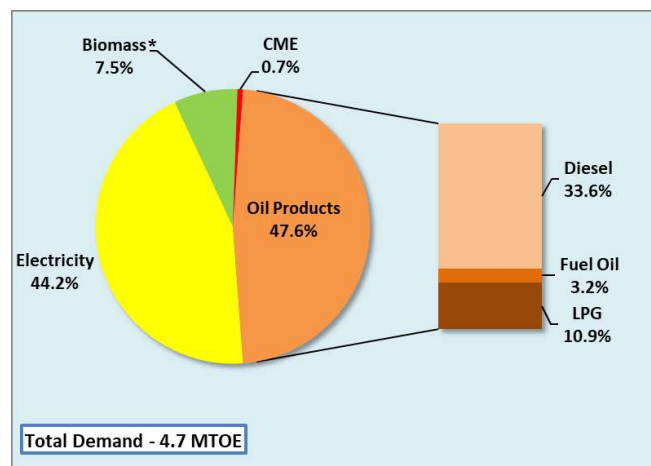
Electricity supplied 44.2 percent of the total energy demand of the sector. Its level increased to 2.2 MTOE in 2018, higher by 5.5 percent than its a year-ago consumption of 2.0 MTOE. Service establishments slightly increase their biomass consumption by 1.5 percent, an increase from 345.0 kTOE in 2017 to 350.2 kTOE in 2018.

#### 5. AGRICULTURE

The agriculture sector posted the biggest downturn in energy utilization among sectors, as its levels went down by 14.8 percent to 439.6 MTOE in 2018 from 515.6 kTOE in 2017 (Table 1).

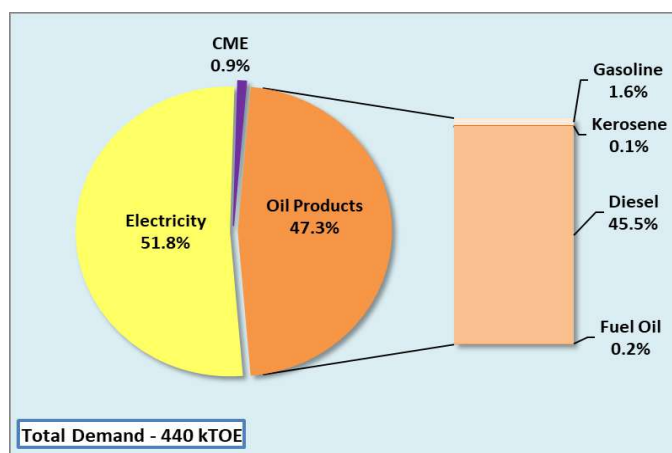
The level of energy requirements for the crop production significantly declined by 15.7 percent due to waning production of major crops during the 4<sup>th</sup> quarter of 2018, such as palay, sugarcane and cassava, brought about

Figure 11. SERVICES FINAL ENERGY CONSUMPTION, By Fuel Shares (Percent), 2018



\*end-use applications

Figure 12. AGRICULTURE FINAL ENERGY CONSUMPTION, By Fuel Shares (Percent), 2018



<sup>12</sup> Trade and services, excluding Transport

by typhoons and inadequate irrigation water. The energy consumption of the livestock and poultry sub sector went up by 4.8 percent in 2018 due to sustained demand from meat processors, hotel and restaurant industries (HRIs) and households coupled with a higher average live weight of marketable hogs and higher farmgate prices.

**Table 1. AGRICULTURE ENERGY CONSUMPTION, By Subsector (kTOE)**

Subsector	2017	2018	Growth Rate (%)
<b>Agri-Industry</b>	<b>246.68</b>	<b>239.37</b>	<b>-2.97</b>
Agri-Crops Product	93.08	78.43	-15.74
Livestock/Poultry	146.33	153.41	4.84
Agri Services	7.27	7.53	3.50
<b>Forestry</b>	<b>6.58</b>	<b>1.04</b>	<b>-84.14</b>
<b>Fishery</b>	<b>262.36</b>	<b>199.14</b>	<b>-24.09</b>
<b>Total</b>	<b>515.62</b>	<b>439.55</b>	<b>-14.75</b>

The fishery sub sector registered 199.1 kTOE of energy, 24.1 percent lower from the previous level of consumption as output was largely reduced due to rough seas, strong winds, high fuel prices, the encroachment of commercial fishing vessels and lesser appearance of the species in the fishing ground were reported in Davao Region.<sup>13</sup> Similarly, the forestry sub sector registered lower consumption of 1.0 kTOE in 2018 from 6.6 kTOE in 2017 as a result of widespread logging tagged as the culprit for continued deforestation in the country.

Aggregate consumption of oil products recorded at 208.0 kTOE, a reduction of 28.3 percent (*Figure 12*) from previous year's level, and accounted for 47.3 percent of the sector's total energy consumption. Roughly, all oil products recorded a downtrend caused by increasing prices. Diesel, being the most consumed fuel in the sector, registered a significant reduction of 26.1 percent with 200 kTOE level of consumption in 2018 from 270.4 kTOE in 2017. Similarly, gasoline and fuel oil consumption likewise declined by 41.0 percent and 90.8 percent, respectively. Electricity compensated for the decline in the consumption of other fuels as it posted steady growth of 3.5 percent during the same period.

## B. TRANSFORMATION

### 1. OIL REFINING

For the year 2018, refining output reached 86.6 million barrels (MMB), up by 12.2 percent from 77.2 MMB in 2017. With two existing oil refineries, the Petron Bataan Refinery in Limay, Bataan and the Pilipinas Shell Oil Refinery located in Tabangao, Batangas City that have a combined maximum working crude distillation capacity of 285.2 thousand barrels per stream day (MBSD), refinery throughput jumped by 12.7 percent from 9.7 MTOE in 2017 to 10.9 MTOE in 2018 (*Figure 13*). Rising domestic demand for oil products resulted in higher utilization rate of the refineries.

<sup>13</sup> 2018 Performance of the Philippine Agriculture, PSA

The total marketable products for the period were composed of diesel (40.9 percent share), gasoline (23.7 percent share) and fuel oil (6.5 percent share). The rest of the products were aviation fuel (9.4 percent), LPG (5.0 percent), kerosene (0.4 percent), and naphtha and other products (14.1 percent).

Figure 13. REFINERY PRODUCTION, Fuel Shares (Percent), 2017 vs 2018

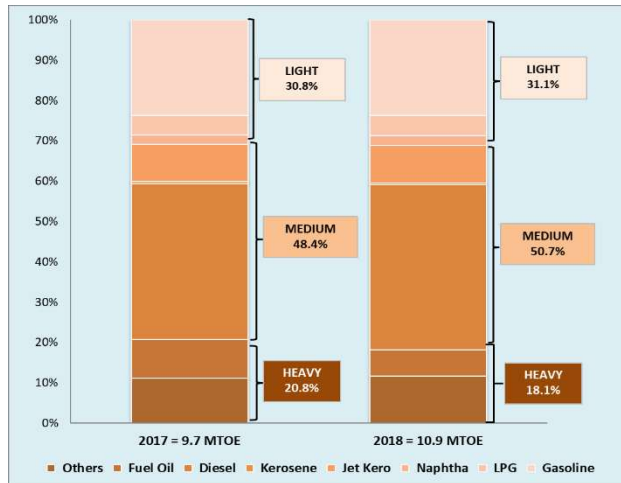
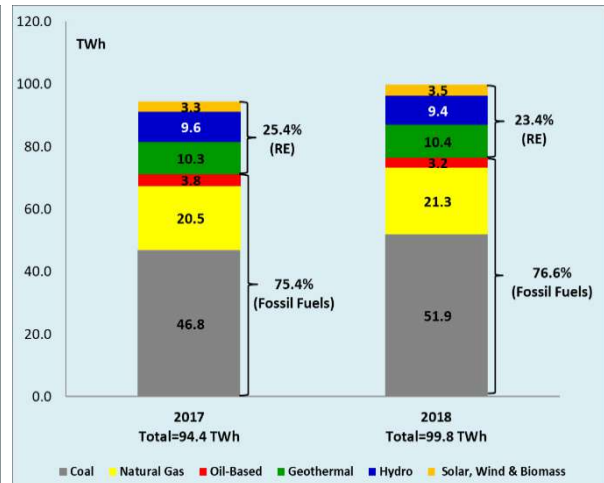


Figure 14. ELECTRICITY GENERATION, By Fuel (TWh and Percent Shares), 2017 vs 2018



## 2. POWER GENERATION

Power generation output increased by 5.7 percent from 94.4 terawatt-hours (TWh) in 2017 to 99.8 TWh in 2018. About half of the country's power generation requirement was sourced from coal (52.1 percent), while natural gas and geothermal provided 21.4 percent and 10.5 percent shares, respectively, to the total power generation.

**Self-sufficiency** in power generation dropped by 2.8 percentage points to 51.0 percent in 2018 due to increased usage of imported coal in power plants.

The total fuel requirements for power generation grew by 5.5 percent in 2018, which stood at 29.7 MTOE. Fossil fuels contributed more than half of the total fuel input (60.0 percent), mainly due to increased share of coal in power generation to offset the reduction in generation output from hydropower plants. Consequently, the demand for renewable

energy (RE) as input to power generation increased by less than 1.0 percent (0.6 percent) in 2018, pulled up by combined inputs from wind and solar to power generation.

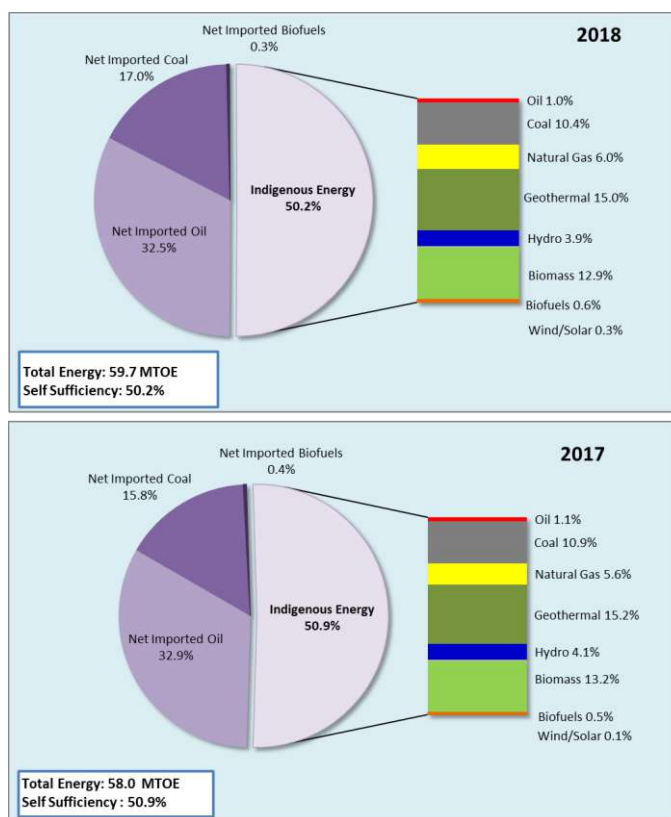
Coal demand (fuel input) for power generation reached 13.8 MTOE in 2018 from 12.3 MTOE in 2017. This level yielded a total generation output of 51.9 TWh, 10.9 percent higher than the 2017 level of 46.8 TWh (Figure 14). Natural gas continued to contribute a significant share in the total power mix, a 3.8 percent increase in generation output equivalent to 21.3 TWh, with fuel input requirement of 3.3 MTOE in 2018. Oil still plays an important role in augmenting the supply of electricity, particularly during peak demand. However, oil only accounted for the lowest contribution among the fossil fuel sources for power generation at 3.2 percent share of the total power mix, as oil-fired power plants experienced a 16.2 percent decline in generation output during the same period. This was likewise reflected in the 24.6 percent reduction of oil demand as fuel input in power generation.

## B. TOTAL PRIMARY ENERGY SUPPLY (TPES)

The country's TPES reached 59.7 MTOE, up by 2.9 percent from its 2017 level of 58.0 MTOE, with an increase 4.6 percent in energy net imports from 28.4 MTOE in 2017 to 29.7 MTOE in 2018. Energy imports compensated the sluggish 1.4 percent aggregate growth in indigenous energy brought about by contraction in production/yield of oil (-4.5 percent), hydro (-2.4 percent), and coal (-1.5 percent). As a result, the 2018 self-sufficiency level, expressed as the ratio of total indigenous energy to total primary supply, was lower by 0.7 percentage points from 50.9 percent in 2017 to 50.2 percent in 2018 (Figure 15).

Oil continued to be the country's major source of supply. It accounts for about one-third (33.5 percent) of the TPES, followed by coal and geothermal, which contributed 27.4 percent and 15.0 percent share, respectively. In 2018, natural gas supply grew fastest at a rate of 11.6 percent, while coal supply rose by 5.7 percent from increased importation. From the intensified programs that promote reliable and sustainable renewable resources, the aggregate supply of renewable energy went up by 0.6 percent to 19.7 MTOE, representing more than a third (34.1 percent) of the TPES. Notable increases were reported in the combined levels of wind and solar (4.7 percent growth), biofuels (2.9 percent growth) and geothermal (1.6 percent growth) during the same period.

Figure 15. TOTAL PRIMARY ENERGY MIX, By Fuel Shares (Percent), 2017 vs. 2018



### 1. INDIGENOUS ENERGY

Total indigenous energy production was slightly higher by 1.4 percent from 29.5 MTOE in 2017 to 29.9 MTOE in 2018. Increased domestic production was reported for biofuels (13.4 percent), natural gas (11.6 percent), wind (5.4 percent), solar (4.0 percent) and biomass<sup>14</sup> (0.2 percent). In terms of contribution to total domestic production, geothermal accounted for 30.0 percent share, biomass with 25.6 percent, coal with 20.7 percent, and natural gas with 12.0 percent. Total indigenous resources accounted for 50.2 percent of the country's total energy supply in 2018.

#### a. Fossil Fuels

- i. **Oil.** Aggregate domestic oil production, including condensate, declined by 4.5 percent, from 621.8 kTOE in 2017 to 593.8 kTOE in 2018, while its contribution to the total indigenous energy supply stood at 2.0 percent share. The reduction was a result of lower production output reported in Nido, Matinloc and Galoc fields during the same period.

<sup>14</sup> Biomass for power and end-use applications (charcoal, fuelwood, rice hull, bagasse, agriculture, animal and municipal wastes)

- ii. **Coal.** Indigenous coal supply, with a share of 20.7 percent of the total domestic energy production, fell by 1.5 percent to 6.2 MTOE in 2018 from 6.3 MTOE in the previous year. The Semirara Mining and Power Corporation (SMPC), the country's major coal producer, accounts for a 99.0 percent share of the total local coal production of the country. The SMPC's 2018 production reached 6.2 MTOE, 1.5 percent lower vis-a-vis its 2017 level.

Aggregate production of private coal mines in Cebu, with a marginal combined share of 0.1 percent to the total domestic production, decreased at a rate of 45.0 percent compared with its 2017 level of 6.3 MTOE. Meanwhile, coal mines in Bicol, Surigao, Zamboanga and small-scale mines located in some parts of the country, with a combined contribution of 0.8 percent share of coal production, registered improved operations as reflected by 17.5 percent growth in production levels from 2017.

- iii. **Natural Gas.** In 2018, natural gas production stood at 3.6 MTOE, translated to a 12.0 percent share of the total indigenous supply. Natural gas production from Malampaya, the country's single source of natural gas, was up by 11.6 percent compared with the 2017 level of 3.2 MTOE. Effective platform operation resulting in zero maintenance activity greatly contributed to the increase in supply level.

## b. Renewable Energy

- i. **Geothermal.** The share of geothermal energy of the total indigenous energy supply reached 30.0 percent in 2018, equivalent to 15.0 percent share to the TPES, as its level was 1.6 percent higher at 9.0 MTOE compared with the 2017 level of 8.8 MTOE. The installed generating capacity of geothermal power plants increased by 1.5 percent from the previous year's level.
- ii. **Hydro.** The country's hydropower production in 2018 contributed 7.8 percent share to the total indigenous energy supply or a 3.9 percent share to the TPES. It posted a 2.4 percent decline to 2.3 MTOE in 2018 as power generation output went down. The reduction was associated with variation in water availability caused by below normal rainfall conditions that signaled the onset of the El Niño phenomenon in the later months of 2018.
- iii. **Solar.** The total power generation output from solar grew by 4.0 percent from its 2017 level of 103.3 kTOE to 107.4 kTOE level in 2018, but only accounted for a 0.4 percent share of the total indigenous energy (and 0.2 percent TPES) in 2018. Solar installed capacity rose from 884 MW in 2017 to 895 MW in 2018, as solar photovoltaic (PV) systems are increasingly becoming popular.
- iv. **Wind.** Production of wind energy stood at 99.1 kTOE, 5.4 percent more than its 2017 level of 94.0 kTOE, albeit a marginal contribution of 0.3 percent to the indigenous energy production.
- v. **Biomass.** Biomass supply,<sup>15</sup> both for power and non-power applications, continued to account for around one-fourth (25.6 percent) of the indigenous energy supply in 2018. Its level reached 7.7 MTOE in 2018, slightly higher by 0.2 percent from its 2017 level of 7.7 MTOE.

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*With 80.0 percent share, natural gas and renewable energy continue to dominate domestic energy supply.*

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<sup>15</sup> Includes charcoal, fuelwood, rice hull, bagasse, agriculture, animal and municipal wastes

The bulk of the biomass supply was used for non-power applications,<sup>16</sup> while biomass for power, including municipal wastes as feedstock, reached 373.8 MTOE in 2018.

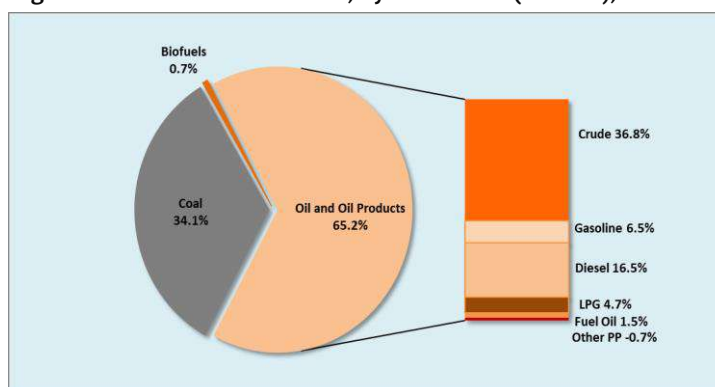
**vi. Biofuels.** The country’s aggregate biofuels (biodiesel and bioethanol) domestic supply recorded a 13.4 percent growth, from 298.0 kTOE in 2017 to 337.9 kTOE in 2018, corresponding to a 1.1 percent combined share to the total indigenous energy for the same period. Bioethanol production grew by 29.3 percent from 131.3 kTOE in 2017 to 169.8 kTOE in 2018. The 12 existing ethanol facilities yielded total sales of 303.7 million liters in 2018. On biodiesel, the 11 existing producers put in a combined sales of about 205.2 million liters in 2018, translating to a supply level of 168.1 kTOE, up by 0.8 percent from the 2017 level.

## 2. NET ENERGY IMPORTS<sup>17</sup>

Net energy imports reached 29.7 MTOE in 2018, 4.6 percent higher from its year-ago level of 28.4 MTOE, and with a 49.8 percent share out of the country’s TPES.

Of the total net imports, oil and oil products accounted for nearly two-thirds (65.2 percent), while coal contributed 34.1 percent, and biofuels with less than 1.0 percent share. The bulk of the increase was due to higher net coal importation, as levels went up by 10.5 percent from 9.2 MTOE in 2017 to 10.1 MTOE in 2018 (Figure 16).

Figure 16. NET ENERGY IMPORTS, By Fuel Shares (Percent), 2018



Oil imports comprised 48.5 percent crudes and 51.5 percent oil products. Despite the higher crude oil prices and weakened value of the peso vis-à-vis dollar during the year,<sup>18</sup> the volume of imported crude increased by 10.5 percent reaching 11.5 MTOE in 2018 from its previous year’s 10.4 MTOE. The Middle East continues to be the major source of the country’s imported crude at 87.0 percent share, while other countries in the Asia-Pacific region<sup>19</sup> supplied the rest of country’s total crude oil importation. Higher crude imports contributed to the increase in refinery output to provide for rising domestic demand for oil, particularly in the transport sector, as the aggregate volume of imported finished oil products slightly went down by 0.5 percent to 12.2 MTOE in 2018, from 12.3 MTOE in 2017. China, South Korea, the United Arab Emirates (UAE) and Singapore are the major sources of imported oil products with shares of 30.2 percent, 28.8 percent, 8.7 percent and 8.1 percent, respectively. These countries are also the top export markets of the Philippines.

Exports of finished oil products went up by 15.3 percent to 1.6 MTOE in 2018, from the previous year’s 1.4 MTOE. Crude oil exports from the Galoc field have been declining for three (3) consecutive years, posting a 24.3 percent reduction in 2018. Meanwhile, exports of condensate from Malampaya was 3.8 percent higher than its 2017 level of 408.6 kTOE.

<sup>16</sup> Biomass demand from the households, services and industry sector was 7.3 MTOE in 2018. This includes charcoal, fuelwood, rice hull, bagasse, agriculture and animal waste

<sup>17</sup> This is derived as total primary energy supply (TPES) less indigenous production. Alternatively, it can also be calculated as the sum of imports and stock change (+/-) less exports and international bunkers (aviation and marine)

<sup>18</sup> Dubai crude oil price per barrel for 2017 was US\$54.22, while for 2018 it was US\$69.42

<sup>19</sup> Includes Indonesia, Malaysia, Singapore, Brunei, Russia, Vietnam and Australia

Despite strong domestic coal production, **85 percent of our total coal supply is imported**. This is to provide for the requirements of power plants for coal with **higher heating value** than those domestically produced.

Coal importation increased by 18.1 percent in 2018, as volume reached 13.9 MTOE in 2018 vis-à-vis 11.8 MTOE in 2017. This was mainly due to higher demand for coal as fuel input in power generation. Indonesia maintains its position as the country's prime coal importer with a share of 88.5 percent, while the remaining portion was supplied by Australia, Vietnam, Russia and South Korea.

Coal exports were down by 18.1 percent to 2.7 MTOE in 2018 from its 2017 volume of 3.3 MTOE. China, the country's top export market (97.8 percent share) for locally produced coal, recorded a 13.5 percent drop in its demand to 4.9 MMT during the period. However, higher requirement for domestic coal was also noted from emerging export markets such as Thailand and India.

Ethanol imports went down by 6.0 percent to reach 144.7 kTOE, from its 2017 level of 154.0 kTOE. This was consistent with the requirements for the bioethanol-blended as the gasoline import also dropped for this particular period.

### C. ENVIRONMENTAL IMPACT

Between 2017 and 2018, total greenhouse gas (GHG) emissions from energy-related activities increased by 4.1 percent, which stood at 123.3 million tons of carbon dioxide equivalent (MtCO<sub>2</sub>e) in 2018 from 118.5 MtCO<sub>2</sub>e the previous year. The increased activities in all sectors contributed to the rise in GHG, notably in the power generation and transport, as both are major sectors that supported the robust economic growth during the period. The GHG emission from power generation grew the fastest at 9.5 percent and contributing the largest share in the total GHG emission, from 49.2 percent share in 2017 to 51.7 percent share in 2018 (Table 2).

Table 2. GHG INVENTORY FOR THE ENERGY SECTOR in FY 2017-2018, By Sector

Sector	CO <sub>2</sub> Emission (MtCO <sub>2</sub> e)		NonCO <sub>2</sub> Emission (MtCO <sub>2</sub> e)		Total GHG Emission (MtCO <sub>2</sub> e)		Percent Change in Total GHG Emission (%)
	2017	2018	2017	2018	2017	2018	2017-2018
Power Generation	57.99	63.48	0.25	0.28	58.24	63.76	9.48
Transport	32.99	34.15	0.20	0.21	33.20	34.36	3.49
Industry	16.26	13.91	0.10	0.08	16.36	13.99	-14.47
Other*	9.95	10.41	0.06	0.06	10.01	10.47	4.61
Energy**	0.68	0.74	0.00	0.00	0.68	0.74	8.56
<b>Total</b>	<b>117.87</b>	<b>122.69</b>	<b>0.61</b>	<b>0.63</b>	<b>118.48</b>	<b>123.32</b>	<b>4.08</b>
<b>% Distribution</b>							<b>Change in Distribution</b>
Power Generation	49.20	51.74	41.19	44.02	49.15	51.71	2.55
Transport	27.99	27.83	33.28	33.46	28.02	27.86	-0.16
Industry	13.80	11.34	15.64	12.60	13.81	11.35	-2.46
Other*	8.44	8.48	9.57	9.70	8.45	8.49	0.04
Energy**	0.57	0.60	0.31	0.21	0.57	0.60	0.02
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	

\* includes emission from the services (excluding transport), households and agriculture sectors

\*\*includes losses incurred in oil refining

Note: sum does not add up due to rounding off

Aside from the power generation sector, GHG emissions from the transport and industry sectors contributed 27.9 percent and 11.3 percent, respectively, of total. The rest came from other sectors such as agriculture and services/commercial (8.5 percent share), and other energy sector's activities (e.g. oil refining) (0.6 percent share). The considerable increase in GHG emission is mainly

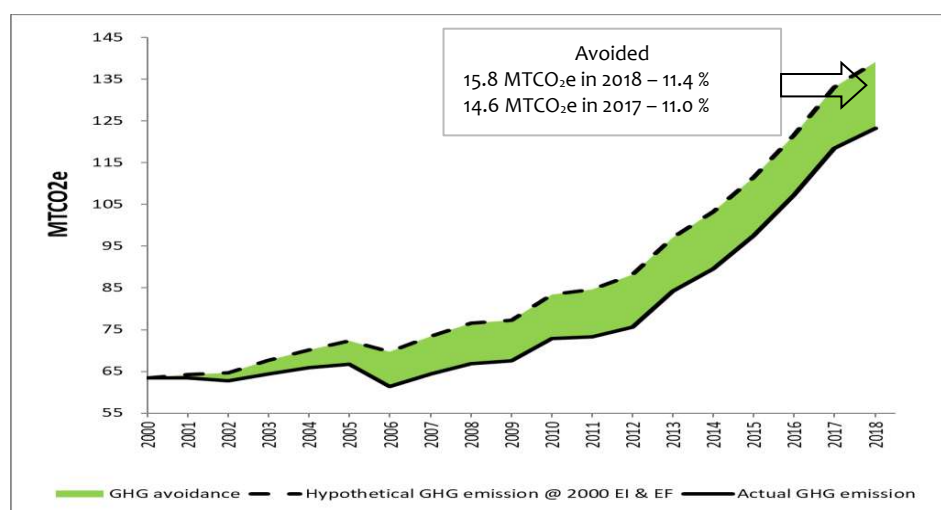
brought about by the continued increase in the utilization of oil in the transport sector and coal for power generation (Table 3).

Table 3. GHG INVENTORY FOR THE ENERGY SECTOR in FY 2017-2018, By Fuel

Sector	CO <sub>2</sub> Emission (MtCO <sub>2</sub> e)		Total NonCO <sub>2</sub> Emission (MtCO <sub>2</sub> e)		Total GHG Emission (MtCO <sub>2</sub> e)		Percent Change in Total GHG Emission (%)
	2017	2018	2017	2018	2017	2018	2017-2018
Oil	50.86	51.43	0.29	0.29	51.15	51.73	1.13
Coal	59.46	62.83	0.32	0.33	59.78	63.16	5.65
Gas	7.54	8.42	0.01	0.01	7.55	8.43	11.64
<b>Total</b>	<b>117.87</b>	<b>122.69</b>	<b>0.61</b>	<b>0.63</b>	<b>118.48</b>	<b>123.32</b>	<b>4.08</b>
<b>% Distribution</b>							<b>Change in Distribution</b>
Oil	43.15	41.92	47.08	46.73	43.17	41.95	-1.22
Coal	50.45	51.21	51.74	52.00	50.45	51.22	0.76
Gas	6.40	6.86	1.18	1.28	6.37	6.84	0.46
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	

Figure 17 and Table 4 show the avoidance vis-a-vis mitigation measures in the energy sector. For 2018, the combined impact of the demand-side mitigation measures, i.e., efficient use of fossil fuel and electricity, biofuels blend and natural gas contributed 11.0 MtCO<sub>2</sub>e net GHG reductions, bringing down the GHG emission level by 7.9 percent from the total hypothetical GHG emission (actual plus total avoidance). The fuel diversification in power generation through the use of renewables and natural gas contributed 3.5 percent (of the hypothetical GHG emission) further reduction in GHG emission during the same period. With the above-stated mitigation measures, the energy sector has avoided a total of 15.8 MtCO<sub>2</sub>e or 11.4 percent GHG emission reduction in 2018. This level translates to an 8.6 percent improvement from avoidance level of 14.6 MtCO<sub>2</sub>e in 2017.

Figure 17. ACTUAL GHG EMISSION, GHG EMISSION AVOIDANCE and HYPOTHETICAL GHG EMISSION, 2000-2018



Note: Hypothetical GHG Emission is equivalent to Actual GHG Emission plus GHG Emission Avoidance; GHG Base year is CY 2000 GHG Emission Level



**Table 4. CO<sub>2</sub> AVOIDANCE FROM THE MITIGATION MEASURES, ktCO<sub>2</sub>e**

GHG Reduction Measures	2017	Reduction Impact* %	2018	Reduction Impact* %	% Change 2017-2018
<b>Demand-side</b>	<b>10,117.14</b>	<b>7.60</b>	<b>11,031.39</b>	<b>7.93</b>	<b>9.04</b>
Efficiency in Electricity Consumption (EEC)	3,076.50	2.31	3,120.95	2.24	1.44
Efficiency in Fossil Fuel Consumption (EEF)	5,363.52	4.03	6,182.36	4.44	15.27
Biofuel	1,677.12	1.26	1,728.07	1.24	3.04
<b>Supply-side</b>					
Fuel Diversification in Power Generation @ 2000 GDP & EF*	4,477.37	3.36	4,815.72	3.46	7.56
<b>Total Avoidance (Demand + Supply - EEC)</b>	<b>14,594.52</b>	<b>10.97</b>	<b>15,847.10</b>	<b>11.39</b>	<b>8.58</b>
Actual GHG Emission	118,482.19		123,317.65		4.08
Hypothetical GHG Emission (Actual + Total Avoidance)	133,076.71		139,164.76		

\*Note: Refers to the percent reduced emission (Total Avoidance / Hypothetical GHG Emission x 100)

## D. ENERGY – ECONOMY AND ENVIRONMENTAL INDICATORS<sup>20</sup>

*The Services sector, including the energy-intensive Transport sector, continue to drive the country's economic growth.*

The country's total economic output, measured in terms of real gross domestic product (GDP), posted a slower growth of 6.2 percent in 2018 vis-à-vis 6.7 percent in 2017 as prices of basic commodities significantly increased due to new or higher excise taxes on consumption and food supply concerns. The Services sector,<sup>21</sup> with a 57.8 percent share of real GDP, remains the major contributor to GDP growth. Despite the slightly weakened performance of domestic trade and other services sub sectors, including banks, insurance and real estate, the sector's aggregate value-added managed to sustain its 6.8 percent in 2018 buoyed by the double-digit growth in government services.

Growth in the Industry sector, with a share of 34.1 percent of GDP, exhibited a slower 6.7 percent growth as a result of the slump in manufacturing output despite the robust 14.9 percent expansion in the construction sub sector. The Agriculture sector, which had the least contribution to GDP at 8.1 percent share, posted a sluggish 0.9 percent increase in gross value added (GVA) as the production of major crops and the fisheries sub sectors contracted during the same period. On the demand side, the slowdown in consumer spending due to inflation was compensated by increased government spending, particularly on infrastructure, and higher capital investments on durable equipment and intellectual property products (primarily on software and knowledge materials).

### 1. ENERGY INTENSITY

The country's economy-wide energy intensity level reached 6.4 tonnes of oil equivalent per million pesos of real GDP (TOE/MPhP) in 2018, lower by 3.4 percent than the 6.7 TOE/MPhP in 2017. Similarly, oil intensity dropped by 5.0 percent to 1.7 barrel per PhP100,000 (bbl/100k PhP), while electricity intensity was 0.5 percent lower at 10.8 watt-hour per peso (Wh/PhP). Reduction in the

*Improving efforts in energy efficiency across all economic sectors contributed to the 3.4 percent reduction in energy intensity to 6.4 tonnes of oil equivalent per million pesos of real GDP in 2018.*

<sup>20</sup> GDP figures as based on the PSA-NSCB's National Accounts of the Philippines (NAP), as of April 2018, 2000-based series

<sup>21</sup> In the PSA's National Accounts, Services includes the Transportation sub-sector

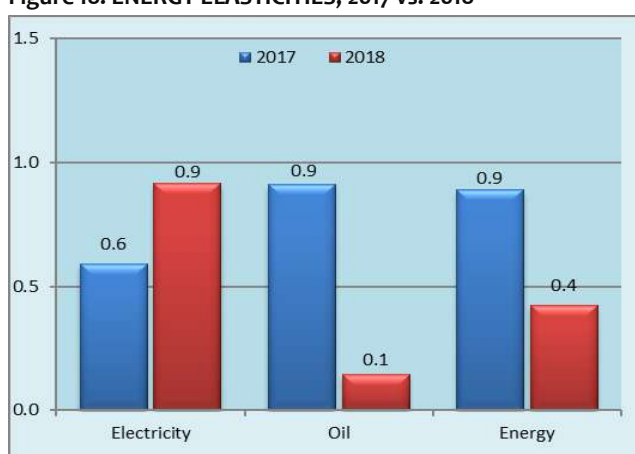
country's energy intensity can be attributed to improving efforts in energy efficiency across all economic sectors.

All sectors registered a decline in their respective energy intensities. The industry sector's energy intensity dropped by 6.11 percent to 1.8 TOE/MPhp in 2018 as the reduced production output, particularly in the manufacturing sub sector, translated to less energy consumed. Likewise, the agriculture sector level of energy intensity went down by 9.9 percent, albeit being the lowest at 0.1 TOE/MPhp, as the sector's energy consumption for crop production and fisheries decreased. The services sector posted an energy intensity level of 2.6 TOE/MPhp, a slight reduction of 1.8 percent than its year-ago level from efficiency gains that slowed down the energy consumption of commercial establishments in 2018. Meanwhile, household energy intensity also went down by 2.4 percent to 1.9 TOE/MPhp during the same year.

## 2. ENERGY ELASTICITY

Energy elasticity with reference to GDP is the percentage change in energy demand<sup>22</sup> for every percentage change in GDP. In 2018, energy-to-GDP elasticity was reported at 0.4, while oil consumption to GDP elasticity registered a 0.1 elasticity. Both posted lower elasticity from 2017 levels indicating that the volume of overall energy consumption (and oil consumption) became less responsive to economic output, that is higher growth in GDP translated to lower growth in energy consumption. On electricity, higher elasticity of 0.9 was registered, which implied that more electricity was utilized with respect to economic output (Figure 18).

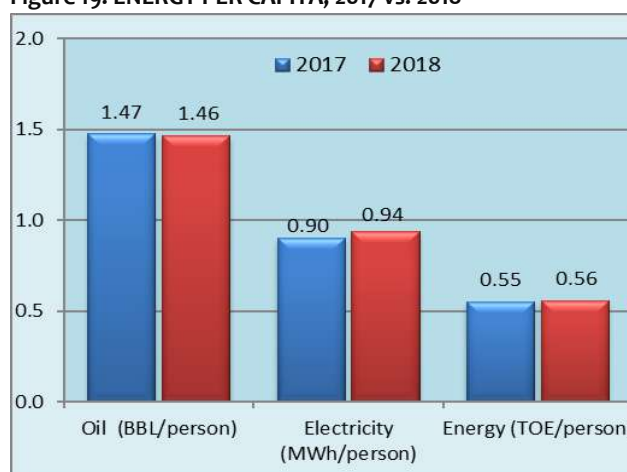
Figure 18. ENERGY ELASTICITIES, 2017 vs. 2018



## 3. ENERGY PER CAPITA

Energy per capita level was only up by 1.0 percent to 0.56 TOE/person in 2018 from last year's 0.55 TOE/person. Electricity per capita posted 4.1 percent growth from the previous year's level to reach 936 kWh/person, while oil per capita registered 1.46 barrel/person, but 0.7 percent lower than its 2017 level. Improved energy and electricity per capita levels in 2018 reflected increased access to energy services due to the extensive efforts of the government and stakeholders in the energy sector. The slight drop in oil per capita can be attributed to the slower consumption caused by increasing domestic oil prices during the year (Figure 19).

Figure 19. ENERGY PER CAPITA, 2017 vs. 2018



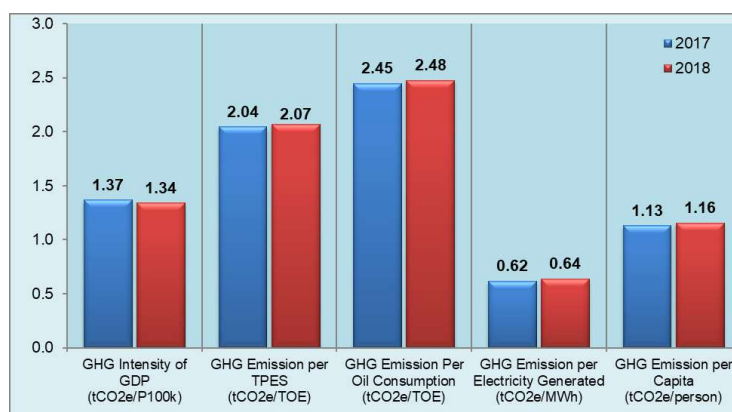
<sup>22</sup> TPED or total primary energy demand. Energy elasticity measures the responsiveness of TPED to a change in GDP.

## 4. GHG EMISSION

For 2018, total GHG emission for every PhP 100,000 of GDP stood at 1.34 tons of CO<sub>2</sub> equivalent (tCO<sub>2</sub>e), 2.0 percent lower than the previous year's level of 1.37 tCO<sub>2</sub>e (Figure 20). Tapered activities of all end-use sectors required less energy, particularly the industry sector, led to a decrease in aggregate GHG emission levels by 14.5 percent during the period in review.

With fossil fuels' 62 percent share in the energy mix, the GHG emission per TPES was 2.07 tCO<sub>2</sub>e/TOE, 1.2 percent more than its 2017 level of 2.04 tCO<sub>2</sub>e/TOE, while GHG emission per TOE of oil consumption was registered at 2.48 tCO<sub>2</sub>e in 2018. As generation output of coal-fired power plants increased vis-à-vis output from renewable energy power plants in 2018, GHG emission per megawatt-hr (MWh) of electricity generation went up by 3.6 percent to 0.64 tCO<sub>2</sub>e in the same period. Given the trend in fossil fuel levels, GHG per capita reflected a 2.7 percent increase, which stood at 1.16 tCO<sub>2</sub>e/person in 2018 from 1.13 tCO<sub>2</sub>e/person a year ago.

Figure 20. ENVIRONMENTAL EMISSION INDICATORS, 2017 vs. 2018



## E. LEAST COST TO CONSUMERS

### 1. ASSESSMENT OF BASIC ENERGY SERVICES

#### i. Gasoline and Diesel

Gasoline and diesel are the most widely used oil products, accounting for 13.2 percent and 26.0 percent, respectively, of the country's TFEC in 2018. These fuels are primarily utilized for transport, while other sectors consume them as fuel for production machineries and generators, among others.

The TRAIN Law or of the Republic Act No. 10963 brings new excise tax schemes that also affected oil-based products. Diesel, previously with no excise tax, was imposed with Php2.50/liter,<sup>23</sup> while gasoline with Php7.00/liter<sup>24</sup> for the first tranche effective 01 January 2018. These new excise taxes pushed up domestic pump prices of gasoline and diesel by as much as Php 11.92/liter for gasoline and Php 14.91/liter for diesel in June 2018 (Table 5).

Table 5. INCREASES IN THE MONTHLY AVERAGE PUMP PRICES OF GASOLINE AND DIESEL (PhP/Liter), 2017 vs. 2018

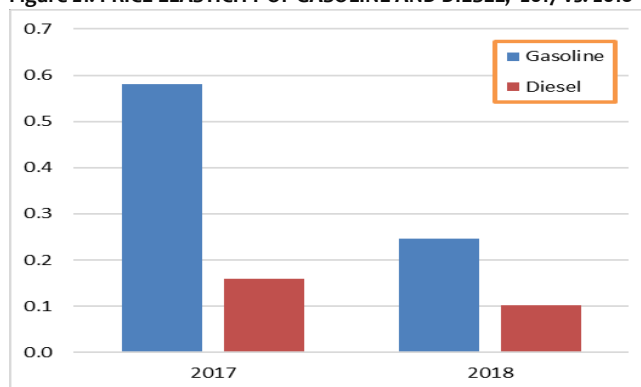
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gasoline	3.57	4.78	6.80	9.50	11.59	11.92	11.30	10.70	11.35	12.91	6.47	1.32
Diesel	8.09	9.86	9.96	11.28	13.08	14.91	13.84	11.87	12.83	13.83	8.76	2.19

Despite price hikes, consumption of gasoline and diesel was still higher by 3.0 percent and 3.5 percent, respectively, in 2018. These trends point to inelasticity demand of gasoline and diesel against price (Figure 21), which means that consumption of these fuels do not respond

<sup>23</sup> PhP 4.50/liter for second tranche effective 01 January 2019, and PhP 6.00 for the third and last tranche effective 01 January 2020.

<sup>24</sup> PhP 9.00/liter for for second tranche and PhP 10.00 for the third and last tranche.

Figure 21. PRICE ELASTICITY OF GASOLINE AND DIESEL, 2017 vs. 2018



proportionately to changes in prices since they have no direct substitutes. This is particularly true for transportation and other grass-roots level groups (farmers, etc.).

Domestic pump prices of gasoline and diesel have fuel cost components, namely import cost and domestic biofuels cost. Import cost, also called peso landed cost (PLC), is pegged to the Mean of Platts Singapore (MOPS) for

gasoline, diesel and imported ethanol. Fluctuations in peso-dollar exchange rates as well as in the Dubai benchmark price of crude oil are likely to impact import costs. Local biofuels costs follow the pricing index set by the Sugar Regulatory Administration (SRA) and prevailing local CME prices, and is dictated by feedstock availability. The existing blend schedule is 10.0 percent ethanol for gasoline and 2.0 percent CME for diesel. The tax costs include the expanded Value Added Tax (e-VAT) or final goods tax, currently at 12.0 percent, and the new excise taxes as discussed above. Completing the cost components are industry take and other costs.

Figure 22. COST COMPONENTS (% SHARE) FOR GASOLINE AND DIESEL, 2017 vs. 2018

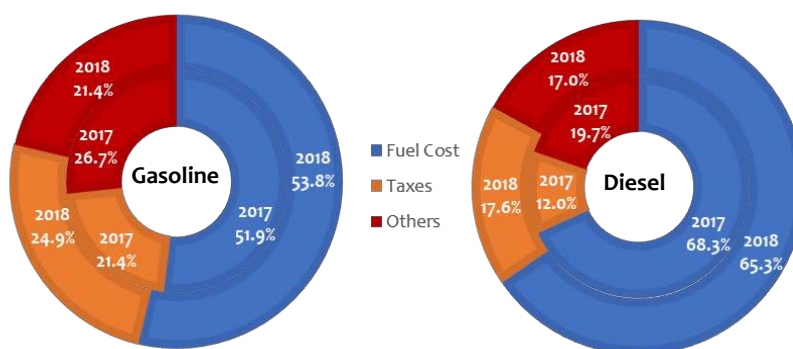


Figure 22 shows the average shares of these cost components based on weekly pump prices of gasoline and diesel in 2017 and 2018. On the average, fuel costs accounted for more than 50.0 – 60.0 percent of the pump prices. For diesel, the fuel cost was around two-thirds of its pump price as compared with gasoline since its global prices are more costly due to the higher cost of production.

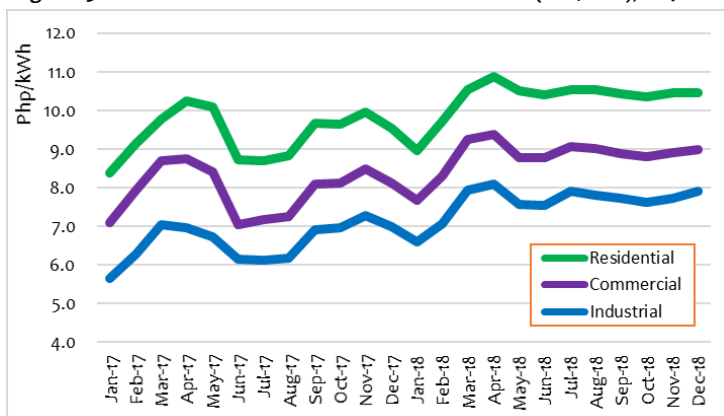
The share of taxes in pump price increased by around 5.0 percentage points between 2017 and 2018, with gasoline having higher tax than diesel under the TRAIN Law. With an increase in taxes, other costs share declined for both fuels in 2018. It also noted that the share of other costs for gasoline tends to be higher than that of diesel since the latter has a lower mark-up owing to its use for mass transportation and in other sectors that directly impact the price of basic commodities.

ii. **Electricity**

Electricity accounted for 19.9 percent of the country’s TFEC in 2018. As electricity is widely consumed, any increase in electricity rates affect the consumers. Monthly electricity power rates for January 2017 to December 2018 are shown in Figure 23.

On the average, electricity rates stood at PhP 7.12/kWh for the industrial customer, while commercial and residential class rates at PhP 8.38/kWh and PhP 9.85/kWh, respectively. Notably, higher electricity rates in March to May or during the summer season in 2017 and 2018 were associated with high usage of electricity for cooling due to high temperature and humidity resulting in increased peak demand.<sup>25</sup>

Figure 23. MONTHLY ELECTRICITY RATES PER CUSTOMER (PhP/kWh), 2017- 2018



The industrial class rate is the cheapest among customer classes due to lower distribution cost since customers can be supplied with a larger amount of electricity using high voltage lines or the sub-transmission asset (138 kilovolt/kV or 69 kV line) for large industrial customers, making delivery of electricity cheaper. In the case of small industrial customers, commercial and residential, different voltage levels are required, from high voltage transmission and distribution lines (138 kV or 69 kV) down to primary level of 13.8 kV (commercial and small industry customer) and low voltage or secondary level of 220 volt (residential). Further, the distribution utilities (DUs) need to install electrical meter and other attendant electrical wirings per household connection, which necessitate more manpower, time and effort to deliver the services.

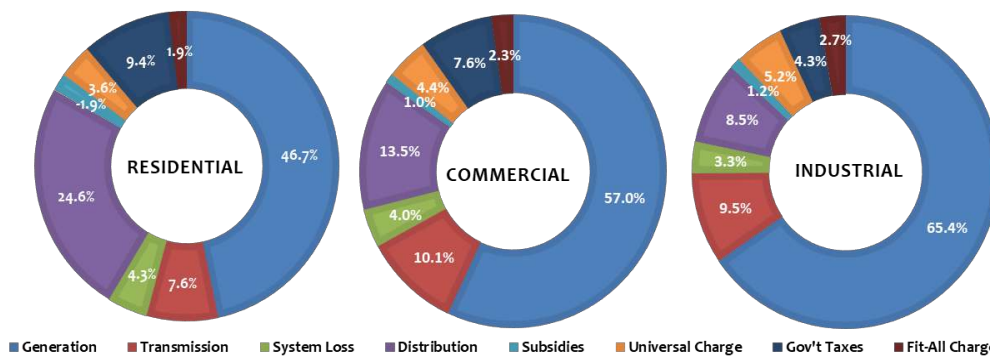
Manila Electric Company (Meralco), the largest private sector distribution utility company in the Philippines which covers much of Luzon, servicing 36 cities and 75 municipalities, charges its customers based on the above customer rate classification. The approved rate schedule set by the Energy Regulatory Commission (ERC) is unbundled showing the cost components as follows:

- *Generation charge* covers the biggest share in the electricity bill; it is a pass-through charge which means the money goes straight to the power suppliers where the distribution utility sourced its power;
- *Transmission charge* is the cost that goes to National Grid Corporation of the Philippines (NGCP) for transporting power from generator to the substations;
- *Distribution charge* goes to the distribution utility for the delivery of power to the customers;
- *Government taxes* comprise value-added tax, energy tax, and local franchise tax; and,
- *Others* include feed-in-tariff allowance, subsidies, system loss and universal charge.

Figure 24 shows the average share of each cost component of unbundled rate per customer of the Meralco franchise for 2017 and 2018. For the *Residential classification*, generation component was about 45.0 percent of the electricity rate followed by distribution with 25.0 percent, while government taxes and transmission charges were at 9.4 percent and 7.6 percent, respectively.

<sup>25</sup> During peak demand, flexible generation plants such as oil and other peaking plants with high generation costs are used to supply electricity.

Figure 24. AVERAGE SHARE (%) OF COST COMPONENTS OF THE ELECTRICITY RATE PER CUSTOMER, 2017-2018



Under *Commercial* classification, the average share of generation charge was at 57.0 percent of the electricity rate. The distribution component was less than 15 percent, while the transmission component was at 10.0 percent. In *Industrial* classification, the generation charge was two-thirds of the electricity rate, on average, but the share of distribution component was lower at 8.5 percent compared with residential and commercial classifications. Transmission component was at almost the same level as in commercial classification with 9.5 percent share of the electricity rate.

The generation and distribution charges accounted for the biggest chunk of the electricity rate with an aggregate share of almost three-fourths of the bill, on average, as shown in Table 6. The industrial class' generation charge got the highest share in its bill at 63.9 percent (2017) and 66.6 percent (2018) as compared with commercial and residential customers. Transmission cost of industrial customers was higher than distribution cost as sub-transmission assets were utilized more for large industries.

Table 6. COMPARATIVE COST COMPONENTS BY CUSTOMER CLASSIFICATION (Percent), 2017 vs. 2018

Cost Components	Residential		Commercial		Industrial	
	2017	2018	2017	2018	2017	2018
Generation	47.3	49.5	55.9	57.8	63.9	66.6
Transmission	8.4	7.5	10.7	9.5	10.4	8.8
System Loss	4.4	4.5	3.9	4.0	3.3	3.3
Distribution	26.9	24.4	14.4	12.9	9.3	7.8
Subsidies*	-2.0	-1.9	1.0	1.0	1.2	1.2
Universal Charge	3.9	3.7	4.6	4.3	5.4	5.0
Fit-All Charge	1.7	2.2	2.0	2.6	2.4	3.0
Government Tax	9.5	10.1	7.4	7.8	4.2	4.4

\*Residential customers consuming 100 kWh or less per month.

The residential class displayed the highest cost on distribution for using more distribution facilities and manpower services than the other customer classes, about 27.0 percent in 2017 and 24.4 percent in 2018 of the electricity bill. And since residential customers are connected to lower voltage, losses are high than the large industrial customers. Electricity losses are inversely proportional to the voltage level of the line, such that the high voltage lines have lower losses compared with lower voltage lines carrying the same amount of power<sup>26</sup>. Further, electricity passes to longer transmission and distribution lines that result in more losses aside from the cases of pilferage by some customers.

<sup>26</sup> <https://www.energy.gov/sites/prod/files/2017/01/f34/Electricity%20Distribution%20System%20Baseline%20Report.pdf>

A subsidy is levied as part of the electricity rate, of which the fund is allocated to subsidize residential customers consuming 100 kWh or less per month. The subsidy component in the residential electricity rate is always negative reflecting the amount of subsidy already given to such type of residential customers, which stood at almost 2.0 percent of the residential class' electricity bill and 1.0 percent for commercial and industrial classes, on average.

A Universal Charge (UC) has been included in the electricity bills of all customer classes, accounting for an average share of 4.0-5.0 percent. The UC collected from sales of electricity is used for, among others, missionary electrification, environmental support (specifically for watershed rehabilitation and management), and, to pay for the stranded debts and stranded contract costs of the National Power Corporation (NPC). The UC for missionary electrification is allotted for the electrification of remote and unviable areas, as well as areas not connected to the grid.

The Feed-in-Tariff Allowance (Fit-All) in the electricity rate is an additional tariff paid for power generation from renewables imposed on consumers of electricity to help renewable energy developers recover their costs. In term of government tax, the industrial class received the lowest tax level with an average of 4.3 percent of the electricity bill, while the residential class levied with highest tax.

Table 7 shows the schedule of new excise tax on fuels used for power generation under the TRAIN Law. From a previously zero excise tax each for diesel and fuel oil, a PhP 2.50 per liter was imposed effective 01 January 2018, and increased to PhP 4.50 in 2019 and PhP 6.0 in 2020. However, the tax shall be suspended when the average Dubai crude oil price based on Mean of Platts Singapore (MOPS) for three months prior to the scheduled increase breaches USD 80.0/barrel. Meanwhile, tax on domestic and imported coal per metric ton went up to PhP 50.0 in 2018, PhP 100 in 2019 and PhP 150.0 in 2020.

**Table 7. EXCISE TAXES ON FUELS USED FOR POWER GENERATION**

Fuels		RA 9337 <sup>27</sup>	RA 10963 <sup>28</sup>		
		2017	2018	2019	2020
<b>Diesel</b>	PhP/Liter	-	2.5	4.5	6.0
<b>Bunker Fuel Oil</b>	PhP/Liter	-	2.5	4.5	6.0
<b>Coal</b>	PhP/Metric Ton	10.0	50.0	100.0	150.0

## 2. POLICY TOWARDS UNBUNDLING

The unbundling policy in electricity tariff is one of the successful missions implemented under Section 36 of RA 9136 or the Electric Power Industry Reform Act (EPIRA) of 2001 which took effect last June 26, 2001. It aims to promote transparency for the consumers to know the components of the electricity rates and paves the way for greater accountability in the power industry. It also provides information for the decision-maker to evaluate which of the components need to be reduced to achieve a lower cost.

<sup>27</sup> An Act Amending Sections 27, 28, 34, 106, 107, 108, 109, 110, 111, 112, 113, 114, 116, 117, 119, 121, 148, 151, 236, 237 And 288 Of The National Internal Revenue Code Of 1997, As Amended, And For Other Purposes, Approved May 24, 2005

<sup>28</sup> An Act Amending Sections 5, 6, 24, 25, 27, 31, 32, 33, 34, 51, 52, 56, 57, 58, 74, 79, 84, 86, 90, 91, 97, 99, 100, 101, 106, 107, 108, 109, 110, 112, 114, 116, 127, 128, 129, 145, 148, 149, 151, 155, 171, 174, 175, 177, 178, 179, 180, 181, 182, 183, 186, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 232, 236, 237, 249, 254, 264, 269, and 288; Creating New Sections 51-A, 148-A, 150-A, 150-B, 237-A, 264-A, 264-B, and 265-A; and Repealing Sections 35, 62, And 89; All Under RA 8424, Otherwise Known as the National Internal Revenue Code of 1997, as Amended, and for Other Purposes. Approved 19December 2017.

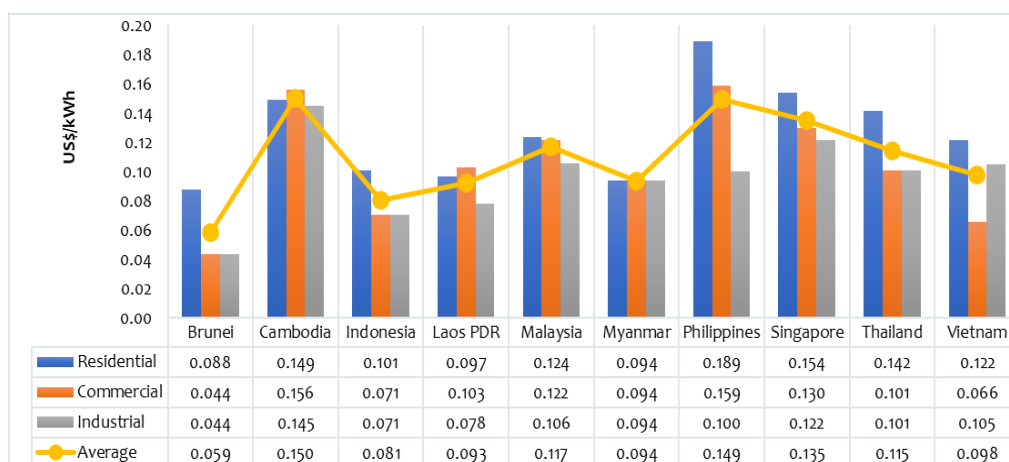
Oil prices that have always been under the scrutiny of the consumer may adopt the same policy to address the clamor of the consumer for oil price hikes. Even in a deregulated scheme, the Department of Energy (DOE) underscores the need for oil companies to unbundle fuel prices by indicating in detail how price adjustments are formulated and computed for greater transparency and to avoid anti-competitive behavior among the players.

### 3. COMPARATIVE ELECTRICITY RATES AMONG ASEAN COUNTRIES

Among the ASEAN Member States (AMS), the Philippines has the second-highest average electricity rate in the region next to Cambodia<sup>29</sup>. On a per customer classification, the Philippines charges the highest electricity rate both for the residential and commercial classes attributed to the absence of subsidy compared with other AMS (Figure 25). The Philippines electricity rates cover government taxes and other fees as presented in Figure 24 and Table 6.

With highly subsidized energy prices for over 20 years, Brunei Darussalam has the lowest electricity tariff in the region. The price of gas delivered to the Department of Electrical Department (DES) and Berakas Power Company (BPC) gas power stations are lower than the market price. Brunei is energy self-sufficient and a net energy exporter with its vast domestically available oil and natural gas. Other AMS providing subsidies are Indonesia, Malaysia and Thailand. Malaysia and Indonesia are also energy net exporters. Malaysia has abundant natural gas and crude oil resources, while Indonesia is a net exporter of coal. Thailand relies on energy imports, accounting for more than half of its energy supply.

Figure 25. ELECTRICITY RATES IN ASEAN COUNTRIES in USD/kWh, August 2020



One of the factors that makes the electricity tariff in the Philippines higher than the other AMS is the imposition of the value-added tax (VAT), which is now at 12.0 percent. Based on the study conducted by the Economic Research Institute for ASEAN and East Asia (ERIA) titled “Comparative Analysis of Power Prices in the Philippines and Selected ASEAN Countries<sup>30</sup>,” the country has the highest VAT imposed on electricity than Indonesia, Malaysia and Thailand. Malaysia levies the lowest VAT at 6.0 percent introduced in April 2015, a reduction from previously 8.0 percent VAT. Thailand enforces a 7.0 VAT, which was supposed to be increased to 10.0 percent in October 2016, but the government did not push through with the proposed hike. Indonesia applies a 10.0 VAT, a

<sup>29</sup> Sources: Brunei Darussalam (BN) – Department of Electrical Services, Effective since January 2012; Cambodia (CM)- Electricity Authority of Cambodia (EAC), Effective since January 2019; Indonesia (ID) – Perusahaan Listrik Negara, Effective until March 2019; Laos PDR (LAO) – Electricite Du Laos, Effective since June 2018; Malaysia (MY) – Tenaga Nasional Berhad, Effective since April 2018; Myanmar (MM)- Ministry of Electricity and Energy, Effective since July 2019; Philippines (PH) – MERALCO, Effective August 2020; Singapore (SG) – Singapore Power, Effective until Sep. 2020, updated quarterly; Thailand (TH)– Metropolitan Electricity Authority, Effective since November 2015; Vietnam (VN) – Electricity of Vietnam – Effective since March 2019

<sup>30</sup> The Study covers Indonesia, Malaysia and Thailand. It was completed in June 2018.



raise from 2.0 percent. The cost of capital (weighted average cost of capital or WACC) in the Philippines is also a contributing factor, which is 3.0-8.0 percent higher than the others. Lower thermal efficiency, specifically for coal power plants, likewise adds to the cost of electricity in the Philippines.

According to the ERIA study, in spite of the efforts to lower electricity tariff in the Philippines, the tariff level remains high. The cost structure of the country’s power distribution/retail companies shows that the power generation comprises the largest portion of the electricity cost at around 50.0 percent of the electricity bill. And to improve the standard of living and industry competitiveness, further cost reduction, particularly in the power generation sector, is needed by lowering the WACC and improving thermal efficiency of power plants. The regulatory frameworks<sup>31</sup> now in place address the concern on WACC with streamlined and reduced processes in securing permits and licenses for the development of energy projects, thus reducing the transaction costs. The thermal efficiency of the power plants is being dealt with through the implementation of the Performance Assessment and Audit (PAA) to evaluate the performance and efficiency of power facilities.

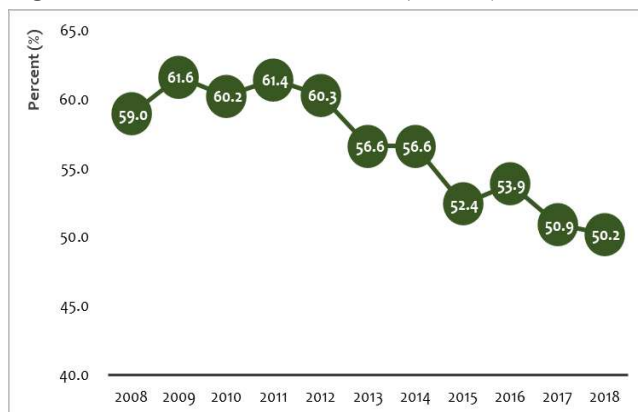
#### 4. STRATEGIC DIRECTIONS

##### i. Energy Self-Sufficiency

The Philippines is known to be heavily dependent on imported fossil fuels, particularly coal and oil. Mindful of the resulting impact of continued reliance on energy imports, the DOE pursued the attainment of a sustainable 60.0 percent energy self-sufficiency beyond 2010 as outlined in its 2007-2014 Philippine Energy Plan (PEP) Update. The achievement of such target was anchored on the effective implementation of plans and

programs that were aimed at: (a) accelerating the exploration, development and utilization of indigenous energy resources; (b) intensifying renewable energy resource development; (c) increasing the use of alternative fuels; and, (d) enhancing energy efficiency and conservation.<sup>32</sup> Figure 26 shows the trend of energy self-sufficiency, or the ratio of indigenous energy resources to total energy supply, for the last 10 years.

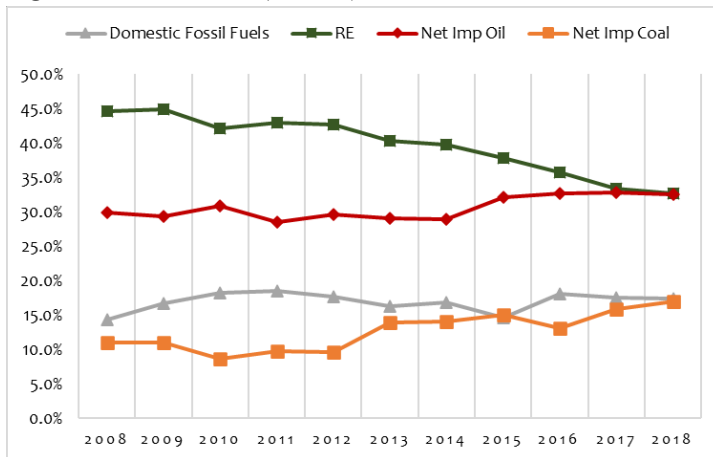
Figure 26. ENERGY SELF-SUFFICIENCY (Percent) , 2008 - 2018



<sup>31</sup> Energy Virtual One Stop Shop Act or EVOSS, Executive Order 30, Ease of Doing Business Act, Administrative Order 30, and the LGU Energy Code. Please see Chapter II of this Plan.

<sup>32</sup> 2007-2014 Philippine Energy Plan (PEP) Update

Figure 27. FUEL SHARES (Percent) TO TPES, 2008- 2018



From 2009 to 2012, the implementation of the above-stated programs resulted in sustained energy self-sufficiency of more than 60 percent. During this period, the share of renewables to the TPES ranged from 43.0 percent to 45.0 percent, combined with increasing levels of indigenous fossil fuels (oil, coal and natural gas) (Figure 27). After 2012, renewable share was on a downtrend, as levels registered dismal growths. This was attributable to the declining utilization of biomass for end-use applications, intermittency of geothermal and hydro (prone to shifts in climate/temperatures), the continuing reliance on coal power plants as baseload for power generation, which utilized higher coal grades being imported from Indonesia, and increasing use of imported oil for the transport sector. Coupled with the steady levels of domestic resources, declining shares of renewables contributed to the further reduction in energy self-sufficiency. In 2018, energy self-sufficiency stood at 50.2 percent, 10.0 percentage points away from the target set forth in 2007. The indigenous fossil fuels were not able to compensate for the decline in renewables that led to the reduction in self-sufficiency, hence, an increased energy importation.

## ii. Job Creation

Under the **AmBisyon Natin 2040** and the Philippine Development Plan 2017-2020, about 1.3 million to 1.5 million jobs are expected to be created every year for two decades. The energy sector is one of the sectors that can potentially contribute to job generation with oil and electricity remaining to be the most utilized fuels to support the growing economy.

In 2018, electricity demand registered a 20.7 percent share to the TFEC, while power supply generated a total of 99.8 TWh. The total installed generating capacity in 2018 reached 23,815 MW, of which 1,087 MW capacities were new additions from the 2017 installed capacity of 22,728.

Table 8. ADDITIONAL JOBS GENERATED IN THE POWER SECTOR, 2018

Type of Plant	Estimate (Job/MW)		Added Capacity in 2018	Additional Jobs Generated		
	Construction <sup>1</sup>	Operations and Maintenance <sup>2</sup>		Construction <sup>3</sup>	Operations and Maintenance	Total
Coal	2.50	0.65	795	1,988	517	2,504
Oil/Gas	2.73	0.13	145	395	19	414
Geothermal	24.55	1.85	28	687	52	739
Hydropower	8.33	0.55	74	617	41	657
Solar	10.83	1.70	11	119	19	138
Wind	8.00	1.93	-	-	-	-
Biomass	9.80	7.75	34	333	264	597
<b>Total</b>			<b>1,087</b>	<b>4,139</b>	<b>910</b>	<b>5,050</b>

<sup>1</sup>Multiplier based on EPNS Submission except for Biomass-fired Plant. Estimate based on 2013 research study "The Contribution of the Power Generation Industry to Employment Generation" of EPPB

<sup>2</sup>Multiplier based on the 2013 EPPB study

<sup>3</sup>Construction period varies per plant technology

Among the power plant types, the coal-fired power plant is the most labor-intensive during the construction and installation period or requiring almost 2,000 manpower. Geothermal and hydroelectric power plants are those with the highest employment generated among the renewable power plants.

A total of 910 additional jobs were generated for the operations and maintenance of the power plants in 2018, the bulk of which were employed in coal plants. With the additional capacity of in 2018, the power sector contributed an estimated 5,050 additional jobs, about half was from coal-fired power plants (Table 8).

### iii. Investments

The DOE formulates the PEP 2018-2040 to support the government's **Ambisyon Natin 2040**. This vision represents a 25-year collective aspirations of the Filipinos especially those in the marginalized sector, for themselves and the country. That is, to have a more stable and comfortable lifestyle, and sense of security knowing that they can provide enough for their daily needs.

In support of this inclusive growth, the energy sector plays an important role in job creation by creating investment opportunities for the sector. The technology-neutral approach of the DOE opens the door to a diversity of options for the possible investors in the country. This in return can lead to an increase in job opportunities for the Filipinos.

### Renewable Energy

The renewable energy's target of 20,000 MW capacity by 2040 balances the energy mix for environmentally sustainable energy. This target will potentially offer green energy investment and green jobs for the country. To encourage prospective investors, the Renewable Energy Act of 2008 provides the following policy mechanisms:

- Renewable Portfolio Standard (RPS) for On-grid and Off-grid;
- Green Energy Option Program (GEOP);
- Competitive Renewable Energy Zones (CREZ);
- Renewable Energy Trust Fund (RETF);
- Omnibus Guidelines governing the awarding and administration of RE contracts and registration of RE developers;
- Renewable Energy Market (REM) Rules;
- Duty-Free importation and monitoring of the utilization of RE machinery
- Operating Permits to RE Suppliers under the GEOP
- Green Energy Auction Program (GEAP)

The promulgation of Energy Virtual One-Stop Shop (EVOSS) or RA 11234 and Executive Order (EO) 30, creating the Energy Investment Coordinating Council (EICC), intend to improve transparency and shorten the processing of the required permits/clearances/certificates for energy projects. With harmonized and streamlined regulatory procedure now in place, potential investors are encouraged to venture in energy projects in any of the energy sub sectors, thereby creating greater investment and job opportunities for the country.

## Alternative Fuels and Technologies (AFETs)

The utilization of Alternative Fuels and Technologies (AFETs) is widely supported due to its role in lessening carbon emission of the transport sector. As a result, investment opportunities flourish in this sector guided by the Alternative Fuels and Technologies Roadmap that prioritizes the use of electric vehicles (EVs), hybrid electric vehicles (HEVs), auto-LPG vehicles, and compressed natural gas (CNG) fed vehicles.

These AFETs have potential to generate investment and job opportunities with its extensive portfolio of innovations. From 2016-2019, the 14 firms engaged in EV manufacturing, assembly and importers provided an initial investment of nearly USD 11.3 million and generated around 1,000 job. The Electric Vehicles Association of the Philippines (EVAP) has envisioned to produce around 9,000 units of EVs from 2019 to 2021.

The policies that can further increase investment interests in the AFET include: providing an income tax holiday through the Omnibus Investments Code of 1987; modification of rates of import duty on parts, components and other accessories under EO 488; and, the TRAIN Law which provides excise tax exemption and discount to pure EVs and HEVs.

## Downstream Industry

The downstream oil industry reached a total of Php6,593.7 million from the expansion projects of import terminals in Regions 3 and 4A which translated to more than 300 jobs. New depots constructed in Pampanga and General Santos City in Mindanao and the transport facilities engaged in the distribution and hauling also poured in investment and job opportunities. The stable business environment in retail marketing likewise continues to bring in investments for the LPG industry.

To tap clean energy, investment opportunities are seen to grow in the downstream Natural Gas industry. Public-private partnerships of the government enables greater private sector participation. The approval of the development of the four Liquefied Natural Gas (LNG) Regasification Terminals requires a total investment of Php64,632 million that could generate more than 4,000 jobs for host communities in the country.

## Power Development

The steady increase in electricity demand driven by economic growth requires huge investment in the power sector. The transition of the power sector structure enables it to have more competitive supply markets as the opportunities were opened to the investors in financing power projects. Further, the transmission and distribution systems need to maintain efficiency and reliability of the power network to improve and ensure reliable service to the consumer.

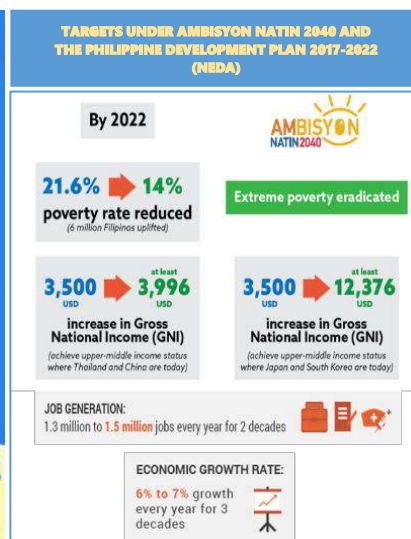
# Chapter II.

# ENERGY SUPPLY AND DEMAND OUTLOOK

## A. MACROECONOMIC AND ENERGY TARGETS

### 1. Macroeconomic Targets

The Energy Outlook considers growth targets aligned with the *Ambisyon Natin 2040* and the *Philippine Development Plan 2017-2022*. The country's gross domestic product (GDP) is expecting to reach its momentum at 8.4 percent expansion by 2030, and moving towards 7.4 percent growth by 2040. The Outlook also uses the population growth rate projections of the Philippine Statistics Authority (PSA), which assumes a 0.84 percent growth for 2035-2040.



The basis for the oil price assumptions is the *World Oil Outlook (WOO) 2016-2040* of the Organization of Petroleum Exporting Countries (OPEC), a proxy for international oil prices. OPEC expects crude oil prices to register at USD 80/barrel in 2020 to USD 123/barrel by 2030, and more than USD 160/barrel by 2040.

### 2. Energy Demand-Side and Production Targets

The Energy Outlook takes into account the targets and assumptions as shown in Table 9 for simulation of two (2) scenarios – the Reference Scenario (REF) or the Business-as-Usual and the Clean Energy Scenario (CES) as an alternative. The Outlook likewise incorporates the Asia-Pacific Economic Cooperation's (APEC) aspirational target to reduce aggregate energy intensity by 25.0 percent in 2030 to 45.0 percent by 2035 with 2005 as the base year period, as well as the ASEAN

Plan of Action for Energy Cooperation (APAEC) 2016-2025 target reduction in energy intensity of 20.0 percent by 2020 and 30.0 percent<sup>33</sup> by 2025.

Table 9. DEMAND AND SUPPLY TARGETS FOR ENERGY OUTLOOK 2018-2040

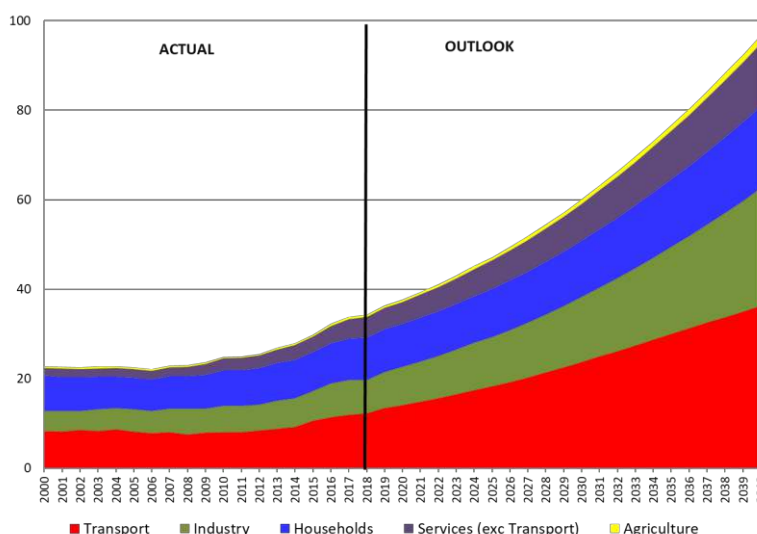
Scenarios	Assumptions	
	Reference Scenario (Business as Usual)	Clean Energy Scenario (Alternative Scenario)
<b>Energy Demand</b>	<ul style="list-style-type: none"> <li>Response to the requirements of the <i>Build, Build, Build infrastructure program</i> and <i>AmBisyon Natin 2040</i>.</li> <li>Maintain 2.0 percent biodiesel and 10.0 percent bioethanol until 2040.</li> </ul>	<ul style="list-style-type: none"> <li>Assumptions under the Reference Scenario, including the following:                             <ul style="list-style-type: none"> <li>✓ 10.0 percent penetration rate for electric vehicles for road transport (motorcycles, cars, jeepneys) by 2040;</li> <li>✓ 3.0 percent increase in aggregate natural gas consumption between 2018 and 2040; and,</li> <li>✓ 5.0 percent aggregate energy savings from oil and electricity by 2040.</li> </ul> </li> </ul>
<b>Energy Supply</b>	<ul style="list-style-type: none"> <li>Present development trends and strategies continue.</li> <li>Consider 6,300 MW committed and 33,200 MW indicative power projects as of December 2018.</li> <li>Increase renewable energy (RE) installed capacity to at least 20,000 MW by 2040.</li> <li>Consider the aspirational target of 35.0 percent share of renewables to the generation mix by 2030.</li> <li>Adopt 25.0 percent reserve margin.</li> <li>Assume 70.0 percent load factor for the total Philippines</li> </ul>	<ul style="list-style-type: none"> <li>Assumptions under the Reference Scenario, including the following:                             <ul style="list-style-type: none"> <li>✓ Highly-efficient power technologies;</li> <li>✓ 10,000 MW additional RE capacity by 2040; and,</li> <li>✓ 1,200 MW from other emerging technologies by 2035.</li> </ul> </li> </ul>

## B. TOTAL FINAL ENERGY CONSUMPTION

Total final energy consumption (TFEC) under the Reference Scenario increases at an average rate of 4.8 percent annually from its 2018 level of 34.3 million tons of oil equivalent (MTOE) to 96.7 MTOE in 2040 (Figure 28).

The transport sector remains the most energy-intensive sector with more than one-third (38.4 percent) share of the TFEC over the planning horizon. The Industry gets around a fourth (24.3 percent average share<sup>34</sup>) of the TFEC. Both sectors contribute significantly to the

Figure 28. TOTAL FINAL ENERGY CONSUMPTION, By Sector (MTOE), 2000-2040



<sup>33</sup> Based on APAEC Phase II (2021-2025), the energy intensity reduction target is set to 32.0-35.0 percent by 2025.

<sup>34</sup> For the Energy Outlook 2018-2040, **average share** refers to the average for 2018-2040

increase in the TFEC levels from 2018 to 2040. The household sector accounts for 21.9 percent average share of the TFEC, followed by the services<sup>35</sup> sector with a 13.7 percent share. The Agriculture sector continues to have the least share at 1.6 percent of the TFEC (Figure 29).

Modernization in the Agriculture sector pushes its energy requirement to exhibit the fastest growth at 6.6 percent a year. While the robust growth in the Industry sector, supported by the government programs to unlock the potential development of the country's manufacturing sector, triggers its energy use to increase by 5.9 percent annually in the planning period. As the business environment improves and contributes to the services sector's role as the main driver of the domestic economy expansion, its energy consumption posts a yearly increment of 5.1 percent. The transport and household sectors register average annual increments of 5.1 percent and 3.1 percent, respectively.

**How energy demand responds to the PDP 2017-2022 and AmBisyon Natin 2040 Policy Framework?**

Demand increases at an average rate of **4.8 percent annually from its 2018 level** of 34.3 MTOE to 96.7 MTOE in 2040.

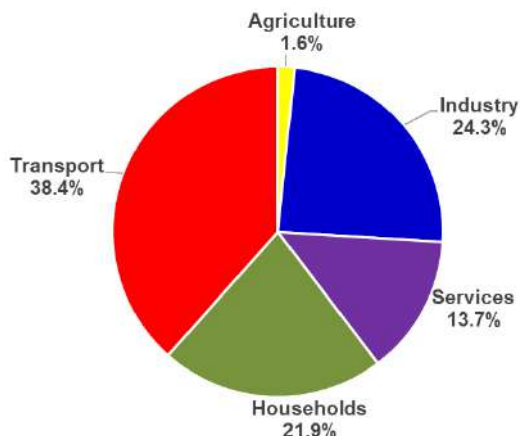
**Transport sector drives energy consumption**, representing more than one-third, followed by the industry and residential sectors.

**Oil and electricity are the most utilized fuel** as their demand levels increase to support the country's economic development goals

*If you want to live a happy life, tie it to a goal. Not to people or things.*

*-Albert Einstein*

Figure 29. TOTAL FINAL ENERGY CONSUMPTION, By Sector Shares (Percent), 2018-2040

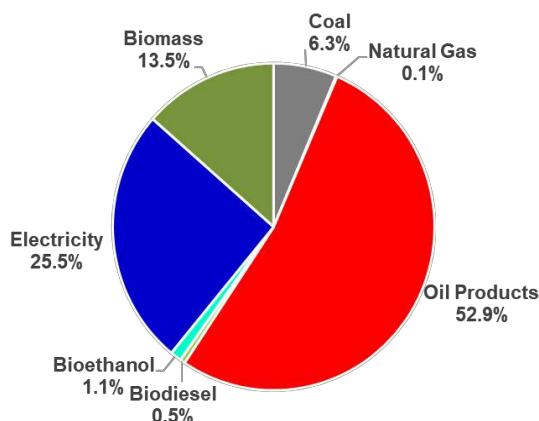


As the business environment improves and contributes to the services sector's role as the main driver of the domestic economy expansion, its energy consumption posts a yearly increment of 5.1 percent. The transport and household sectors register average annual increments of 5.1 percent and 3.1 percent, respectively.

**1. TOTAL FINAL ENERGY CONSUMPTION BY FUEL**

Oil products account for more than half (52.9 percent) of the TFEC (Figure 30). Notwithstanding the steady increase in oil prices in the international market, demand for oil products increases by an average of 5.2 percent per year between 2018 to 2040. A combined share of diesel and gasoline stands at 74.6 percent of the total oil demand. Oil products are primarily used for transport, as the sector accounts for more than two-thirds (69.6 percent) of the total oil demand for the entire planning period.

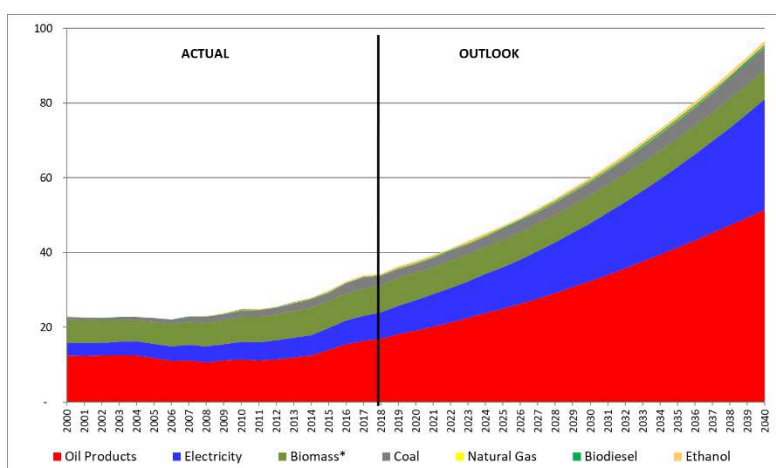
Figure 30. FINAL ENERGY CONSUMPTION, By Fuel Shares (Percent), Average for 2018-2040



<sup>35</sup> Excluding transportation

Next to oil products, electricity contributes an average share of 25.5 percent of the TFEC, while its demand increases by 6.7 percent annually (Figure 31). With the scheduled expansion plans of existing mass rail systems, electricity use in the transport sector reaches 302 kTOE in 2040, translating to an average annual increase of 17.3 percent from its 9 kTOE in 2018. The industry and residential sector constitute the largest portion of electricity demand with a combined average share of 67.1 percent across the planning period.

Figure 31. FINAL ENERGY CONSUMPTION, By Fuel (MTOE), 2000-2040



\*non-power applications

Improvement in standards of living coupled with a greater preference for energy-efficiency technologies as a result of rising income reduces the consumption of biomass<sup>36</sup> for end-use applications in the TFEC to sluggish growth of 0.3 percent between 2018 and 2040. However, it remains the third most consumed fuel next to oil and electricity with a 13.5 percent average share to the TFEC within the planning period. For household consumption, biomass for end-use application continues to figure in the demand mix as it reaches 4.9 MTOE in 2040, albeit declining at an average rate of 0.7 percent from its 2018 level of 5.7 MTOE. But there remains a significant biomass consumption in the sugar manufacturing sub sector, as well as in commercial establishments.

**Electricity registers the fastest growth rate at 6.7 percent per year – as demand from industries and households increases.**

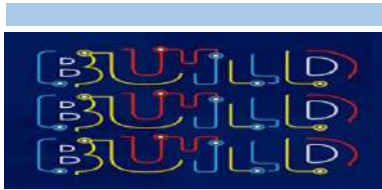
Coal consumption for end-use applications expands by 4.4 percent a year, with an average share of 6.3 percent of the TFEC. Its consumption rises from 2.4 MTOE in 2018 to 6.2 MTOE in 2040. Coal is the major fuel in the cement and basic metals industry – primary building materials for public and private construction projects.

Implementation of the mandated blend schedule for bioethanol and biodiesel pushes the total biofuels demand from 0.5 MTOE in 2018 to 1.1 MTOE in 2040. This translates to a 4.6 percent and 5.4 percent increase in the demand for biodiesel and bioethanol, respectively.

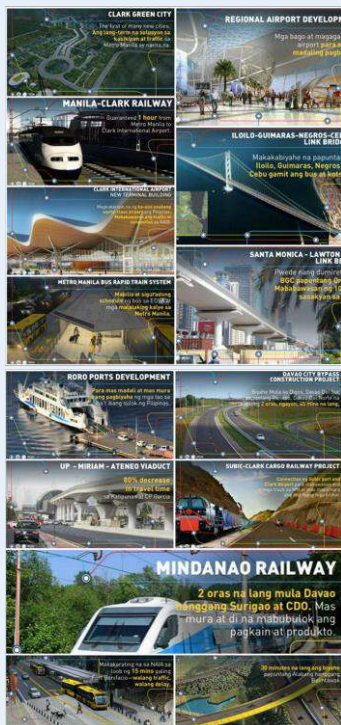
Consumption of natural gas for end-use applications grows measily at 0.4 percent a year, equivalent to 65 kTOE in 2040, as the industry sector only manages to sustain its demand across the planning period.

<sup>36</sup> Includes charcoal, fuelwood, rice hull, bagasse, agriculture and animal waste





The **Build Build Build Program** is envisioned to increase the productive capacity of the economy, create jobs, increase incomes, and strengthen the investment climate leading to sustained inclusive growth.



“We will make the next few years the **golden age of infrastructure in the Philippines** to enhance our mobility and connectivity, and thereby spur development growth”- **PRRD, SONA 2017**

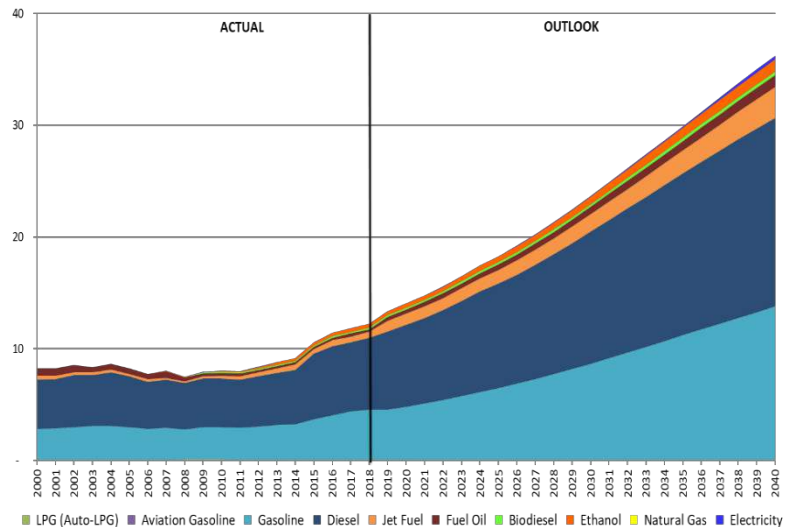
## 2. TOTAL FINAL ENERGY CONSUMPTION BY SECTOR

### a. Transport

The government’s Build, Build, Build Infrastructure Program plans to roll out a total of 75 flagship projects worth at least PhP 2.18 trillion by 2022. The country’s transport network will benefit from the construction of three (3) bus rapid transits, four (4) seaports, six (6) airports, nine (9) railways and 31 roads and bridges that would help bring down the costs of production, improve rural incomes, encourage countryside investments, make the movement of goods and people more efficient, and create more jobs .

These anticipated major upgrades in the road, railway and port systems increase the energy requirement of the transport sector with an annual rate of 5.1 percent to reach 36.2 MTOE in 2040, translating to 37.5 percent share of the TFC during the same year. The bulk of the sector’s energy demand is for road transport, as it accounts for about 80.0 percent of domestic traffic and 60.0 percent of freight traffic. Oil remains the sector’s primary fuel with a hefty share of 95.8 percent of the sector’s total energy requirement across the planning period.

Figure 32. TRANSPORT FINAL ENERGY CONSUMPTION, By Fuel (MTOE), 2000-2040



Aggressive market promotions and availability of flexible financing schemes together with rising incomes and the government’s Comprehensive Automotive Resurgence Strategy (CARS) will sustain vehicle sales over the planning horizon. These serve as the impetus behind the 5.2 percent and 4.5 percent average growth in gasoline and diesel demand, translating to an aggregate share of 86.0 percent of the sector’s total oil demand. Combined consumption for these major fuels rises to 30.6 MTOE in 2040 from 11.0 MTOE in 2018 (Figure 32).

The Department of Energy's (DOE) initiative for sustainability will drive the following trends in the utilization of alternative fuels for the transport sector within the planning horizon:

- *Biofuels demand* expands by an average rate of 5.2 percent between 2018 and 2040 due to the DOE's continuous monitoring of the strict compliance of the oil companies with the mandated biofuel blend. Bioethanol and biodiesel consumption grows by 5.4 percent and 4.6 percent per year, respectively, and displaces part of the consumption for both gasoline and diesel across the planning period.
- *Electricity demand* escalates to 302 kTOE by 2040 in line with the expansion plans of existing mass and light railway systems.



The Toyota Prius (shown in the picture) is a full hybrid electric automobile developed and manufactured by Toyota. Japan donated 45 units under its Non-Project Grant Aid to the Philippines for the procurement and delivery of next generation vehicles (i.e. hybrid vehicles, plug-in hybrid electric vehicles and electric vehicles) (Source: DOE)

Table 10. TRANSPORT FINAL ENERGY CONSUMPTION, By Fuel (MTOE)

Fuel Type	2018		2030		2040		AAGR* (%)
	Levels	% Shares	Levels	% Shares	Levels	% Shares	'18-'40
<b>Oil Products</b>	11.75	95.96	22.69	95.71	34.48	95.13	<b>5.01</b>
LPG (Auto-LPG)	0.01	0.08	0.02	0.09	0.01	0.03	0.62
Aviation Gasoline	0.00	0.04	0.02	0.08	0.03	0.09	9.15
Gasoline	4.50	36.77	8.62	36.37	13.73	37.89	5.20
Jet Fuel	0.58	4.72	1.58	6.67	2.78	7.67	7.40
Diesel	6.45	52.68	11.80	49.76	16.87	46.53	4.46
Fuel Oil	0.20	1.66	0.65	2.73	1.06	2.92	7.80
<b>Biodiesel</b>	<b>0.13</b>	<b>1.03</b>	<b>0.24</b>	<b>1.01</b>	<b>0.34</b>	<b>0.95</b>	<b>4.64</b>
<b>Ethanol</b>	<b>0.35</b>	<b>2.86</b>	<b>0.70</b>	<b>2.93</b>	<b>1.11</b>	<b>3.06</b>	<b>5.38</b>
<b>Electricity</b>	<b>0.01</b>	<b>0.07</b>	<b>0.06</b>	<b>0.26</b>	<b>0.30</b>	<b>0.83</b>	<b>17.29</b>
<b>Total</b>	<b>12.25</b>	<b>100</b>	<b>23.71</b>	<b>100.00</b>	<b>36.25</b>	<b>100</b>	<b>5.06</b>

\*average annual growth rates (AAGR) for 2018 to 2040

### b. Households

With the number of households rising to around 35 million by 2040, aggregate energy consumption nearly doubles from the 2018 level of 9.4 MTOE to 18.3 MTOE in 2040, posting a yearly increment of 3.1 percent across the planning horizon. The rise in household incomes from expected economic expansion, improved employment opportunities and declining income tax rates contribute to the shift in the sector's preference towards more efficient fuels, such as electricity and



TOWNHOUSES WITH SOLAR ROOFTOPS. Solar installed rooftops are gaining popularity among households that seek to minimize their electricity bills (Source: Solaric Corporation Philippines)

LPG. This effectively reduces the sector’s demand for conventional fuels, such as biomass and kerosene (Figure 33).

As household usage of biomass<sup>37</sup> for end-use applications declines by 0.7 percent a year due to fuel switching, its share to the sector’s total energy consumption drops by more than 30 percentage points from its 60.9 percent share in 2018, as the level reaches 4.9 MTOE by 2040.

As incomes improve, households double their energy consumption by 2040.

Achievement of the government’s 100 percent household electrification target by 2022 is a major contributing factor in more than a four-fold rise in electricity demand to 10.0 MTOE in 2040, from 2.4 MTOE in 2018. This translates to 6.6 percent growth a year. Household consumption of LPG exhibits the same pattern of increase, albeit, slower at 4.8 percent growth per year. The shift towards electricity and LPG, as the preferred fuel for cooking and heating owing to their convenient use in homes and other residential dwellings, contributes to the 4.0 percent average yearly reduction in kerosene between 2018 and 2040.

Figure 33. HOUSEHOLD FINAL ENERGY CONSUMPTION, By Fuel (MTOE), 2000-2040

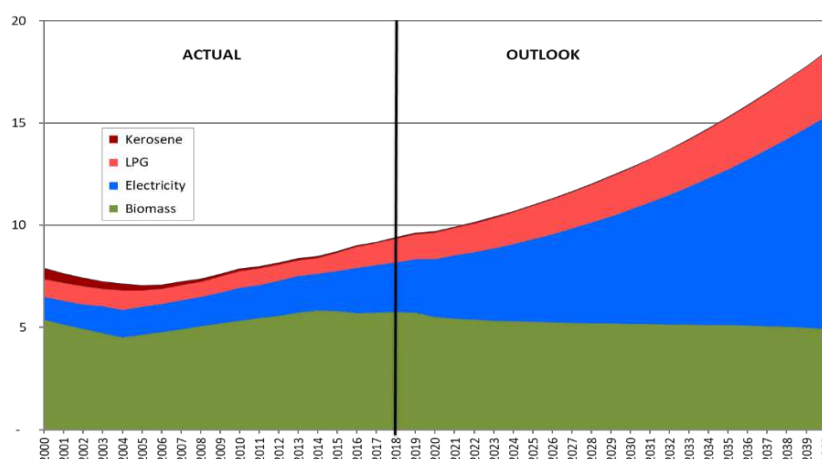


Table 11. HOUSEHOLD FINAL ENERGY CONSUMPTION, By Fuel (MTOE)

Fuel Type	2018		2030		2040		AAGR* (%)
	Levels	% Shares	Levels	% Shares	Levels	% Shares	'18-'40
<b>Oil Products</b>	1.25	13.30	2.11	16.78	3.35	18.30	<b>4.56</b>
LPG	1.18	12.47	2.06	16.40	3.31	18.12	4.82
Kerosene	0.08	0.83	0.05	0.38	0.03	0.18	-4.00
<b>Electricity</b>	<b>2.43</b>	<b>25.77</b>	<b>5.29</b>	<b>42.09</b>	<b>10.00</b>	<b>54.70</b>	<b>6.64</b>
<b>Biomass</b>	<b>5.75</b>	<b>60.93</b>	<b>5.17</b>	<b>41.13</b>	<b>4.94</b>	<b>27.01</b>	<b>-0.68</b>
<b>Total</b>	<b>9.43</b>	<b>100</b>	<b>12.57</b>	<b>100.00</b>	<b>18.29</b>	<b>100</b>	<b>3.06</b>

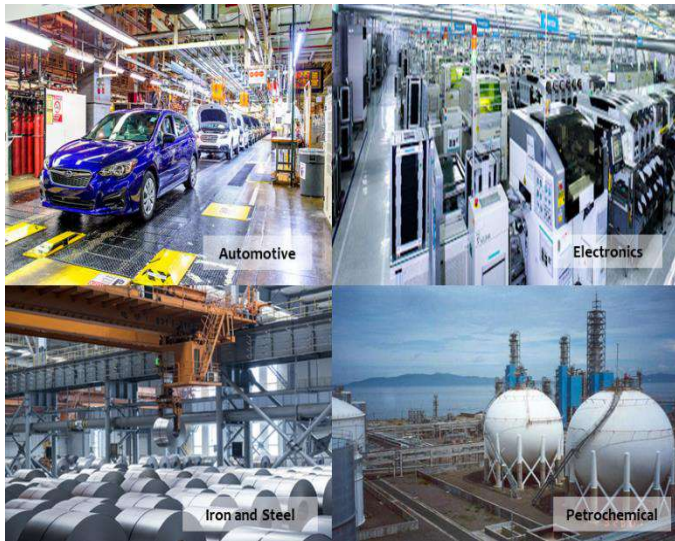
\*average annual growth rates (AAGR) for 2018 to 2040

### c. Industry

The Industry sector contributes to economic growth and employment in the long-run as backed by effective implementation of the government’s Manufacturing Resurgence Program. The said program envisions a globally competitive manufacturing industry serving as the regional and international production hub of automotive, electronics, garments and food supported by well-managed supply chains. These programs

Manufacturing Resurgence Program (MRP) pushes energy use of the Industry sector to increase more than thrice its 2018 level to 26 MTOE by 2040.

<sup>37</sup> Includes charcoal, fuelwood, agriculture waste



Included under the Manufacturing Resurgence Program (MRP) are the automotive, electronics, iron and steel, and petrochemical sectors. These sectors are also considered as energy-intensive industries that heavily rely on energy inputs (Sources: Subaru, Tsukiden, HBIS Group and DTI MRP website)

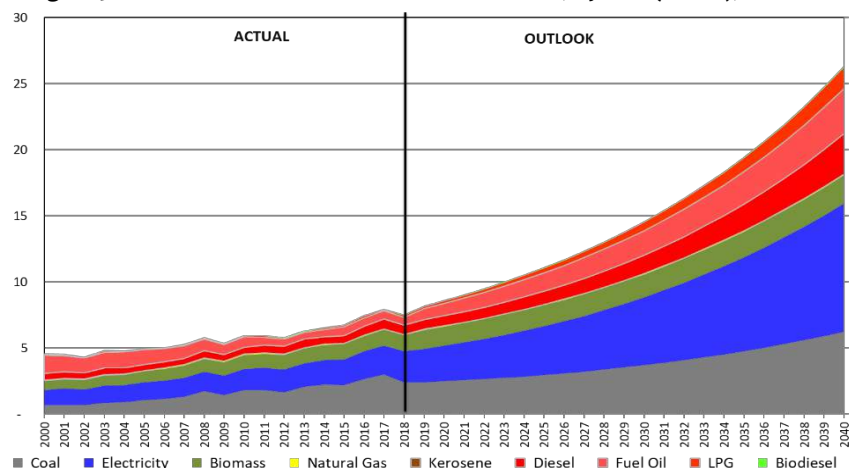
increase energy use for industrial processes by more than three-fold from its 2018 level of 7.5 MTOE to 26.3 MTOE in 2040, translating to an average annual growth rate of 5.9 percent, while contributing an average share of 24.3 percent in the country's TFE (Figure 34).

Electricity becomes the major fuel for industrial processes, taking up an average share of 34.4 percent of the sector's total energy demand for machinery/equipment and basic metal production, textile/apparel and other food production uses. From its 2018 level of 2.4 MTOE, the total electricity consumption of the sector grows by 6.6 percent average per year, reaching 9.7 MTOE in 2040.

The industry remains the major end-user of coal, as the fuel accounts for an average share of 26.2 percent of the sector's energy demand. Cement, petrochemical and basic metals sub sectors register increasing coal consumption as these industries serve as the backbone of rapid infrastructure developments in succeeding years for both the public and private sectors. Demand for coal of other manufacturing industries, such as paper production and beverages, will also increase across the planning horizon. With these, aggregate coal consumption in the sector expands by an average rate of 4.4 percent per year, while doubling up its 2018 level of 2.5 MTOE to 6.2 MTOE by 2040.

Aside from coal and electricity, oil is still an important fuel for production processes with an average share of 26.1 percent of the industry's energy demand mix. Its level will reach 8.1 MTOE by 2040 from 1.5 MTOE in 2018, equivalent to an average yearly increment of 8.8 percent. Among oil products, diesel and fuel oil constitute around 80.0 percent of the sector's oil demand with an average yearly increase of 7.0 percent and 8.4 percent, respectively. LPG consumption also rises significantly at an average rate of 10.1 percent a year to meet the increased requirements of food processing and other industries.

Figure 34. INDUSTRY FINAL ENERGY CONSUMPTION, By Fuel (MTOE), 2000-2040



**Table 12. INDUSTRY FINAL ENERGY CONSUMPTION, By Fuel (MTOE)**

Fuel Type	2018		2030		2040		AAGR* (%)
	Levels	% Shares	Levels	% Shares	Levels	% Shares	'18-'40
<b>Oil Products</b>	1.47	19.52	3.89	26.73	8.13	30.85	<b>8.09</b>
LPG	0.20	2.61	0.65	4.46	1.62	6.16	10.08
Kerosene	0.00	0.03	0.01	0.06	0.02	0.06	9.81
Diesel	0.69	9.21	1.38	9.48	3.08	11.68	7.01
Fuel Oil	0.58	7.68	1.85	12.72	3.41	12.95	8.41
<b>Coal</b>	<b>2.41</b>	<b>32.05</b>	<b>3.71</b>	<b>25.45</b>	<b>6.24</b>	<b>23.71</b>	<b>4.42</b>
<b>Natural Gas</b>	<b>0.06</b>	<b>0.79</b>	<b>0.06</b>	<b>0.43</b>	<b>0.06</b>	<b>0.25</b>	<b>0.40</b>
<b>Biodiesel</b>	<b>0.01</b>	<b>0.18</b>	<b>0.03</b>	<b>0.19</b>	<b>0.06</b>	<b>0.23</b>	<b>7.10</b>
<b>Electricity</b>	<b>2.37</b>	<b>31.53</b>	<b>5.12</b>	<b>35.17</b>	<b>9.69</b>	<b>36.77</b>	<b>6.60</b>
<b>Biomass</b>	<b>1.20</b>	<b>15.93</b>	<b>1.75</b>	<b>12.05</b>	<b>2.16</b>	<b>8.19</b>	<b>2.71</b>
<b>Total</b>	<b>7.52</b>	<b>100</b>	<b>14.57</b>	<b>100</b>	<b>26.34</b>	<b>100</b>	<b>5.86</b>

\*average annual growth rates (AAGR) for 2018 to 2040

To guarantee sufficient energy for its production processes, industries are likely to tap other energy sources, such as biomass. Thus, biomass<sup>38</sup> for end-use applications remains in the sector's demand mix with an average share of 12.6 percent. Biomass consumption, particularly for sugar production, food and other manufacturing industries, stands at 2.2 MTOE by 2040. Consumption of natural gas for industrial purposes increases steadily to 65 kTOE in the same year.

#### **d. Services (Excluding Transport)**



ARTHALAND Century Pacific Tower (ACPT), a mixed-used commercial building located in Taguig business district, is the first in the world to receive EDGE Zero Carbon Certification. The tower has offset 100 percent of its operational emissions and with projected energy savings of 45.0 percent (Source: EDGE Buildings Facebook page)

The policy measures by the government to attract more foreign direct investments, such as limiting constraints in doing business to cut red tape and liberalize business practices further support the expansion in the commercial/services sector. These policies will sustain the growth of trade, financial intermediation, real estate and other business activities, including business process outsourcing (BPO) and information technology. As such, the aggregate energy requirement of commercial establishments increases at an average rate of 5.1 percent – from 4.7 MTOE in 2018 to 14.1 MTOE in 2040.

Electricity is the main source of fuel of the sector, as it accounts for over a half (54.2 percent) of its total energy demand. Increased use of electricity for lighting and cooling requirements of the rising number of commercial/service establishments, particularly hotels, office spaces, banks, and other services, drives up the demand level to 8.6 MTOE by 2040, more than four times higher than the 2018 level (2.1 MTOE), while posting an annual increment of 6.7 percent throughout the planning period (Figure 35).

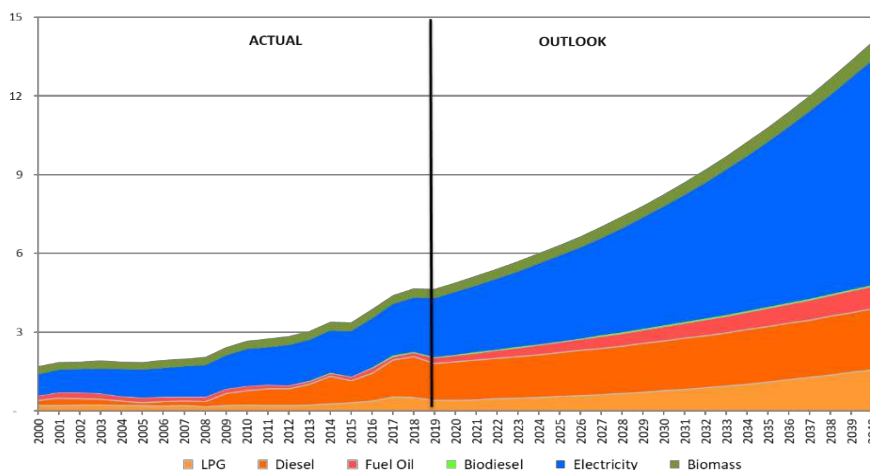
<sup>38</sup> Includes charcoal, fuelwood, rice hull, bagasse, agriculture and animal waste

Consumption of oil products, primarily used by establishments engaged in food, accommodation and other related services, registers yearly increment of 3.5 percent. LPG, fuel oil, and diesel increase annually by 5.3 percent, 8.3 percent and 1.8 percent, respectively.

Correspondingly, biodiesel demand also rises reaching 46 kTOE in 2040. The sustained biomass demand for end-use applications from food establishments and restaurants, mainly used for cooking and heating, contributes to steady growth of 3.2 percent a year, from 345 kTOE in 2018 to 695 kTOE.

**Renewed investor confidence** will sustain the growth of services sector, driving **energy use to 14 MTOE in 2040 – three times its 2018 level.**

**Figure 35. SERVICES FINAL ENERGY CONSUMPTION, By Fuel (MTOE), 2000 – 2040**



**Table 13. SERVICES FINAL ENERGY CONSUMPTION, By Fuel (MTOE)**

Fuel Type	2018		2030		2040		AAGR* (%)
	Levels	% Shares	Levels	% Shares	Levels	% Shares	'18-'40
<b>Oil Products</b>	2.22	47.61	3.21	38.89	4.75	33.77	<b>3.51</b>
LPG	0.51	10.85	0.76	9.23	1.57	11.16	5.28
Diesel	1.57	33.59	1.90	23.04	2.32	16.49	1.80
Fuel Oil	0.15	3.17	0.55	6.62	0.86	6.11	8.33
<b>Biodiesel</b>	<b>0.03</b>	<b>0.65</b>	<b>0.04</b>	<b>0.45</b>	<b>0.05</b>	<b>0.33</b>	<b>1.88</b>
<b>Electricity</b>	<b>2.07</b>	<b>44.24</b>	<b>4.54</b>	<b>54.95</b>	<b>8.58</b>	<b>60.97</b>	<b>6.69</b>
<b>Biomass</b>	<b>0.35</b>	<b>7.50</b>	<b>0.47</b>	<b>5.70</b>	<b>0.69</b>	<b>4.94</b>	<b>3.16</b>
<b>Total</b>	<b>4.67</b>	<b>100</b>	<b>8.26</b>	<b>100</b>	<b>14.07</b>	<b>100</b>	<b>5.14</b>

\*average annual growth rates (AAGR) for 2018 to 2040

### e. Agriculture

Despite being the least energy user, the energy demand of the Agriculture sector grows annually at 6.6 percent reaching 1.8 MTOE in 2040 (Table 14). Electricity, primarily used in livestock and poultry subsectors, accounts for more than half (51.5 percent) of the sector’s energy demand. Its consumption stands at 969 kTOE by 2040, increasing at an average of 6.8 percent per year from 228 kTOE in 2018.



Modernization and mechanization of the PH agriculture sector, including improvement of technology and logistics, is aimed at reducing post-harvest losses and ensure increased productivity. (Source: PIA/DA)

Increasing population vis-à-vis per capita consumption on food pushes the **Agriculture** sector **energy demand to increase by four-fold despite being the lowest user.**

The anticipated modernization of the agriculture sector expands the share of electricity in the sector's demand mix as more agricultural types of machinery and technologies using electricity are made available to farmers. On the other hand, the aggregate consumption of oil products takes

47.6 percent of the sector's energy consumption, exhibiting a slightly slower growth rate at 6.3 percent. Diesel consumption for farm equipment, crop production and fishery escalates to 765 kTOE by 2040, representing the bulk of the sector's oil demand. As a result, biodiesel demand registers 15 kTOE by 2040.

**Table 14. AGRICULTURE SECTOR FINAL ENERGY CONSUMPTION, By Fuel (MTOE)**

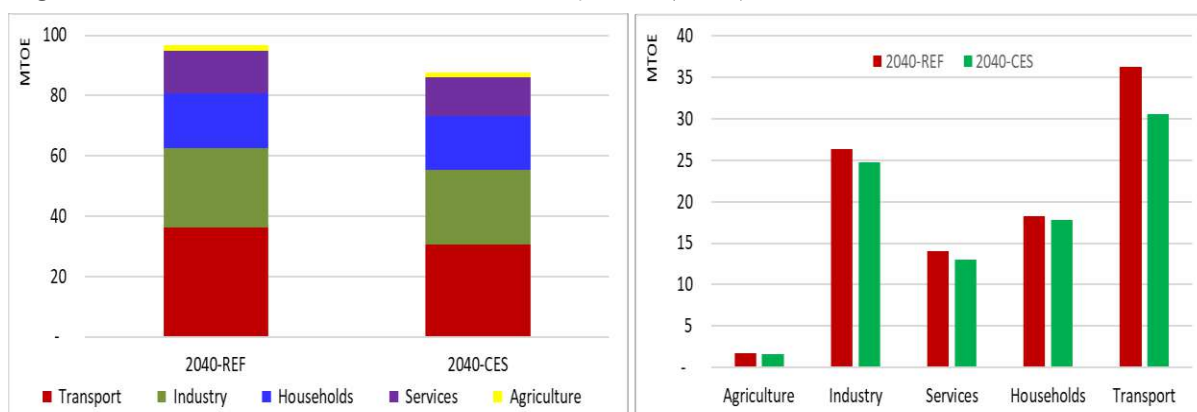
Fuel Type	2018		2030		2040		AAGR* (%)
	Levels	% Shares	Levels	% Shares	Levels	% Shares	'18-'40
<b>Oil Products</b>	208.03	47.33	478.56	47.84	790.72	44.55	<b>6.26</b>
Kerosene	0.40	0.09	0.15	0.02	0.07	0.00	-7.51
Diesel	199.88	45.47	455.73	45.56	764.59	43.08	6.29
Gasoline	7.06	1.61	9.74	0.97	12.16	0.69	2.50
Fuel Oil	0.69	0.16	12.94	1.29	13.90	0.78	14.63
<b>Biodiesel</b>	3.87	0.88	8.99	0.90	15.09	0.85	<b>6.38</b>
<b>Electricity</b>	227.65	51.79	512.74	51.26	969.18	54.60	<b>6.81</b>
<b>Total</b>	<b>439.55</b>	<b>100</b>	<b>1,000.29</b>	<b>100</b>	<b>1,774.98</b>	<b>100</b>	<b>6.55</b>

\*average annual growth rates (AAGR) for 2018 to 2040

### 3. IMPACT OF CLEAN ENERGY SCENARIO TO TOTAL FINAL ENERGY CONSUMPTION

Incorporating the energy demand assumptions under the CES results in slower growth of the TFEC at 4.4 percent a year. The CES requires 87.7 MTOE, 9.3 percent lower than the REF. Of the 9.0 MTOE reduction in energy demand between the two scenarios, the transport sector contributes the largest share at 63.7 percent or 5.7 MTOE (Figure 36).

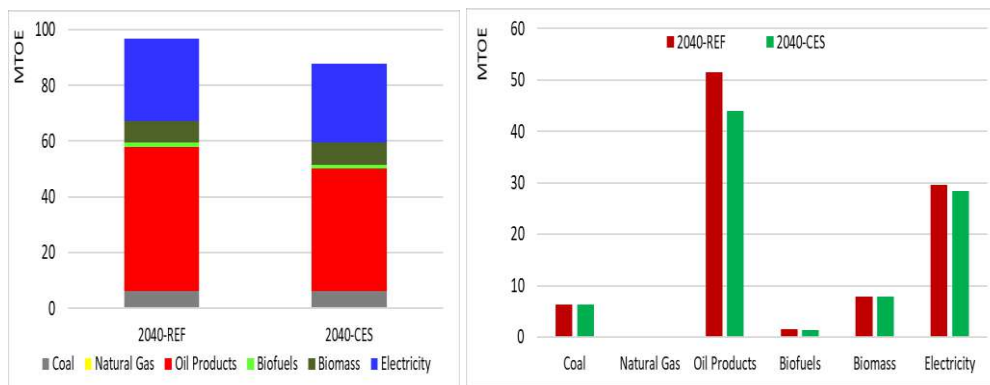
**Figure 36. REFERENCE vs. CLEAN ENERGY SCENARIO, By Sector (MTOE), 2040**



Fuel diversification and improvements in vehicle efficiencies and standards in the transport sector, as well as the expected savings in the consumption of oil products, result in a 14.8 percent reduction in oil demand reaching 43.9 MTOE by 2040 vis-à-vis 51.5 MTOE under REF. Consequently, oil's share drops to 50.0 percent in the CES from its 53.2 percent share in the REF for the same year.

Electricity displaces part of oil consumption in the transport sector under the CES, expanding its share to 32.3 percent from 30.5 percent in the REF, despite aggregate levels being 4.0 percent lower due to electricity savings in other end-use sectors (Figure 37).

Figure 37. REFERENCE vs. CLEAN ENERGY SCENARIO, By Fuel (MTOE), 2040



### How the Policies under the Clean Energy Shifts Energy Demand towards Cleaner Fuels?

**Clean energy policies contribute to 14.8 percent reduction in oil demand vis-à-vis Reference.**

**Oil consumption in the transport sector drops by 21.0 percent** due to combined effects of fuel diversification improvements in vehicle efficiencies and standards and 10.0 percent penetration of electric vehicles by 2040.

**Natural gas consumption increases by 4.0 percent between 2018 and 2040**, as commercial and transport increase their demand in addition to industry.

**Energy savings of 5.0 for oil and electricity by 2040** slow down the growth of the TFECC at **4.4 percent a year**.

Contributing to the drop in oil consumption in the CES are the 10.0 percent increase in the penetration rate of electric vehicles (EVs) and full operation of the expanded and modernized railway systems: Light Rail Transit (LRT) Line 1 (Baclaran – Cavite), LRT Line 2 East (Masinag), LRT 2 West (Recto-Pier); Metro Rail Transit (MRT) 7 and Metro Manila Subway Phase 1; PNR North-South Commuter Railway (Clark-Malolos-Manila-Calamba), PNR South Long Haul (Manila-Bicol) and Subic-Clark Railway; Cebu Metro Rail System; and, the Mindanao Rail Network.

These infrastructure projects, covering a total of 1,900 kilometers of railway systems that aim to benefit around 4.5 million passengers per day, effectively contribute to transport modal shift, resulting in a lesser dependence on oil for road transport. Likewise, the availability of buses running on compressed natural gas (CNG) allocates around 12 kTOE consumption for transport.

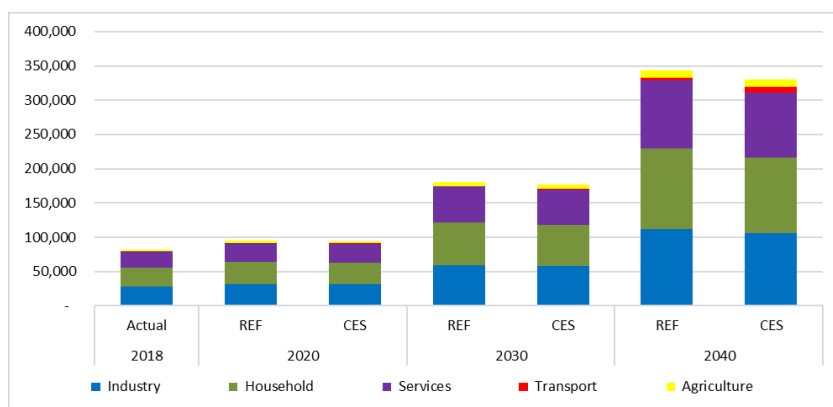


## C. POWER SUPPLY AND DEMAND OUTLOOK

### 1. Total Electricity Consumption

From the 2018 level of 82,602 gigawatt-hour (GWh), total electricity consumption reaches 343,516 GWh in 2040 in the REF. Electricity savings under the CES reduce consumption by 4.0 percent equivalent to 329,786 GWh by 2040. However, transport electricity consumption increases by as much as twice its 2040 level in the REF as more EVs penetrate the country's road system along with fully operational mass and light railway systems. The industry and residential sectors comprise the bulk of total electricity demand across the planning horizon. Meanwhile, the transport sector improves its share by 9.1 percent in 2040 from 0.1 percent in 2018 (Figure 38).

Figure 38. REFERENCE vs CLEAN ENERGY SCENARIO: Electricity Consumption, By Sector (GWh) for Milestone Years



#### How the Power Sector Responds to the Requirements of the PDP 2017-2022 and Clean Energy Policy

Electricity demand will increase by an average of 6.7 percent annually.

Transport's electricity consumption under the CES doubles its level by 2040 due to 10.0 percent penetration rate of electric vehicles and full operation of mass and light railway systems.

Annual savings of 5.0 percent slows down electricity demand by 0.2 percentage points – from 6.7 percent under Reference to 6.5 percent under CES

### 2. Peak Demand and Capacity Requirements

Under the REF, the total installed capacity reaches 90,584 megawatts (MW) by 2040 as compared with 93,482 MW of the CES (Table 15). The projected total peak demand of 60,034 MW in the REF and 57,303 MW in the CES require an additional total installed capacity of 71,817 MW (REF) and 75,325 MW (CES) by 2040 from the 23,815 MW total installed capacity as of end-2018 (Figure 39).

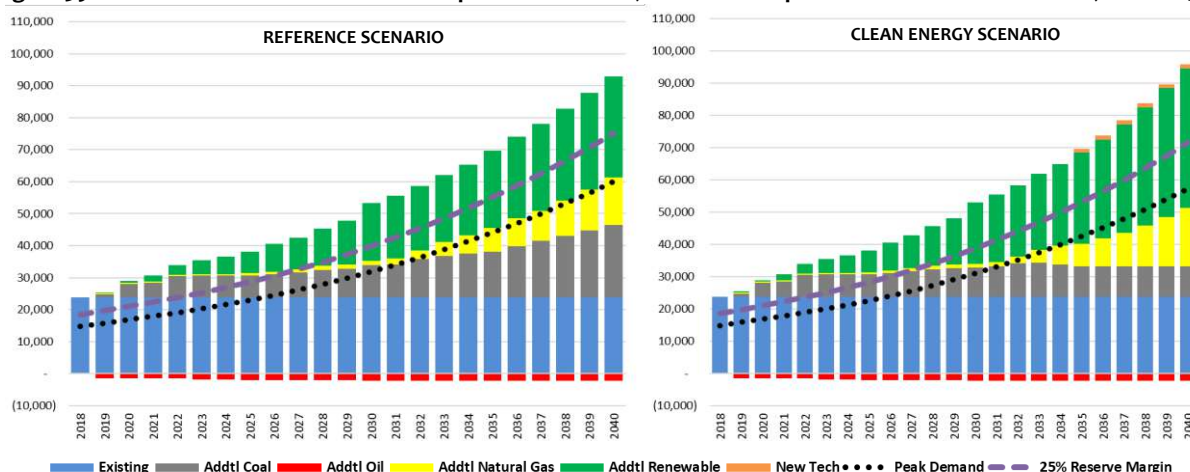
Table 15. REFERENCE vs. CLEAN ENERGY: TOTAL INSTALLED CAPACITIES AND TOTAL CAPACITY ADDITIONS by 2040, By Fuel (MW) for Milestone Years

Fuel Type	Installed Capacities					Total Capacity Additions by 2040	
	2018	2030		2040		REF	CES
	Actual	REF	CES	REF	CES		
Coal	8,844	18,900	17,850	31,470	18,150	22,626	10,506
Oil-Based	4,292	1,993	1,993	1,993	1,993	115	75
Natural Gas	3,453	4,760	4,620	18,240	21,660	14,787	18,207
Renewable	7,226	25,266	26,259	38,881	50,479	34,289	45,337
Geothermal	1,944	1,890	1,890	1,770	2,770	697	1,597
Hydro	3,701	9,247	9,920	9,629	12,302	7,659	9,882
Biomass	258	660	660	660	1,550	402	1,292
Solar	896	11,393	11,393	22,050	24,960	21,154	24,064
Wind	427	2,076	2,396	4,772	8,897	4,378	8,503
Other Technology	-	-	-	-	1,200	-	1,200
<b>Total</b>	<b>23,815</b>	<b>50,919</b>	<b>50,722</b>	<b>90,584</b>	<b>93,482</b>	<b>71,817</b>	<b>75,325</b>

The requirements of off-grid areas account for around two percent of the total electricity supply of the country.

Consistent with the accelerated efforts to push for environment-friendly and sustainable fuels under the CES, the bulk of the capacity additions come from renewables, natural gas, other low carbon and highly efficient technologies.

**Figure 39. REFERENCE vs. CLEAN ENERGY: Capacities: Installed, Additional Capacities vis-à-vis Peak Demand, 2018-2040**



The Luzon grid's peak demand increases by four times, from the 10,876 MW in 2018 to 39,987 MW in 2040 (Table 16). The electricity demand growth requires an additional of 45,740 MW by the end of 2040. This additional capacity comprises 15,220 MW for baseload capacity, 8,400 MW for intermediate capacity, 18,500 for the variable capacity, 3,200 MW for the flexible capacity, and 420 MW for the peaking capacity (Figure 40).

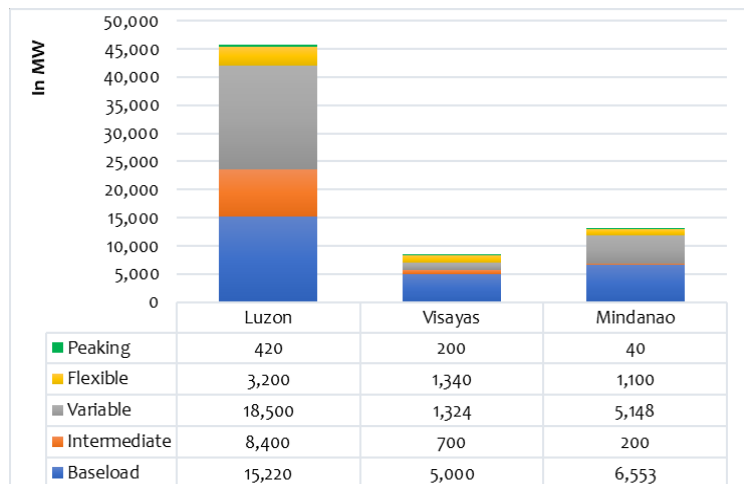
**Table 16. PEAK DEMAND FORECAST BY GRID (MW), 2018-2040 under REFERENCE SCENARIO**

Year	Peak Demand Forecast (MW)							
	Luzon	Luzon Growth %	Visayas	Visayas Growth %	Mindanao	Mindanao Growth %	Philippines	Philippines Growth %
2018	10,876	-	2,053	-	1,853	-		
2019	11,476	6.40	2,211	7.70	2,130	14.95	15,817	7.66
2020	12,169	6.04	2,415	9.23	2,274	6.76	16,858	6.58
2021	12,916	6.14	2,568	6.34	2,442	7.39	17,927	6.34
2022	13,680	5.92	2,737	6.58	2,627	7.58	19,044	6.23
2023	14,494	5.95	2,923	6.80	2,830	7.73	20,247	6.32
2024	15,371	6.05	3,126	6.94	3,051	7.81	21,548	6.43
2025	16,312	6.12	3,348	7.10	3,292	7.90	22,951	6.51
2026	17,322	6.19	3,590	7.23	3,555	7.99	24,467	6.61
2027	18,409	6.28	3,854	7.35	3,843	8.10	26,106	6.70
2028	19,575	6.33	4,142	7.47	4,157	8.17	27,874	6.77
2029	20,828	6.40	4,457	7.61	4,499	8.23	29,784	6.85
2030	22,177	6.48	4,801	7.72	4,874	8.34	31,851	6.94
2031	23,595	6.39	5,168	7.64	5,273	8.19	34,036	6.86
2032	25,085	6.31	5,559	7.57	5,700	8.10	36,344	6.78
2033	26,650	6.24	5,977	7.52	6,155	7.98	38,781	6.71
2034	28,293	6.17	6,421	7.43	6,640	7.88	41,354	6.63
2035	30,019	6.10	6,895	7.38	7,156	7.77	44,070	6.57
2036	31,830	6.03	7,403	7.37	7,706	7.69	46,940	6.51
2037	33,731	5.97	7,944	7.31	8,291	7.59	49,966	6.45
2038	35,721	5.90	8,518	7.23	8,913	7.50	53,152	6.38
2039	37,806	5.84	9,127	7.15	9,573	7.40	56,506	6.31
2040	39,987	5.77	9,774	7.09	10,273	7.31	60,034	6.24

The Visayas grid's peak demand rises by more than four-fold, from 2,053 MW in 2018 to 9,774 MW in 2040. This translates to a total of 8,564 MW additional capacity by the end of 2040 requiring 5,000 MW of baseload capacity, 700 MW of intermediate capacity, 1,324 MW of the variable capacity, 1,340 MW of the flexible capacity, and 200 MW of the peaking capacity.

The Mindanao's peak demand picks up by more than five (5) times, from 1,853 MW in 2018 to 10,273 MW in 2040. The grid then needs a total of 13,041 by the end of 2040 to meet the demand growth. The additional capacity constitutes 6,553 MW for baseload, 200 MW for intermediate capacity, 5,148 MW for the variable capacity, 1,100 MW for the flexible capacity, and 40 MW for peaking capacity.

Figure 40. 2040 ADDITIONAL CAPACITIES PER GRID (MW)



**CAPACITY REQUIREMENT DEFINITION**

**PEAKING**

- Produce power during peak system demand periods
- More responsive to changes in electrical demand and can be started up relatively quicker.

**FLEXIBLE**

- Facility with fast ramping/fast start-up and shutdown capabilities connected directly to the transmission or distribution system that helps manage fluctuations in supply and addresses the intermittency of increasing variable renewable energy power plants.

**VARIABLE**

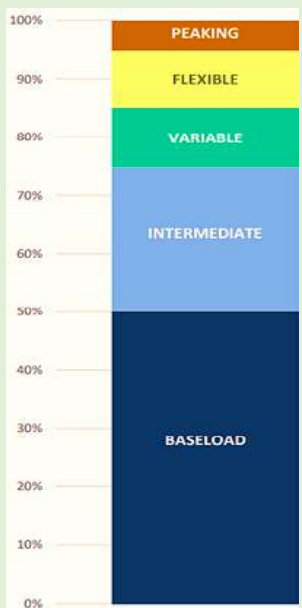
- Generators with Variable output based on the availability of energy resources.

**INTERMEDIATE**

- Fill the gap between baseload and peaking plants.
- Runs more efficiently.

**BASELOAD**

- Plants which can generate consistent power to meet daily demand.
- Produce continuous, reliable and efficient power at low cost.
- Run at all times through the year except in the case of repairs or scheduled maintenance.



### 3. Gross Generation and Fuel Input

With the capacity additions under the REF, total gross generation increases by 6.5 percent a year, from 99.8 terawatt-hours (TWh) in 2018 to 394.5 TWh in 2040. In this scenario, coal contributes the bulk to the country's power generation requirement with an average share of 57.6 percent share, followed by renewable and natural gas with 27.5 percent and 13.7 percent shares, respectively (Table 17).

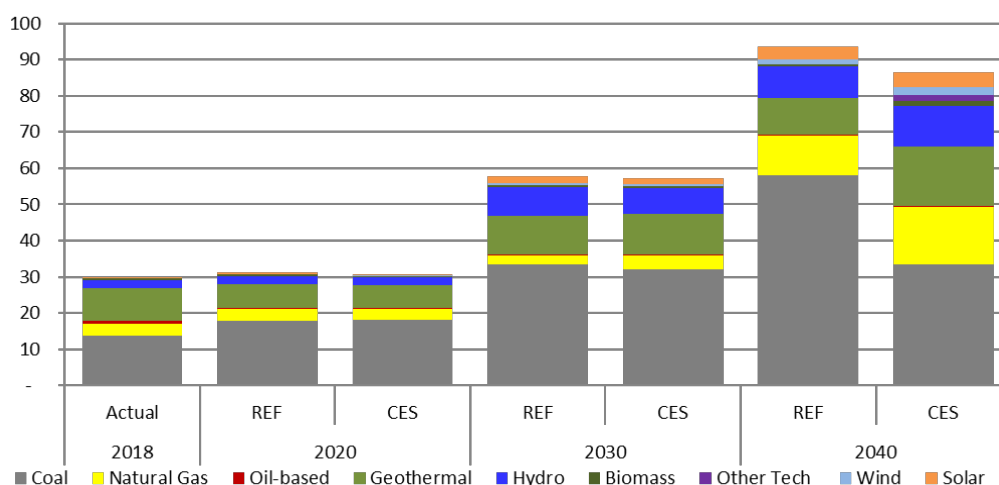
Table 17. GROSS GENERATION, By Fuel Type (TWh)

Fuel Type	2018	2030		2040		AAGR (%) 2018-2040	
	Actual	REF	CES	REF	CES	REF	CES
Coal	51.93	126.31	121.13	218.34	126.39	6.75	4.13
Natural Gas	21.33	14.91	24.40	71.14	100.78	5.63	7.31
Oil-based	3.17	1.35	1.35	1.23	1.23	-4.20	-4.20
Renewable	23.33	73.86	68.80	103.81	140.91	7.02	8.52
Geothermal	10.44	12.35	12.84	11.84	19.05	0.57	2.77
Hydro	9.38	31.92	28.89	34.82	44.64	6.14	7.35
Wind	1.15	6.39	7.41	14.99	26.96	12.37	15.41
Solar	1.25	21.39	18.19	40.35	46.11	17.11	17.82
Biomass	1.10	1.81	1.48	1.81	4.15	2.26	6.20
Other Technology	0.00	0.00	0.00	0.00	9.49	-	-
<b>Total</b>	<b>99.76</b>	<b>216.43</b>	<b>215.68</b>	<b>394.52</b>	<b>378.80</b>	<b>6.45</b>	<b>6.25</b>

\*average annual growth rates (AAGR) for 2018 to 2040

The total fuel requirement for power generation grows by 5.3 percent across the planning period reaching 93.5 MTOE in 2040 from 29.7 MTOE in 2018. By the end of the planning period, fossil fuel accounts for 74.1 percent of the fuel input mix due to increased share of coal (Figure 41).

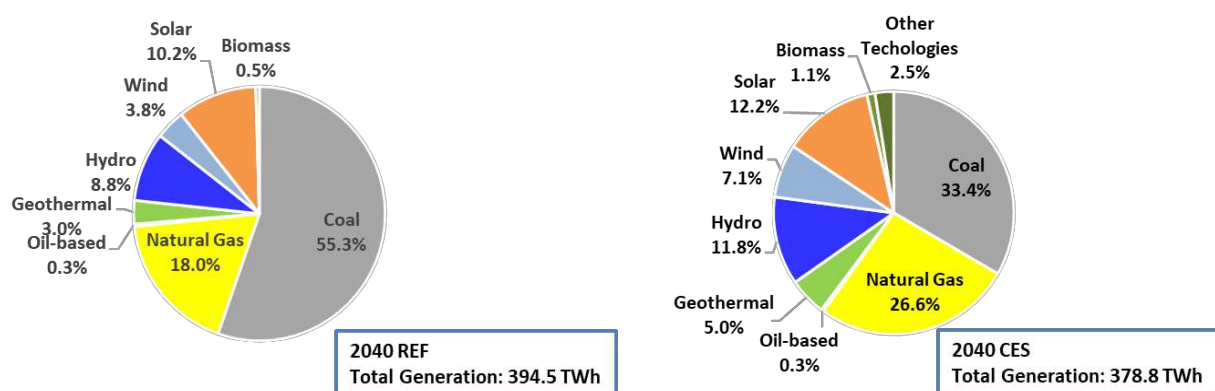
Figure 41. REFERENCE vs. CLEAN ENERGY SCENARIO, Generation Input for Milestone Years (MTOE)



In the CES, generation output registers a 6.3 percent average yearly increase reaching 378.8 TWh by 2040. Despite the slowdown vis-à-vis the REF, the mix of energy resources significantly changes in this scenario in 2040 as the share of coal drops to 33.4 percent, as displaced by renewables, natural gas and other low carbon technologies. As such, the aggregate gross generation from clean energy sources (RE, natural gas, and other technologies) jumps to 251.2 TWh, almost six times its 2018 level of 44.7 TWh, and accounts for 66.3 percent of the generation mix by 2040. The CES provides a window for the entry of other low carbon technologies contributing 9.5 TWh in the generation mix by 2040 (Figure 42).

The influx of highly efficient coal technologies under the CES leads to a reduction in the utilization of coal as fuel input for power generation. By 2040, coal's share to total fuel input drops to 38.8 percent compared to 61.9 percent under the Reference Scenario (Figure 41). RE and natural gas compensate for the reduction in coal input, increasing faster under the CES at 7.3 percent and 5.1 percent growth, respectively, across the planning horizon.

Figure 42. REFERENCE vs. CLEAN ENERGY SCENARIO, 2040 Power Generation Mix, By Fuel Shares



## Energy Supply and Demand in 2020 with COVID-19 Pandemic and under Recovery Programs for 2021-2022<sup>39</sup>

### ENERGY SITUATION BEFORE THE PANDEMIC (FY 2019)

#### Energy Demand

- The TFEC for 2019 stood at 36.3 MTOE or 1.6 percent higher than its 2018 level.
- Transport and residential account for the largest shares with their respective energy consumption up by 3.7 percent and 3.0 percent during the year.
- The agriculture sector registered the fastest increase in energy utilization at 7.3 percent, while commercial establishments reported a 5.3 percent hike in consumption. The

Table 18. TOTAL FINAL ENERGY CONSUMPTION (TFEC), By Sector and Fuel, 2018 vs. 2019

Fuel	2018		2019		'18-'19 GR (%)
	MTOE	% Share	MTOE	% Share	
Coal	2.57	7.20	2.36	6.49	-8.36
Natural Gas	0.06	0.17	0.06	0.17	3.60
Oil Products	18.17	50.86	18.51	50.98	1.89
Biofuels	0.52	1.47	0.56	1.54	6.56
Electricity	7.10	19.89	7.49	20.63	5.45
Biomass	7.29	20.42	7.33	20.19	0.50
<b>Total</b>	<b>35.72</b>	<b>100</b>	<b>36.31</b>	<b>100</b>	<b>1.65</b>
Sector	2018		2019		'18-'19 GR (%)
	MTOE	% Share	MTOE	% Share	
Agriculture	0.44	1.23	0.47	1.30	7.31
Industry	7.52	21.06	7.39	20.35	-1.79
Services (exc Transport)	4.67	13.07	4.91	13.54	5.29
Households	9.43	26.40	9.71	26.74	2.97
Transport	12.24	34.26	12.69	34.94	3.68
Non-Energy	1.42	3.98	1.14	3.13	-20.15
<b>Total</b>	<b>35.72</b>	<b>100</b>	<b>36.31</b>	<b>100</b>	<b>1.65</b>

The slowdown in manufacturing output resulted in a contraction of 1.8 percent in the amount of energy used for industrial processes. These trends in sectoral energy consumption were consistent with the 6.0 percent increase in the country's aggregate economic output in 2019, as measured by GDP.

<sup>39</sup> Refers to the range of economic stimulus packages and legislations across all sectors that are geared to pump-prime the economy for 2020-2022. It includes, but not limited to, Bayanihan 2, PH Progresso (<https://www.dof.gov.ph/the-duterte-administrations-philippine-program-for-recovery-with-equity-and-solidarity-ph-progresso/>), Build, Build, Build, House Bill 6815 or the ARISE Bill, among others.

- Oil remained the most consumed fuel with a 51.0 percent share, followed by electricity and biomass, with a 40.3 percent combined share to the TFEC.
- Coal utilization registered an 8.0 percent slump from its previous year's level of 2.4 MTOE to 2.2 MTOE in 2019. This was attributable to the slack in product volumes amidst the slowdown in construction activities, as well as delays in priority public infrastructure projects due to the late passage of the national budget. Non-energy demand, specifically that of coal and oil as raw materials in industrial processes, declined by 20.1 percent.

### Energy Supply

- The Total Primary Energy Supply (TPES) level in 2019 registered a measly 0.6 percent increase from its year-ago level of 59.7 MTOE to 60.1 MTOE in 2019. The sluggish growth was a result of lower crude oil imports due to prolonged refinery shutdown by Petron and the declining production from domestic oil sources because of the near depletion of Matinloc and Nido oil fields.
- Self-sufficiency improves to 51.4 percent, which means that around 31.9 MTOE of the TPES was indigenous energy sources, while 29.2 MTOE was net energy import.

Table 19. TOTAL PRIMARY ENERGY SUPPLY (TPES), By Source, 2018 vs. 2019

Source	2018		2019		'18-'19 GR (%)
	MTOE	% share	MTOE	% share	
<b>Indigenous Energy</b>	<b>29.98</b>	<b>50.92</b>	<b>30.88</b>	<b>51.37</b>	<b>3.00</b>
Oil	0.59	1.07	0.52	0.87	-12.00
Natural Gas	3.60	5.57	3.63	6.03	0.69
Coal	6.20	10.87	7.26	12.08	16.98
Hydro	2.34	4.13	2.00	3.32	-14.47
Geothermal	8.97	15.24	9.19	15.29	2.45
Biomass	7.72	13.20	7.74	12.87	0.14
Wind	0.10	0.16	0.09	0.15	-9.65
Solar	0.11	0.18	0.11	0.18	-0.24
Biodiesel	0.17	0.29	0.18	0.30	5.99
Bioethanol	0.17	0.23	0.17	0.28	-0.47
<b>Net Imported Energy</b>	<b>29.74</b>	<b>49.08</b>	<b>29.23</b>	<b>48.63</b>	<b>-1.73</b>
Oil	19.40	32.86	18.78	31.25	-3.18
Coal	10.14	15.83	10.22	17.01	0.78
Bioethanol	0.19	0.38	0.22	0.37	13.26
<b>Total Primary Energy</b>	<b>59.72</b>	<b>100</b>	<b>60.10</b>	<b>100</b>	<b>0.65</b>

### Assumptions for Impact of COVID19 to Energy Supply and Demand for 2020-2022

In order to assess the impact of COVID19 to the level of energy supply and demand in the short-term (2020–2022), as well as the risks that will crucially impact the energy supply, the following assumptions were made:

- For 2020: Actual energy data for supply and demand situation available as of June 2020: Energy Balance Table (EBT) for 2019, electricity peak demand for January to June 2020; oil situation for January to June 2020; Quarantine protocols per issuances of the Inter-agency Task Force on Emerging Infectious Diseases (IATF-EID) reflective of the impact of COVID-19; and, the National Economic and Development Authority-Development Budget Coordinating Committee (NEDA-DBCC) estimated contraction in the economic output (measured in terms of real GDP) of 5.5 percent for 2020
- For 2021-2022: growth targets of NEDA-DBCC (as of 28 July 2020) pegged at 7.0 percent each year; effect of programmed economic stimulus packages and recovery plans as embodied in the projected economic rebound for 2021-2022 pushing energy demand to move via energy-to-GDP relationship, i.e. sectoral energy intensity

## 2020 with COVID-19 Pandemic

## 2021-2022 with Recovery Programs

### Economic Targets<sup>40</sup>

- Bearing the brunt of one of the longest imposed quarantine restrictions among countries battling with COVID-19, the country's economic output for January to June 2020 took a steep 16.5 percent plunge.
- With this, the country's economy contracts by 5.5 percent for FY 2020, based on the assumption that the economy will gradually resume its activities in the remaining months of the year.
- The country's economy rebounds with a 7.0 percent expansion in 2021, sustaining the same growth trend by 2022. Growth is largely hinged on the implementation of recovery programs, including allocated economic stimulus packages across all sectors.
- The "Build, Build, Build" Program, once in full operation, provides the needed impetus towards economic recovery.

### Energy Demand

- The contraction in economic output results in a 7.8 percent reduction in the TFEC for 2020, down by 12.0 percentage points from the projected growth under the Business-as-Usual (BAU)<sup>41</sup>.
- The transport sector bears the brunt of the restrictions imposed under varying levels of community quarantine, as its energy consumption registers a sharp decline of 16.9 percent.
- The energy consumption in the industry and services sectors drops by 5.5 percent and 10.1 percent, respectively, due to the strict community quarantine restrictions which have crippled the businesses.
- ✓ Energy use in the agriculture sector manages to grow albeit a measly 0.3 percent during the same period.
- Household energy consumption increases the fastest at 3.0 percent as a large portion of the working population shall be or are already relegated to work-from-home (WFH) as part of the shift towards the "new normal."
- Energy demand posts strong positive increments with a 5.1 percent turnaround in the growth of the TFEC in 2021, followed by 4.7 percent in 2022.
- The improvements in transport infrastructures induce mobility and energy consumption in the sector to pick up by 6.7 percent in 2020, followed by 6.4 percent in 2022. The expected gradual recovery of air travel increases aviation fuel consumption by as much as 8.7 percent by 2022.
- The renewed investor confidence and effective tax programs refuel the country's industry and services sectors, primarily the micro, small and medium enterprises.
- ✓ The agriculture sector, benefiting from modernization programs, increase its energy utilization by 2.0 percent in 2021, followed by a 2.3 percent expansion in 2022.
- ✓ Service establishments register a sustained 5.5 percent hike in its energy consumption in 2021 and 2022.
- ✓ The industrial sector's energy requirement recovers with 5.8 percent in 2021, and by 5.7 percent in 2022 coinciding with the revival of the manufacturing subsector.
- Household energy consumption registers a positive growth of 2.8 percent and 1.9 percent for 2021 and 2022, respectively. Gradual recovery from the pandemic may now allow those who have been previously telecommuting to return to their office spaces, while maintaining minimum health standards.

<sup>40</sup> Based on NEDA-DBCC targets for 2020-2022 (as of 28 July 2020)

<sup>41</sup> Refers to the scenario without impact of COVID-19 in 2020, following the growth projections set forth under PDP 2017-2022 as discussed in Section A. Macroeconomic Assumptions of this Chapter.

- The aggregate oil demand (including non-energy and fuel input to power generation) drops by 13.5 percent, down by 8.9 percentage points from the BAU. This is attributable to the contraction in oil consumption in the transport sector and power plants, combined with a further deceleration in other end-use sectors due to the lockdown restrictions
- Electricity consumption contracts by 2.4 percent in 2020 vis-à-vis 2019, shelving off 8.7 percentage points from its growth under the BAU. The residential sector registers the fastest and with only positive increment of 6.0 percent.
- The aggregate oil demand posts an uptick of 5.9 percent in 2021 and then increases by 5.5 percent in 2022 with improved economic activity. The bulk of the increase comes from the transport and industry sectors.
- Electricity consumption increases by 4.9 percent in 2021 and by 5.9 percent in 2022. The transport sector's electricity utilization doubles in 2021 as the MRT-7 becomes fully operational.

**Table 20. ENERGY DEMAND, By Sector and Fuel, 2018 - 2022**

Sectors	Levels (MTOE)					Growth Rates (%)		
	2018	2019	2020	2021	2022	19-20	20-21	21-22
Agriculture	0.44	0.47	0.47	0.48	0.49	0.3	2.0	2.3
Industry	7.52	7.39	6.98	7.38	7.80	-5.5	5.8	5.7
Services	4.67	4.91	4.42	4.66	4.91	-10.1	5.5	5.5
Residential	9.43	9.71	10.00	10.28	10.47	3.0	2.8	1.9
Transport	12.24	12.69	10.54	11.25	11.97	-16.9	6.7	6.4
Non-Energy	1.42	1.14	1.08	1.15	1.20	-5.1	6.9	4.5
<b>Total</b>	<b>35.72</b>	<b>36.31</b>	<b>33.49</b>	<b>35.21</b>	<b>36.85</b>	<b>-7.8</b>	<b>5.1</b>	<b>4.7</b>

Fuel	Levels (MTOE)					Growth Rates (%)		
	2018	2019	2020	2021	2022	19-20	20-21	21-22
Coal	2.57	2.36	2.25	2.49	2.71	-4.8	11.1	8.7
Natural Gas	0.06	0.06	0.03	0.00	0.00	-54.8	-100.0	-
Oil Products	18.17	18.51	16.10	17.11	18.09	-13.1	6.3	5.7
Biofuels	0.52	0.56	0.49	0.52	0.55	-12.7	6.4	5.4
Electricity	7.10	7.49	7.31	7.67	8.12	-2.4	4.9	5.9
Biomass	7.29	7.33	7.32	7.41	7.39	-0.1	1.2	-0.3
<b>Total</b>	<b>35.72</b>	<b>36.31</b>	<b>33.49</b>	<b>35.21</b>	<b>36.85</b>	<b>-7.8</b>	<b>5.1</b>	<b>4.7</b>

\*red font: short term outlook

### Energy Supply

- The TPES shrinks by 9.0 percent or 10.4 percentage points lower than the BAU due to the continued restriction in the operation of non-essentials, which relies heavily on electricity, and the depressed demand for oil effectively leads to a reduction in the volume of imported oil.
- To meet the increase in energy demand vis-à-vis increased economic activities for 2021 and 2022, the TPES increases by 4.3 percent in 2021, and by 4.5 percent in 2022.
- The impending threats for the reduction of coal and oil imports due to associated risks pave the way for higher utilization of indigenous supply i.e., oil, coal, gas, and renewables for power generation. Thus, the share of renewables increases to 36.9 percent compared with 32.8 percent in 2019 compensating for the anticipated reduction in oil and coal imports.
- Renewable share remains around 36.0 percent in 2021 and 2022 and contributes positively to higher self-sufficiency level for the same years.



**Table 21. ENERGY SUPPLY, By Fuel, 2018-2022**

Fuel	Levels (MTOE)					Growth Rates (%)		
	2018	2019	2020	2021	2022	19-20	20-21	21-22
Coal	16.35	17.48	14.54	15.37	16.74	-16.8	5.7	8.9
Natural Gas	3.60	3.63	3.34	3.31	3.32	-8.0	-0.8	0.2
Oil	19.99	19.31	16.60	17.57	18.53	-14.0	5.8	5.5
Renewable	19.77	19.69	20.20	20.78	21.00	2.6	2.9	1.0
Hydro	2.34	2.00	2.48	2.51	2.56	24.1	1.4	1.7
Geothermal	8.97	9.19	9.01	9.14	9.17	-2.0	1.5	0.3
Solar	0.11	0.11	0.26	0.41	0.52	138.5	59.3	27.6
Wind	0.10	0.09	0.16	0.18	0.18	74.2	17.6	0.0
Biomass	7.72	7.74	7.81	8.01	8.02	1.0	2.6	0.1
Biofuels	0.53	0.57	0.49	0.52	0.55	-13.8	6.5	5.4
<b>Total</b>	<b>59.72</b>	<b>60.10</b>	<b>54.68</b>	<b>57.03</b>	<b>59.58</b>	<b>-9.0</b>	<b>4.3</b>	<b>4.5</b>
<b>RE Share (%)</b>	<b>33.11</b>	<b>32.76</b>	<b>36.94</b>	<b>36.44</b>	<b>35.24</b>			

\*red font: short-term outlook

### Environmental Impact

- Greenhouse Gas (GHG) emission reaches 114.5 million tons of CO<sub>2</sub> equivalent (MTCO<sub>2e</sub>), down by 14.1 percent as compared with the 2019 levels. The positive impact on GHG emissions may be due to decreased energy demand and preference for indigenous supply considering the risk associated with imported fuels.
- Ambient air quality improves with particulate matter (PM) lower by 16.1 percent at 33.3 MT vis-a-vis 2019 levels. This is among the impacts of the restrictions imposed on mass transportation and the limited movement of people and vehicles. Energy consumption for transport accounts for close to half of the PM, albeit, registering reductions of 18.6 percent for 2020.
- The resumption of economic activity pushes GHG emissions to increase by 5.3 percent and 6.9 percent each year for 2021 and 2022, respectively.
- The PM under the recovery program scenario returns close to its pre-COVID levels, albeit slightly lower, rising by as much as 5.6 percent and 7.9 percent in 2021 and 2022, respectively.
- The bulk of GHG and PM emissions shall come from the transformation (power generation) and transport sectors.

**Table 22. GHG EMISSIONS, By Fuel, 2018-2022**

Fuel	Levels (MTCO <sub>2e</sub> )					Growth Rates (%)		
	2018	2019	2020	2021	2022	19-20	20-21	21-22
Natural Gas	8.43	7.96	7.84	7.78	7.79	-1.5	-0.8	0.2
Coal	63.16	68.62	57.64	60.90	66.31	-16.0	5.7	8.9
Oil	51.73	56.68	49.04	51.87	54.74	-13.5	5.8	5.5
<b>Total GHG</b>	<b>123.32</b>	<b>133.25</b>	<b>114.52</b>	<b>120.55</b>	<b>128.84</b>	<b>-14.1</b>	<b>5.3</b>	<b>6.9</b>

**Table 23. PARTICULATE MATTER (PM), By Fuel, 2018-2022**

Fuel	Levels (MT)					Growth Rates (%)		
	2018	2019	2020	2021	2022	19-20	20-21	21-22
Natural Gas	0.71	0.73	0.70	0.69	0.69	-3.8	-0.8	0.2
Coal	27.11	29.04	24.08	25.44	27.70	-17.1	5.7	8.9
Oil	9.60	9.93	8.54	9.03	9.53	-14.0	5.8	5.6
<b>Total PM</b>	<b>37.42</b>	<b>39.70</b>	<b>33.32</b>	<b>35.17</b>	<b>37.93</b>	<b>-16.1</b>	<b>5.6</b>	<b>7.9</b>

\*red font – short-term outlook

## D. TOTAL PRIMARY ENERGY SUPPLY

The country's TPES under the REF grows at an average rate of 4.6 percent a year to reach 160.7 MTOE in 2040 from 59.7 MTOE in 2018. Coal and oil continue to dominate the supply mix with 36.2 percent and 32.3 percent average shares, respectively. Renewables contribute significantly in the TPES with an aggregate average share of 27.2 percent, while natural gas accounts for the remaining, with an average share of 4.4 percent across the planning period (Table 24).

Table 24. TOTAL PRIMARY ENERGY SUPPLY, By Fuel (MTOE)

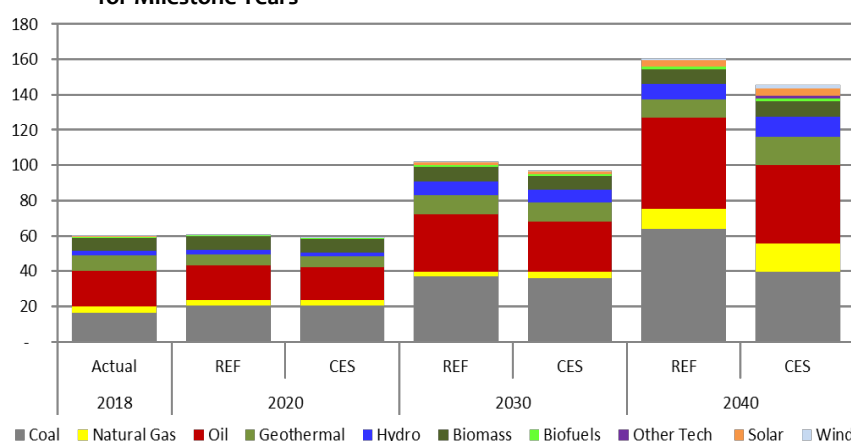
Fuel Type	2018	2030		2040		AAGR '18-'40 (%)	
	Actual	REF	CES	REF	CES	REF	CES
Coal	16.35	37.22	35.84	64.17	39.77	6.41	4.12
Natural Gas	3.60	2.39	3.91	11.19	15.88	5.29	6.98
Oil	19.99	32.69	28.20	51.78	44.19	4.42	3.67
Renewable	19.72	29.95	29.19	33.57	44.26	2.45	3.74
Geothermal	8.97	10.62	11.04	10.18	16.38	0.57	2.77
Hydro	2.34	7.95	7.19	8.67	11.11	6.14	7.35
Wind	0.10	0.55	0.64	1.29	2.32	12.37	15.41
Solar	0.11	1.84	1.56	3.47	3.96	17.11	17.82
Biomass	7.67	7.99	7.89	8.38	9.16	0.41	0.81
Biofuels	0.53	1.02	0.87	1.58	1.32	5.07	4.22
Other Technology	-	-	-	-	1.63	-	-
<b>Total</b>	<b>59.66</b>	<b>102.25</b>	<b>97.15</b>	<b>160.71</b>	<b>145.74</b>	<b>4.61</b>	<b>4.14</b>
<b>Self-sufficiency (%)</b>	<b>50.2</b>	<b>50.9</b>	<b>59.0</b>	<b>58.0</b>	<b>64.1</b>		

\*average annual growth rates (AAGR) for 2018 to 2040

In the CES, the TPES rises to 145.7 MTOE in 2040, 9.3 percent lower than the REF as growth slows down to 4.1 percent a year. The supply mix changes significantly between the two scenarios with 4.4 percentage point's reduction in the combined average share of oil and coal (64.1 percent in the CES against 68.5 percent in the REF). Expanding use of alternatives in the transport, greater utilization of renewables and highly efficient technologies cause the displacement of fossil fuels, particularly oil and coal, in the supply mix.

Aggregate supply from renewables grows to 44.3 MTOE, while diffusion of other technologies in the CES contributes 1.6 MTOE to the TPES by 2040 (Figure 43). Energy Self-sufficiency improves in the CES as the share of indigenous energy resources increases to 64.1 percent in 2040 compared with 58.0 percent under the REF.

Figure 43. TOTAL PRIMARY ENERGY SUPPLY By Fuel Type, CES vs Reference: (MTOE) for Milestone Years



## 1. Fossil Fuels

- i. **Oil** primary supply grows by 4.4 percent a year, on average, in the REF, from 20.0 MTOE in 2018 to 51.8 MTOE in 2040. Still, oil contributes significantly to the country's total energy mix with an average share of 32.3 percent during the planning horizon.

With the influx of alternative fuels (e.g., EVs, HEVs, CNG and biofuels) and improved vehicle efficiencies and mileage under the CES, dependence on oil drops by as much as 14.7 percent. Its annual average share to the TPES falls to 30.0 percent, as oil supply grows at a slower rate of 3.7 percent a year reaching 44.2 MTOE in 2040.

- ii. **Coal** supply increases by 5.3 percent annually as its level rises four-fold from the 2018 level of 16.3 MTOE to 64.2 MTOE in 2040. This translates to an average share of 36.2 percent of the TPES over the planning period under the REF. This is to provide for the rising requirement of coal in the power sector, as well as demand from the industry sector, specifically for cement and basic metals production.

Reduction in coal capacity and generation output in the CES results in a slower growth rate at 4.1 percent a year, equivalent to 39.8 MTOE of coal supply requirement in 2040.

- iii. **Natural Gas** supply increases at a rate of 5.3 percent a year, from 3.6 MTOE in 2018 to 11.2 MTOE in 2040. Aside from the production coming from the Malampaya field and additional gas supply (uncontracted gas) until 2025, there are other natural gas sources (from smaller fields), such as the Libertad gas field in Cebu that started its commercial production in 2010. The potential gas fields that are foreseen to produce commercially within the next 20 years include *Sultan sa Barongis* and *Sampaguita* by 2023, and the *Sulu Sea* by 2025, among others.

Natural gas supply under the CES reaches 15.9 MTOE in 2040, assuming the realization of production targets. The growth is largely due to the government's effort to promote the utilization of cleaner fuel<sup>42</sup> for power generation.

## 2. Renewable Energy

Renewable energy accounts for an annual average share of 27.2 percent across the planning period under the REF, increasing at an average rate of 2.4 percent a year, from 19.7 MTOE in 2018 to 33.6 MTOE in 2040. In the CES, renewables contribution improves to an average of almost 30.0 percent with 44.3 MTOE in 2040. Geothermal and biomass provide the largest share to total renewables both under the REF and CES.

### How Energy Supply Responds Vis-À-Vis Energy Demand under PDP 2017-2022 and Ambisyon 2040?

**Total energy supply in the REF grows at 4.6 percent annually, reaching 160.7 MTOE in 2040. By the end of the planning period, the energy mix is composed of coal (40.0 percent), oil (32.0 percent), natural gas (7.0 percent) and renewables (21.0 percent).**

Under the **CES, growth slows down to 4.1 percent per year. By 2040, the share of renewables to energy mix increases to 30.0 percent, compensating the reduction in oil and coal.**

**Geothermal and biomass** contribute the largest share to total renewables both under the REF and the CES.

The **CES** also provides a window for **the entry of other technologies, particularly nuclear power.**

**By 2040, energy self-sufficiency improves to 64.1 percent under CES.**

<sup>42</sup> Renewables and Natural gas

- i. **Geothermal energy** remains to be the country's major renewable resource accounting for an average share of 37.5 percent of the total renewables under the REF. Its production stands at 10.2 MTOE in 2040 from 9.0 MTOE in 2018, which translates to a steady growth of 0.6 percent. In the CES, its contribution expands at 2.8 percent a year, which is translated to 16.4 MTOE in 2040 with an average share of nearly 40.0 percent of the total renewables. This is equivalent to an 11.8 percent share to the TPES in the CES.
- ii. **Hydropower** supply exhibits an average annual growth of 6.1 percent, from 2.3 MTOE in 2018 to 8.7 MTOE in 2040, and contributes an average share of 5.3 percent of the TPES in the REF. Under the CES, the hydropower increases its levels to 11.1 MTOE in 2040 at an average rate of 7.3 percent a year.
- ii. **Solar and wind** under the REF improve their levels from around 0.2 MTOE in 2018 to 4.8 MTOE in 2040, and expands further to 6.3 MTOE for the same period in the CES, translating to a yearly increase of 16.8 percent, on average.
- iv. **Biomass**<sup>43</sup> for power and end-use applications contributes 8.7 percent average share to the TPES under the REF, posting an increment of 0.4 percent a year to reach 8.4 MTOE by 2040. Under the CES, biomass supply increases to 9.2 MTOE by 2040, corresponding to 0.8 percent annual growth per year, and accounting for an average share of 9.1 percent of the TPES. Despite the expected reduction in end-use biomass (non-power application<sup>44</sup>), its contribution gradually steps up for power generation from additional capacities of biomass power plant over the planning period.
- v. **Biofuels** current blend schedules of 2.0 percent biodiesel (B2) and 10.0 percent bioethanol (E10) increase the aggregate level by 5.1 percent in the REF – from 0.5 MTOE in 2018 to 1.6 MTOE in 2040. However, the reduction of gasoline and diesel demand in the transport sector due to displacement from electricity and natural gas under the CES slows down aggregate biofuel consumption to 4.2 percent a year, on average.

## E. GREENHOUSE GAS EMISSION

In the REF, total GHG emission from fossil fuels (oil, coal and natural gas) increases at 6.0 percent per year across the planning period from 123.3 MtCO<sub>2</sub>e in 2018 to 444.5 MtCO<sub>2</sub>e in 2040. Emission from the consumption of coal accounts for an average share of 56.9 percent of the total GHG emission, while those from oil-based fuels exhibit an average share of 39.1 percent, and natural gas with a 4.0 percent share.

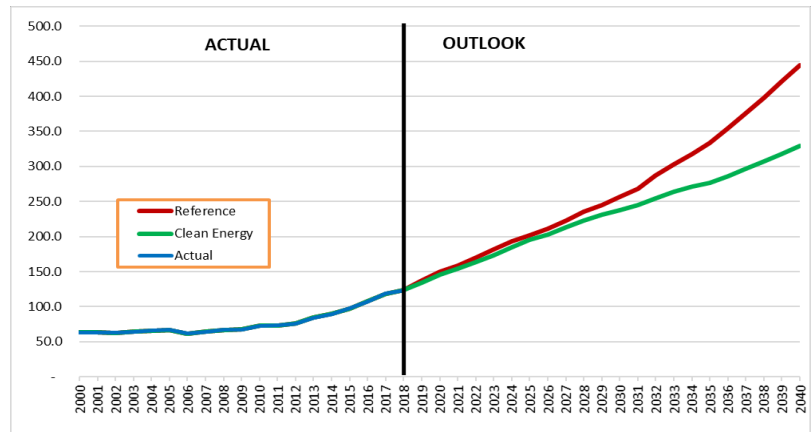
Under the CES, where cleaner and more efficient fuels for transport and highly efficient coal and natural gas technologies take hold, along with the increased share of renewables, total GHG emission drops to 329.1 MtCO<sub>2</sub>e in 2040, down by 26.0 percent than the REF, as growth slows down at an annual average rate of 4.6 percent across the planning horizon (Figure 44).

<sup>43</sup> Includes charcoal, fuelwood, rice hull, bagasse, agriculture, municipal and animal waste

<sup>44</sup> Includes charcoal, fuelwood, rice hull, bagasse, agriculture and animal waste

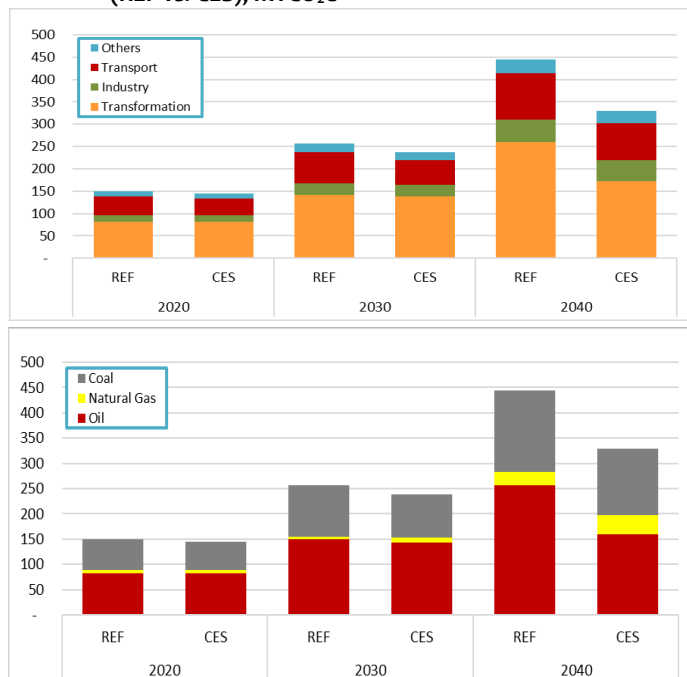
More than half (54.8 percent) of the total emission under the REF comes from the transformation sector, specifically in power generation due to significant contribution of coal-fired power plants. Among the energy end-use sectors, transport registers the largest share of the total GHG emission at an average of 26.6 percent, followed by industry with a 10.9 percent share. Other sectors (commercial, residential and agriculture) account for 7.7 percent share of total.

**Figure 44. TOTAL GHG EMISSION, 2000 – 2040 ACTUAL vs OUTLOOK, Clean Energy & Reference (MTCO<sub>2</sub>e)**



With the emergence of clean and highly efficient technologies for power generation and transport under the CES, the bulk of the reduction in GHG emission vis-à-vis Reference Scenario consequently come from the transformation and transport sector. In terms of fuel, the decreased utilization of oil for transport and coal in power generation lower the GHG emission under the CES (Figure 45).

**Figure 45. GHG EMISSION, By Sector and Fuel, Milestone Years (REF vs. CES), MTCO<sub>2</sub>e**



**How Climate Change Initiatives under PDP 2017-2022 and AmBisyon2040 Impact the Energy Sector?**

Under the REF, total GHG emission from energy-related activities increases by 6.0 percent a year from 123.3 million tons of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>e) in 2018 to 444.5 MtCO<sub>2</sub>e in 2040.

Cleaner and more efficient fuels for transport, and highly-efficient technologies for coal and natural gas under the CES reduces GHG emission to 329.1 MtCO<sub>2</sub>e in 2040, 26.0 lower than the REF, while growth slows down by 4.6 percent across the planning horizon.

Bulk of the reduction in GHG emission comes from power generation and transport.

## F. COST-EFFECTIVENESS OF SCENARIOS BASED ON THE BLENDED RATE OF POWER GENERATION

The blended rate of power generation under the REF registers yearly increments of 0.4 percent from 5.1 PhP/kWh in 2018 to 5.51 PhP/kWh in 2040 (Table 25). With the increased share of variable renewable energy or VRE (solar and wind) and other low carbon technologies in the mix, the blended rate under the CES increases at a bit faster rate of 0.7 percent a year resulting in 5.90 PhP/kWh in 2040, up by 7.1 percent than the REF blended rate for the same year.

Despite the downward trend in investment costs of VRE, the blended rate under the CES is higher due to lower capacity factors of these technologies, thus, requiring more capacity additions than the REF.

Table 25. BLENDED RATE PER SCENARIO (PhP/kWh)

Resource	Reference Scenario			Clean Energy Scenario		
	2020	2030	2040	2020	2030	2040
Oil	0.07	0.03	0.02	0.07	0.04	0.02
Natural Gas/LNG	0.89	0.46	0.99	0.88	0.65	1.57
Coal	2.92	3.27	3.05	3.14	3.25	1.97
Geothermal	1.02	1.87	1.45	1.04	1.85	2.19
Hydro	0.32	0.31	0.17	0.34	0.34	0.30
Biomass	0.18	0.54	0.56	0.16	0.49	0.72
Wind	0.39	0.81	0.49	0.43	0.77	0.70
Solar	0.07	0.16	0.21	0.08	0.20	0.42
Other Technologies	0.04	0.05	0.03	0.04	0.04	0.06
Battery Storage	0.00	0.00	0.00	0.00	0.00	0.15
<b>Blended Rate (PhP/kWh)</b>	<b>4.90</b>	<b>5.64</b>	<b>5.51</b>	<b>5.12</b>	<b>5.78</b>	<b>5.90</b>

Note: The computation of the blended rate used a conversion rate of Php50/USD to determine the power rate in the future. MERALCO's blended rate of PhP5.1/kWh in 2018 is used to represent generation cost from existing power plants.

## G. POLICY IMPLICATIONS AND WAY FORWARD

The results of this Outlook merit several policy implications and recommendations:

### TRENDS / IMPACTS

1. The energy-economy indicators show significant trends, such as:
  - a. Economy-wide energy intensity under the CES drops by 53.0 percent (absolute terms) in 2040 to 3.0 TOE/MPhP from its 2018 level of 6.4 TOE/MPhP, which is well below the APEC and ASEAN reduction targets with 2005 as base year. Annual decline in energy intensity hinges on the successful implementation of energy efficiency programs, apart from structural changes in the economy (e.g., the emergence of more non-energy intensive industries/processes).
  - b. Energy use per capita is expected to nearly double its 2018 level of 0.6 TOE to 1.0 TOE in 2040 as a greater portion of the population gains access to energy services. Electricity per capita increases faster at 4.6 percent to 2,234.5 kilowatt-hours/person (kWh/person) by 2040. Achievement of the higher per capita level is guaranteed through the realization of the 100.0 percent household electrification level by 2022, as well as the fully operational grid interconnection project – the Mindanao-Visayas Grid Interconnection project.

2. The target of increasing the renewable capacity to at least 20,000 MW based on 2010 level in the REF brings the share of RE to almost 50.0 percent of the total capacity mix in 2040. This corresponds to 33.0 percent share of renewables in the generation mix for the same year, which falls short to the aspirational target of 35.0 percent share under the Renewable Portfolio Standards (RPS) for On-Grid.<sup>45,46</sup> Eventually, the said target share is achieved in the CES in 2040 with a 37.3 percent contribution to the power generation mix vis-à-vis a 54.0 percent share in the capacity mix.
3. If there are no additional discoveries of natural gas reserves, supply depends solely on the importation of Liquefied natural gas (LNG) to meet domestic requirements after Malampaya’s resource depletion.
4. Although higher energy self-sufficiency level (58.0 percent in REF and 64.1 percent CES) is seen to achieve over the planning period as compared with the 2018 level, still a considerable portion of the supply mix is sourced overseas. Dependence on imported energy, specifically oil and coal, and even LNG, is vulnerable to impeding threats of supply disruption from natural and human-induced disasters and pandemics that place the country’s energy supply security at risk.
5. Implementing a technology-neutral policy allows for the entry of other technologies in the country’s supply and power mix. Such policy intends to diversify the energy portfolio that balances the country’s goals of energy security, environmental sustainability and greater access to affordable energy that are deemed essential towards sustainable development. Renewables and natural gas contribute more to the country’s supply mix, consistent with achieving the goal of a low carbon future.
6. Increasing biofuel blend to 20.0 percent for both biodiesel and bioethanol greatly contributes to decreasing further the GHG emission from the transport sector.
7. Higher penetration of electric vehicles reduces GHG emissions in the transport sector but potentially pushes up the GHG emissions from increased electricity production.
8. Passage of the Republic Act (RA) 11285 or Energy Efficiency and Conservation (EE&C) Act strengthens the implementation of the government’s EE&C programs intended to reduce the energy intensity of the different economic sectors. The energy savings target from EE&C programs is incorporated in the energy demand modeling.
9. The trade-offs in using renewables as a mitigation option for GHG emission is the increase in generation cost that pushes up the electricity tariff. This has to be balanced with reliable low carbon technologies to lessen the impact on the electricity tariff.

#### How PDP 2017-2022 and Ambisyon2040 Impact the Energy Sector?

**Energy intensity halves by 2040** to 3.0 MTOE/MPhP from 6.5 MTOE/MPhP in 2018 level.

**Energy use per capita nearly doubles by 2040** – from its 2018 level of 0.6 TOE to 1.0 TOE by 2040

**Renewable** capacity reaches 25,266 MW by 2030 – almost **50.0 percent of the total capacity mix.**

**Clean energy policies under the CES** reduces the TPES by an **average of 4.8 percent** between 2018 and 2040. The same policies also reduce **GHG emission by 26.0 percent** by 2040.

Under the CES, generation output from **renewables is expected to reach 140.9 terawatt-hour (TWh)**, representing a **37.3 percent share of the generation mix.**

<sup>45</sup> Department Circular DC 2017-12-0015, Rule 2, Section 7

<sup>46</sup> Please refer to Annex 18 for Impact Analysis on RPS RE Target vis-à-vis Total Generation

## WAY FORWARD

Overall targets and programs of the energy sector under the CES result in reduction of the TPES by 9.3 percent in 2040. At the same time, this leads to a drop in GHG emission by 26.0 percent. In order to realize these targets, the following are recommended:

1. Strengthen the implementation of existing policy mechanisms under the Renewable Energy Act of 2008 (RA 9513) to achieve the targets set forth in the National Renewable Energy Program (NREP) and attract new investments in the sector.
2. Mechanisms to enhance opportunities for foreign-owned companies to engage in renewable energy development should be pursued, including the timely implementation of the green energy auction program (GEAP) in 2020-2021, green energy options program (GEOP) in 2020-2021; and renewable energy market (REM) for renewable energy certificates (RECs) trading in 2021.
3. Accelerate the policy mechanisms for LNG under the Philippine Downstream Natural Gas Regulation (PDNGR), which include the Gas Policy Development Program (GPDP), among others. The program aims to provide technical assistance in the evaluation of natural gas investment project applications to help develop the country's LNG potential vis-à-vis energy security consideration of importing LNG.
4. Conduct studies to come up with an appropriate pricing mechanism to make renewable and natural gas more competitive, specifically against coal. These should also assess the potential or positive impact in lowering electricity prices when tapped as dominant energy resources for power generation.
5. Consider establishing contingency measures to address the adverse impact of supply disruption on imported energy.
6. Promote an innovation culture, support new technologies and business models that have the potential to transform the energy system into a more efficient that addresses the real needs of the country.
7. Pursue a national position for the introduction of nuclear power as long-term energy options, which may also require a comprehensive assessment of its feasibility and applicability in the country. Nuclear energy is a prospective energy source that could be harnessed for greater energy security and supply stability in the near future and a potential option for GHG mitigation. This also improves the diversification of the supply mix, which may lead to a more competitive electricity rate.

### What can be done?

- Strengthen the implementation of RE Law
- Identify the policy mechanisms for LNG under the PDNGR
- Identify appropriate pricing mechanism for competitive RE and natural gas
- Establish contingency measures to address the adverse impact of supply disruption on energy imports
- Promote innovative technologies that have the potential to transform the energy system
- Pursue a national position for nuclear power and other technology
- Improve the transparency and analysis in the energy rates with the adoption of unbundling policies
- Encourage investments and market competition in the power sector thru the implementation of the competitive selection process (CSP)
- Ensure public support for the implementation of alternative fuels for the transport sector
- Balance the trade-offs due to higher EVs in transport vis-à-vis increased electricity production
- Establish accurate baseline indicators to measure the effectiveness of EE&C Law implementation



8. Continue to promote a technology-neutral policy and fuel diversification to remain responsive to the triple challenge of finding solutions on ensuring a secured, affordable and environmentally-sensitive energy – **the Energy Trilemma Index**. The intermittency of renewable energy sources must be supported by other indigenous energy resources to lessen the country’s reliance on imported energy and enhance energy supply security and independence.
9. Improve the transparency of energy rates or prices with the adoption of unbundling policies. The details on price adjustments will also prevent any anti-competitive behavior among the industry players. With the passage of the Electric Power Industry Reform Act of 2001 (EPIRA) or RA 9136 that mandates the unbundling of electricity prices, the rate of the price increase slowed down vis-à-vis pre-EPIRA regime. The decline in the commercial and industrial prices relative to their pre-EPIRA levels were registered,<sup>47</sup> while the removal of cross-customer subsidies contributed to the divergence across customer rates, which reflect the actual cost of service delivery.
10. Conduct policy studies to cushion, if not arrest, the impact of higher electricity rates through, but not limited to, the removal of UCME and mandating higher efficiency improvements in the transmission.
11. Encourage investments and market competition in the power sector through the implementation of the CSP policy for power supply agreements (PSAs), including procurement of ancillary services. The CSP is envisioned to address the energy supply and affordability issues as it mandates distribution utilities (DUs) to auction off their PSAs to achieve adequate and stable supply, while allowing competition and least cost prices to ensure reasonable tariffs.
12. Conduct a study on the feedstock selection and availability, as well as the associated economic cost of biofuels.
13. Conduct a study on higher penetration of EVs on the trade-off between the possible reduction in GHG emission in the transport sector and the potential increase in GHG emission from increased electricity production.
14. Establish accurate baseline indicators for the evaluation EE&C programs in identified priority sectors. These indicators are best provided by institutionalizing the conduct of energy-related surveys in the household, buildings, industry and transport sectors and other forms of data collection.
15. Ensure public support in government programs for the implementation of alternative fuels for the transport sector, such as the promotion of EVS and other vehicle modernization programs.
16. Ensure the implementation and realization of the sectoral roadmaps and targets under this Plan to achieve the optimal energy scenario in the medium- and long-term through strict implementation of the Energy Virtual One-Stop Shop (EVOSS) Act or RA 11234 and the Executive Order (EO) 30.

<sup>47</sup> Brucal, Ancheta (2018) “The Philippine Electric Power Industry Under EPIRA” <https://pidswebs.pids.gov.ph/CDN/PUBLICATIONS/pidspn1819.pdf>

## H. ENHANCING THE ROLES OF GOVERNMENT-OWNED-OR-CONTROLLED CORPORATIONS (GOCCS), PRIVATE SECTOR PARTNERS AND REGULATOR

### *National Electrification Administration*

The National Electrification Administration (NEA) was created under RA 6038 signed in July 1969 to carry out the total electrification of the country through the Rural Electrification Program (REP). It supervises the 121 Electric Cooperatives (ECs) as DUs in 78 out of 81 provinces of the country. The ECs play an important role, being one of the front-runners, in expanding energy access and attaining energy security. In 2019, the ECs provide electricity services to 78 provinces, 90 cities, 1,385 municipalities, 36,065 barangays, 124,582 sitios and 13.47 million connections.

The NEA remains committed in its mandate of providing electricity up to the remotest of villages of the country in line with the President's directive to accelerate electrification by 2020 and the energy sector development agenda of expanding electricity access. Aside from its programs in electrification, NEA was also engaged in improving power distribution in Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), the unification of Davao del Norte Electric Cooperative, Inc. (DANECO) and mobilizing task forces to improve the reliability of electric services in specific areas, such as Task Forces of Palawan Electric Cooperative (PALECO), Occidental Mindoro Electric Cooperative (OMEKO), and Abra Electric Cooperative (ABRECO).

### *National Power Corporation*

The National Power Corporation (NPC) under the deregulated power industry serves as the government's arm in providing reliable and reasonably-priced electricity supply in the "missionary areas or off-grid areas." As of 2019, the NPC- Small Power Utilities Group (NPC-SPUG) owns a total of 139 power generating facilities, and manages the transmission and substation assets of the government in off-grid areas.

As the major power supply provider in off-grid areas, the NPC supports the government's program in providing greater access to electricity and in achieving the 100.0 percent household electrification level. The NPC continues to improve its operation by adding additional power generating capacities to extend the operating hours of electricity services of the ECs in off-grid areas. It has also completed the transmission network projects in Masbate province<sup>48</sup> – the long-stalled Mobo to Cataingan and Mobo to Aroroy 1 and 2 69kV transmission lines.

The NPC launched the 300 kW Pandami Diesel Power Plant in Sulu in pursuit of its goal to achieve electrification in the off-grid islands<sup>49</sup>. Pandami is a fourth-class municipality in Sulu, which has a potential household of 2,300. The municipality's major source of livelihood is fishing and farming.<sup>50</sup> Likewise, the NPC is set to energize new areas in Samar province consisting of nine communities

For the coming years, the NPC envisions to be a world-class power corporation providing reliable and reasonably-priced electricity in all missionary areas by 2025 and commits to perform the power and functions as provided under existing laws.

<sup>48</sup> [https://www.napocor.gov.ph/npc2020/images/doe/PEP\\_2017-2040\\_Energy\\_Annual\\_Report\\_2017.pdf](https://www.napocor.gov.ph/npc2020/images/doe/PEP_2017-2040_Energy_Annual_Report_2017.pdf)

<sup>49</sup> <https://philippinepowerinsights.wordpress.com/power-news-roundup/npc-launches-diesel-power-plant-in-sulu/>

<sup>50</sup> <https://powerphilippines.com/npc-launches-diesel-power-plant-sulu/>

### **National Transmission Corporation**

The National Transmission Corporation (TransCo) is a government-owned and controlled corporation created in 2001 under EPIRA, and a corporate entity wholly owned by the Power Sector Assets and Liabilities Management (PSALM). It is responsible for the operation and management of the power transmission system<sup>51</sup>. Given this mandate, TransCo is one of the most crucial attached agencies of the DOE. The country's transmission network is composed of 20,505 circuit-kilometer (ckt-km) of transmission line with a total substation capacity of 34,852 megavolt-ampere (MVA). The TransCo's asset inspection teams continuously monitor the environmental compliance of the concessionaire (NGCP) pertinent to its operation and maintenance of transmission facilities in Luzon, Visayas and Mindanao grids.

### **National Grid Corporation of the Philippines**

The National Grid Corporation of the Philippines (NGCP) is a private-owned entity in charge of operating, maintaining, and developing the state-owned power grid<sup>52</sup> and transmission assets under RA 9511<sup>53</sup>. It is a consortium of three corporations, namely Monte Oro Grid Resources Corporation, Calaca High Power Corporation, and the State Grid Corporation of China.

The NGCP prepares the Transmission Development Plan (TDP), which includes the ideal locations of future power plants that would best benefit the already existing transmission network. Resiliency planning is likewise embodied in the TDP, manifested as enhancement of transmission lines, careful site selection, increase of transmission tower strength and capacity, and security of transmission assets. The NGCP submits monthly status reports of the transmission projects and has also installed Wholesale Electricity Spot Market (WESM) compliant metering and real-time monitoring facilities for gleaning up to date information.

### **Power Sector Assets and Liabilities Management Corporation**

The Power Sector Assets and Liabilities Management Corporation (PSALM) is one of the DOE's attached agencies whose principal purpose is to manage the orderly sale, disposition and privatization of the NPC generation assets, real estate and other disposable assets and the Independent Power Producer (IPP) contracts with the objective of liquidating all NPC financial obligations and stranded contract costs in an optimal manner.

### **Philippine Electricity Market Corporation and the Independent Electricity Market Operator of the Philippines**

The Philippine Electricity Market Corporation (PEMC) is the governing arm of the WESM. The IEMOP was formed following the joint endorsement of the DOE and the industry participants of the transition to the IMO as required by the EPIRA. On 19 September 2020, PEMC and IEMOP executed an Operating Agreement transferring the operations of the WESM to IEMOP while retaining PEMC's governance functions.

### **Energy Regulatory Commission**

The Energy Regulatory Commission (ERC) was created through the EPIRA as an independent, quasi-judicial regulatory body, which abolished the old Energy Regulatory Board (ERB). The ERC is

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<sup>51</sup> links power plants to the respective electric distribution utilities on a national scale

<sup>52</sup> interconnected system that transmits gigawatts of power to where it is needed

<sup>53</sup> An Act Granting the National Grid Corporation of The Philippines A Franchise to Engage In The Business Of Conveying Or Transmitting Electricity Through High Voltage Back-Bone System of Interconnected Transmission Lines, Substations And Related Facilities, And For Other Purposes (01 December 2008)

tasked to promote competition, encourage market development, ensure customer choice and penalize abuse of market power in the electricity industry. It ensures that the activities and rates of the energy players are unbundled to promote efficiency and transparency.

### ***Philippine National Oil Company***

The Philippine National Oil Company (PNOC) is an energy company established through Presidential Decree (PD) 334<sup>54</sup> during the Marcos Administration as a response to the 1973 First Oil Crisis. It is intended to serve as the corporate arm of the DOE and ensure oil supply in the country. Since then, various amendments on its charter have been made through the issuances of policies that modified its functions, including RA 7638 or the Department of Energy Act 1992.

Aside from forging partnerships with oil suppliers, PNOC has been at the forefront of indigenous oil exploration and geothermal resources<sup>55</sup>. Currently, the PNOC is working towards the development and implementation of a gas distribution system, and the establishment of the strategic petroleum reserve of the country.

In 2018, the PNOC commenced the solicitation for project proposal on the envisioned LNG Hub or Trading and Trans-shipment Hub that would place the country as an LNG distributor and exporter as well. The said project has been declared by the DOE as an Energy Project of National Significance (EPNS).

The PNOC has two subsidiaries that aid in the realization of its mandate: the PNOC-Exploration Corporation (PNOC-EC) and PNOC-Renewables Corporation (PNOC-RC).

#### ***a. PNOC-Exploration Corporation (PNOC-EC)***

The PNOC-EC is a subsidiary assigned to take the lead in the exploration, development, utilization and marketing of oil, gas and coal, and other viable energy resources. With over 30 years of industry presence, the PNOC-EC has established itself in the local petroleum setting with eight (8) petroleum service contracts, one of which is the SC 38 or the Malampaya Natural Gas Field.<sup>56</sup> The PNOC-EC continues to deliver by studying more viable petroleum and coal reserves to secure the future demands these resources for the country.

#### ***b. PNOC-Renewable Corporation (PNOC-RC)***

The PNOC-RC is a fully-owned subsidiary established in 2008, the same year the RE Law was enacted, to promote the development and implementation of renewable resources that can be harnessed in the country. With the utilization of renewable sources, it targets to reduce the country's reliance on oil importation, reduce GHG emissions, and further drive up energy security and self-sufficiency. Since 2008, it has developed several renewable projects, such as the 32-MW Maibarara Geothermal Project, 44-MW Nalatang Hydropower Project, and Solar PV Rooftop Projects in Metro Manila and Cebu.

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<sup>54</sup> Signed on 9 November 1973

<sup>55</sup> Geothermal development function was affected when the PNOC-Energy Development Corporation (PNOC-EDC) was privatized in 2007.

<sup>56</sup> The PNOC-EC holds a 10.0 percent stake in the Malampaya project with Chevron Malampaya LLC holding 45.0 percent and Shell Philippines Exploration (SPEX) getting the remaining 45.0 percent.

## I. CREATING A REFORMED ENERGY INVESTMENT ENVIRONMENT

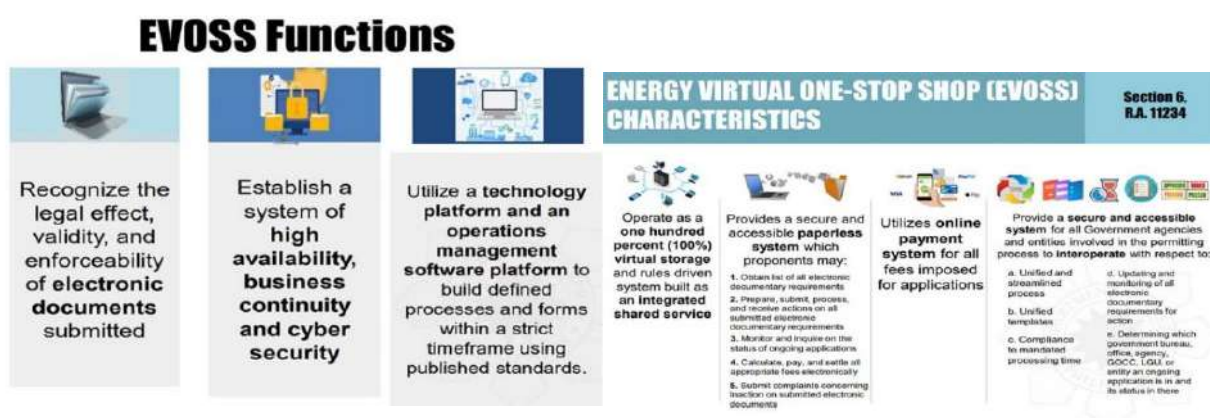
Realizing the important role of energy in fueling the country’s economic growth, the government has put in place several legislations to guarantee that investments in the energy sector are given utmost priority and immediate action. Issuances from the DOE were likewise promulgated to support such legislation in anticipation that energy investments will significantly increase and later on pave the way for the building of much-needed energy infrastructures to ensure a continuous, adequate and reliable supply of energy for the country.

### 1. THE ENERGY VIRTUAL ONE STOP SHOP SYSTEM: Putting Up a Virtual Energy Investment-Friendly System

The EVOSS Act<sup>57</sup> was promulgated on 19 March 2019 to streamline the permitting process of new projects for power generation, transmission and distribution. An EVOSS Steering Committee has been formed to finalize and concretize the framework on the detailed process flow of permitting procedures, including internal process of each member agency. The Office of the President serves as the Chair of the EVOSS Steering Committee and the DOE sits as the Vice-Chair with members from the different government agencies, private entities and end-users<sup>58</sup>.

The EVOSS system, an online system, shall be set up to allow coordinated submission and synchronous processing of required data and information and provide a single decision-making portal for actions on application for permits and licenses for energy projects. It is a paperless and electronic platform that serves as gateway for easier transactions among regulators and energy stakeholders, thereby reducing the burdens of doing transactions in the energy sector. Part of the main functions of EVOSS is to recognize the legal effect, validity and enforceability of electronic documents submitted relative to energy project applications. An online payment system shall also be instituted for all fees imposed for application for permits/licenses/certifications of energy projects, and provide a paperless processing system for energy proponents (Figure 46).

FIGURE 46. EVOSS FUNCTIONS AND CHARACTERISTICS PER SECTION 6 OF R.A. 11234



<sup>57</sup> The EVOSS as defined in RA 11234 refers to an online system that allows the coordinated submission and synchronous processing of required data and information and provides a single decision-making portal for actions on application for permits/licenses/certifications necessary for energy projects.

<sup>58</sup> EVOSS Steering Committee is composed of the following members following: Department of Agriculture (DA), Department of Agrarian Reform (DAR), Department of Environment and Natural Resources (DENR), Department of Interior and Local Government (DILG), Department of Information, Communication and Technology (DICT), Department of Works and Highways (DPWH), Energy Regulatory Commission (ERC), National Commission on Indigenous Peoples (NCIP), National Water Resource Board (NWRB), Head of Market and System Operators and Representatives from Power Generation, Transmission and Distribution Sectors and End-Users.

Likewise, the EVOSS provides a leeway for the member government agencies and entities to reassess/review their regulatory processes and procedures on the issuance of permits/licenses/certificates, and correspondingly reduce the turn-around time allotted for each process and procedure to comply with the timeframe as listed in *Table 26*.

The EVOSS System is the first inter-agency energy on-line virtual system designed to cater to energy applications and at the same time work as a repository of project-related information relative to permits issuance and approval. Further, it is a web-based monitoring system that is shared among government agencies involved in the processing and issuance of permits/licenses/certificates for energy projects to promote and ensure transparency and accountability.

Currently, the EVOSS System includes the application for renewable energy development projects. As the lead agency, the DOE is continuously working on the enhancement of the System to incorporate other features stipulated in the Act. Since its roll-out on 24 July 2020, the System holds a total of 12 energy project applications - which are all renewable projects.

## 2. EXECUTIVE ORDER 30: Creation of Energy Investment Coordinating Council (EICC)

On 28 June 2017, President Rodrigo Roa Duterte issued EO 30 to ensure a continuous, adequate and economic supply of energy throughout the country. The said EO created the Energy Investment Coordinating Council (EICC) and set the definition and specific attributes for the declaration of certain projects as **“Energy Projects of National Significance (EPNS).”** Under the EO, the EICC is mandated to spearhead and coordinate national government efforts to streamline regulatory procedures, simplified approval process, and harmonized rules and regulations of all permitting government agencies to expedite the development of energy projects and avoid delays. The EICC is chaired by the DOE and composed of representatives from 18 different government agencies as Council Members<sup>59</sup>.



On 25 April 2018, Secretary Alfonso G. Cusi, Chairperson of the EICC, issued DC 2018-04-0013 providing the Implementing Rules and Regulations (IRR) of EO No. 30. The IRR governs the permitting process for the approval and implementation of logical, systematic, organized and speedy issuance of permits and clearances for the EPNS.

### **Nominating an Energy Project of National Significance (EPNS)**

Pursuant to EO 30 and its IRR, EPNS are major energy projects for power generation, transmission and/or ancillary services including those required to maintain grid stability. These projects should be in consonance with the policy thrusts and specific goals of the PEP, and which possess any of the following attributes:

<sup>59</sup> The EICC Member Agencies are the following: Department of Trade and Industry-Board of Investment (DTI-BOI), Department of Environment and Natural Resources (DENR), Department of Justice (DOJ), Department of Finance (DOF), Department of Transportation (DOTr), Department of Interior and Local Government (DILG), Department of Agrarian Reform (DAR), Department of Human Settlements and Urban Development (Formerly Housing and Land Use Regulatory Board (HLURB)), National Commission for Indigenous Peoples (NCIP), Mindanao Development Authority (MinDA), National Electrification Administration (NEA), National Grid Corporation of the Philippines (NGCP), National Power Corporation (NPC), National Transmission Corporation (TransCo), Energy Regulatory Commission (ERC), National Water Resources Board (NWRB), National Economic Development Authority (NEDA), and Palawan Council for Sustainable Development (PCSD).

- a. Significant Capital Investment of at least PHP 3.5 Billion;
- b. Significant Contribution to the Country’s Economic Development;
- c. Significant Consequential Economic Impact;
- d. Significant Potential Contribution to the Country’s Balance of Payment;
- e. Significant Impact on the Environment;
- f. Complex Technical Processes and Engineering Designs; and/or,
- g. Significant Infrastructure Requirements.

Through the issuance of a Certificate of EPNS (CEPNS), a project is given specific rights, namely:

- a. Action within 30 working day period (*Table 26*) upon submission of complete documentary requirements to the relevant permitting agencies. All concerned agencies involved in the processing and approval of permits and licenses are directed, with respect to the permits and processes within their jurisdiction, to act and determine the compliance of the project within the aforementioned period; and,
- b. Presumption of prior approval specifies that the government agency can no longer defer the processing until the issuance of other government agencies’ permits/licenses are granted as pre-condition(s) for the application. It is this concept that would allow for the simultaneous or parallel application of permits/license in the different government agencies as there is no need to wait for the others to act first. The government agency can issue a provisional permit/license subject to the granting of other permit(s)/license(s) from other agencies.

**Table 26. EVOSS AND EO 30 TIMEFRAME FOR THE MEMBER AGENCIES/ENTITIES FOR THE ISSUANCE OF PERMITS/LICENSES/CERTIFICATES.**

Agency	EVOSS Calendar Days	EO 30 Working Day
DOE	60	30
DAR	75	30
DAR	60	30
DENR	120	30
ERC		
All applications	60	30
Quasi-judicial cases	270	30
<b>System Operator &amp; Transmission Network Provider</b>	150	30
NWRB	60	30
IEMOP	15	(same as EVOSS)
DOTr	30	(same as EVOSS)
PNP	15	(same as EVOSS)
DPWH	30	(same as EVOSS)
PNRI	15	(same as EVOSS)
<b>Other Agencies</b>	15	(same as EVOSS)
<b>LGUs</b>		
Cities	15	(same as EVOSS)
Municipalities	15	(same as EVOSS)
Provinces	15	(same as EVOSS)
<b>NCIP</b>		(same as EVOSS)
CNO	10	(same as EVOSS)
FPIC	105	30

**Table 27. ENERGY PROJECT OF NATIONAL SIGNIFICANCE (EPNS) SUB-ATTRIBUTES**

<p><b>1. Significant Capital Investment of at least PhP 3.5 Billion</b></p> <p>The total amount of investment of any EPNS application should be able to finance the construction, at minimum equivalent capacity, of any of the following:</p>	
<ul style="list-style-type: none"> <li>▪ 13 MW Nuclear Power Plant;</li> <li>▪ 45 MW Coal Power Plant (Sub-Critical);</li> <li>▪ 40 MW Coal Power Plant (Super Critical);</li> <li>▪ 75 MW Natural Gas Plant;</li> <li>▪ 75 MW Diesel Power Plant;</li> <li>▪ 70 MW Bunker C;</li> <li>▪ 13 MW Geothermal Plant;</li> <li>▪ 20 MW Hydropower (run-of-river) Plant;</li> <li>▪ 30 MW Biomass Plant;</li> <li>▪ 40 MW Solar Plant;</li> </ul>	<ul style="list-style-type: none"> <li>▪ 38 MW Wind Plant;</li> <li>▪ 0.20 Million Tons per Year (MTPY) of LNG Terminal (can fuel 95 MW of Natural Gas at 85.0 percent capacity factor, or 190 MW at 50.0 percent capacity factor);</li> <li>▪ 1.70 thousand barrels per day (MBD) capacity of Oil Refinery; and,</li> <li>▪ 23 wells (USD 3 million per well) drilling for onshore; 7 wells (USD 10 million per well) drilling for offshore.</li> </ul>
<p><b>2. Significant Contribution to the Country's Economic Development</b></p> <p>Aside from promoting greater energy supply security and access to energy, a project must contribute to wealth creation for the country through the following:</p> <ul style="list-style-type: none"> <li>▪ ER 1-94 Benefits to Host Communities of at least PhP 22 million annually; and/or,</li> <li>▪ Contribution to National Wealth Tax of at least PhP 100 million annually.</li> </ul>	
<p><b>3. Significant Consequential Economic Impact</b></p> <p>A project has a potential to generate jobs quantified by the number of workers employed, and/or contribution to providing greater access to electricity in off-grid areas as follows:</p> <ul style="list-style-type: none"> <li>▪ Contribute to local job generation of at least 150 workers (during operation including indirect employment) and 1,000 workers during construction; and,</li> <li>▪ Potential for Micro-Grid in areas offered for Qualified Third Party in small islands/SPUG areas in support of productive use of electricity.</li> </ul>	
<p><b>4. Significant Potential Contribution to the Country's Balance of Payments</b></p> <p>A project must have a potential to contribute to the inflow of foreign investment capital and reduction in the country's balance of payments:</p> <ul style="list-style-type: none"> <li>▪ At least 40% Foreign Investment of total project Investment; and</li> <li>▪ Contribution to reduction of energy imports. <ul style="list-style-type: none"> <li>○ Equivalent avoidance of at least or in excess of 130,000 metric tons of coal annually.</li> <li>○ Equivalent avoidance of at least or in excess of 2.0 billion cubic feet of LNG annually.</li> <li>○ Equivalent avoidance of at least or in excess of 180,000 barrels of oil annually.</li> </ul> </li> </ul>	
<p><b>5. Significant Impact on the Environment</b></p> <p>A project with a potential to contribute to energy infrastructure sustainability and/or with minimal adverse effects to the environment through:</p> <ul style="list-style-type: none"> <li>▪ Entry of climate-resilient energy facilities; and,</li> <li>▪ Contribute to the Greenhouse Gas (GHG) emission reduction/avoidance of at least 200 thousand tons (kTon) of CO<sub>2</sub> equivalent.</li> </ul>	
<p><b>6. Complex Technical Processes and Engineering Designs</b></p> <p>A project introducing newly and emerging energy technologies and/or pioneering energy systems as determined by the following:</p> <ul style="list-style-type: none"> <li>▪ Entry of new and emerging energy technologies with higher efficiency factors than existing ones: <ul style="list-style-type: none"> <li>○ Coal at 45.0 percent (existing 28.0-35.0 percent);</li> <li>○ Oil-based at 40.0 percent (existing 25.0- 40.0 percent);</li> <li>○ Gas Turbine at 40.0 percent (existing 33.0 percent-38.0 percent);</li> <li>○ Combined Cycle Gas Turbine (CCGT) at 60.0 percent (existing 33.0-50.0 percent); and</li> <li>○ Biomass 40.0 percent (existing 30.0-35.0 percent).</li> </ul> </li> <li>▪ Pioneering Projects (Waste to Energy, Battery Storage, etc.).</li> </ul>	
<p><b>7. Significant Infrastructure Requirements</b></p> <p>A project with associated infrastructure necessary for the delivery of energy services and supply, which can be realized through the following:</p> <ul style="list-style-type: none"> <li>▪ With associated infrastructure, such as alternative transmission corridors and pipeline;</li> <li>▪ Build! Build! Build! Program Projects which relate to the delivery of energy services and/or supply; and</li> <li>▪ Project completion by 2022 as required by the energy systems.</li> </ul>	



As of June 2020, the EICC issued CEPNS to 145 various projects with potential investments of about PHP 681.9 billion. These include 66 power plants, 57 transmission projects, 16 renewable energy development, four exploration activities, and two LNG facilities.

To further screen and ensure that only those projects that qualify as EPNS shall be declared and granted with a certificate (CEPNS), and to show a concrete illustration of the attributes under the EO 30, the EICC has established a set of Sub-Attributes serving as the parameters for the evaluation of projects applying for CEPNS as shown in *Table 27*.

With EVOSS already enforced, all energy projects granted with CEPNS will be integrated in the EVOSS System adopting the 30-day timeframe, or whichever is shorter (EVOSS timeframe) as shown in *Table 26*.

### 3. *Ease of Doing Business and Efficient Government Service Delivery Act of 2018*

On 28 May 2018, the RA 11032 or otherwise known as “*Ease of Doing Business and Efficient Government Service Delivery Act of 2018*” was signed into law by the President. It is one of the major policy milestones of the government, which aims to streamline and improve the current systems as well as procedures of government services. This is consistent with Priority 3 of the of the Duterte Administration’s Ten-Point Socio-Economic Agenda that seeks to improve the competitiveness of and ease of doing business in the Philippines. The Law applies to all government offices and agencies in the executive branch including local government units (LGUs), GOCCs, and other government instrumentalities that provide services covering business-related and non-business transactions.

With the passage of the Law, the Ease of Doing Business and Anti-Red Tape Advisory Council has been created. The DTI chairs the Council with Anti-Red Tape Authority (ARTA), Department of Information and Communications Technology (DICT), DILG, DOF and representatives from the private sector as members. The Council serves as the policy and advisory body with the responsibility of formulating policies and programs that will continuously enhance and improve the country’s competitiveness and ease of doing business.

The Law also provides for the re-engineering of government systems and procedures to eliminate bureaucratic red tape and reduce processing time. Thus, to enforce the reduction of processing time for business transactions, a timeframe per transaction (*Table 28*) is mandated to all government agencies including LGUs, GOCCs and other instrumentalities.

**Table 28. TIMEFRAME PER TRANSACTIONS AS PROVIDED BY RA NO. 11032**

<b>Simple Transaction</b>	Action within 3 days
<b>Complex Transaction</b>	Action within 7 days
<b>Highly Technical Transaction</b>	Action within 20 days

### 4. *Administrative Order (AO) No. 23: Eliminating Overregulation to Promote the Efficiency of Government Processes*

To promote efficiency in government process, President Duterte issued on 21 February 2020 the Administrative Order (AO) 23 titled “*Eliminating Overregulation to Promote Efficiency of Government Processes*” to eradicate overregulation and improve the government system in delivering services to the people. The said AO stipulates that the timelines provided for by the EVOSS Act shall be complied and applied to all processes/procedures relative to all energy

projects. Moreover, the EVOSS Steering Committee will accept recommendations from the ARTA.

#### **5. Joint Memorandum Circular (JMC) No. 2020-1: Enhancing Energy Investments thru Partnership with Local Government Units (LGUs)**

On April 30, 2020, the DOE and DILG signed a Joint Memorandum Circular (JMC) 2020-1 to facilitate the implementation of energy projects in the LGU unit level. The JMC aims to establish, strengthen and integrate the national energy plans, programs, policies and mechanisms into local development plans with respect to energy safety practices, energy efficiency and conservation, energy resiliency and energy planning, which include energy access and resource development. It harmonizes and accelerates the implementation of the EVOSS Act, Ease of Doing Business (EODB) Act, and Executive Order (EO) 30 and AO 23 with the establishment of a unified and streamlined permitting process.

Through the JMC, the benefits to host communities from the energy projects will be maximized. The JMC also aims to implement the other necessary energy programs and projects to spur total development of the LGUs.

Through a whole-of-government approach, the mentioned initiatives will effectively result in streamlining and reduction of turn-around time required in regulatory processes and procedures, while promoting transparency and accountability among government agencies involved in the approval of energy projects. Also, the DOE, as the lead agency in implementing both the EVOSS Act and the EO 30 is working on the harmonization of the said two important policies to come up with an efficient and reformed energy investment-friendly environment for its stakeholders. It is thus expected that these efforts shall ease the burden of stakeholders engaged in doing energy investments in the country.

# Chapter III.

## OIL, GAS & COAL

Harnessing indigenous energy resource is one of the government's priority thrusts to ensure continuous deliver of energy services as a prerequisite for the country's economic growth and progress. With rapidly increasing domestic energy demand, the Department of Energy (DOE) has been resolute in finding new discoveries of fossil fuel resources to further improve energy self-sufficiency level of the country and provide Filipinos with stable energy supply. The DOE is guided by Presidential Decree (PD) Nos. 87 (Oil Exploration and Development Act of 1972) and 972 (Coal Development Act of 1976) in its continuing efforts to promote the discovery, exploration, development, production and utilization of indigenous oil, gas and coal resources.

The development of conventional energy resources will not only bring investments for the country but will benefit the local government units (LGUs) as well. As indicated in Chapter 2 of the Local Government Code of 1991, LGUs are entitled to equitable share in the proceeds derived as host community of natural resources, to be allocated as 20.0 percent for the province, 45.0 percent for component city or municipality and 35.0 percent for barangay<sup>60</sup>. In turn, LGUs are expected to allocate 80.0 percent of the funds to the reduction of electricity costs while 20.0 percent to local development and livelihood projects.



Mindful of the importance of securing oil supply for the country during the first oil crisis in 1973 and to embark on measures for stable supply of petroleum products, the Philippine National Oil Company (PNOC) and its subsidiary, the PNOC Exploration Corporation (PNOC-EC) were created through PD 334 (November 1973) and Batas Pambansa (BP) Blg. 68 (April 1976), respectively. Various amendments were made to their Charters to include exploration, exploitation and development of all energy resources.

<sup>60</sup> If in case where the natural resources are located in two (2) or more provinces or in two or more component cities or municipalities or in two or more barangays, their respective shares shall be computed on the basis of population (70.0 percent) and land area (30.0 percent).

## UPSTREAM OIL AND GAS

The DOE has been steadfast in boosting investment opportunities in the upstream oil and gas sector, especially with the impending depletion of the Malampaya<sup>61</sup> gas field in the near future.

The global trend points towards the use of cleaner energy sources such as renewables. However, the promotion of an optimal energy mix utilizing all available energy sources is pivotal to meet the growing energy requirements of the country. This view is supported by the World Economic Forum<sup>62</sup> noting that around 31.0 percent of primary energy used globally is oil-based fuels, while natural gas represents 21.0 percent of the total world energy supply.

The country has modest resource potential located in 16 sedimentary basins covering an area of more than 700,000 square kilometers (km<sup>2</sup>) with a combined potential of 4,777 million barrels of fuel oil equivalent (MMBFOE) of oil and gas resources (Figure 47).

Figure 47. SEDIMENTARY BASINS IN THE PHILIPPINES

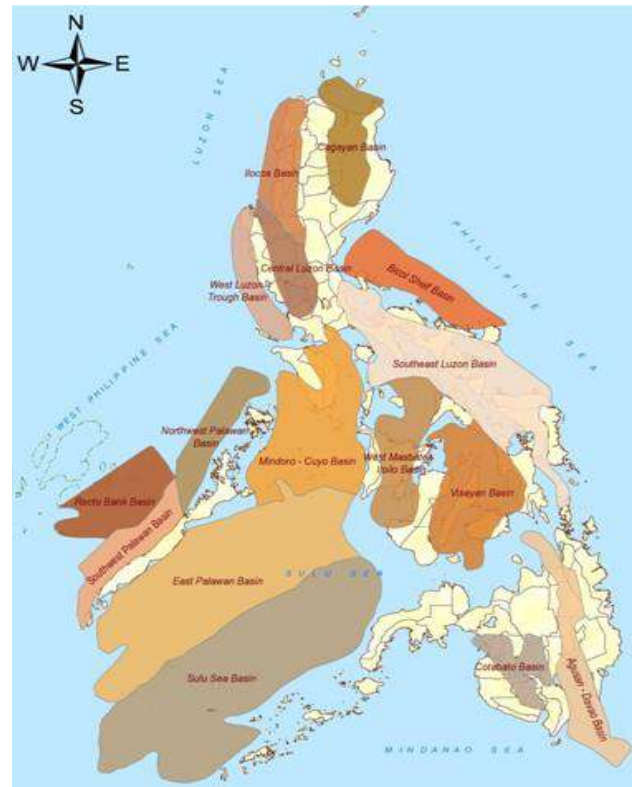
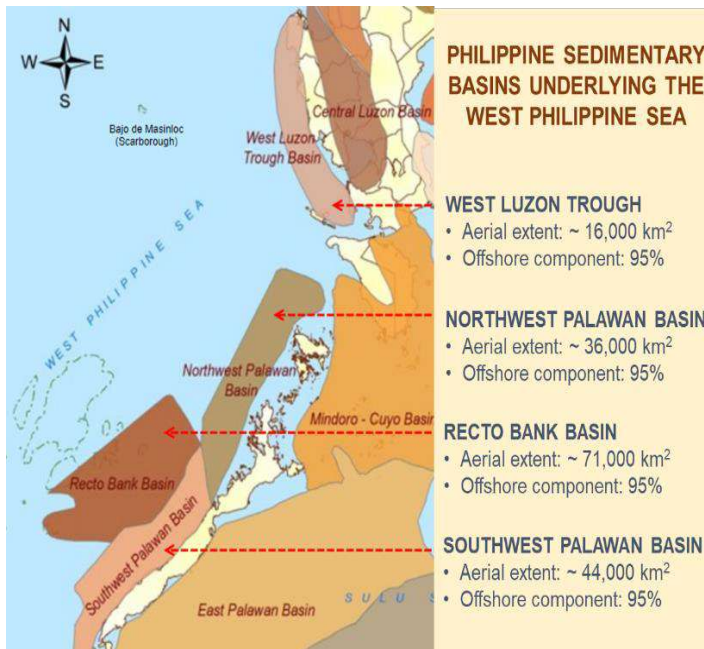


Figure 48. SEDIMENTARY BASINS IN THE WEST PHILIPPINE SEA



These basins are located in the following areas: (1) Ilocos Shelf; (2) Cagayan; (3) Central Luzon; (4) Bicol Shelf; (5) Southeast Luzon; (6) Mindoro-Cuyo; (7) West Masbate-Iloilo; (8) Visayan; (9) Agusan-Davao; (10) Cotabato; (11) Sulu Sea; (12) East Palawan; (13) Southwest Palawan; (14) Reed Bank; (15) Northwest Palawan; and (16) West Luzon Trough. The sedimentary fill ranges from one (1) km. (Northwest Leyte sub-basin of the Visayan Basin) to as thick as 15 kms. (Southern part of the Sulu Sea Basin).

As shown in Figure 48, four (4) sedimentary basins with total aerial extent of 167,000 km<sup>2</sup> are underlying the West Philippine Sea.

<sup>61</sup> The Malampaya Deep Water Gas to Power Project of Shell Philippines Exploration B.V. (SPEX) has been the country's major source of natural gas since 2001. The consortium's Service Contract (SC) 38 contract will expire by 2024.

<sup>62</sup> Source: Global Agenda Council on the Future of Oil and Gas by the World Economic Forum published in April 2016

1. **West Luzon Trough** may be a frontier basin with limited data and information but shows great potential based on recent geophysical survey in the area.
2. Majority of producing fields are located in the **Northwest Palawan Basin**. It is proven to host petroleum resources in the country.
3. The presence of hydrocarbon is already proven in **Recto (Reed) Bank Basin** with the discovery of natural gas during the drilling of Sampaguita wells.
4. The **Southwest Palawan Basin** has high potential to contain hydrocarbon resources based on the location's proximity to the Malaysian basin.

## A. ASSESSMENT

The Malampaya Deep Water Gas-to-Power project remains the largest source of natural gas in the country since the start of its commercial production in January 2002. Its production fuels five (5) natural-gas power plants contributing nearly 30.0 percent of power generation in Luzon in 2018 and 2019.

From January 2002 until June 2018, the government already collected royalties amounting to PhP 263 billion from the Malampaya project in accordance with PD 1234<sup>63</sup> issued on 08 November 1977.



*“The DOE is aggressively pursuing the implementation of the PCECP so the country could establish a strong ‘Explore, Explore, Explore’ program.” Secretary Alfonso G. Cusi during the launching of the PCECP*

To maximize the exploration and development of indigenous petroleum and coal resources, the DOE issued in September 2017 the Department Circular (DC) 2017-12-0017 introducing the “*Philippine Conventional Energy Contracting Program (PCECP)*.” The PCECP is a new contracting scheme for petroleum and coal exploration wherein two modes of awarding Service Contract (SC) is envisioned. The first mode is through the nomination process, which enables investors to apply for service/operating contracts anywhere in the country at any

given time, while the other mode is through application in Pre-Determined Areas (PDAs) previously identified/delineated by the DOE.

The DOE conducted a series of local and international roadshows to promote the PCECP during the last quarter of 2018 and first half of 2019 in the Cities of Puerto Princesa, Davao and Zamboanga, as well as in Singapore, Cape Town (South Africa) and Texas (USA).

<sup>63</sup> Institutionalizing a Procedure for the Management of Special and Fiduciary Funds Earmarked or Administered by the Departments, Bureaus, Offices and Agencies of the National Government, Including Government-Owned or Controlled Corporations.

The 180-day application period for the 14 pre-determined areas for offer started during the Program’s launching ceremony held on 22 November 2018 at the Shangri-la in Bonifacio Global City in Taguig City. As a result, revenues on data and application fees amounting to PHP 9.28 million was recorded from 10 interested companies under the PCECP.

**PCECP**

AREAS 3, 6, 7 AND 10 WERE APPLIED FOR FROM NOVEMBER 2018 TO AUGUST 2019.

TWO APPLICATIONS WERE RECOMMENDED FOR AWARDING TO THE OFFICE OF THE PRESIDENT

In terms of exploration and development, the DOE monitored and supervised the operation of 20 active SCs (Figure 49) as of 2019. The DOE’s attached agency, PNOEC, currently operates three (3) contracts located in Isabela (SC 37), Calamian Block in Northwest Palawan (SC 57), and Southwest Palawan (SC 59) covering a total area of 25,630 km.

Figure 49. ACTIVE SERVICE CONTRACTS IN THE PHILIPPINES



The newest oil field discovery located in Alegria, Cebu was inaugurated by President Rodrigo R. Duterte on 19 May 2018. Under SC 49, its operator, China International Mining Petroleum Company Limited (CIMP), discovered about 27.9 MMBO with a possible production recovery of 3.4 MMBO. The field also has natural gas reserves of 9.4 BCF with estimated recoverable resource of 6.6 BCF, which could fuel a power plant connected to the local power grid. This oil field is expected to contribute to the country’s energy supply needs.

Petroleum production in 2017 reached 1.6 million barrels of oil (MMBO), 138.5 billion cubic feet (BCF) of gas and 3.9 MMBO of associated condensate. Although oil production decreased in 2018<sup>64</sup> at only 1.3 MMBO, gas and associated condensate recorded significant increases at 154.6 BCF and 4.1 MMBO, respectively.

<sup>64</sup> Production in 2019 recorded 776,093 MMBO of oil, 155.7 BCF of gas and 4.0 MMBO of associate condensate.

Another major accomplishment of the sector is the President's signing of SC 76<sup>65</sup> in Eastern Palawan on 17 October 2018, the first SC signed under the Duterte administration. The Ratio Petroleum Ltd. (proponent of SC 76) will conduct exploration activities covering the Area 4 in East Palawan Basin for potential energy resources. The area covers 416,000 hectares (has.) with minimum total expenditure valued at USD 34.4 million.

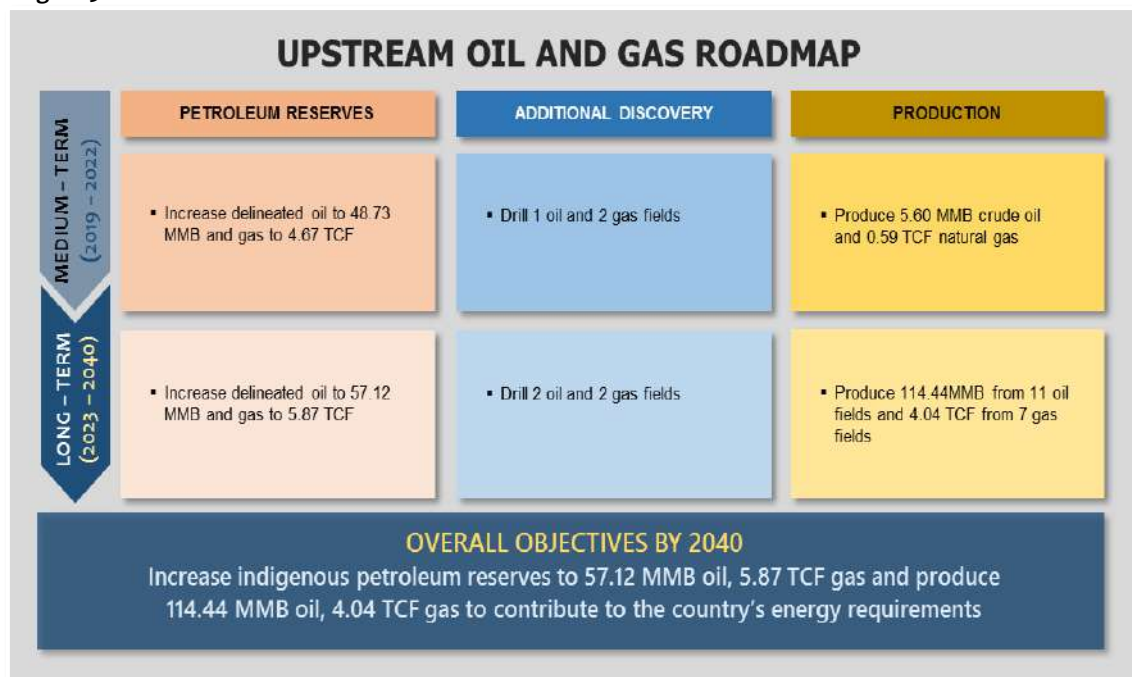


DOE Secretary Alfonso G. Cusi discusses the specifics of the Alegria oil field with Guests of Honor, President Rodrigo R. Duterte and Senator Christopher Lawrence "Bong" Go, during the launching of the new oil field located in Cebu. The said oil field has the distinction of being the country's first onshore discovery.

## B. PLANS AND PROGRAMS

To achieve the overall objectives of the upstream oil and gas sector by 2040, the DOE identified several targets to include drilling of additional oil and gas fields during the planning horizon (Figure 50).

Figure 50. UPSTREAM OIL AND GAS ROADMAP



<sup>65</sup> Under initial stages of exploration including geological and geophysical study of the area. Acquisition of seismic data is being undertaken for an in-depth information on the area's potential.

### 1. Medium-Term

The drilling of an oil prospect in the Visayan Basin will bring in potential recoverable reserves of up to 20.0 MMBO, while a total of 2.2 trillion cubic feet (TCF) of gas could be produced from the drilling of two gas prospects in Northwest Palawan.

In terms of production, crude oil output is expected to reach 5.6 MMBO with biggest contribution of 3.4 MMBO from the Galoc field in Northwest Palawan. West Linapacan-A is likewise forecasted to provide 1.2 MMBO of oil when it commences production in 2022. The marginal fields may also account for about 1.0 MMBO for the same period with projected production of 540,200 barrels (bbl) from Polyard Area 6. Moreover, significant contribution of 513,000 bbl may be expected beginning 2021 from Octon and Cadlao.

For gas, Malampaya field will continue to supply 99.3 percent of the country's natural gas contributing 584,000 million standard cubic feet (MMSCF) out of the expected 588,331 MMSCF during the four-year period (2019-2022).



### 2. Long-Term

Two oil prospects over the Visayan and Northwest Palawan Basins with potential recoverable reserves of 3.6 and 20.0 MMBO, respectively, and two gas prospects in Northwest and Southwest Palawan Basins with 3.6 TCF of reserves are targeted to be drilled between 2023 and 2040.

Oil production of 114.4 MMBO is projected to come from Galoc, West Linapacan A, Camago-Malampaya oil prospects, as well as from marginal fields of Polyard Area 6, Octon, Cadlao, Linapacan, Calautit, Malolos, and two other oil prospects.

Meanwhile, gas production of 4.04 TCF is expected to come from seven (7) fields: Malampaya, San Martin, Sampaguita, Polyard A8, Mangosteen, and two other gas prospects.

### 3. Strategies

With the current issues on the West Philippine Sea affecting the exploration and production in the oil and gas industry, the DOE will continue to advocate the government's initiatives in resolving the pending issues affecting the stability of the petroleum SCs and enable the resumption of exploration activities of SCs that are under Force Majeure.

Another strategy is the implementation of Executive Order (EO) 60, series of 2011 reorganizing the Philippine Gas Project Task Force to the Philippine Upstream Petroleum Task Force. This will enable the government and industry stakeholders to establish a more effective platform to address inter-agency issues affecting the timely and efficient implementation of petroleum service contracts and formulate policy measures to address such issues and concerns.

In terms of legislative agenda, part of the sector's action plan to accomplish the sector's medium- and long-term targets is the continuous formulation and implementation of policy issuances on the



upstream petroleum sector, such as the streamlining of petroleum-related activities of SC operators/holders and other relevant policies to hasten the exploration activities and discovery of new fields in the country. The DOE will also review the provisions of PD 87 and formulate necessary amendments such as the 60-40 sharing scheme on joint explorations for oil and gas.

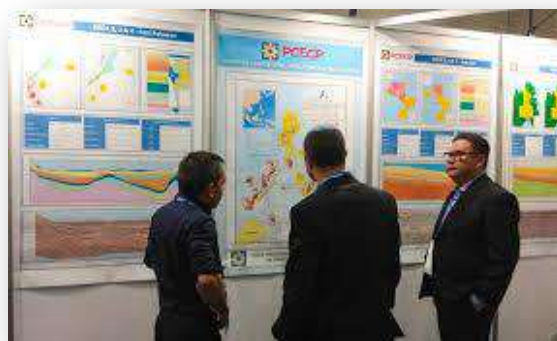
Moreover, continuous bilateral and multilateral cooperation with other countries to strengthen oil and gas activities, petroleum security and potential synergy between parties is seen as an effective program to further boost the sector.

Lastly, the DOE will assess the required oil and gas transportation and storage infrastructure to further benefit the country's petroleum industry.

### C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

Under the PCECP, the country may expect a total investment of USD 48.6 million upon the President's signing of the two SCs recommended for awarding. The projects' various stages of exploration, development, and production will also generate jobs to Filipinos.

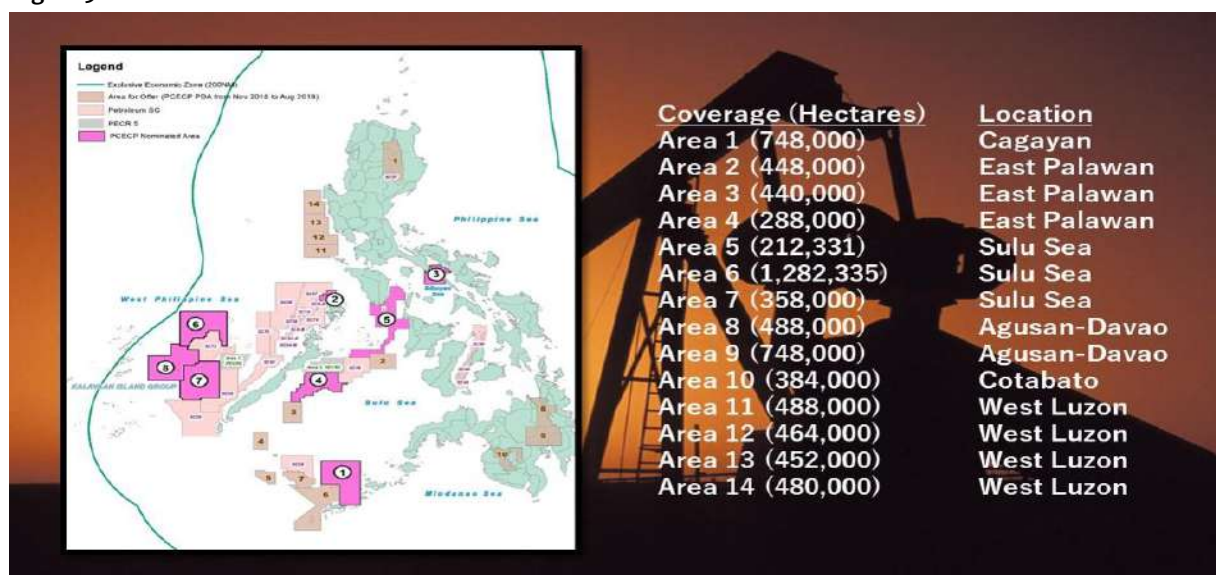
An additional potential investment of USD 43.7 million may be generated upon approval of applications received for Nominated Areas 1 and 5 and PDAs 6 and 7.



DOE addresses inquiries of investors during the PCECP International Road Show in San Antonio, Texas, USA

Since the implementation of the PCECP, the DOE has been continually accepting nominations for various areas of interests delineated by interested parties. Figure 51 shows the 14 areas for offer under the PCECP, while the requisites for documentation to be submitted by proponents in the contracting program for petroleum are outlined in Annex A of DC 2017-12-0017<sup>66</sup>.

Figure 51. AREAS FOR OFFER UNDER THE PCECP



<sup>66</sup> Adopting the PCECP of Awarding Petroleum SCs and Creating the Review and Evaluation Committee (REC)

The option for investors to propose their own exploration area makes oil and gas exploration a dynamic investment prospect for players in the energy sector.

## UPSTREAM COAL

Coal is currently the most important energy source for electricity generation, accounting for approximately 38.4 percent of global electricity generation in 2017 due to abundance, low cost and ability to generate base load electricity<sup>67</sup>.

As coal proves itself to be economically-viable being one of the most reliable and affordable sources of energy, the DOE will strengthen its efforts to embrace less polluting and more efficient technologies.

In response, the San Buenaventura Power Plant<sup>68</sup> in Mauban, Quezon is set to become the first supercritical power generation plant in the country using the state-of-the-art emissions control technology, an electrostatic precipitator for fly-ash capture and removal, and a sea water desulfurizer to further reduce potential air pollution.



The 500-MW supercritical coal-fired power plant of San Buenaventura Power Ltd. Co. in Mauban, Quezon (source: tribune.net.ph)

### A. ASSESSMENT

#### 1. Exploration and Development Activities

The country has vast coal resource potential standing at 2.4 billion metric tons (BMT) from the 14 coal regions spread all over the country with additional 397 million metric tons (MMMT) of in-situ coal reserves. The largest resource potential is in Semirara, Antique with 550 MMMT, while the smallest is in Quezon with 2.0 MMMT.

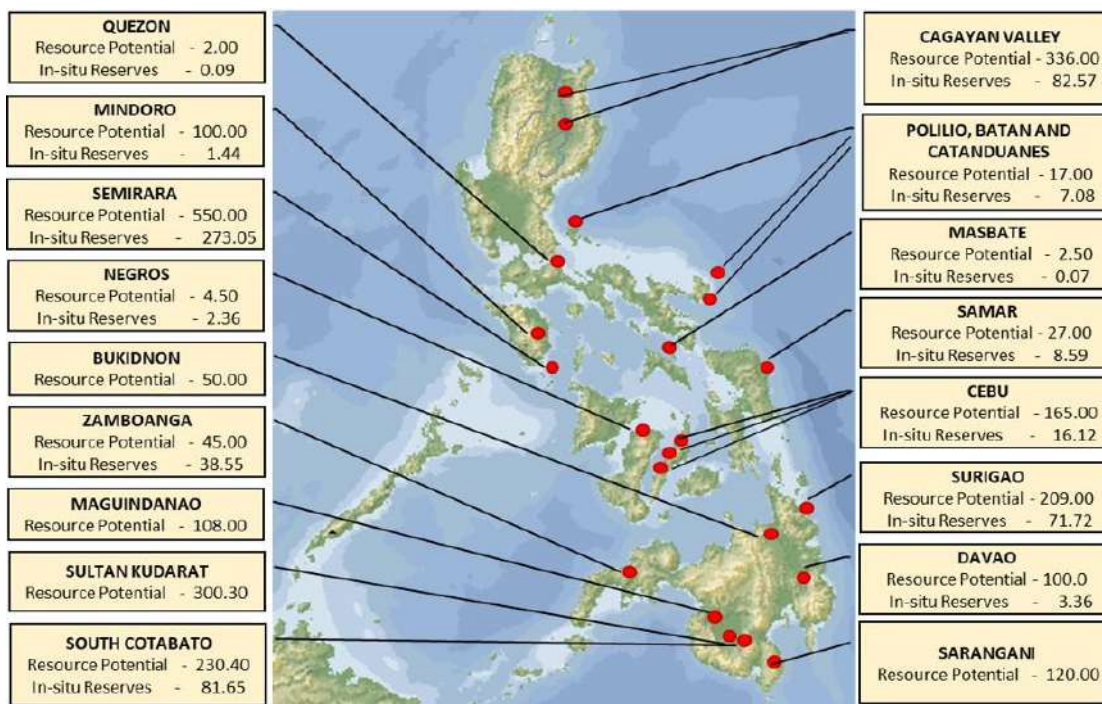
The 14 coal regions with available resource potential and in-situ reserves are listed in *Figure 52*.



<sup>67</sup> International Energy Agency, World Energy Outlook 2018

<sup>68</sup> Commenced commercial operation in October 2019 with installed capacity of 500 MW

Figure 52. COAL RESOURCES IN THE PHILIPPINES



In 2018, the DOE continued to administer and monitor 62 existing Coal Operating Contracts (COCs) with respect to their corresponding work commitments. Of the total COCs, 31 are in the development and production stage, while the remaining 31 are in the exploration phase as shown in Table 29 and Figure 53. The PNOC-EC currently operates four coal operating contracts: COCs 41, 185 and 186 located in Zamboanga Sibugay and COC 122 in Isabela.

Total coal production in 2018<sup>69</sup> was recorded at 13.1 MMT, a slight decrease from 2017 level of 13.3 MMT. Bulk of which was sourced from the Semirara, the largest producer of coal in the country.

Table 29. LIST OF COAL OPERATING CONTRACTS

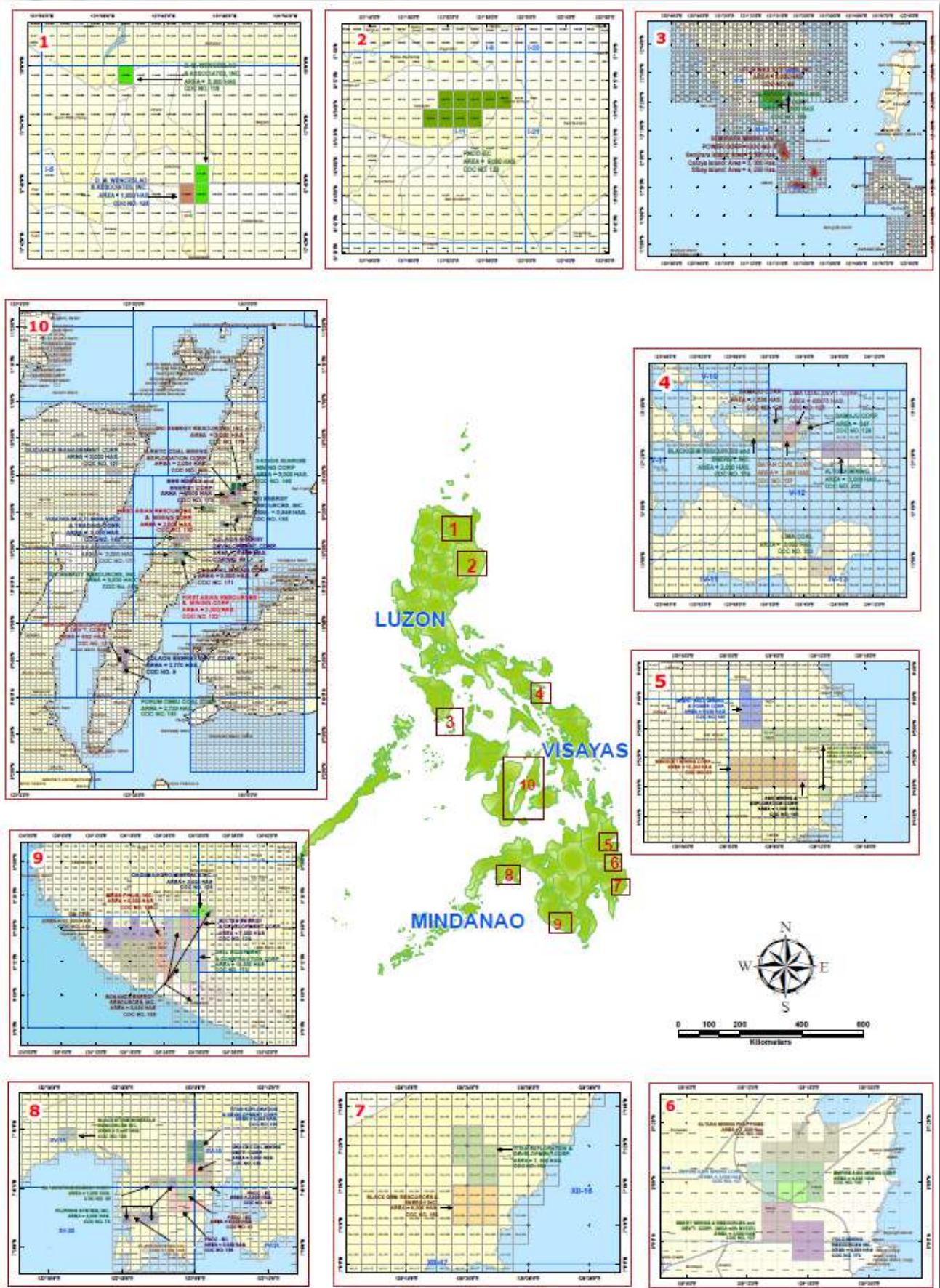
	Name of Company	COC No.	Location	Area (Has)
<b>DEVELOPMENT / PRODUCTION COAL OPERATING CONTRACTS (COCs)</b>				
1	Semirara Mining and Power Corporation	5	Antique	15,000
2	Adlaon Energy Development Corporation	9	Cebu	2,770
3	Ibalong Resources & Development Corporation	13	Cebu	932
4	PNOC-Exploration Corporation	41	Zamboanga Sibugay	6,000
5	Filipinas (Prefab) Systems, Inc.	68	Oriental Mindoro	8,000
6	Filipinas (Prefab) Systems, Inc.	77	Zamboanga Sibugay	1,000
7	Filipinas (Prefab) Systems, Inc.	78	Zamboanga Sibugay	4,000
8	Benguet Corporation	83	Surigao del Sur	12,000
9	A Blackstone Energy Corp.	93	Zamboanga Sibugay	1,000
10	D. M. Wenceslao and Associates, Inc.	116	Cagayan Valley	3,000
11	PNOC-Exploration Corporation	122	Isabela	9,000
12	D. M. Wenceslao and Associates, Inc.	123	Cagayan Valley	1,000
13	Lima Coal Development Corporation	125	Albay	400
14	Daguma Agro Minerals Inc.	126	South Cotabato & Sultan Kudarat	2,000

<sup>69</sup> Coal production in 2019 reached 15.2 MMT

**Table 29. LIST OF COAL OPERATING CONTRACTS**

	Name of Company	COC No.	Location	Area (Has)
15	Smart Mining and Resources Development Corp.	127	Surigao del Sur	2,000
16	Samaju Corporation	128	Albay	1,400
17	Samaju Corporation	129	Albay	542
18	Grace Coal Mining and Development, Inc.	130	Zamboanga Sibugay	2,000
19	Forum Cebu Coal Corp.	131	Cebu	2,720
20	First Asian Resources Mining Corp.	132	Cebu	2,000
21	Sultan Energy Phil. Corp.	134	Sultan Kudarat & South Cotabato	7,000
22	SKI Construction Group, Inc.	135	Cebu	5,946
23	Batan Coal Resources Corp.	137	Albay	1,087
24	Bonanza Energy Resources, Inc.	138	South Cotabato	8,000
25	Visayas Multi-Minerals Mining & Trading Corp.	142	Cebu	3,000
26	Great Wall Mining and Power Corporation	145	Surigao del Sur	5,000
27	Abacus Coal Exploration & Development Corp.	148	Surigao del Sur	7,000
28	IL Rey'c Coal Mining Exploration Corp.	149	Cebu	2,054
29	Guidance Management Corp.	151	Negros Occidental	3,000
30	Lima Coal Development Corp.	153	Sorsogon	3,000
31	BBB Mining and Energy Corp.	173	Cebu	4,000
<b>EXPLORATION COCs WITH APPLICATION FOR CONVERSION TO DEVELOPMENT/PRODUCTION CONTRACTS</b>				
32	Titan Mining and Energy Corp.	159	Davao Oriental	7,000
33	3Kings Sunrise Mining Corp.	165	Cebu	3,000
34	Titan Mining and Energy Corp.	166	Zamboanga Sibugay	4,000
35	Blackgem Resources & Energy Inc.	169	Davao Oriental	6,000
36	Dell Equipment & Construction Corp.	170	Saranggani & South Cotabato	10,000
37	Cedaphil Mining Corp.	171	Cebu	3,000
38	Core 8 Mining Corp.	172	Cebu	2,000
39	Yolo Mining Resources, Inc.	176	Agusan del Sur & Davao Oriental	4,000
<b>EXPLORATION COCS</b>				
40	SKI Energy Resources, Inc.	136	Cebu	1,000
41	DMC-Construction Equipment Resources, Inc.	154	Sultan Kudarat	3,000
42	ASK Mining & Exploration Corp.	162	Surigao del Sur	1,000
43	BlackGem Resources and Energy, Inc.	175	Davao Oriental	9,000
44	Timberwolves Resources, Inc.	181	Surigal del Norte	5,000
45	Altura Mining Philippines, Inc.	182	Catanduanes	7,000
46	Blackstone Mineral Resources, Inc.	183	Zamboanga Sibugay	2,000
47	PNOC-Exploration Corporation	185	Zamboanga Sibugay	2,000
48	PNOC-Exploration Corporation	186	Zamboanga Sibugay	5,000
49	ALCO Steam Energy Corp.	187	Agusan del Sur	4,000
50	MEGA Philippines Inc.	188	South Cotabato, Sultan Kudarat and Sarangani	6,000
51	Semirara Mining and Power Corporation	189	Oriental Mindoro	7,000
52	Semirara Mining and Power Corporation	190	Soth Cotabato and Sarangani	10,000
53	South Davao Development Corp., Inc.	191	Oriental Mindoro	9,000
54	Coalblack Mining Corporation	193	Surigal del Sur	4,000
55	Sahi Mining Corporation	194	Agusan del Norte and Agusan del Sur	8,000
56	Sahi Mining Corporation	195	Agusan del Norte and Agusan del Sur	7,000
57	Altura Mining Philippines, Inc.	200	Albay	3,000
58	Empire Asia Mining Corp.	201	Agusan del Norte	4,000
59	Altura Mining Philippines, Inc.	202	Surigao del Sur	7,000
60	Empire Asia Mining Corp.	203	Surigao del Sur & Agusan del Sur	3,000
<b>EXPLORATION COCs WITH APPLICATION FOR CONVERSION TO DEVELOPMENT/PRODUCTION CONTRACTS</b>				
61	BlackGem Resources and Energy, Inc.	174	Albay	2,000
62	Empire Asia Mining Corp	192	Surigao del Sur	4,000

Figure 53. PHILIPPINE COAL OPERATING CONTRACTS



## 2. Policy Issuances

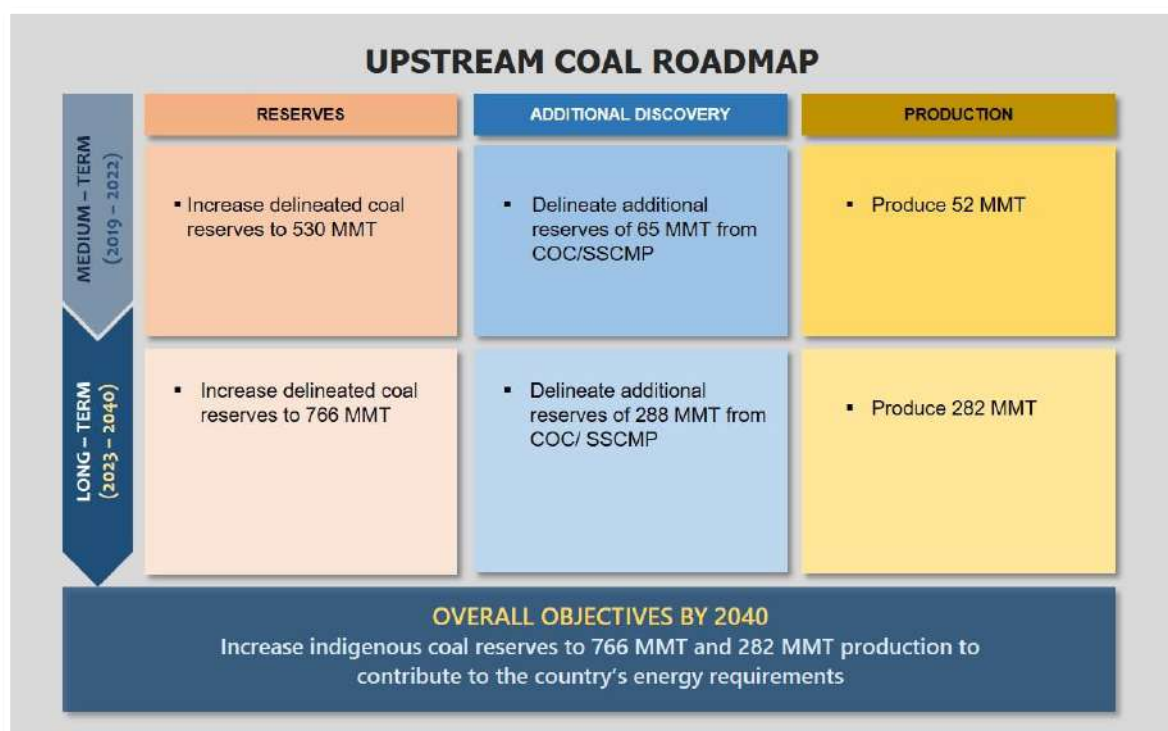
As the DOE prioritizes the health and safety of all workers involved in the coal mining operations, Secretary Cusi signed DC 2018-12-0028 titled “Coal Mine Safety and Health Rules and Regulations” on 28 December 2018. The new Circular repealed the 40-year old Bureau of Energy Development Circular No. 1, otherwise known as “Coal Mine Safety Rules and Regulations,” issued on 03 January 1978. The new rules and regulations are more applicable to the present local coal mining conditions and are aligned with the requirements of the International Labor Organization Convention on Safety and Health in Mines (ILO C176).

Likewise, the DOE issued DC 2018-03-0006 on 15 March 2018 to further streamline and simplify the processing and issuance of tax-exempt certificates, as provided under PD 87 and PD 972. The said Circular shall govern the application, processing, approval, and issuance of tax-exempt certificates for the importation, exportation, and disposal of machinery, equipment, spare parts and materials used for petroleum and coal operations.

## B. PLANS AND PROGRAMS

The overall 2040 objective of the sector to contribute to the country’s energy requirements through increasing indigenous coal reserves will be realized upon the accomplishment of the medium- and long-term targets highlighted in Figure 54.

Figure 54. UPSTREAM COAL ROADMAP



### 1. Medium-Term

Based on the roadmap and overall objectives of the upstream coal sector, the DOE intends to increase the delineated<sup>70</sup> coal reserves to 530.0 MMT and additional reserves of 65.0 MMT from existing and new COCs and Small-Scale Coal Mining Permits (SSCMPs) by 2022.

In terms of production, 52.0 MMT is targeted in the next three (3) years as the sector's targets and contribution to meet the country's energy requirements.

### 2. Long-Term

For the period 2023-2040, further increases of delineated coal reserves up to 766.0 MMT including additional reserves of 288.0 MMT are also expected from existing and new COCs and SSCMPs.

Coal production in the long-term period is forecasted to reach 282.0 MMT from the existing and committed coal projects in the country.

### 3. Strategies

To hurdle the challenges that may impede the realization of the targets and the fulfillment of the sector's overall objectives, the DOE will put in place the following strategies:

- Strengthen existing policy on coal handling, transport, storage and distribution to include stricter safety/security and environmental regulation and pollution control protocols.
- Attract more investors to participate in the upstream coal exploration, development and production;
- Review, amend and formulate policies on exploration, development, and utilization of coal as well as address the emerging environmental and community issues in the conduct of coal mining activities;
- Assess the required infrastructure support for coal development;
- Coordinate with local government units (LGUs) and key stakeholders to resolve community issues about coal operations;
- Monitor compliance of COCs with work commitments and regulations relating to the exploration, development and production activities;
- Close coordination with other government agencies in the acquisition of necessary permits, licenses and endorsements to ensure efficient implementation and success of energy projects;
- Conduct and participate in resource assessment projects to update the current indigenous coal resources; and,
- Pursue international bilateral and multilateral cooperation activities to keep abreast with the development in the industry.

## C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

Pursuant to Executive Order (EO) 30 creating the Energy Investment Coordinating Council (EICC), two coal projects have been issued with Certificate of Energy Projects of National Significance (CEPNS) by the DOE. These projects by PNOC-EC are expected to yield total potential investments of PhP 143.8 million for exploration activities (*Table 30*).

<sup>70</sup> Determined coal reserves based on computation

**Table 30. LIST OF COAL PROJECTS ISSUED WITH CEPNS**

Proponent	Project	Province	Investment Cost (PhP '000)
PNOC-EC	Coal Operating Contract 185	Zamboanga Sibugay	52,100
PNOC-EC	Coal Operating Contract 186	Zamboanga Sibugay	91,700
<b>Total</b>			<b>143,800</b>

Another project from PNOC-EC is COC 41 which is located in Diplahan, Malangas and Imelda in Zamboanga Sibugay. The project is expected to yield an estimated PhP 4.0 billion in investments and may generate more than 1,000 jobs during its construction. The COC 41 also has an estimated production of 1.33 MMT.

By the end of the planning horizon, the expected investment based on the target additional production in the sector’s roadmap will reach PhP 609.3 billion. For the medium-term, a total of PhP 112.4 billion is projected upon the production of 52 MMT of additional coal production. On the other hand, almost PhP 497.0 billion may be generated from the target 230 MMT coal production during the long-term period (Table 31).



PNOC-EC's COC 41 Zamboanga Sibugay Coal Project

**Table 31. PROJECTED INVESTMENTS ON COAL, 2019-2040**

	Additional Production (in MMT)	Investments (PhP Million)
Medium-term (2019-2022)	52	112,356
Long-Term (2023-2040)	230	496,957
<b>Total</b>	<b>282</b>	<b>609,313</b>

**Note:** Investment for production ranges from PhP 1,017 to PhP 3,305 per metric ton. In estimating investment requirement, the average (PhP 2,161) is used. The unit investment cost already considered the average inflation from 2016 until 2019.

**Source:** APEC Energy Demand and Supply Outlook 6<sup>th</sup> Edition, May 2016





# Chapter IV. DOWNSTREAM INDUSTRY

The downstream oil and natural gas industries are integral for the growth of global economy as both continue to be key components of the energy system. In 2018, oil and natural gas accounted for about 35.0 percent and 24.0 percent of the global primary energy consumption, respectively<sup>71</sup>. Global forecast shows that oil grows on 0.4 percent per year, while natural gas increases at a much faster rate of 1.6 percent per year, overtaking coal as the second biggest energy source by 2040. Despite a slower growth rate, oil remains an important fuel with 27.6 percent share to global primary energy consumption in 2040<sup>72</sup>. Natural gas maintains its share at around 25.0 percent.

In the local setting, oil and gas industries made significant contributions to economic development, energy security, safety and health, and environmental protection through the institutionalization of standards and practices. Together, these industries are important drivers for economic growth and prosperity of the country.

## NATURAL GAS INDUSTRY

In 1991, Shell Philippine Exploration B.V. (SPEX) drilled the Malampaya gas field, which became the largest gas discovery in the country with proven reserves of 2.7 to 3.2 trillion cubic feet (Tcf). The Malampaya Deep Water Gas-to-Power project is one of the largest and most significant industrial endeavors in Philippine history. The project is spearheaded by the DOE, developed and operated by SPEX on behalf of joint venture partners – Chevron Malampaya LLC and the Philippine National Oil Company-Exploration Corporation (PNOC-EC).<sup>73</sup>

As the principal agency for the development of the country’s natural gas industry, the DOE envisions a roadmap towards its acceleration and growth. The roadmap serves as the guidepost in the realization of the essential mechanisms to accelerate the development of the country’s natural gas industry. Said roadmap has an overall objective to “establish a world-class, investment driven and efficient natural gas industry that makes natural gas a bridge fuel by all end-use sectors.”

<sup>71</sup> BP Statistical Review of World Energy, 2019. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf>

<sup>72</sup> IEA, World Energy Outlook 2018. Under the New Policy Scenario where energy policies also play a critical role, notably those relating to energy efficiency, renewable resources, measures to curb air pollution and the phasing-out of fossil fuel subsidies. [https://webstore.iea.org/download/direct/2375?fileName=World\\_Energy\\_Outlook\\_2018.pdf](https://webstore.iea.org/download/direct/2375?fileName=World_Energy_Outlook_2018.pdf)

<sup>73</sup> Overview of Malampaya retrieved from <https://malampaya.com/about/>

This roadmap intends to reinforce the downstream natural gas industry development program, formulate and implement the required policies, and achieve a globally competitive manpower through constant development of skills for the regulators and industry players.

Transforming the industry from an emerging developmental stage to a matured industry with cutting-edge technologies does not only provide a cleaner source of energy but creating more jobs for the country. Our neighboring countries like Japan, China, and India are importers of liquefied natural gas (LNG) as a crucial fuel source in their energy supply mix.

On the domestic front, the Philippines, with its strategic location, should also capitalize on this global trade and benefit from the LNG market. With this, the DOE envisions the country as an LNG trading and trans-shipment hub to distribute LNG to other importing countries in the Asia-Pacific Region.

## **A. ASSESSMENT**

### **1. Implementation of the Natural Gas Quality Standard**

On 01 February 2019, Secretary Alfonso G. Cusi signed Department Circular (DC) 2019-02-0004, which promulgates the rules to regulate the importation, trading, supply and distribution of natural gas in the country with the intention of making it an LNG trading and trans-shipment hub in the Asia-Pacific Region. Under the rules, the DOE will require all businesses engaged in natural gas to submit the proper reportorial requirements in compliance with the Philippine Downstream Natural Gas Regulation (PDNGR)<sup>74</sup>. The submissions will include the use of standard measurements for natural gas, namely cubic meters (m<sup>3</sup>) for natural gas under standard temperature and pressure (STP); joules (J) for natural gas energy; megajoules per cubic meter (MJ/m<sup>3</sup>) for superior calorific value and wobbe index; percent mole for the chemical composition of natural gas such as methane, oxygen, total inerts; and, milligrams per cubic meters for total sulfur and hydrogen sulfide. The Circular provides a mandatory compliance to the gas quality for the LNG importer and supplier of natural gas to end-users. Compliance to the Philippine National Standard (PNS) on gas quality is important as it presents safety issue as quality variation has implications for the operation of all gas equipment due to changes in combustion performance.

### **2. Joint Administrative Order (JAO) for the creation of the Philippine Inter-Agency Health, Safety, Security and Environment - Inspection Monitoring Team (HSSE-IMT)**

In order to maintain HSSE best practices, policies and regulations in the operation of the natural gas facility, all operators shall comply with the Philippines and internationally accepted safety standards and best practices in areas of design and construction, management system, operation system, maintenance system, personnel development and training on Community Health and Safety Preparedness and Emergency Response. The HSSE standards encourage best practices and ensure compliance with international HSSE standards and best practices under a system of safe operation, high-quality service and consumer protection.

The JAO intends to enhance the cooperation of the concerned agencies for the effective and well-coordinated inspection, as well as the respective permitting activities with the appropriate standards into each member agency's regulatory framework. The HSSE-IMT's members include the Department of Interior and Government (DILG), the Department of Environment and Natural

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<sup>74</sup> Promulgated through DC 2017-11-0012 issued on 28 November 2017

Resources (DENR), the Department of Health (DOH), the Department of Transportation (DOTr), the Maritime Industry Authority (MARINA), and the Philippine Coast Guard (PCG).

### 3. Philippine Downstream Natural Gas Industry

The DOE conducted a total of 18 pre-application conferences in 2018. In addition, the DOE granted the following permits and endorsement to various players in the industry:

**Issuance of Permits to the following:**

- Energy World Corporation (EWC) - Permit to Construct <sup>75</sup>
- Tanglawan Philippine LNG Inc. - Notice to Proceed (NTP)<sup>76</sup>

**Issuance of Acknowledgement and Endorsement to the following:**

- Acknowledgement to supply and transport natural gas by SPEX to Pilipinas Shell Refinery (PSPC)
- Acknowledgement to supply and transport natural gas by PNOG to PSPC
- Seven (7) Endorsements to the Security and Exchange Commission (SEC)

### 4. Communication Initiative of the Natural Gas Industry

In 2018, the DOE conducted 10 information, education and communication (IEC) campaigns focused on natural gas, eight (8) of which were on market profiling of natural gas in various Economic Zones. These Economic Zones (i.e. Subic Special Economic and Freeport Zone, Clark Special Economic and Freeport Zone) are self-sustaining, progressive and designed as independent communities with minimum government interference and favorable entitlements. On the other hand, the other two (2) IECs conducted were for the Senate, as well as for the DOE's Centralized Review and Evaluation Committee (C-REC) Secretariat for familiarization with and appreciation of existing natural gas facilities and natural gas users.

### 5. Legislative Agenda and Policy Advocacy Campaign

The Senate Bill No. 765 or the Downstream Natural Gas Development Bill, once passed into law, shall provide a framework for the development of a Philippine Downstream Natural Gas Industry (PDNGI). The PDNGI's transition from an emerging to a mature industry status with competitive natural gas market will define the responsibilities of various government agencies and private entities in furtherance of this national goal.

The DOE, in addition to its existing powers and functions, shall have the overall responsibility of supervising and monitoring the development of the downstream natural gas industry. This responsibility includes regulation of the construction and operation of natural gas pipelines and other related facilities for the transmission, distribution and supply of natural gas.

### 6. Memorandum of Agreement (MOA) with University of the Philippines Statistical Center Research Foundation Inc. (UPSCRFI)

The DOE signed a MOA with UPSCRFI on 07 December 2018 for the implementation of the Gas Policy Development Program (GPDP) I through funding support from U.S. Department of State under the Enhancing Development and Growth through Energy (EDGE) Program in Asia. In this agreement, the UPSCRFI will provide policy recommendations, capacity building activities, and other relevant

<sup>75</sup> Issued on 21 Dec 2018

<sup>76</sup> NTP expired in June 2019

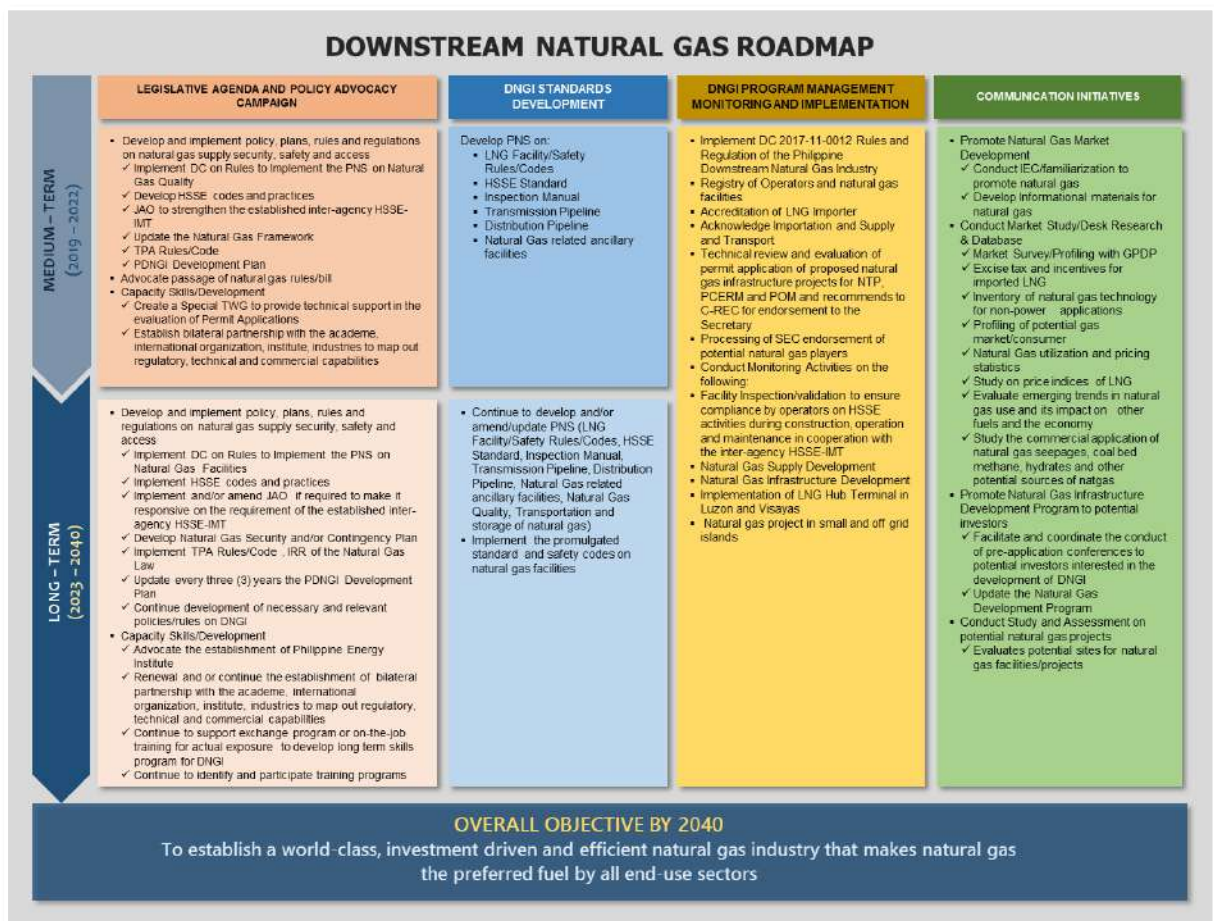
forms of assistance to the DOE for the evaluation of natural gas investment projects. In addition, UPSCFRI will also contribute in crafting of technical, financial, and economic guidelines to be used for review and evaluation of LNG related project proposals. The DOE and UPSCFRI also agreed to conduct specific research activities together to deliver a clearer and in-depth understanding of the LNG industry and other pertinent policies.

## B. PLANS AND PROGRAMS

### Medium-Term

In the medium-term (Figure 55), the roadmap is expected to advance the country’s emerging natural gas industry which is unbundled with various players from retail to wholesale supply competition that would result in a reasonable price for natural gas. Likewise, the roadmap aims to develop standards, codes of practices and expand the industry’s market reach. All the envisioned targets will require policy support and legislation to further the development of the industry.

Figure 55. DOWNSTREAM NATURAL GAS ROADMAP



### 1. Standards Development

With the promulgation of the PDNGR, the DOE will formulate the following PNS or adopt relevant international or foreign standards to help the natural gas industry produce quality products and services and raise productivity:

- LNG Facility/Safety Rules/Codes;
- HSSE Standards;
- Inspection Manual;
- Transmission Pipeline;
- Distribution Pipeline; and,
- Natural Gas related ancillary facilities.

The PNS for natural gas industry protects the welfare of the consumers and facilitate trade in the global market. The natural gas industry’s domestic development is crucial for transforming the Philippines as an LNG trading and trans-shipment hub in the Asia-Pacific Region.

The development of standard for LNG facility and safety rule in the operation of the facility aims to provide a harmonized standard procedure in the operation of the LNG facility in the country to ensure safety operation to protect people and property. On the other hand, the safety code sets the guidelines for safety operations. In formulating these standards, a Technical Working Group (TWG) shall be created consisting of industry stakeholders.

## 2. Communication Initiatives

Increasing awareness to promote natural gas development is vital. The conduct of IEC campaign to familiarize stakeholders with the natural gas industry is essential. Moreover, crafting informational materials will certainly help in market development of PDNGI. Likewise, the conduct of the study regarding natural gas assessment, potential sites, market and database will encourage potential investors’ interest in the development of the industry. The scope of the said study should cover a wide array, such as market survey and profiling, excise tax and incentives, utilization and pricing, emerging trends and commercial application among others. Lastly, by facilitating the conduct of pre-application conferences, study and assessment of potential natural gas projects by the DOE would help the promotion of natural gas infrastructure development program to interested investors.



Site visit to First Gen Clean Energy City Plant

## 3. Sector Regulation

The PDNGR provides the stakeholders with a guide that outlines the issuance of permit on the construction, expansion, rehabilitation, modification, operation and maintenance of Downstream Natural Gas Facility. The Department created a database regarding registry of operators and their natural gas facilities, accreditation of LNG importer, technical review and evaluation of permit application of proposed natural gas infrastructure projects are among the identified activities in support of the said regulation.

Simultaneously, natural gas infrastructure monitoring activities and supply development is equally important. Facility inspection/validation to ensure compliance by operators on HSSE activities during construction, operation and maintenance in cooperation with the HSSE-IMT. Likewise, The

PNS requirements on natural gas production, sale, importation, and consumption must also be monitored to meet the standard's quality requirement. Also, DOE will continue to be abreast on emerging technologies on LNG storage and transport together with upstream activities of the sector to come up with improvements on policy, safety, and standards, among others.

#### 4. Legislative Agenda and Policy Advocacy Campaign

Policy and legislative framework support are necessary to accelerate the development of the downstream natural gas industry in the country. The development and implementation of policy, plans, rules and regulations on natural gas supply security, safety and access is vital to the sector's growth. Such are targeted to be implemented in the medium-term as follows: a) DC on Rules to Implement the PNS on Natural Gas Quality; b) HSSE codes and practices; c) JAO to strengthen the HSSE-IMT; and, d) Third Party Access (TPA) Rules/Code, and e) PDNGI Development Plan.

In line with the upcoming frameworks of the sector, personnel capacity skills and development are essential in order to evaluate project applications. These include all phases of the project from securing permits, construction, and maintenance, as well as its commerciality, safety and security. In support of this, the DOE personnel's participation in relevant trainings related to the industry is a must. Likewise, continue establishing bilateral partnerships with the academe and other relevant organizations, either local and/or international, is beneficial in order to map out regulatory, technical and commercial capabilities. Lastly, the creation of a special TWG to provide technical support in the evaluation of permit applications would also benefit the DOE to determine the feasibility of potential natural gas projects.

#### 5. Extension of MOA with UPSCRFI for the GPDP II

The GPDP I was able to lay the foundation for the LNG sector by facilitating the capacity development of the regulators, such as the DOE-Natural Gas Management Division including the members of the HSSE-IMT. Further, the GPDP 1 also initiated to put in place the mechanisms for potential LNG imports in preparation for the anticipated depletion of the Malampaya gas field.

With the successful implement of the GPDP I, the U.S. Department of State has favorably considered the implementation of the GPDP II to continue the technical assistance and sustain the efforts made in the earlier program. The subsequent program aims to operationalize a more streamlined process of securing permits and application process by working with partner agencies and bureaus apart from the DOE through the HSSE-IMT, promote market development, and realization of investment for LNG facilities. It also intends to implement related and associated activities towards the development of the country's downstream natural gas industry.

#### Long-Term

As shown in *Figure 55*, the long-term roadmap goals intend to amend and/or update policies and standards to keep up with the global trends and changes. Regulations will be critical for the industry to grow. These include investments, compliance to safety from inception to commercial operations, and validation and inspection.

##### 1. Standards development

With the promulgation of standard and safety codes on natural gas in place, the code of standards and safety implementation will be the next step. After which, the **PNS/DOE Quality Standards (QS) 011:2016** titled "Petroleum gas – Natural gas – Quality Specification" development and amendment

aims to establish a successful natural gas industry. Moreover, the PNS serves as a guide in crafting and development of the following to ensure a robust natural gas sector:

- LNG Facility/Safety Rules/Codes;
- HSSE Standard;
- Inspection Manual;
- Transmission Pipeline;
- Distribution Pipeline;
- Natural Gas related ancillary facilities;
- Natural Gas Quality; and,
- Transportation and storage of natural gas.

## 2. Sector Regulation

The DOE will continue to monitor and regulate the industry. With the promulgation and implementation of DC 2017-11-0012 titled “*Rules and Regulation of the Philippine Downstream Natural Gas Industry and/or the Natural Gas Law,*” applicants’ submission of required documents of proposed natural gas infrastructures will undergo technical review and evaluation prior to awarding of permits and endorsements (i.e. SEC, NTP from the DOE). Similarly, facility inspection/validation is equally important to ensure compliance by operators on HSSE activities during construction, operation and maintenance. Likewise, natural gas supply development and monitoring activities (e.g. production, sales, and consumption) will also be pursued during the planning period to come up with necessary policies, planning, and programs to keep the industry self-sustainable for years to come.



*Regular Inspection & Monitoring of Natural Gas Facilities in the Philippines*

## 3. Legislative Agenda and Policy Advocacy Campaign

Natural gas related policies formulation and amendments including legislative framework for the long-term period will be carried out to support the expansion of gas industry in the country. During this timeframe, the Implementing Rules and Regulations (IRR) of the Natural Gas Law will need to be in place together with various polices (i.e. Rules to Implement the PNS on Natural Gas Facilities, HSSE Codes and Practices, Natural Gas Security and/or Contingency Plan) will need to be harmonized in accordance with the law.

Moving forward, the DOE is committed to keep up with international/regional trend as policy thrusts in the industry are evolving. It is necessary that the underlying science, engineering, and economics are similarly given emphasis (i.e. natural gas value chain, bilateral partnerships, other relevant trainings related to natural gas etc.) to effectively assess the implementation of future energy policies and programs for the sector. Lastly, the DOE’s bureaus particularly the Oil Industry Management Bureau (OIMB), Energy Resource Development Bureau (ERDB), and Energy Policy and Planning Bureau (EPPB) will continue to address research and policy gaps in the local energy

sector and push for reforms that will directly benefit our country. The results of research and policy development activities will be used to craft energy sector reforms for the benefit of the national economy and the welfare of all Filipinos.

## C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

### Potential Investments

One key initiative to develop the downstream natural gas industry is to encourage domestic and private sector participation and investment in the development of the required infrastructure, such as the LNG Import receiving facilities. With the long-term goal of tapping this clean energy, the government will provide an enabling environment to encourage greater private sector involvement in its development, through the issuance of the relevant policies to improve the regulatory framework that serves as transparent guidelines for the investors.



Turn-over ceremony of the Philippine Downstream Natural Gas Industry: LNG Investors' Guide

The DOE approved the permits authorizing the development and construction of LNG Regasification Terminal projects proposed by different proponents as shown in *Table 32*. The LNG import facility development and construction require huge capital investment from the private sector. From these projects, potential investment amounts to PhP 64,632 million. More investments are expected for other necessary natural gas infrastructure like satellite terminals, transmission and distribution pipelines and refueling stations when demand for natural gas ramps up in the near future.

An LNG import facility in Batangas will provide value proposition since the existing anchor markets are available in the area – that is when Malampaya gas field runs dry. Meanwhile, the LNG facility in Quezon will be serving the potential markets in the area and nearby provinces.



Visayas and Mindanao have also potential to host LNG terminal facilities with prior intents received from possible investors (specifically in Mindanao). The study conducted by the Economic Research Institute for ASEAN and East Asia (ERIA) titled “Seeking Optimal Solutions on Delivering LNG to Medium and Large Islands in the Philippines” showed that Cebu, Tacloban, Tagbilaran, Zamboanga, Iligan, Bislig, Surigao and General Santos City are possible locations for bulk LNG receiving terminals. Both Cebu and Zamboanga are suggested as the primary LNG receiving terminals with the capacity to redistribute the LNG to other demand centers in southern districts using Floating Storage Regasification Unit (FSRU) solutions. Cebu delivers LNG to subordinate (secondary and tertiary) terminals in Tacloban and Tagbilaran in the Visayas, and Bislig and Surigao in Mindanao. On the other hand, Zamboanga transports LNG to Bislig and General Santos City.

**Table 32. POTENTIAL INVESTMENT IN THE DEVELOPMENT OF LNG TERMINAL**

	Project	Target Operation	Location	Capacity	Total Construction Cost (Million PhP)
<b>FGEN LNG Corporation</b>	Floating Storage & Regasification Unit (FSRU) Terminal	2022	Barangays Sta. Clara, Sta. Rita Aplaya, and Bolbok in Batangas City	5.26 MTPA	13,284
<b>Excelerate Energy L.P.</b>	Floating Storage Regasification Unit (FSRU) Terminal	2022	About 9.5 km offshore in Bay of Batangas	1.5 MTPA	6,387
<b>Energy World Gas Operations Philippines Inc</b>	LNG Storage and Regasification Terminal	2022	Barangay Ibabang Polo, Pagbilao Grande Island, Quezon Province	3 MTPA	7,408
<b>Batangas Clean Energy, Inc</b>	LNG Storage and Regasification Terminal	2025	Barangay Pinamucan-Ibaba, Batangas City	3 MTPA	37,553

Note: MTPA stands for Million Ton Per Annum

### Estimated Jobs Generated

The proposed LNG regasification and terminal projects are estimated to provide jobs as shown in the Table 33. Under the PDNGR, the proponents shall give preference to qualified local talents for hiring of manpower required during construction and operation.

**Table 33. ESTIMATED JOB GENERATION FROM PROPOSED LNG PROJECTS**

Proponent	Estimated Jobs
FGEN LNG Corporation	945 during construction and 80 during operation
Excelerate Energy L.P.	100 during construction and 60 during operation
Energy World Gas Operations Philippines Inc	500 during construction and 70 during operation
Batangas Clean Energy, Inc	3,000 during construction and 115 during operation

More jobs are required during the construction phase of the projects, a total of around 4,500 workers for the proposed facilities. During operation, a total of 325 technical personnel will be required to operate the LNG facilities.

### Infrastructure Support

The transportation of natural gas from production to consumption needs an extensive and elaborate transportation system. Natural gas produced from the Malampaya gas field has to travel

long distance to reach its point of use. The transportation system for natural gas consists of a complex network of pipelines designed to quickly and efficiently transport natural gas from its origin to its market. Transportation of natural gas also requires storage if the resource is not immediately required. Natural gas liquefaction is a way to move natural gas from producing wells to markets. The LNG facilities received natural gas by pipeline and liquefy the gas for transport on LNG ships or tankers. Likewise, LNG is transported in smaller containers that can be placed on ships and on trucks. The transportation system along with associated facilities offers additional job opportunities for the country.

## OIL INDUSTRY

The enactment of Republic Act (R.A.) 8479, otherwise known as the Downstream Oil Industry Deregulation Act of 1998 provides the framework and guiding principles of a truly competitive market under a regime of fair prices, adequate supply of environmentally clean and high-quality petroleum products.

As stipulated in the said Act, the DOE monitors the quality of petroleum products and compliance with the Philippine National Standards (PNS) including refining and manufacturing processes of local petroleum products to ensure that clean and safe technologies are applied. The PNS is in accordance with R.A. 8749, or the Philippine Clean Air Act, which is a comprehensive air quality management policy and program aims to achieve and maintain healthy air for all Filipinos.

The DOE likewise keeps track of the daily international crude oil prices and examines the movement of domestic oil prices to prevent market abuses in a deregulated environment. Inventory level of crude oil and petroleum products are recorded to determine conformity to the minimum inventory requirement (MIR) and the level of domestic supply. Current MIR for refiners is in-country stocks equivalent to 30 days, while an equivalent of 15 days stock is required for the bulk marketers and seven days for the LPG players.

To achieve the DOE's goal of improved policy and ensure high quality and right quantity of petroleum products in the market, the Department crafted a roadmap to have a clear vision from 2018 to 2040. The short-term goals of the roadmap are reviewed and assessed to see if strategies and indicators were able to meet targets and adjust accordingly to catch-up and reach future aspirations.

### Existing Downstream Oil Facilities

The downstream oil infrastructure has been increasing at a steady rate with a total of 325 industry participants<sup>77</sup> in 2018, up by almost 14.0 percent from 286 participant in 2017, with accumulated investment of PhP 180.8 billion (since 1998). These players are engaged in various downstream oil business, such as fuel bulk and retail marketing, LPG refilling and marketing, petroleum transport, terminalling and bunkering.

**Table 34. EXISTING DOWNSTREAM OIL FACILITIES, 2018**

Oil Facilities	No.	Capacity (ML)
<b>Depots</b>	<b>115</b>	<b>695</b>
Major	35	265
Others	80	430
<b>Import Terminals</b>	<b>54</b>	<b>2,380</b>
Major	16	544
Others	38	1,836
<b>Refinery</b>	<b>2</b>	<b>2,322</b>
Petron	1	1,516
Shell	1	806
<b>Grand Total</b>	<b>171</b>	<b>5,397</b>

<sup>77</sup> In 2019, industry participants went up to 355 players with total accumulated investment of PhP 183.8 billion.

In 2018, the country’s total storage capacity stood at 5,397 million liters (ML) (Table 34). It comprised 171 facilities, two refineries, 54 import terminals, and 115 depots/distribution networks.<sup>78</sup> The refineries contributed 43.0 percent of the total storage capacity, equivalent to 2,322 ML. On the other hand, the depots provided 12.9 percent with 695 ML, while import terminals constituted 44.1 percent of total with 2,380 ML. The Pilipinas Shell Petroleum Corporation owns a refinery facility in San Pascual, Batangas, and Petron Corporation’s refinery is located in Limay, Bataan.

### Retail Marketing Business

For retailing activity, there were newly constructed retail outlets and at the same time closure and re-branding in 2018 to modernize the facilities and services as part of compliance to the issued DC 2017-11-0011 or the “Revised Retail Rules.” The industry reported an increase of 1.0 percent in retail outlets operating nationwide, bringing the total number of outlets to 8,803<sup>79</sup> as of end of 2018. Among the country’s three (3) major islands, Luzon secured the greatest number of retail outlets (Table 35).

Table 35. NUMBER OF RETAIL OUTLETS, 2018

Regions	Number
NCR	1,198
Luzon	5,130*
Visayas	1,750
Mindanao	1,923
<b>Total</b>	<b>8,803</b>

\*Luzon Includes the number of retail outlets in NCR

## A. ASSESSMENT

### 1. Fuel Quality and Facility, And Process Standards Development

The passage of the Philippine Clean Air Act of 1999 (or RA 8749) sets strict fuel specifications to reduce emissions that affect air quality. In line with the objectives of the law and the vision of a low carbon future, the DOE continuously formulates standards on petroleum fuels and related products along with oil facilities to ensure a more stringent quality of fuels and other related products in the country.

The DOE crafted the following downstream oil market, fuel quality and infrastructure standards within the short-term planning horizon:

#### Fuel Quality Standards

- a. **PNS/DOE QS 004:2017: Coco-Methyl-Ester (CME) Blended Automotive Diesel Oil<sup>80</sup> Specifications.** The standard specifies the requirement for CME-blended diesel oil suitable for various types of automotive diesel engines. In this edition, the Euro2 fuel grades (500 ppm maximum sulfur content) was removed and thus effectively provided only the Euro IV-PH automotive diesel oil grade (50 ppm maximum sulfur content) to align with the emission requirement of DENR under DAO 2015-04 and 2016-23.
- b. **PNS/DOE QS 013:2017: CME Blended Industrial Diesel Oil Specifications.** The standard indicates the requirement for CME-blended diesel oil suitable for various types of industrial diesel engines. In this edition, a new PNS number was created to separate the requirements of industrial diesel oil (IDO) from automotive diesel oil (ADO), which carried the original designation of PNS/DOEQS004.

<sup>78</sup> In 2019, total depots and import terminals grew to 127 and 58, respectively.

<sup>79</sup> As of December 2019, the total number retail outlets nationwide reached 9,381.

<sup>80</sup> Biodiesel blend

- c. **PNS/DOE QS 006:2018: Industrial Fuel Oils Specification.** The standard requires industrial fuel oils used wholly or as blending component of different grades for various types of fuel oil-burning equipment. It is a revision/update of PNS/DOE QS006:2005 with minor revision made particularly the deletion of the word “bunker” and referred only as industrial fuel oil, as well as updating of test methods.
- d. **PNS/DOE QS 008:2018: E-Gasoline Specification (E10<sup>81</sup>).** This standard is a revision/update of PNS/DOE QS 008:2012. In this edition, the Euro2 fuel grades (500 ppm maximum sulfur content) was removed and thus effectively provided only the Euro4-PH gasoline fuel grades (50 ppm maximum sulfur content) to align with the emission requirement of the DENR under Department Administrative Orders (DAOs) 2015-04 and 2016-23. The standard specifies the requirements for bioethanol-blended gasoline (e-gasoline) used as fuel in spark-ignition internal combustion engines, excluding aviation gasoline.
- e. **PNS/DOE QS 014:2018: Residual Marine Fuels Specification.** The standard indicates the requirements for fuels use in marine diesel engines and boilers, prior to conventional onboard treatment (settling, centrifuging, filtration) before use. The specifications for fuels can also be applied on fuels used in stationary diesel engines of the same or similar type of those utilized for marine purposes. In this standard, the statutory requirement for the sulfur content is set at 3.0 percent, mass, maximum based on PNS for Fuel Oils (PNS/DOE QS 006).
- f. **PNS for Kerosene (DPNS/DOE QS 009:2019<sup>82</sup>).** The standard is a revision/update of PNS /DOE QS 009:2007 with minor revision made only in the property of color and updating of test methods. The standard updates the fuel quality specification in terms of current requirement of the industry, its users and manufacturers. It is also harmonized with international/regional environmental standards.

### Facilities Standards

- a. **PNS/DOE Facility Standard (FS) 10:2017: Code of Safety Practices for Liquid Petroleum Product (LPP) in Retail Outlet (new) promulgated by the Department of Trade and Industry-Bureau of Product Standards (DTI-BPS).** The Code of Safety practices is intended for managers/operators of LPP Retail Outlet focusing on safety and good practice procedures with reference to relevant health and safety standards.
- b. **DPNS/FS 2:2018: LPG Refilling Plant (promulgated by DTI-BPS).** The standard is a review of PNS/DOE 2:2006, which was circulated to all concerned sectors from 13 April-13 June 2018 for comments.<sup>83</sup> This edition incorporates a new chapter adopting energy resiliency in the planning and programming of the energy sector to mitigate potential impacts of disaster.
- c. **Handbook on Code of Safety Practices in LPG Refilling Plant.** This standard covers the requirements for the installation of an LPG refilling plant, including the associated bulk storage tank facility and other related equipment and facilities.
- d. **Code of Safety Practices in LPP Depot<sup>84</sup>.** This Code constitutes good industry practices for oil terminals/ depots and is designed to prevent accidents at LPP terminal/ depot facilities and ensure product quality.

<sup>81</sup> 10.0 percent bioethanol blended gasoline

<sup>82</sup> The PNS was promulgated on 23 December 2019.

<sup>83</sup> Adopted on 03 April 2019 with ongoing corrigendum.

<sup>84</sup> Published on 19 September 2019

## 2. Supervision and Monitoring

The DOE conducted various inspections and sampling of LPP in several depots/terminals and retail outlets nationwide. In line with this core function, the DOE started utilizing its newly procured sets of portable instruments in conducting field testing especially in oil depots for more efficient product quality monitoring. These activities are part of the DOE's measures to ensure compliance of industry players with existing national standards and to protect the consumers in their purchase of petroleum products. In 2018, the DOE carried out the following activities:

- Inspected/verified 49 players/storage facilities and retail outlets giving fuel discounts to public utility vehicles (PUVs);
- Issued inspection reports (IRs) to 2,165 gasoline stations and LPG establishments;<sup>85</sup>
- Examined 1,515 denaturing activities;
- Conducted 113 depot product sampling/ testing;<sup>86</sup> and
- Performed six (6) inspection and monitoring activities in compliance of HSSE program by operators.

## 3. Communication Initiative of The Downstream Oil Industry

The DOE regularly conducts IECs to raise awareness and disseminate information regarding the benefits of and process of participation in various DOE programs. These IECs embody the process of learning that empowers people to make decisions, modify behaviors and change social conditions.

In 2018, the DOE conducted 18 IEC activities covering various sub sectors of the downstream oil industry. Of the total, 18 focused on the oil sector - 12 of which under the safety of LPG projects, while the other six were on the overview of the downstream oil industry, oil pricing, and investments.



Nationwide IEC Campaign on Downstream Oil Industry, LPG and LPP safety

## 4. Legislative Agenda and Policy Advocacy Campaign

The DOE reviewed and amended several existing rules and regulations, crafted a Department Order to study the option for a strategic petroleum reserve, and improved process systems, among others. In 2018-2019, the DOE drafted and/or promulgated the following issuances/policies:



Meeting with oil companies on DOE-OIMB's reportorial requirements in August 2019

<sup>85</sup> The DOE inspected 3,925 out of 16,662 gasoline stations and LPG establishments in 2019.

<sup>86</sup> In 2019, the DOE conducted product sampling/testing for 88 depots nationwide out of 127, equivalent to 69.0 percent area coverage.

- **DC 2018-03-0004** prohibiting the sale and distribution of small-sized 2.7-kg capacity and below LPG cylinders without the required “For Outdoor Use Only” marking in addition to the usual mandatory markings for LPG cylinders and for other purposes.
- **Joint Administrative Order (JAO) No. 1 series of 2018** for the distribution and transportation of LPG cylinders. The DOE, DILG, DOTr, and Metro Manila Development Authority (MMDA) through the JAO directed all LPG participants to observe the minimum safety standards.
- Drafted an **Omnibus Circular** on notice and reportorial requirements compliance. The Omnibus Circular was crafted to improve the quality and timeliness of reports submitted by the industry. Further, OIMB aims to unify notice formats for easy monitoring and simple compliance of industry players to the notice and reportorial requirements of RA 8479 and RA 9367.

#### **Policies issued in 2019 and 2020**

- **DC 2020-05-0012** issued on 11 May 2020 providing the Guidelines Implementing the Temporary Modification of Import Duty Rates on Crude Petroleum Oil and Refined Petroleum Products as Provided Under Executive Order (E.O.) No. 113. The Circular promulgates the rules and regulations for the effective implementation of the Executive Order 113, titled “Temporarily Modifying the Rates of Import Duty on Crude Petroleum Oil and Refined Petroleum Products under Section 1611 Of Republic Act No. 10863, Otherwise Known as the “Customs Modernization and Tariff Act.” It aims to provide the guidelines for the reversion to zero percent as international oil prices increase based on trigger prices indexed to oil prices in the world market.
- **Memorandum Order (MO) 2019– 11–0001** issued on 14 November 2019 directing the Philippine National Oil Company (PNOC) to conduct a study for the establishment of a Strategic Petroleum Reserve (SPR) Stockpiling. The MO shall be known as the implementing Guideline for the establishment of the Philippine Strategic Petroleum Reserve Program, institutionalizing the establishment of a Government-owned oil and/or finished petroleum products reserve program to ensure security of supply and cushion the impact of supply interruptions in the world market. The Government, through the DOE and PNOC, shall facilitate the immediate implementation of the Philippine Strategic Petroleum Reserve Program; hence the issuance of the MO.
- **DC 2019-06-0009** issued on 06 June 2019 implements the modified PNS specifications for liquefied petroleum gases (PNS/DOE QS 005:2016 and PNS/DOE QS 012:2016). The Circular supersedes previous issuances and effectively implements the latest specifications of non-motor fuel LPG as PNS/DOE QS 005:2016 and motor fuel LPG as PNS/DOE QS 012:2016. Its objective is to mandate the latest LPG standards for compliance purposes by oil industry players, and become the basis for OIMB monitoring on industry compliance.
- **DC 2019-05-0008** or the “Revised Guidelines for the Monitoring of Prices in the Sale of Petroleum Products by the Downstream Oil Industry in the Philippines” was promulgated on 28 May 2019. Pursuant to the DOE’s mandate on efficient data-driven policymaking and in ensuring greater market transparency, the said Circular amends the existing DC 2005-08- 007. This policy measure is consistent with the declared policy of the oil deregulation law to ensure a competitive market under a regime of fair prices. In addition to the current contents of the notification, added in the amended Circular is the Section on Unbundled Price Adjustment, which would provide details on how oil players arrived at their pump prices. The implementation, however, of this Circular has been the subject of restraining orders issued by different courts in Metro Manila in separate cases filed by major industry players.
- **DC 2019-05-0006** issued on 15 May 2019 implementing the Specifications for CME Blended Automotive Diesel Oil (PNS/DOE QS 004:2017) and CME Blended Industrial Diesel Oil (PNS/DOE QS 013:2017). The Circular mandates the latest auto and industrial diesel standards for compliance purposes by oil industry players and become the basis for OIMB monitoring of industry compliance.
- **DC 2019-02-0005** on proper retention of duplicate liquid petroleum fuel samples in depots and retail outlets was issued on 13 February 2019. The Circular repeals Memorandum Circular (MC) 2001-02-001 to consider also the use of clear glass sampling bottle in the product quality monitoring. Further, it provides for the inclusion of depot facilities in the requirement of fuel sample retention aside from retail outlets. This is to provide flexibility in accessing sampling bottle for fuel quality monitoring purposes, as well as to expand coverage of the requirement on fuel sample retention in depot facilities.
- **DC 2019-02-002** issued on 04 February 2019 implementing the Specifications for E-Gasoline (PNS/DOE QS 008:2018). The Circular mandates the latest gasoline standard for compliance purposes by oil industry players and becomes the basis for monitoring of industry compliance.

Further, there are legislative agenda still pending in Congress for approval, as follows:

**Senate Bill No. 853<sup>87</sup>/House Bill No. 4550<sup>88</sup>**

The Bill amends RA 8479 to ensure transparency in the pricing of petroleum products by oil industry players and to determine computations or assumptions used in price adjustments to avoid unwarranted profiteering. The Bill shall also declare it unlawful for oil companies to engage in unwarranted oil price increases, or unreasonable amount of price increase or decrease as may be determined by the DOE, coupled with the imposition of heavier penalties against erring oil companies and officials.

To safeguard the consumers, the Bill strengthens the Task Force created under Section 14 (of the said Bill), which is mandated to investigate and file complaints against unreasonable rise in the prices of petroleum products. The Task Force shall be composed of representatives from the DOE, DTI, Department of Justice (DOJ), Commission on Audit (COA), and from consumer and public transport groups. The COA, with its auditing and accounting expertise, will fortify the capability of the Task Force in scrutinizing financial documents and reports of oil companies. The Task Force shall be authorized to post the prevailing retail prices of petroleum products in the DOE website (twice a month) and in at least two newspapers of general circulation.

**Senate Bill No. 413<sup>89</sup>/House Bill No. 302 and No. 5642<sup>90</sup> or the LPG Industry Safety Bill**

The Bill aims to monitor and supervise the business operations of the LPG industry in order to ensure safety of the consuming public and protect the general welfare. It intends to establish a more efficient and effective monitoring and supervisory framework for refining, importation, refilling, transportation, distribution, marketing and sale of LPG.

Some of the Bill's provisions are the formulation of appropriate programs and standards for the importation, manufacture, sale, distribution, exchange, swapping, repair, requalification and rehabilitation of LPG cylinders and other ancillary equipment, such as hoses and valves. The DTI as the lead agency will undertake coordinated efforts to monitor and supervise compliance of industry participants to the national product quality and safety, environmental and occupational safety, and consumer welfare standards.

The Bill proposes the creation of the LPG Industry Monitoring and Inspection Committee, which shall formulate the specific guidelines for mandatory compliance with established quality standards and enforce sanctions for violations.

## **B. PLANS AND PROGRAMS**

### **Medium-Term**

The DOE will continuously amend and/or revise policies governing the downstream oil sector to further encourage private sector participation, meet the industry challenges and keep abreast of the international trends. This is to ensure secure and stable supply of high quality and right quantity petroleum products in the market. Further, the government's existing rules and regulations must evolve specifically those involving taxation, incentives, and licensing to reassure investors of a robust domestic downstream oil industry (*Figure 56*).

<sup>87</sup> Refiled on 06 Aug 2019 at the 18th Congress by Senator Recto as SB 868

<sup>88</sup> Filed on 11 Sept 2019 by Congresswoman Santos-Recto

<sup>89</sup> Filed on 25 Nov 2019 at the 18th Congress by Senator Gatchalian as SB 1188

<sup>90</sup> Filed on 01 July 2019 by Congressman Yap and by Congressman Uy on 27 Nov. 2019

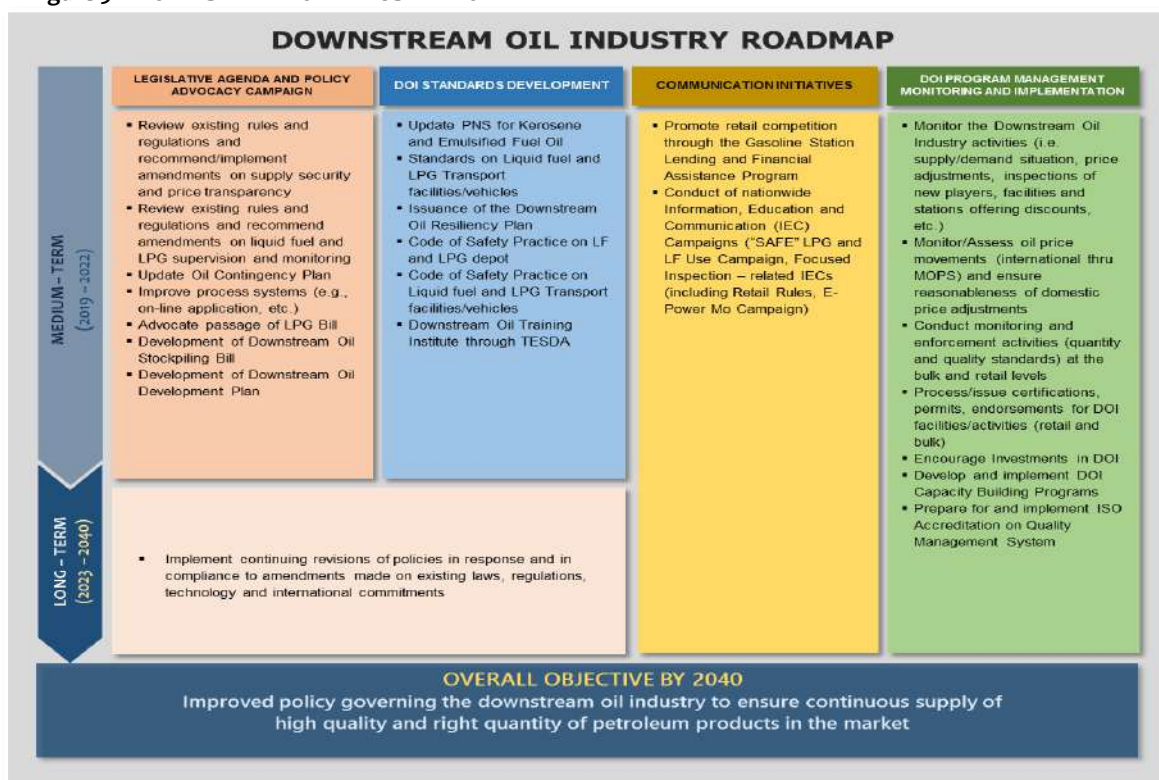
## DOI Standards Development

Targets for the medium-term provides specific items to be crafted for future promulgation. Meanwhile, facility standards will focus on liquid fuel/LPG transport facilities and vehicles. The fuel quality and facilities standards support the formulation of the standard provisions of the Liquid Fuel Industry Rules, as well as planned revision on the LPG Industry Rules. Also, the draft *Downstream Oil Contingency Plan* is in the development stage to ensure adequate and continuous fuel supply in times of supply interruptions due to natural disasters. Lastly, the Code of Safety Practices is also being developed for LPG refilling plant and petroleum products in depots. All these future developments shall be pursued to enhance structural integrity, improve safety, enable cost reductions and reduce the environmental impact of the downstream oil industry operations in the country.



DOE conduct testing on samples obtained using DOE portable instruments

Figure 56. DOWNSTREAM OIL INDUSTRY ROADMAP



## 2. Communication Initiatives

The Gasoline Station Lending and Financial Assistance Program’s (GSLFAP) continuous promotion encourages retail competition since this would entice investors to construct their own gas stations. The GSLFAP is designed to encourage new industry participants from the private sector, transport cooperatives, and transport groups. For the medium-term, IECs will focus on safety of LPG and liquefied fuels use, revised retail rules, and the E-Power Mo! Campaign. This is the DOE’s way of



raising awareness and empowering end-users to equip them with information regarding the downstream oil industry and other energy sectors as well.

### 3. Legislative Agenda and Policy Advocacy Campaign

Seeking to promote and enhance public service, the DOE in its medium-term roadmap is focusing on improving its process systems (e.g. online application, etc.) to enable stakeholders to transact with government with just a click of a button. The said automation of critical business processes can digitally transform the DOE's operations, services, internal communications, and engagement with the public. The digital transformation will significantly reduce processing time while greatly improving the convenience for stakeholders.

To improve data on petroleum products importation, a MOA between the DOE and Bureau of Customs (BOC) is being crafted. The draft MOA is an initiative to assist both parties in data reconciliation on petroleum products and bioethanol importation. The agreement will identify and qualify the information that will be used for exchange, set the manner and period of exchange, assign the offices that will receive, distribute, collate, and reconcile the information from each party, create a reconciliation committee, and guide both parties in enforcement use and observation of confidentiality of information. This initiative will help DOE and BOC- Assessment and Operations Coordinating Group (AOCG) to reconcile the imports volume of petroleum products and bioethanol notified and actually discharged, and consequently be able to assess the proper taxes.

The DOE is also looking into the possibility of establishing a Strategic Oil Stockpiling Program (SOSP). The Philippines, which imports more than 90.0 percent of its oil requirements, has been reeling from the incessant spikes in the oil prices in the world market.

#### Long-Term

The implementation of revisions and amendments in the medium-term is critical to realize its impact in the long-term. To put forward the sector's targets on legislative agenda and standards development, the DOE will continue to implement amendments of policies in response and compliance to amendments made on existing laws, regulations, technology and international commitments. With unwavering commitment to protect the interest of the country, the DOE continuously safeguards the welfare of the consumers nationwide to ensure that petroleum products are of high quality and of the right quantity.

Anchored on the DOE's mandate to *"formulate and implement policies, plans, programs and regulations and monitors developments in the downstream oil industry,"* most activities identified in the roadmap for the long-term include the continuing promotion of the GSLFAP and various IEC campaigns regarding the safe transport of LPGs, handling of liquid fuels, and other related matters in the industry. Moreover, the program management and monitoring include the oil price movements in the local and international setting, conduct of enforcement activities, and the process and issuance of permits and endorsement of activities, among others.

## C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

A total of PhP 8,374.1 million was invested by the new players in various activities in the downstream oil industry in 2019 (Table 36). The additional investments provided employment for an estimated number of 753 people in various activities.

**Table 36. INVESTMENT IN OIL FACILITY, 2019 vs 1<sup>st</sup> Semester 2020**

Facility	2019 Total Actual Cost of Investment (Million PhP)	2020 Total Actual Cost of Investment (Million PhP)	2019 Estimated Number of Jobs Generated	2020 Estimated Number of Jobs Generated
Import Terminal	6,593.7	767.7	320	83
Depot	1,224.7	766.0	152	98
Transport facilities*	555.7	139.3	281	43
<b>Total</b>	<b>8,374.1</b>	<b>1,673.0</b>	<b>753</b>	<b>224</b>

Note: Investments are based on the submitted Company Profile for fully complied downstream oil players. Estimated jobs generated based on the number of distribution/hauling facilities submitted. Investment figures include potential players with notice prior to engage applications.

\* For players engaged in the distribution and hauling activity.

Of the total, PhP 6,593.7 million investments came from the construction/expansion projects of import terminals in Regions 3 and 4A. The expansion projects employed an estimated of 320 people. Meanwhile, the investments for the construction of new depots in Pampanga and General Santos City in Mindanao with total storage capacity of 26.73 million liters totaled PhP 1,224.7 million. The new depots construction provided jobs for 152 persons. On the other hand, the transport facilities engaged in the distribution and hauling poured in PhP 555.7 million investment with job generation of 281 persons.

For the 1st half of 2020, new downstream oil industry players invested a total of PhP 1,673 million, which generated an estimated number of 224 job employment. Of the total investments, PhP 767.7 million investments came from the continuation of construction of new import terminal in Sariaya, Quezon for the storage of various petroleum products. The project provided employment to around 80 persons. On the other hand, investments for the construction of new depots in Camarines Sur and Davao Del Norte totaled at PhP 766 million and employed an estimated number of 98 persons. In addition, investments for the transport facilities engaged in distribution and hauling activities totaled PhP 139.3 million and provided jobs for about 40 persons.

### Retail Marketing Business

The business environment in retail marketing has seen steady growth with the continuous entry of investors in the liquid fuel and LPG industries. A total of 84 new players were accounted bringing the total LPP industry players to 9,381 in 2019. Meanwhile, with five (5) new entrants in the LPG industry in South Luzon, there were already 297 Refilling Plants. The new entrants poured in a combined investment of over PhP 250 million (Table 37).

**Table 37. LPP RETAIL AND LPG REFILLING INVESTMENT, 2019**

Activity	Number of New Players	Cost of Investment (In Million PhP)	Number of Jobs Generated
LPP Retail Marketing	84 *	231.3	410
LPG Refilling	5 **	19.6	50
<b>Total</b>	<b>89</b>	<b>250.8</b>	<b>460</b>

\* Based on Standards Compliance Certificate (SCC) and Certificate of Compliance (COC) applications. Includes 47 independent gas stations

\*\* Independent LPG Refilling Plants

Notably, with the construction of new facilities, 460 individuals were gainfully employed. This was seen to have contributed to the economic and social development in the areas where the facilities operate.

In the first quarter of 2020, two additional LPP and LPG facilities were constructed giving employment to 15 individuals. The same facilities have total investment costs of over 50 Million.<sup>91</sup>

<sup>91</sup> LPP Retail and LPG refilling investments data 1Q of 2020

## Infrastructure Support

The downstream oil sector relies heavily on the transport industry support in moving large volumes of petroleum products across the country. There are four (4) primary methods for transporting petroleum products – pipeline, train, oil tankers and trucks. To support the upstream and downstream sectors, the need for more distribution infrastructure is important in moving petroleum products from the refineries, ports and depots to retail outlets and markets all over the country. The construction of expressways, bridges, local ports and depots will help accelerate the delivery of petroleum products in the retail market. The distance and variety of transportation modes used can increase the risk of contamination for the refiners that must maintain strict product specifications. Transport cost also affects petroleum product prices. Thus, adequate distribution of infrastructures must be put in place to enable industry players to comply with environmental regulations and reduce cost. This will result in cleaner and more stringent product characteristics and reduce petroleum products price that will benefit consumers and environment.

## The Oil Industry and the TRAIN Law

On 19 December 2017, President Rodrigo Duterte signed RA 10963 or the “Tax Reform for Acceleration and Inclusion (TRAIN Law).” The Act amends and repeals certain provisions of the previously amended RA No. 8424 (the National Internal Revenue Code of 1997). Included in the Law is the increase in excise taxes of petroleum products, thus, the active involvement of the DOE in its implementation.

### A. The Tax Table

Table 38. IMPACT OF EXCISE TAX ON PETROLEUM

Product	Pre-TRAIN Law			1ST TRANCHE - JAN 2018					
	Excise Tax	12% VAT	Total	Excise Tax	12% VAT	Total	2018 Total		
							Excise Tax	With 12% VAT	
	Peso/liter								
Gasoline	4.35	0.52	4.87	2.65	0.32	2.97	7.00	7.84	
Avturbo	3.67	0.44	4.11	0.33	0.04	0.37	4.00	4.48	
Kerosene	0.00	0.00	0.00	3.00	0.36	3.36	3.00	3.36	
Diesel	0.00	0.00	0.00	2.50	0.30	2.80	2.50	2.80	
Fuel oil	0.00	0.00	0.00	2.50	0.30	2.80	2.50	2.80	
LPG (motive fuel)	0.00	0.00	0.00	2.50	0.30	2.80	2.50	2.80	
LPG, P/kg	0.00	0.00	0.00	1.00	0.12	1.12	1.00	1.12	

Product	2ND TRANCHE - JAN 2019			3RD TRANCHE - JAN 2020						
	Excise Tax	12% VAT	Total	2019 Total		Excise Tax	12% VAT	Total	2020 Total	
				Excise Tax	With 12% VAT				Excise Tax	With 12% VAT
	Peso/liter									
Gasoline	2.00	0.24	2.24	9.00	10.08	1.00	0.12	1.12	10.00	11.20
Avturbo	0.00	0.00	0.00	4.00	4.48	0.00	0.00	0.00	4.00	4.48
Kerosene	1.00	0.12	1.12	4.00	4.48	1.00	0.12	1.12	5.00	5.60
Diesel	2.00	0.24	2.24	4.50	5.04	1.50	0.18	1.68	6.00	6.72
Fuel oil	2.00	0.24	2.24	4.50	5.04	1.50	0.18	1.68	6.00	6.72
LPG (motive fuel)	2.00	0.24	2.24	4.50	5.04	1.50	0.18	1.68	6.00	6.72
LPG, P/kg	1.00	0.12	1.12	2.00	2.24	1.00	0.12	1.12	3.00	3.36

The Law took effect on 01 January 2018, and the excise tax was implemented in three tranches, from 2018 to 2020, as illustrated in Table 38. By 2020, the full amount of tax affected all products.

### B. Methodology Implemented to Protect the Consumers

**Advisory to the oil industry.** While the implementation of the excise tax was on 01 January of each year, the application of such would depend on the levels of inventory (and the corresponding daily

withdrawals in their depots) of the oil refiners and bulk importers as of 31 December of the preceding year, which were taxed with the old excise rates. Accordingly, the DOE issued advisories to the oil players before the yearly implementation to ensure and advise their dealers that pump prices should only reflect stocks that have the new excise tax imposed. Old stocks should be sold on the old excise rate or at zero rate for diesel, kerosene, fuel oil and LPG.

**The DOE Directive on TRAIN implementation.** The DOE, in each year of implementation, issued to oil companies in early January, the Directive calling for the following:

- Submission of a duly notarized inventory report as of 31 December of the preceding year. Implementation of the excise tax under TRAIN shall not be applied unless the 31 December stocks of finished products are fully exhausted.
- For effective monitoring, the inventory shall be on per depot and per product basis.
- Submission of the daily summary of withdrawal starting 01 January of the following year until the depletion of the declared inventory as of 31 December, supported by the Withdrawal Certificates.
- Retailers to post in a conspicuous area, for transparency, notice of new excise tax implementation under the TRAIN in a signage measuring 1 meter by 1 meter in size.

**Verification of the submitted reports.** The verification focused on the levels of inventory per depot vis-à-vis the withdrawals to properly gauge the depletion date and for proper application of the new tax scheme in the retail sector.

**Actual monitoring of the retail outlets.** During the first tranche of implementation, the DOE responded to initial reports of early implementation by some LPP retail outlets pending receipt of the documents instructed for submission as specified in the Directive. Thus, Show-Cause Orders (SCOs) were issued to several outlets directing them to explain in writing, within five days from its receipt, why they have already imposed the excise tax, and to include supporting documents to substantiate the imposition of the correct excise tax. Validation of documents submitted ensued, though not for the whole industry given the immense number of retail outlets nationwide, and those validated were found to be compliant in their implementation of the new tax scheme.

### **C. Savings for Consumers: Estimate of excise tax prevented from being improperly imposed.**

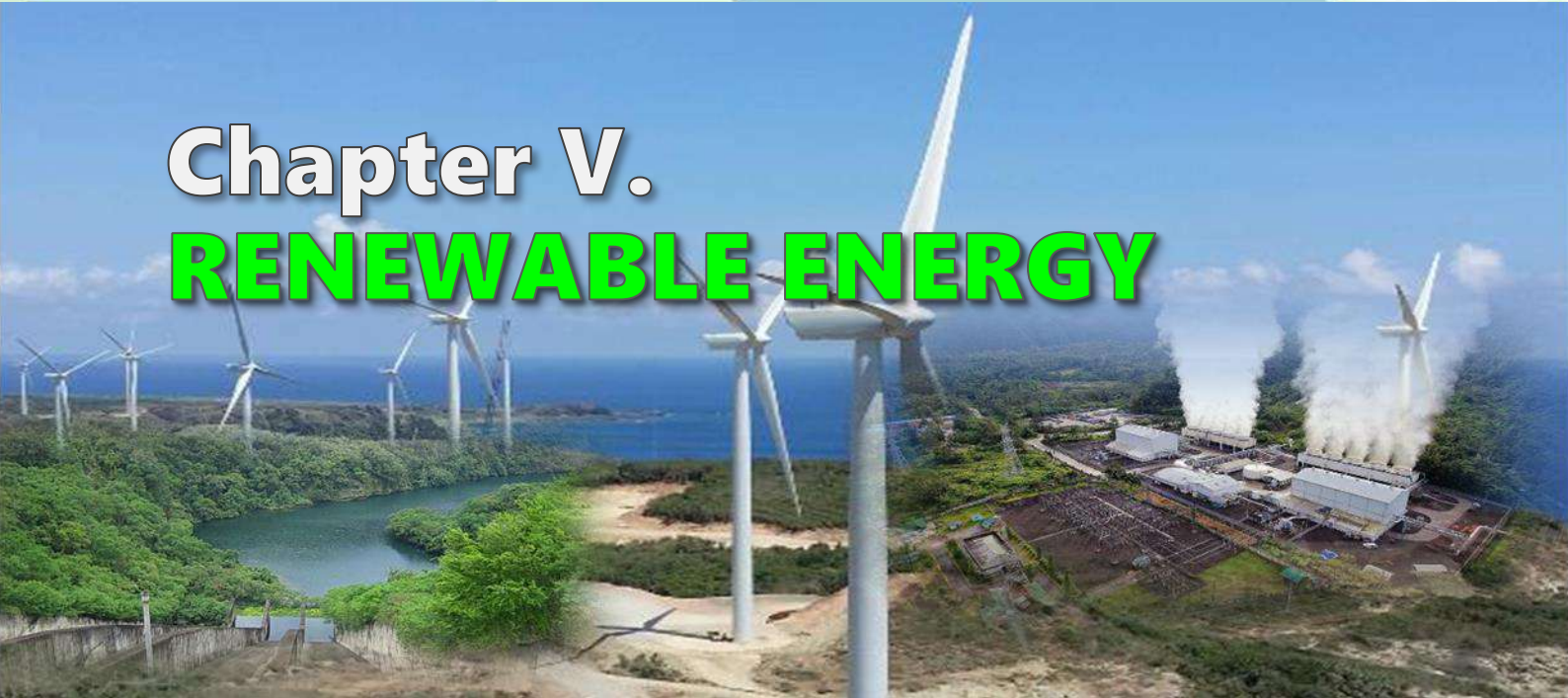
The efforts by the DOE helped the customers in saving billions of pesos, thereby ensuring that the imposition of the new excise tax rates on petroleum products under the TRAIN Law in the industry is fairly and responsibly implemented by all the participants.

The DOE estimated that its actions saved consumers around PhP 7.96 billion for liquid petroleum fuels, and PhP 591.65 million from LPG after the three tranches of implementation. Such was based on submitted inventory and daily summary of withdrawals reports of the oil companies in compliance with the DOE directive as explained above.

To validate whether the implementation of the TRAIN Law was proper, the DOE closely examined the supply chain, starting with the dates of the source depot run-out vis-à-vis the implementation dates of price increases due to TRAIN, including checking of submitted delivery invoices. The delivery dates of the excised products were then compared to the implementation dates of the price increase in the outlet or gas station involved.

# Chapter V.

# RENEWABLE ENERGY



## BIOFUELS

The growing concerns on energy security and environmental sustainability have stirred countries across the world to explore alternative clean sources of energy, including biofuels. Global prospects for biofuel production as an alternative to petroleum is seen to substantially contribute to greenhouse gas (GHG) emission reduction in the future.

Countries in Southeast Asia have continuously advancing the development of biofuels by increasing the blend rates with petroleum (bioethanol for gasoline and biodiesel for diesel) supported with comprehensive policies and programs that are in place (Figure 57).

Thailand introduced its first 2.0 percent biodiesel blend rate (B2)<sup>92</sup> and voluntary use of 5.0 percent bioethanol blend rate (E5) in 2007, which increased to the mandated B5 and E10 in 2016 and subsequently started implementing B6.5-B7 a year later along with price incentives on using E20. Thailand plans to further increase its biodiesel blend rate to B10 by 2020 and is also eyeing to implement B20<sup>93</sup> for buses and trucks.

Indonesia has also set an ambitious target of B30 by 2020 and E20 by 2025

Figure 57. ASEAN MEMBERS WITH EXISTING COMPREHENSIVE POLICIES ON BIOFUEL



Source: The ASEAN Post

<sup>92</sup> Source: United State Department of Agriculture (USDA) Foreign Agricultural Service

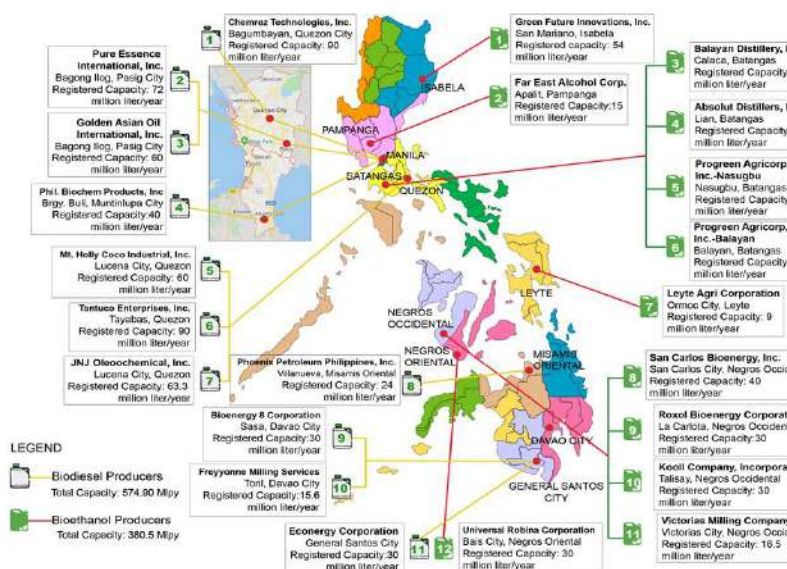
<sup>93</sup> Source: Bangkok Post

through a Ministerial Regulation No. 12/2015. On the other hand, Malaysia introduced the mandated B5 in 2014 and expanding further its mandated B7 in 2015 to B10 in 2019. The implementation of B20 biodiesel mandate is still pending. Malaysia has no program on bioethanol due to lack of domestic feedstock industry support.

Vietnam is also looking towards utilizing biofuels to sustain its energy needs in the transport sector and has been encouraging the production and consumption of B5 and E5 for domestic use. It started implementing B10 in 2018 and currently conducting large-scale on-road test for B25 and E25.

At the domestic front, the mandated B2 and E10 are being enforced. The initiatives of increasing the blend rates for biofuels form part of the DOE's long-term undertaking. Pursuing further the development of biofuels has been one of the ongoing activities of the DOE in compliance with Republic Act (RA) 9367 or the Biofuels Act of 2006. As of 2018<sup>94</sup>, there are 11 biodiesel and 12 bioethanol accredited producers in the country as shown in Figure 58 with total production capacity of 574.9 million liter per year (Mlpy) and 380.5 Mlpy, respectively.

Figure 58. EXISTING BIOFUELS PRODUCERS (2018)



## A. ASSESSMENT

### 1. Biofuel Production

With the current B2 blend for biodiesel and E10 for bioethanol, the actual production for biodiesel increased by 9.8 percent, from 220.0 Mlpy in 2018 to 241.5 Mlpy in 2019, while 16.7 percent increase was recorded for the production of bioethanol, with 296.5 Mlpy in 2018 to 346.1 Mlpy in 2019.

Table 39. BIOFUELS PRODUCTION

Year	Accredited Biofuel Facilities (as of 2018)		2018 (Mlpy)		2019 (Mlpy)	
	No. of Projects	Capacity (Mlpy)	Production	Sales	Production	Sales
<b>Biodiesel</b>	11	574.9	219.98	205.24	241.50	217.52
<b>Bioethanol</b>	12	380.5	296.54	303.73	346.14	355.55

The DOE also facilitated the establishment of two (2) bioethanol distilleries, Victorias Milling Company, Inc. and Progreen Agricorp Inc. (Balayan), and one (1) capacity expansion of Kooll Company Inc., from its existing capacity of 14.12 to 30.0 Mlpy in 2018. These new facilities have combined capacity of 98.38 Mlpy making the total bioethanol production capacity to 380.5 Mlpy.

<sup>94</sup> In 2019, one (1) biodiesel production facility, Archemicals Corporation, was awarded with Certificate of Accreditation under RA 9367 with a rated annual capacity of 33 million liters, bringing the total biodiesel production capacity to 607.9 Mlpy.

## 2. Social Amelioration and Welfare Program (SAWP)

In accordance with Section 17 of the Biofuels Act, the SAWP has been institutionalized where biofuel producers contribute a corresponding “lien”<sup>95</sup> per liter of biodiesel and bioethanol produced and sold. Currently, a lien of PhP 0.05 per liter of coco methyl ester (CME)-based biodiesel, PhP 0.19 per liter of sugarcane-based bioethanol, and PhP 0.07 per liter of molasses-based bioethanol are being imposed by the Department of Labor and Employment (DOLE). Under the SAWP, qualified biofuel workers are able to avail various assistance, such as for livelihood, training, education, social protection and welfare, and emergency.

As of 31 December 2018, a total of PhP 53.5 Million was collected from the CME producers, while PhP 10.2 million was generated from sugarcane-based bioethanol producers and PhP 44.8 million from molasses-based. Of the amount collected, 95.0 percent is allocated for Socio-Economic Project Fund (SEPF) and 5.0 percent for Administrative Expense Fund (AEF).

## 3. Research and Development for Non-Power

There are other alternative biofuel feedstock sources that can be tapped and harnessed to address the issue on supply sustainability. Implementation of higher blend may also be hastened through the development of indigenous biofuel feedstock. In the case of the biodiesel, feedstock sources are: (a) jatropha, (b) waste cooking oil, (c) microalgae, and (d) rubber seed oil. While for bioethanol, feedstock sources include: (a) sweet sorghum, (b) cassava, (c) microalgae, (d) nipa sap, and (e) cellulosic materials, among others.

In 2017, the DOE, in coordination with the Department of Science and Technology-Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD), the Technological University of the Philippines–Integrated Research and Training Center (TUP-IRTC), and the University of the Philippines–National Center for Transportation Studies (UP-NCTS) initiated the conduct of an actual on-road using B5<sup>96</sup> and employing dedicated test vehicles (Toyota Innova and Hilux) procured in 2014. The test completed the 13,431-km (Hi-Lux) and 14,234-km (Innova) distance covering flat and high altitude/elevated terrains with varying weather conditions. Initial results showed a mileage increase of about 10.0 percent for B5 as compared to B2. However, the DOE needs to complete the remaining 16,596 kilometers for a more conclusive result on mileage savings.

## B. PLANS AND PROGRAMS

Several developmental issues encountered by the industry contributed to the delays in the biofuel sector’s roadmap. It has always been a continuing challenge for the industry to sustain the level of production and supply to meet the growing demand, particularly on increasing the mandated biofuels blend rate.

The rise in demand of biofuels is always paralleled with the rise in demand for feedstock. The sustainability of feedstock, such as sugarcane and coconut oil for bioethanol and biodiesel production, respectively, poses a challenge for the industry specifically on the issue of food security and pricing. There is also a concern related to potential impact of higher biofuels blend to current vehicle fleet.

<sup>95</sup> Lien refers to the levy collected from the production of biofuels (with different feedstock sources) to support the SAWP for biofuels plant workers.

<sup>96</sup> 5.0 percent biodiesel blend

Pricing is a major factor that challenges the stability of the domestic biofuel industry with relatively higher per liter price of local biodiesel and bioethanol than gasoline and diesel. Thus, this affects the pump price of the transport fuel, which further makes higher blends more expensive. However, it should be noted that biofuels improve compliance of vehicles to existing emission standards.

The National Biofuel Board (NBB) deems it necessary to address these issues through a holistic analysis as the basis in finalizing a decision to increase biofuel blends.

Consistent with the objectives of the Biofuels Act, the DOE continuously conducts the following:

- Regular monitoring, inspections, validation and evaluation of existing and proposed biofuels/biomass projects and facilities nationwide, and sampling laboratory testing of biofuels in all biofuel production facilities and feedstock production areas and biofuel-blended gasoline and diesel in all blending/distribution facilities;
- Research and development activities and studies on biofuels, biofuel-blended gasoline and diesel, and/or other biomass-derived fuels for use in motors and engines including air transport and other vehicle technologies. Thus, continuance of actual on-road and performance testing for B5 and the implementation of research/demonstration projects using alternative feedstock; and,
- Encourage investments and provide fiscal incentives to entities engaged in the production of biofuels and biofuels feedstock.

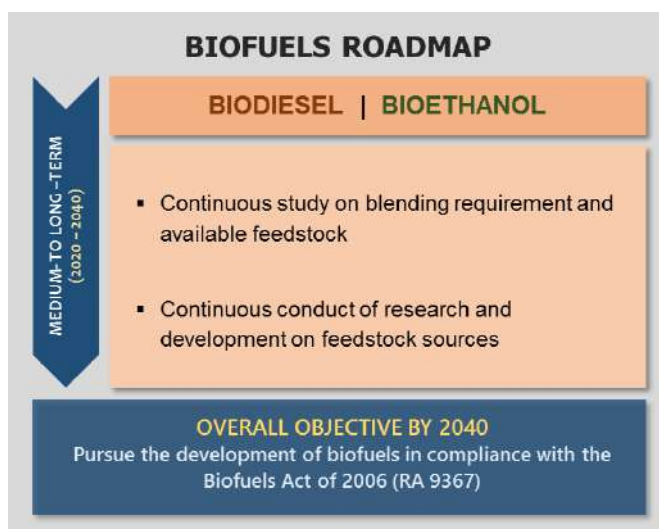
## BIOFUELS ROADMAP

While maintaining the current blend for biodiesel (B2) and bioethanol (E10) until 2019, the DOE along with NBB and other stakeholders will revisit the biofuel blend requirements and available feedstock. Continuous research study and development on potential feedstock sources will also be conducted.

An economic impact study relating to GDP need to be updated if the mandated biodiesel blend (B2) increases to B5 by 2020. The study will assess the economy-wide impacts of biodiesel expansion on household welfare, other sectors of the economy, rural development, employment and income generation, which redound to better energy supply security, and incremental growth in the economy. Higher blend rate can intensify agriculture production and agriculture crop prices.

A sensitivity analysis will also be conducted for the determination of the break-even price per kilogram of copra and per liter of coconut oil. This could be evaluated if the mill gate / farm gate prices of copra to CME are reasonably competitive and beneficial to the farmers. Further deliberation on price and its effect on the final pump price will also be considered.

Figure 59. BIOFUELS ROADMAP





## Expansion / Production Target

In addition to the production capacity of the existing 12 biodiesel producers in the country, four (4) additional facilities are foreseen to be operational by 2020-2025 with combined capacity of 397.65 Mlpy (Table 40). With continued R&D and resource assessment, additional 400 Mlpy is targeted for the long-term period.

**Table 40. REGISTERED WITH NOTICE TO PROCEED / FOR CONSTRUCTION**

Proponent	Location	Production Capacity (in Mlpy)
<b>Bioethanol</b>		
1. Cavite Biofuels Producers, Inc.	Magallanes, Cavite	38.00
2. Asian Alcohol Corporation	Manapla, Negros Occidental	30.00
<b>Total</b>		<b>68.00</b>
<b>Biodiesel</b>		
1. Bio Renewable Energy Ventures, Inc.	Jasaan, Misamis Oriental	150.00
2. Greentech Biodiesel Inc.	Gumaca, Quezon	100.00
3. Voice Development Corp.	Tayabas, Quezon	27.65
4. Econergy Corporation - Polomok	Polomok, South Cotabato	120.00
<b>Total</b>		<b>397.65</b>

One additional facility (Asian Alcohol Corporation at 30 Mlpy) and capacity expansion (Roxol Bioenergy Corporation from 30 to 45 Mlpy) are likely to be added by 2020 from the existing capacity of the 12 accredited bioethanol producers. Further, the Cavite Biofuels Producers, Inc. with 38 Mlpy capacity is expected to be online by 2021. The amendment of rated production capacities of some of the existing bioethanol producers is also projected to provide additional aggregated capacities of 56 Mlpy until the year 2025 due to progressive optimization of bioethanol plant production and additional feedstock supply. For the period 2030-2040, possible additional capacity can reach 400 Mlpy based on available feedstock (Table 41).

**Table 41. PRODUCTION CAPACITY TARGET**

Year	Production Capacity (Mlpy)	
	Biodiesel	Bioethanol
2019	607.90*	380.50*
2020	707.90	425.50
2025	885.55	519.50
2030	1,285.55	919.50
2035		
2040		

\*Existing Capacity

## C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

The biofuel industry also provides opportunities for livelihood and increase rural employment and income. The construction of new biofuel facilities and capacity expansion projects during the planning period requires a total investment of PhP 922.4 billion while creating jobs of more than 120,000. By 2040, it is expected that 51 biofuel producers with total production capacity of 2,205 Mlpy will be operating throughout the country.

**Table 42. INVESTMENT AND JOB OPPORTUNITIES FROM NEW BIOFUELS FACILITIES / CAPACITY ADDITION**

Biofuels	No. of RE Projects by 2040	Annual Rated Production Capacity By 2040 (Mlpy)	Total Investment Cost (Million PhP)	Jobs Generation
Biodiesel	27	1,285.55	207,104.07	43,162
Bioethanol	24	919.50	715,316.35	77,463
<b>Total</b>	<b>51</b>	<b>2,205.05</b>	<b>922,420.42</b>	<b>120,624</b>

## RENEWABLE ENERGY SYSTEMS

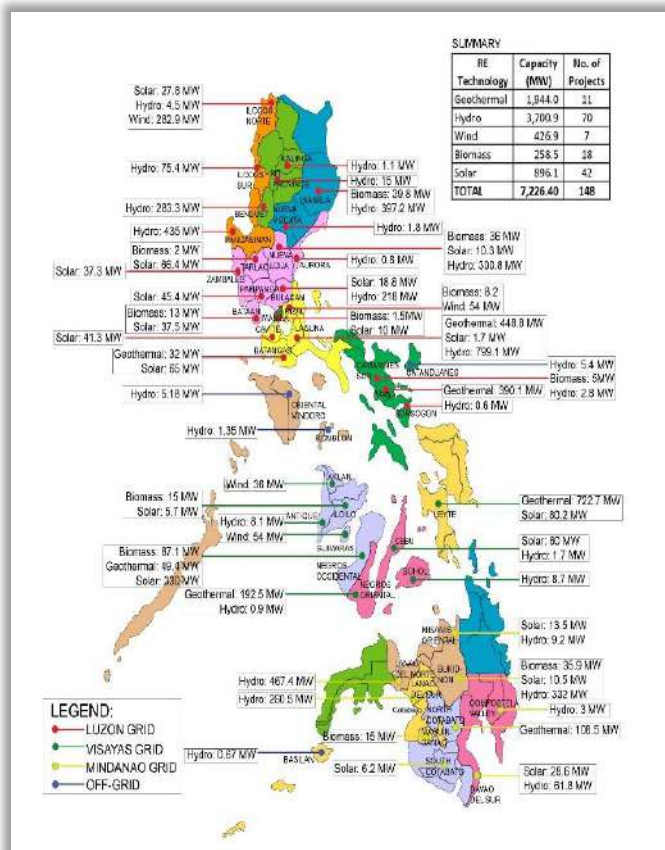
The government’s regulatory framework on renewable energy (RE) development provides the platform for growth of indigenous clean energy sources in the country. The promulgation of RA 9513 or the Renewable Energy Act of 2008 establishes a wide range of measures and strategies to further drive the development of the RE industry sector.

Key actions to strengthen policies and program framework remain a priority thrust of government to stimulate RE development and foster innovation on technology advancement. Consistent with this, the DOE formulated and updated the National Renewable Energy Program (NREP) and the implementing Roadmap to serve as guideposts for a country-wide approach to achieve the aspirational goal of increasing the installed RE capacity to **at least 20,000 MW by 2040**. This goal is expected to sustainably improve the energy supply security, mitigate the effects of climate change and catalyze rural development.

An affirmation of the government’s ardent efforts in exhausting the full potential of renewable resources are the number of commercially operating RE facilities in the country (Figure 60). As of 2018, the 148 RE facilities provided a total of 7,226.4 MW<sup>97</sup> (both on- and off-grid), equivalent to 30.3 percent of the country’s total generating capacity.

Hydro and geothermal contributed bulk of these capacities with 3,700.9 MW and 1,944.0 MW, respectively. On the other hand, solar and wind capacities expanded significantly over a 10-year period. Solar capacity increased to 896 MW in 2018 from only 1 MW in 2008, while wind capacity rose to 427 MW from 33 MW for the same period.

Figure 60. EXISTING RE FACILITIES (2018)



### A. ASSESSMENT

Progress has been made on the short-term targets (2017-2018) of the RE roadmap in terms of the number of achievements and completed activities as discussed below.

#### 1. Accelerated RE Position

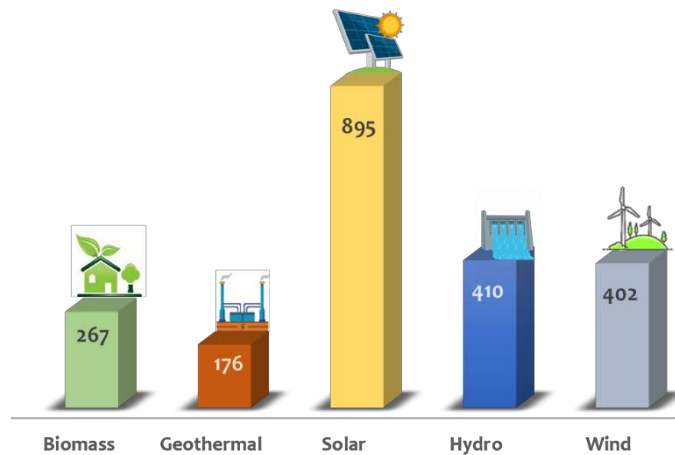
The government’s forefront policies on RE, coupled with the unwavering efforts from the private sector have secured critical investment for the development of renewables since the implementation of the RE Act. Completion of development contracts has resulted in an aggregate

<sup>97</sup> In 2019, total RE capacity reached 7,399 MW. Additional capacities came from solar and biomass.

additional capacity of 2,150 MW from renewables (Figure 61). About 40.0 percent of additional capacity came from solar, while wind and hydro contributed around 19.0 percent each of total. Biomass and geothermal added 8.0 – 10.0 percent to renewable capacity.

To further attract investments and encourage greater deployment of more renewables, the DOE issued and promulgated the following rules and guidelines:

Figure 61. RE CAPACITIES INSTALLED (2008-2018), MW



- **Renewable Portfolio Standard (RPS) for On-Grid** (Department Circular / DC 2017-12-0015) issued on 22 December 2017. The RPS is a market-based policy mechanism under the RE law that requires load-serving entities to source an agreed portion of their energy supply from eligible RE facilities.
- Rules and Guidelines Governing the **Establishment of the Green Energy Option Program (GEOP)** (DC 2018-07-0019) issued on 18 July 2018, which provides end-users the option to choose RE resources as their source of energy.
- Rules and Guidelines Governing the Establishment of **Renewable Portfolio Standards for Off-Grid Areas** (DC 2018-08-0024) issued on 24 August 2018.
- Establishment and Development of **Competitive Renewable Energy Zones (CREZ)** (DC 2018-09-0027) issued on 13 September 2018, which covers upgrading and expanding transmission facilities through policy initiatives and activities that shall enable the optimal use of the indigenous RE resources of the country.
- Adopting the Guidelines for the **Operationalization of the Renewable Energy Trust Fund (RETF)** (DC 2018-10-0018) issued on 23 October 2018. The RETF shall be used to finance research, development, demonstration, and promotion of the widespread and productive use of RE systems both for power and non-power applications.

The Feed-in-Tariff (FiT) scheme for biomass and run-of-river hydro, which expired in 2017 was extended for two years (2018-2019) or until fully subscribed. This is for the purpose of completing the installation targets of the remaining unsubscribed – **29.4 MW for biomass** and **105.4 MW for run-of-river hydro** (as of 31 March 2020). Private entities have ample time to invest in the energy sector and deploy additional power supply utilizing renewables. In 2019, the DOE issued Certificates of Endorsement to ERC for FiT Eligibility of four hydropower projects with a total capacity of 32.18 MW and seven (7) biomass projects with an aggregate capacity of 70.35 MW.

Through the conduct of detailed technology and resource assessment, the DOE was able to identify frontier areas for RE development. In 2018, two areas in Quezon Province and five (5) areas in Nueva Viscaya were assessed for hydropower potential resource. Meanwhile, the two areas identified as candidates for the conduct of detailed wind resource assessment include

Barangay Caragsacan in Dingalan Aurora and Barangay Sinisian East in Lemery Batangas. Continuous data collection to validate the initial collected wind data using Sonic Detection and Ranging (SODAR) equipment will be undertaken in the following areas:

1. Brgy. Poblacion, Pantabangan, Nueva Ecija;
2. Brgy. Malasin, San Jose City, Nueva Ecija;
3. Brgy. Malacapas, Dasol, Pangasinan;
4. Brgy. Ibis, Bagac, Bataan; and,
5. Brgy. Puro, Magsingal, Ilocos Sur.

#### **Policies issued in 2019 and 2020**

- Promulgating the **Omnibus Guidelines governing the awarding and administration of RE contracts and the registration of RE developers** (DC 2019-10-0013) issued 01 October 2019. Under said DC, RE projects for own-use and/or RE projects for Non-Commercial Purposes shall not require the issuance of RE Contracts but shall comply with the registration requirements provided under the Circular.
- Promulgating the **Renewable Energy Market Rules** (DC 2019-12-0016) issued on 04 December 2019. This establishes the market for the trading of RE Certificates (RECs) between and among trading participants.
- Guidelines on the **Duty-Free Importation and monitoring of the utilization of RE machinery, equipment, materials and spare parts and their transfer and other disposition** (DC 2020-02-0005) issued on 13 February 2020.
- Guidelines governing the **issuance of Operating Permits to RE Suppliers under the GEOP** (DC 2020-04-0009) issued on 22 April 2020, which sets rules and procedures in the issuance, administration, and revocation of GEOP Operating permits to RE suppliers.
- The **Green Energy Auction Program (GEAP)** (DC 2020-07-0017) issued on 14 July 2020. It sets the framework for which the DOE shall facilitate the procurement of supply from RE projects by the mandated participants under the RPS on-grid rules through a competitive process for compliance with the RPS program and as applicable for their long-term power supply requirements.

## **2. Conducive Business Environment**

In line with government's initiative on the *Ease of Doing Business Act*<sup>98</sup> (RA 11032), the DOE further improved transparency and shorten the processing time for the issuance of RE service contracts and permits. This helps unleash the full potential of private sector investments for renewable energy.

Setting the progressive pace for RE developers, the DOE revised the existing guidelines and procedures governing the awarding and administration of Renewable Energy Service/Operating Contracts (RESCs/REOCs), and providing for the Registration Process of Renewable Energy Developers. From 45 working days, the processing period has been reduced to not more than 25 working days.

This was supported with the issuance of the **DC 2019-10-0013** on 1 October 2019 promulgating the Omnibus Guidelines governing the awarding and administration of RE contracts and the registration of RE developers. Under the Circular, renewable projects for own-use and/or for non-commercial purposes shall not require the issuance of RE Contracts, but shall only comply with the registration requirements as provided in the Circular.

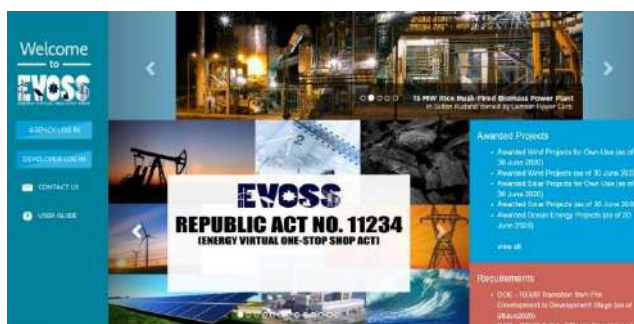
<sup>98</sup> President Rodrigo R. Duterte signed Republic Act (RA) 11032 or the "Ease of Doing Business Act" on 28 May 2018.

Recognizing that expeditious realization of energy projects aids economic progress, the **Executive Order (EO) 30** has been issued declaring some energy projects as “Energy Projects of National Significance (EPNS). As of December 2019, 16 RE projects were endorsed and awarded with a Certificate of EPNS as indicated in Table 43.

**Table 43. LIST OF RE PROJECTS WITH ISSUED CEPNS<sup>99</sup>**

	Resources	Name of Project	Company	Type of CEPNS	Date Issued
1	Geothermal	Kalinga Geothermal Project	Aragon Power and Energy Corporation	Pre-Development	14 August 2018
2	Wind	151.2 MW Talim Wind Power Project	Island Wind Energy Corporation	Pre-Development	30 August 2018
3	Hydro	500 MW Kibungan Badeo Pumped Storage Project	COHECO Badeo Corporation	Pre-Development	26 October 2018
4	Biomass	1.2 MW Biogas Power Plant Project	First Quezon Biogas Corporation	Commerciality	26 November 2018
5	Biomass	6 MW Pangasinan Green Atom Waste to Energy Project	Green Atom Renewable Energy Corporation	Commerciality	27 November 2018
6	Solar	100.8 MW TPI Sarangani Solar Power Project	Total Power Inc. Sarangani	Pre-Development	20 December 2018
7	Hydro	Oilicon Hydropower Project	SN Aboitiz Power Group	Commerciality	10 April 2019
8	Hydro	Alimit Pumped Storage	SN Aboitiz Power Group	Commerciality	10 April 2019
9	Hydro	19.7 MW Ilaguen 3A Hydropower Project	Rio Norte Hydro Corporation	Pre-Development	10 April 2019
10	Wind	600 MW Rizal Wind Power Project	Rizal Wind Energy Corporation	Pre-Development	10 April 2019
11	Hydro	Alimit Hydroelectric Power Plant	SN Aboitiz Power Group	Pre-Development	27 May 2019
12	Hydro	20-MW Sablan 1 Hydroelectric Power Plant	Hedcor, Inc.	Pre-Development	6 June 2019
13	Hydro	15.7 MW Maladugao River (Lower Cascade) Hydroelectric Power Project	Bukidnon Maladugao Hydro Power Corporation	Commerciality	18 July 2019
14	Geothermal	Mahanagdong Geothermal Brine Optimization Plant	Energy Development Corporation (EDC)	Pre-Development	10 September 2019
15	Geothermal	Mt. Malinao Geothermal Project	Philippine Geothermal Production Company, Inc. (PGPC)	Pre-Development	20 September 2019
16	Geothermal	M3 Binary Power Plant Project	Energy Development Corporation	Pre-Development	11 December 2019

Complementing the EO 30 is the “**Energy Virtual One Stop Shop (EVOSS) Act**” or **Republic Act (RA) 11234**. Prospective developers, including RESC holders can apply, monitor, and receive all needed permits and applications, submit all documentary requirements, and even pay for charges and fees through this online system platform.



EVOSS Portal ([www.evoss.ph](http://www.evoss.ph))

Moreover, 275 Certificate of Endorsements (COE) for duty-free importation were also issued to RE developers to lower the investment cost. As part of the DOE’s promotional strategy and to incentivize local technology producers, the DOE

<sup>99</sup>Certificate of Energy Projects of National Significance (CEPNS)

endorsed seven RE accredited manufacturers, fabricators, supplier of locally-produced RE equipment and components in 2017 and 2018.

### 3. Reliable and Efficient Infrastructure

Since the country is vulnerable to natural calamities, energy facilities and infrastructures should be made stronger to withstand the adverse effects in the energy system. In view of this, the DOE issued **DC 2018-01-0001 adopting energy resiliency in the planning and programming of the energy sector** to mitigate potential impacts of disasters. The policy aims to: (1) strengthen existing infrastructure facilities; (2) implement the “*build back better*” principle in terms of reconstruction and rehabilitation; (3) improve existing operational, maintenance and practices to ensure continuous operations and energy supply; and, (4) develop resiliency standards as bases for future construction of energy facilities.

In compliance to the DC, all energy industry participants need to submit their respective Resiliency Compliance Plans (RCPs) to the DOE containing adaptation measures, which include both structural and non-structural measures options. This is to gauge infrastructure and human resource preparedness during and in the aftermath of disruptive events. In 2018, a total of 94 RE industry participants submitted their RCPs coming from 12 geothermal projects, 60 hydropower projects, 13 wind projects, and nine (9) solar projects.

To further strengthen resiliency of the RE systems, some projects have been proposed, among which are:

- Adoption of Solar-Powered Emergency Shelter Solution (SPESS) as an Energy Resilience Tool for Natural Disaster Relief in the Philippines Project; and,
- Adoption of Resilient Solar Energy Solution for Calamity Susceptible Areas Project (RESCUE).

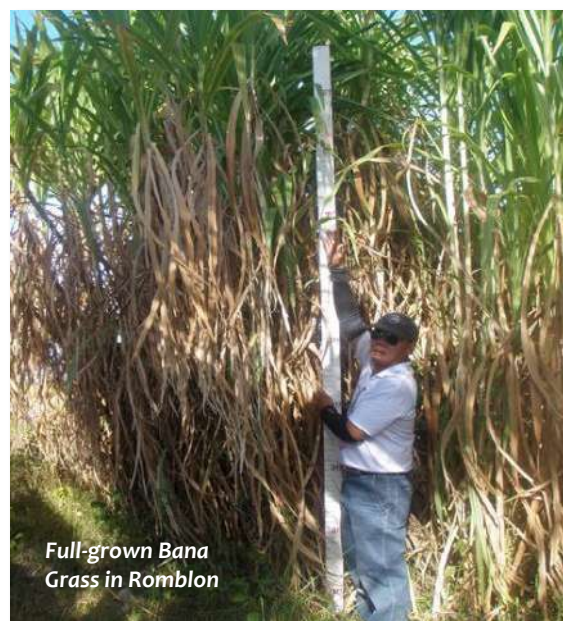
### 4. Promote and Enhance Research, Design and Development (RD&D) Agenda

#### Non-Power

Research and development on other alternative biofuel feedstock sources including second generation biofuels is a continuing undertaking of the DOE. The second-generation biofuels, also known as advanced biofuels, are feedstock that can be manufactured from various types of non-food biomass.

#### Power

Implementation of demonstration project using biomass gasification technology for household electrification has also been pursued. The 18.0-kW Biomass Gasifier Demonstration Project in Sitio Bagong Silang, Barangay Alad, Romblon, Romblon has already completed its testing and commissioning and now operational since November 2018. The gasifier was specifically designed for the locally available feedstock, such as bana grass, coconut husk and shell.



Full-grown Bana Grass in Romblon

Source: Romblon Electric Cooperative Inc. (ROMELCO)

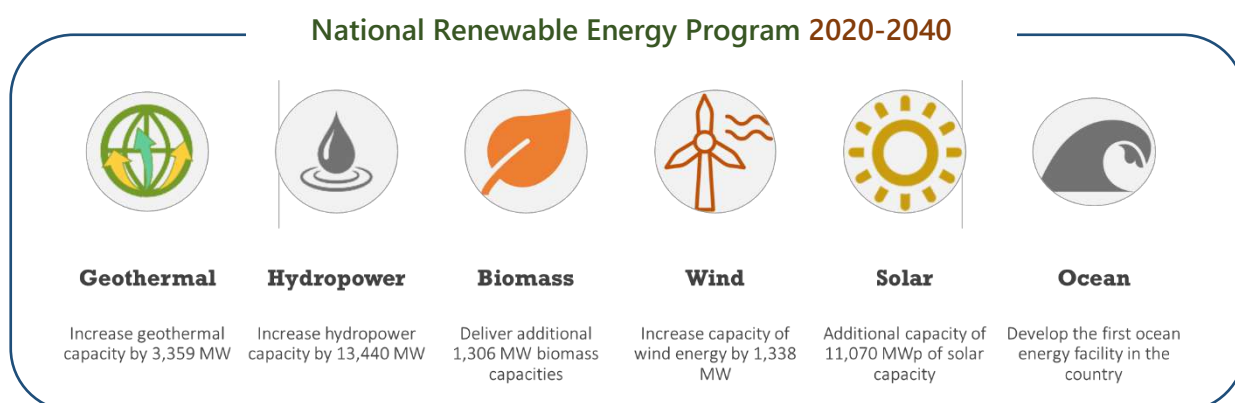
## B. PLANS AND PROGRAMS

There has been a growing global call urging governments and financial institutions to increase investments on renewables as clean sources of energy to reduce the risks from burning fossil fuels affecting human health and environment. Increasing the share of renewables allows the displacement of carbon-intensive energy sources, and thus reduces GHG emissions, while sustaining the country's energy supply base.

In support of this goal, the government has set forth a national commitment to intensify the use of renewable energy resources as a major policy. The DOE has been encouraging private entities to mobilize more investments for the development of renewable resources and technologies. To strategically guide prospective investors, the DOE has updated the National Renewable Energy Program (NREP) and revised the RE Roadmap containing the targets and deliverables necessary to further progress the expansion of renewables in the energy system.

### NATIONAL RENEWABLE ENERGY PROGRAM (NREP) 2020-2040

The draft NREP provides an indicative interim capacity targets for each RE technology within the new timeframe covering 2020 to 2040 to reach the total aspirational **RE capacity target of more than 30,000 MW by 2040** (from the original target of 15,304 MW of installed capacity by 2030). The program foresees that an additional 20,000 MW capacity is expected to be mainstreamed and integrated into the grid on top of existing RE capacity. These capacities have been incorporated in the energy outlook as discussed in Chapter II of the PEP. The National Renewable Energy Board (NREB) is currently finalizing the NREP 2020-2040 for endorsement to the DOE.



New capacities of 1,453 MW, in addition to the existing **geothermal** capacity of 1,906 MW, are seen to be installed within the planning period bringing the total capacity to 3,359 MW by 2040. This is based on the inventory and assessment of geothermal resource, as well as from research and studies on geothermal potentials in the country.

A total of 13,440 MW additional capacities from **hydropower** resources are likewise expected to be in place by 2040. Of the total, Luzon hosts 10,722 MW, Visayas claims 894 MW, and Mindanao holds 1,824 MW. The target capacity additions are dependent on the development and completion of identified hydropower potentials in the medium- to long-term period.

The awarded **biomass** operating contracts (as of December 2017) indicate that new capacities totaling 1,305.7 MW is foreseen to be added in the energy system within the planning horizon. About 192.0 MW of biomass projects are to be installed in the short-term period (2018-2020), 313.4 MW in the medium-term (2021-2025), and 800 MW in the long-term.

Resulting from the resource assessment and awarded service contracts, **wind** capacity is likely to increase by 1,337.7 MW. On the other hand, the capacity target of 11,070 MW for **solar** is anticipated from existing awarded service contracts, committed and indicative projects.

### A Shift on RE Perspective

The NREP 2020-2040 also introduces a paradigm shift on renewables wherein it categorizes RE systems into three (3) main baskets refocusing towards a consumer-centered use from the then grid-centered approach.

1. **Consumer + RE Systems.** It encourages the development of RE systems to be utilized by the consumers in the agriculture, fisheries, health, and education. This basket aims to maximize the integration of battery and other energy storage systems, as well as the use of information and communications technology (ICT).
2. **Consumer + RE Systems + Distribution Utility (DU).** This basket aims to promote investments in the Net Metering Program, demand-side participation schemes and distributed energy systems through innovative, technical, and commercial approaches.
3. **Consumer + RE Systems + DU + System and Market Operations.** This facilitates and improves compliance to the RPS, GEAP, RE Rules, GEOP and smart grid policy, among the other systems and policies.

### RE ROADMAP

Moving towards the realization of the NREP goals, the DOE has intensified the strategies and implementing mechanisms as reflected in the revised RE Roadmap (*Figure 62*), which encompasses medium- to long-term period. The Roadmap encapsulates new policy directions and programs that need to be institutionalized and strengthened including the positive stance on new initiatives. It seeks to provide an inclusive approach to mainstream the **targeted 20,000 MW RE capacity by 2040**.

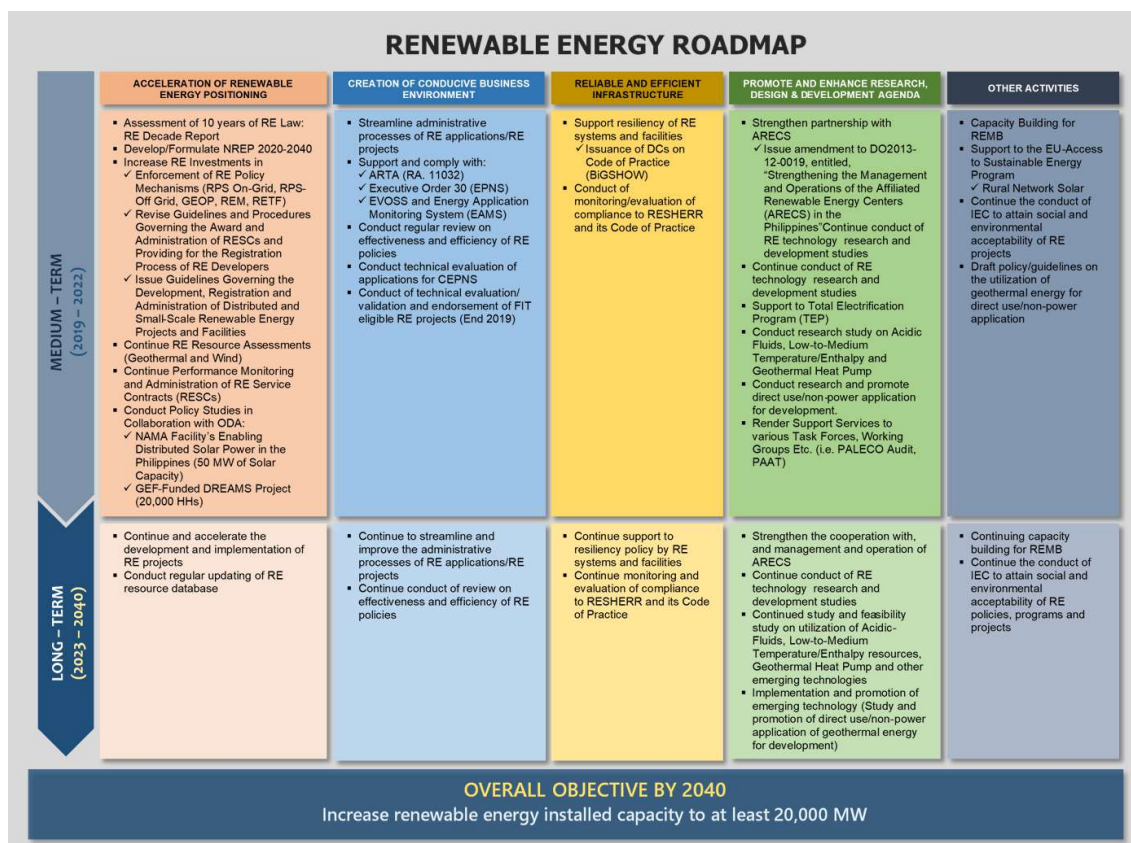
#### 1. Accelerate RE Positioning

With government pursuing its commitment to accelerate the position of RE into a higher level, enforcement and fast tracking of all policy mechanisms as required under the RE Law should be put in place to fully realize objectives of the Law. Upcoming issuances to strengthen RE development include: (a) Renewable Energy Safety, Health and Environment Rules and Regulations (RESHERR) Code of Practice; (b) Operational Guidelines for the RE Trust Fund; (c) NREP 2020-2040; (d) Guidelines for RE Suppliers under GEOP; (e) Enhanced Net Metering; (f) Green Energy Pricing; and, (g) Updated Guidelines on the Duty-Free Importation and monitoring of the utilization of RE machineries, equipment, materials and spare parts.



The DOE also recognizes that streamlining of existing guidelines and procedures for the awarding and administration of RESCs/REOCs and registration process of RE developers will facilitate expeditious implementation of RE projects. This also includes the governing guidelines for the development, registration and administration of all distributed and small-scale renewable energy projects and facilities.

Figure 62. RENEWABLE ENERGY ROADMAP



Continued assessment of renewable resources and regular updating of RE database remain to be part of the long-term strategy of the DOE to improve prospective investors' access to data and information on the country's renewable potentials. This also facilitates the mapping of new potential renewable resources in the country.

## 2. Creation of a Conducive Business Environment

As discussed above, the "Ease of Doing Business Act," EO30 and EVOSS demonstrate the government's commitment to providing a conducive environment for investors, making doing business in the country easier and faster. These policies remove bureaucratic red tape and eliminate corrupt practices.

With improved and streamlined processes in the issuance of RESCs/REOCs and other required permits and clearances, the development of RE projects shall move forward without delays, and thus encourages more investments. A reduced processing time for securing permits and clearances trims down transaction cost leading to lowering of investment cost. From these policies, RE projects shall be expected to be commercially available as scheduled.

### 3. *Reliable and Efficient Infrastructure*

It is the primary focus of the DOE to continuously improve the reliability, availability, and resilience of energy infrastructure and facilities in the countryside. As such, it is the policy of the DOE to incorporate energy resiliency in the planning and programming of the energy sector as part of its long-term strategies in mitigating the potential impacts of disasters.

Also forming part of the DOE's medium- to long-term strategy is the intensification of RESHERR Code of Practice to all RE operators. This is to ensure safety and protection against hazards to health, life and property, as well as pollutions (air, land and water) from all RE projects.

### 4. *Promote and Enhance Research, Design and Development Agenda*

The DOE continues to explore and conduct research development studies on RE technologies, including the viability of new technologies. This is one of the government's strategic approach to further expand the share of renewables in the energy supply mix to fuel the country's industrialization and urbanization, while simultaneously being mindful of its environmental responsibility.

Further, the DOE will promote an innovation culture through supporting new and emerging renewable technologies, as well as innovative business models in the renewable energy industry.

Research studies on acidic fluids, low-to-medium temperature/enthalpy and geothermal heat pump will be the focus in the medium-term plan (2019-2022). Corresponding policy guidelines for the development of low-to-medium enthalpy geothermal energy resources for small-scale power generation, agro-industrial and direct use/non-power application will also be undertaken.

To strengthen partnership with Affiliated Renewable Energy Centers (ARECs), the DOE facilitated the amendment of Department Order (DO) 2013-12-0019<sup>100</sup> through the issuance of DO 2019-03-0007. This is to streamline the criteria, requirements, process of selecting and establishing ARECs, which shall be need-driven and conducted in a competitive and cost-effective manner.

### 5. *Other Activities*

Enabling policy guidelines on the utilization of geothermal energy for direct use/non-power applications will also form part of the medium-term plan. The conduct of Information, Education and Communication (IEC) campaign to convey the benefits of RE will also increase awareness and social acceptance.

## **D. INVESTMENT AND EMPLOYMENT OPPORTUNITIES**

With government's aggressive promotion and adoption of cost-competitive sustainable RE technologies, the scale of investment into clean energy has been encouraging. As the country is abundant with these resources, investments in renewables propel a sustainable energy future.

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<sup>100</sup> DO2013-12-0019 titled, "Strengthening the Management and Operations of the ARECs in the Philippines."

## Renewable Energy Service/Operating Contracts

With a number of RESCs/REOCs being awarded annually for the development of RE technologies, greater employment opportunities have also been favorable to Filipinos. Additional green energy projects and jobs are expected to be deployed within the planning period as 277 RESCs under pre-development stage were awarded as of end-2018 (Table 44). These contracts translated to an equivalent potential capacity of 15,109.2 MW.

Hydropower holds the greatest number of awarded RESCs with 119 providing an equivalent potential capacity of 6,798.9 MW followed by solar with 86 RESCs with potential capacity of 6,464.7 MW. Awarded RESCs for wind totaled 39 with potential capacity of 1,239.70 MW, while geothermal has 25 RESCs with 585 MW, and ocean energy has 8 RESCs with 21 MW.

**Table 44. SUMMARY OF INVESTMENT COST UNDER PRE-DEVELOPMENT STAGE (as of 31 December 2018)<sup>101</sup>**

Resources	No. of RE Projects	Potential Capacity (MW)	Investment Cost (Million PhP)	Jobs/Project	Jobs Generation
Hydropower	119	6,798.86	2,039,658.00	15	1,785
Ocean Energy	7	21	73.97	15	105
Geothermal	25	585	16,721.25	280	7,000
Wind	39	1,239.70	343.02	20	780
Solar	86	6,464.67	5,177.72	11	946
<b>Total</b>	<b>277</b>	<b>15,109.23</b>	<b>2,061,973.96</b>	<b>341</b>	<b>10,616</b>

These projects under pre-development stage require a total investment of PhP 2,062.0 billion, which could potentially create employment of 10,616. With most number of RESCs issued and requiring extensive pre-development works, hydropower gets the large chunks of the estimated investment cost for pre-development, more than 95.0 percent of total. Other renewable resources get less than 1.0 percent of total estimated investment. The falling costs of solar and wind make them economically competitive. Solar and wind farms have estimated investment of around PhP 5.5 billion.

## Competitive Renewable Energy Zones (CREZ)

Another prospective investments from RE are expected to come from the **25 candidate RE zones (REZ)** (Figure 63) with highest concentrations of high-quality wind and solar resources combined with demonstrated interest from project developers.

The CREZ is a stakeholder-driven planning process chaired by the DOE with financial support from the United States Agency for International Development (USAID) and technical support from the U.S. National Renewable Energy Laboratory. This is in accordance with the DOE's issued DC 2018-09-0027, "Establishment and Development of CREZs in the Philippines." This initiative aims to encourage the transmission upgrades and expansion towards the optimal utilization of the country's indigenous RE resources.

The CREZ involves a proactive transmission planning approach, which aims to connect CREZ to the power system. Thus, these zones open the opportunities for private sector development and reduce investment barriers by directing transmission development and RE developers to the country's most promising RE opportunities.

<sup>101</sup> In 2019, additional 144 RE projects with total potential capacity of 7,420.3 MW were awarded. Pre-development of these new RE projects could generate an additional investment of PhP 459.5 billion while creating employment to 2,470 Filipinos.

Figure 63. 25 CANDIDATE CREZs



Moreover, CREZ supports cost-effective RE development given that that the zones are pre-screened for high-quality resources, suitable topography, potential land-use constraints, and demonstrated developer interest, thereby bringing down overall feasibility assessment costs.

The 25 selected CREZs across the Philippines have an estimated gross capacity of 152 GW of wind and solar photovoltaics (PVs) potentials. The zones also include an estimated 365 MW of geothermal, 375 MW of biomass, and over 650 GW of hydropower capacity distributed across the Luzon, Visayas and Mindanao systems (Table 45). The gross RE resources represent an upper bound assessment for each zone.

Table 45. CREZ GROSS RE POTENTIAL CAPACITY

System	CREZ Gross Capacity Potential (MW)					Total (MW)
	Solar PV	Wind	Geothermal	Hydropower	Biomass	
Luzon	35,031	54,115	285	270,603	210	360,244
Visayas	11,876	25,429	40	1,917	71	39,333
Mindanao	11,203	14,443	40	382,514	93	408,293
<b>Total</b>	<b>58,110</b>	<b>93,987</b>	<b>365</b>	<b>655,034</b>	<b>374</b>	<b>807,870</b>

Initial results of the transmission expansion scenario models captured the integration of more than 30 GW of wind and solar in CREZs by 2040. Renewable projects in CREZs with high capacity factors result in lower cost per megawatt-hour (Php/MWh) and greater utilization of transmission assets.



# Chapter VI.

## POWER DEVELOPMENT

Power sector development plays an invaluable role in fueling the economy and nation building. The country's electric power industry is governed by Republic Act (RA) 9136 or the Electric Power Industry Reform Act (EPIRA) of 2001 that envisions a regime of a liberalized power industry towards fully achieving a competitive and a market-driven electricity sector. The EPIRA's goals and objectives were further strengthened by RA 9513 or the Renewable Energy (RE) Act of 2008 that pushes the utilization of indigenous and new renewable energy resources to increase energy self-sufficiency and reduce dependence on imported fuels.

As the power sector continuously evolves along with technology innovation, the DOE remains committed with its mandate of formulating plans, programs, and policies to usher the sector's unimpeded growth. This translates to a number of benefits such as ensuring economic stability, creation of wealth for communities and the people, and consumer empowerment, among others.

To heed the Administration's call for inclusive growth and development, the DOE aligns its power-related development plans with the Philippine Development Plan (PDP) 2017-2022, the *"Build, Build, Build, Infrastructure"* Program and Ambisyon 2040, as a converging strategy to fast-track the attainment of the President's priority thrusts and agenda.

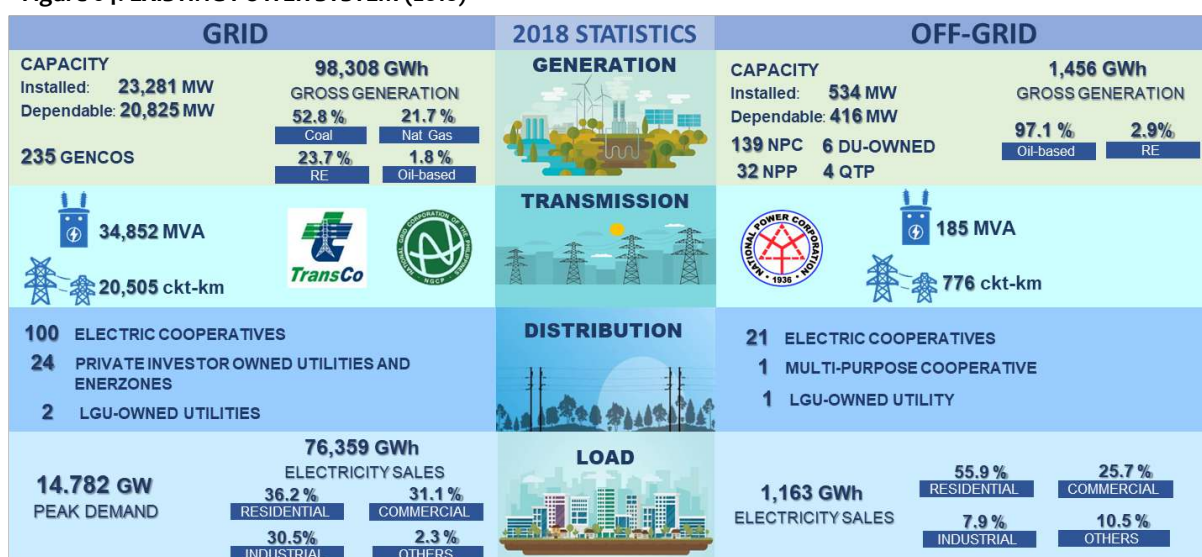
In addition, the DOE crafted Power Sector Roadmap that encapsulates the generation, transmission, distribution and supply subsectors, including missionary and household electrification. The sub sector roadmaps outline the various strategies and approaches, which are targeted for implementation in the short- up to the long-term period. Each of the roadmaps are anchored on the power sector's overall objectives by 2040, which are to: 1) ensure quality, reliable, affordable and secure supply; 2) expand access to electricity; 3) ensure a transparent and fair playing field in the power industry; and 4) accelerate total electricity access in the country.

Key legislations and their corresponding Implementing Rules and Regulations (IRRs) were likewise passed in 2019. These include RA No. 11234 or the Energy Virtual One Stop Shop Act, RA 11371 or the Murang Kuryente Act, and RA 11361 or the Anti-Obstruction of Power Lines Act. With these laws in place, the benefits to be drawn by the electric power industry participants and stakeholders include accelerated implementation of power projects, continuous delivery of electricity service, and easing the burden on consumers.

## A. EXISTING POWER SYSTEM

The Philippines is an archipelago made up of 7,641 islands. With its geographical nature, the country's electricity network is characterized by grid and off-grid power systems. The main grid is composed of three (3) sub-grids, namely, the Luzon and Visayas grids that are already interconnected via submarine cable, and the Mindanao grid that remains an independent grid anticipating the completion of the Mindanao-Visayas Interconnection Project (MVIP). Once completed, the major grids can benefit from sharing of available capacities as a "One Grid Philippines."

Figure 64. EXISTING POWER SYSTEM (2018)



Source: DOE, NGCP and NPC

### ▪ Main Grid

In 2018, the main grid recorded a peak demand of 14,782 megawatts<sup>102</sup> (MW). There were 235 generating facilities with a total installed capacity of 23,281 MW<sup>103</sup> and a dependable capacity of 20,825 MW. Gross power generation in the same period stood at 98,308 gigawatt-hour<sup>104</sup> (GWh). More than half of the electricity produced were sourced from coal-fired power plants, while a fifth came from natural gas. Renewable-based generation, such as geothermal, hydro, biomass and variable solar and wind power plants, contributed nearly one-fourth of total power generation. Oil-based power plant roughly supplied around 2.0 percent of electricity generated (Figure 64).

Electricity generated by the power plants is delivered at a higher voltage through the transmission system. The existing transmission assets, with total substation capacity of 34,852 Megavolt-Ampere (MVA) and combined transmission line length of 20,505 circuit-kilometers (ckt-kms), are owned by the government through the National Transmission Corporation (TransCo). It is being operated and maintained by privately-owned company – National Grid Corporation of the Philippines (NGCP) – by virtue of RA 9511 or the NGCP Franchise Law<sup>105</sup>. Under the said franchise, the initial concession agreement between government and NGCP is for a duration of 25 years that can be renewed for another 25 years.

<sup>102</sup> In 2019, the main grid recorded a peak demand of 15,581 MW.

<sup>103</sup> In 2019, the main grid has a total installed capacity of 25,006 MW and total dependable capacity of 22,317 MW.

<sup>104</sup> The 2019 gross power generation of the main grid reached 104,417 GWh.

<sup>105</sup> Signed on 01 December 2008.

The distribution utilities (DUs) supply electricity to the end-users. As of 2018, the National Electrification Administration (NEA) supervises the operation of 100 Electric Cooperatives (ECs), while the 24 Private Investor Owned Utilities (PIOUs) and Enerzones<sup>106</sup> including the two (2) LGU-Owned Utilities (LGUOUs) directly report to the DOE. During the period, total electricity sales or the amount of electricity consumed by the end-users of DUs in the main grid was 76,359 GWh<sup>107</sup>. The residential and commercial sectors are among the largest power users, which account for 36.2 percent and 31.1 percent of total sales, respectively. Electricity consumption of the industrial sector closely followed with 30.5 percent, while the remaining 2.3 percent was accounted for the “others” sector for electricity used by public buildings and streetlights.

#### ▪ Off-Grid

Off-grid power systems or “missionary areas” are those that are not yet connected to the main grid. These are typically small islands and isolated grids (SIIGs) whose electricity supply is being provided majority by the National Power Corporation (NPC), privately-owned New Power Providers (NPPs) for relatively large off-grid islands, and some Qualified Third Party (QTP) providers servicing far-flung and remote areas.

For the period in review, there are 181 power generation facilities in missionary areas. Of the total, 139<sup>108</sup> power plants are operated by the NPC-Small Power Utilities Group (NPC-SPUG), 32 from NPPs, six (6) are DU-owned, and four (4) from QTPs. Existing power plants have a total installed capacity of 534 MW and a dependable capacity of 416 MW<sup>109</sup>. In terms of power generation, total power produced reached 1,456 GWh<sup>110</sup>. About 97.1 percent was sourced from oil-based power plants, with only a small portion from RE-based generation facilities, particularly mini-hydro that contributed about 2.9 percent of the gross generation.

Aside from generating facilities, NPC-SPUG owns, manages and operates the transmission and substation assets of the government, with total substation capacity of 185 MVA and 776 ckt-kms of transmission lines. On the other hand, the NEA administers and supervises 21 Off-grid ECs, while the DOE directly oversees one (1) Multi-purpose Cooperative (MPC) and one LGUOU that act as local distribution utilities in SIIGs.

The 2018 electricity consumption of the off-grid was 1,163 GWh<sup>111</sup>, representing only 1.5 percent of the total electricity consumption of the main grid. The residential sector accounted for the largest share demanding more than half of total. Meanwhile, the commercial, industrial and other sectors required 25.7 percent, 7.9 percent and 10.5 percent of the total electricity consumption, respectively.

## B. GENERATION

The power generation sector’s roadmap articulates short- to long-term strategies anchored on the government’s overarching thrust and energy agenda of achieving power supply security, reliability, and sustainability throughout the country. It forms as an integral part of the holistic approach toward realizing the full restructuring and reform of the electric power industry in support of national development.

<sup>106</sup> Enerzones are duly authorized entities operating within economic zones.

<sup>107</sup> In 2019, the electricity sales of the main grid was 81,237 GWh, excluding directly connected customers (DCC).

<sup>108</sup> Excluding the 135 small-scale power plants in the PRES mini-grids.

<sup>109</sup> In 2019, off-grid power plants have a total installed capacity of 526 MW and a dependable capacity of 419 MW.

<sup>110</sup> In 2019, gross power generation in off-grid areas reached 1,623 GWh.

<sup>111</sup> In 2019, total electricity sales in off-grid areas reached 1,278 GWh.

## ASSESSMENT

For the short-term period, the DOE has taken strategic strides to attain these key targets outlined in the roadmap. Relatedly, the electric power industry also welcomed milestone developments, new policy directions and crucial interventions that are instrumental in meeting the envisioned goals and outcomes of the sector.

### 1. Declaration of Major Power Projects as Energy Projects of National Significance

The promulgation of Executive Order No. 30 (EO30) creating the *Energy Investment Coordinating Council (EICC)* is a paramount development in the energy sector, particularly in securing a conducive business environment for energy investments. Through this executive issuance, the establishment of a simplified and streamlined regulatory process essentially can benefit the electric power industry investors in pursuing and expediting the implementation of proposed power infrastructure projects that are vital in ensuring the country's energy security.

Two power generation projects have been granted with a Certificate of Energy Project of National Significance (CEPNS), namely:

- The Atimonan One Energy 2 x 600 MW Coal-fired Power Project; and,
- The Energy World Corporation 650 MW Combined Cycle Gas Turbine Power Project with Liquefied Natural Gas (LNG) Import Terminal and Regasification Facility.

#### ▪ Addressing Issues Relative to Real Property Tax (RPT) and Local Taxes

In fulfillment of its mandate to provide a sustainable and reasonably-priced energy for the people, the DOE continues to establish strategies to make electricity costs more competitive. Among the identified measures being considered by the DOE include the relaxation of government tariffs, such as exemption from real property and other local taxes being imposed by the LGUs to the power generation companies.

In 2018, the DOE fully supported the Department of Finance (DOF) in proposing for an Executive Order mandating the reduction and condonation of real property taxes, interests and penalties for the period 2017. The proposed EO will cover the power generation facilities of the Independent Power Producers (IPPs) under the Build-Operate-Transfer (BOT) contracts with the Government Owned and Controlled Corporations (GOCCs). It also intends to relieve the burden of the privatized IPPs that are yearly encountering problems on the assessment and payment of real property tax to the concerned LGUs. This initiative is in relation to the administration of IPP contracts, as part of the major functions of the Power Sector Assets and Liabilities Management (PSALM) Corporation wherein the DOE sits as one of the agency's Board of Directors.

#### ▪ Granting of Business Permits and Licenses to Operate

The DOE evaluates, processes and issues necessary endorsements and certifications including permits and licenses to operate, which form part of the basic requirements of other government agencies relative to the construction of new power generating facilities. For the period in review, the DOE granted a total of 272 clearances in 2017 and endorsed 261 power projects in 2018 as presented in *Table 46*.



**Table 46. NUMBER OF CLEARANCES/ENDORSEMENTS ISSUED TO POWER GENERATION COMPANIES, 2017-2018**

Requesting Agency	Type of Clearance/Certificate	2017	2018
Securities and Exchange Commission (SEC)	Certificate of Endorsement (COE) for Company Registration/Incorporation	160	117
National Grid Corporation of the Philippines (NGCP)	Clearance to Undertake System Impact Study (SIS)	73	84
Energy Regulatory Commission (ERC)	COE for the issuance of ERC Certificate of Compliance (COC)	30	46
National Commission on Indigenous Peoples (NCIP)	Certificate of Non-Overlap (CNO) / Certificate of Precondition (CP)	9	14
<b>Total</b>		<b>272</b>	<b>261</b>

## 2. Establishment of Power Mix Policy for Power Generation towards Optimal Portfolio

The DOE remains cognizant of its crucial role in empowering the nation by ensuring the delivery of stable, secure, sufficient and accessible energy supply. In carrying out this mandate, the DOE firms up its strategies by instituting an appropriate power mix for electricity generation, which considers an optimal supply portfolio that meets the growing electricity demand including the reserve requirements of the grid. The optimal portfolio constitutes the required baseload, mid-merit and peaking power plant capacities based on least-cost options.

Parallel with this policy thrust, the DOE regularly formulates, on an annual basis, the power demand-supply outlook using a simulation software that provides optimal capacity addition planning. The Power Outlook 2018-2040 was presented in the E-Power Mo campaign held in Iloilo City last 09 October 2018.

## 3. Plant Performance Assessment and Audit/Benchmarking of Power Generation Facilities

On 03 May 2017, the DOE promulgated the Department Circular (DC) 2017-05-0008 titled “Providing for the Policies and Guidelines on the Conduct of Performance Assessment and Audit for All Power Generation, Transmission and Distribution Systems and Facilities.” The Circular provides the policy for the conduct of performance assessment and audit (PAA) of all facilities related to the power system – power generation, transmission, and distribution systems and facilities. In support of this issuance, DC 2017-12-0016 titled, “Adopting the Guidelines for the Performance Assessment and Audit of All Power Generation, Transmission and Distribution Systems and Facilities” was then issued on 28 December 2017, embodying the implementing guidelines of all PAA activities of the DOE.

These Circulars are enforced to serve as effective guideposts to evaluate the overall performance and efficiency of power facilities with respect to their mandated operational standards. In addition, these policies are also aimed at identifying existing gaps and challenges in the policies and regulations in the electric power industry, as well as the necessary action plans that are instrumental for the review and development of corrective policy measures.

In the last quarter of 2018, the DOE’s Performance Assessment and Audit Team on Power Generation Facilities (PAAT-PGF) spearheaded the conduct of PAA in the following grid-connected power generation facilities listed in *Table 47*.

**Table 47. LIST OF COMPLETED PAA ACTIVITIES ON GRID-CONNECTED POWER GENERATION FACILITIES**

Grid	Facility	Date of PAA
Luzon	Tiwi Geothermal Power Plant	21 November 2018
Visayas	Bohol Diesel-fired Power Plant	13-14 November 2018
	Janopol Mini-Hydroelectric Power Plant	13-14 November 2018
Mindanao	Therma South Inc. (TSI) Coal-fired Power Plant	16-17 October 2018

Likewise, the DOE is firming up the engagement of professional consultants to strengthen the sustainability, institutional capacity and the overall improvement of the program. In line with this, the DOE completed the procurement process for the Consultancy Services that is responsible for enhancing the PAA implementing guidelines, including the accreditation of the third-party independent auditors.

#### 4. Periodic Monitoring of Power Generation Projects

As part of its regular function, the DOE closely monitors the development phase of power generation projects that are in the pipeline to ensure that these capacity additions are timely commissioned based on their scheduled commercial operations.

In 2018, new generating capacities with an aggregate capacity of 934 MW were commissioned during the period as enumerated in *Table 48*. Of the total, nearly 80.0 percent was coal, 13.0 percent from renewables and less than 10.0 percent oil-based plants. New capacities from renewables comprised of 80 MW hydropower, 34 MW biomass and 12 MW geothermal. About 70.0 percent of these newly installed capacities are located in Luzon, and the remaining in Mindanao. Meanwhile, Visayas maintained a stable power supply despite no additional capacities that came online in the region.

**Table 48. LIST OF NEWLY COMMISSIONED POWER PLANTS in 2018 (On-Grid)**

Facility	Operator	Location	Capacity (MW)	
			Installed	Dependable
<b>LUZON</b>			<b>659.90</b>	<b>636.40</b>
<b>Coal</b>			<b>570.00</b>	<b>555.00</b>
Pagbilao Unit 3	Pagbilao Energy Corporation (PEC)	Pagbilao, Quezon	420.00	420.00
SCPC Unit 3	SMC Consolidated Power Corporation (SCPC)	Limay, Bataan	150.00	135.00
<b>Oil-based</b>			<b>50.00</b>	<b>46.00</b>
SLPGC Unit 3	Southwest Luzon Power Generation Corporation (SLPGC)	Calaca, Batangas	25.00	23.00
SLPGC Unit 4	SLPGC	Calaca, Batangas	25.00	23.00
<b>Geothermal</b>			<b>12.00</b>	<b>12.00</b>
Maibarara Unit 2	Maibarara Geothermal Inc.	Sto. Tomas, Batangas	12.00	12.00
<b>Hydropower</b>			<b>8.50</b>	<b>8.00</b>
Maris 1 Main Canal	SN Aboitiz Power Magat, Inc.	Ramon, Isabela	8.50	8.00
<b>Biomass</b>			<b>19.00</b>	<b>15.40</b>
ACNC	Asian Carbon Neutral Power Corporation	Tarlac City, Tarlac	2.00	0.60
BBEC	Bicol Biomass Energy Corporation (BBEC)	Pili, Camarines Sur	5.00	4.00
SJCI Power Phase II	San Jose City I Power Corporation	San Jose City, Nueva Ecija	12.00	10.80
<b>MINDANAO</b>			<b>274.10</b>	<b>255.00</b>
<b>Coal</b>			<b>150.00</b>	<b>135.0</b>

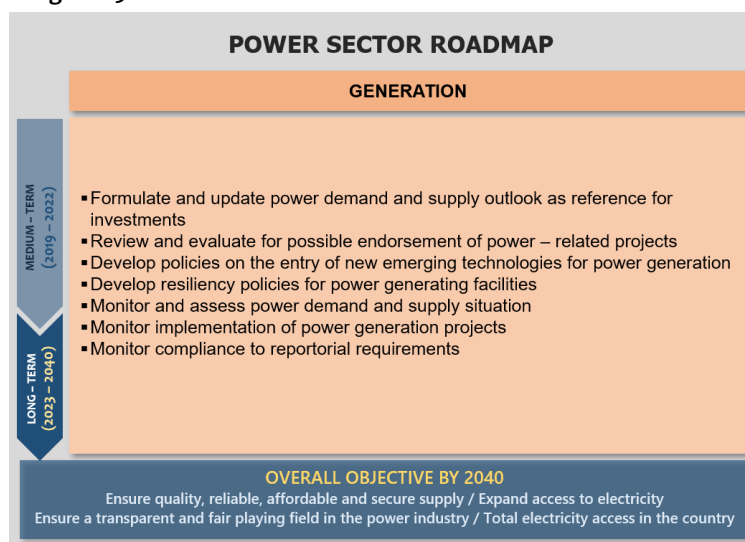
**Table 48. LIST OF NEWLY COMMISSIONED POWER PLANTS in 2018 (On-Grid)**

Facility	Operator	Location	Capacity (MW)	
			Installed	Dependable
SMC Malita Unit 2	San Miguel Consolidated Power Corporation	Malita, Davao Occidental	150.00	135.00
<b>Diesel</b>			<b>37.30</b>	<b>34.70</b>
KEGI-Jimenez	King Energy Generation Incorporated (KEGI)	Brgy. San Isidro, Jimenez	7.80	7.50
PBI	Peak Power Bukidnon Inc. (PBI)	Bukidnon	10.40	10.40
PSFI 2	Peak Power San Francisco (PSFI)	San Francisco, Agusan del Sur	5.20	5.20
PSI 2	Peak Power Soccsargen (PSI)	General Santos City	13.90	13.90
<b>Hydropower</b>			<b>71.80</b>	<b>71.80</b>
New Bataan HEPP	Euro Hydro Power (Asia) Holdings, Incorporated	New Bataan, Compostela Valley	3.00	3.00
Manolo Fortich Unit 1	Hedcor Bukidnon, Incorporated	Santiago, Bukidnon	43.40	43.40
Manolo Fortich Unit 2	Hedcor Bukidnon, Incorporated	Santiago, Bukidnon	25.40	25.40
<b>Biomass</b>			<b>15.00</b>	<b>13.50</b>
Lamsan Power Corporation	Lamsan Power Corporation	Maguindanao	15.00	13.50
<b>Total</b>			<b>933.60</b>	<b>880.60</b>

## PLANS AND PROGRAMS

Mindful of its crucial role in powering the nation, the DOE is poised to buckle up concrete strategies under the generation roadmap for greater power supply security, grid stability, and increase sustainability in the long-run. In pursuit of this goal, the DOE continues to bring forth suitable policy regulations coupled with pragmatic mechanisms to promote full competition and increase transparency in the power sector (Figure 65).

**Figure 65. POWER GENERATION ROADMAP**



### 1. Formulation and Updating of Power Demand and Supply Outlook as Reference for Investments

To upkeep the DOE’s societal contributions toward national development, the formulation and periodic updating of the country’s power demand and supply outlook remains as a priority program. In carrying out this mandate, the DOE stays vigilant in developing its electricity projections giving due consideration on optimal power mix, technology neutral approach, and fuel diversity.

The power outlook serves as a firm reference for enticing more investments in the electric power industry, and as a responsive measure to meet the dynamic needs of surging economy. The positioning of landmark policies and regulations aimed at revamping the rigid business processes and transaction-making in the government are seen to revitalize the private sector’s investment interest with a big appetite for the energy sector. These remarkably flag a turning point to attract more investors and infuse the much-needed capital, particularly in the power generation business.

## 2. Monitor Implementation of Power Generation Projects

To support the power outlook, the DOE constantly monitors the committed and indicative power projects to facilitate their timely completion to fill up the requirement of the grid. As of 31 December 2018, a total of 45 committed power projects with corresponding aggregate installed capacity<sup>112</sup> of 6,329 MW were listed in the private sector initiated power projects of the DOE. On a per grid basis, Luzon requires three-fourths of the committed, while Visayas and Mindanao share the remaining as shown in Figure 66 and Table 49.

Among fuel sources, capacity from conventional power plant type (coal, oil-based and natural gas) totals 5,813 MW, constituting more than 90.0 percent of the committed capacity. Meanwhile, renewables (geothermal, hydro, solar, wind, and biomass) make up a little less than 10.0 percent of the total capacity, or 516 MW.

Figure 66. COMMITTED POWER PROJECTS (As of 31 December 2018)

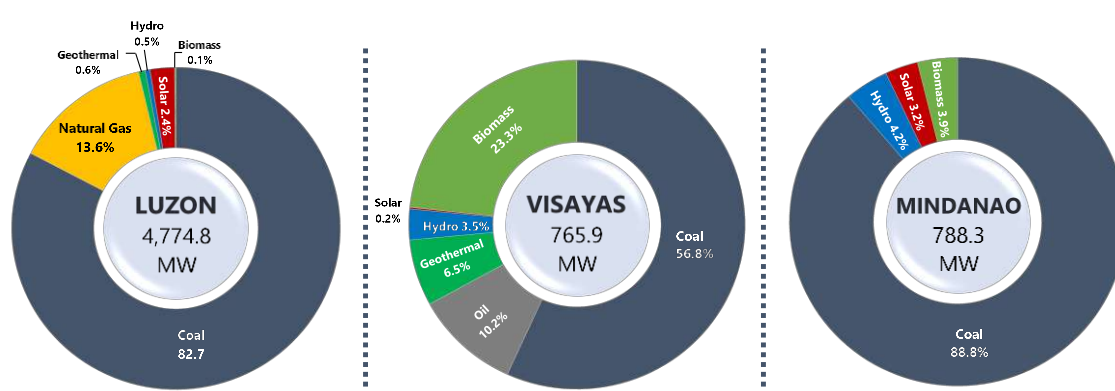


Table 49. SUMMARY OF COMMITTED POWER PROJECTS (As of 31 December 2018)

Plant Type	Luzon		Visayas		Mindanao		Philippines	
	No. of Projects	Rated Capacity (MW)	No. of Projects	Rated Capacity (MW)	No. of Projects	Rated Capacity (MW)	No. of Projects	Rated Capacity (MW)
Coal	6	3,950.0	2	435.0	2	700.0	10	5,085.0
Oil-based	-	-	2	78.0	-	-	2	78.0
Natural Gas	1	650.0	-	-	-	-	1	650.0
Geothermal	1	31.0	1	50.0	-	-	2	81.0
Hydropower	8	22.6	2	23.1	2	33.0	12	78.7
Solar	1	115.0	3	1.2	1	25.0	5	141.2
Wind	-	-	-	-	-	-	-	-
Biomass	2	6.2	6	178.6	5	30.4	13	215.1
<b>Total</b>	<b>19</b>	<b>4,774.8</b>	<b>16</b>	<b>765.9</b>	<b>10</b>	<b>788.3</b>	<b>45</b>	<b>6,329.0</b>

<sup>112</sup> Installed capacity is the rated or nameplate capacity of the power plant.

In the same reference period, the DOE is tightly monitoring 292 indicative power projects with a total capacity equivalent to 33,099 MW. Of the total, 26,705 MW capacities are lined up in Luzon, 3,903 MW in Visayas and 2,491 MW in Mindanao (Figure 67).

Figure 67. INDICATIVE POWER PROJECTS (As of 31 December 2018)

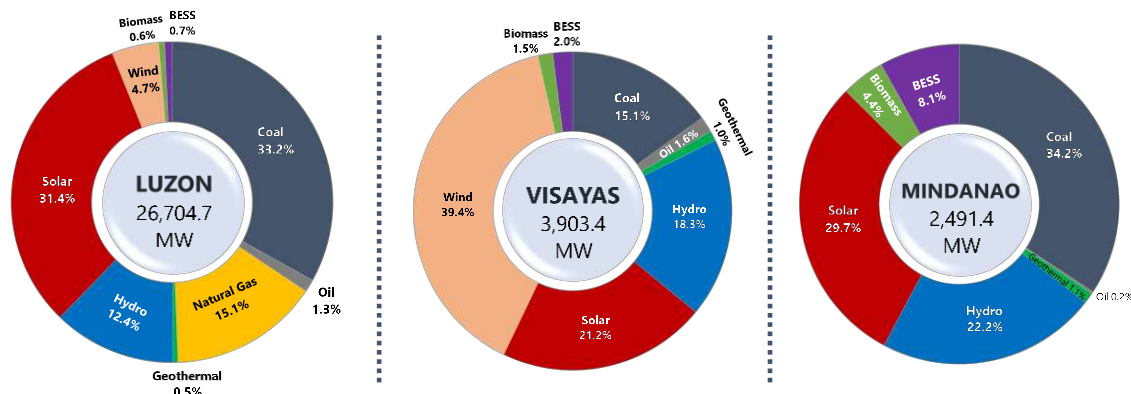


Table 50. SUMMARY OF INDICATIVE POWER PROJECTS BY ISLAND GRID (As of 31 December 2018)

Plant Type	Luzon		Visayas		Mindanao		Philippines	
	No. of Projects	Rated Capacity (MW)	No. of Projects	Rated Capacity (MW)	No. of Projects	Rated Capacity (MW)	No. of Projects	Rated Capacity (MW)
Coal	11	8,935.0	2	600.0	3	928.0	16	10,463.0
Oil-based	3	346.0	4	63.5	1	5.9	8	415.4
Natural Gas	5	4,060.0	-	-	-	-	5	4,060.0
Geothermal	3	130.0	1	40.0	1	30.0	5	200.0
Hydropower	62	3,344.2	19	728.2	19	603.2	100	4,675.6
Solar	58	8,450.0	15	843.7	20	805.0	93	10,098.6
Wind	11	1,275.4	13	1,568.0	-	-	24	2,843.4
Biomass	14	164.0	5	60.0	8	119.4	27	343.4
BESS	8	200.0	4	80.0	2	220.0	14	500.0
<b>Total</b>	<b>175</b>	<b>26,704.7</b>	<b>63</b>	<b>3,903.4</b>	<b>54</b>	<b>2,491.4</b>	<b>292</b>	<b>33,099.5</b>

By fuel type, renewable-based generation facilities sum up at 18,161 MW, accounting for 54.9 percent of the total indicative capacity, mostly from solar (Table 50). On the other hand, fossil-based fuels, composed of coal, natural gas and oil represent 31.6 percent, 12.3 percent, and 1.3 percent shares, respectively. Meanwhile, the 14 projects using battery energy storage system (BESS) are also included in the indicative projects with an aggregate capacity of 500 MW. The detailed list of the committed and indicative power projects as of 31 December 2018 can be found in Annexes 19-24.

### 3. Endorsements of Power-related Projects

Considering the positive economic outlook of the country, the DOE deems it vital to have adequate and sufficient capacity additions across the grids. To realize this, the DOE strictly reviews, evaluates and endorses power-related projects with due diligence consistent with existing policies and regulatory framework. In conjunction, the DOE continually processes and issues pertinent clearances and endorsements, and oversees project implementation to ensure the timely completion and commercial operations of the power generation projects.

#### **4. Crafting of Policies on the Entry of New Emerging Technologies for Power Generation**

The policy direction of the DOE on fuel source diversity aims to address the reliance of the power sector to a particular fuel source toward electricity supply security. In parallel with this thrust, the DOE is set to pursue the formulation of enabling policies to push for the strategic pacing and mainstreaming of advanced and emerging technologies for power generation, such as ocean thermal energy conversion (OTEC), fuel cells, nuclear energy, and energy storage system (ESS), among others.

To initiate the development of the policy framework on the adoption of ESS in the country, the DOE steered several Focus Group Discussions (FGDs) and consultations nationwide among energy agencies, electric power industry participants, and stakeholders. Inputs from the said FGDs and Public Consultations form part of the DC 2019-08-0012 titled “*Providing a Framework for Energy Storage System in the Electric Power Industry*”, which was signed on 01 August 2019. The implementation of the Circular is timely for the medium- to long-term targets of the roadmap.

Another technology that the DOE monitors is the development of Liquefied Natural Gas (LNG) in the power sector. In 2017, the DOE issued a policy for the Philippine Downstream Natural Gas Regulation (PDNGR), which aims to expedite the entry of LNG to the country in time for the depletion of the Malampaya Natural Gas reservoir.

Meanwhile, initiatives for the development of administrative policies on other emerging technologies for power generation are already underway and remain as continuing targets of the roadmap within the planning period.

#### **5. Development of Resiliency Policies for Power Generating Facilities**

Ensuing the promulgation of the universal framework for Energy Resiliency Policy, the DOE also focuses on developing the governing policies to reinforce the resiliency of power generation facilities. The policy broadly grasps operational protocols and contingency measures to make power facilities withstand all forms of natural and human-induced calamities and immediately restore the electricity service.

The said policy is primarily aimed at mitigating and adapting to adverse impacts of climate change and strengthen safety and dependability of the power system of the country. It is seen as an imperative strategy for continuous delivery of power services amidst uncontrollable disruptive events.

#### **6. Monitoring and Assessment of Power Demand and Supply Situation**

In the performance of its regular function, the DOE constantly monitors and assesses power demand and supply situation, which is imperative for conveying timely, strategic, and proactive measures for the sector. Learning from previous experiences, the DOE ardently executes full authority over mandated industry participants to ensure quality, reliability, affordability and security of supply of electric power across the country.

#### **7. Monitoring of Compliance to Reportorial Requirements**

The DOE upholds its supervisory role to all electric power industry participants, including energy stakeholders, by monitoring their compliance to reportorial requirements set forth by existing laws

policies and regulations of the government. These reports serve as decisive platform and effective tool to strengthen and improve the DOE’s planning and policy making functions.

## C. TRANSMISSION

The Transmission Development Roadmap is a clear and comprehensive pathway that directly supports the national goal of achieving reliability and integrity of the country’s transmission grid. This roadmap assessment highlights the implementation of the commitments set out in the short-term (2017-2018) linked to realizing the target goals for medium- to long-term.

### ASSESSMENT

#### 1. Timely Completion of Transmission Projects

With the growing load and steadily increasing demand, the timely completion and commissioning of transmission infrastructures remain high in the DOE’s agenda. Such is in pursuit of decongesting the existing transmission facilities and enabling the connection of new power projects to the grid allowing greater market competition.

For the short-term assessment, the NGCP focused on upgrading substation capacities and expanding transmission backbones to support entry of new generating facilities. From 2017 to 2018, the NGCP completed a total of 552.24 ckt-km of overhead transmission lines, installed additional 851 MVA of substation capacities, and added 35 megavolt amperes reactive (MVAR) or reactive power for voltage improvement (Table 51).

To ensure timely completion of the planned projects, the DOE endorsed a total of 48 transmission projects of the NGCP as “Energy Projects of National Significance.” To date, all these projects have already been issued with CEPNS by the DOE, and thus, entitled to all the rights and privileges under EO30. (Please see Annex 25 for the List of Projects with CEPNS). With priority status, expeditious implementation and development of transmission projects is highly expected.

Table 51. LIST OF COMPLETED PROJECTS, 2017-2018

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
<b>LUZON</b>					
<b>Luzon S/S Expansion Project 4</b> - Daraga S/S - Gamu S/S (transferred from Santiago S/S)	To add substation capacity to accommodate load growth.	100 50	-	-	May 2017 Jul 2017
<b>Las Piñas S/S Expansion Project</b>	To add capacity and provide N-1 security to adequately and reliably meet the increasing load in Metro Manila.	300	-	-	Jun 2017
<b>Santiago–Tuguegarao 230 kV T/L<sup>113</sup></b>	To provide N-1 contingency for the existing transmission corridor serving Isabela and Cagayan.	-	-	118	Sep 2017
<b>Luzon Voltage Improvement Project 3</b> - Laoag S/S	To maintain the voltage profile at various substations within the prescribed limits.	-	35	-	Sep 2017

<sup>113</sup> Kilovolt transmission line

<b>Eastern Albay 69 kV T/L, Stage 1</b> - Daraga–Sto. Domingo T/L - Daraga S/S - Sto. Domingo LES	To provide a more reliable transmission corridor in the eastern coast of Albay	10	-	21	Dec 2017 Dec 2017 Dec 2017
<b>Bataan 230 kV Reinforcement</b> - Reconductoring of Mexico–Hermosa T/L & Mexico–Cabanatuan “Cut in” Cruz na Daan Line 1 & 2 - Reconductoring of Hermosa–Limay T/L Line 1 & 2	To accommodate the connection of the committed 300 MW SMC CPC CFPP project to the Luzon Grid	-	-	36 38	Mar 2018 Jun 2018
<b>Luzon Substation Reliability 1</b> - Labo S/S	To add substation capacity that will provide N-1 contingency	50	-	-	Jun 2018
<b>VISAYAS</b>					
<b>Culasi–San Jose 69 kV T/L Schedule 2A &amp; 2B</b>	To provide N-1 contingency for the existing corridor.	-	-	31.5	Jan 2017
<b>Visayas S/S Reliability Project 1</b> - Samboan S/S - Bacolod S/S	To provide N-1 contingency transformers at various Substations.	50 100	-	-	Mar 2017 Apr 2017
<b>Upgrading of Panitan-Nabas 138 kV T/L</b>	To address system limitation and improve the reliability of the Panitan-Nabas 139 kV Transmission Line.	-	-	-	Mar 2017
<b>Upgrading of Ormoc/Tongonan-Isabel 138 kV T/L (Typhoon Yolanda)</b> - Ormoc–Isabel Line 1 - Tongonan–Isabel Line 1 - Tongonan–Isabel Line 2	To address system limitation and improve the reliability of the Ormoc/Tongonan- Isabel 138 kV Transmission Line.	-	-	-	May 2017 Jul 2017 Sep 2017
<b>Visayas S/S Reliability Project 1</b> - Amlan S/S	To provide N-1 contingency transformers at various substations.	50	-	-	Dec 2017
<b>Eastern Panay Transmission Line Project</b> - Concepcion–Barotac Viejo 138 kV T/L 1 - Concepcion–Tapping pt. near Sara 69 kV OHTL	To provide a more reliable transmission service to Eastern Panay and accommodate entry of PCPC’s 270 MW CFPP.	-	-	42 14.2	Nov 2017 Sept 2018
<b>Ormoc–Babatngon 138 kV Transmission Line</b> - Ormoc–Babatngon T/L - Ormoc Substation Exp. - Babatngon Substation Exp.	To provide N-1 contingency for the existing corridor by installing a second circuit.	-	-	78.54	8 Dec 2018
<b>MINDANAO</b>					
<b>Aurora–Polanco 138 kV T/L Line 2</b> - Aurora Substation Exp. - Polanco S/S (New)	To serve the growing demand of Dipolog City and neighboring load centers as well as ensure continuous and reliable power supply in the Zamboanga Del Norte area.	75	-	158	20 Jun 2018 22 Jul 2018 20 Jun 2018 20 Jun 2018
<b>Manolo Fortich Switchyard 138 kV Switchyard Project</b> - HBI Hydro Power Plant – Manolo Fortich Switchyard T/L - Manolo Fortich S/S	To enable the full capacity dispatch of the 68.8 MW Manolo Fortich Hydroelectric Power Plant	66	-	15	28 May 2018
<b>Agus 6 Switchyard Upgrading / Rehabilitation Project</b>	To upgrade the existing obsolete and aging primary and secondary equipment and devices in Agus 6 Switchyard	-	-	-	31 Oct 2018
<b>Total</b>		<b>851</b>	<b>35</b>	<b>552.24</b>	

Source: NGCP



In addition, the DOE also endorsed to the NCIP for the issuance of a Certification Precondition/Certificate of Non-Overlap (CP/CNO) of the following major transmission projects:

- Mindanao-Visayas Interconnection Project or MVIP;
- Nabas-Caticlan-Boracay Transmission Project;
- Cebu-Negros-Panay 230 KV Backbone Project (Stage 3); and,
- Tiwi Substation Upgrading Project.

## 2. Power Plants Siting

As part of continuous enhancement in the formulation of Transmission Development Plan (TDP), the NGCP has included in the Plan the ideal locations of power plants to maximize the capability of the existing network and to serve as a guide for investors in power generation (Figures 68, 69 and 70). The recommended connection points are the areas with existing substations that can still accommodate additional connection of new power plants without the need for any transmission reinforcement. Future siting of power plants reduces the need for major transmission reinforcement to address congestion, as well as to cater bulk generation capacity addition.

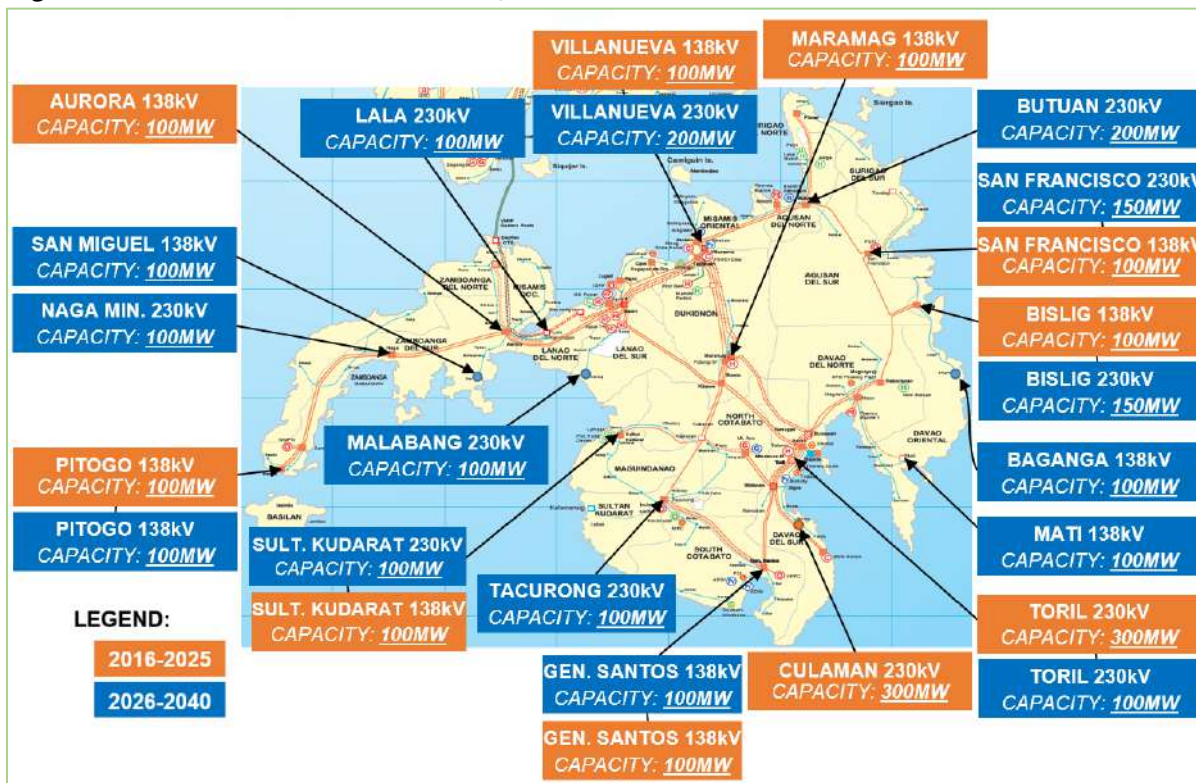
Figure 68. IDEAL LOCATION OF POWER PLANTS, Luzon



Figure 69. IDEAL LOCATION OF POWER PLANTS, Visayas



Figure 70. IDEAL LOCATION OF POWER PLANTS, Mindanao



### 3. Expedite Interconnection of Major Grids

For the short-term, the DOE is committed to facilitate the interconnection of the three major grids (Luzon, Visayas, and Mindanao) to ultimately achieve the longstanding goal of a unified national grid. Hence, the project with the highest priority among other interconnection projects is the MVIP.

Considered as one of the biggest power infrastructure projects, the implementation of the MVIP is in the close watch of the DOE. In July 2017, the NGCP was granted by the ERC the provisional authority to implement the project. In May 2018, the project qualified as an EPNS and was issued with CEPNS. With this, the issuance of regulatory and documentary requirements by the different local and national government agencies will be expedited to meet the target completion date of December 2021.

### 4. Monitoring of Compliance with Transmission Development Plan

As part of its continuing activities, the DOE is closely monitoring the implementation of projects identified in the TDP 2016-2040. The projects mainly consist of continuous upgrading, rehabilitation, and expansion of existing transmission lines, substations and other related facilities. Currently, one of the monitoring mechanisms is through the NGCP's submission of monthly status report of transmission projects that indicates the progress of various project items including securing permits and clearances.

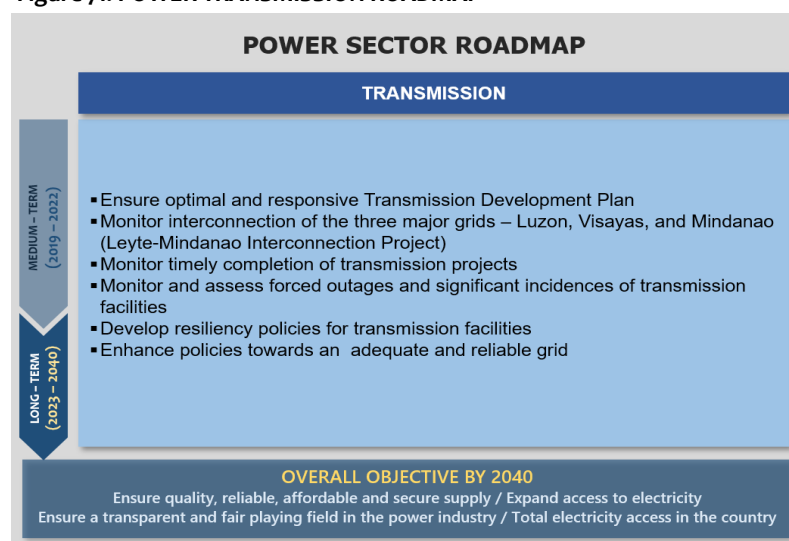
### 5. Resiliency Planning

With the introduction of the Resiliency Policy by the DOE, one of the key highlights of TDP is the planning considerations for resiliency to improve the ability of the power system to withstand the effects of adverse environmental conditions, man-made power interruptions, and other system disturbances. To make the transmission system resilient, the NGCP included in its resiliency planning the enhancement of transmission line and substation site selection, increase of transmission towers strength and capacity, and security of transmission assets.

## PLANS AND PROGRAMS

To fulfill the vision of a strong, unified electricity transmission network that can meet the country's increasing power needs until 2040, the DOE warrants the formulation of a responsive TDP through the NGCP, giving due importance on continuous transmission system upgrades and expansion, generation siting with no reinforcement requirement, island interconnections, and building necessary transmission infrastructures to enable the connection of renewable energy plants.

Figure 71. POWER TRANSMISSION ROADMAP



Responding to the need to upgrade and expand the existing transmission system, the DOE continues its initiative to monitor and facilitate the timely completion of transmission projects with reference to the TDP 2019-2040, a 22-year roadmap for the expansion of the Philippine power grid. As shown in Table 52 and Figure 72, part of the priority projects is the development of new transmission backbones and island interconnections that are geared towards the DOE's and the NGCP's vision to build the strongest power grid in Southeast Asia and improving the country's transmission network consistent with the long-term Transmission Master Plan (TMP).

Figure 72. TRANSMISSION BACKBONES AND ISLAND INTERCONNECTIONS

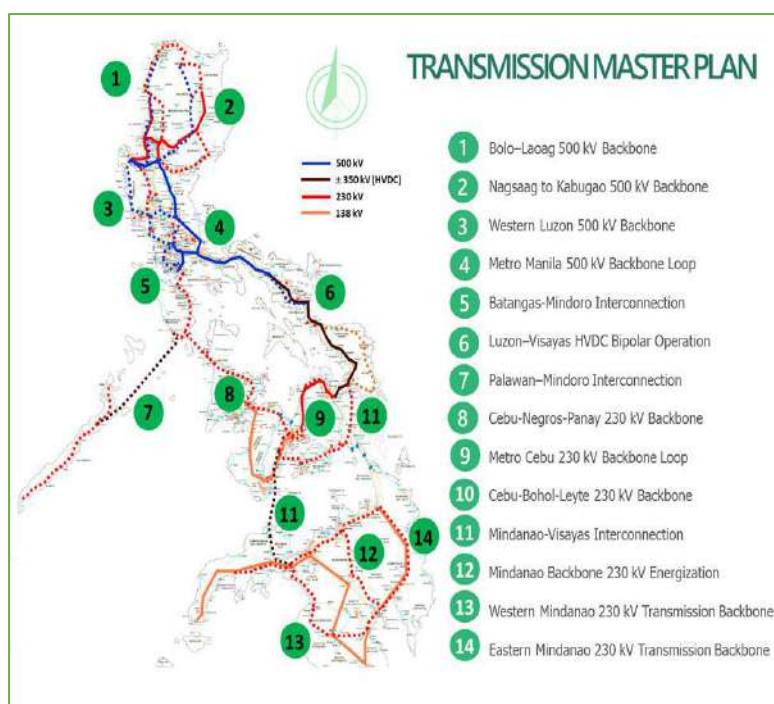


Table 52. TMP PROPOSED PROJECTS, 2019-2040

Project Name	Provinces	Expected Time of Completion
<b>LUZON</b>		
Metro Manila 500 kV Backbone Loop	Taguig	Sept 2022
Bolo to Laoag 500kV Backbone	Ilocos Sur, La Union, Pangasinan	Dec 2024
Batangas-Mindoro Interconnection Project	Batangas, Oriental Mindoro, and Occidental Mindoro	Dec 2023
Palawan-Mindoro Interconnection Project	Mindoro and Palawan	Dec 2024
Western Luzon 500 kV Backbone	Pangasinan, Zambales	Aug 2024
Luzon-Visayas HVDC Bipolar Operation	Camarines Sur and Leyte	Dec 2030
Nagsaag to Kabugao 500kV Backbone	Isabela, Pangasinan, and Apayao	Dec 2035
<b>VISAYAS</b>		
Cebu-Negros-Panay 230 kV Backbone	Cebu, Negros Occidental, Iloilo	Dec 2022
Cebu-Bohol-Leyte 230 kV Backbone	Cebu, Bohol, and Leyte	Dec 2035
Metro Cebu 230kV Backbone Loop	Cebu	Dec 2040
<b>MINDANAO</b>		
Mindanao 230 kV Backbone	Mindanao Island	Dec 2020
Mindanao-Visayas Interconnection Project	Cebu, Lanao del Norte, Zamboanga del Norte	Dec 2021
Eastern Mindanao 230 kV Transmission Backbone	Agusan Del Norte, Agusan Del Sur, Compostella Valley	Jan 2025
Western Mindanao 230 kV Transmission Backbone	Zamboanga del Sur, Sultan Kudarat, Maguindanao, South Cotabato	Dec 2040

Since some of the segments of these huge and complicated backbone projects included in the TMP are still subject for detailed studies, the DOE focuses more attention to the following significant projects programmed for completion up to 2025 and considered crucial in the development of the grid:

## 1. Metro Manila 500 kV Backbone Loop

The only Extra High Voltage (EHV) drawdown facilities servicing Metro Manila are the two existing 500 kV substations located in San Jose del Monte City, Bulacan and Dasmariñas, Cavite. These become critical nodes in the grid as capacity expansion and space limitations in these substations could result in grid congestion. For a more efficient power network, part of the proposed long-term expansion plan for Metro Manila is the development of the new 500 kV substations, such as the Taguig EHV Substation. Taguig City is considered as the priority site due to its proximity to the load center. The development of Taguig EHV Substation including its associated 500 kV Lines will support the load growth and strengthen the grid by forming loop configurations. Aside from Taguig EHV Substation, major 500/230 kV drawdown substations will be developed around the area – the Marilao 500 kV Substation and Silang 500 kV Substation including its associated 500 kV lines (Figure 73).

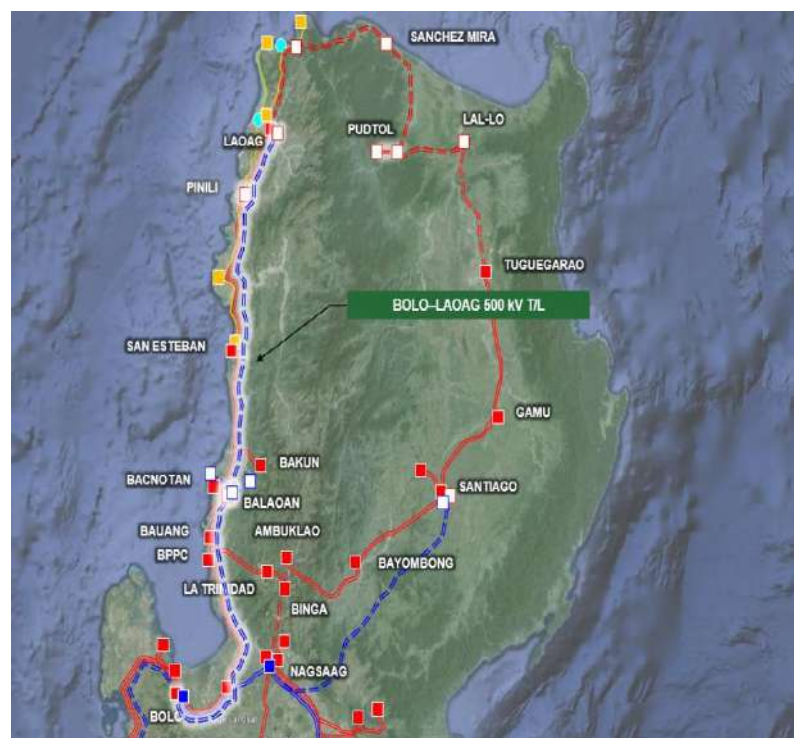
Figure 73. METRO MANILA TRANSMISSION OUTLOOK



## 2. Bolo to Laoag 500 kV Backbone

The development of Bolo to Laoag 500 kV Transmission Line addresses the entry of the proposed coal, hydro, and wind power generating plants in the north eastern part of the grid (Figure 74). The backbone development is consisted of two projects: (1) Bolo–Balaoan 500 kV Transmission Line to support the entry of large generation capacity, such as the 4x335 MW Luna Coal Plant in La Union, and the 500 MW Pumped- Storage Hydro Power Plant in Benguet; and, (2) Balaoan–Laoag 500 kV Transmission Line to accommodate the additional wind farm project in Ilocos area and address the overloading of the San Esteban–Laoag 230 kV Line during N-1 contingency.

Figure 74. BOLO TO LAOAG 500 KV BACKBONE



### 3. Batangas-Mindoro Interconnection Project (BMIP)

The project intends to develop a 230 kV interconnection via submarine cable between the island of Mindoro and main Luzon grid. This allows the island to have access on bulk generation sources in the main grid, while at the same time, export possible excess power once the generation potentials within the island have been developed. Based on the conducted transmission line route investigation, the nearest connection substation is the proposed Pinamukan 500 kV Substation in Batangas. The expected improvement in supply reliability can result in better economic growth as the island could attract more investors for industrial and commercial loads, and for the tourism industry (Figure 75).

Figure 75. CONNECTION CONFIGURATION OF BMIP



### 4. Palawan-Mindoro Interconnection Project (PMIP)

The envisioned Batangas-Mindoro Interconnection Project gives rise to the proposed interconnection of Palawan to the Luzon Grid through the Mindoro Grid. The Palawan Mindoro Interconnection Project (PMIP) aims to provide the Mainland Palawan a more reliable supply of power and to address the power quality issues, which result in frequent blackouts experienced by the customers. The project development will be implemented in a stage-by-stage basis. Stage 1 covers the conduct of detailed studies to determine the submarine cable route, as well as the preparation of the Mindoro Backbone through the development of Calapan–San Jose 230 kV Transmission Line

Figure 76. CONNECTION CONFIGURATION OF PMIP

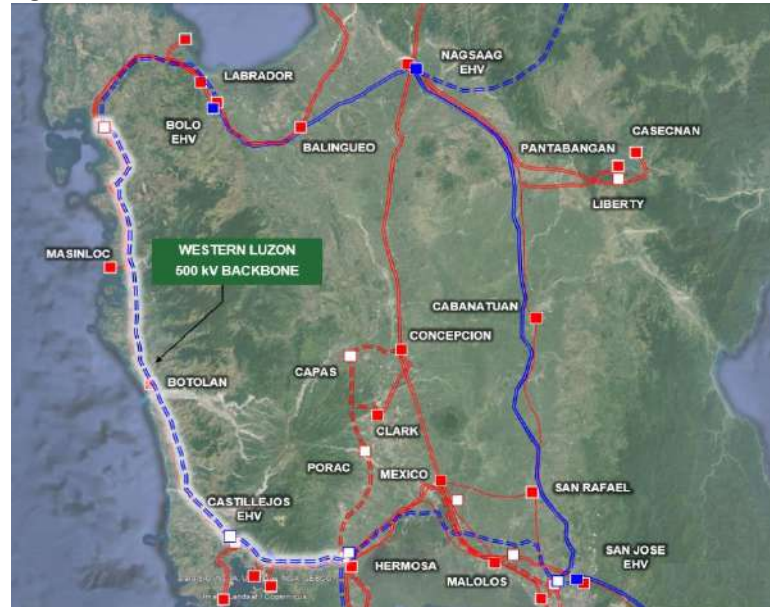


Backbone and San Jose 230 kV Substation in Occidental Mindoro. The Stage 2 involves the physical implementation of the PMIP (Figure 76).

### 5. Western Luzon 500 kV Backbone

The first stage of this grid expansion project is the construction of Castillejos-Hermosa 500 kV Transmission Line to accommodate the bulk generation in Zambales, such as the 2X300 MW RP Energy Coal-Fired Power Plant. The new line will be initially energized at 230 kV voltage level and will form part of the proposed long-term plan for 500 kV backbone loop development from Bolo (Kadampat) down to Hermosa Substation. The second stage will complete the reinforcement of the capacity of the western corridor presently consisting of a single-circuit line from Labrador down to Botolan to Hanjin then to Olongapo, which involves the construction of a new Castillejos Substation, Bolo Substation, and the Castillejos-Bolo 500kV Transmission Line, creating the Bolo–Castillejos–Hermosa 500 kV Transmission Line backbone in Western Luzon (Figure 77). The long-term development plan considers providing higher level of reliability up to N-2 contingency for the 500 kV backbone system of the Luzon grid.

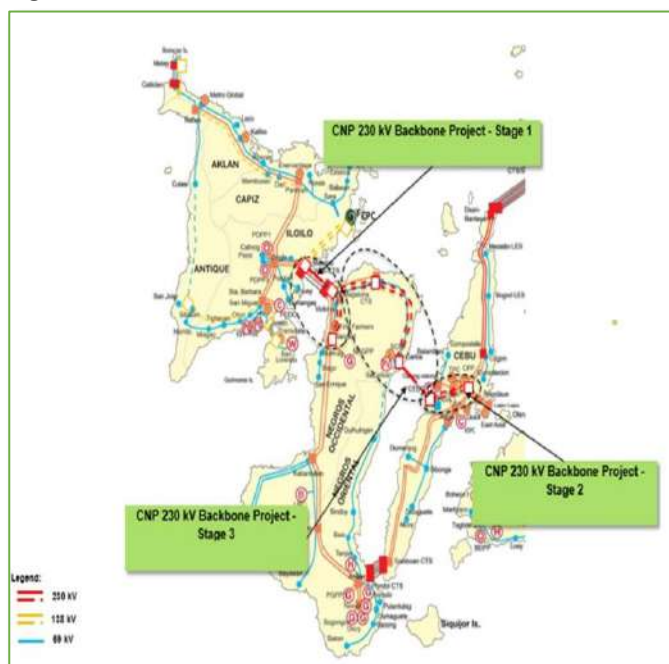
Figure 77. WESTERN LUZON 500 KV BACKBONE



### 6. Cebu-Negros-Panay 230 kV Backbone

The development of 230 kV transmission backbone from Cebu up to Panay Island is divided into three stages. The development of high capacity transmission corridor via submarine cable between Negros and Panay forms part of the first stage of the project. The submarine cable component was already energized in October 2016 addressing the congestion and market issues brought about by the limited capacity of the existing single-circuit 138 kV link (Figure 78).

Figure 78. CEBU-NEGROS-PANAY 230 KV BACKBONE



The second stage involves the construction of 230 kV facilities in the existing Cebu 138 kV Substation. It aims to facilitate the termination of the proposed overhead transmission line from the 300 MW coal-fired power plant of Therma Visayas, Inc. in Toledo City, Cebu.

To enable the sharing of power supply among the three islands, the last stage includes the development of 230 kV facilities extending from Barotac Viejo Substation in Panay to a new Magdugo Substation in Cebu. It is intended to accommodate the transmission of excess power from Panay and Negros Islands towards the rest of the Visayas grid and possibly, the Luzon grid.

### 7. Mindanao 230 kV Transmission Backbone

This backbone project aims to further strengthen the entire Mindanao grid upon the entry of new generating plants. It entails two major activities – the construction of the 230 kV Transmission Line traversing Matanao-Toril-Bunawan route, and the energization of the existing Mindanao Transmission Backbone (Balo-i-Villanueva-Maramag-Bunawan) to 230 kV voltage level. Energizing the Mindanao Backbone to 230 kV voltage level allows full dispatch of the new large power plants and eliminate the vulnerability of power supply to hydropower (Figure 79).

Figure 79. MINDANAO 230 KV TRANSMISSION BACKBONE

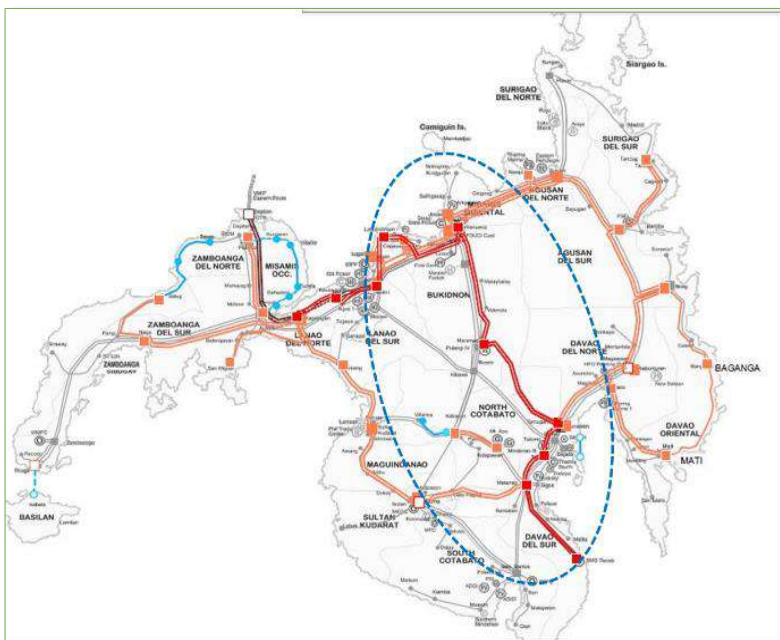
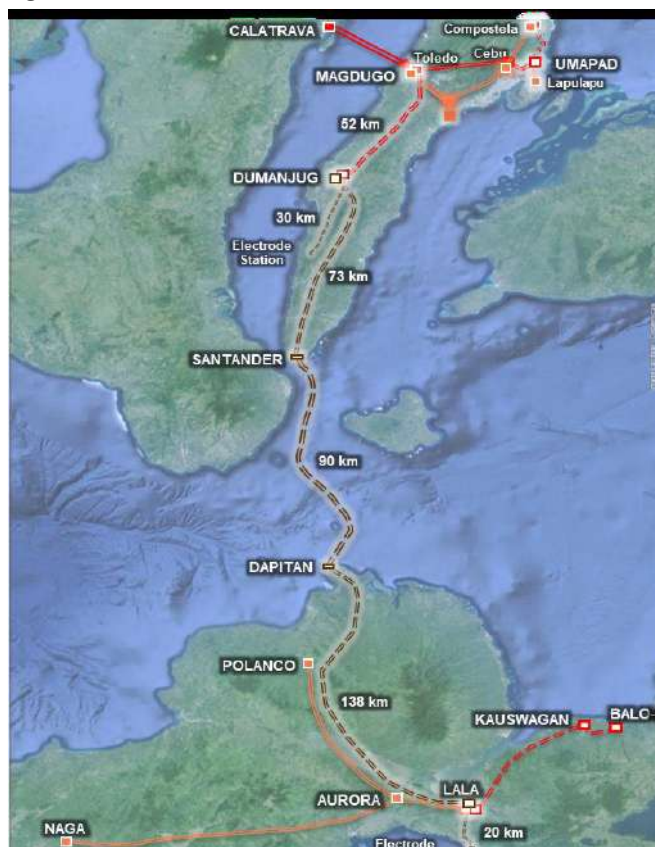


Figure 80. CONNECTION CONFIGURATION OF MVIP

### 8. Mindanao-Visayas Interconnection Project (MVIP)

Formerly known as the Visayas-Mindanao Interconnection Project, the change to MVIP aims to highlight the importance and priority given to Mindanao grid, which has long been isolated. The project aims to realize a single, unified national grid by connecting the Mindanao grid to the Visayas grid. Based on the desktop study and results of the hydrographic survey, the recommended route traverses the country’s western seaboard through the Zamboanga del Norte-Cebu interconnection (Figure 80).

The project’s potential benefits is on reduced investments in power generation due to sharing of system reserves, lesser investment in power generation in either the Visayas or Mindanao to maintain the one-day Loss of Load Probability (LOLP), and reduction of operating cost due to economic dispatch of



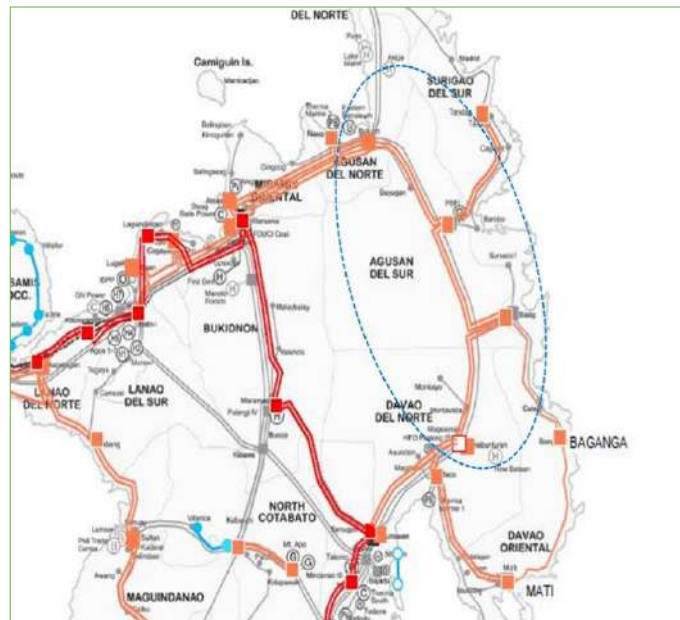


generators. Further, it will help optimize the use of available energy resources and additional generation capacities in the country in support to the operation of the electricity market to include the Mindanao grid.

### 9. Eastern Mindanao 230 kV Transmission Line

The project entails reinforcement of the existing 138 kV single circuit transmission line serving the substations of Butuan, San Francisco, Bislig and Nabunturan in eastern Mindanao, which already lacks the single outage contingency requirement as prescribed in the Philippine Grid Code (PGC). This development addresses the anticipated power quality problems caused by possible operations of huge mining loads in the area. More so, it serves as an initial step in establishing a higher transmission corridor in the north eastern Mindanao area. The implementation of the project requires a total of 282.68 km of new 230 kV transmission lines, required power circuit breaker (PCBs) and associated equipment (Figure 81).

Figure 81. EASTERN MINDANAO 230 KV TRANSMISSION



The list of transmission projects identified in the TDP is summarized in Annexes 26-27, detailing all ongoing and future projects including the expected completion dates.

From a number of transmission projects that are part of the TDP, the DOE embarks to keep a tight watch on the implementation of MVIP to fully realize the vision of one Philippine grid in 2020. Similarly, the interconnection of emergent island-grids to the main grid are also envisioned to be implemented by building new interconnection facilities that link the isolated islands to the main grids (Annex 28).

The DOE is also set to monitor and assess forced outages and significant incidences of transmission facilities to avoid major system disturbances causing power interruptions and transmission-related outages. To efficiently address the damage brought by natural and man-made disasters to transmission lines and facilities, the grid operator and the DOE will continue to disaster-proof the country's transmission network for long-term resilience through developing climate-resilient transmission infrastructures and implementing resiliency policies and programs specific for transmission subsector.

The DOE deems it necessary to continuously enhance the transmission policies to achieve the targets specified for medium- to long-term and carry out the implementation schemes in the TDP.

## D. DISTRIBUTION

The DOE provides continuous support to the DUs in increasing their capacities and improving the quality of service provided to their franchise areas through new policies and programs. These include the issuance of a policy on the conduct of PAA on the distribution system and facilities and

the drafting of DCs directing amendments and additional guidelines on the Distribution Development Plan (DDP).

Policy on the conduct of Competitive Selection Process (CSP), framework for the uniform monthly electric bill format, and the rules governing the review and evaluation of direct connection applications were also issued in accordance with the DOE's mandate in ensuring transparent and a reasonable price of electricity.

## **ASSESSMENT**

### **1. Distribution Development Plan**

To effectively implement the DC 2004-02-002 titled *“Prescribing the Guidelines for the Formulation of a Five-Year Distribution Development Plan”* pursuant to Section 2 of DC 2003-12-011, *“Enjoining all Distribution Utilities to Supply Adequate, Affordable, Quality and Reliable Electricity,”* the DOE drafted a DC directing amendments and providing additional guidelines to DC 2004-02-002.

The draft guidelines will require DU's additional information on the existing and potential contestable customers for Retail Competition and Open Access (RCOA), available renewable resources and the number of customers with net-metering in preparation for the Renewable Portfolio Standards (RPS) and the Green Energy Option Program (GEOP). Information on the capital expenditure projects and financing requirements should also be reflected in their respective five-year DDPs. Through these provisions, the DOE will be able to closely monitor, in close coordination with ERC, the operability of all distribution facilities and the progress in project implementation.

In 2018, the DOE completed the DDP 2017-2026, which outlines the 10-year demand outlook and supply requirements of the DUs and their contracted supply mix. The plan highlights the growth rate of peak demand annually over the 10-year planning period, as well as the main drivers of projected load growth. It also presents a comparative analysis of the estimated values for 2016 on the number of customers, energy sales and system loss from the previous DDP 2016-2025 vis-a-vis the actual 2016 data as indicated in the DDP 2017-2026.

### **2. Uniform Monthly Electric Bill Framework**

To protect public interest affected by rates and services of the DUs and electricity supply providers, the DOE promulgated the Framework for the Uniform Monthly Electric Bill Format through DC 2018-08-0026 issued on 14 September 2018. The framework provides that all entities issuing electricity bills – *PIOUs, ECs, LGOUs and other entities authorized by law to distribute and/or supply electricity, including the Retail Electricity Suppliers* – shall use a uniform bill format. The uniform bill should reflect all corresponding charges, such as, but not limited to generation, transmission and ancillary services, distribution, supply and metering charges, universal charges and bill deposits, subject to the rules and regulations that the ERC may promulgate. In June 2018, four public consultations on the draft DC were conducted in Mandaluyong City, General Santos City, Cebu City and Puerto Princesa City, Palawan.

Efforts to continuously empower electricity consumers with greater understanding on monthly electricity bill, the DOE has prepared regular statistics on electricity charges on generation rates, transmission rates, unbundled distribution costs and the Wholesale Electricity Spot Market (WESM) prices, which can be accessed via the DOE website ([www.doe.gov.ph](http://www.doe.gov.ph)).

### 3. Competitive Selection Process Policy

With the government's thrust of ensuring that all the DUs must supply an adequate power and reserves to serve its respective captive market in the least cost manner, the CSP Policy through DC 2018-02-0003 titled "Adopting and Prescribing for the Competitive Selection Process in the Procurement by the Distribution Utilities of Power Supply Agreement for the Captive Market" was issued on 01 February 2018. The policy prescribes the conduct of CSP as a clear, transparent and fair supply procurement process that will promote competition and greater private sector participation in the provision of least-cost, reliable and adequate supply of electricity. It addresses the power supply contracting of the electric power utilities serving both on-grid and off-grid areas in the country.

In compliance with its provisions, the DUs are required to establish a Third-Party Bids and Awards Committee (TPBAC) or Joint TPBAC or may opt to engage a Third-Party Auctioneer in lieu of the TPBAC or Joint TPBAC. Further, the selection process of the TPBAC or Joint TPBAC captive customer representatives must be submitted to the DOE for approval. As of December 2018, the DOE approved the selection process for 16 DUs.

During the initial implementation of the policy, 16 DUs (15 DUs and 1 PI OU) were granted a Certificate of Exemption as of December 2018 as listed in Table 53.

**Table 53. LIST OF DUS GRANTED WITH EXEMPTIONS FROM THE CONDUCT OF CSP**

DU	CSP Exemption	Date Approved
Ifugao Electric Cooperative Inc. (IFELCO)		5 September 2018
Manila Electric Company (MERALCO)	One-Year PSA with Therma Mobile, Inc.	11 September 2018
Romblon Electric Cooperative, Inc. (ROMELCO)	Cobrador Solar-Diesel Battery Hybrid Power Generation System	18 September 2018
Northern Samar Electric Cooperative, Inc. (NORSAMELCO)	Contract for the Supply of Electric Energy (CSEE) with PSALM for the period 26 December 2018 to 25 December 2019	6 November 2018
Iloilo III Electric Cooperative, Inc. (ILECO III)	PSA with National Power Corporation (NPC) for Gigantes Island, Iloilo for the period 26 December 2017 to 25 December 2022	27 November 2018
Leyte II Electric Cooperative, Inc. (LEYECO II)	CSEE with PSALM for the period 26 December 2018 to 25 December 2019	27 November 2018
Leyte IV Electric Cooperative, Inc. (LEYECO IV)	CSEE with PSALM for the period 26 December 2018 to 25 December 2019	27 November 2018
Bohol I Electric Cooperative, Inc. (BOHECO I)	CSEE with PSALM for the period 26 December 2018 to 25 December 2019	27 November 2018
Samar I Electric Cooperative, Inc. (SAMELCO I)	CSEE with PSALM for the period 26 December 2018 to 25 December 2019	27 November 2018
Don Orestes Romualdez, Electric Cooperative, Inc. (DORELCO)	CSEE with PSALM for the period 26 December 2018 to 25 December 2019	27 November 2018
Eastern Samar Electric Cooperative, Inc. (ESAMELCO)		27 November 2018
Biliran Electric Cooperative, Inc. (BILECO)		11 December 2018
Southern Leyte Electric Cooperative, Inc. (SOLECO)		11 December 2018
Samar II Electric Cooperative, Inc. (SAMELCO II)		20 December 2018
Isabela I Electric Cooperative, Inc. (ISELCO I)		20 December 2018

#### 4. Performance Assessment and Audit

To implement the PAA for the distribution system, the Performance Assessment and Audit Team on Distribution System Facilities (PAAT-DSF) has been created under DC 2017-05-0008. The PAAT-DSF is chaired by the DOE and composed of NEA, Distribution

**Table 54. PAA ACTIVITIES CONDUCTED in 2018**

Grid	Facility
Luzon	Masbate Electric Cooperative, Inc. (MASELCO) First Catanduanes Electric Cooperative, Inc. (FICELCO) Oriental Mindoro Electric Cooperative, Inc. (ORMECO) Albay Electric Cooperative, Inc. (ALECO)
Visayas	Bohol I Electric Cooperative, Inc. (BOHECO I) Bohol II Electric Cooperative, Inc. (BOHECO II) Bohol Light Company, Inc. (BLCI)
Mindanao	Davao Light and Power Company (DLPC)

Management Committee, TransCo, and Philippine Electricity Market Corporation (PEMC). The list of 2018 PAA conducted activities for distribution system is shown in Table 54.

Findings and recommendations from PAA activities were presented on 21 May 2019 during a workshop organized by the DOE in coordination with the NPC and NEA. The workshop was intended to have a common understanding of the situation, and to ensure implementation of the recommended policies, programs and strategies through an action Plan.

#### 5. Direct Connection Applications of Industrial, Commercial and Other Electricity End-Users

Pursuant to Section 9 of the EPIRA, which states that TransCo or its Buyer/Concessionaire shall provide open and non-discriminatory access to its transmission system to all electricity users, the DOE issued DC 2018-08-0025 on 24 August 2018 “Prescribing the Rules Governing the Review and Evaluation of Direct Connection Applications of Industrial, Commercial and Other Electricity End-Users.” The Circular allows transparent guidelines on the assessment of applications for direct connections to the grid or sub-transmission assets that are still owned by TransCo. Applications were previously being reviewed by the ERC until the Supreme Court ruled that the distribution of energy resource, specifically direct supply of electricity is not within the authority of the ERC but falls within the DOE’s jurisdiction. In May 2014, the ERC endorsed to the DOE all direct connection applications.

The DC also provides the creation of the Direct Connection Review and Evaluation Committee (DREC) with primary mandate to evaluate all applications and recommend for the approval of the DOE Secretary. As of October 2018, 15 applications were reviewed and evaluated by the DREC, of which, two applications were approved, namely Summit Iron and Pueblo de Panay Technopark (Table 55).

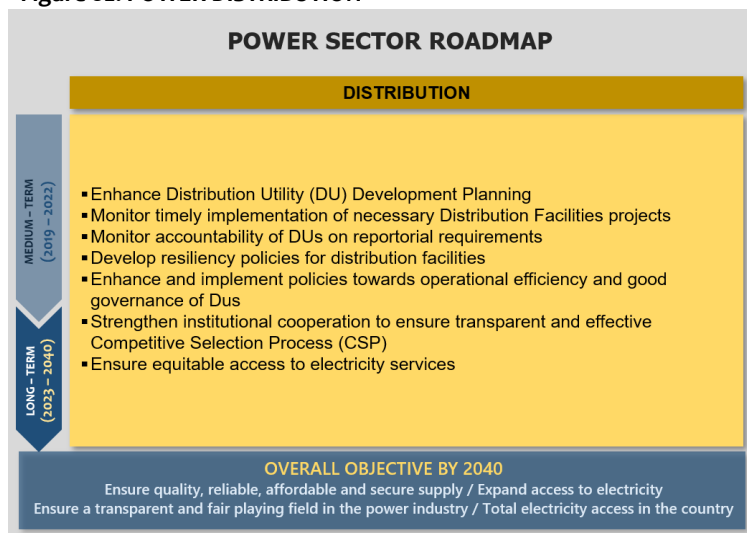
**Table 55. STATUS OF APPLICATIONS FOR DIRECT CONNECTION as of 28 October 2018**

	No. of Projects
Approved	2
Denied	1
Confirmed	4
Terminated	8
<b>Total</b>	<b>15</b>

## PLANS AND PROGRAMS

The initiatives implemented in the short-term remain as continuing agenda for the DOE in the medium- to long-term period. Realization of infrastructure projects is a priority undertaking of the government coupled with effective policy framework and reinforced strategies and programs. These efforts are expected to improve the operations and quality of services provided to the electricity end-users.

Figure 82. POWER DISTRIBUTION



### 1. Enhancement of Distribution Utility's Development Planning

A draft circular directing amendment and providing additional guidelines to DC 2004-02-002, titled “Prescribing the Guidelines for the Formulation of a Five-Year Distribution Development Plan,” is expected to be adopted and promulgated within the medium-term. The corresponding manual of instructions will be drafted and disseminated to properly guide the DUs in filling out the new DDP form (DOE-EPIMB Form 2018-01-01), which is composed of four major sections, namely; (1) Introduction and Legal Basis; (2) Objective; (3) Forms and Annexes; and (4) Summary Outputs.

In accordance with the timeline set forth in the EPIRA, the DOE-EPIMB Form 2018-01-01 shall be submitted every 25<sup>th</sup> of January each year. A series of workshops will also be conducted to ensure that the DUs conform with prescribed new guidelines.

### 2. Monitoring of Timely Implementation of necessary Distribution Facilities Projects

To ensure reliability, security and sustainable delivery of electricity to the consuming public, the DOE will facilitate the timely completion of the following infrastructure projects as indicated in the DDP 2017-2026:

- 19,934 MVA additional substation capacity;
- 5,156 ckt-km for the expansion and rehabilitation of sub-transmission lines;
- 39,944 ckt-km for the expansion and rehabilitation of distribution lines.

Distribution line upgrades and expansion programs also form part of the medium- to long-term strategies to safeguard the power distribution network across the country. Interceding barriers, such as right-of-way issues, that hinder sustainable development will also be properly addressed.

### 3. Monitoring of DUs' Compliance to Reportorial Requirements

Improving data quality and developing more robust in-country monitoring and reportorial of the distribution systems will also be a major concern of the DOE within the planning period to ensure progress in the implementation of projects by the DUs. An appropriate template/matrix will be promulgated to guarantee reportorial compliance and performance indicator of the DUs.

As provided under DC 2017-12-0016 (guidelines for performance assessment and audit or PAA), the DUs need to submit the compliance audit form to effectively implement the PAA of distribution system. This enables the thorough inspection and evaluation of the operations and facilities, and adheres to the principle of efficiency, effectiveness, appropriateness and safety of the distribution network.

#### **4. Implementation of Policies toward Operational Efficiency and Good Governance of the DUs**

The DOE continues to espouse policies to improve the operational efficiency of the distribution system in the country. Creating better working conditions further improve performance, and thus achieve developmental objectives, including enhancing cooperation within the distribution network.

#### **5. Strengthening Institutional Cooperation to ensure Transparent and Effective Competitive Selection Process**

The DOE institutionalizes collaboration among participating entities under the CSP policy to effectively implement the governing principles stipulated in the Circular. Allowing equal opportunity and wide dissemination of bid opportunities to eligible and qualified generation companies encourage greater participation. This will also gather wide range and broad-based support and cooperation among energy stakeholders.

#### **6. Ensure Equitable Access to Electricity Services**

Enabling access to basic electricity services brings significant economic benefits to communities. This redounds to increased business activities, economic productivity and income. Mindful of this, the DOE continues to look for strategic solutions and pragmatic approaches to achieve sustainable development towards the delivery of an affordable and reliable electricity services across the country.

### **E. RETAIL ELECTRICITY SUPPLY**

The DOE is keen on the full implementation of RCOA to allow electricity end-users to buy electricity from the suppliers of their choice. Being the conduit between the suppliers and end-users of electricity, the DUs recovers their investments through the imposition of distribution wheeling charges. The move toward RCOA is pursuant to Section 31 of the EPIRA. RCOA took effect when the ERC declared compliance to the conditions set forth in the EPIRA, which are: a) establishment of the WESM; b) approval of unbundled transmission and distribution wheeling charges; c) initial implementation of cross subsidy removal scheme; d) privatization of at least 70.0 percent of the generating assets of the NPC in Luzon and Visayas; and, e) transfer of the management and control of at least 70.0 percent of the total energy output of power plants under contract with the NPC to the Independent Power Producer Administrators (IPPA).

In continuing pursuit of the objectives of the EPIRA, the Supply Sector Roadmap for the short-term (2017 – 2018) resulted in promulgation of policies that facilitated the following: a) mandatory contestability for one Megawatt (MW) and up electricity end-users; b) full open access for 750 kilowatt (kW) and above contestable customers; c) retail aggregation for a minimum of 750 kW aggregated demand; and d) conduct market studies for lowering contestability to 500 kW.

## ASSESSMENT

### 1. Retail Competition and Open Access

With the electricity industry having complied with the conditions as stipulated in the EPIRA, RCOA was introduced on 26 June 2013 and allowed electricity end-users of 1.0 MW and above to choose their electricity suppliers. The end-users categorized as contestable customers are permitted to source their supply from retail electricity suppliers (RES) and the use of transmission and distribution systems and associated facilities subject to the payment of distribution wheeling charges duly approved by the ERC. The implementation of RCOA presented a voluntary participation from contestable customers. It was only in December 2016 that the mandatory participation of the contestable customers with an average demand of 1.0 MW and above was directed.

A Supreme Court restraining order on RCOA prompted the DOE to revert to voluntary participation. To advance RCOA's implementation, the threshold was reduced to 500 kW in December 2018. The implementation of retail aggregation<sup>114</sup> was intended to commence last December 2018 subject to the issuance of relevant guidelines.

The DCs promulgated by the DOE for RCOA's transparent and efficient implementation are highlighted in *Table 56*.

**Table 56. DEPARTMENT CIRCULARS ISSUED ON RCOA IMPLEMENTATION<sup>115</sup>**

DC No.	Title
2011-06-0006	Creating the Steering Committee Defining the Policies for the Commencement of Retail Competition and Open Access
2012-05-0005	Prescribing the General Policies for the Implementation of Retail Competition and Open Access
2012-02-0002	Designating the Philippine Electricity Market Corporation as the Central Registration Body
2012-11-0010	Providing for Additional Guidelines and Implementing Policies for Retail Competition and Open Access and Amending DC 2012-05-0005
2013-01-0002	Promulgating the Retail Rules for the Integration of the Retail Competition and Open Access in the Wholesale Electricity Spot Market
2013-05-0006	Enjoining all generation companies (GenCos), DUs, Suppliers and Local Suppliers to Ensure an Effective and Successful Transition Towards the Implementation of the Retail Competition and Open Access.
2013-07-0014	Promulgating the Retail Manuals for the Implementation of the and Providing for Transitory Arrangement
2013-07-0013	Providing Supplemental Policies to Empower the Contestable Customers under the Regime of Retail Competition and Open Access and Ensure Greater Competition in the Generation and Supply Sectors of the Philippine Electric Power Industry
2015-06-0010	Providing Policies to Facilitate the Full Implementation of Retail Competition and Open Access in the Philippine Electric Power Industry
2016-04-0004	Providing Timelines for Compliance with the Full Implementation of Retail Competition and Open Access in the Philippine Electric Power Industry
2017-12-0013	Providing Policies on the Implementation of the Retail Competition and Open Access for Contestable Customers in the Philippine Electric Power Industry
2017-12-0014	Providing Policies on the Implementation of the Retail Competition and Open Access for Retail Electricity Suppliers in the Philippine Electric Power Industry
2018-04-0009	Adopting Further Amendments to the Retail Rules and its Market Manual on Metering Standards and Procedures for the Implementation of Enhancements to the WESM Design and Operations

<sup>114</sup> Allows customers in a contiguous area whose aggregate demand is not less than 500 kW to source their electricity supply requirement on a group basis from a licensed supplier.

<sup>115</sup> On 29 July 2019, the DOE issued Department Circular No. 2019-07-0011, entitled Amending Various Issuances on the Implementation of the Retail Competition and Open Access<sup>114</sup> in order to address gaps and ensure the implementation of RCOA.

As of April 2019, the total prospective participants for RCOA already reached 2,033, an increase of 112.0 percent from 961 participants during RCOA's initial commercial operation (Table 57). Contestable customers comprised 93.0 percent (1,884) of the prospective participants, 3.0 percent (55) from suppliers (including local retail electricity suppliers<sup>116</sup>), and the remaining 4.0 percent (94) from RCOA service providers.

**Table 57. SUMMARY OF RCOA REGISTRATION**

Membership Category		Prospective*			Registered**		
		Jun 2013	April 2019	Increase	Jun 2013	April 2019	Increase
Contestable Customers	D ≥ 1MW	892	1,356	52%	239	999	318%
	750kW ≥ D > 1MW	0	528		0	241	
	Total	892	1,884	111%	239	1,240	419%
Suppliers	RES	19	30	58%	15	30	100%
	LRES	13	25	92%	3	14	367%
	Total	32	55	72%	18	44	144%
SOLR		9	46	411%	0	24	
RMSP		28	48	71%	18	48	167%
<b>Grand Total</b>		<b>961</b>	<b>2,033</b>	<b>112%</b>	<b>275</b>	<b>1,356</b>	<b>393%</b>

For the same period, the total RCOA participants registered with the Central Registration Body (CRB) stood at 1,356<sup>117</sup>. From the registered contestable customers, 81.0 percent (999 customers) is within the 1.0 MW threshold, and the rest (19.0 percent or 241 customers) is within the 750 kW – 1 MW.

Policy and regulatory issuances relating to RCOA were also promulgated in 2018 and these are *ERC Resolution No. 9 Series of 2018*<sup>118</sup> and the *DOE DC 2018-04-0010*<sup>119</sup>. The former specifies that the customer may choose its payment option whether single or multiple billing scheme. It also provides that the contestable customers have the option to contract on its own directly to the RES and/or the WESM for their supply and to the network service provider for metering services. In such setup, customers are billed separately for the services. Meanwhile, the latter clarifies the application and treatment of retail market participants under the WESM rules and specifies the application of standards under the DUs to the contestable customers.

RCOA is one of the policies that will impact consumers or end-users. The policy empowers consumers because they can opt for their preferred electricity supplier, provided they belong to the right threshold of contestable customers. Having the freedom of preference for electricity supply has a bearing on electricity cost reduction and expands transparency in the electricity industry.

## PLANS AND PROGRAMS

As a continuing action plan that spans from the medium- to long-term, the supply subsector will be resolute in the monitoring and development of policies to enhance RCOA participation (Figure 83).

<sup>116</sup> Local Retail Electricity Suppliers (LRES) refer to DUs authorized by the ERC to serve contestable customers.

<sup>117</sup> Contestable customers, suppliers and RCOA service providers are required to register in the CRB. The new designated CRB is IEMOP, the current IMO which assumed the market operator function of PEMC in 25 September 2018.

<sup>118</sup> Resolution Adopting the ERC Rules Supplementing the Switching and Billing Process and Adopting a Disconnection Policy for Contestable Customers.

<sup>119</sup> Adopting Further Amendments to the Wholesale Electricity Spot Market (WESM) Rules, Retail Rules and Retail Market Manual on Metering for Clarifications on Retail Market Integration.



The policies to be developed further the realization for electricity end-users to secure their preferred supply sources – those within the thresholds of 1.0 MW and above, 750 kW – 1.0 MW, and 500 kW – 749 kW. Once the end-users (contestable customers) have the power of choice, it marks a turning point for the industry.

The retail aggregation covering the 750 kW–1.0 MW demand accordingly relies on ERC’s promulgation of requisite guidelines to ensure proper application. In addition, the DOE and ERC are bent on formulating/developing policies to lower the threshold to 500 kW and aggregation for the specified demand.

Figure 83. POWER SUPPLY ROADMAP



## F. WHOLESALE ELECTRICITY SPOT MARKET DEVELOPMENT

The Market Development Roadmap identified a number of action plans carried out in the short-term (2017 – 2018) geared towards enhancing the implementation of the WESM. Specifically, strategies are anchored on developing policies and monitoring compliance on the following: a) WESM design improvements / new market management system (NMMS); b) appointment of independent market operator (IMO); c) privatization of the NPC assets; d) policy for embedded generators; e) establishment of the Mindanao Electricity Market; f) development of a roadmap and policy on the utilization of smart grid and other technologies; g) Renewable Energy Market or REM in line with RPS implementation; h) reserve/energy market co-optimization; i) demand bidding in the WESM; and j) forwards market/financial transmission rights/day-ahead market/derivatives market.

Enhancing the electricity market through policy development is a continuing action plan and covers the period from the short- to long-term (2017 – 2040). Policies were also aligned with the requirements of RA 9513 (RE Act of 2008), which mandates the preferential treatment and higher utilization of RE.

### ASSESSMENT

#### 1. WESM Design Improvements / NMMS

The WESM’s commercial operation in Luzon was on 26 June 2006 while Visayas grid’s integration in the WESM commenced on 26 December 2010. The market serves as the venue for trading electricity as a commodity and a clearing house to reflect the economic value of electricity for a particular period as indicated by a spot price.

The electricity market’s key features are: a) a gross pool system for scheduling contracted and uncontracted generation and balancing supply and demand; b) a price determination process, which sets the marginal value of all electricity produced and consumed by time and location at all nodes; and c) a financial settlement process in which the customers pay for electricity purchases and generators receive payments for electricity produced.

The DOE's promulgation of DC 2015-10-0015 titled "Providing Policies for Further Enhancement of the WESM Design and Operations" in November 2015 prompted the move to develop the WESM design and operations enhancements. The enhanced WESM design features the following changes: a) shortening of scheduling and pricing intervals from one hour to five minutes, and ex ante only pricing to better reflect the changes in supply and demand, and potentially reduce the requirement for frequency regulation reserve; b) automatic re-runs when prices reflect constraint violations to provide timely disclosure of settlement-ready prices; and, c) hour-ahead projections (in addition to the week-ahead and day-ahead projections) to facilitate commitment decisions of trading participants.

The PEMC as the Market Operator (MO) procured the NMMS that bears the changes and capable of: a) automatically detecting non-compliances to the WESM rules, specifically must-offer rule and conformity to dispatch standards; and, b) accommodating additional market products (e.g. reserve market and forwards market).

The MO also procured, side by side with the NMMS, the Central Registration and Settlement System (CRSS), which automates registration and settlement processes for both wholesale and retail transactions.

In 2018, the MO carried out the following activities related to the market system: a) roll-over of software certification audit activities of the NMMS; b) parallel operations of the NMMS in Luzon and Visayas and Trial Operations in Mindanao; and c) soft launch of the CRSS in Luzon and Visayas and Trial Operations in Mindanao. The DOE also continued to monitor the completion of the software certification audit of the NMMS and carried out various activities to assist the MO in the successful deployment of its NMMS and the CRSS. It should be noted that NMMS' operation is dependent on the approval by the ERC of the amended WESM price determination methodology (PDM), which reflects the enhancements made in the WESM design.

To date, the Independent Electricity Market Operator of the Philippines (IEMOP), in collaboration with the PEMC, DOE and ERC, is finalizing the independent certification audit of the NMMS and CRSS to ensure that the new developed software and systems are in accordance with the market rules. Further, the PEMC together with the IEMOP conducted market readiness and assessment (MRA) through an independent consultant and the final report was presented to the Philippine Electricity Market (PEM) Board last 31 July 2019. The IEMOP has been continuously implementing the NMMS parallel operation to further test and familiarize the market participants with the new NMMS and CRSS.

As mandated by the EPIRA, the DOE continually reviews and promulgates proposed changes to the WESM Rules, Retail Rules and Market Manuals to ensure consistency of amendments with the objectives of the EPIRA, WESM and RCOA. Under the action plan of developing policies related to the WESM design improvements and NMMS, the DOE promulgated nine (9) related DCs in 2018 as shown in *Table 58*.

**Table 58. PROMULGATED DCs RELATED TO WESM AMENDMENTS TO ENHANCE MARKET DESIGN, DISPUTE RESOLUTIONS AND RULES CHANGE PROCESS**

DC No.	Title	Objective
2018-04-0007	Adopting Further Amendments to the WESM Rules and Market Manual on Dispatch Protocol for the Implementation of Enhancements to the WESM Design and Operations.	Facilitates the implementation of the new market features pursuant to the DOE policies on enhancements to market design and operations and the amended WESM Rules for NMMS through DC Nos. 2015-10-0015 and 2016-10-0014.
2018-04-0008	Adopting Further Amendments to the WESM Market Manuals on Billing and Settlement and Load Forecasting Methodology for the Implementation of Enhancements to the WESM Design and Operations.	Facilitates the implementation of the new market features pursuant to the DOE policies on enhancements to market design and operations and the amended WESM Rules for the NMMS.
2018-04-0009	Adopting Further Amendments to the Retail Rules and its Market Manual on Metering Standards and Procedures for the Implementation of Enhancements to the WESM Design and Operations.	Aligns the provisions of the Retail Manual on Metering Standards and Procedures with the Retail Rules and relevant regulatory issuances for the smooth implementation of RCOA. Amendments reflect the enhancements to the design and operations of the WESM.
2018-04-0011	Adopting Further Amendments to the WESM Market Manual on Market Operator Information Disclosure and Confidentiality for the Implementation of Enhancements to the WESM Design and Operations.	Provides changes in the publication of market information classification, categories and requirements for the implementation of the new market features as provided under the DOE policies on enhancements to market design and operations and the amended WESM Rules for the NMMS.
2018-04-0012	Adopting Further Amendments to the WESM Market Manuals on Price Determination Methodology and Constraint Violation Coefficients and Pricing Re-Run for the Implementation of Enhancements to the WESM Design and Operations.	<p>Corrects the calculation of price adjustments for customers during market intervention or suspension. Clarifies provisions on additional compensation for Must-Run Units and constrained-on generating units.</p> <p>Provides details and additional constraints on transmission equipment, revise the order and nomenclature of constraint violation coefficients (CVCs) for consistency with the newly amended Philippine Grid Code.</p>
2018-05-0015	Adopting Further Amendments to the WESM Rules and Market Manuals for the Implementation of Enhancements to the WESM Design and Operations (Provisions for Metering, Market Trading Node and Scheduling Point).	Addresses possible instances when main revenue meters fail and enhance documentation and metering processes to address independent market operations audit findings. Aims to enhance the performance rating of the WESM Metering Services Provider, clarify the location of metering points in the WESM for the improvement on the accounting of system losses, consider the implementation of enhancements to the design and operations of the WESM and update the affected Market Manuals, which include Market Network Model Development and Maintenance – Criteria and Procedures and Registration, Suspension and De-registration Criteria and Procedures.
2018-05-0016	Adopting Further Amendments to the WESM Rules and Market Manual on Dispute Resolution.	Enhances the procedures in the WESM mediation and arbitration and updates the provisions for schedule of arbitration fees and administrative costs.
2018-07-0018	Adopting Further Amendments to the WESM Rules and Market Manual on Procedures for Changes to the WESM Rules, Retail Rules and Market Manuals.	Reflects the revised procedures for the approval of amendments to the WESM Rules and Market Manuals as set out in DC 2015-07-0013.
2018-08-0022	Adopting Further Amendments to the WESM Rules and Market Manuals on the Participation of Battery Energy Storage Systems and Pumped-Storage Units in the WESM.	Provides a framework for the WESM participation of emerging electrical resources such as the battery energy storage systems and pumped-storage units. Includes amendments on the provisions for registration, dispatch protocol and market network model.

## 2. Appointment of an Independent Market Operator

The creation of an IMO stems from the EPIRA provision on the WESM (Section 30). Part of Section 30 explicitly mentions that the WESM shall be implemented by a Market Operator (MO) in

accordance with the WESM rules. The MO shall be an autonomous group, to be constituted by the DOE, with equitable representation from electric power industry participants, initially under the administrative supervision of the TransCo. The MO shall undertake the preparatory work and initial operation of the WESM. Not later than one year after the implementation of the WESM, an independent entity shall be formed and the functions, assets and liabilities of the market operator shall be transferred to such entity with the joint endorsement of the DOE and the electric power industry participants.

The WESM establishment paved the way for the creation of the PEMC<sup>120</sup> which served as the Autonomous Group Market Operator (AGMO) from August 2004 to 25 September 2018. The DOE in coordination with the PEMC undertook several activities to ensure compliance with the required establishment of an IMO, one of which is the conduct of studies on appropriate arrangements and consultations with the various stakeholders and the Joint Congressional Power Commission (JCPC).

On 17 January 2018, the DOE issued DC 2018-01-0002 titled “*Adopting Policies for the Effective and Efficiency Transition to the Independent Market Operator for the Wholesale Electricity Spot Market*”, which reiterates that the IMO shall be an independent entity incorporated as a private corporation under the Corporation Code of the Philippines. The IMO shall execute the functions of the MO as espoused in the EPIRA and its IRR, WESM Rules and Market Manuals and other relevant rules/regulations and issuances. The governance function is retained by the PEMC as it will still be responsible for overseeing and monitoring the activities of the IMO for it to perform its obligations as set out in the WESM Rules and Market Manuals.

The industry participants of PEMC during its membership meeting on 6 February 2018 endorsed the transition to the IMO with the approval of the “Plan for Transition to the IMO of the Philippine WESM.” The IEMOP<sup>121</sup> was incorporated on 15 May 2018 in the Securities and Exchange Commission (SEC) with a Company Registration No. CN201807379, and will function separately from PEMC. IEMOP’s incorporation was made by individuals who are independent from the electric power industry participants and from the government. The initial IEMOP Board was selected and confirmed by the PEM Board and the DOE Secretary last 25 June 2018 during the first PEMC annual membership meeting. The current Board of Directors of IEMOP<sup>122</sup> is seen in *Table 59*.

**Table 59. IEMOP BOARD OF DIRECTORS**

Name	Position
Lt. Gen. Ralph A. Villanueva AFP (Ret)	Chairman
Atty. Richard J. Nethercott	President and CEO
Atty. Caroll U. Tang	Director and Corporate Secretary
Maj. Gen Vicente M. Porto AFP (Ret)	Director and Treasurer
Engr. Jose Mari T. Bigornia	Director
Engr. Jose Rodelio Varilla Mangulabnan	Director

An operating agreement was signed between the PEMC and IEMOP on 19 September 2018 for the transfer of assets, liabilities, personnel and market operator related functions. This agreement defines the parties’ rights and obligations in relation to the transfer and outlines the parties’ roles and functions (*Table 60*). The functions of the MO as provided in the EPIRA and its IRR, WESM Rules, WESM Market Manuals and other official issuances were assumed and performed by the IEMOP on 26 September 2018 at 00:00 hour.

<sup>120</sup> Incorporated in November 2003 as a non-stock and non-profit corporation. Designated as AGMO in August 2004.

<sup>121</sup> Name for the IMO Company. Non-stock and non-profit corporation that is separate from PEMC.

<sup>122</sup> Source: <http://www.iemop.ph/inner.php/about/iemop/leadership>

**Table 6o. OBLIGATIONS AND RESPONSIBILITIES OF IEMOP AND PEMC**

IEMOP	PEMC
1. Market Operator Services and Market Operator Performance Standards	Retains all its other assets and associated liabilities that are not included in the assets and liabilities transferred to the IEMOP, including but not limited to the systems and infrastructures being used to support its governance function.
2. Other Services a. Central Registration Body b. Mindanao Transactions c. Training of market participants, PEMC, DOE, ERC, PCC and other stakeholders d. Other participant services	
3. Renewable Energy Market Registrar	

The DOE issued the Department of Order (DO) 2019-03-0009 on 18 March 2019 creating a Special Task Force that will assess the performance of WESM under its current structure of operations. Such assessment covers the following as stated in Section 2: a) assessment of PEMC as the governance arm of the WESM; b) assessment of the performance of IEMOP as the IMO; and c) over-all performance of WESM.

The Interim Board of IEMOP has a limited term of one (1) year, which expired last 24 June 2019. However, the PEM Board recommended to keep the existing Interim Board to prevent disruption of services and ensure continued operations of WESM until the assessment results are put into place or until a regular Board has been duly elected. The DOE agreed with the said recommendation as the conditions for transition to IMO under Section 8 of DC 2018-01-0002 are yet to be fulfilled.

### 3. Establishment of the Wholesale Electricity Spot Market in Mindanao

With WESM already established in Luzon and Visayas, Mindanao remains without an electricity market on operation.

On 04 May 2017, the DOE issued DC 2017-05-0009 titled “Declaring the Launch of Wholesale Electricity Spot Market (WESM) in Mindanao and Providing for Transition Guidelines.” The said Circular provides for the following: a) commencement of registration of the WESM participants; b) application of the Interim Mindanao Dispatch Protocol until commercial operations is declared by the DOE; and, c) termination of the Interim Mindanao Electricity Market (IMEM).

On 28 June 2017, WESM was formally launched in Mindanao and it is seen as a medium for providing an efficient scheduling, dispatch and settlement of energy withdrawal and injections in the grid. The market also embodies competition and transparency that is aimed at the Mindanao electricity consumers. This also signaled the commencement of the Trial Operations Program (TOP) that was participated in by the MO, System Operation (SO) and trading participants.

For its part, the DOE monitors all preparatory activities related to the full commercial operation of WESM in Mindanao. The DOE conducted FGDs, Information, Education and Communication Campaigns, Registration Drive, and Hands-on-Trainings on 2017-2019. As such, the declaration of full commercial operation will be made once the criteria set forth is complied with – *systems and procedure, TOP, operationalization, trainings, PDM and NMMS*. The DOE also continues to work with both MO and SO to ensure the systems and infrastructure readiness for the WESM’s commercial operation.

Part of the DOE's joint endeavors with the other key agencies from the electricity market include reconciling of MO-SO on the list of expected WESM trading participants with required metering points, the conduct of the study on the impact of over-declaration, proposed improvements on TOP workshop design, and the testing of the new back-up system of the NMMS. Corollary to this, major interface links between the two (MO and SO) have been established and tested for consistency, accuracy and redundancy. The NGCP has also installed the WESM compliant metering and real-time monitoring facilities in most trading participants' sites in Mindanao. Further, software certification of all market systems including the critical modules, enhancements, fixes and Net Settlement Surplus enhancements for the NMMS and CRSS have been completed.

Another significant criterion in the declaration of commercial operation of WESM in Mindanao is the registration of power industry participants. As of August 2020, a total of 24 out of 88 expected total participants have completed the registration process with the MO. The MO is currently conducting online registration drive to increase the turnout of registration.

The WESM in Mindanao will be operationalized upon the ERC's approval of the PDM adopting the five-minute dispatch interval and certification of market readiness.

#### **4. Policies on Embedded Generators, Ancillary Service and Demand Bidding in the WESM**

Policy development is an integral component in the power sector's roadmap. In the short-term, the DOE formulated policies covering embedded generators and ancillary services (AS). Discussions were also started on demand bidding in the WESM.

- **Embedded Generators**

Embedded generators (EGs) pertain to generating units that are indirectly connected to the grid through the DUs' lines or industrial generation facilities that are synchronized with the grid.

With the influx in the use of EGs, the DOE needed to clarify the policies governing decentralized generation considering the benefits it may provide, while ensuring that these are operated within the framework of centralized power system. To set the context in relation to its optimal operation or utilization, the DOE issued on 08 February 2019 DC 2019-02-0003 titled "*Providing for the Framework Governing the Operations of Embedded Generators.*"

As embodied in the Circular, EG shall operate within the following framework: a) provision of central dispatch by SO to EGs with material impact to grid operations in the interest of achieving economic operation and maintenance of quality, stability, reliability and security of the transmission system; b) compliance to the EPIRA and its IRR, PGC, Philippine Distribution Code (PDC), WESM Rules and its Market Manuals, Philippine Electrical Code and other pertinent issuances by the DOE, ERC and other relevant government instrumentalities having authority over the grid reliability and supply security; and c) market share and bilateral contracts limitation under Section 45<sup>123</sup> of the EPIRA and other relevant regulations issued by the ERC concerning abuse of market power and competition.

The Circular also specified the requirements for licensing, connection, market registration and participation. It also covers the EGs' provision of ancillary, as well as metering services. Likewise, the Circular provides for the delineation of responsibilities and support of the DUs, MO, Transmission Network Provider, SO and the ERC.

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<sup>123</sup> Cross Ownership, Market Power Abuse and Anti-Competitive Behavior

- **General Framework Policy for Ancillary Services**

As a means to effectively utilize ancillary services in the grid, the DOE issued DC 2019-12-0018 on 04 December 2019 adopting a general framework on the provision and utilization of such services. As defined, ancillary service refers to the services necessary to support the transmission of capacity and energy from resources to loads, while maintaining reliable operation of the transmission system in accordance with good utility practice and the Grid Code to be adopted in accordance with the EPIRA.

The Circular provided a general framework for ancillary service encompassing the issues identified, which include among others the following: a) harmonization of the guidelines, rules, and regulations concerning the operation of the grid; b) proper accountability among concerned entities in the efficient and transparent operation of the grid; c) transparent and cost-effective procurement of ancillary services taking into account compliance to reserve requirements of each grid; d) co-optimization of energy and reserves in the WESM, through central dispatch and the commercial operation of the WESM Reserve Market; and e) transparent accreditation process for ancillary services.

The Circular also established the creation of a Technical Working Group (TWG), chaired by the DOE and the ERC. The TWG is a recommendatory body to assist in the implementation of the Circular.

- **Demand Side Bidding in the WESM**

The DOE's initiatives on demand side bidding are based on the initial discussions made with the PEMC and on the matter of market derivatives.

A derivative is a contract between two or more parties whose value is in accordance with the agreed-upon underlying financial asset (like a security) or set of assets (like an index). The most common instruments include bonds, commodities, currencies, interest rates, market indexes and stocks. Derivatives are secondary securities whose value is solely based (derived) on the value of the primary security that they are linked to. Commonly used derivatives are futures contract, forward contracts, options, swaps and warrants. Derivatives are used either to mitigate risk (hedging) or assume risk with the expectation of commensurate reward (speculation)<sup>124</sup>.

Applying this on the sector leads to the energy derivatives, which are financial instruments wherein the underlying assets are energy products including oil, natural gas and electricity. These are traded either on an exchange or over-the-counter. Moreover, energy derivatives can be options for futures or swap agreements. The value of the derivative varies as a result of the changes in price of the energy product<sup>125</sup>.

## **5. Development of Power Generation Policies including Rewards-and-Penalty System**

The generation sector plays a critical role in maintaining the demand and supply balance of the power system. With the goal of enforcing full accountability of the power industry players during forced outages, the DOE explored mechanisms that aimed to penalize power generation companies for lapses and negligence incurred from their end. This measure is viewed not only to provide safety nets to the consumers but also to ensure power supply security to prevent unwanted disruptions and mitigate impacts to the power grid.

<sup>124</sup> Source: <https://www.investopedia.com/ask/answers/12/derivative.asp>

<sup>125</sup> Source: <https://www.investopedia.com/terms/e/energy-derivative.asp>

As early as 2017, the DOE initiated a policy review on the “Causer Pay Policy Program” and subjected the same to several FGDs and public consultations among the concerned stakeholders in the electric power industry. In the same period, the DOE drafted and finalized the DC on “Causer Pays Mechanism.” Under the proposed DC, the penalty system imposes the incremental costs of procuring higher priced electricity to the GenCos, DUs and the SO, provided that such forced outages are intentional or has transpired as a result of negligent or incompetent operations.

Recognizing the need to align the draft DC with other cross-cutting policies, the DOE embarked on the formulation of a general policy framework for ancillary service.

## 6. Creating a Roadmap for Smart Grid and Other Technologies

According to the United States-Department of Energy (US-DOE), making the grid “smarter” can be achieved through the use of cutting-edge technologies, equipment and controls that communicate and work together to deliver electricity more reliably and efficiently. This reduces the frequency and duration of power outages, limits storm impacts, and restore service faster when outages occur<sup>126</sup>.

In 2013, the DOE created an Inter-Agency Steering Committee to develop a smart grid roadmap with the issuance of DC 2013-03-003 titled “Creating an Inter-Agency Steering Committee for the Development and Formulation of a Comprehensive and Holistic Smart Grid Policy Framework and Roadmap for the Philippine Electric Power System.”

Among the deliverables of the Inter-Agency Steering Committee as postulated in Section 3 are: a) propose a National Strategy for Smart Grid for the period until 2030 with major consideration on the possible impact to the price of electricity; b) formulate and prepare the transition policies and guidelines for the effective implementation of Smart Grid by all electric power industry participants; c) prepare a roadmap for Smart Grid implementation; and, d) formulate customer education and information framework for countrywide Smart Grid.

**Table 61. SG-TWG DOE LEADS**

TWG	DOE Lead Bureau/Service/Office
1. Power Systems Operation	Electric Power Industry Management Bureau (EPIMB)
2. Sustainable and Renewable Energy	Renewable Energy Management Bureau (REMB)
3. ICT and Cyber Security	Information Technology and Management Services (ITMS)
4. Standardization	Energy Utilization Management Bureau (EUMB)
5. Regulatory Support	Legal Services (LS)
6. Consumer Empowerment	Consumer Welfare and Promotion Office (CWPO)

Taking off from the said Circular, the DOE is cognizant that it is timely to formulate a Smart Grid Policy Framework with the following objectives: a) ensure and encourage greater participation from power sector stakeholders; and, b) promote technology innovation, business growth and job creation. The DOE also created the Smart Grid–Technical Working Groups (SG-TWG), which focuses on six (6) key areas: a) power systems operations; b) sustainable and renewable energy; c) ICT and cyber security; d) standardization; e) regulatory support; and f) consumer empowerment (Table 61).

A Smart Grid Forum was initiated by the DOE in 2017 and followed by one-on-one workshop with the leading DUs, as well as FGDs with energy agencies, PIOUs and ECs. The results of these

<sup>126</sup> Source: <https://www.energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid>



discussions served as inputs to the DC to be formulated. The proposed Smart Grid Roadmap specifically for the distribution sector is shown in Figure 84.

Figure 84. PROPOSED ROADMAP FOR DISTRIBUTION SECTOR



## PLANS AND PROGRAMS

The course of the medium-term implies that the sector still needs to undertake policy development to supplement the initiatives accomplished in the short-term. These policies aspire to enhance the already established initiatives – WESM design improvements/NMMS, embedded generators, establishment of WESM Mindanao, Reserve/Energy Market Co-optimization, demand bidding in the WESM, Forwards Market/Financial Transmission Rights/Day-ahead Market/Derivatives Market.

In the long-term, the market development subsector undertakes monitoring of several initiatives that were carried out in the short-term and for continuous implementation in the medium-term, including new efforts. Policy development is steadily pursued to improve further transparency and competitiveness of the electricity market. Specifically, this covers the WESM rules changes, periodic audit on market operations, market operator performance standards, compliance to the WESM rules, metering service provider performance standard, and enforcement. Throughout the planning period, the DOE warrants a regular capacity-building for the WESM monitoring and assessment.

Figure 85. MARKET DEVELOPMENT ROADMAP



## G. INSTITUTIONAL AND SUPPORT MECHANISM

The institutional and support mechanism was put in place to sustain the implementation of the action plans identified in each power subsector for the planning horizon. As a cross-cutting and cross-sectoral initiative, it is primarily attuned to assist in the fulfilment of the EPIRA objectives.

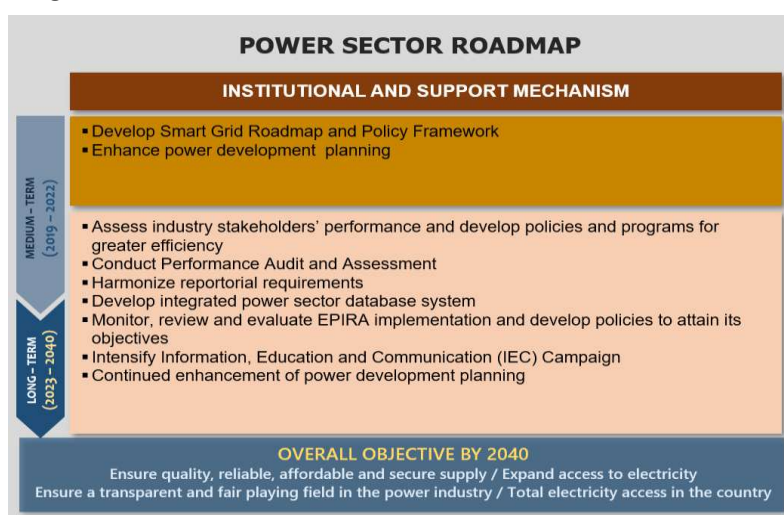
### ASSESSMENT

The action plans completed in the short-term dwelled on the following: a) improvement of public and stakeholder understanding through IECs; b) provision of support in the conduct of audit and review of the WESM relative to market operations, WESM rules, market manuals and retail rules; c) maintenance of the electric power database management including the development of interim systems and preparation of market operations and variable renewable energy monitoring reports; d) submission of reports to oversight – *Joint Congressional Power Commission (JCPC)* – to ensure compliance to the requirements of the EPIRA and other laws; and e) enhancement of power planning, specifically in generation and transmission with the aid of modelling tools and optimization software.

### PLANS AND PROGRAMS

Over the medium-term, the objective is two folds – *develop smart grid roadmap and policy framework and enhance power development planning*. The action plans from the medium-to long-term mirror what were initially implemented and accomplished in the short-term. It is deemed fundamental to be continuously executed to bring about performance efficiency in the industry so that services delivered to stakeholders and consumers adhere to quality, reliability, affordability, and security. Moreover, these action plans put emphasis on the realization of the EPIRA’s objectives for the electricity industry.

Figure 86. INSTITUTIONAL AND SUPPORT MECHANISM ROADMAP



#### 1. Smart Grid Roadmap and Policy

The smart grid policy and roadmap are among the action plans specified under market development for the short-term. Advancing from DC 2013-03-003 wherein an Inter-Agency Steering Committee was created, the DOE led various discussions with concerned stakeholders of which the results were incorporated as inputs in the draft DC. The draft Smart Grid Circular was presented to public consultations and posted on DOE’s website for further comments of stakeholders. Correspondingly, an initial roadmap has been created for the distribution sector, known as the *National Smart Distribution Utility Roadmap (SDUR)*.

Correspondingly, the DOE promulgated on 12 March 2020 DC 2020-02-0003 titled “Providing a National Smart Grid Policy Framework for the Philippine Electric Power Industry and Roadmap for Distribution Utilities.” The criteria to be adopted as the country’s power system transitions into a

smart grid by 2040 are safety, reliability, efficiency, flexibility/sustainability, resiliency, and consumer empowerment.

## **2. Enhancement of Power Development Planning**

As a continuing action plan over the planning period, enhancement of power development planning is critical in the DOE's mandate. The DOE is required to formulate and update annually the PDP, which details the electricity demand and supply outlook of the country. Improvement in supply expansion planning capability entails the procurement and application of power planning tools, specific for generation and transmission.

## **3. Assessment of Industry Stakeholder's Performance and Development of Policies and Programs for Greater Efficiency**

As an approach in the evaluation of industry performance, the DOE is set to continue conducting PAA activities. It also functions as a mechanism to gauge the performance and efficiency of power facilities based on mandated operational standards.

## **4. Continuous Monitoring, Review and Evaluation of the EPIRA Implementation**

The DOE, after a series of FGDs and public consultations with the stakeholders, drafted a DC titled, "Amending Certain Provisions of the Rules and Regulations to Implement the EPIRA."

The draft Circular proposes to, among others, (a) Clarify the responsibilities of the DOE, ERC, TransCo and its buyer/concessioner relative to the TDP; (b) Clarification on the mandate of the NEA relative to its authority and responsibility over the ECs towards viably operating in the deregulated electricity market and ensuring the total electrification of the country; (c) Alignment of the ERC mandate to ensure that Suppliers would comply to rules concerning anti-competitive behavior and market share limitations, including unbundling provisions as required under Section 36 of the Law; (d) Emphasis on the compliance of generation companies including embedded generators and distribution utilities to the PGC, PDC and WESM Rules; (e) Rationalization of the subsidies for missionary electrification; (f) Authority for TransCo or its buyer/concessionaire to operate, maintain, and develop the transmission system in any SPUG area that has been identified by the DOE as viable; (g) Separation of accounts of related business of distribution and transmission utilities subsidization among related businesses; (h) Determination of remote and unviable areas for the provision of electricity; (i) Exemption from the imposition of universal charge (UC) for self-generating entities; (j) Rationalization of lifeline rates subsidy; and (k) Clarification on the PSALM mandates on the administration of UC.

### **▪ Privatization of NPC Assets**

The EPIRA mandates the overall restructuring of the country's electricity industry and calls for the privatization of NPC. The move for privatization was deemed to introduce competition and level the playing field in both generation and supply sectors. The government's privatization efforts primarily pinpoint to power generating facilities, as well as the power supply contracts. Majority of the privatization activities done by the government were from 2007–2016 wherein major assets of NPC, IPP Contracts and transmission assets were turned over to the private sector.

The privatization level of the NPC's generating assets in Luzon and Visayas is already at 87.0 percent as of April 2019 wherein 4,364.30 MW of the 5,014.30 MW are already privatized (Figure 87). The remaining 13.0 percent for privatization is the Malaya Thermal Power Plant (MTPP) with a capacity of 650 MW.

On the IPP contracts, privatization was recorded at 78.3 percent of the total contracted capacities equivalent to 3,415.00 MW of the 4,362.92 MW (Figure 88). This covers coal (Sual and Pagbilao), hydro (San Roque, Bakun), natural gas (Ilijan) and geothermal (Unified Leyte Strips of Energy).

The revenue generated by PSALM from the privatization of generation assets, transmission business and IPP contracted capacities totaled PhP 910.16 billion. Actual collections as of April 2019 stood at PhP 571.43 Billion and with a collectible balance of PhP 338.73 Billion<sup>127</sup>. PSALM was able to achieve 100.0 percent collection stemming from the auctioned generating assets and decommissioned plants. The remaining collectibles are from the balances of TransCo's transmission assets (concession fees) and appointment of IPPA. The utilization of the privatization proceeds was solely used for the liquidation of PSALM's financial obligations as provided under the EPIRA.

- **Malaya Thermal Power Plant<sup>128</sup>**

The privatization package of MTPP in line with the DOE's directive to PSALM and as relayed by the latter to the DOF includes the land underlying the plant with an estimated area of 26.28 hectares (ha) consisting of five parcels of land registered under the Republic of the Philippines.

Four bidders were declared compliant by PSALM-Bids and Award Committee (BAC) on 28 November 2018 with all the requirements of the documentary deliverables. The compliant bidders are: 1) AC Energy Inc.; 2) D.M. Wenceslao & Associates, Inc.; 3) DMCI Power Corporation; and 4) FGEN Reliable Energy Holdings, Inc. The Final Asset Purchase Agreement was issued to the qualified bidders, after a meeting held with them. PSALM also issued Supplemental Bid Bulletin No. 6 amending the bid submission deadline from 24 April 2019 to 14 June 2019. This was

Figure 87. PRIVATIZATION OF GENERATION (As of April 2019)

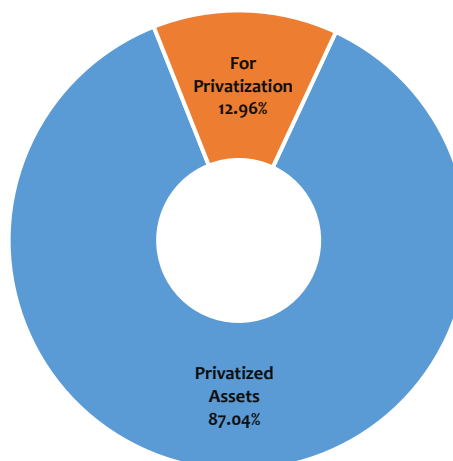
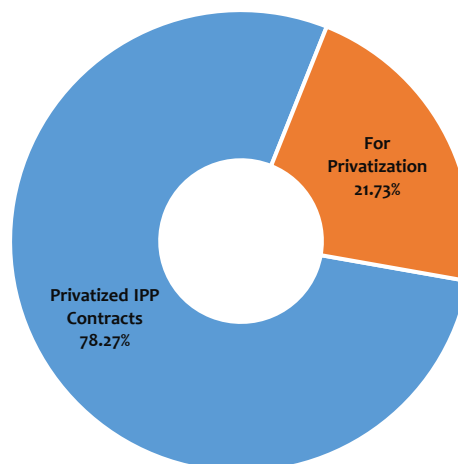


Figure 88. PRIVATIZATION OF IPP CONTRACTS (As of April 2019)



<sup>127</sup> Source: <https://psalm.gov.ph/financial/privatizationproceeds>

<sup>128</sup> PSALM EPIRA Status Report for December 2018

considered in time for the issuance of the Notice to Proceed (NTP) to the Third-Party Consultant for the valuation of the MTPP.

- **Procurement of the Third-Party Consultant for the Valuation of MTPP**

PSALM’s Board of Directors directed the procurement of a third-party consultant to undertake the valuation of assets. Three bidders participated during the bidding held on 04 March 2019, namely a) Price Waterhouse Coopers (PWC), b) Beyond Energy, Inc. (BEI), and c) Lantau Group.

On 15 March 2019, the PSALM-BAC declared PWC as the winning bidder with the highest rated technical proposal, and subsequently approved by the Head of the Procuring Entity. PSALM issued the Notice of Award to PWC on 22 April 2019. In line with this, the timeline for MTPP’s privatization activities has also been adjusted.

- **Privatization Schedule**

To date, eight (8) generating assets are still up for privatization with a total capacity of 1,651.1 MW (Table 62). The privatization of the Agus-Pulangi hydro complexes will be subject to consultation with Congress and PSALM Board’s policy direction. On the appointment of IPPAs, there are still three plants remaining with a total capacity of 1,225.92 MW, the largest of which is the Caliraya-Botocan-Kalayaan (CBK) hydroelectric power plant with a capacity of 797.92 MW (Table 63).

**Table 62. INDICATIVE PRIVATIZATION SCHEDULE FOR GENERATION ASSETS, 30 April 2019**

Plant Name	Rated Capacity (MW)	Bid Date
Malaya Thermal Power Plant	650.00	2019
Agus 1 & 2 HEPP	260.00	For rehabilitation. Privatization is subject to consultation with Congress and PSALM Board's policy direction.
Agus 4 & 5 HEPP	213.10	
Agus 6 & 7 HEPP	273.00	
Pulangi 4 HEPP	255.00	
<b>Total</b>	<b>1,651.10</b>	

Source: <https://psalm.gov.ph/rpa/rop>

**Table 63. INDICATIVE PRIVATIZATION SCHEDULE FOR THE APPOINTMENT OF IPPAS, 30 April 2019**

Plant Name	Rated Capacity (MW)	Bid Date
Caliraya-Botocan-Kalayaan (CBK) HEPPs	797.92	2020
Casecnan HEPP	228.00	2021
Mindanao Coal-fired Thermal Power Plant (CFTPP)	200.00	2022
<b>Total</b>	<b>1,225.92</b>	

Source: <https://psalm.gov.ph/rpa/rop>

## H. MISSIONARY ELECTRIFICATION

Consistent with its overall mandate and the policy objectives of the EPIRA, the DOE remains firm in fulfilling its commitment to perform missionary electrification functions throughout the country. In pursuit of this thrust, the DOE continues to develop key policies, programs and strategic measures to ensure the delivery of quality, reliable, secure and affordable electricity service in marginalized communities located in far flung and remote areas.

In support of the government’s total electrification agenda, the DOE is putting best efforts to bring missionary areas into commercial viability level, to contribute in attaining inclusive growth and

development. Relatedly, to realize policy reforms in the power sector, the DOE is exploring for feasible measures to rationalize the subsidy mechanism, introduce necessary improvements in system operations including the modernization and entry of emerging and efficient technologies across all small island grids.

## ASSESSMENT

### 1. Development of the Omnibus Guidelines for Off-Grid Areas

The DOE crafted the Omnibus Guidelines for Off-Grid Areas anchored on three main objectives that aims to: (1) accelerate access to sustainable energy; (2) rationalize the Universal Charge for Missionary Electrification (UCME); and (3) improve the efficiency, sufficiency and reliability of electricity services in off-grid areas.

Prior to its approval and signing on 25 January 2019, the DC has gone through a series of preparatory activities, such as FGDs and public consultations, which were participated in by government agencies, electric power industry participants and other stakeholders involved in missionary electrification as presented in *Table 64*. The Omnibus Guidelines for Off-Grid Areas became effective on 10 March 2019 following its publication in the *Business World* and the *Daily Tribune* on 22 February 2019.

**Table 64. PREPARATORY ACTIVITIES CONDUCTED FOR THE OMNIBUS GUIDELINES FOR OFF-GRID AREAS**

Activity	Stakeholders	Date	Venue
Focus Group Discussion	NEA, NPC, DOF, NEDA, ERC, PSALM, TransCo, NGCP, Distribution Management Committee (DMC), Access to Sustainable Energy Programme (ASEP)	03 Aug. 2018	DOE AVR, Taguig City
Public Consultation	Existing and potential New Power Providers (NPPs) and Qualified Third Party (QTP) Providers interested in Missionary Electrification	03 Oct. 2018	The Legend Villas, Mandaluyong City
Public Consultation	Luzon Electric Cooperatives (ECs)	04 Oct. 2018	Sulo Riviera Hotel, Quezon City
Public Consultation	Visayas ECs	19 Oct. 2018	Cebu Parklane Hotel, Cebu City
Public Consultation	Mindanao ECs	24 Oct. 2018	The Marcian Hotel, Zamboanga City
Meeting	Busuanga Island Electric Cooperative, Inc. (BISELCO), NEA and NPC	12 Nov. 2018	NPC Boardroom, Quezon City

As a comprehensive policy governing off-grid power development, the completion of the Omnibus Guidelines encapsulates the key accomplishments based on the short-term targets under the missionary electrification roadmap.

- **Ensure Adequate Supply in Off-Grid Areas**

To date, the NPC-SPUG still supplies majority of the power requirements in the off-grid areas despite having a Private Sector Participation (PSP) Program in place. As such, the timely completion and implementation of capacity additions and uprating projects are imperative to sustain power supply security in the islands.

Along with this effort, the NPC-SPUG took advantage of EO30 by applying 32 of its power generation projects in missionary areas as EPNS. With foreseen contributions of bringing positive

economic impacts to the off-grid islands, the proposed power generation projects have been granted with CEPNS as listed in *Table 65*.

**Table 65. LIST OF NPC POWER PROJECTS ISSUED WITH CEPNS**

Plant Type	Name of Project	Type of CEPNS	Date Issued
Oil-based	Hikdop, Surigao del Norte (1 x 200kW)	Commerciality	16 Jan. 2019
Oil-based	Talicud, Davao del Norte (3 x 200 kW)	Commerciality	16 Jan. 2019
Oil-based	Balut, Davao del Sur (1 x 300 kW and 2 x 200 kW)	Commerciality	16 Jan. 2019
Oil-based	Sacol, Zamboanga (1 x 200 kW)	Commerciality	16 Jan. 2019
Oil-based	Basilan DPP, Basilan (5 x 1,000 kW)	Commerciality	16 Jan. 2019
Oil-based	Ninoy Aquino (1 x 500 kW)	Commerciality	16 Jan. 2019
Oil-based	Palimbang (1 x 300 kW)	Commerciality	16 Jan. 2019
Oil-based	Kalamansig DPP (3 x 1,500 kW)	Commerciality	16 Jan. 2019
Oil-based	Balimbing (1 x 300 kW and 1 x 200 kW)	Commerciality	16 Jan. 2019
Oil-based	Tandubas (1 x 300 kW and 2 x 100 kW)	Commerciality	16 Jan. 2019
Oil-based	Sibutu (2 x 300 kW)	Commerciality	16 Jan. 2019
Oil-based	Manuk Mangkaw (2 x 200 kW)	Commerciality	16 Jan. 2019
Oil-based	Tandubanak (2 x 300 kW)	Commerciality	16 Jan. 2019
Oil-based	Gibusong Island, Loreto, Dinagat (2 x 50 kW)	Commerciality	16 Jan. 2019
Oil-based	Sibanag Island, Dinagat (2 x 50 kW)	Commerciality	16 Jan. 2019
Oil-based	Dinagat Island, Dinagat (2 x 1.50 MW)	Commerciality	16 Jan. 2019
Oil-based	Sarangani DPP (1 x 100 kW and 1 x 200 kW)	Commerciality	16 Jan. 2019
Oil-based	Tausan Pilas Island, Haji Muhtama (2 x 100 kW)	Commerciality	16 Jan. 2019
Oil-based	Tictabon (1 x 90 kW)	Commerciality	16 Jan. 2019
Oil-based	Manalipa (1 x 40 kW)	Commerciality	16 Jan. 2019
Oil-based	Tumaloptap (1 x 40 kW)	Commerciality	16 Jan. 2019
Oil-based	Sitangkai DPP, Tawi-Tawi (1 x 500kW)	Commerciality	16 Jan. 2019
Oil-based	Great Sta. Cruz (1 x 10 kW)	Commerciality	16 Jan. 2019
Oil-based	West Simunul (2 x 600 kW)	Commerciality	29 Jan. 2019
Oil-based	Pangapuyan (1 x 10 kW)	Commerciality	29 Jan. 2019
Oil-based	Ninoy Aquino DPP, Sultan Kudarat (2 x 500 kW)	Commerciality	29 Jan. 2019
Oil-based	Cagayan De Tawi-Tawi (Mapun), Tawi-Tawi (2 x 600 kW)	Commerciality	29 Jan. 2019
Oil-based	Tampakan Dampong DPP, Tawi-Tawi (1 x 150 kW)	Commerciality	29 Jan. 2019
Oil-based	Taganak Turtle Island DPP, Tawi-Tawi (1 x 150 kW)	Commerciality	29 Jan. 2019
Oil-based	Lugus Island, Sulu (1 x 150 kW)	Commerciality	29 Jan. 2019
Oil-based	Saluping Island DPP, Basilan (1 x 150 kW)	Commerciality	29 Jan. 2019
Oil-based	Tapiana Island DPP, Basilan (1 x 150 kW)	Commerciality	29 Jan. 2019

On the other hand, one private power provider, the DMCI Power Corporation has also been granted with a CEPNS for its 15-MW coal power plant project in Masbate.

As CEPNS holders, NPC-SPUG and DMCI Power Corporation are entitled to the full benefits of EO30 for the timely implementation of their proposed off-grid power generation projects.

- **Conduct Policy Studies on Optimal Energy Mix for Off-grid Areas**

As part of its continuing advocacy to identify and establish the optimal energy mix for small islands and isolated grids, the DOE endeavors the formulation of a sound Missionary Electrification Development Plan (MEDP). Relative to this, the policy on optimal energy mix is embodied in the priority goals and objectives of the MEDP, in conjunction with DC 2018-08-0024 or the “RPS for Off-

Grid.” Currently, the DOE has ongoing efforts focused on the generation planning for the five island provinces namely, Mindoro, Palawan, Masbate, Marinduque and Romblon.

Along with this thrust, the DOE is assisted by the European Union – Access to Sustainable Energy Programme (EU-ASEP) in conducting studies and facilitating capacity building activities to help improve off-grid operations as part of the Programme’s Technical Assistance (TA) component. Among the activities undertaken by the DOE and the ASEP in 2018 include the study to improve the efficiency of the NPC-SPUG diesel power plants, and the training on the enhanced Simplified Planning Tool (SPT) for the optimization of supply mix.

- **Rationalize and improve UCME Subsidy System**

As a key intervention to attain countryside development, off-grid areas are intensely supported by a subsidy mechanism through the UCME, which is being passed on to all electricity consumers. With the objective of easing power rates that burden all end-users, the rationalization of existing tariffs including the phase-out of the UCME subsidy mechanism is one of the salient provisions underscored in the Omnibus Guidelines for Off-Grid Areas.

In line with this, the DOE identified feasible measures to propel the rationalization of the UCME mechanism, which include: (a) tariff differentiation among customers and missionary areas; (b) methodology review for the determination of the True Cost Generation Rate (TCGR) and Subsidized Approved Generation Rate (SAGR) for the NPP Program; (c) methodology review for determination of the Full Cost Recovery Rate (FCRR) and Subsidized Approved Retail Rate (SARR) for the QTP Program; (d) provisional review of the cash generation-based incentive for RE Developers aligned with the context and objectives of UCME; and (e) interconnection of SPUG islands to the main grids of Luzon, Visayas and Mindanao or intra-connection among adjacent small islands not connected to the main grids.

- **Performance Assessment and Benchmarking**

With the goal of improving small grid power system operations, the DOE has undertaken PAA activities in three off-grid areas in Luzon. These activities enabled the DOE to wholly assess the power situation including the operational efficiencies of the generation, transmission and distribution system facilities serving small islands and isolated grids.

As a priority measure, the main results of the off-grid PAA were instrumental in the formulation of the Omnibus Guidelines for Off-Grid Areas that facilitated the establishment of benchmark data and information with respect to technical standards and operating guidelines of small grid systems.



Activities related to the conduct of PAA in MASELCO on 18-29 June 2018



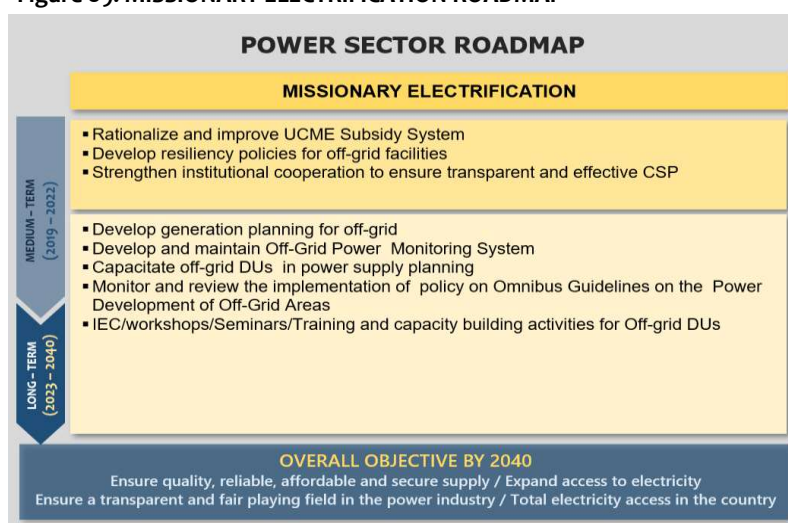
Along with this initiative, the DOE piloted its first off-grid PAA in Oriental Mindoro Electric Cooperative, Inc. (ORMECO) in November 2017 followed by a post-audit activity, which was conducted in the last quarter of 2018. Likewise, the DOE implemented the same undertaking in Masbate Electric Cooperative, Inc. (MASELCO) in June 2018. The last off-grid PAA was carried out in the First Catanduanes Electric Cooperative, Inc. (FICELCO) in July 2018.

As a continuing program of the DOE, the results of future PAA activities will primarily serve as firm bases in identifying appropriate policy measures and programs to further improve the reliability, efficiency and modernization of off-grid power systems.

## PLANS AND PROGRAMS

The issuance of the Omnibus Guidelines for Off-Grid Areas is a bold move of the government in setting a clear track for power development in small islands and isolated grids and unviable areas. Now that the governing policy is already in place, the DOE concentrates on harmonizing efforts among energy agencies, including the stakeholders mandated with missionary electrification functions, to ensure the timely and effective implementation of the said policy within the medium- to long-term horizons.

Figure 8g. MISSIONARY ELECTRIFICATION ROADMAP



At the early stage of the policy execution, the DOE prioritizes the rationalization and the enhancement of the UCME subsidy mechanism to cushion the potential and encumbering impacts to electricity users in off-grid areas. As an instrument of social justice, the UCME subsidy mechanism will be reviewed and reformulated to enable the marginalized consumers to afford the cost of electricity and use it efficiently.

Considering also that a number of off-grid islands are regularly stricken by calamities, the DOE pushes for resiliency policies to fortify existing and upcoming power facilities serving small island grids. Coherent with the DOE's energy resiliency thrust, this action plan also serves as a complementing strategy to ensure energy security in the off-grid areas.

To address the pressing concern for a stable power supply in the small islands, the DOE strictly advocates for stronger institutional cooperation between the NEA and NPC-SPUG toward the fulfilment of their sworn mandates. Essential in their mandates are the timely programming and delivery of respective plans, programs, and missionary electrification related projects in off-grid areas, among others. Likewise, full compliance to administrative and regulatory policies to include the fair and transparent execution of CSP for power supply sustainability needs to be efficiently enforced.

As a continuing program of the DOE, the MEDP is periodically formulated to embark on the generation and overall planning for off-grid areas. Along with this, the DOE undertakes various

capacity building programs to boost the technical competencies of the DUs in off-grid with respect to power development planning. Relatedly, the DOE will develop and maintain a suitable off-grid power monitoring system, and work on the necessary improvements accordingly, and as the need arises.

In the long run, the DOE firmly monitors the implementation of the Omnibus Guidelines for Off-Grid Areas and conducts policy review to assess its applicability, consistency and relevance with the overall energy agenda of the DOE.

## I. TOTAL ELECTRIFICATION PROGRAM

The government continues to put premium on the importance of expanding electricity access as this remains in the energy sector development agenda. Viewed as a tool that improves the quality of life of Filipinos, the sector is driven with the goal of attaining 100.0 percent electrification of unserved and underserved<sup>129</sup> areas in the country by 2022 based on 2015 Census of Population. The government has formulated the Total Electrification Program (TEP) with the main objective of providing electricity to all households by 2040.

With the President's directive to accelerate electrification by 2020, the Total Electrification Master Plan has been crafted under the TEP. As a concrete step, the Task Force E-Power Mo! (TFEM) was created by virtue of DO2018-05-0010 signed on 24 May 2018. The Task Force, chaired by the DOE, is responsible for overseeing the government's TEP and ensuring that electricity reaches the unserved and underserved communities within the franchise areas of the DUs/ECs. The TFEM is also tasked to develop the National Unified Strategy for TEP based on the consolidated and reviewed comprehensive Total Electrification Master Plan of the individual DU/EC. The plan likewise pushes for increased private sector participation specifically on areas where the DUs/ECs cannot perform their responsibilities.

The TFEM has identified three major forms of electrification programs – *household electrification*, *grid electrification* and *off-grid electrification*. Household and grid electrification programs include the following strategies: a) the provision of house wiring subsidy for unenergized households situated in areas with distribution facilities such as the DOE's Nationwide Intensification of Household Electrification (NIHE); b) extension of distribution line facilities to unserved areas such as NEA's Sitio Electrification Program (SEP) and the Barangay Line Enhancement Program (BLEP).

On the other hand, off-grid electrification programs include: a) DU's installation of individual photovoltaic – solar home systems (PV-SHS) under the DOE and the EU-ASEP PV Mainstreaming; b) implementation of mini/micro-grid system through potential entry of private sector as QTP, partner in a joint venture agreement (JVA), and the NPC-SPUG Mini-Grid Scheme.

The obligation of providing electricity service to areas throughout the country remains with the DUs. Electricity must be supplied in the least cost manner to its captive market subject to the collection of retail rate duly approved by ERC<sup>130</sup>. The provision of universal service by the DUs also includes unviable areas and if there is no viable solution, these areas may be transferred to another DU (if any is available). The performance of the DUs particularly its obligation in electrification of its franchise area is overseen by the NEA.

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<sup>129</sup> Underserved area refers to those areas with less than 24-hour electricity service.

<sup>130</sup> Section 23 of RA 9136

The electrification solution is opened to QTPs if the DUs are unable to serve the remote and unviable villages<sup>131</sup>. The DOE has the responsibility of declaring these remote and unviable areas that cannot be served by the DUs open for private sector participation. As support to the total electrification program and for an environment that is more conducive to private sector participation particularly in unviable areas, the DOE issued DC 2019-11-0015 or the Revised QTP Guidelines on 22 November 2019. The policy basically updates and revises the existing guidelines on QTP participation.

The NPC-SPUG’s role in electrification comes when neither a DU nor QTP cannot provide electricity service in an area. It is responsible for providing power generation and its associated power delivery systems in areas that are not connected to the grid and cannot be serviced by the DUs and other QTPs<sup>132</sup>.

The short-term targets espoused in the TEP are as follows: a) process, evaluate and approve projects that contribute to the attainment of 90.0 percent household electrification by 2017 (based on 2010 Census<sup>133</sup>); b) monitoring of household electrification development plan (HEDP) programs; c) establish off-grid database management system; and d) develop proposal for NIHE Phase 2.

## ASSESSMENT

### 1. Process, Evaluate and Approve Projects that Contribute to the Attainment of Household Electrification Target by 2017

The energy sector in the short-term was guided with the goal of attaining its household electrification target – that is 90.0 percent of the total households in the country have electricity access by 2017.

As early as December 2016, the DOE together with NEA has already reach the 90.0 percent household electrification level based on the 2010 Census of Population.

In December 2017, the country posted a household electrification level of 91.1 percent wherein a total of 20,936,498 households out of the potential 22,984,971<sup>134</sup> have access to electricity. This is translated to 2,048,473 households without electricity service throughout the country. Luzon registered the highest electrification level at 99.9 percent, while Visayas and Mindanao had 89.5 percent and 70.2 percent electrification levels, respectively (Figure 89 and Table 66).

Table 66. HOUSEHOLD (HH) ELECTRIFICATION, December 2017

	Total HH	Energized HH	Unenergized HH	Electrification Level (%)
<b>Luzon</b>	13,318,261	13,304,567	13,694	99.90
<b>Visayas</b>	4,401,698	3,937,317	464,381	89.45
<b>Mindanao</b>	5,265,012	3,694,614	1,570,398	70.17
<b>Philippines</b>	<b>22,984,971</b>	<b>20,936,498</b>	<b>2,048,473</b>	<b>91.09</b>

<sup>131</sup> Section 59 of RA 9136

<sup>132</sup> Rule 13 Section 3 of EPIRA-IRR

<sup>133</sup> The base year for the current electrification targets is based on the 2015 Census of Population (POPCEN 2015) of PSA

<sup>134</sup> Total potential households based on the 2015 Census of Population (POPCEN 2015).

The country's electrification level improved by 4.0 percentage points in December 2018 at 95.3 percent. Of the total households<sup>135</sup>, 21,896,816 now have electricity, leaving only 1,088,155 without access to this basic service. Luzon is now 100.0 percent energized. Visayas' electricity level already reached 94.0 percent, while Mindanao still had the lowest at 78.2 percent (Figure 91 and Table 67).<sup>136</sup>

Shown in Table 68 are the electrification projects, as approved by the DOE, contributing to expanding electricity access throughout the country. These projects include NIHE, Energy Regulations (ER) 1-94, PV mainstreaming – government counterpart, PV Mainstreaming under the ASEP and QTP.

Figure 90. HOUSEHOLD (HH) ELECTRIFICATION, December 2017



Figure 91. HOUSEHOLD (HH) ELECTRIFICATION, December 2018



Note: Luzon recorded more than 100 percent household electrification level as the target household is based on 2015 Census of Population from PSA

Table 67. HOUSEHOLD (HH) ELECTRIFICATION, December 2018

	Total HH	Energized HH	Unenergized HH	Electrification Level (%)
Luzon	13,318,261	13,640,593	-322,332	102.42
Visayas	4,401,698	4,137,125	264,573	93.99
Mindanao	5,265,012	4,119,098	1,145,914	78.24
<b>Philippines</b>	<b>22,984,971</b>	<b>21,896,816</b>	<b>1,088,155</b>	<b>95.27</b>

<sup>135</sup> Total potential households based on the 2015 Census of Population (POPCEN 2015). The 2018 data reflected as of 15 May 2019. The DOE is still awaiting submission of the DUs/ECs of their DDP for 2019.

<sup>136</sup> Electrification level in December 2019 stood at 92.96 percent indicating that 23,229,866 households are with electricity service. The remaining 1,618,264 households without electricity are based on actual unserved households of the DUs throughout the country. Electrification level on a per grid basis is as follows: Luzon (97.78 percent), Visayas (93.88 percent) and Mindanao (79.99 percent).

**Table 68. ELECTRIFICATION PROGRAMS WITH APPROVED PROJECTS, 2018**

Program Name	Program Description	No. of Approved Projects
Locally-Funded Project (LFP) – NIHE (2015 – 2018)	Provision of service connection is a grant subsidy amounting to Php 3,750 per household which includes house wiring materials (at least two (2) bulbs and one (1) convenience outlet), service drop wire and kilowatt-hour meter.	78 projects (344,090 households)
ER 1-94	The provision of benefits to communities hosting generating facilities or energy resource development projects as stated in Section 5 (i) of RA 7638, Section 66 of RA 9136 and Rule 29 of the EPIRA-IRR. Utilization of 50% of the one centavo per kilowatt-hour (Php 0.01/kWh) of the total electricity sales of all generation facilities as financial benefits (electrification fund).	57 projects (7 EF, 26 DLF and 24 RWMHEEF)
LFP–PV Mainstreaming (2017 – 2018)	Adopts a fee-for-service business model in which ECs install PV – solar home systems (SHS) in unenergized households within its franchised area that are unviable for grid extension.	6 projects (9,984 households)
PV Mainstreaming – ASEP (2017 – 2018)	Adopts a fee-for-service business model in which ECs install PV – solar home systems (SHS) in unenergized households within its franchised area that are unviable for grid extension. Funded by ASEP.	10,000 of 40,500 households in four provinces
QTP	Serves unviable and waived areas by the DUs. Responsible for generation of power and its equivalent distribution.	6 sites endorsed to ERC with 1,342 households

## 2. Develop Proposal for NIHE Phase 2

The NIHE program was implemented from 2015 to 2017. However, with the need to further expand the program, the DOE carried out a review and evaluation of its existing mechanism to further enhance and streamline the requirements. In the later part of 2017, the DOE issued the implementation guidelines that included the streamlined process in project approval, implementation and monitoring. In effect, approval was made to 13 out of the 18 projects under 2018 NIHE with a total beneficiary of 81,770 households. The ECs with approved projects are: Ilocos Sur Electric Cooperative (ISECO), Ifugao Electric Cooperative (IFELCO), Pangasinan III Electric Cooperative (PANELCO III), Marinduque Electric Cooperative (MARELCO), Antique Electric Cooperative (ANTECO), Iloilo III Electric Cooperative (ILECO III), Iloilo II Electric Cooperative (ILECO II), Leyte V Electric Cooperative (LEYECO V), Agusan del Norte Electric Cooperative (ANECO), Misamis Occidental Electric Cooperative (MOELCI), Misamis Oriental I Electric Cooperative (MORESCO I), Surigao del Sur I Electric Cooperative (SURSECO I), and Zamboanga del Sur I Electric Cooperative (ZAMSURECO I) (Table 69). These ECs signed a Memorandum of Agreement (MOA) with the DOE for the project implementation within their franchise areas.

## 3. Policy Issuances

The targeted as well as identified beneficiaries in the underserved and unserved areas in the Government’s electrification program are considered as consumers, given they have been provided with electricity service. Electrification’s considerable impact to the people (would be

**Table 69. APPROVED NIHE PROJECTS, 2018**

Electric Cooperative	No. of Households
ISECO	3,367
IFELCO	478
PANELCO III	6,636
MARELCO	4,118
ANTECO	3,122
ILECO III	3,886
ILECO II	7,651
LEYECO V	11,500
ANECO	2,177
MOELCI	1,344
MORESCO I	5,927
SURSECO I	9,296
ZAMSURECO	22,268
<b>Total</b>	<b>81,770</b>

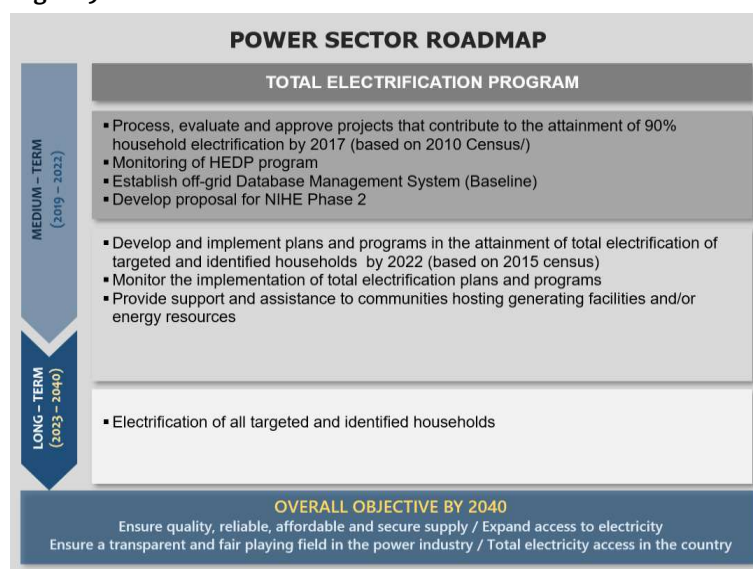
consumers) is its ability to uplift living conditions and serve as a conduit for the delivery of basic services to those who have been deprived of electricity access.

Consumers who have electricity service are helping other consumers or would be consumers as a portion of the payment in electricity bills (the Universal Charge – Missionary Electrification) is utilized in subsidizing electricity in missionary or off-grid areas. Electrification is a program that enhances local development and transcends to every consumer.

## PLANS AND PROGRAMS

For the medium-term, the TEP has the objective of developing and implementing plans and programs in the attainment of total electrification of targeted households by 2022 (based on 2015 Census). In the long-term, it is envisioned that electricity service is provided to all households throughout the country. Continuing action plans will be pursued within the medium- to long-term period, which include: a) monitoring of implementation of total electrification plans and programs; and b) provision of support and assistance to communities hosting generating facilities and/or energy resources.

Figure 92. ELECTRIFICATION ROADMAP



### 1. Development, Monitoring and Implementation of Total Electrification Plans and Programs

Cognizant of the total electrification target by 2022, the DOE is unwavering in the implementation of its identified electrification strategies in both grid and off-grid areas. This entails the management of the DOE approved projects and programs covering the following: a) TEP, in collaboration with the NEA and NPC-SPUG, as the project implementers; b) PV Mainstreaming both by the DOE and the EU-ASEP; c) Electrification Fund (EF) projects under ER 1-94 of the DUs; and d) QTP.

The TFEM continuously ensures that electricity access reaches communities that remain unserved and underserved by the DUs. Thus, the DUs are enjoined to execute their respective Total Electrification Masterplans outlining the appropriate electrification strategies and fund resources.

A pragmatic and timely approach in project implementation greatly contributes in attaining the objective of providing electricity access to the targeted households in the country.

## 2. Provide support and assistance to Communities Hosting Generating Facilities and/or Energy Resources

On ER 1-94<sup>137</sup>, the DOE is on the standpoint to continue providing support and assistance to host communities from medium- to long-term period. It may be noted that in 2018, two pertinent policies on ER 1-94 were issued – DC 2018-03-0005<sup>138</sup> and DC 2018-08-0021<sup>139</sup>. The former, promulgated on 20 March 2018, recognizes the rights of indigenous cultural communities (ICCs) / indigenous peoples (IPs) in their ancestral domains to have equitable share from the financial benefits under ER 1-94. The latter, promulgated on 23 August 2018, effects the transfer of financial benefits to the DUs/ECs and to host LGUs and ICCs/IPs. The Circular stipulates that the EF component will be remitted directly to the DUs/ECs, while the development and livelihood fund (DLF) and reforestation, watershed management, health and/or environment enhancement fund (RWMHEEF) will be remitted to the host LGUs and ICCs/IPs.

To guide the ICCs/IPs in availing their share, the DOE issued DC 2019-06-0010<sup>140</sup> on 14 June 2019 specifying the administrative operating guidelines (AOG) to facilitate the transfer and utilization of financial benefits by the ICCs/IPs whose ancestral domains are host to generation facilities and/or energy resources.

### ▪ ER 1-94 Status

The ER 1-94 is a program that intends to recompense for the contribution made by communities hosting energy generating facilities and/or energy resources. The promulgation of DC 2018-08-0021 in August 2018 provides the guidelines on the direct remittance of financial benefit to host beneficiaries, while DC 2019-06-0010 specified the AOG to facilitate the transfer and utilization of the funds.

**Table 70. ER 1-94 FUNDS REMITTED BY DOE TO HOST LGUs (Sept 2019 - 12 August 2020)**

Fund Type	Amount (Billion PhP)
EF	1.452
DLF	0.748
RWMHEEF	0.714
<b>Total</b>	<b>2.913</b>

As a means for host LGUs to have additional fund source in addressing the COVID-19 pandemic, the DOE issued DC 2020-04-0008 on 07 April 2020 titled “Rationalizing the Utilization of ER 1-94 by LGUs in Response to COVID-19 Public Health Emergency.” The Circular stipulates that all available and unremitted ER 1-94 Funds (as of December 2019) that is with DOE and concerned GenCos shall be immediately distributed to host LGUs in order to have a readily available fund for undertaking COVID-19 related responses. An Advisory was also issued last 14 July 2020 for the implementation of the said Circular and to provide clarification on particular sections, as well as for the continuity of processes and activities.

For the period September 2019 to 12 August 2020, the DOE remitted a total of PhP 2.9 billion of ER 1-94 funds to host LGUs with half of the remitted amount comprised the EF (Table 70).

<sup>137</sup> The provision of benefits to communities hosting generating facilities or energy resource development projects is stipulated in Section 5 (i) of RA 7638, Section 66 of RA 9136, and Rule 29 of the EPIRA-IRR.

<sup>138</sup> “Prescribing the Guidelines Recognizing the Rights of Indigenous Cultural Communities (ICCs) / Indigenous Peoples (IPs) in their Ancestral Domain and Access to the Financial Benefits as Host Communities under the ER 1-94 Program and Rule 29 (A) of the Implementing Rules and Regulations of Republic Act No. 9136 otherwise known as Electric Power Industry Reform Act of 2001”

<sup>139</sup> “Providing for the Amendments to Rule 29 Part (A) of the Implementing Rules and Regulations of RA 9136”

<sup>140</sup> “Prescribing the Administrative Operating Guidelines for the Availment and Utilization of Financial Benefits by the Indigenous Cultural Communities/Indigenous Peoples pursuant to DOE Department Circular No. 2018-03-0005”

## J. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

Investments in the power sector must be highly promoted to ensure that power supply remains steadily available for the production and delivery of electricity to fuel economic growth. One important aspect for the future of power sector is the need to meet the necessary investment requirements for expansion of power generation capacity and development of required additional infrastructure to strengthen the existing power system.

The restructuring of the country's power sector paved the way for a more competitive electricity supply market as the government opened the opportunities of financing power projects to private investors. Considering that power projects are highly leveraged investment undertaking, building up substantial portfolios of investment in the sector should be of greater interest to encourage greater capital investments and private sector participation.

Table 71 shows the investment requirement in the generation sub sector and the capacity addition per scenario to support the expanding electricity demand. The estimated financing requirements are slated for building new power plants to augment existing capacities and ensure adequate and reliable power supply. Under the Reference Scenario, the total capital investment needed to develop additional generation capacities amounts to USD 104,650 million. With higher shares of renewables in the capacity addition, the Clean Energy Scenario (CES) is expected to be more expensive by 18.5 percent (USD 19,325 million), reaching USD 123,975 million due to high upfront cost in building more renewable power plants.

**Table 71. INVESTMENT REQUIREMENTS FOR GENERATION PROJECTS (USD Million)**

Technology	Reference Scenario		Clean Energy Scenario	
	Capacity Addition by 2040, MW	Investment Cost	Capacity Addition by 2040, MW	Investment Cost
Coal	22,626	40,727	10,506	22,063
Oil-Based	115	81	75	53
Natural Gas	14,787	7,394	18,207	18,207
Renewable	34,289	56,449	45,337	78,553
Other Technology	-	-	1,200	5,100
<b>Total</b>	<b>71,817</b>	<b>104,650</b>	<b>75,325</b>	<b>123,975</b>

To increase the grid capacity and complement the entry of new generating facilities, the transmission sub sector will need to invest USD 7,011.82 million covering the period 2019 to 2025 (Table 72). These projects are mostly comprised of upgrade and expansion of transmission backbones and development of island interconnections. For ongoing projects, only the remaining investments needed to complete the projects are considered. For projects already filed and to be filed before the ERC for approval, some of the estimated investments only represent portion of the total project cost as there are still additional investments needed beyond 2025 to complete such projects.

**Table 72. INVESTMENT REQUIREMENTS FOR TRANSMISSION PROJECTS, CY 2019-2025 (USD Million)**

	Luzon	Visayas	Mindanao	Total
Ongoing Projects	1,345.82	840.56	1,303.07	3,489.45
Proposed Projects up to 2025	1,384.42	1,644.94	493.01	3,522.37
<b>Total</b>	<b>2,730.24</b>	<b>2,485.50</b>	<b>1,796.08</b>	<b>7,011.82</b>

Source: NGCP



Note that the investment for transmission development only pertains to projects up to 2025 since other future projects still need further assessment to estimate the total project cost for engineering, procurement, and construction.

For the benefit of the customers, increasing network efficiency and improving the performance of distribution services also necessitate large amounts of new investments to achieve long-term reliability. *Table 73* enumerates the needed investments for distribution development projects planned to be implemented in the next ten years (2019-2028).

**Table 73. INVESTMENT REQUIREMENTS FOR DISTRIBUTION PROJECTS (USD Million)**

Capital Expenditures	Luzon	Visayas	Mindanao	Total
<b>Network Assets</b>	<b>5,072</b>	<b>504</b>	<b>996</b>	<b>6,571</b>
Sub-transmission Facilities	264	26	153	443
Distribution Facilities	2,942	189	300	3,431
Substation Capacities	1,013	74	204	1,291
Other Network Assets	852	214	339	1,405
<b>Non-Network Assets</b>	<b>642</b>	<b>83</b>	<b>230</b>	<b>955</b>
<b>Electrification Projects</b>	<b>2,963</b>	<b>37</b>	<b>5896</b>	<b>8,896</b>
<b>Total</b>	<b>8,678</b>	<b>624</b>	<b>7,121</b>	<b>16,423</b>

Source: Distribution Development Plan 2019-2028

The estimated capital spending to further develop the country's distribution sector amounts to USD 16,423 million. More than half (54.2 percent) of the total cost is allotted for electrification projects. This is followed by network projects taking 40.0 percent (USD 6,571 million) and mostly consisting of additional substation and sub-transmission facilities, upgrading and rehabilitation of the existing distribution system. The remaining is shared out to non-network projects which range from acquisition of property, equipment, safety gadgets, software, vehicles, and others that assist DUs in its operations and delivery of services.

Investments in the power sector have been supporting the growth of the economy by stimulating potential jobs related to construction and operation of power sector's infrastructure or services. Likewise, the power sector's skilled workforce generally has higher level of incomes thus contributing higher spending per capita for the economy.

The total potential employment associated with power generation projects is expected to be around 515, 881 jobs under the Reference Scenario (*Table 74*). The Clean Energy Scenario necessitates an additional of 110,192 employment in comparison with the Reference Scenario, equivalent to 626,073 estimated job opportunities. Since Clean Energy Scenario needs more capacity additions due to high share of renewables, the required workforce will considerably increase especially during the construction and installation phases. Renewable energy technologies tend to be more labor intensive as revealed by several available related literatures and studies. It must be noted that the job generation presented only reflects the projected number of jobs for the construction and operation and maintenance activities.

**Table 74. ESTIMATED JOB GENERATION IN POWER GENERATION PROJECTS**

Type of Plant	Estimated Job/MW		REF		CES	
	Construction	Operations and Maintenance	Capacity Additions by 2040, MW	Additional Jobs	Capacity Additions by 2040, MW	Additional Jobs
Coal	2.50	0.65	22,626	71,272	10,506	33,094
Oil	2.73	0.13	115	329	75	215
Natural Gas	2.73	0.13	14,787	42,291	18,207	52,072
Geothermal	24.55	1.85	697	18,392	1,597	42,152
Hydropower	8.33	0.55	7,659	68,009	9,882	87,749
Biomass	9.80	7.75	402	7,055	1,292	22,675
Solar	10.83	1.70	21,154	265,060	24,064	301,522
Wind	8.00	1.93	4,378	43,474	8,503	84,435
Other	1.2	0.6	-	-	1,200	2,160
<b>Total</b>			<b>71,817</b>	<b>515,881</b>	<b>75,325</b>	<b>626,073</b>

Notes: 1. Construction multiplier based on EPNS submission except for biomass-fired Plant. Estimate based on 2013 research study by EPPB titled "The Contribution of the Power Generation Industry to Employment Generation."

2. Operation and Maintenance multiplier based on the 2013 EPPB Study.

3. Estimates for "Other" based on the 2018 joint report "Measuring Employment Generated by the Nuclear Power Sector" of OECD Nuclear Energy Agency (NEA) and the International Atomic Energy Agency (IAEA).

4. Construction period varies per plant technology.



# Chapter VII.

## ENERGY EFFICIENCY AND CONSERVATION

The energy efficiency and conservation (EE&C) is fast evolving into a key policy solution to high energy cost, energy security and the threat of climate change. It is also seen as the **heart of the consumers' participation** to ensure sustainable growth and development of the country's energy future.

The DOE crafted the Energy Efficiency and Conservation Roadmap in 2018 with the overall objective of reducing energy intensity – that is the energy consumed per unit of the Gross Domestic Product (GDP). The Roadmap highlights the strategies and approaches to trim down energy intensity across economic sectors – residential, transportation, industrial, commercial and agricultural. This puts EE&C initiatives at the core of consumer protection programs, empowering energy users to be more proactive and intelligent in terms of energy choices. The EE&C also provides consumers the means to save on their energy cost, while contributing to the macro-economic goal of de-carbonizing the environment.

*Republic Act (RA) 11285 or the “Act Institutionalizing Energy Efficiency and Conservation, Enhancing the Efficient Use of Energy, and Granting Incentives to Energy Efficiency and Conservation Projects” was signed by President Rodrigo R. Duterte on 12 April 2019. This long-awaited policy measure came as a result of the DOE’s relentless effort to pursue its advocacy to curb energy demand without sacrificing economic productivity.*

*Secretary Alfonso G. Cusi signed the Implementing Rules and Regulations (Department Circular/DC 2019-11-0014) on 22 November 2019, and became effective on 21 December 2019. The EE&C Act shall serve as a measure to create institutional framework at different levels of government to promote energy efficiency and conservation practices in the country.*

With relevant policies and strategies now in place on EE&C, it may not take long for it to be considered as an energy resource that is equally important as other existing supply resources, even considering it as part of the Philippine energy mix by 2040.

### A. ASSESSMENT

#### 1. Energy Efficiency and Conservation Act of 2019

RA 11285 (EE&C Act) establishes a framework for introducing and institutionalizing fundamental policies on EE&C, promoting the efficient and judicious use of all energy resources, and increasing the use of energy-efficient and renewable-energy technologies. All national government agencies

(NGAs), government-owned and controlled corporations (GOCCs), local government units (LGUs) and state universities and colleges (SUCs) are directed to adopt energy efficiency measures and ensure implementation of such in their daily operations – offices, facilities, and vehicles, among others. The issuance of Department Order (DO) 2020-01-0001 created an Inter-Agency Energy Efficiency and Conservation Committee (IAEECC) to evaluate and approve government energy efficiency projects, as well as provide strategic direction for the implementation of the Government Energy Management Program (GEMP). The new Guidelines for GEMP was signed by Secretary A. G. Cusi as Chairman of IAEECC.

The conduct of Energy Audit Spot Check is a regular activity of the DOE for NGAs, GOCCs, LGUs, and SUCs to ensure government compliance to GEMP. This task has transitioned into the Virtual Energy Audit Spot Check relative to the “new normal” activities of DOE.

In 2018<sup>141</sup>, the GEMP initiative of the DOE was able to save the country about 6.55 GWh of electricity which is equivalent to PhP 52.32 million in monetary savings and reduction of 3,351.4 tons of carbon dioxide in the environment.

A National Energy Efficiency and Conservation Plan (NEECP)<sup>142</sup> will also be formulated to serve as the national comprehensive framework on EE&C programs detailing sectoral targets and strategies, as well as a monitoring and evaluation scheme. The EE&C Act empowers the LGUs to develop and implement Local Energy Efficiency and Conservation Plan (LEECP) which should be aligned with NEECP. Likewise, an Energy Efficiency Conservation Office (EECO) will be established to oversee and monitor the implementation of EE&C plans and programs under the GEMP.

Among the salient features of the EE&C Act include the following:

- Categorization of establishments based on their energy consumption threshold as Type 1 (0.5 to 4.0 GWh annual consumption) and Type 2 (>4.0 GWh annual consumption);
- Designation of a Certified Energy Conservation Officer (CECO) for Type 1, and a Certified Energy Manager (CEM) for Type 2;
- Development and compliance to Minimum Energy Performance (MEP) standards for the commercial, industrial, and transport sectors, and energy-consuming products covering appliances, lighting, electrical equipment, and machinery, among others;
- Development and enforcement of a mandatory energy efficiency rating and labeling system for energy-consuming products (i.e. air-conditioners, refrigerators, lighting products and television sets), and performance labeling for vehicle manufacturers, importers, and dealers;
- Implementation of the Guidelines on Energy Conserving Design on Buildings for the construction of new buildings by the LGUs; and,
- Submission of the Annual Energy Consumption and Conservation Report (ECCR) by the 15<sup>th</sup> of April of every year to the DOE.

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<sup>141</sup> In 2019, recorded energy savings from the implementation of GEMP was at 5.112 GWh of electricity, equivalent to PhP 49.5 million in monetary savings. This also reduced about 2,617 tons of carbon dioxide emission from the environment

<sup>142</sup> The DOE has been implementing the National Energy Efficiency and Conservation Program since 2004, which covers Information, Education and Communication Campaign, Energy Labelling Program, Energy Management Program and GEMP, among others.

In the MEP and labelling provisions, no manufacturers, distributors and importers are allowed to sell energy-consuming products (covered by the Philippine Energy Labelling Program or PELP) unless t compliant with MEP and labelling requirements.

## 2. Cross-Sectoral Energy Performance and Rating Systems

The EE&C Act sets up a data collection mechanism where large energy-consuming sectors (commercial, industrial and transport) shall submit to the DOE their respective annual consumption reports. To effectively implement this provision, a comprehensive data collection framework shall be required to guide how data will be managed and monitored. Moreover, a National Energy Consumption database will be developed to serve as a reference in the formulation and adoption of MEP across the different sectors.

In 2020, the **Memorandum Circular 2020-05-0001** was signed specifying the Rules on the Submission of the Annual Energy Consumption Report for Designated Establishments in the Commercial, Industrial and Transport Sectors.

The DOE, in partnership with the DPWH, is updating the Philippine Green Building Code, specifically the Chapter on Energy Efficiency in Buildings which comprises sections on the building envelop and the mechanical and electrical systems. On the other hand, the Building for Ecologically Responsive Design Excellence (BERDE) *Green Building Rating (GBR) System* was expanded and enhanced through the partnership between the DOE and the Philippine Green Building Council (PGBC). This will ensure the use of efficient technologies and measures in building design, such as the development of appropriate building measures for roofs and insulation to bring down heat from the atmosphere, thereby reducing demand for cooling.

Benchmarking and ratings for building information and reporting are also in the Roadmap. This involves the monitoring of energy consumption and collection of relevant data, which can be useful in the formulation of new policy directions by the government to enhance energy efficiency measures.

## 3. Integration of EE&C at the Local Government Units

The DOE, in partnership with the Development Academy of the Philippines (DAP), aims to assist LGUs in integrating concrete EE&C programs, projects and supporting policies into their respective local development plans and LEECPs.

Its objectives are to: (1) promote mainstreaming of EE&C in all energy-demand sectors at the LGU level; (2) guide the LGUs in developing EE&C action plans and policies for implementation and integration into



Mainstreaming Energy Efficiency and Conservation at the LGU Level



Baguio City

their local development plans; and (3) monitor and document best practices of LGU-related EE&C measures.

In 2018<sup>143</sup>, the DOE conducted six (6) seminars on mainstreaming of EE&C at the LGU level in the cities of Cebu, Davao, Batangas, Baguio and Dumaguete.

#### 4. Market Demand Scoping

The DOE's energy database system for determining market demand shall be strengthened to comply with the provision of the EE&C Act. Energy consumption data/information of energy-consuming sectors that were submitted to the DOE shall be used to establish a sectoral MEP. The EE&C Act strengthened the requirement of manufacturers, distributors, importers, and dealers of electrical appliances, and other energy consuming products to comply with the Philippine Energy Standard and Labeling Program (PESLP).

To ensure adherence to the PESLP, continuous coordination and cooperation activities were carried out with private organizations. These organizations include: Energy Practitioners Association of the Philippines (ENPAP), Institute of Integrated Electrical Engineers (IIEE) of the Philippines, Cement Manufacturers' Association of the Philippines, Semiconductors and Electronics Industries of the Philippines, Inc., Chamber of Automotive Manufacturers of the Philippines, Association of Vehicles Importers and Distributors, Inc., and Certified/Accredited Energy Service Companies (ESCOs).

The PESLP shall be implemented by the DOE covering the following household appliances with their corresponding MEPs: (1) *air-conditioning units* with cooling capacity below 3.33 kW and with mandatory MEP of 3.08 Cooling Seasonal Performance Factor (CSPF), for units with cooling capacity between 3.33 and 9.99 kW, the MEP is 2.81 CSPF; (2) *household refrigerators* ranging from 113 to 600 liters – for Single Door Direct Cooling, the MEP is 200 Energy Efficiency Factor (EEF), for Two-Door Direct Cooling, the MEP is 230 EEF, and for Frost-Free units, the MEP is 180 EEF; and (3) *Lighting Products*, such as compact fluorescent lamp (CFL), linear fluorescent lamp (LFL), fluorescent circular lamp (FCL), ballast and light emitting diode (LED) lamps), which have varying MEPs based on a per specification as provided for under the DC 2020-06-0016 (Minimum Energy Performance for Products or MEPP). On program expansion, the DOE conducted market characterization surveys for electric fans and washing machines.

For the government sector, relevant data on the implementation of GEMP is obtained from the government entities (NGAs, LGUs, SUCs, GOCCs, and GFI or government financial institutions).

#### 5. Information, Education and Communication (IEC) Campaign on EE&C Practices through E-Power Mo

One of government's crucial responsibilities is to promote energy awareness and disseminate useful information on energy efficiency measures and recommended practices for all economic sectors. The **E-Power Mo** is the DOE's vehicle to empower energy consumers and inform the public on available options for a wiser and more intelligent use of energy. It summarizes the government's energy policy agenda on the following:

- **E-SAFETY** – Undertake safety and saving measures through energy efficiency;
- **E-SECURE** – Secure the delivery of quality, reliable and affordable energy services;

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<sup>143</sup> In 2019, the DOE conducted seminars for the LGUs on the development of their respective LEECPs.

- E-DISKARTE – Empower consumers through a wide range of options in utilizing conventional and alternative energy sources.



Series of E-Power Mo campaigns

A total of 51 IEC events were conducted nationwide with the theme “Energy Efficiency and Conservation.” The IECs were also conducted for E-Power Mo events in Pasay City, Cebu City, Davao City, Clark, Pampanga, Baguio City, Tagaytay City and Iloilo City, and Energy 101 for media in Tagaytay City and Iloilo City. The DOE was able to educate various sectors of society to make them aware of the energy efficiency programs of government with the objective of managing energy supply and reducing the country’s dependence on imported fuel sources.

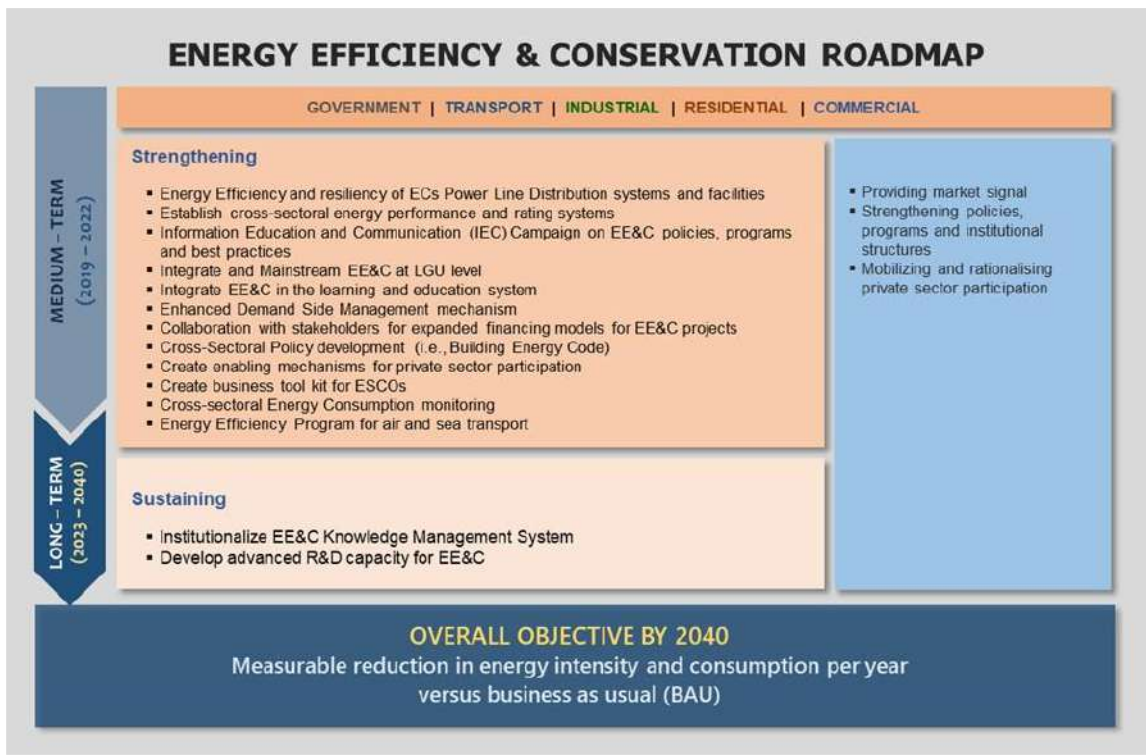
The DOE, using the EU-assisted project on Access to Sustainable Energy Programme, conducted a series of fora on the EE&C Act and its Implementing Rules and Regulations (IRR) to promote LGU participation in EE&C initiatives, particularly in developing and implementing LEECP, instituting an energy management program, strengthening the GEMP, concessional financing packages from government financing institutions (GFIs) for EE&C projects and providing incentives through the Local Investment Incentives Plan. Likewise, awareness-raising materials were developed in 2019 to promote the EE&C Act and how it impacts consumers and energy stakeholders.

## B. PLANS AND PROGRAMS

The DOE seeks to reduce inefficient energy consumption in all sectors (including the government) in order to achieve a sustainable, secure, sufficient supply of energy and sustain modernization and development in the sector.

The *Philippine Energy Efficiency and Conservation Roadmap* provides the framework outlining the drivers and sectoral targets to be undertaken in support of the country’s economic development goals through the efficient use of energy. The revised Roadmap for the planning period lines up priority initiatives and strategies of the government in the medium-to long-term, as shown in *Figure 93*, to achieve the overall objective of making EE&C a “Way of Life” for the Filipinos.

Figure 93. ENERGY EFFICIENCY & CONSERVATION ROADMAP



**Medium-Term**

**1. Energy Efficiency and Resiliency of Electric Cooperatives’ (ECs) Power Line Distribution Systems and Facilities**

A detailed strategy setting out appropriate mechanisms on energy efficiency and resilience of the ECs’ power line distribution systems and facilities shall be formulated. As most interruptions result from damages in the distribution system (caused by weather disturbances, accidents or aging equipment), power figure system’s reliability and efficiency must be improved through enhanced strategies to improve resiliency against any events that can cause long duration outages. A baseline study shall be conducted on energy efficiency, reliability and resiliency of the system. The resiliency and modernization of distribution systems and facilities are critical in sustaining the use and consumption of energy by all economic sectors.

**2. Cross-sectoral Energy Performance and Ratings**

The EE&C Act provides a policy framework on the implementation of PELP. With the approval of IRR of the EE&C Act, implementation of the PELP (which used to be under the Department of Trade and Industry (DTI) as prescribed in the Consumer Act of 1992 (RA 7394)] will now be transferred to the DOE.

The DCs for the PELP (DC 2020-06-0015) and the Minimum Energy Performance of Products (DC 2020-06-0016) were approved in June 2020, superseding DC 2016-04-0005. The Implementing Guidelines of the said Circulars shall undergo public consultation before being finalized.



Implementation of the labelling program itself will start with the opening of the DOE Online PELP Platform by the end of 2020 covering company registration, product registration and energy label issuance.

The DOE will monitor compliance of the manufacturers, importers, dealers and retailers to the PELP through market monitoring (label inspection) and verification activities by way of testing the actual market samples.

Aside from the mandatory energy efficiency and labeling system for energy-consuming products, such as room air conditioners, refrigeration units, television sets and lighting products, the Fuel Economy Performance Labeling requirements for transport vehicles will also be implemented covering all manufacturers, importers, distributors and dealers of vehicles in the country.



The draft policy on Particular Product Requirements (PPR) is currently for comments of the energy stakeholders and the general public. The said PPR will help energy consumers choose wisely in buying electric appliances, such as refrigerators, air-conditioning sets, lighting products and television sets that are energy-efficient.

### 3. IEC Campaign on EE&C Policies, Programs and Best Practices

Dissemination of information on energy efficiency policies, programs, best practices and other initiatives shall be conducted regularly through the most effective channels like social media, mass media and localized events.

The *Roadmap* embodies action plans that will be widely communicated so that government objectives are made known, as well as enable the private sector partners to recognize their roles and contributions towards the coordinated action on energy efficiency.

### 4. Integrate and Mainstream EE&C at LGU Level

The integration and mainstreaming of EE&C at the LGU level will be a continuing program within the planning horizon as stipulated in the EE&C Act. The LGUs (except barangays), through their respective EECOs and Planning Development Offices (PDOs), will have to develop and implement LEECPs to be incorporated in the local development plans.

Related activities include target monitoring and walk-through energy audits of selected LGUs per region. Monitoring of lighting, air conditioners and other equipment will also be conducted at the LGU level in partnership with DAP.

### 5. Integrate EE&C in the Learning and Education System

The DOE has strengthened collaboration with the Department of Education (DepEd), Commission on Higher Education (CHED) and Technical Education and Skills Development (TESDA) for the

inclusion of EE&C in the school curricula. Relatedly, several IEC's will be designed for educational campaigns. Aside from these, other activities include teachers' training, and stronger linkage with the Environmental Education Program of the Department of Environment and Natural Resources (DENR).

During the 2<sup>nd</sup> quarter 2020, a draft Memorandum of Agreement (MOA) between the DOE and TESDA on the CECO Training Regulation Development is being circulated for comments. Under this MOA, the TESDA (in collaboration with the DOE, CHED and the Department of Science and Technology or DOST) shall develop training regulations for certifications of energy managers and EE&C officers. This will also ensure promotion of energy efficiency practices through TESDA's technical-vocational education and training programs.

#### **6. Enhanced Demand Side Management Mechanism**

Implementation of the Demand Side Management (DSM) Program, specifically for large energy consumers, is mandated under the DC 2014-08-0014. This policy enjoins all electricity-consuming sectors to implement DSM programs and other conservation measures. In compliance with EE&C Act, the DSM will be strengthened and extensively applied over the planning horizon. Lower tariff rates could be imposed during off-peak hours, while higher rates will be given during peak hours to encourage less power usage during periods of high demand.

#### **7. Collaboration with Stakeholders for Expanded Financing Models of EE&C Projects**

The DOE will facilitate the execution and promotion of successful case studies that demonstrate the procurement of energy services and the financial model used especially in the public building sector as part of capacity building efforts for ESCOs. Along with this, a template contract on government energy efficiency project (GEEP) was also developed.

#### **8. Cross-Sectoral Policy Development (i.e., Building Energy Code)**

The development of a more energy-efficient commercial, industrial and transport sectors requires the support and participation of relevant stakeholders involved in developing policies that embody appropriate measures and effective strategies. For instance, sectoral policy development in the commercial and industrial sectors is necessary toward the effective transition to a more energy-efficient building infrastructure. Inclusion of efficiency measures in the Philippine Green Building Code can create large-scale impact based on existing Guidelines for Energy Conserving Design of Buildings. This involves strong enforcement, collaboration and coordination in the policy making process.

Further, the DOE shall develop a web-based online reporting platform on energy consumption for all designated establishments with an annual energy consumption starting from 100,000 kWh and above in compliance with their reportorial obligation under the EE&C Act.

#### **9. Smart Grid by 2040**

The DOE looks forward to its long-term vision of transitioning the energy sector into a smart grid by 2040. In addition to improving grid reliability, efficiency and resiliency, smart grid technologies will empower consumers allowing monitoring and management of energy consumption and promotion of new and emerging technologies (such as electric vehicles, net metering, smart monitoring equipment and appliances), as well as the development of smart homes and cities incorporating smart building technologies and home automation systems.

In 2015, MERALCO rolled out its Smart Meter Program starting with pre-paid meters within its franchise area. This allows customers to monitor their electricity consumption, allowing them to budget their consumption and expenses.

The DOE is conceptualizing a policy on Smart Homes. In line with this, the issuance of a DC on Building Energy Code for Low Rise Residential Building is being considered based on the guidelines set by the Department. Likewise, another policy is being formulated for buildings with a threshold energy consumption of 100,000 kWh per year and above (high-rise condominiums).

#### **10. Create Enabling Mechanisms for Private Sector Participation**

As a support for the realization of **AmBisyon 2040** and **Dutertenomics** in the country's quest to realize the "Golden Age of Infrastructure, the DOE recognizes that for a secured energy future, government must provide the right environment for investments in energy infrastructures and efficient energy technologies.

Significantly, RA 11234 (the Energy Virtual One-Stop Shop Act) and RA 11032 (the Ease of Doing Business and Efficient Government Service and Delivery Act of 2018) were enacted to eradicate "red tape" and expedite business transactions in the public sector. EO 30, Creating the Energy Investment Coordinating Council and *Administrative Order 23 (AO 23)* titled "Eliminating Overregulation to Promote Efficiency of Government Processes" were also issued by the Office of the President to accelerate reforms in government processes so as to remove overregulation (i.e. redundant or burdensome processes to the public) in the public sector. As stated in AO, timelines in the processing of energy projects under the EVOSS Act shall be strictly complied with.

Recognizing the private sector's role in promoting economic growth, the implementation of the foregoing laws and executive issuances will provide a conducive environment for investments, as well as create enabling mechanisms for private sector participation. An effective mechanism must be in place for private sector participation that would stimulate capital investments. Partnerships with the private sector through business organizations like the Association of the Chamber of Commerce and Industry will have a pivotal stake in the implementation of key initiatives of the government. Fora, where project financings are discussed, could also be another pertinent platform for dialogues and knowledge sharing for investment opportunities in EE&C related projects.

#### **11. Create the Business Toolkit for ESCOs**

The participation of the ESCO industry in the energy efficiency market is vital in accelerating the promotion of energy efficient technologies in large energy consuming industries (more than 4 million kWh per year). To further enhance ESCOs crucial participation in the energy sector's quest for energy efficient industries, a business tool kit shall be created and adopted by the DOE under the NEECP. Energy data of ESCOs will be compiled, including assessment of their performance to determine the implementation of best practices. The said information is required for submission to the DOE every three (3) years prior to their application for renewal of ESCO accreditation.

#### **12. Cross-sectoral Energy Consumption Monitoring**

A comprehensive data collection and management platform must be considered for the effective monitoring of activities, as well as to check on whether intended results or objectives are achieved. Likewise, an appropriate monitoring and evaluation system will have to be established whereby a

data collection system is enhanced through improved indicators and reporting, as well as dissemination of performance results to stakeholders.

### 13. Energy Efficiency Program in Air and Sea Transport

The energy efficiency and conservation program toward an efficient air and sea transport system is an innovative initiative highlighted in the revised Roadmap.

Under the EE&C Act, the air and marine transport sectors are now required to submit reports to the DOE on their specific energy consumption, and other relevant details in order to establish a MEP specific to these sectors. The MEP for the transport sector will be introduced in a time-phased manner to keep pace with best practices internationally.

### 14. Policy Development in the Medium-term

The DOE is working on other pending policies to make EE&C a “game changer” in terms of lowering energy demand, increasing energy security and improving the country’s productivity.

#### Pending Policies

- The DC on the Guidelines in the Administration, Classification and Certification of Energy Service Company (ESCO)
- The DC on the Guidelines for the Assessment, Registration and Certification of Energy Conservation Officer, Energy Manager and Energy Auditors
- IAEECC Resolution No. 2. Adopting the GEMP Guidelines
- The DC on the Guidelines for the Endorsement of Energy Efficiency and Conservation Projects to the Board of Investments for Fiscal Incentives
- The DC on Prescribing the Guidelines of the Philippine Energy Labeling Program (PELP) for Compliance of Importers, Manufacturers, Distributors and Dealers of Electrical Appliances and other Energy-Consuming Products (ECP) Implementing Guidelines

### Long-Term

#### 1. Institutionalize a Knowledge Management System

The DOE shall institutionalize knowledge management practices in order to capture, retain, and share EE&C related information with all relevant stakeholders as required by RA 11285 and its IRR. To sustain this program, the DOE shall develop a repository of knowledge and resource database to facilitate retrieval and for sustainability purposes as it shall keep linkages with various economic industries, relevant government agencies, academe, non-government organizations, professional organizations, research institutions, among others.

#### 2. Develop the Advance Research and Development (R&D) Capacity

The conduct of R&D programs is vital for advancing energy-efficient technologies and practices in the country. For this, the DOE will continuously foster collaborative efforts to develop and update existing technologies through active participation to international fora and trainings related to R&D on EE&C.

## C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

As the country advances its energy efficiency standards in terms of new technologies and infrastructure projects (e.g., net zero buildings), the EE&C programs can support the government’s

economic stimulus programs through the creation of “green jobs and investments” specifically in the construction and manufacturing sectors.

Initiatives to promote the efficient use of energy have the potential to bring about socio-economic benefits for the country. When investments are channeled to manage energy demand, businesses become more competitive, which can then boost local employment. Likewise, production and manufacturing of energy efficient equipment and technologies are labor-intensive activities, thus creating more jobs for the labor market.

For the EE&C sector, the generation of investments and employment would focus on firms or businesses whose principal activity is the supply of energy efficient goods and services with the main goal of generating energy savings. The DOE’s accreditation of ESCOs is one area that contributes to such initiative. ESCOs are businesses that deliver energy efficiency upgrades to include design, development, and financing of projects that reduce energy consumption, as well as operating and maintenance (O&M) costs of their customers’ facilities. In 2018, the DOE accredited 26 ESCOs,<sup>144</sup> which brought in an estimated investment of PhP 1.62 billion, as well as employment for 390 personnel to implement EE&C projects.

Implementation of EE&C Act during the planning horizon will broaden the window of opportunity that generates more investments and employment in the EEC sector. For the commercial, industrial and transport sectors, the law provides the need to employ a CECO for Type 1 Designated Establishments, CEM for Type 2 Designated Establishments, and Energy Auditors. Both the CECO and CEM may either be chosen from within the organization or through external recruitment.

The CECO Certification System will be developed by the DOE and TESDA, while the certification and assessment system of CEM shall be established by DOE and CHED. These certification systems shall be conducted by the DOE-accredited training institutions using the training modules developed/approved by the DOE and the members of the technical working group (TWG).

For the national government agencies (NGAs, GOCCs, SUCs), the EE&C Act provides for the designation of the EECO for the development and implementation of the agency’s energy efficiency and conservation plans and programs (EECP) in accordance with IAEECC directives under the GEMP Action Plan. For the LGUs, a Local Energy Efficiency and Conservation Officer (LEECO) will be selected from the existing personnel, preferably from the Local Development Office.

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<sup>144</sup> In 2019, the DOE posted a total of 34 accredited ESCOs.

Figure 94. ENERGY SAVING TIPS

# ENERGY SAVING TIPS

### REFRIGERATOR

Sa pagbibig ng refrigerator hangin ang Energy Efficiency Factor (EEF) label na ipapakita sa unit.

Maa rin itong makatipid sa enerhiya sa mas mababang EEF, mas mababang at mas wastang sa konsumo ng kuryente.

Humang pagpapal nangal ng label sa 1/2 pagpapal ang yuko sa freezer.

Panatilihin malinis sa walang sirang ang gasket.

Panatilihin malinis ang paglalagat ng condenser coil. Ang yuko sa inverter-type ng mababang EEF.

### PLANTS

Magkaroon ng salubong aron sa isang lugar, lung lung sun pagpapal ang matatag na pamamaraan.

Maraming green ang pamamaraan sa unang lung kulan malalang ang panatilihin sa malalang.

Unang pamamaraan ang makatipid na makatipid na diwa at ang matatag upang ang matatag na mga plants, matatag alitan sa salubong, ay laban na magamit.

### E-POWER MO

**TIPID TIPS SA BAHAY**

Sa bahay o sa opisina makatipid tayong sa paggamit ng kuryente at bayarin. Narito ang mga paraan:

**We have the Energy Ability.**

Tamang pag-ingat, pag-aalaga, at disastre.

My abilidad tayong mapangalagat ng paraan sa isang mga pangangalagan ang Enerhiya ng Ating Bayan.

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### LIGHTING MANAGEMENT

Turn off all unnecessary lights.

Use natural (daylight) lighting to maximum advantage whenever possible.

Integrate daylight with electric light systems. Ensure that lights in areas where natural daylight is separately switched.

Clean lamps and luminaires regularly to maintain the required illumination level.

Regularly clean or, if possible, repaint surfaces, such as walls, ceilings and furniture with light colors. This assures that more light will be reflected in work areas, thus reducing the need for artificial lighting.

Reduce exterior lighting to the lowest acceptable level for security purposes.

Reduce or omit the use of outdoor lighting for decorative and advertising purposes.

Use the most efficient light sources available. Consider replacing incandescent lamps (IPL) with either Compact Fluorescent Lamps (CFL) or Light Emitting Diodes (LED). In the case of Linear Fluorescent Lamps, consider to replace T12 (40 watts) with T5 (28 watts) or with lower kW LED.

Schedule janitorial services to overlap with off-hours so that lights may be turned off earlier.

Consider the scheduling of duty rotations of night.

### AIR CONDITIONING

Keep all doors and windows closed when the air conditioning system is on.

Clean filters, fans, belts, cooling coils, ducts, etc., regularly.

Clean the filters at least once a month to maximize air flow through the units.

Do not lower the thermostat setting more than recommended. The prescribed thermostat setting for air-conditioned buildings is 78° F (25.5°C).

Turn off AC units in any room not being used.

Turn off computers and other heat-emitting equipment when not in use.

Minimize infiltration (leaks or leaking in) and exfiltration (leak or leaking out) by repairing deteriorated windows and installing automatic door locks.

For buildings with big glass areas or windows which are facing direct sunlight, consider installing window films or solar heat while still transmitting visible light. This can reduce solar heat gain up to 75%, reduce the cooling load. Tinting also reduces glare and fading due to ultra-violet radiation.

If possible, put sun shading such as plants, overhangs, awnings or shutters in windows which are facing direct sunlight.

### ELEVATOR OPERATION

If the building has two or more elevators, operate all elevators only in the morning when majority of the regular office hours in and out before the end of the regular office hours. In between only one elevator may be used.

For high-rise buildings with heavy people traffic, operate the elevator such that each unit will serve even-numbered floors. Another option is to have one elevator serve the first half of the floors while the other serves the second half.

If possible, start elevator service at the third floor.

Encourage people to use the stairs for one or two flights.

**We have the Energy Ability.**

### Air conditioners

If you intend to leave the room for a long time, turn off your air conditioner. Keep the room temperature at 25°C.

Check air conditioning unit with high Energy Efficiency Ratio (EER) i.e., inverter type. A unit with higher EER has a more efficient motor than the one with lower EER and consumes less electricity.

Use a small electric fan to spread cool air around your room. This prevents the cool air from "layering" or settling to the floor.

Turn off unused lights and other appliances that give off heat. Lighting is also one of the cooling loads of air-conditioning unit. Use low-wattage but efficient lamps like LED.

Replace incandescent bulbs (IPL) with LED. Most of the energy consumed by IPL is converted to heat and only 20% is used as light source. Illumination of 30-watt IPL is equivalent to 5-watt LED.

### Refrigerators and Freezers

Defrost coils and freezers regularly. More than an inch build-up of frost puts up an extra load on the compressor motor.

Check refrigerator if it is not closing or cooling because of a leaking gasket. Test the gasket by closing the door on a piece of lit lit slip of cloth. If the lit slip cloth when you pull on it, either the gasket needs a replacement or the door needs adjustment.

Prepare spacing and closing of coils, contributes to frost or ice build-up and causes compressor motor to work overtime. As much as possible, keep the door closed.

Don't set the thermostat colder so get it started on the theory that it will freeze faster.

Choose the right size or capacity of refrigerator suitable to your need. Large capacity of refrigerator compressor that requires more power to run.

Choose a refrigerator with high Energy Efficiency Ratio (EER). A unit with high EER has a more efficient motor than the one with lower EER and consumes less electricity. Inverter type refrigerator has high EER.

### Kitchen Appliances

Do not boil water in an open pot. Always clean range top, burners, and reflectors. Don't reduce heat transfer. Switch the electric stove to "low" when food begins to boil.

Turn off electric stove shortly before cooking time is up. The heating element will stay hot enough to finish the job without using more electricity.

Never put small pans on large heating elements (on electric stoves) or big burners (on gas stove). Flame or heat that exceeds the diameter of the pan is lost in the air.

Have all appliances ready when cooking to avoid frequent switching.

### TIPS PARA SA DRIVER NG SASAKYAN:

Makatipid ng 5-10% sa konsumo ng gasolina kung may sapat na hangin ang gulugug.

Mas mababang pagpapal ng gasolina sa unang 3 kays sa gab. Kays sa tanghali.

Mas mababang pagpapal ng gasolina sa unang 3 kays sa gab. Unimay sa trapiko sa pamamagitan ng paggamit ng alternative routes, kays sa tanghali.

Mas mababang pagpapal ng gasolina sa unang 3 kays sa gab. Iwasan ang bigat ang pagpapal o pagpapal sa dam.

Ugaling maging alerto sa kabit.

Hangga't maari huwag palayagan ng ibang sasakyang nakatigil sa isang mababang pagpapal ng gasolina sa unang 3 kays sa gab.

Hangga't maari huwag palayagan ng ibang sasakyang nakatigil sa isang mababang pagpapal ng gasolina sa unang 3 kays sa gab.

Iwasan ang aksapal.

Isaang mababang pagpapal ng gasolina sa unang 3 kays sa gab.

Magkaroon ng pasahero o ng mga gaganap na mababang pagpapal ng gasolina. Ang pagpapal ng labay ay mas makatipid sa gasolina kays sa isang sasakyang nakatigil sa isang mababang pagpapal ng gasolina sa unang 3 kays sa gab.

Ugaling pagpapal ng gasolina sa unang 3 kays sa gab.

Ugaling pagpapal ng gasolina sa unang 3 kays sa gab.

Ugaling pagpapal ng gasolina sa unang 3 kays sa gab.

### The Energy Label Guide

Check whether the brand and model of product match the information on the label.

his refers to the net total space inside the unit available for storage of food.

This indicates the energy consumption of the model per 24 hr as tested under standard test conditions.

Use this formula to estimate the daily cost of operating the unit and compare it with other brands with similar storage volume.

This shows the energy consumption of the model as stated in the top-right corner of this energy label.

This is the cost of energy in your area. Your monthly electricity bill will give a good estimate of the power rate.

Example: kWh Used = 500 kWh, Net Bill Amount = ₱4,150.00

Net Bill Amount

Energy Cost = kWh Used x ₱8.30/kWh

- When buying a new refrigerator, consider a unit that sells you a need and with higher Energy Efficiency Factor (EEF).
- Don't leave the refrigerator door open longer than necessary.
- Defrost your refrigerator regularly. Frost acts as an insulating blanket, which causes the motor to work overtime, resulting in increased power consumption.
- Cool food to room temperature before storing in the refrigerator. Placing warm food in the refrigerator increases the temperature inside.
- Cover liquids and wrap food you are storing, otherwise, moisture released inside the refrigerator will cause the motor to work harder than normal. The moisture is the source of frost.
- Place the refrigerator far enough from the cooking stove or gas range so that it will not be affected by the heat generated while cooking. Install it where air can circulate freely around it.
- Don't overcrowd your refrigerator. This interferes with air circulation and overworks the compressor.
- Check refrigerator if it is not cooling its cool because of a leaking gasket. Test the gasket by closing the door on a piece lit lit slip of cloth. If the lit slip cloth when you pull on it, either the gasket needs a replacement or the door needs adjusting.
- Clean the compressor units and condenser of the refrigerator periodically following manufacturer's directions.

### ENERGY SAVING TIPS

#### CARPPOOLING Program

A carpool consists of three or more people that commute to work or other destinations in a private vehicle in which members work out their own arrangements on who drives and how often, schedules, and payments for gas and maintenance.

#### PARK & RIDE Program

Park and ride offers transport options that encourage the use of public transport such as the MRT and LRT to help lessen traffic congestion at the same time provide seamless journey for the travelling public. Accessible or strategic sites will be provided near the stations of the public transport for the vehicle owners to park their units and ride to and from their destinations, using the identified transportation means.

#### CARLESS DAY Program

When are we carless? It is when we are not conscious of the environmental impact we create while using our cars. However, we have a smaller ecological footprint if we share our cars with others on our way to work and vice versa!

This fuel conservation measure that encourages commuters to burn calories instead of fossil fuel, reduce traffic congestion and air pollution, and leave the car at home one day. The motorist will avail instead of the public transport (jeppeng, buses, LRT, MRT) or may ride/share during their carless day.

#### PARK & PICK Program

Park and Pick Program encourages drivers, particularly taxis, to park only at designated places or sites. They will not be allowed to just roam around commercial complexes and mall areas to pick up passengers. Passengers, on the other hand, should proceed only to designated places for their taxi ride.

#### PARK & WALK Program

Walking instead of riding is another option to save on fuel and let the vehicle owner realize that walking a distance is a more healthful option that will result to less vehicle emission, preservation of a healthy Mother Earth. A short distance walk is a better alternative than a heavy consumption of fuel for a short trip.

#### My CARLESS Day is FRIDAY

**"Don't be Carless, Go Carless"**



# Chapter VIII.

## ALTERNATIVE FUELS and ENERGY TECHNOLOGY

The Department of Energy's (DOE) continuing plans and programs in promoting alternative fuels and energy technologies (AFETs) remain as important measures in addressing the increasing demand of the transport sector and the high dependency on imported conventional fuels. Greater penetration of alternative fuels in the energy mix contributes to energy supply security and to reducing greenhouse gas (GHG) emission for improved air quality. Providing option for gradual replacement of fossil fuels with alternative fuels is one of the key strategies in meeting the country's Nationally Determined Contribution (NDC) to the Paris Agreement.

To expand and intensify promotion, the DOE formulated the Alternative Fuels and Energy Technologies Roadmap that envisions the successful adoption and commercialization of AFETs. This endeavor will be carried out through close coordination and collaborative partnership between the government and private sectors in providing the enabling mechanisms and building-up local capacities.

### A. ASSESSMENT

The roadmap provides a detailed outline of the strategic plans and actions required to create a country that is both efficient and environment-friendly in terms of energy utilization.

#### 1. Policy Issuances

As a policy-making body, the DOE's primal responsibility lies in the formulation of policies and programs to ensure sustainable, secure, sufficient, and accessible energy supply to support the country's overall economic development.

In the short-term and to harmonize AFET-related policies with inter-agency jurisdiction/concern, the DOE:

- Drafted a Department Circular (DC) prescribing the Policy Framework for the Development of the Fuel Economy Rating, Fuel Economy Performance, and Related Energy Efficiency and Conservation Policies for the Transport Sector and Other Support Infrastructures. This is an energy efficiency and conservation (EE&C)-related policy framework in the transport sector including the development and operation of electric vehicles (EVs) and electric vehicle charging station (EVCS) infrastructures. The said Circular is anchored on the Energy Efficiency and Conservation Act of 2019.

- Signed four (4) Memoranda of Agreement (MOA) and 36 Deeds of Donation with qualified local government units (LGUs) and national government agencies (NGAs) in Regions I, II, III V, IV-A, IV-B, V, VI, ARMM and the National Capital Region (NCR) regarding the deployment of 3,000 electric tricycles (e-trikes) under the Market Transformation through the Introduction of Energy Efficient Electric Vehicles Project.
- Signed 15 MOAs and Deeds of Donation with the NGAs and offices for the introduction of next generation vehicle package (85 units) under the Japan Non-Project Grant Aid (NPGA). The vehicle package consisted of for four EVs, four plug-in hybrid EVs (PHEV), 32 hybrid EV (HEV) sedans, and 45 HEV patrol cars. The beneficiaries include the Office of the President (OP), Department of Finance (DOF), Department of Foreign Affairs (DFA), Department of Budget and Management (DBM), National Economic Development Authority (NEDA), Department of Interior and Local Government (DILG), Department of Science and Technology (DOST), DOST-Philippine Council for Industry, Energy, and Emerging Technology Research and Development (DOST-PCIEERD), Department of Trade and Industry (DTI), Department of Tourism (DOT), Department of Environment and Natural Resources (DENR), Department of Transportation (DOTr), Philippine National Police (PNP), Philippine Information Agency (PIA), Office of Civil Defense (OCD), and PNP Region VIII.
- In support of the EVs program, charging stations were put in the following LGUs and national government Agencies/Offices (*Table 75*).

**Table 75. LIST OF LGUS/GOVERNMENT AGENCIES WITH CHARGING STATIONS FOR E-TRIKE AND EVs**

E-Trike	EVs
1. Valenzuela City	1. Office of the President
2. Carmona, Cavite	2. Department of Energy
3. Biñan City, Laguna	3. Department of Science and Technology
4. Armed Forces of the Philippines	
5. Mandaluyong City	
6. Tuguegarao City	
7. Las Piñas City	
8. Quezon City	
9. Sagñay, Camarines Sur	
10. San Vicente, Palawan	
11. Odiongan, Romblon	
12. Brooke's Point Palawan	
13. Dumalneg, Ilocos Norte	
14. San Jose Del Monte, Bulacan	

- Facilitated the promulgation of the Philippine National Standards (PNS) 05:2019 - *Road Vehicles – Code of Conduct for the use of Liquefied Petroleum Gas (LPG)* by the DTI-Bureau of Philippine Standards (DTI-BPS) as revised and updated by the Auto-LPG Technical Working Group (TWG) under the supervision of the DTI- Technical Committee on Road Transport.
- Issued Department Order (DO) 2019-07-0015 titled “*Creation of the Special Financial Audit Team for the Alternative Fuels Fund (AFF) under the Natural Gas Vehicle Program for Public Transport (NGVPPT)*” on 18 July 2019. The DO stipulates that the constituted Audit Team shall conduct financial assessment and evaluation of the AFF covered under the following aspects: compressed natural gas (CNG) sales volume under the NGVPPT; amount collected by Pilipinas Shell Petroleum Corporation (PSPC) for remittance to DOE; and, other financial obligation and/or liability of PSPC that may arise under the current government accounting and auditing rules and regulations. Along with the issuance of DO, Special Order 2019-07-



0045 was also issued designating the DOE officials and employees responsible in carrying out the tasks of assessment and evaluation stated under the issued DO and to come up with an Audit Report for submission to the Office of the Secretary and the Commission on Audit (COA).

## 2. Legislative Advocacy

The DOE supports various legislations/policies to further boost the promotion and adoption of AFETs. Relatedly, the DOE issued two (2) legislative position papers to wit: Inputs on pending bills related to alternative fuels vehicles (AFVs) presented at the House of Representatives (HOR) – Ecology Committee, and inputs/position paper to the Implementing Rules and Regulations (IRR) of Excise Tax incentives for AFVs, particularly hybrid and pure EVs, under the Tax Reform for Acceleration and Inclusion (TRAIN) Act<sup>145</sup>.

## 3. Partnership / Leveraging

As a necessary step towards sustainable, more efficient, and environmentally safe alternative fuels and energy technologies, there is a need to access public and private sectors support, attract investments and establish partnerships to drive funding, financing, or competitive grants.

In 2018, the DOE entered into a partnership with the DOST-PCIEERD through a MOA on the conduct of research and development (R&D) for the Prototyping of PNS-compliant auto-LPG jeepney; Field Demonstration of EV Fast Charging; and Development of Minimum Energy Performance (MEP) Protocol for EVCS. A MOA was also signed between the two agencies in 2019 for the “Prototyping of Solar-Assisted Plug-in Electric Motor-Powered Boat.” Likewise in 2019, the DOE entered into a MOA with the Cavite State University (CvSU) on the conduct of various research and development activities for emerging energy technologies.

## 4. Prioritization / Promotion

The identified and promoted priority AFET activity in 2018 was the **Solar Assisted Plug-in Electric Motor-Powered Boat** for Tourist and harnessing Human Kinetics from gym and playground for electricity generation. The DOE, in partnership with the PIA, also promoted the identified AFETs through the conduct of 18 information, education and communication (IEC) campaigns and three (3) promotional events nationwide.

In 2019, the DOE conducted 22 IECs on the promotion of research, development, demonstration, and utilization of AFETs, as well as other promotional activities, specifically in NCR and Regions I, III and IV-A.










## 5. Technology Demonstration

To gain in-depth understanding of energy efficient technologies, the DOE organized a technology demonstration activity for the validation and pilot testing of AFETs with potential for commercialization. The conducted technology demonstrations are: a) **hybrid vehicles** using the combination of internal combustion engine (ICE) and electric motors as prime movers; b) **plug-in hybrid**, similar to the hybrid, but utilizing a battery charger that could directly charge from a power outlet; and c) **pure EV** using only electric motors as prime mover and could charge directly from power outlet.

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<sup>145</sup> Republic Act (RA) 10963 or the Tax Reform for Acceleration and Inclusion (TRAIN) Act.

Further, two technology assessments were completed to wit: the UP-ALAMAT's vehicle entry to the 2018 Shell Eco-Marathon whereby the recommendation for new body frame configuration and

TYPE	DESCRIPTION	EFFICIENCY	CO <sub>2</sub> EMISSION
<p><b>Hybrid Vehicles</b></p> 	<ul style="list-style-type: none"> <li>Combination of two (2) or more distinct power sources i.e, gasoline engine and electric motor</li> </ul>	<p><b>Gasoline:</b> 19.58 km/L</p> <p><b>Hybrid:</b>  31 km/L</p>	<p><b>Gasoline:</b> 152 g CO<sub>2</sub>/km</p> <p><b>Hybrid:</b>  86 g CO<sub>2</sub>/km</p>
<p><b>Plug-in Hybrid</b></p> 	<ul style="list-style-type: none"> <li>Power input can either be gasoline or electric</li> <li>Intelligent system maximizes efficiency of gasoline and electric</li> </ul>	<p><b>Gasoline:</b> 17.58 km/L</p> <p><b>PHEV:</b>  45 km/L</p>	<p><b>Gasoline:</b> 120 g CO<sub>2</sub>/km</p> <p><b>PHEV:</b>  41 g CO<sub>2</sub>/km</p>
<p><b>Electric Vehicles</b></p> 	<ul style="list-style-type: none"> <li>Powered by electricity through battery packs</li> </ul>	<p><b>Gasoline:</b> 29.23 km/L</p> <p><b>EV:</b>  51 km/L equivalent</p>	<p><b>Gasoline:</b> 101 g CO<sub>2</sub>/km</p> <p><b>EV:</b>  No Tailpipe emission</p>

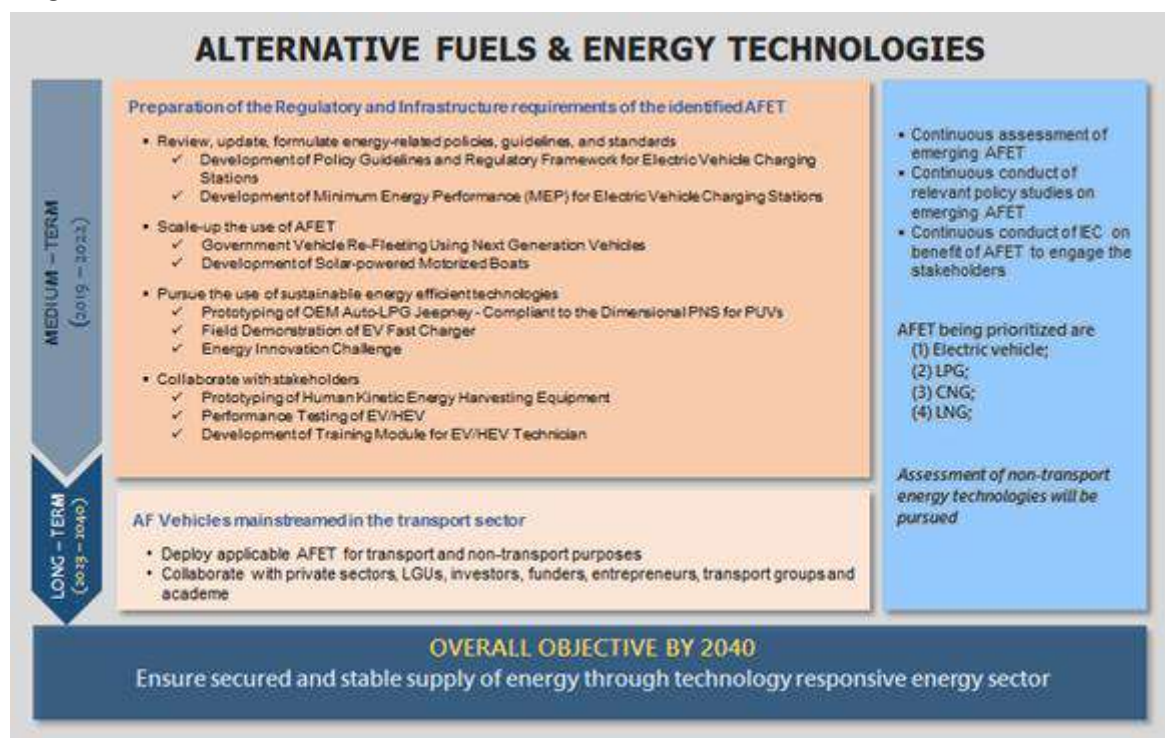
materials to reduce weight was made; and the Le Guider's (Philippines) locally converted EV Model was developed with the recommendation to improve the transmission gear ratio to match with the electric revolution per minute (RPM) and torque. In addition, six (6) alternative fuel technologies were also pre-screened for assessment:

- Waste Cooking Oil Filtration Technology developed by Renergy Inc. to power EV charging stations;
- Biogas Production Technology using organic waste feedstock developed by BioGTS Inc.;
- Vanadium Flow Battery Storage developed by SenTek Inc.;
- Presentation of Kanasawa Engineering Systems on E-Trike Development in the Philippines;
- EV Charging Stations Technology by Hong Kong Jade Corporation; and,
- EV Charging Stations Technology by Nomura Research Institute.

## B. PLANS AND PROGRAMS

With the overall objective of ensuring a secure and stable supply of energy through a technology responsive energy sector, the Roadmap addresses regulatory and infrastructure requirements for the promotion and deployment of AFETs. Specific targets are also identified for the medium- to long-term planning horizons (Figure 95).

Figure 95. ALTERNATIVE FUELS & ENERGY TECHNOLOGIES ROADMAP



### Medium-Term

#### 1. Review, update and formulate energy-related policies, guidelines, and standards

The DOE will establish concrete measures for the development of required infrastructure through a holistic approach to flourish the deployment of alternative fuel vehicles (AFV). The use of clean, sustainable, reliable, affordable, and safe energy forms is essential in the mobility of the economy. Thus, the promotion of EVs and the establishment of charging stations.

**Policy Guidelines and Regulatory Framework for EVCS.** Policy guidelines and regulatory framework will be developed for the establishment of required infrastructures (e.g. EVCS) and to support related laws in the mainstreaming of EVs. Through these guidelines, the DOE will be able to provide alternative energy that would power not only homes and industries but also sustain the electric vehicles industry in the future.

**Minimum Energy Performance for Electric Vehicle Charging Stations.** As required by law, all manufacturers, importers, distributors and retailers of energy consuming products (e.g. household appliances, lighting products, vehicles, etc.) shall comply with the MEP and the Philippine Energy Labelling Program (PELP) guidelines set by the DOE. The MEP is set for specific energy consuming products to include EVs and EVCS to be developed by DOE in consultation with relevant stakeholders involved in the manufacturing, sale and use of the products covered.

#### 2. Scale-up the use of AFET

**Government Vehicle Re-Fleeting Using Next Generation Vehicles.** Motor vehicles are indispensable for the efficient and effective performance and delivery of essential government services. Several policies support the purchase and modernization of government vehicles, such as Administrative

Order (AO) 14<sup>146</sup>, and Republic Act (RA) 11285 or the Energy Efficiency and Conservation Act of 2019 (EE&C Act)<sup>147</sup>. Anchored on the provision of Section 36, the DOE is working on the issuance of rules and regulations governing the re-fleeting of government agencies towards the use of AFVs, which specifically provide the guidelines on the procurement of AFVs for government offices. The AO 14 allows all government offices to procure in the most efficient and economic manner, motor vehicles that are cost effective, fuel-efficient and environment friendly.

Further, the EE&C Act highlights the government-wide program called the “Government Energy Management Program (GEMP),” which mandates all government agencies to reduce their monthly consumption of electricity and petroleum products through efficient use of electricity efficiency and conservation of fuels for government vehicles, among others. Under this program, the DOE is looking for a more economical and cost-effective approach towards fleet acquisition of vehicles/shuttles and the savings generated from GEMP can be used to purchase vehicles with preference for AFVs. This is responsive to the preference for AFVs of all government offices, such as biofuels, natural-gas, solar and electric power.

**Memorandum of Understanding (MOU) between the DOE and Star Scientific Limited in relation to the development of the Philippines’ transition to a hydrogen economy.** With more than half of the current power generation in the country sourced from coal with a strong reliance on the imports, the DOE plans to explore the use of hydrogen as a fuel for power generation, and its significant contribution to the domestic economy as a whole. Through this MOU, assessment of potential hydrogen production in the country will be undertaken to improve energy self-sufficiency level and contribute to the reduction of GHG emissions.

**Development of Solar-powered Motorized Boat.** A unique way to revolutionize sea transport is the development of solar-assisted motorized boat. The DOE entered into a MOA with the DOST-PCIEERD on the prototyping of the solar-assisted electric boat. To motorize our *bangka*, the project will study the sourcing of its power directly from the sun with the use of solar photovoltaic (PV) panels and storage batteries. The solar PV provides for a clean, sustainable, and environment-friendly mode of water transport.

### 3. Pursue the use of sustainable energy efficient technologies

Greater partnership with relevant stakeholders and recognizing the fundamental role of the private sector in pursuing the use of these energy efficient vehicle technologies is crucial in effectively implementing this government initiative.

**Prototyping of OEM Auto-LPG Jeepney - Compliant to the PNS for Public Utility Vehicles (PUVs).** In view of the escalating prices of petroleum products, the promotion of auto-LPG is being pursued as a viable option for transport fuel. Although it is a petroleum-based fuel, the price is much cheaper and stable as it is not considered as conventional fuel like gasoline and diesel. The promotion is aligned with the concept of providing continuous supply of fuels to the public, as well as lessening the impact of oil price fluctuations. Auto-LPG is clean and environment-friendly as it has lower GHG/toxic emissions compared with conventional fuels. However, safety and health concerns regarding its use need to be addressed. To discount health speculation on its use, the DOE conceptualized the prototyping of Original Engine Manufacturer (OEM) for auto-LPG jeepneys, which should be compliant with the PNS for PUVs in support of the PUV Modernization

<sup>146</sup> AO 14, s. 2018 provides for the Consolidation and Rationalization of the Rules on the Acquisition of Government Motor Vehicles, Adopting a Centralized System of Procurement Therefor, and for Other Purposes.

<sup>147</sup> Under the GEMP’s IRR, the use of alternative fuels in government vehicles is encouraged, among others, to help achieve at least 10.0 percent reduction in transport fuel consumption.

Program of the DOTr. The DOE will showcase the OEM auto-LPG jeepney to demonstrate the safe use and viability of auto-LPG as an alternative fuel for the public transport sector.

**Field Demonstration of EV Fast Charger.** Another continuing project is the Field Demonstration of EV Fast Charger. The DOE entered into a MOA with the DOST-Science and Technology on Energy Application (STEA) for showcasing and demonstrating technologies that could energize electric vehicles faster than the usual charging methods. As charging infrastructure is vital to the growth of EVs, the DOE, together with its partner institutions, shall continue to build capacities on fast charging options as a support for EV industry mainstreaming in the transportation and energy industries.

**LPG as fuel for farm equipment.** With the objective to expand the utilization of LPG as fuel source, the DOE in partnership with Isabela State University, has converted farm equipment engine to use LPG to lessen the carbon footprints in the agricultural sector, which is identified as one of the sectors that emit extensive amount of GHG. This will help in the agricultural operations and innovation of farm equipment for efficient and faster way of harvesting and processing agricultural products for countryside development.

**Energy Innovation Challenge.** To further develop AFETs, the energy sector will be more responsive to market conditions and current demand, with the goal of resorting towards more efficient technology evolution and innovation. This program is intended to ignite interest among stakeholders to create, design or conceptualize technological innovations on AFETs.

#### 4. Collaboration with Stakeholders

The role of stakeholders in all phases of technology development from conceptualization and design, up to the implementation stage is critical. Their involvement, be it financial, technical or advisory, is significant to the success of energy technology program implementation. To ensure the development and exploitation of new energy technologies, the DOE is collaborating with relevant stakeholders on the following programs:

**Prototyping of Human Kinetic Energy Harvesting Equipment.** This program tends to use ambient energy to provide electricity for small and mobile equipment sourced or generated from human motion. Energy harvesting is now a development in power sourcing as it is always available, requiring no fuel or any logistical processes. For this, the DOE is collaborating with concerned government agencies and academic institutions in securing consultancy services for the full development of this project.



Electricity from Human Kinetics

**Performance Testing of EV/HEV.** In compliance with the PELP and the MEP requirement as mandated by the EE&C Act, the DOE will continue to conduct performance testing of EVs in collaboration with DOST, UP-Diliman and the Cagayan State University. Performance testing is necessary to gather benchmark data for EV technology modeling and EV development programs, including the development of the required MEP.

**Development of Training Module for EV/HEV Technician.** To help sustain the EV industry, the development of effective training modules for EV/HEV technicians is highly significant. This module will help produce well-trained technicians to have the necessary skills to repair electric vehicles safely from basic maintenance to full diagnostic and repair.



DOE Team inspecting the Toyota Prius Hybrid Electric Vehicle

**Development of Emergency Response Protocol.** To ensure safety use of efficient AFVs (e.g. EV, HEV, PHEV, etc.), the development of emergency response protocol is needed. Together with the Bureau of Fire Protection (BFP), the response protocol will be adopted by the regional BFP sub-units to respond on the issues and concerns related to the AFVs, while maintaining its safety and reliability as alternative mode of transport.



Performance testing of E-trike in Cagayan Valley

### Long-Term

#### 1. Alternative Fuel Vehicle mainstreamed in the transport sector

To achieve the objective of mainstreaming of AFVs in the transport sector, the DOE will continue working on the following initiatives:

**Deploy applicable AFETs for transport and non-transport purposes.** As a long-term strategy, the DOE seeks to deploy applicable AFETs for transport to further decarbonize the sector and reduce dependence on oil. For non-transport purposes, the DOE shall also continue to identify and promote AFETs through collaborative efforts with relevant stakeholders for the effective mainstreaming of AFETs in the market.

**Strong collaboration with stakeholders** – government agencies, private sector, LGUs, investors, funders, entrepreneurs, transport groups and academe – shall be intensified to achieve greater adoption and commercialization of AFETs with full government support.

#### 2. Continuing Government Initiatives

**Assessment of emerging AFET.** Assessment of emerging energy technologies shall be undertaken regularly. The government shall then continue to encourage and provide support and cooperation to the private sector for investment generation across to maximize the benefits of alternative fuels, and advanced and emerging energy technologies.

**Conduct of relevant policy studies on emerging AFET.** To advocate and promote the use of AFETs, the DOE will strengthen research activities for its local adoption. This will come in the form of building up local capability for R&D and partnership with the DOST, state universities, and other research institutions.

**Conduct of IEC on the benefits of AFET to engage the stakeholders.** The DOE shall continue to conduct IECs to create greater awareness and appreciation of the importance of cleaner AFETs, and efficient utilization of energy. By mainstreaming and encouraging the public to resort to AFET, it creates a long-term benefit to the people and the environment.

### 3. Priority Alternative Fuels and Energy Technologies

Following are various AFETs that will be promoted within the planning horizon:

**Electric vehicles.** The EVs shall be continuously promoted by encouraging investments especially in after sales services such as charging stations, parts and supply service centers, among others, to make it more commercially competitive and be integrated in the transportation network.

In particular, the HEV utilizes an electric motor and an internal combustion engine that work together or separately to propel the vehicle, while simultaneously charging the battery. It is a reliable and efficient transportation that supports the objective of the government for a more efficient, cleaner, and sustainable mobility. Although there are some challenges in the infrastructure to support its development, the DOE continues to encourage investments from the private sector to advance expansion of the HEV industry.

**Auto-LPG.** This supports the use of LPG as a clean alternative fuel for transportation and other equipment. The DOE shall continue to validate performance of LPG as a fuel for vehicles and formulate standards and policies to ensure public safety and welfare of the public. Likewise, research and studies for other application of LPG shall be undertaken.

**Compressed Natural Gas.** The commercial viability of CNG shall be demonstrated, as well as its technical requirements, market demand, and impact of incentives and public acceptance to the public transport sector. Policies and various fiscal and non-fiscal incentives shall be formulated and provided to cover the standards regarding the vehicle, refueling station, gas cylinder, and gas quality to support the implementation of the program.

### 4. Assessment of non-transport energy technologies will be pursued

Evaluation, testing and validation of emerging energy technologies for domestic application, specifically in the transport sector shall be given utmost attention. Also, the evaluation and validation of the following non-transport energy technologies will be conducted:

- Smart control and sensors at home for energy savings;



Hybrid Electric Vehicle (HEV)

- Grass-based biomass fuel (Bugang/Napier) for domestic cooking to address deforestation and reduce indoor pollution; and
- Alternative fuel derived from waste rubber and plastics.

## 5. Infrastructure Support

The government institution partners – DOE, DOTr, DTI, DOST, DENR and Department of Public Works and Highways (DPWH) and other relevant agencies – are underway in the establishment of infrastructure support for the EV transport through close coordination and collaboration. Lawmakers have proposed bills to come up with policies, regulatory framework and incentives that will help sustain the development of the EV industry. The infrastructure measures will focus on following: a) development of dedicated parking lots with installed charging stations in every public and private establishments; b) installation of public charging stations at gasoline stations, public buildings and establishments; and c) provision of green routes or alternate lanes where EVs and other alternative transport such as bicycles, e-bikes, e-scooters will exclusively pass through.

There are now several opened bicycle lanes in Metro Manila cities where bicycles and e-scooters traverse. Plans and programs are in progress in the provision of bicycle lanes in existing and future road plans of the DPWH. The LGUs will be mandated to create or identify the feasible green routes in their local public transport plan. When realized, this alternative mobility option will be convenient to the growing number of local residents who consider shifting their transport mode to bicycles, e-bikes and e-scooters in going around town/city or travelling between home and work.

## C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

### Electric Vehicle Industry

The EV market in the Philippines is segmented into e-tricycles/e-trikes, e-bikes/motorcycles/scooters, e-jeepneys, e-quads, passenger EVs, and service vehicles. The market is projected to significantly grow over the next decade owing to the country's economic growth.

As a result of the intensive promotional activities and implementation of the DOE on the Market Transformation through Introduction of Energy Efficient Electric Vehicles (E-Trike) Project together with the vehicle manufacturing industry incentives of the DTI, the PUV modernization of the DOTr and the efforts of the LGUs to clean up air in their locality, the Project was able to catalyze the market by attracting 14 investors. These were formed from 2013 to 2019 and engaged in the business of electric vehicle manufacturing, assemblers and importers with a corresponding investment of PhP 562 Million (USD 11.3 Million<sup>148</sup>) and generated about 1,050 direct jobs supporting the creation of the electric vehicle industry in the country (Table 76).

With full coordination and support from the government and stakeholders on the EV industry initiatives, additional EVs are being envisioned by the Electric Vehicles Association of the Philippines (EVAP) to be on the road by year 2021 covering all types of EVs such as e-trikes, e-jeeps, e-shuttles, e-buses and e-cars for both public and private transportation as illustrated in Table 77.

<sup>148</sup> USD = PhP 50.0



**Table 76. GENERATED JOBS FROM E-VEHICLE COMPANIES**

No.	Company Name	Employment	Project Location	Region
1	BEMAC Electric Transportation Phils., Inc.	206	Carmona, Cavite	IV-A
2	Emotors, Inc.	25	Binan, Laguna	IV-A
3	Gerweiss Motor, Inc.	43	Malay, Aklan	VI
4	K.E.A. Industrial Corporation	24	Bacoor, Cavite	IV-A
5	Pangea Phils., Inc.	175	Carmona, Cavite	IV-A
6	Phil-Etro EV, Inc.	97	Carmona, Cavite	IV-A
7	PhUV, Inc.	97	Caloocan, Metro Manila	NCR
8	PinoyAko Corp.	26	Cainta, Rizal	IV-A
9	PinoyAko Corporation	8	Mandaue City, Cebu	VII
10	Prozza Hirose Manufacturing, Inc.	42	Cebu City, Cebu	II
11	Ropali-Teco Corporation	115	Subic Freeport Zone, Subic, Zambales	III
12	Terramotors Philippines Corp.	27	Calamba, Laguna	IV-A
13	Tojo Motors Corp	41	Sta. Rosa, Laguna	IV-A
14	Le'Guider International E-Trike Electronics Assembly Philippines, Inc.	124	Bacoor, Cavite	IV-A
<b>Total Jobs Generated</b>		<b>1,050 Jobs</b>		

Source: DTI-BOI 2019 data

**Table 77. NUMBER OF ELECTRIC VEHICLE REGISTERED (2019) and MARKET PROJECTION (2020-2021)**

Vehicle Type	No. of Units Per Year			Total
	2019***	2020****	2021****	
E-Trikes*	4,318	1,597	1,758	7,673
E-Quads**	71	50	55	176
E-Jeeps	89	70	80	239
Other EVs (e-Motorcycles, e-Truck, and e-Bus)	524	33	37	594
<b>Total</b>	<b>5,002</b>	<b>1,750</b>	<b>1,930</b>	<b>8,682</b>

Source: EVAP and Philippine Electric Vehicle Industry Domestic Market Projection

Notes: \* Inclusion of the 3,000 e-trikes under the DOE E-Trike Project

\*\* Defined as four-wheeled light electric vehicle for demonstration and non-commercial use

\*\*\* Registered number of EVs at LTO

\*\*\*\* Market projection for 2020-2021 is seen to be greatly affected by the ongoing COVID-19 pandemic and recovery in the EV market sales may come in the second semester of 2021

To achieve sustainable development of the industry, the DTI implements **Executive Order No. 226** or the “Omnibus Investments Code of 1987” which provides Income Tax Holiday of six years to a maximum of eight years for new registered pioneering firms that will engage in the business of EVs, Alternative Fuels Vehicles, charging stations and environment/climate change-related projects, as well as Duty Free importation of capital equipment, spare parts and supplies.

**Executive Order 488** (s. 2006) was also issued modifying the rates of import duty on components, parts and accessories for the assembly of hybrid, electric, flexible fuel and CNG motor vehicles to **zero rate**, thereby allowing EV manufacturers to import components at a more affordable cost.

The Department of Finance (DOF) through the Bureau of Internal Revenue (BIR) implements TRAIN Act, which provides excise tax incentives as follows:

- Pure EV will be fully exempt from the excise tax on automobiles; and,
- Hybrid Vehicles will be taxed 50.0 percent of the applicable excise tax rates on automobiles.

Also, the proposed **Senate Bill No. 1382 and House Bill 4075** will provide the national energy policy and regulatory framework for the use of EVs and the establishment of charging stations. This applies to the manufacture, importation, installation, utilization, and regulation of EVs, charging station, parts and components, and batteries. When enacted, this will provide a clear direction and related incentives to boost the EV industry.



# Chapter IX.

# ENVIRONMENTAL MANAGEMENT

Energy production and consumption produce greenhouse gas emission (GHG). These should be continuously balanced with sustainable the development of a growing economy. As such, the energy sector takes into account a sound environmental management as an integral part of the sector's strategic directions, specifically on strengthening consumer protection and promoting a low carbon future to achieve a sustainable development.

In support of President Duterte's "Build, Build, Build Program," sufficient energy supply must be ensured to meet the growing energy demand of the economy and achieve the government's economic goals. However, economic growth and rising energy requirement could result in greater environmental impacts if not managed conscientiously. Such environmental impacts can be reduced to moderate levels through stakeholders' commitments to environmental protection. The following are the best practices on environmental management in the country's energy sector:

- Integration of environmental issues into business decisions through the use of management systems;
- Integration of health, safety and environmental management systems;
- Consideration of all environmental components (air, water, land, people and biodiversity) in decision making at strategic and operational levels;
- Implementation of appropriate pollution prevention techniques, including the re-use and/or recycling of waste components;
- Evaluation of alternatives on a cost, benefit and risk bases that include environmental values;
- Minimization of resource inputs through efficiency measures; and,
- Innovation and improvement on environmental protection.

## **A. ASSESSMENT**

### **1. *The Philippines Environmental Impact Statement System and Environmental Impact Assessment Reports of Energy Projects***

The Philippines Environmental Impact Statement System (PEISS), established in 1979 through Presidential Decree (PD) 1586, requires project proponents to prepare and submit an Environmental Impact Statement (EIS) that describes the potential effects of a project on environment and the corresponding mitigating measures. It serves as a planning tool for incorporating environmental management measures in project design, as well as a means for

compliance with environment laws, such as: the Clean Air Act, Clean Water Act, Solid Waste Management Act, and Toxic Substances and Hazardous Waste Management Act.

Under Department of Environment and Natural Resources (DENR) Administrative Order (AO) 03-30<sup>149</sup> issued in August 2007, the PEISS categorizes projects or undertakings, including major expansion, rehabilitation and/or modification of existing projects, and resumption of projects that ceased operations for a long period based on the following:

- **Category A** projects or undertakings classified as Environmentally Critical Projects (ECPs), as they pose high risks or negative environmental impacts (e.g. energy facilities and infrastructure projects, power plants);
- **Category B** projects or undertakings classified as ECP under Category A, and significantly affect the quality of environment due to their location in an Environmentally Critical Area (ECA) – an ecologically, socially, or geologically sensitive area (e.g. renewable energy projects);
- **Category C** projects or undertakings, not classified under Category A or B, that intend to directly enhance the quality of environment or directly address existing environmental problems; and,
- **Category D** projects or undertakings that are deemed unlikely to cause significant adverse impact on the quality of environment. These projects are not covered by PEISS.

Categories A and B are required to secure an Environmental Compliance Certificate (ECC), which contains specific measures and conditions that must be met by the project proponent before and during operation of the project. All ECC applications should be accompanied by an Environmental Impact Assessment (EIA) Report in the form of an EIS, an Initial Environmental Examination (IEE) Checklist Report, an Environmental Performance Report and Management Plan (EPRMP), Programmatic EIS or Programmatic EPRMP. On the other hand, *Categories C and D* only need to obtain a Certificate of Non-Coverage (CNC) stating that the proposed project is not covered by the PEISS.

For the past 30 years of PEISS implementation, the DOE is actively participating in the continuous enhancement and/or improvement, specifically on the procedures and requirements in the conduct and review of EIA Studies and in the Environmental Compliance Monitoring and Validation Reporting. In the review and evaluation of the ECC application, the DENR-Energy Management Bureau (EMB) commissions experts who will form part of the EIA Review Committee, while the DOE expert serves as a resource person.

In 2018, ECC was issued to 28 coal-fired power plants, 23 oil-based power plants, eight (8) natural gas-fired power plants, nine (9) geothermal power plants, 29 hydro plants, 13 biomass power plants, six (6) wind power, 18 solar, two (2) petroleum refineries, and one (1) gas processing plant.

## 2. Environmental Compliance and Monitoring

The DOE regularly conducts environmental compliance monitoring of energy projects and facilities to ensure that social and environmental safeguards are effectively applied. This is done through the Multi-partite Monitoring Team (MMT), a required mechanism under the PEISS. Under DENR

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<sup>149</sup> This refers to DENR Administrative Order on the Revised Procedural Manual and Guidelines of PEISS under the PD 1586.

AO 2017-15, only Category A or environmentally critical projects are required to organize its MMT after its ECC is awarded, thus not all energy projects have MMTs.

The MMT aims to encourage public and/or stakeholders' participation and provide appropriate check and balance mechanisms in monitoring the development and implementation of projects. It is composed of representatives from the relevant government agencies, local government units (LGUs), non-government organizations (NGOs), and peoples' organizations (POs), the community, the women's sector, and whenever necessary, from the academe and other sectors. For some projects, the DOE has been nominated to solely lead or co-lead the MMTs.

The MMT activity is guided by the following objectives:

- Ensure compliance of project proponent with standards as stipulated in the Environmental Management Plan, Environmental Monitoring Plan, Social Development Plan, as well as other ECC conditions, and related permits;
- Share knowledge, experiences and provide recommendations to improve monitoring procedures;
- Assist in harmonizing the relationship of all stakeholders to ensure public and social acceptability of energy projects;
- Prepare, integrate and disseminate monitoring reports and submit recommendations to the DENR; and,
- Monitor Information, Education and Communication (IEC) activities.

The MMT is operationalized through the formulation of an annual monitoring plan that covers air and water quality, biophysical and socioeconomic monitoring activities. The DOE, as member of the MMT, participates in the environmental compliance monitoring and verification of various energy projects and facilities.

Table 78 shows the number of energy projects/facilities that have Environmental Management Plan (EMP), Environmental Monitoring Fund (EMF), Environmental Guarantee Fund (EGF), and the Environmental Management and Monitoring Plan (EMMOPs). The EMPs and EMMOPs cover four (4) segments – air quality, water quality, biodiversity and waste management, and people. Implementation of efficiency and conservation program is likewise incorporated in the EMPs and EMMOPs.

**Table 78. ENERGY PROJECTS/FACILITIES with EMP, EMF, EGF and EMMOPs**

Coal Power Plants	28
Oil Power Plants	23
Natural Gas Power Plants	8
Geothermal Power Plants	9
Hydro Power Plants	29
Biomass Power Plants	13
Wind Power Plants	6
Solar Power Plants	18
Petroleum Refineries	2
Gas Processing Plants	1
Coal Mines	5
Oil Exploration Companies	2
Gas Exploration Companies	1
Geothermal Production Companies	9

The EMF is a requirement upon the issuance of ECC to support the environmental management activities of the project, while EGF is the fund to cover potential public risk of the projects or undertakings, such as damage to life, health, property, and the environment requiring rehabilitation or restoration measures.

The DOE shall encourage energy projects that are not ECPs or those that do not have MMTs to take the initiative to establish multi-sectoral/multi-stakeholder activities to monitor their compliance to ECC conditions and permits. This is to promote a more transparent engagement of the energy sector to host communities. Likewise, it helps future energy projects to be supported and accepted by the stakeholders.

Energy projects and facilities are committed to integrate health, safety and environment management system (HSEMS) in their operations. These projects/facilities must also adopt existence international standards, such as the International Standards Organization (ISO) 9000 for quality management and the ISO 14000 for environmental management.

### 3. Pollution Control Technologies

The energy sector has been proactive in evaluating and introducing new engineering and operational techniques to prevent and reduce pollution. To prevent waste at its source, the energy facilities are equipped with the following pollution control systems and technologies, namely:

- Electrostatic precipitators and bag filters for particulate matter emissions (PM);
- Flue gas desulfurizer for sulfur oxides (SOx) emissions;
- Low Nitrogen Oxides (NOx) Burners/Dry Low NOx combustion technology/selective catalytic reduction technology for particulates NOx emissions;
- Waste water treatment facility, oil-water-gas separator, skimming/gas flotation, static hydrocyclones, mechanical centrifugation, gas stripping for treating wastewater; and,
- Ash disposal system, sedimentation basin, hazardous waste storage and disposal facility, materials recovery facility for reducing and removing solid wastes.

### 4. Addressing Climate Change

The energy sector is an important component of the National Climate Change Action Plan (NCCAP) under its Sustainable Energy Program Framework. The Framework identified both mitigation actions and adaptation measures to address climate change. With the country's positive economic outlook, the energy sector is mindful of the need to institutionalize policy and program mechanisms, and interventions to mitigate the effects of climate change and global warming.

The energy sector's component of the NCCAP is harmonized with the targets and timelines of the Philippine Energy Plan (PEP) in pushing for renewable energy (RE), alternative fuels and energy efficiency measures. These are considered as strategic elements of greening economic growth toward a sustainable low carbon future. Mainstreaming of RE increases the share of clean energy sources in the country's on-grid electricity supply. Moreover, the decentralized renewable system is crucial in addressing the energy demand and supply requirements of the communities in off-grid and isolated areas.

The attainment of the National Renewable Energy Program (NREP) target of additional 15,000 MW by 2030 of generating capacity from renewables is supported by the RE technology roadmap. To complement this, the renewable energy research and development agenda will be pursued in

collaboration with the state university-based Affiliated Renewable Energy Centers (ARECs) of the DOE, as well as the engagement with the science and technology community.

The nationwide implementation of the NEECP will be accelerated as it seeks to reduce fuel and electricity consumption of all the economic sectors of society: industrial, transport, commercial, residential, and agriculture. The passage of the Energy Efficiency and Conservation (EE&C) Act is seen to intensify the use of energy efficient technologies, including substantive values re-orientation campaign on the benefits of energy efficiency and conservation. To sustain and scale up promotional efforts, the NCCAP considers the tripartite partnership network among the government, private sector and civil society as a major strategy.

Under the sustainable energy component of the NCCAP, the energy sector is expected to contribute to the attainment of an environmentally sustainable transport system. Among the sector's programs to support this goal include: (1) use of alternative transport fuels sourced from compressed natural gas, liquefied petroleum gas, biofuels (CME and E10) and electricity; (2) conduct of research and studies on higher biofuel blends; and, (3) undertake a feasibility study on hybrid systems, such as fuel cells, among others. Likewise, energy efficiency standards and labeling for new vehicles will be implemented.

## **B. PLANS AND PROGRAMS**

The energy sector is also facing the challenges brought about by climate change, thus, mitigation measures and adaptation strategies also need to be implemented by the sector. It should be emphasized that mitigation actions are being implemented as a function of adaptation strategies. These actions are primarily being implemented to address and achieve energy security, reliability, resiliency and environmental sustainability while at the same time reducing and/or avoiding the greenhouse gas emissions. This is also the approach being adopted for the development of the energy sector's share to the Nationally Determined Contribution (NDC) of the country.

### **1. Climate Change Mitigation**

To successfully implement the mitigation measures to reduce the energy sector's GHG emissions, several issues and concerns have to be addressed such as: (1) development barriers on renewable energy (i.e., high capital cost, cost of transmission access, and off-take risks), which constrain commercial bank financing; (2) financing barriers on the implementation of energy efficiency programs/projects partly due to the invisibility of measures and difficulty in demonstrating and quantifying results; and (3) accounting and reporting actual emission level and emission reduction from contributing energy-consuming sectors.

Amid these challenges, the DOE will carry out the following within the planning horizon:

- Integration of climate change mitigation measures in energy policies, plans and strategies including laws and regulations;
- Development of guidelines on accounting and reporting of GHG emissions and emission reduction to cover capacity building for the establishment of reporting forms and database;
- Implementation of emission reduction programs and projects;
- Dissemination of knowledge, research and best practices on mitigation;
- Development and adoption of sustainable financing mechanisms; and,
- Monitoring, reporting and evaluation systems of mitigation policies and measures.

These actions are vital to achieve the initiatives outlined in the energy sector's NDC with the target GHG emission avoidance and/or reduction of 480.2 million tons of carbon dioxide equivalent (CO<sub>2</sub>-

e) in total primary energy supply (TPES) in the Clean Energy Scenario (CES), which is about 11.3 percent lower than the Reference/Business-as-Usual (BAU) Scenario from 2020 to 2040 (*Please see Figures 36 and 37 in Chapter II*). The transport sector is excluded from the total GHG emissions which the Department of Transportation (DOTr) shall lead per EO 174, “*Institutionalizing the Philippine Greenhouse Gas Inventory Management and Reporting System.*”

Over the planning horizon, GHG emissions from coal and oil decrease by 14.0 percent to 15.0 percent (in TPES) with increased utilization of renewable energy, improved efficiency of fossil-based technology and increased use of natural gas specifically for power generation.

## 2. Climate Change Adaptation

In recent years, the Philippines experienced a series of devastating natural disasters like extreme weather events and natural calamities that affected energy infrastructure and facilities. From these catastrophic events, the energy sector has been identified as among the most vulnerable sectors to climate change, and thus needs to develop suitable coping mechanisms and interventions focusing on energy supply security, particularly in off-grid areas. These areas are so remote that connection to the main grid is not an immediate option. Electricity in these areas is mainly sourced from diesel generators putting the supply at risk in times of energy disruptions. In view of environmental considerations and technology innovations, the use of renewables (i.e. such as solar, wind and hydro) provides alternative off-grid solutions.

However, adaptation measures are not only for high risk areas most affected by climate change since the whole energy system faces an equally daunting challenge on how to climate-proof the country’s energy facilities. Improving the resiliency of energy facilities is a critical adaptation measure for energy infrastructures as it will help them endure the adverse impact of the changing patterns of climatic conditions.

Guided by previous adaptation actions, it is important that the planning process of energy projects/facilities embrace the principles of sustainable energy, disaster responsive power systems and environmental protection through the establishment of energy resilient infrastructures. The social and economic impacts of climate change-related consequences, such as energy supply disruptions/outages as results of extreme climatic events (e.g. typhoons, floods, landslides), also redounds to adverse economic losses for the country. As such, the long-term goal is to mainstream adaptation in energy development projects by climate proofing energy infrastructures and systems to withstand extreme weather events. Thus, the programs and activities to be identified in the Energy Resiliency Road Map and the formulation of the Energy Resiliency Standards are also vital to the climate change adaptation strategies of the energy sector.

To pursue climate change adaptation strategies in the energy sector, the following gaps and issues should be properly addressed: (1) assessment of energy infrastructures and systems’ vulnerability, including pressures on energy demand and supply; and (2) development of models on climate change impacts of weather extremes, seasonal variability, changes in temperature and wind speeds to assess implications on energy supply resources (e.g. wind, solar and hydro), and on energy consumption patterns.

In view of the above, the climate change adaptation action plan will be implemented within the planning horizon:

- Conduct of impact and vulnerability assessments of the energy systems and infrastructures (i.e. power generation, transmission and distribution, fuel production and transport);



- Institutionalize the Energy Resiliency Policy and other measures such as: (1) integration of structural adaptations into the structural design/strengthening of energy infrastructures and, (2) implementation of infrastructure reinforcement measures on:
  - power transmission and distribution systems, underground cabling for power distribution system;
  - fuel distribution systems, underground fuel pipeline distribution system;
  - infrastructure intervention e.g. sea walls/coastal defense; and,
  - soil erosion control system.
- Mainstream climate change adaptation in energy policies, plans and programs including laws and regulations;
- Develop strategies on changing demand patterns focusing on:
  - Investments in technological change to address energy demand and supply options;
  - Establishment of sustainable financing mechanisms; and,
- Share and disseminate knowledge, research and best practices on adaptation.

To present a balanced energy sector approach, these adaptation strategies as well as the required estimated financial requirements to implement such responses will also be incorporated in the energy sector’s NDC.

### 3. National Framework Strategy on Climate Change

The National Framework Strategy on Climate Change (NFSCC) serves as the foundation in addressing climate change, and identifies adaptation as the anchor strategy, while mitigation as a function of adaptation.

**Table 79. DOE RESPONSIBILITIES FOR NCCAP OUTCOMES/OUTPUT AREAS**

Strategic Priority/Outcome	Output	Responsibility
<b>Sustainable Energy</b>		
Energy efficiency and conservation promoted and implemented	Government Energy Management Program (GEMP) implemented	Co-lead with DOTr and DENR
	Private sector and community participation in energy Efficiency and conservation increased.	Co-lead with the Climate Change Commission (CCC)
Sustainable and renewable energy development enhanced	NREP and RE Technology Roadmap based on Renewable Energy Act of 2008 and its Implementing Rules and Regulations (IRR).	DOE as Lead Agency
	Off-grid, decentralized community-based renewable energy system to generate affordable electricity adopted.	DOE as Lead Agency
Environmentally sustainable Transport promoted and adopted	Environmentally sustainable transport strategies and fuel conservation measures integrated in development plans.	No explicit leadership role
Energy systems and infrastructure made climate resilient, rehabilitated and improved	Energy systems and infrastructures made climate resilient.	Co-lead with DOST, DENR
<b>Knowledge and Capacity Development</b>		
Knowledge on climate science Enhanced	GHG inventory completed.	DOE as Lead Agency (Energy sector Per EO No.174)
<b>Water Sufficiency</b>		
Water governance restructured toward a climate and gender responsive water sector	Enabling policy environment for Integrated Water Resource Management (IWRM) and climate change adaptation created.	Coordinating Agency
	Climate change adaptation and vulnerability reduction measures for water resources and infrastructure implemented.	Coordinating Agency

To achieve it, the NCCAP has identified the following strategies: (1) sustainable energy strategies (focusing on energy efficiency and conservation, renewable energy, and environmentally sustainable transport systems); (2) knowledge and capacity development strategies (knowledge of climate science, e.g. GHG inventory); and (3) water sufficiency strategies focusing on water governance restructured toward a climate and gender responsive water sector (Table 79).

#### **4. Development of the National GHG Inventory Management and Reporting System**

As stipulated under EO 174, the DOE leads the GHG inventory of the energy sector. Specifically, the DOE is tasked to conduct, document, archive and monitor GHG inventory (accounting and reporting of GHG emissions from combustion of fossil fuels in stationary sources, mobile sources (though this will be accounted by the DOTr as the lead agency for transport sector's GHG inventory), and fugitive emissions. The inventory enables the government to define ways of reducing emissions and adopt low carbon pathways to support the NDC.

In 2018, the DOE submitted the 2010 GHG Emission Inventory Report of the Energy Sector to the Climate Change Commission. It was subjected to quality assurance (QA) by experts from the United Nations Framework Convention on Climate Change (UNFCCC) and was subsequently enhanced and integrated in the National GHG Inventory Report. The said report is the basis of the NDC and will also be incorporated in the Third National Communication (TNC).

The DOE, as a member of the Climate Change Database Keepers Committee, supports the development of the National Integrated Climate Change Database and Information Exchange System (NICCDIES) within the planning horizon. The NICCDIES is an integrated, comprehensive, and highly accessible national database with an information exchange facility to cater to climate change data clients or end-users.

#### **5. United Nations Framework Convention on Climate Change and the Paris Agreement (PA)**

The UNFCCC was adopted in 1992 as an international political response to climate change, which sets out a framework for action aimed at stabilizing atmospheric concentrations of GHG to avoid "dangerous anthropogenic interference" with the climate system. Meanwhile, the Kyoto Protocol adopted in 1997, commits industrialized countries and countries in transition to a market economy to achieve GHG emission reduction targets by an average of 5.2 percent (below the 1990 levels).

In 2015, Conference of Parties (COP) to the UNFCCC adopted the PA as a new legally-binding framework for an internationally coordinated effort to tackle climate change. It recognizes the different responsibilities and actions that each Party can take to achieve the goal of limiting the increase of global temperature to below 2.0 degrees Celsius (°C).

The COP also adopted a decision that guides pre-2020 action and sets out implementation details for the PA before its entry into force, which contain the detail and guidance on how to develop and formulate NDCs.

The decision calls for enhanced action on mitigation including the second commitment period to Kyoto Protocol, mitigation pledge, technical examination process and cooperation with non-country stakeholders. The technical examination focusing on lessons sharing and cooperative actions were identified for adaptation, while developed countries were urged to scale up the level of financial support.

## 6. Energy Sector NDC

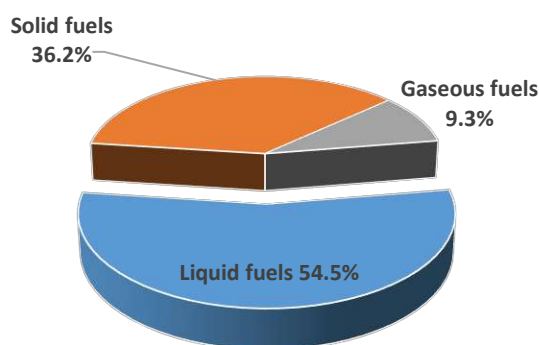
As envisioned in Ambisyon 2040, the Philippine economy shall grow and expand, thus the energy sector will need to fuel and sustain country's progress and development, while at the same time address GHG emissions. This will be achieved through policies, programs and projects focusing on renewable energy development and utilization, biofuels program, natural gas projects, energy efficiency and conservation programs and the use of highly efficient and emerging technology for power generation.

The energy sector has transformed over the years as reflected in the country's energy mix. Total energy consumption has moved alongside economic development and population growth, which resulted in increased levels of GHG released into the atmosphere. The GHG emissions from the energy sector is mainly from the combustion of fossil fuels and other activities related to the production of energy. This NDC includes all the GHG-emitting sectors with 2010 as the base year for the GHG emission and projections until 2040. It is consistent with the Philippine Development Plan (PDP), NFSC, NCCAP and the PEP, which utilizes the gross domestic product (GDP) growth rates provided by the National Economic and Development Authority (NEDA) and the population growth rates from the Philippines Statistics Authority (PSA).

The DOE started its efforts on GHG inventory for the Initial National Communication (INC) with the 1994 GHG inventory, and was followed by the 2000 GHG Inventory for the Second National Communication (SNC) as part of the country's commitment to the UNFCCC. From then on, the energy sector has come up with annual GHG inventory using the 1996 IPCC Guidelines. For the base year GHG emission of the NDC (2010 GHG inventory), the 2006 IPCC Guidelines and software were used for both Top-Down or Reference Approach, and the Bottom-up or Sectoral Approach.

Using the Reference Approach, a total of 76.8 million metric ton CO<sub>2</sub>e (MTCO<sub>2</sub>e) was emitted by the energy sector, which included the emissions from the use of fuels by the transport sector. Liquid fuels accounted for 54.5 percent, while solid fuels and gaseous fuels contributed 36.2 percent and 9.3 percent, respectively (Figure 96). Liquid fuels include crude oil, motor gasoline, aviation gas, jet kerosene, other kerosene, diesel oil, residual fuel oil, liquefied petroleum products and other petroleum products, while coal and the natural gas from Malampaya are those considered in the solid and gaseous fuels.

Figure 96. 2010 GHG EMISSIONS PER FUEL TYPE



For the Sectoral Approach or Bottom-Up Approach, Table 80 shows that fuel combustion and fugitive emissions from fuels stood at 77.3 MTCO<sub>2</sub>e. Energy industries accounted for more than 42.7 percent of the emissions followed by the transport sector at 31.3 percent, manufacturing industries and construction at 15.6 percent and other sectors at 10.3 percent. Fugitive emissions only accounted for 0.1 percent. The energy sector contributed 68.7 percent of the 2010 inventory or about 53.1 MTCO<sub>2</sub>e of GHG emissions (total emission of 77.3 MTCO<sub>2</sub>e less 24.2 MTCO<sub>2</sub>e from the transport sector).

Table 80. SUMMARY OF GHG EMISSIONS OF THE ENERGY SECTOR (Gg CO<sub>2</sub>-E), 2010

Source Categories		Carbon Dioxide (CO <sub>2</sub> )	Methane (CH <sub>4</sub> )	Nitrous Oxide (N <sub>2</sub> O)	Total Emissions	
		MTCO <sub>2</sub> -e	MTCO <sub>2</sub> -e	MTCO <sub>2</sub> -e	MTCO <sub>2</sub> -e	%
<b>1. Energy</b>		<b>74.43</b>	<b>2.01</b>	<b>0.85</b>	<b>77.29</b>	<b>100.0</b>
<b>A.</b>	<b>Fuel Combustion</b>	<b>74.41</b>	<b>1.92</b>	<b>0.85</b>	<b>77.18</b>	<b>99.86</b>
<b>1</b>	<b>Energy Industries</b>	<b>32.80</b>	<b>0.05</b>	<b>0.17</b>	<b>33.02</b>	<b>42.72</b>
	Electricity Production	31.72	0.05	0.17	31.93	
	Petroleum Refining	1.09	-	-	1.09	
<b>2</b>	<b>Manufacturing Industries and Construction</b>	<b>11.89</b>	<b>0.06</b>	<b>0.10</b>	<b>12.04</b>	<b>15.58</b>
<b>3</b>	<b>Transport</b>	<b>23.73</b>	<b>0.13</b>	<b>0.33</b>	<b>24.18</b>	<b>31.29</b>
	Civil Aviation (Domestic)	0.71	0.00	0.01	0.71	
	Road Transportation	20.82	0.12	0.31	21.24	
	Railways	0.01	-	-	0.01	
	Water-borne Navigation (Domestic)	2.20	0.01	0.02	2.22	
<b>4</b>	<b>Other sectors</b>	<b>6.00</b>	<b>1.69</b>	<b>0.26</b>	<b>7.94</b>	<b>10.28</b>
	Commercial/Institutional	2.85	0.09	0.02	2.95	
	Residential	2.50	1.60	0.24	4.34	
	Agriculture/Forestry/ Fishing/Fish Farms	0.65	-	-	0.65	
<b>B.</b>	<b>Fugitive Emissions from fuels</b>	<b>0.01</b>	<b>0.09</b>	<b>0.00</b>	<b>0.11</b>	<b>0.14</b>

Bulk of the energy industries' emissions came from electricity production equivalent to 96.7 percent of the total GHG emission. For transport, road use contributed 87.8 percent of the sector's emissions, while the residential utilization of fuel accounted for more than half of the emissions of the "other sectors" followed by the commercial/institutional users at 37.2 percent.

With the energy sector's 2010 GHG emissions as the base year and the *Energy Demand and Supply Outlook* in Chapter 2 using the same the key parameters and macroeconomic assumptions of the other sectors with NDC targets (transport, industry, waste, forestry, and agriculture), the foundations of the energy sector's NDC have been defined. The energy sector's NDC utilizes the results of the energy demand and supply projections in total final energy consumption (TFEC) and TPES excluding the transport sector (with separate sectoral NDC), and the power demand and supply outlook.

Table 81. GHG EMISSIONS AND AVOIDANCE OF HIGHLIGHT YEARS, in MTCO<sub>2</sub>e

	2010	2020	2025	2030	2035	2040	Total
<b>BAU</b>	<b>53.11</b>	<b>109.89</b>	<b>151.50</b>	<b>192.26</b>	<b>246.15</b>	<b>339.48</b>	<b>4,277.59</b>
Transformation	33.02	81.39	115.19	145.69	185.55	259.48	3,241.16
Industry	12.04	15.99	20.63	27.00	36.26	50.08	612.53
Others	8.05	12.51	15.67	19.56	24.34	29.93	423.90
<b>CES</b>	<b>53.11</b>	<b>107.19</b>	<b>147.74</b>	<b>182.03</b>	<b>206.99</b>	<b>246.75</b>	<b>3,751.99</b>
Transformation	33.02	79.82	113.71	138.89	150.97	172.47	2,787.52
Industry	12.04	15.20	19.24	25.01	33.67	46.89	570.73
Others	8.05	12.18	14.79	18.13	22.35	27.39	393.74
<b>Total GHG Avoidance / Reduction</b>	<b>-</b>	<b>2.71</b>	<b>3.76</b>	<b>10.22</b>	<b>39.16</b>	<b>92.73</b>	<b>525.59</b>
<b>Unconditional Targets: GHG Avoidance / Reduction included in BAU and CES</b>	<b>-</b>	<b>1.13</b>	<b>2.28</b>	<b>3.43</b>	<b>4.58</b>	<b>5.72</b>	<b>71.96</b>

The Reference Scenario of the PEP serves as the BAU Scenario of the energy sector’s NDC, which incorporates existing policies and programs on renewable energy, alternative fuels and energy efficiency, as well as the committed and indicative power projects. It also integrates the Asia-Pacific Economic Cooperation’s (APEC) aspirational target to reduce aggregate energy intensity by 25.0 percent in 2030 to 45.0 percent by 2035 from the 2005 level. The BAU and CES scenarios cover unconditional NDC targets that the government will implement through the energy efficiency programs with an estimated reduction of 72.0 MTCO<sub>2</sub>e over the next 20 years, or equivalent to 3.43 MTCO<sub>2</sub>e per year (*Table 81*).

Sustaining these programs in the BAU Scenario, while improving energy security and enhancing the sector’s resilience, are the key drivers of the CES, which targets to maintain at least 35.0 percent of renewable energy share in the capacity and generation mix. The CES likewise allows the entry of highly efficient and emerging technologies, electric vehicles, and use of natural gas in other sectors and energy efficiency improvement across all sectors.

From 2020 to 2040, the GHG emissions from CES reaches 3,751.99 MTCO<sub>2</sub>e, about 12.29 percent lower than BAU with 4,277.59 MTCO<sub>2</sub>e. The 525.59 MTCO<sub>2</sub>-e of GHG emissions translates to an average of about 9.59 percent avoidance/reduction per year from 2020-2040. Although increased utilization natural gas leads to increasing emission over the planning period, such is offset by the emission reduction from decreased coal and oil utilization. Most of the emission reduction comes from the decreased utilization of coal in the electricity generation.

**Table 82. BUILD COST OF THE SCENARIOS (Billion USD)**

	2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
<b>REF/BAU</b>	7.01	13.76	33.95	20.56	26.97	<b>102.25</b>
<b>CES</b>	7.99	14.69	36.05	30.23	32.15	<b>121.13</b>

As shown *Table 82*, the required build cost (capital investment) for additional generating capacity under the BAU amounts to USD 102.25 billion. A much higher investment is needed for CES with an average of USD 5.8 billion per year or a total of USD 121.13 billion for the power generating capacity, up by 18.49 percent from BAU. More than 60 percent of the CES investment is allotted for the installation of 45,337 MW of new renewable energy capacity from 2020-2040. System cost (i.e., reliability, transmission and distribution and storage costs) needs to be factored in to provide a more complete investment requirement to achieve the target. The costs of other mitigation actions included in energy efficiency and alternative fuels plans and programs also need to be studied to determine the total mitigation costs of the NDC.

The GHG emission avoidance/reduction is aggregated for all mitigation measures to provide flexibility in terms of implementation. The energy sector likewise maintains that the NDC targets can only be realized if the necessary financing, technology and capacity development are provided to the stakeholders together with new and enhanced policies, programs and projects, as well as the institutionalization of the necessary enabling environments. Thus, the energy sector’s NDC target of 12.29 percent GHG reduction/avoidance in CES is conditional.

Further, the adaptation strategies discussed in this Chapter will likewise form part of the NDC to provide a comprehensive approach to climate change response. These adaptation responses are complementary to mitigation actions and thus a priority of the energy sector.

# Chapter X. NUCLEAR POWER PROGRAM

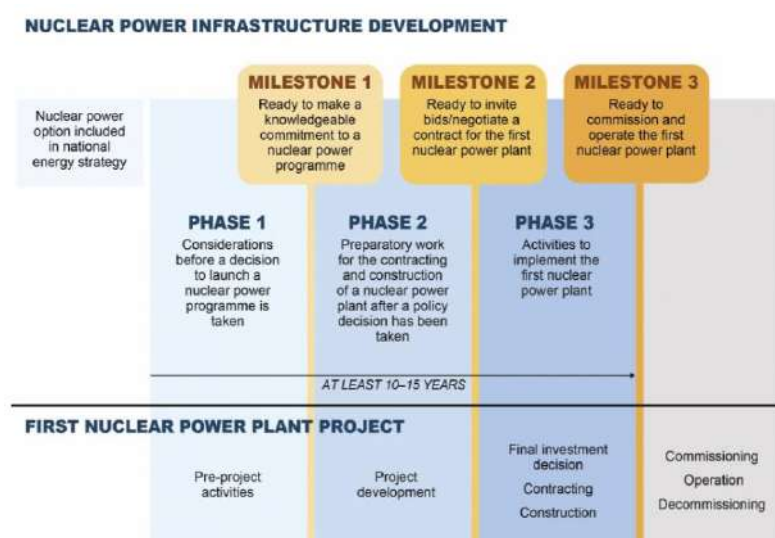
The Department of Energy (DOE) puts a premium on a sustainable future through an open technology approach for alternative energy sources for the country to provide greater energy security, stability, reliability and affordability. The vision for a low carbon future is anchored on a technology-neutral policy, to develop a diversified and balanced energy mix. As such, the DOE remains steadfast in its position of taking a calculated and scientific approach to tapping nuclear energy as a long-term fuel option for power generation given its technical and economic viability.

The DOE adopts the Milestones Approach in the Development of a National Infrastructure for Nuclear Power of the International Atomic Energy Agency (IAEA), to assist countries that are considering or planning their first nuclear power plant, and to help the Member States understand the commitments and obligations associated with developing a Nuclear Power Program (NPP)<sup>150</sup>. Likewise, the Milestones Approach provides the countries with nuclear power plants an opportunity to assess their preparedness for expansion.

## A. ASSESSMENT

In 2016, the DOE, in partnership with the Philippine Nuclear Research Institute (PNRI), availed technical assistance from the IAEA<sup>151</sup> to assess the possibility of the entry of nuclear power in the country under a technical cooperation project (IAEA TCP-PHI2011) titled, “Assessing the Development of Nuclear Power Program in the Philippines (Phase I).”

Figure 97. IAEA's MILESTONE APPROACH IN THE DEVELOPMENT OF NATIONAL INFRASTRUCTURE OF NUCLEAR POWER PROGRAM

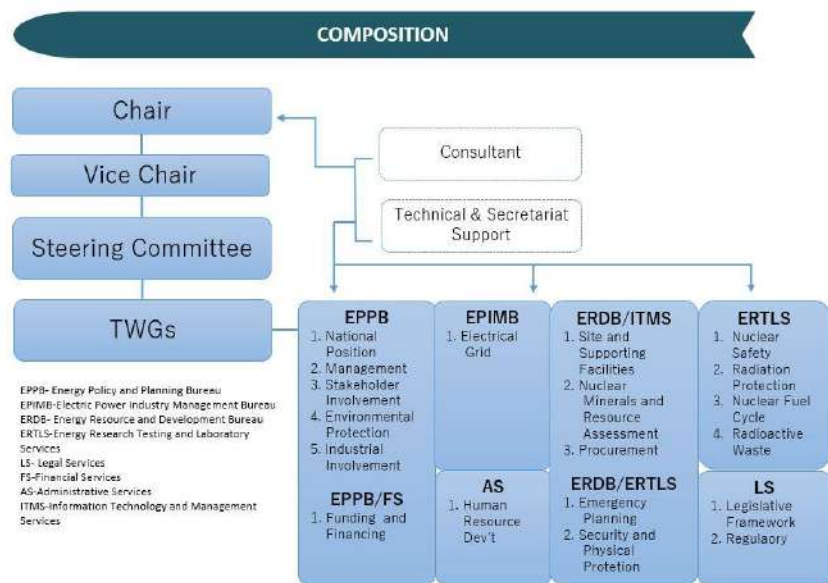


<sup>150</sup> IAEA Nuclear Energy Series NG-G-3.1 Rev. 1

<sup>151</sup> An inter-governmental agency for scientific and technical co-operation for the peaceful use of nuclear technology and nuclear power worldwide

In compliance with the mandate of the DOE, the Philippine Nuclear Energy Program Implementing Organization (NEPIO) was established on 24 October 2016 through Department Order (DO) 2016-10-0013. The creation of the DOE-NEPIO was one of the major recommendations during the IAEA's conference on the Prospects of Nuclear Power in the Asia Pacific region hosted by the Philippines in August 2016.

Figure 98. NEPIO COMPOSITION PER DO 2016-10-0013



Following the IAEA's Milestones Approach, the establishment of the DOE-NEPIO places the Philippines in Phase 1 before Milestone 1 (Figure 97). The DOE-NEPIO coordinates the tasks and activities of the organizations involved in nuclear infrastructure development as its mandate. The DOE Undersecretary and an Assistant Secretary serves as Chair and Vice-Chair, respectively, of the DOE-NEPIO. The DOE-NEPIO is divided into technical working groups (TWGs) for a specific infrastructure issue under the concerned DOE Bureau/Service Directors. Heads of the TWGs form part of the Steering Committee to ensure the effective and timely implementation of NEPIO's functions and responsibilities.

The TWGs' mandate is to work on the specific infrastructure issues on the development of Nuclear Power that needs an in-depth study before embarking on a nuclear power program (Figures 98 and 99).

Figure 99. 19 INFRASTRUCTURE ISSUES OF THE IAEA'S MILESTONE APPROACH



Under Phase 1 of the Milestone Approach, the DOE-NEPIO conducted the Energy Planning Studies (EPS) and Pre-Feasibility Studies 2017 of Nuclear Infrastructure Issues (PFS 2017) with the technical assistance of the IAEA under TC-PHI2011 project. The studies support the assessment of the 19 infrastructure issues necessary for drafting the country's national position to embark on nuclear energy program.

## ENERGY PLANNING STUDY FINDINGS

The Energy Planning Study (EPS) findings show that coal continues to dominate the generation mix without policy intervention for low carbon technology (Figure 100). This will push the greenhouse gas emission (GHG) to increase significantly under the Business-As-Usual (BAU) Scenario. Under a Sustainable Scenario 1 (Sustain1), the GHG emission reduces by 30.0 percent with LNG replacing coal by more than half of its share by 2050 coupled with the maximum utilization of renewable energy with over 20-gigawatt (GW) capacity by 2030. This increases the total installed capacity by 18.0 percent due to a higher share of variable RE (VRE)<sup>152</sup>. Higher LNG importation impacts energy security through increased dependence on imported fuel.

The second sustainable scenario option (Sustain2) includes nuclear power, which will displace a portion of coal (Figure 101) resulting in a more diversified mix in both the BAU and Sustain1 scenarios, which signifies a more secure and reliable mix. The system cost decreases under Sustain2 as compared with the Sustain1 scenario. Nuclear Power comes in as early as 2027 under the Sustain2 scenario.

### Sensitivity Analysis

The study further simulated a sensitivity analysis to determine the factors affecting the entry of nuclear power generation in the power mix. Results show the following:

- A 20.0 percent increase of nuclear power plant investment cost delays the entry of nuclear power by five (5) years, or moved to 2032;
- A 20.0 percent decrease in electricity demand by 2030 and 30.0 percent by 2040 and onwards delay the entry of nuclear power plant by two (2) years or 2029;
- A 20.0 percent decrease in LNG price shows no impact;
- A 20.0 percent increase in investment cost of nuclear power plant and 20.0 decrease in demand by 2030 and 30.0 percent by 2040 and onwards, and combined with 20.0 percent decrease in demand delay the entry by two years or 2029; and,

Figure 100. EPS GENERATION MIX by Scenario

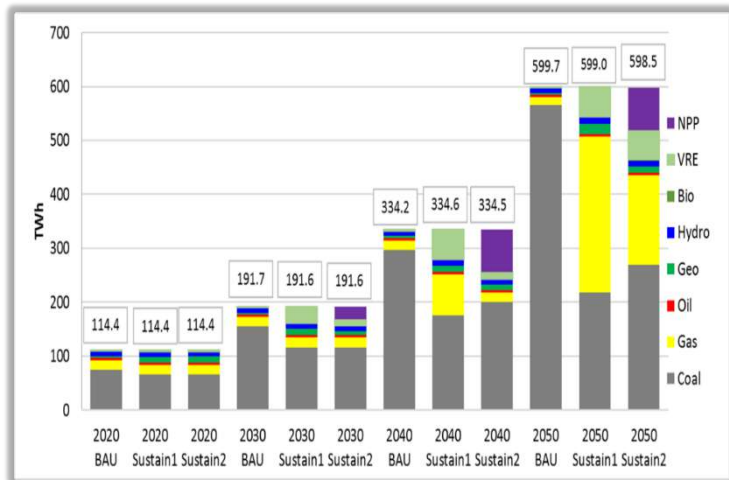
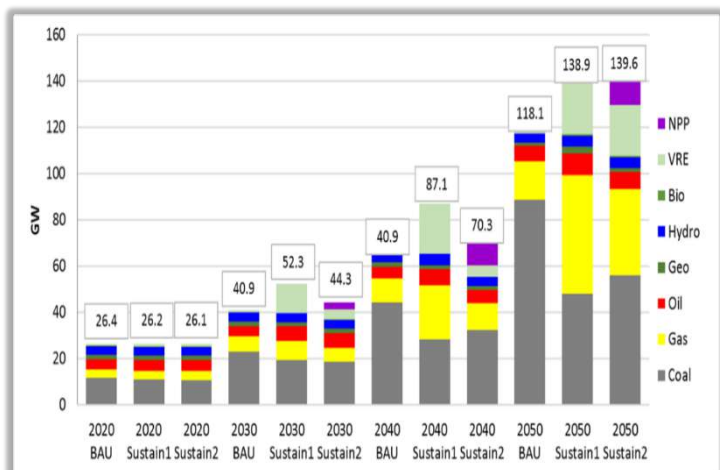


Figure 101. EPS TOTAL INSTALLED CAPACITY MIX by Scenario



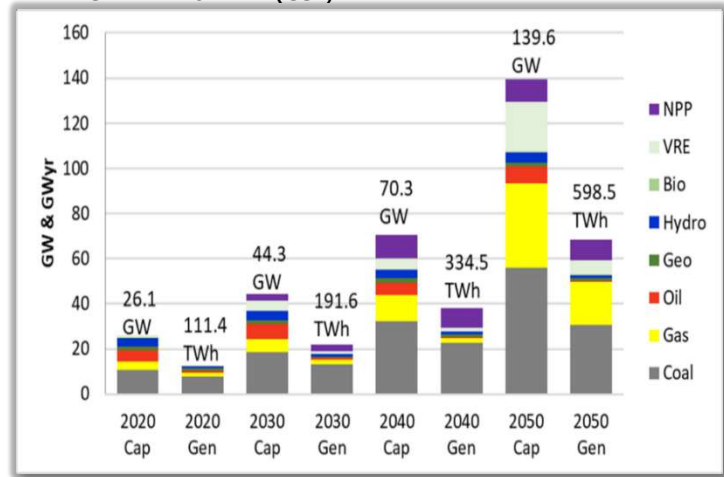
<sup>152</sup> VREs such as wind and solar have a lower capacity factor than other technologies due to the availability of their energy sources.



- Entry of variable renewable energy (VRE) sources with storage battery complements the inclusion of Small Modular Reactors (SMRs) within Visayas and Mindanao grids by 2042 and 2041, respectively, but delays the introduction of a large reactor by three (3) years or 2030.

In summary, the study finds that natural gas and renewables, as clean energy options, compete with each other; thus, the need for other low carbon technologies to lower coal shares in the power mix. Nuclear power significantly mitigates GHG emission and is complementary to natural gas and renewables in power generation. The sensitivity analysis shows that the entry of nuclear power is feasible as a mitigation option but it can be delayed depending on the level of electricity demand and investment cost.

**Figure 102. EPS RESULT: SUSTAIN II SCENARIO, CAPACITY MIX VS. GENERATION MIX (Gen)**



### Conclusion and Findings of Pre-Feasibility Studies on Infrastructure Issues

The assessment of the 19 infrastructure issues entails the following measures to address major challenges and gaps under Phase 1 of the Milestone Approach of IAEA:

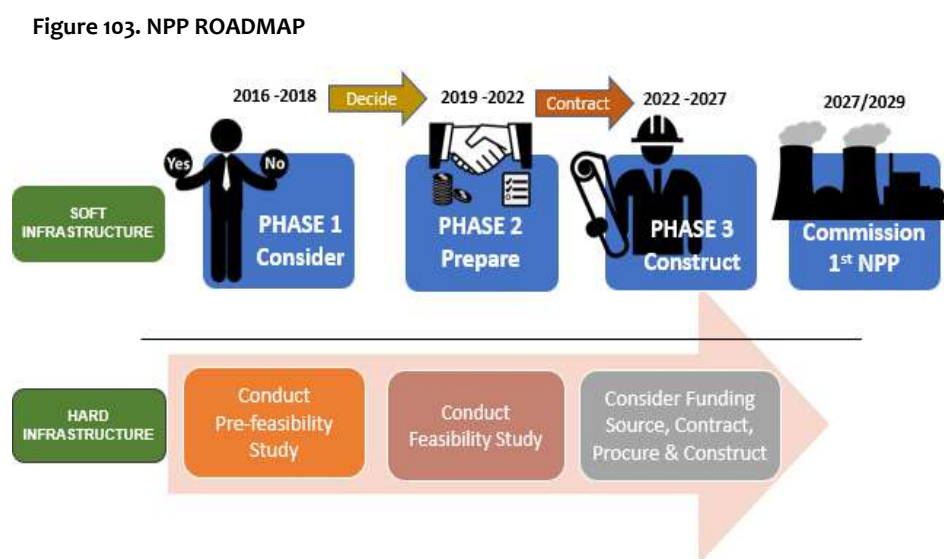
- Push for the passage of a comprehensive nuclear law with a provision for the establishment of a separate and independent nuclear regulatory authority that will ensure nuclear safety;
- Amend and review of the Electric Power Industry Reform Act (EPIRA) to provide for the inclusion of nuclear power in its provision (ownership, funding and financing aspects);
- Conduct further study to consider the possible sites in the electric grid and assess its system impact, as well as guarantee environmental impact assessment during the licensing process;
- Ensure stronger commitment among government agencies and other stakeholders in the public and private sectors;
- Mitigate the negative perception about nuclear energy that is still prevalent despite present technology and access to information through a broad-based and updated communication plan to address stakeholder issues;
- Develop/enhance knowledge and competence on nuclear safety of officials and professionals working on the nuclear power program (NEPIO, academe, regulatory body, and operator); and,
- Expand the coverage of the current national nuclear security plan (NNSP) to include the physical protection of nuclear power plants, including cyber-security.

## B. PLANS AND PROGRAMS

### NUCLEAR POWER PROGRAM ROADMAP

The Nuclear Power Program (NPP) Roadmap was established for the guidance of the implementation and timeline of activities of the NEPIO based on the earliest optimal entry of nuclear energy by 2027, and findings of the pre-feasibility studies, as shown in *Figure 103*.

The NPP Roadmap has three phases as follows:



In **Phase 1**, the DOE-NEPIO conducts studies taking into account the considerations before launching an NPP. These include the energy planning and pre-feasibility studies done by the DOE-NEPIO and the 19 infrastructure issues identified in the Milestone Approach (*Figure 99*). Those hard infrastructure issues include pre-development stage studies for NPP. The DOE-NEPIO hosted the IAEA peer review to assess the undertakings under Phase 1.

The activities for 2019 to 2022 are set for **Phase 2** of the roadmap, as well as the milestone approach. The result of the peer review will pave the way for NEPIO to undertake preparations for a knowledgeable commitment for the NPP. After policy decision has been taken, the DOE-NEPIO will then establish a management team, create an independent regulatory body that will ensure the safe, secure and peaceful use of nuclear power by ratifying related treaties and conventions, establish bilateral agreements with international suppliers, and develop policies, guidelines and procedures for procurement and contracting procedures. At the end of Phase 2, the DOE-NEPIO will need another peer review through IAEA to evaluating the country's NPP.

The result of the evaluation at the end of Phase 2 will indicate the readiness to contract and construct a nuclear power project under Phase 3. At **Phase 3**, the role of the DOE-NEPIO will diminish paving the way for the establishment of the Technical Support Organizations (TSO), and the Research and Development Programs, while the independent regulatory body will have to start implementing its guidelines for its rules and regulations of putting-up a nuclear power project. At the end of this stage, a self-evaluation is needed to assess the programs and the readiness to commission and operate the first nuclear power plant.

The self-evaluation at the end of each phase means that the DOE-NEPIO and the IAEA take into account all issues that may hinder a nuclear power program before the construction of a nuclear power plant.

## IMPLEMENTATION OF KEY ACTIVITIES FOR 2018-2019

### A. Establishing the National Position

The DOE-NEPIO submitted the recommendation for a **“National Position to Embark on a Nuclear Power Program”** to the Office of the President in April 2018. The national position was based on the Energy Planning and Pre-Feasibility Studies, which evaluated the status of the 19 nuclear infrastructure issues in the Philippines. Among the action agenda for the President included in the national position are the following:



Photo taken during the opening program of the INIR Missions Phase 1 which was participated in by Secretary Alfonso G. Cusi (3rd from left, in front), followed by Dir. Dohee Hans of IAEA, Milko Kovachev, the Team Leader for the IAEA INIR Mission Team, and NEPIO members led by the NEPIO Chair Undersecretary Donato D. Marcos

1. Declaration that the Philippines is open to nuclear power and ready to embark on a NPP;
2. Certification as urgent of a Comprehensive Nuclear Law or any equivalent law to establish a separate and independent nuclear regulatory authority; and,
3. Issuance of an Executive Order (EO) to expand the current composition of the DOE-NEPIO to cover other relevant government agencies, academe and representatives from the private sector.

A "National Position" is a technical term used in developing a nuclear power program that serves as the premise statement of a country's preliminary position and evaluation subject to validation by addressing the 19 infrastructure issues or gaps based on IAEA standards. If the issues are addressed and validation are successful, the position will be elevated as a "National Decision," which would then be the backbone of an NPP.

A National Position must cover and provide the following: (1) economic, social, political environmental and national energy directions of a country; (2) commitment to safe, secure and peaceful development of nuclear power program; (3) recognition of international and national legal arrangements including the establishment of an independent regulatory body with the commitment to cooperate with the international community (i.e., IAEA) to ensure a safe, secure, transparent and peaceful nuclear power program; and, (4) strengthening stakeholders' involvement. Such should likewise lead to a National Policy Recommendation to put a determination on closure on the Bataan Nuclear Power Plant (BNPP) rehabilitation, or a construction of new nuclear power plants.

### B. Self- and Peer Evaluation of the NPP Phase 1

Having done the studies for Phase 1 and submitted the recommendation for a national position to the Office of the President, the DOE-NEPIO saw the need to conduct a Self- and Peer Evaluation of Phase 1 activities to assess whether the program is ready to move to Phase 2. Consequently, the

Self-Evaluation Report (SER) was submitted to IAEA on 31 October 2018 as a prerequisite for the conduct of the “Integrated Nuclear Infrastructure Review (INIR) Mission. The SER is a summary of all the studies and activities implemented by the DOE-NEPIO-TWGs in Phase 1. The preparation of SER and the conduct of INIR was supported by the TC-PHI2012 project of IAEA.

The Philippines hosted the INIR Mission Phase 1 on 11-17 December 2018 in Shangri-La Manila and attended by 13 experts commissioned and funded by IAEA. It evaluated the status of the national infrastructure issues in Phase I of the IAEA’s Milestone Approach. Further, the review identified areas needing actions to achieve the Milestone Goal in Phase I. The IAEA team also provided recommendations and suggestions, which can be used by the government and national stakeholder institutions in the preparation of an action plan addressing the gaps identified in the review.

The key benefits of an INIR Mission include:

1. Providing the Member States with an opportunity to evaluate their NPP based on the Milestones publication;
2. Drawing attention to areas requiring additional work;
3. Providing a forum for peer discussions and exchange of experiences on infrastructure development; and,
4. Making available to senior officials of the host Member State, an independent peer review report on the status of the infrastructure for NPP.



Sec. Alfonso G. Cusi giving his welcome remarks to the IAEA delegates and NEPIO members at the Shangri-La Manila on 11 December 2018

### **Hand-over of the Official INIR Mission for Phase I Report**

On 30 October 2019, the IAEA represented by Deputy Director Mikhail Chudakov and Nuclear Infrastructure Development Section (NIDS) Head Milko Kovachev turned over the official INIR



Energy Secretary Alfonso G. Cusi (center-left) formally receives the copy of the official Phase 1 INIR Mission Report from IAEA Deputy Director-General Mikhail Chudakov (center-right) at the Hand-Over Ceremony held on 30 October 2019 at the F1 Hotel in Taguig City. Other officials in photo are (L-R) DOE-NEPIO Vice Chairperson Assistant Secretary Gerardo D. Erguiza Jr., DOE-NEPIO Chair Undersecretary Donato D. Marcos, Philippine Ambassador to Austria Maria Cleofe R. Natividad, PNRI Director Dr. Carlo A. Arcilla, and IAEA NIDS Head Milko Kovachev.

Mission Report for Phase I to the Philippine government through Energy Secretary Alfonso G. Cusi and DOE-NEPIO Chairperson Undersecretary Donato D. Marcos. The ceremony was held in F1 Hotel, BGC, Taguig City and attended by representatives from different government agencies, academe, and media.

It was concluded by the IAEA-INIR team that the Philippines is committed to a systematic approach in finalizing its nuclear power strategy and completing the associated infrastructure development. The country likewise recognizes the importance of open and transparent public communication and the need to include a broader range of stakeholders in preparations to introduce nuclear power. Currently, the DOE-NEPIO has conducted stakeholders' involvement and the public perception survey.

#### **Key Areas for Further Action**

1. Need to involve a broader range of stakeholders in completing the work required to enable a national commitment to introduce nuclear power.
2. Develop a legal and regulatory framework that ensures and demonstrates a commitment to safety, security and non-proliferation.
3. Further develop its understanding of and enhance its approaches to several issues related to a future nuclear power project.

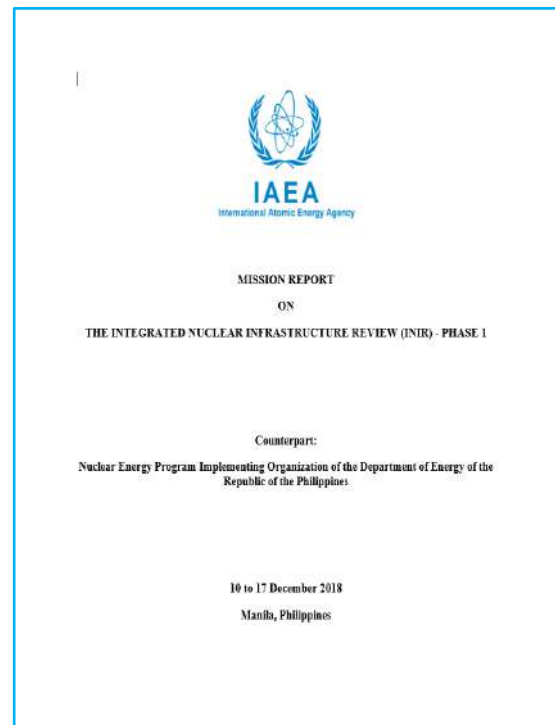
The DOE-NEPIO is strengthening the capacity of its technical personnel through collaboration with international agencies. It is also strengthening the stakeholders' involvement through the development of a Comprehensive Public Communication Plan on Nuclear Energy from the results of the recently conducted Public Perception Survey on Nuclear in the Philippines.

#### **C. Public Perception Survey on Nuclear Energy**

The DOE, in coordination with the Social Weather Stations (SWS), conducted a public perception survey on the use of nuclear energy in the country from 27 April – 12 May 2019.

**Objective.** The purpose of the survey was to provide a scientifically established basis on the acceptability of nuclear energy for power generation in the country in support of the proposed EO for the country to embark on an NPP to be submitted by the DOE to the President. Likewise, the survey aimed to provide scientifically acquired information in the preparation of the Comprehensive Communication Plan and Strategy in the engagement of the public and other stakeholders for the development of NPP.

**Methodology.** The survey involved face-to-face interviews with 4,250 Filipino adults aged 18 and above nationwide and covered 17 study regions. The target population was the non-institutionalized population aged 18 and above who are Filipino citizens and currently residing in the Philippines.



**Findings.** The survey results indicated that nuclear energy should be entrenched in the energy mix. Generally, the results impart that nuclear energy brings more benefits than risks.

The survey showed positive or favorable perception with 79.0 percent approval/acceptability for possible use (and rehabilitation) of the BNPP and 65.0 percent approval/acceptability of building a new nuclear power plant. Further, the survey revealed that 70.0 percent of the respondents prefer to source the money for the construction of a nuclear power plant from the government funds, a good indicator that nuclear energy is acceptable.



Front (L-R) Syahril Syahril (IAEA), DOST Assistant Secretary Teodoro M. Gatchalian, DOE Assistant Secretary Gerardo D. Erguiza, Philippine Ambassador to Austria Maria Cleofe R. Natividad, PNRI Dir. Carlo A. Arcilla, Mr. Milko Kovachev (IAEA), Eric Mathet (IAEA) and other delegates during the IWP in Vienna, Austria

The majority of the respondents expressed interest to learn more about Nuclear Energy. The preferred primary means of communication to reach the general public based on the result of the survey are television, internet, social media, radio, and Information, Education and Communication (IEC) campaign.

#### ***D. Integrated Work Plan for the Nuclear Power Program***

The Consultancy Meeting for the Integrated Work Plan (IWP) of the Philippines was held in Vienna, Austria last 12-15 November 2019 and attended by a delegation from the DOE-NEPIO, the Department of Science and Technology (DOST), and DOST-Philippine Nuclear Research Institute (PNRI). Its main objective was to review the Philippines' IWP to organize and prioritize future cooperation in the field of nuclear power infrastructure development with the IAEA.

The IWP as defined by the IAEA is a strategic document describing the relevant activities delivered by the Agency to support nuclear infrastructure development in a specific Member State. The IWP covers a period of two to three years, and identifies activities implemented through Technical Cooperation (TC) projects, as well as direct assistance activities from the relevant agencies' technical departments and the Office of Legal Affairs (OLA). It will be reviewed and updated once a year in a joint meeting of the Member State and Agency Core Team.

#### ***E. Joint Pre-Feasibility Study for the Deployment of SMR in CEZA, Philippines***

On 27-28 February 2019, the members of the DOE-NEPIO Steering Committee and TWG members held a kick-off Meeting with representatives of Korea Hydro & Nuclear Power (KHNP). The meeting discussed the Small Modular Reactor (SMR) Technology as presented by experts from Korea Atomic Energy Research Institute (KAERI) and King Abdullah City for Atomic and Renewable Energy (K.A.CARE).

The said meeting involved preliminary exchange of information between the DOE and KHNP to collaborate on the conduct of a Pre-Feasibility Study (FS) on System-integrated Modular Advanced Reactor Technology (SMART). The purpose of the Pre-FS was to review the feasibility of SMART construction in the Cagayan Economic Zone Authority (CEZA) in Sta Ana, Cagayan. The CEZA is being developed as a hub for trade, commerce, finance, technology and leisure area, thus needs a stable supply of power to meet its future requirement for electricity.



Senior Undersecretary Jesus Cristino P. Posadas (middle) DOE-NEPIO Vice-Chair Assistant Secretary Gerardo D. Eргуiza Jr. (left) and KHNP VP Lim Seung Yeol during the SMART Pre-FS turn over.

A site characteristic survey was conducted by the experts from KHNP and the DOE in March 2019 in CEZA. Prior to the said site survey, the Siting TWG of the DOE-NEPIO undertook a Field Verification Survey and Ocular Inspection in the proposed site(s) using Preliminary Siting Criteria.

The DOE and KHNP collaboration on Pre-FS on SMART was part of the Memorandum of Understanding (MOU) signed on 27 July 2018 for comprehensive cooperation on the establishment of infrastructure for possible nuclear energy projects in the Philippines. The “Pre-FS on SMART Deployment in CEZA” was drafted through combined efforts of the DOE-NEPIO-TWGs, CEZA and KHNP. The final version of the Pre-FS was turned over in December 2019.

## DEVELOPMENT IN THE NUCLEAR POWER PROGRAM ACTIVITIES IN 2020

### A. The 10th Nuclear Energy Cooperation Sub sector Network Annual Meeting

The Philippines Chaired the 10th Nuclear Energy Cooperation Sub sector Network (NEC-SSN) Annual Meeting held virtually last 23 June 2020. The meeting discussed the progress and plans of NEC-SSN for ASEAN Plan of Action for Energy Cooperation (APAEC) Phase I: 2016-2020. Likewise, the Member States agreed and adopted the key strategy, outcome-based strategies, action plans and annual priorities including the engagement of dialogue partners and international organizations for the APAEC Phase II: 2021-2025.

### B. Executive Order 116 s. 2020

The EO 116 s. 2020 titled “Directing a Study for the Adoption of a National Position on Nuclear Energy Program, Constituting a Nuclear Energy Program Inter-Agency Committee, and for Other Purposes” was signed by President Rodrigo Duterte on 24 July 2020. The EO establishes the Nuclear Energy Program-Inter-Agency Committee (NEP-IAC), which is tasked to conduct a study for the adoption of a National Position on NPP in accordance with pertinent IAEA guidelines, relevant laws, rules and regulations. The NEP-IAC shall be composed of the following agencies and offices:

- Chairperson : Department of Energy (DOE)
- Vice-Chairperson : Department of Science and Technology (DOST)

Members : Department of Environment and Natural Resources (DENR)  
Department of Interior and Local Government (DILG)  
Department of Finance (DOF)  
Department of Foreign Affairs (DFA)  
National Economic and Development Authority (NEDA)  
National Power Corporation (NPC)  
National Transmission Corporation (Transco)  
Philippine Nuclear Research Institute (PNRI)  
Philippine Institute of Volcanology and Seismology (PHIVOLCS)

## **DRIVERS AND BARRIERS for NPP**

The challenges identified in the development of an NPP are:

1. Approval of the National Position on the NPP. While the EO 116 expands the membership of the NEPIO to a multi-sectoral composite team, the government still needs to conduct a study to support the national position.
2. Establishment of an Independent Regulatory Body through a Comprehensive Nuclear Law. The DOE-NEPIO supports the passage of the Comprehensive Nuclear Bill to pave the way for an encompassing legislative and regulatory framework to address the issues and demands for nuclear safety and security.
3. Public acceptance for a nuclear power plant. A broad-based and updated communication plan should be developed to address stakeholder issues to effectively manage and change the negative perception about nuclear energy, which is still prevalent despite the present technology and access to information.
4. Signing and ratification of relevant international instruments. While the Philippines is a Party to most of the relevant international instruments, the country should ratify the following important conventions/treaties, specifically related to the Convention on Nuclear Safety: (1) Joint Convention on the Safety Management of Spent Fuel and Safety Management of Radioactive Waste; and, (2) Amendment to the Convention on the Physical Protection of Nuclear Materials.





# Chapter XI.

## EMBRACING A CULTURE OF RESILIENCY IN THE ENERGY SECTOR

The Department of Energy (DOE) renders efficient services through formulation and implementation of policies and programs that are relevant to the emerging needs of the energy sector to improve the quality of life of all Filipinos. Among the priorities within the planning horizon is to ensure an energy system that is resilient from risks and vulnerabilities of both natural and human-induced hazards.

The promulgation of the *Philippine Disaster Risk Reduction and Management Act of 2010 or Republic Act (RA) No. 10121* resulted in a paradigm shift – from disaster-centered response into four (4) thematic areas covering disaster mitigation, disaster preparedness, disaster response and disaster recovery and rehabilitation. Towards the goal of a “**safer, adaptive and disaster-resilient communities,**” the National Disaster Risk Reduction & Management Council (NDRRMC)<sup>153</sup> has been strengthened to serve as the country’s focal entity in terms of disaster risk reduction. On the other hand, the DOE, pursuant to its mandate of ensuring energy access, shall formulate policies and establish standard operating procedures to have a coherent coordination mechanism among energy industry participants.

It is within these premises where the Energy Resiliency Policy (ERP) has been formulated to guide the energy industries in adopting measures to enhance reliability and security of the energy system. While still in its infancy stage, the ERP has gained traction from the industry to focus on cooperation and partnership between the government and the private sector, and among energy participants as the benefits of working together in times of disasters are realized.

### A. ASSESSMENT

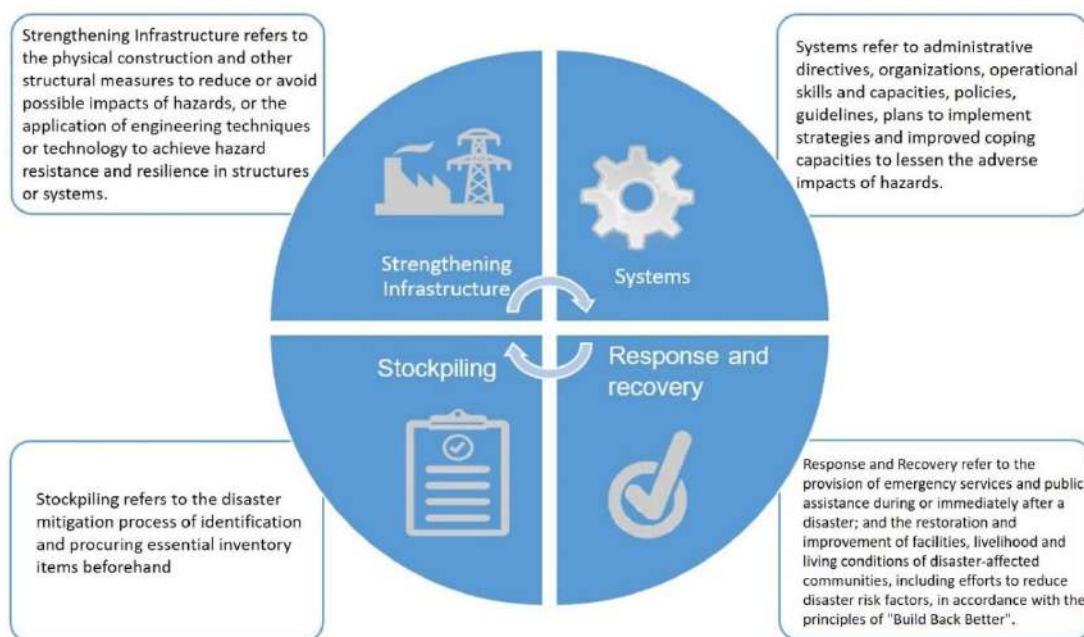
#### ADOPTION OF THE ENERGY RESILIENCY POLICY

On 17 January 2018, Secretary Alfonso G. Cusi signed Department Circular (DC) 2018-01-0001 titled “*Adoption of Energy Resiliency in the Planning and Programming of the Energy Sector to Mitigate Potential Impacts of Disasters,*” which aims to:

- Institutionalize the development, promotion and implementation of a comprehensive Resiliency Compliance Plan (RCP) to strengthen the capacity, promote a safety culture and disaster preparedness, and improve response mechanisms of the energy sector;

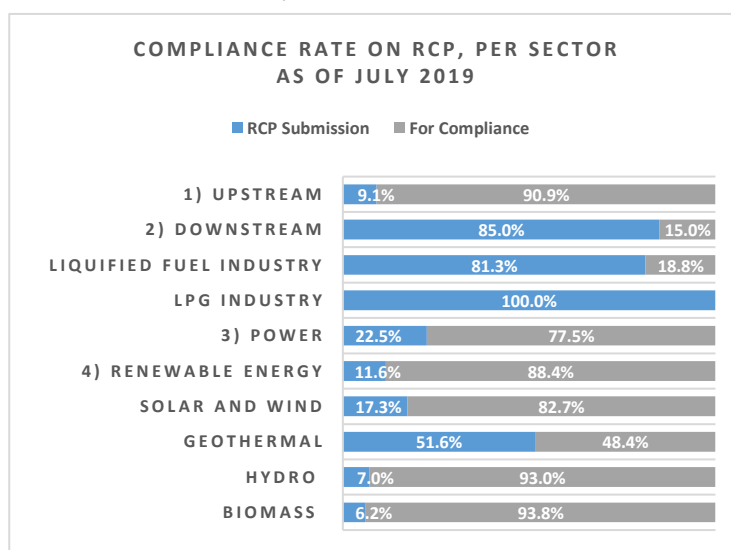
<sup>153</sup> Formerly known as the National Disaster Coordinating Council (NDCC).

Figure 104. RESILIENCY COMPLIANCE PLAN CATEGORIES



- Strengthen existing infrastructure facilities to adapt to and withstand adverse conditions and disruptive events;
- Incorporate mitigation improvements into the reconstruction and rehabilitation of damaged infrastructure in accordance with the *Build Back Better* principles;
- Improve operational and maintenance standards and practices to ensure efficient restoration of energy supply in the aftermath of disruptive events; and
- Develop resiliency standards for future construction of energy facilities to ensure minimal damage and adoption of measures for timely recovery and restoration of energy supply.

Figure 105. COMPLIANCE RATE OF RCP SUBMISSION VS. ACTIVE PROJECTS, By Sector



The RCP intends to mainstream disaster risk reduction programs into planning and investments to ensure continuous delivery of and enhance existing energy infrastructure. It provides both engineering and non-engineering measures to ensure infrastructure and human resource disaster preparedness. Likewise, it encompasses activities such as stockpiling, system development and

planning, response and recovery including disaster protocols (Figure 104). As of 30 July 2019, a total of 147 RCPs was submitted to the DOE across the different sectors (Figure 105).

### Preparing and Planning for the “BIG” One

The Philippine Institute of Volcanology and Seismology (PHIVOLCS) recorded an average of 20 earthquakes a day. The “Big One” remains a big threat with an estimated magnitude of 7.2 (intensity VIII) resulting from the movement of the West Valley Fault (WVF) system that will affect Metro Manila and other neighboring regions through massive destruction to infrastructure and facilities, among others.



During the signing of MOA with the DOST-PHIVOLCS on the use of REDAS software

The DOE already started looking into the preparedness measures to ensure availability of energy supply in the event of an earthquake. This initiative has been established even before the passage of Executive Order (EO) No. 52 titled “Creating the Program Management Office for Earthquake Resiliency of the Greater Metro Manila Area” on 8 May 2018. This sets the proactive approach of the energy sector in tackling energy resiliency issues and concerns.

On 16 March 2018, the DOE in partnership with the Department of Science and Technology (DOST) – PHIVOLCS, signed a Memorandum of Agreement (MOA) titled “Capacity Enhancement of the Energy Sector on Hazard, Risk Assessment and Exposure Database Development through the use of the Rapid Earthquake Damage Assessment System (REDAS) Software.” The REDAS, a



REDAS participants from various DOE Units and NEA together with the trainers from the DOST-PHIVOLCS led by Deputy Director Bartolome C. Bautista.

locally developed software, provides a quick and near real-time simulated earthquake hazard information to help disaster managers assess the distribution and extent of the impacts of a strong earthquake. The software could help the energy sector decide and prioritize the deployment of timely operations. Further, it serves as a tool in convincing land use planners, policymakers, city and town development planners, and even local government executives to consider earthquake hazards in their planning and development efforts to have a long-term mitigation of seismic risks. On 02-07 September 2019, representatives from the DOE and National Electrification Administration (NEA) participated in the REDAS training at Kasa Luntian in Tagaytay City.

As an off-shoot activity, a Focus Group Discussion (FGD) with about 15 energy industry players was conducted on 11 September 2019. The FGD was conducted to address issues and concerns raised during the workshop on the Updating of the National Contingency Plan for the "Big One", specifically on determining a collective Recovery Time Objective (RTO) for the industry, information sharing and classification of confidentiality, sharing of resources and deployable assets, stockpiling and cross-training, to name a few.

The DOE also participated in various workshops on the standardization of the BCP template, development of the Public Service Continuity Plan (PSCP) and harmonization of the National Contingency Plan in preparation for the "Big One."



The Workshop on updating the NECP was held on July 24-25, 2019 at F1 Hotel Manila, Bonifacio Global City, Taguig City.

### Updating of the National Energy Contingency Plan

The *National Energy Contingency Plan* (NECP) was developed to address both oil and power supply disruption. It was guided by the principles of prioritization in the restoration of electricity service for installations vital to national security, allocation of petroleum products for critical and strategic activities, and considerations of associated effects on domestic socio-political stability that shall be addressed immediately by concerned agencies.

The updating of NECP seeks to cover the following: (1) exposure database of energy facilities; (2) identify possible scenario and assumptions (including associated effects on domestic socio-political stability arising from energy interruptions); (3) develop the concept of operations indicating the proposed systems and capabilities that may be employed to achieve the desired objectives; and (3) develop an organizational structure, including command structure and control mechanisms, for emergencies and disasters and harmonize it with other plans.



Participants from the Power & Oil Sectors during the NECP Writeshop at Quest Hotel, Clark, Pampanga

As the National Capital Region (NCR) was among the pilot areas for the Nationwide Simultaneous Earthquake Drill, MERALCO was given opportunity to test its BCP and re-validate its coordination mechanisms during disasters on 14 November 2019. The simulation exercise was evaluated by the Office of Civil Defense (OCD-NCR) and the DOE. Results of the exercise showed improvement in some of the response protocols, but MERALCO was generally able to perform those indicated in its BCP.



*Opening Ceremony of the 4th Quarter NSED at MERALCO Compound attended by Pasig Mayor Vico Sotto, Usec. Lopez of DOE, Usec. Solidum of DOST-PHIVOLCS, President Rene Meily of PDRF, and Other Officials from MERALCO, OCD and PNP*

The DOE likewise conducted a seminar / forum on resiliency planning for the downstream oil industry players to revisit and/or improve their respective Downstream Oil Contingency Plans and the Downstream Oil industry Resiliency Plans on 20 - 22 November 2019. The activity with a theme “Resiliency: Beyond Business Continuity, HOPE” provided current challenges the industry must prepare for and address relative to mitigating the impact of natural disasters.

### **Strengthening Partnerships**

To further widen the reach of promoting energy resiliency, the DOE and the Safety and Health Association of the Philippine Energy Sector, Inc. (SHAPES Inc.) entered into an MOU on 17 August 2018 detailing the engagement of different stakeholders in supporting the development and implementation of policies, strategies, programs and activities to institutionalize mechanisms to prepare for, respond to and recover from disasters.



*MOU between the DOE and the PDRF on 27 November 2018*

Recognizing the participation of private industry players in the energy sector, the TFER pursued such partnership for the implementation of policy framework, strategies, programs and activities to link government agencies, private sector organizations and other partners to attaining a resilient energy sector.

## SECURING ENERGY FACILITIES DURING EMERGENCIES AND DISASTERS

### TROPICAL CYCLONE

The geographical location of the Philippines makes the country one of the most vulnerable to natural hazards, experiencing about an average of 20 tropical cyclones per year, causing flash floods, storm surges and landslides. The Task Force on Energy Resiliency (TFER), created under DC 2018-01-0001, monitored and responded to the following tropical cyclones, which affected the country:

#### 2018

**Typhoon “Ompong” (International Name: Mangkhut)** recorded peak intensity of 205 kilometer per hour (kph) and made landfall on 15 September 2018 over the remote portion of Baggao, Cagayan. It was the strongest tropical cyclone to hit the country affecting mostly the energy facilities in Northern Luzon and some parts of Southern Luzon. The NEA activated its Task Force Kapatid, a bayanihan program that mobilized 43 contingents from the different electric cooperatives (ECs) and private distribution utilities (DUs) to hasten the power restoration efforts in Cagayan.

**Typhoon “Rosita” (International Name: YUTU)** entered the country on 27 October 2018, barely a month after the devastation of Typhoon Ompong and only a few days after the completion of power restoration efforts of the affected ECs. Following the track of Typhoon Ompong, it affected the Northern and Central Luzon with an intensity of 200 kilometer per hour (kph). Typhoon Rosita affected Northern and Central Luzon.

**Tropical Depression Samuel** had maximum sustained winds of 55 kph and gustiness up to 65 kph and made landfall on 21 November 2018 affecting energy facilities in some parts of the Visayas region and Southern Luzon.

**Tropical Depression Usman** was the last recorded tropical cyclone towards the end of 2018 but eventually weakened into a Low-Pressure Area (LPA) upon landfall in the vicinity of Eastern Samar on 29 December 2018. There were no significant effects reported during the LPA. However, the consistent moderate to heavy rains affected some energy facilities in Luzon and Visayas regions.

#### 2019

While people expected 2019 to be the tipping point of catastrophic earthquakes, two (2) waves of Typhoons still made landfall before the end of the year (Table 83). On 25 November 2019, Typhoon “Tisoy” initially formed as a tropical depression in the Pacific and developed into a Category 4-equivalent typhoon before making a landfall on 05 December 2019 in the Bicol Region, which left heavy damages in the sector. Followed by Typhoon “Ursula” that made landfall just before Christmas day and affected mostly the provinces in Visayas region.





**Typhoon “Tisoy” (International Name: Kammuri)** had a maximum sustained wind from 165 kph to 215 kph, which caused severe damages in the energy facilities in Regions III, CALABARZON, MIMAROPA, V, VIII,



Bayanihan Efforts: Contingents from Other Electric Cooperatives Assist in Bringing Power of Affected Areas

CARAGA and CAR. The energy family continued working together for the immediate full restoration of energy services, specifically in the Southern Luzon area.

Table 83. SUMMARY OF EFFECTS OF TYPHOONS TISOY AND URSULA





TROPICAL CYCLONE	 <b>POWER GENERATION</b>	 <b>TRANSMISSION</b>	 <b>DISTRIBUTION</b>	 <b>OIL SUPPLY</b>
<p><b>Typhoon Tisoy</b></p> <p>30 November– 05 December 2019</p> <p><b>Highest winds:</b> 215 kph</p> <p><b>Areas/Regions Affected:</b> Regions III, CALABARZON, MIMAROPA, V, VIII, CARAGA and CAR</p>	<ul style="list-style-type: none"> <li>NPC reported 47 affected Diesel Power Plants (DPPs) / Power Barges in the areas of Mindoro, Romblon, Marinduque, Quezon, Aurora, Isabela, Catanduanes, Albay, Camarines Norte, Camarines Sur, Masbate and Samar.</li> </ul>	<p><b>Albay</b></p> <ul style="list-style-type: none"> <li>Affected Customer: 2nd District</li> <li>Affected Lines: three (3) Transmission Lines</li> <li>Structure Damage Assessment: 19 toppled towers</li> </ul> <p><b>Camarines Sur</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Camarines Sur Electric Cooperative (CASURECO) I, II, III, IV</li> <li>Structure Damage Assessment: 94 leaning poles, 86 toppled poles, eight (8) broken poles, three bended poles</li> </ul> <p><b>Sorsogon</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Sorsogon Electric Cooperative (SORECO) I and II</li> <li>Structure Damage Assessment: six (6) bend / broken / cut poles, 56 leaning poles, 31 toppled poles</li> </ul>	<ul style="list-style-type: none"> <li>Affected ECs: 27</li> <li>Total Household Connection: 2,547,751</li> <li>Preliminary Assessment of Damage: Php 911.7 million</li> </ul> <p><b>Task Force Kapatid</b></p> <ul style="list-style-type: none"> <li>Line Workers: 465</li> <li>Boom Trucks / Utility Vehicle: 96</li> </ul>	<ul style="list-style-type: none"> <li>Most of oil companies reported enough supply and operational. However, some retail outlets were closed due to damages in Bicol.</li> </ul>
<p><b>Typhoon Ursula</b></p> <p>23 - 28 December 2019</p> <p><b>First landfall:</b> 24 December 2019</p> <p><b>Highest winds:</b> 180 kph</p> <p><b>Areas/Regions Affected:</b> Eastern Visayas, Northeastern Mindanao, Bicol Region, Central Visayas, CALABARZON, MIMAROPA and Western Visayas</p>	<ul style="list-style-type: none"> <li>As a safety protocol, the NPC-SPUG power plants in Bicol suspended operations due to strong winds and heavy rainfall.</li> </ul>	<p><b>Panit-an-Nabas 138 kV</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Major backbone, no customer connected</li> <li>Structure Damage Assessment: 14 toppled towers</li> </ul> <p><b>Nabas – Avon 69 kV</b></p> <ul style="list-style-type: none"> <li>Affected Customer: No load</li> <li>Structure Damage Assessment: two toppled pole and one (1) leaning pole</li> </ul> <p><b>Northern Leyte (Ormoc-San Isidro &amp; Babatngon-Apitong-Arado)</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Don Orestes Romualdez Electric Cooperative (DORELCO), Leyte Electric Cooperative (LEYECO) II and III</li> <li>Structure Damage Assessment: 12 toppled poles and 15 leaning poles</li> </ul> <p><b>Eastern Samar (Paranas-Taft-Borongan-Quinapondan)</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Eastern Samar Electric Cooperative (ESAMELCO)</li> <li>Structure Damage Assessment: 11 toppled poles and three leaning poles</li> </ul> <p><b>Negros Oriental (Amlan-Guihulngan)</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Negros Oriental Electric Cooperative (NORECO) I and II</li> <li>Structure Damage Assessment: one toppled pole</li> </ul> <p><b>Iloilo (Concepcion-Sara-Estancia)</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Iloilo Electric Cooperative (ILECO) III</li> <li>Structure Damage Assessment: five (5) toppled poles, five leaning poles and one broken pole</li> </ul> <p><b>Capiz (Panit-an-Sapian)</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Capiz Electric Cooperative (CAPELCO)</li> <li>Structure Damage Assessment: one leaning pole</li> </ul> <p><b>Aklan (Nabas-Sapian)</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Aklan Electric Cooperative (AKELCO) Structure Damage Assessment: one toppled pole and one leaning pole</li> </ul> <p><b>Antique (Nabas-Culasi)</b></p> <ul style="list-style-type: none"> <li>Affected Customer: Antique Electric Cooperative (ANTECO)</li> <li>Structure Damage Assessment: No damage</li> </ul>	<ul style="list-style-type: none"> <li>Affected Electric Cooperative: 18</li> <li>Total Household Connection: 1,617,749</li> <li>Preliminary Assessment of Damage: Php 579.5 million</li> </ul> <p><b>Task Force Kapatid</b></p> <ul style="list-style-type: none"> <li>Line Workers: 507</li> <li>Boom Trucks / Utility Vehicle: 77</li> </ul>	<ul style="list-style-type: none"> <li>18 retails stations were rendered unoperational due to damages in Capiz, Aklan, Leyte and Biliran.</li> <li>Price freeze on petroleum products took effect in the areas placed under a State of Calamity.</li> </ul>

**Typhoon “Ursula” (International Name: Phanfone)** entered the country nearly a month after while power restoration of energy facilities from the effects of Typhoon Tisoy was still on-going. On 23 December 2019, Typhoon Ursula barreled through Central Visayas leaving devastation to a lot of areas. With the magnitude of effects brought by both Typhoon Tisoy and Ursula, the NEA’s Task Force Kapatid was activated and mobilized more than 972-line workers and 173 boom trucks / utility vehicles from assisting electric cooperatives from all over the country. MERALCO also joined the Task Force to assist in the power restoration in the Bicol Region.

## EARTHQUAKES

**Magnitude 6.1 Earthquake in Castillejos, Zambales.** On 22 April 2019, an earthquake with a magnitude 6.1 shook the provinces of Zambales, Pampanga and vicinity. The epicenter was located 18 kilometers east of Castillejos, Zambales, on a mountainous area and at a depth of 10 kilometers.

**Table 84. SUMMARY OF EFFECTS OF THE 2019 EARTHQUAKES**

EARTHQUAKE	 <b>POWER GENERATION</b>	 <b>TRANSMISSION</b>	 <b>DISTRIBUTION</b>	 <b>OIL SUPPLY</b>
Magnitude 6.1 Earthquake in Castillejos, Zambales  5:11 pm, 22 April 2019	<ul style="list-style-type: none"> <li>Four power plants went on unplanned / forced outage with total capacity of 780MW.</li> </ul>	<ul style="list-style-type: none"> <li>Eight transmission lines were isolated.</li> </ul>	<ul style="list-style-type: none"> <li>One private distribution and 15 ECs were affected.</li> </ul>	<ul style="list-style-type: none"> <li>A price freeze for household liquefied petroleum gas (LPG) and kerosene products after the declaration of State of Calamity in Pampanga on 22 April 2019.</li> </ul>
Magnitude 5.9 Earthquake in Itbayat (Batanes)  4:16 am, 27 July 2019	<ul style="list-style-type: none"> <li>Itbayat DPP went on automatic shutdown at 4:20 am. At 11:00 am, Itbayat DPP was ready for operation and waiting for signal to operate from BATANELCO.</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>	BATANELCO <ul style="list-style-type: none"> <li>Out of 885 households, 113 were totally damaged by the earthquake.</li> <li>Date/Time Off: 3:50 am, 27 July 2019</li> <li>Date Restored: 02 August 2019</li> </ul>	<ul style="list-style-type: none"> <li>Petron gasoline station in Basco, Batanes was under normal operation but advised to stop operations due to aftershocks.</li> <li>No reported damages on fuel station in Basco, Batanes. Fuel supply was normal at 60 kiloliter (kl) per month.</li> </ul>
Cotabato Fault System Earthquake Series	<ul style="list-style-type: none"> <li>MGPP and MAGPP Units 1 and 2 were affected.</li> </ul>	<ul style="list-style-type: none"> <li>The Mindanao transmission backbone remained intact. However, the NGCP’s Kidapawan substation suffered damages.</li> </ul>	<ul style="list-style-type: none"> <li>DASURECO and COTELCO were affected.</li> </ul>	<ul style="list-style-type: none"> <li>Nine gasoline stations in some parts of Cotabato and Digos were temporarily closed due to minor damages and/or precautionary safety measure.</li> </ul>
Ms6.9 Earthquake in Davao Del Sur  2:11 pm, 15 December 2019	<ul style="list-style-type: none"> <li>Five power plants with total capacity of 309 MW went on unplanned / forced outage but were restored immediately.</li> </ul>	<ul style="list-style-type: none"> <li>Power transmission services of Mindanao remained normal.</li> <li>The Mindanao Grid remained intact. However, three transmission lines tripped due to the earthquake.</li> </ul>	<ul style="list-style-type: none"> <li>DASURECO and COTELCO were affected.</li> </ul>	<ul style="list-style-type: none"> <li>Two gasoline stations in Digos were unoperational due to structural damage.</li> </ul>

Immediately after the earthquake, the TFER alerted its members to activate their respective Operation Centers, conduct continuous monitoring of the situation, undertake precautionary measures in their areas of responsibility, activate action plans and/or contingency plans, adopt and implement mitigating measures, and regular submission of status of facilities/systems/ areas, as well as any emerging problem that may affect energy supply. The National Grid Corporation of the Philippines (NGCP) immediately activated its 24/7 monitoring for the status of transmission facilities in Luzon. On the other hand, the NEA advised all the concerned ECs to take appropriate



contingency measures to mitigate the impacts of potential threats that might affect electricity service to the consumers. *Table 84* shows the affected regions and provinces by the earthquake.

After the conduct of restoration efforts in the affected franchise areas, MERALCO dispatched canter vehicles and generator sets with floodlights to Porac, Pampanga to support the search and rescue operations in the collapsed supermarket caused by the earthquake.

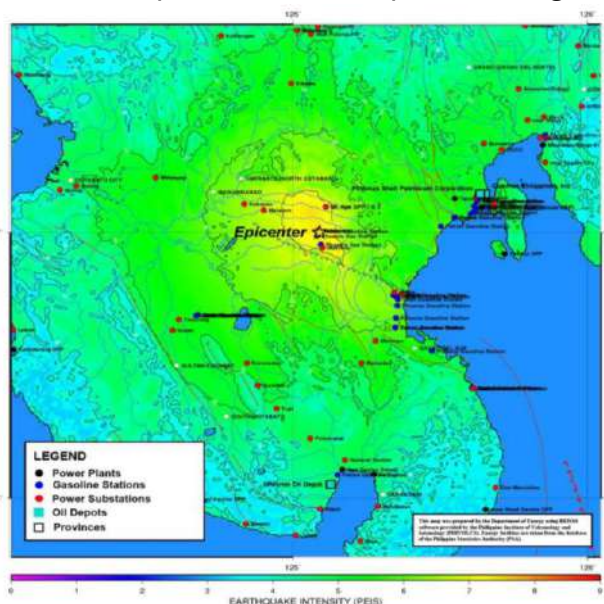
**Magnitude 6.5 Earthquake in San Julian (Eastern Samar).** A day after the devastation of the magnitude 6.1 in Zambales, a magnitude 6.5 earthquake hit San Julian in Eastern Samar on 23 April 2019. The earthquake shook the Visayas provinces including nearby provinces in the Bicol Region.

An outright assessment was done by members of the TFER. Power plants were reported to be on normal operations. In terms of transmission system, restoration of power transmission lines was conducted in the entire franchise of Northern Samar Electric Cooperative (NORSAMELCO), specifically the Paramas – Quinapondan line.

**Magnitude 5.9 Earthquake in Itbayat (Batanes).** On 27 July 2010, at 4:16 AM, a Magnitude 5.6 earthquake was recorded in Itbayat (Batanes). Itbayat Diesel Power Plant went on automatic shutdown but was ready for operations afterwards. Batanes Electric Cooperative (BATANELCO) reported that 113 households were totally damaged by the earthquake and power was restored on 2 August 2019. Supply of petroleum products was on normal operation with no reported damages.

#### **Cotabato Fault System Earthquake Series.**

Months after the earthquake experiences of Luzon and Visayas, Mindanao was shook by Magnitude 6.3 earthquake with an epicenter in Tulunan (Cotabato) on 16 October 2019. Days after, another strong earthquake with Magnitude 6.6 hit the same municipality. Mindanao Geothermal Power Plant (MGPP) and Mt. Apo's Geothermal Power Plant (MAGPP) Units 1 and 2 went on preventive shutdown. The NGCP's Kidapawan substation suffered damages but Mindanao transmission backbone remained intact. Davao Del Sur Electric Cooperative (DASURECO) and Cotabato Electric Cooperative (COTELCO) were affected and nine (9) gasoline stations in some parts of Cotabato and Digos temporarily closed due to minor damages and for precautionary safety measure.



Intensity Map generated through the Rapid Earthquake Damage Assessment System (REDAS) by the Information Technology and Management Services of Magnitude 6.5 Earthquake in Tulunan (Cotabato)

**Magnitude 6.9 Matanao, Davao Del Sur Earthquake.** Still planning for the rehabilitation of areas affected by Cotabato Fault System Earthquake Series, a strong Magnitude 6.9 shook the whole province of Davao Del Sur and nearby areas. As reported, five power plants with aggregated supply of 309 MW went on unplanned outage but immediately restored. Further, Mindanao transmission backbone remained intact. DASURECO and COTELCO reported damages to their franchise areas. Oil supply remained sufficient even though two gasoline stations in Digos became unoperational.

## SYNCHRONIZED BARANGAY AND SANGGUNIANG KABATAAN ELECTION (BSKE) 2018 AND NATIONAL MID-TERM ELECTIONS 2019

With the ERP serving as an overarching policy, the DOE issued DC 2018-05-0014 “Creating the Energy Task Force Election (ETFE) to “Ensure Adequate and Reliable Energy Supply Before, During and After Elections.” The Circular served as a guidepost in securing energy facilities to maintain undisruptive supply of energy during the conduct of elections. The ETFE was composed mainly of representatives from the energy family, key support organizations and the security group.



Energy Secretary Alfonso G. Cusi received a commendation from the COMELEC Acting Chairman Al A. Parreño on 23 August 2018 for ensuring sufficient power supply during the nationwide Sangguniang Kabataan Elections on 14 May 2018.

### **Synchronized Barangay and Sangguniang Kabataan Election (BSKE) 2018**

Adequate and reliable power supply was ensured before, during, and after the BSKE 2018, though there were reports of isolated line tripping in some areas that were immediately restored/responded by the concerned agencies. The active participation of the energy family in the BSKE 2018 was recognized by the Commission on Elections (COMELEC) with the commendation award given to the DOE for ensuring sufficient power supply during the election.

### **2019 National Mid-term Election**

The COMELEC Resolution No. 10471 deputized government agencies to provide sufficient uninterrupted electrical power supply and secure the transmission infrastructure and facilities during critical days of the election. In view of this, the ETFE was activated and a series of preparedness meetings were held.

The DOE, as the Chair of the TFER, activated the ETFE on 04 February 2019 through DC 2018-05-0014 that defined responsibilities of the agencies including the tasks for monitoring and reporting of preparedness measures, status of facilities and other incidents monitored.

For proper and effective coordination among the concerned agencies, energy family and the security group, the Energy Command Center was activated on 10 May 2019 located at the DOE premises. Likewise, Command Centers of the power sector located nationwide were activated as well from 12-14 May 2019, while the DOE technical personnel were detailed in the COMELEC Monitoring and Command Center (CMCC) in Parañaque City. The NEA Power Task Force Election (NPTE) 2019 was created pursuant to the NEA Office Order No. 2019-033 to ensure a 24-hr operation of the ECs before, during and after elections. On the other hand, the TransCo was tasked to oversee the operations status of the grid through the NGCP’s National and Regional Command and Control Centers.

The NPC set up the Operation Center Head Office located at the NPC compound in Quezon City that functioned as the central point for receiving reports from Mindanao and Satellite Operation Centers in off-grid areas. The Mindanao Satellite Operation Center located in the NPC Mindanao

Office in Iligan City was the focal point for receiving reports from the Agus and Pulangi hydro plants, while the Satellite Operation Centers located in various locations were the focal points for receiving reports in off-grid areas.

## COVID-19 RESPONSES AND MEASURES

On 07 February 2020, the DOE called an emergency meeting with Downstream Oil Industry Stakeholders in connection with the **Department of Health (DOH) Memorandum Circular No. 2020-04** on the **“Guidelines at All Seaports for Prevention and Spread of 2019-N-COV”** to ensure sufficient oil supply for the country. The oil companies ensured one to two months sufficient supply.

**Presidential Proclamation No. 922 or the “Declaration of a State of Public Health Emergency throughout the Philippines”** was issued on 09 March 2020 to mobilize government and non-government agencies to respond to the threat due to the developing situation on COVID-19. Further, Proclamation No. 922 states that the outbreak of COVID-19 constitute an emergency that threatens national security which requires a whole-of-government response.

In response, the DOE issued a Memorandum on 14 March 2020 to all government agencies, LGUs and energy-related service providers regarding the Implementation of the Memorandum from the Office of the Executive Secretary dated 13 March 2020 on *Ensuring the Unimpeded Delivery of Energy Services* that covers the following:

- Movement of energy-related goods;
- Movement of energy personnel;
- Management of permits; and,
- Adherence to health precautionary measures.

## Effects of Taal Volcano Eruption 2020

Still coping with the series of disaster in 2019, on 12 January 2020, DOST-PHIVOLCS raised the Taal Volcano alert status to ALERT LEVEL 4. Upon receipt of the alert status, the TFER alerted its members pursuant to the Department Circular No. DC 2018-01-001.

The phreatic or steam-driven activity of Taal Volcano progressed into MAGMATIC ERUPTION and generated 800-meter tall dark gray steam-laden plumes that drifted to the general southwest. On January 12, 2020, the System Operation declared Market Intervention at 1807H for the trading interval 1900H due to un-implementable Real Time Dispatch (RTD) at Group 3 (Ilijan, San Lorenzo and Sta Rita Power Plants) due to line constraint. On January 17, 2020, Market intervention initiated by System Operator was lifted at 0355H, Market resumed for 0500H (0401H-0500H) trading period.

The NGCP implemented contingency measures and reported the affected six (6) transmission lines.

The NEA reported two (2) affected electric cooperatives: Batangas I Electric Cooperative, Inc. and Batangas II Electric Cooperative, Inc., with a total of 251,917 household connections in 349 barangays. In terms of MERALCO franchise areas, a total of 183,538 affected customers were recorded in provinces of Cavite and Laguna due to ash fall.

A State of Calamity (SOC) has been declared in the entire province of Batangas and prompted price freeze for household LPG and kerosene products.

The Oil Industry Management Bureau accounted 22 gasoline stations in Batangas, two (2) in Laguna and seven (7) in Cavite that became non-operational due to ash fall and other restrictions.

Immediately after the eruption, the DOE conducted electrical inspections of service drops, panel conditions, and load types of lighting, fans, and charging to ensure that proper power services are being provided in the evacuation centers on the affected areas. Further, the DOE team distributed emergency lights, portable solar power lamps, solar power banks, and clothing to volunteers.

Likewise, the DOE established a **Bayanihan Energy Service 24/7** hotlines to cater to all energy-related concerns during the Enhanced Community Quarantine (ECQ).

On 18 March 2020, a Memorandum from the Energy Secretary was issued calling on **public and private power sector corporations to defer payments of obligations and dues for 30 days** after the conclusion of the ECQ period on 14 April 2020.

Upon the passage of Republic Act No. 11469 or “*Bayanihan to Heal as One Act*,” Secretary Cusi released a Special Order for the Creation of an “*Energy Committee under the Bayanihan to Heal as One Act*,” to ensure compliance to the said Act on 02 April 2020.

The DOE also directed the power stakeholders to submit their respective Business Continuity Plan (BCP) under the ECQ and further expanded to include energy resource development and downstream oil stakeholders.

On 6 April 2020, Secretary Cusi issued DC 2020-04-0008 titled “**Rationalizing the Utilization of ER 1-94 Fund by Host Local Government Units in Response to COVID-19 Public Health Emergency**,” which provides for the utilization of such funds by the host LGUs to strengthen their programs and measures against COVID-19 during this period. The funds can be used for the following:

- Facilitation of mass testing by providing and constructing facilities and/or acquiring proper medical testing kits to detect COVID-19;
- Provision of an emergency subsidy in the form of non-food to low income households while the State of Public Health Emergency is still in effect; and
- Adoption of measures to minimize disruption in the supply chain, among others.

On 07 May 2020, an *Advisory on Providing Grace Period to all Power Sector Bills Falling Due During the ECQ as extended until 15 May 2020* was released for guidance of all electric power industry participants. All bills being paid during the extended grace period shall bear no interest, penalties, fees and charges.

In response to the issued Administrative Order (AO) of the DOH, the DOE released Department Order (DO) 2020-04-007 on 29 April 2020 titled “*Providing for Minimum Health Standards for COVID-19 Mitigation to DOE Personnel and its Workplace and Shared for Application to All Players and Stakeholders in the Entire Energy Industry.*”

As a result of submitted BCPs of the energy stakeholders, the DOE issued COVID-19 Response Protocol through AO 2020-05-0001 on 21 May 2020. The Protocol's general framework is based on



Energy Secretary Alfonso G. Cusi during the Senate Committee of the Whole briefing on crucial sector updates amid the COVID-19 situation in the Philippines on 21 May 2020



Energy Secretary Alfonso G. Cusi asked the executives of the Manila Electric Company (MERALCO) to explain the spike in May bills and other related complaints including the imposition of convenience fee on 26 May 2020.

the following interventions: (1) Prevention, (2) Detection, (3) Isolation, (4) Treatment, (5) Reintegration to the Workforce, and (6) Adapting to the "New Normal."

For the DOE and its attached agencies, the COVID-19 Response Protocol shall be incorporated in their respective Public Service Continuity Plans, while energy industry players are required to incorporate the same into their BCPs, or their equivalent.

Subsequently, a PSCP was released through DO 2020-06-001 on 26 June 2020 to established protocols, measures and strategies for managing the immediate consequences of the COVID-19 pandemic for DOE.

## **B. PLANS AND PROGRAMS**

Cognizant of the vital contribution of energy in fuelling the economy, any disruption or failure in the energy system would have negative consequences on the country's economic activities and daily life of the people. With this backdrop, the development of the energy sector Disaster Risk Reduction and Management (DRRM) plans, policies, programs, and standards operating procedures is crucial to ensuring continuous delivery of energy services to the economy and the public.

The energy sector is moving toward mainstreaming the culture of resiliency through strengthening the energy infrastructure, establishing standards and systems, formulating response and recovery protocols, mitigation/contingency plans and activities to address the impacts of disasters on energy supply and services. Integrating energy resiliency into development planning and disaster operations of the energy sector will propel the formulation of DRRM plans, frameworks and policies of the energy sector, conduct of operations during emergencies and disasters and ensure building back better reconstruction and rehabilitation of affected energy facilities. Key activities initially identified are:

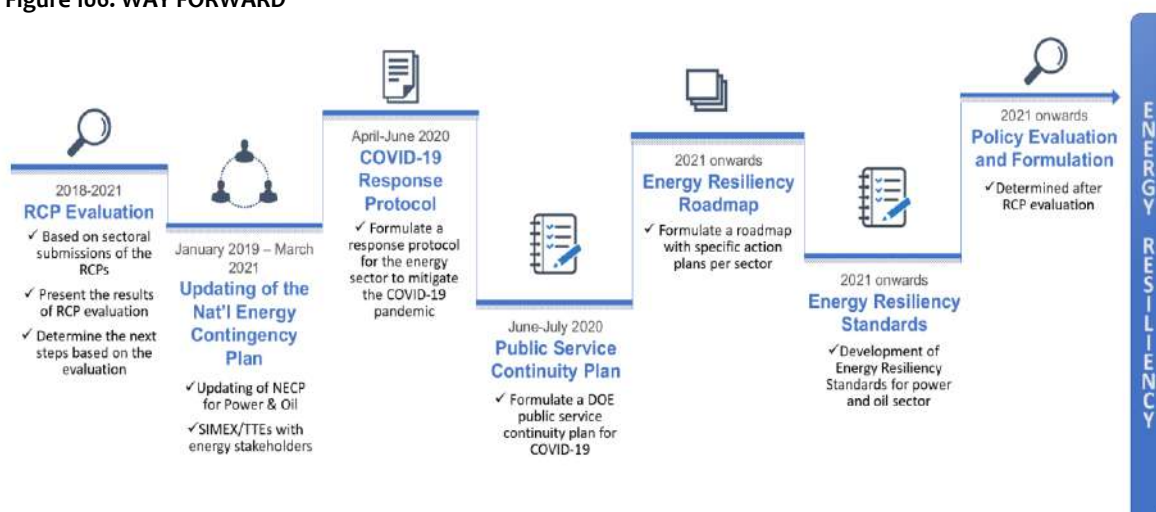
- Developing a sector-based preparedness plan encompassing capacity building, energy response activities including standard operating procedures and other operational manuals linkages;
- Designing and programming the disaster risk and reduction (DRR) activities of the energy sector;
- Conducting researches on related DRR programs, policies, and activities of the energy sector;
- Formulating DRRM risk assessment and plan, framework and policies of the energy sector;
- Disseminating information and raise public awareness of DRRM related activities of the energy sector;
- Conducting continuous monitoring and mobilizing personnel during emergencies;
- Establishing linkages with the stakeholders before, during and after emergencies and disasters;
- Conducting comprehensive damage and loss assessment in the energy sector;
- Conducting periodic monitoring and inspection of rehabilitation programs and projects of the energy sector;
- Formulating standards for rehabilitation development for inclusion in the DRR measures in the energy sector; and,
- Assisting in processing and evaluating proposals for funding of projects and activities.

## WAY FORWARD

Energy resiliency remains a flagship program of the DOE. With lessons learned from previous tropical cyclones, earthquakes and even human-induced disasters, the promulgation of the ERP propelled the advocacy to mainstream energy resiliency into programs, plans and activities of all industry participants.

With the changing landscape of disaster risk reduction, the energy resiliency put priority actions (Figure 106) to improve the whole value chain of the sector in terms of strengthening the ability of the energy system to withstand the impact of hazards and recover from any disruption of the energy supply.

Figure 106. WAY FORWARD



The submission of the RCP, along with the set programs, paves the way for the formulation of the ERP that constitutes short-, medium- and long-term plans, programs and activities. The NECP for oil and power will also be updated to strengthen preparedness, mitigation, and response and recovery measures to have continuous energy supply during emergencies and disasters. It is the government's priority to have a faster recovery from projected threat of the "Big One." As an end goal and to institutionalize resiliency mechanisms, energy resiliency standards will be formulated to safeguard energy facilities. As a contribution to the fight against COVID-19 pandemic and for future similar diseases, the DOE formulated COVID-19 Response Protocol and the PSCP shall be updated periodically.

With an overall objective of mainstreaming the DRRM plans, frameworks and policies into the energy sector, the Energy Resiliency Roadmap, together with the development of the Energy Resiliency Standards, will set the course and direction of the sector toward achieving a higher level of resiliency to disaster. This will be developed in sectoral approach to include the upstream oil and gas, downstream oil and gas, power, renewable energy, and energy utilization. The roadmap will be aligned to and guided with the principles stipulated in the Energy Resiliency Policy.

Moving forward for an energy resilient Philippines with a shared vision of stable, secure, sufficient, accessible and reasonably-priced energy, the DOE continues to strive for greater energy supply security as a precursor for sustainable economic development.



# Chapter XII.

## PHILIPPINE AGENDA WITH THE INTERNATIONAL COMMUNITY

The Philippines builds its diplomatic and international relations based on its national interest. It is a universal policy to collaborate and cooperate with concrete and tangible intention of reaping values or benefits from the competencies and strength of other states or international and regional groupings. Most importantly, the Philippines exerts enormous effort to provide a conducive environment and seamless opportunities for local and foreign investors.

The country is blessed with abundant natural wealth including untapped indigenous energy resources. It used to rank second in the world in geothermal energy production (next to the United States, and the Department of Energy (DOE) is resolute to regain the spot. With its strategic location and archipelagic character, it serves as an ideal trading hub in the Asia-Pacific region, a perfect base for business and a critical entry point of millions of people in the ASEAN market. It has one of the highest literacy rates in the region, with 93.9 percent of the population capable of being trained for essential skills and competencies. Its unique edge comes from the high level of English proficiency of the Filipinos. In fact, the Philippines is the third largest English-speaking country in the world and the top-ranked country in the world for Business English.

### **A. SUCCESSFUL COLLABORATIONS WITH DEVELOPMENT PARTNERS IN RECENT YEARS**

Aside from the recent Executive Orders (EOs) and Memorandum Circulars (MCs) that the government issued to make the environment attractive to investors, the Philippine energy sector has a good track records in terms of engagement and collaboration with various international organizations. The following are some of the recent notable initiatives and successful collaboration:

#### **1. Access to Sustainable Energy Program**

The Access to Sustainable Energy Program (ASEP) is a European Union Assistance to the Philippine energy sector with total funding support amounting to Euro 66 million. The program aims to promote sustainable energy for all, and help meets rural electrification targets using renewable energy (RE), wider adoption of efficient use of energy. It intends to assist the government in expanding the application of sustainable energy to meet the growing energy needs of the country and provide greater energy access to poor and marginalized sector in accordance with the Philippine Development Plan (PDP).

Specifically, the program envisages to generate more electricity from renewables, greater application of energy efficiency and conservation measures, and expand access of the poor to affordable, disaster-resilient energy. Under this Program, around 100,000 to 150,000 poor households in remote areas will be provided with access to electricity utilizing innovative energy solutions. Further, a 20 megawatts (MW) of renewables are to be installed, and greenhouse gas (GHG) emissions equivalent to the discharged of a 50-MW coal-fired power plant are to be avoided by 2020.



ASEP Rural Electrification and Energy Efficiency Activities

The Program has three (3) components, namely:

- a. Technical Assistance (TA) Component with three sub-components:
  - i. Rural Electrification,
  - ii. Energy Efficiency (EE) and
  - iii. Cross-cutting Activities.
  
- b. Investment Support for Renewable Energy Component, which the World Bank (WB) is implementing with three sub-components:
  - i. Solar Photovoltaic (PV) Mainstreaming,
  - ii. PV Rural Network Solar, and
  - iii. TA for the National Electrification Administration (NEA), Energy Regulatory Commission (ERC), Renewable Energy for Rural Electrification (RE4RE), Bangsamoro, and Climate Resilience.
  
- c. Call for Proposals for pro-poor and climate resilient energy solutions, which is implemented by the EU Delegation under direct management.

As of December 2019, ASEP completed a feasibility study (FS) on rural electrification, and installed 10,000 units Solar Homes System (SHS) and contracted seven (7) projects in various stages of capacity building, procurement and arrangements with counterpart institutions and the local government units (LGUs). The Program likewise supported the formulation of the Implementing Rules and Regulations (IRR) of the Republic Act (RA) 11285 or the “Energy Efficiency and Conservation Act of 2019.”

## 2. *Development for Renewable Energy Applications Mainstreaming and Market Sustainability (DREAMS) Project*

The Development for Renewable Energy Applications Mainstreaming and Market Sustainability (DREAMS) is a five (5)-year (2017-2022) project being implemented by the DOE through funding support from the Global Environment Facility (GEF) and the United Nation Development Program (UNDP). The primary objective of the project is to promote and facilitate the commercialization of the renewable energy markets through the removal of barriers to increase investments in RE-based power generation projects. It envisions to achieve a direct lifetime GHG emission reduction



of around 2,500 kiloton (kt) of carbon dioxide equivalent (CO<sub>2</sub>e), and indirect CO<sub>2</sub>e reduction ranging from 4,889 to 141,000 ktCO<sub>2</sub>e.

The project has the following four (4) major components:

- **RE Policy, Planning and Financing.** The expected output will lead to the enforcement of supportive policy and regulatory environment that will leverage increased investment in RE development and application at the local level.
- **Institutional Strengthening for RE Mainstreaming.** The intent is to address the barriers associated with the need for improved capacity in the Philippines, mainly at the local level on RE issues and the development, operation and management of projects. The outcome is envisioned to strengthen institutional capacity that will lead to increased RE investment at the local level.
- **‘Capitalized’ RE Market Development.** This component will address the barriers relating to the absence of a functional RE Market that represents tangible government measures to ensure compliance with the mandated utilization of RE generation and spur the growth of the RE industry. The RE projects in the RE Market are to fall within standards of the Renewable Portfolio Standards (RPS) that provide clarity on rules and regulations and qualify certain RE projects to be issued RE Certificates (RECs).

The outcome resulting from the outputs from this component will be a “capitalized” RE Market and an accompanying RE registrar that will contribute to an increased share of RE-based power capacity, and an increased number of RE project developers at the local level.

- **RE Commercialization.** This component will address barriers related to lack of successful RE projects in the Philippines. The expected outcomes are:
  - Increased confidence of local RE developers that leads to an enhanced uptake of RE projects at the local level; and
  - Increased number of RE projects using proven and emerging technologies, thus boosting successful replication.

As of December 2019, DREAMS supported the development and passage of six (6) RE policies and guidelines and established the Philippine Renewable Energy Market System (PREMS) used by RE Registrar.

### 3. **Building Low Emissions Alternatives to Develop Economic Resilience and Sustainability (B-LEADERS)**

The B-LEADERS project was implemented to strengthen the capacity of the government and key partners to plan, design, and implement low Emissions Development Strategies (LEDS). This project builds on the successful work of the United States Agency for International Development (USAID) - Climate Change and Clean Energy Project (CEnergy). Its goal is to further strengthen the competency of the government to undertake the LEDS contributing to the formulation of the Nationally Appropriate Mitigation Actions (NAMAs) in the energy and transport sectors, and to a certain extent, the forestry/land use sector.

To achieve this goal, the project was implemented under two (2) complementary tasks, namely:

- Conduct in-country capacity building on low emission development; and
- Increase investment in clean energy projects.

Aside from those mentioned above, the DOE also collaborated with other development partners, such as the Asian Development Bank (ADB), Japan International Cooperation Agency (JICA), Korea International Cooperation Agency (KOICA), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), United Kingdom (UK), other United Nations system, and Economic Research Institute for ASEAN and East Asia (ERIA). Also, the DOE supported the World Wildlife Fund (WWF) current project on the formulation of local energy plan and capacity building for Butuan City in Mindanao with focus on greater integration of renewable energy.

The DOE will continuously explore collaboration with these development partners during the planning period to advance the implementation of policies, programs and projects of each energy sub sector as contained in this Plan Update.

## **B. STRATEGIES TO PUSH FOR NATIONAL INTEREST IN INTERNATIONAL COMMUNITY**

### **1. Participating in the Major Regional Groupings**

The Philippines recognizes the opportunities from bilateral and multilateral cooperation agreements in advancing the national agenda in global economic community. As such, the DOE has been involved in various bilateral and regional/multilateral energy cooperation, among which are: (a) Association of South East Asian Nations (ASEAN); (b) Asia Pacific Economic Cooperation (APEC); (c) East Asia Summit (EAS); (d) Brunei-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA), (e) United Nations Framework Convention on Climate Change (UNFCCC); (f) Economic Partnership and Free Trade Agreements; and, (g) other bilateral and regional energy-related undertakings.

These cooperation agreements serve as platform for significant discourses on collaborative efforts, policy issues and concerns that effect both regional and national growth.

#### **Association of South-East Asian Nations (ASEAN)**

In ASEAN, energy cooperation is carried out through the implementation of the ASEAN Plan of Action on Energy Cooperation (APAEC) 2016-2025 with Phase I (2016-2020) already nears completion, which adopted a theme “Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All.”



During the 37<sup>th</sup> ASEAN Ministers on Energy Meeting held on 2-6 September 2019 in Bangkok, Thailand

The formulation of the APAEC Phase II covering the period 2021-2025 (a continuation of Phase I) is ongoing with a sub-theme “Accelerating Energy Transition and Strengthening Resilience through Greater Innovation and Cooperation.” The final draft shall be presented at the 38th Senior Officials Meeting on Energy (SOME) on 24-28 August 2020, and for endorsement/adoption by the 38th ASEAN Ministers on Energy Meeting (AMEM) on 02-06 November 2020.

The APAEC Phase II serves as the blueprint for transition of the ASEAN region’s energy landscape to a more sustainable future with higher aspirational targets and new initiatives. The Phase II takes into account the recent global economic and energy trends including emerging technologies, and integrates the UN Sustainable Development Goals (SDG) and the Paris Agreement. It sets a more aggressive energy intensity reduction of around 32.0–35.0 percent<sup>154</sup> by 2025 (based on 2005 levels), and 23.0 percent<sup>155</sup> RE share in the total primary energy supply (TPES) and 35.0 percent RE share in the ASEAN installed power capacity by 2025. The outcome-based strategies and action plans to achieving these targets are incorporated in the APAEC Phase II with identified mechanisms to mobilize private sector investment. The 6<sup>th</sup> ASEAN Energy Outlook (AEO6) provides the complementary modelling and forecasting analyses needed as bases for the strategies, outcomes and targets of the Phase II.

The APAEC covers seven (7) program<sup>156</sup> areas with each has its own outcome-based strategies and action plans. These program areas are:

- a. ASEAN Power Grid (APG);
- b. Trans-ASEAN Gas Pipeline (TAPG);
- c. Coal and Clean Coal Technology;
- d. Energy Efficiency & Conservation;
- e. Renewable Energy;
- f. Regional Energy and Policy Planning; and,
- g. Civilian Nuclear Energy.

With the assistance of various development partners and international organizations, notable milestones have been accomplished in the APAEC program areas towards greater energy security, integration of regional energy infrastructures and creating responsive policies in the context of sustainable development.

- The APG focuses on advancing multilateral power trade that supports the goal of the ASEAN Economic Community (AEC) 2025 through enhanced connectivity, greater energy security and sustainability. The Heads of ASEAN Power Utilities and Authorities (HAPUA), a Specialized Body, leads the APG in collaboration with the ASEAN Energy Regulators Network (AERN)<sup>157</sup> and other ASEAN energy bodies. A total of 25 GWh of electricity was traded under Phase I through the first multilateral power trade project, the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). The APG has 16 interconnection projects including the Philippines. Under Phase II, HAPUA has conducted feasibility studies of the remaining eight (8) APG projects.
- The TAPG is being implemented by the ASEAN Council on Petroleum (ASCOPE), also a Specialized Body, consisting of heads of national oil and gas companies of the ASEAN Member States (AMS), with the objective of ensuring greater security of natural gas supply in the region, and developing policy and regulatory framework to progress the TAPG project. The project

<sup>154</sup> In Phase I, the aspirational target of 20.0 percent energy intensity reduction by 2020 (based on 2005 levels) was achieved at 24.4 percent.

<sup>155</sup> Adopted the same RE target in Phase I. The target excludes traditional biomass.

<sup>156</sup> Except for APG and TAGP, which are being led by Specialized Bodies, each Program Area has its Sub sector Network.

<sup>157</sup> Consists of energy regulators from the AMS.

has a cross-border natural gas infrastructure connecting six AMS through 13 pipelines with total length of 3,631 kilometers (kms) and eight LNG regasification terminals (RGT) with combined total capacity of 37.85 million tons per annum (MTPA). To increase utilization of natural gas as an alternative fuel, ASCOPE is tasked to implement the recommendations of the study on Small-Scale LNG and LNG Bunkering. Continuing activity will include the development of technical database that covers gas infrastructure such as gas pipelines, gas processing plants, LNG liquefaction and RGT terminals.

- The Coal and Clean Coal Technology program area is focused on the promotion, dissemination and deployment of the clean coal technologies (CCT) to enhance environmental sustainability. The ASEAN Forum on Coal (AFOC) takes the lead in this program area. Japan, as key partner provides support for capacity building activities focusing on CCT, carbon capture and storage, upgrading of low rank coal as well as the conduct of studies. Future strategic work will be on influencing and engaging the use of coal to power up requirements of countries while addressing environmental challenges.
- Recognizing the most cost-effective way of enhancing energy security, addressing climate change and promoting competitiveness, the adoption of energy efficiency and conservation (EE&C) measures reduced the regional energy intensity to a level surpassing the 2020 target (under Phase I). In achieving a higher target of 32.0-35.0 percent energy intensity reduction, action plans cover pursuing market transformation, harmonization of the Minimum Energy Performance Standards (MEPS) for electrical and electronic equipment (e.g., motors, transformers and fans), Mutual Recognition Agreement (MRA) on testing methods of energy efficiency standards, and financing mechanism design for projects.
- In pursuit of the aspirational target of increasing the share of renewables in the ASEAN energy mix, the AMS have been improving their respective policies and targets to align with the regional target on RE. Among the action plans and strategies to meet the regional targets include: (a) deployment of large-scale RE systems; (b) expansion of shares of RE in APG; (c) promotion of smart grids, decentralized and distributed RE systems; and, (d) exploration of waste-to-energy and RE-based hydrogen, among others.
- Aside from closely monitoring the implementation of the different APAEC program areas, the Regional Energy and Policy Planning program area works to better profile the ASEAN energy sector internationally through annual publications on ASEAN energy cooperation. Part of its deliverables are the periodic publication of the ASEAN Energy Outlook, Energy Statistics, Policy Review and Analysis, and issues related to energy and climate change, prices and emerging technologies.
- In line with the strategic goal of the Civilian Nuclear Energy program area to build capabilities in policy, technology and regulatory aspects, the Philippines, as the chair of the Nuclear Energy Cooperation Sub sector Network, organized and hosted a capacity building seminar on Regional Cooperation on Nuclear Security and study visit at the Philippine Nuclear Research Institute back-to-back with the annual meeting of the Network in Manila on 20-23 May 2019. The Network will focus its next activities on public acceptance of nuclear energy by developing a public acceptance strategy, as well as conduct of perception survey and sharing of experience on public engagement.

## Asia-Pacific Economic Cooperation (APEC)

APEC is a regional economic forum established in 1989 to leverage the growing interdependence of the Asia-Pacific. It envisions to ensure that goods, services, investment and people move easily across borders. It operates as a cooperative, multilateral economic and trade forum. Member economies participate on the basis of open dialogue with utmost respect to the views of all participating economies. All economies have an equal say and decision-making is reached by consensus. However, unlike in ASEAN, there are no binding commitments or treaty obligations required. Commitments are undertaken on a voluntary basis and capacity building projects help members implement the APEC initiatives.

APEC's structure is based on both a "bottom-up" and "top-down" approach. Four core committees and their respective working groups provide strategic policy recommendations to APEC Leaders and Ministers who annually set the vision for overarching goals and initiatives. The working groups are then tasked to implement these initiatives through a variety of APEC-funded projects. The Energy Working Group (EWG) is one of most important Working Groups established a year after APEC was created in 1989.

The EWG is a voluntary, regionally-based forum operating under the APEC umbrella with participation by all 21 APEC member economies. Launched in 1990, the EWG meets formally twice a year to discuss developments and progress on energy policy issues, helping further APEC goals to facilitate energy-related-trade and investment, and seeks to maximize the energy sector's contribution to the region's economic and social well-being, while mitigating the environmental effects of energy supply and use.

### The Energy Working Group

The EWG is composed of policy officials and technical experts from APEC member economies who work with experts in other APEC fora, academia, private industry, and regional and international organizations to build capacity aimed at:

- Strengthening regional and domestic energy security and resilience across the region;
- Lowering the carbon intensity of energy supply and use;
- Promoting the diversification of fuels and sources; and
- Training a gender-inclusive energy workforce.

The EWG's work incorporates guidance from APEC Economic Leaders, Ministers and Energy Ministers to form a solid foundation for APEC energy cooperation, including:

- Work towards the APEC aspirational target of reducing aggregate energy intensity by 45.0 percent from 2005 levels by 2035 through collaboration on analysis of available energy efficient technologies, energy efficiency standard harmonization and peer review on energy efficiency;
- Thrive towards achieving the APEC aspirational target on "doubling the share of renewables in the region's energy mix,<sup>158</sup> including in power generation," from 2010 levels by 2030;
- Make further progress toward rationalizing and phasing out inefficient fossil fuel subsidies, while providing energy access to those in need;
- Work towards improving resiliency of energy infrastructure to natural disasters and climate change within the region through "APEC Initiative for Enhancing the Quality of Electric Power Infrastructure," and conducting vulnerability assessment on energy infrastructure;

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<sup>158</sup> Excluding traditional biomass.

- Support community-based low carbon development in the region through the APEC Low-Carbon Model Town Project, APEC Energy Smart Community Initiative Knowledge Sharing Platform, and APEC Cooperation Initiative for Jointly Establishing an Asia-Pacific Urbanization Partnership;
- Implement Oil and Gas Security Initiative to address the challenges faced and to improve security exercises, as well as create favorable conditions for trade and investments to support a diversified, flexible, and integrated natural gas market in the APEC region through “APEC Regional LNG Trade Facilitation Initiative;”
- Implement “APEC Green Energy Finance Initiative” to ensure financial sustainability of green energy development in the region; and,
- Strengthen cross-fora collaboration and public private partnership on APEC energy issues.

Significant agenda items are discussed in EWGs, among them are the short- and long-term measures to implement the Energy Security Initiative (ESI), which is based on the directive set by the APEC Energy Ministers.

The APEC Energy Ministers’ Meetings (EMMs) provide the EWG with political guidance and directions regarding the development and implementation of key priorities, initiatives and future work programs. The EMM also provides an opportunity for the EWG to report and receive feedback on the progress of ongoing work programs, and enable Energy Ministers to share dialogue on key energy issues with each other, with EWG members and with the APEC business community through the EWG Business Network.

#### ***Brunei-Indonesia-Malaysia-Philippines East Asia Growth Area (BIMP-EAGA)***

The BIMP-EAGA initiative was established in 1994 by the four countries as a shared strategy to accelerate socio-economic development of the less developed and geographically remote areas in the member countries. From its inception, the cooperation program adopted a public-private approach to development with private sector serving as the engine of growth and the public sector taking an enabling role.

The BIMP-EAGA covers the entire sultanate of Brunei Darussalam; the provinces in Kalimantan, Sulawesi, Maluku and Papua in Indonesia; the states of Sabah and Sarawak and the federal territory of Labuan in Malaysia; and the entire island of Mindanao and the island province of Palawan in the Philippines.

The BIMP-EAGA Power and Energy Infrastructure Cluster (PEIC) formulated a nine (9)-year Roadmap (2017-2025) to promote the optimal use of sub-regional energy resources to expand energy access especially in rural areas, and optimize the use of domestic energy resources. The PEIC likewise intends to improve regional energy security for the different sub sectors, such as power interconnection, renewables, rural electrification, and sub-regional energy efficiency and conservation (EE&C) rolling pipeline projects as included in the final BIMP-EAGA Vision 2017-2025 (BEV2025).

The PEIC aims to achieve a resilient and improved energy sector for sustainable development with reliable and stable power supply, and enhanced electrification in the respective member countries. In order to achieve this, the Cluster need to come up with enclave power connection (in-country) or interconnection (two or more countries involve) projects coupled with renewable projects, and energy efficiency and conservation programs within the sub-region. This initiative resulted in a proposal of the BIMP-EAGA Senior Officials to request the ADB for the conduct of a pre-feasibility

study on East Kalimantan, Borneo-Mindanao Power Interconnection in February 2014 in response to the power supply shortage in Mindanao.

In observance of the ASEAN tradition of rotating the hosting of events among its member states, the Philippines hosted the 6<sup>th</sup> Annual Meeting of the PEIC back-to-back with the Capacity Building on Biomass in July 2018. One of the significant milestone achievements of the Philippine Chairmanship is the signing of a Memorandum of Understanding involving two Electric Cooperatives (MORESCO II and ZAMSURECO II) from the Mindanao region and a private company (T.S. Renewable Energy Solutions PTE Ltd) from Singapore in the development and commercial operation of Biomass distribution facility in Mindanao.

### ***Trade-related Undertakings / Agreements***

The Philippines is a signatory to the World Trade Organization (WTO) – General Agreement on Tariff and Trade (GATT) and General Agreement on Trade and Services (GATS). With this, the country is committed to negotiate and conclude bilateral, regional and multilateral Free Trade Areas/Regional Trade Areas (FTAs/RTAs). Liberalization and market integration is a global trend which developing countries like the Philippines should proactively participate.

The DOE has been part of the Philippine negotiating team in different multilateral and bilateral fora primarily to safeguard and make the local energy industry (goods and services) more competitive with what the others are offering, as well as capitalize on available resources and investment opportunities. These agreements are very comprehensive in nature covering negotiations on trade in goods and services, economic cooperation, investments, dispute settlements, among others. The foreseen economic returns from these agreements shall contribute to economic growth and energy security for the country.

To date, the DOE is engaged in FTAs/RTAs under the WTO, ASEAN Free Trade Agreement (AFTA) (now called ASEAN Trade in Goods Agreement or ATIGA) and ASEAN Framework Agreement on Services (AFAS). Other bilateral FTAs and RTAs include the Philippines-Japan Economic Partnership Agreement, Philippine-European Free Trade Association (EFTA), Philippine-European Commission Economic Partnership and Cooperation Agreement, ASEAN-Australia and New Zealand, ASEAN-China, ASEAN-European, ASEAN-Hong Kong, ASEAN-India, ASEAN-Japan, ASEAN-Korea, ASEAN-Canada, ASEAN-United States, and the Regional Comprehensive Economic Partnership (RCEP) Agreement.

Upcoming bilateral FTAs/RTAs initial scoping have also begun

- Philippines-EU FTA;
- Philippines-Australia FTA;
- Philippines-Taiwan Joint Economic Cooperation (PTJEC);
- Philippines-Russia Joint Committee on Trade and Economic Cooperation (JCTEC);
- Philippines-US Bilateral Strategic Dialogue (BSD);
- PH-US Trade and Investment Framework Agreement (TIFA);
- Investment and Industry Dialogue (PATIID) under the APEC Committee on Trade and Investment;
- Free Trade Area of Asia Pacific (FTAAP) under APEC; and,
- Trans-Pacific Partnership (TPP).

## **United Nations Framework Convention on Climate Change (UNFCCC) and Conference of Party (COP)**

As energy is one of the major contributors to greenhouse gas (GHG) emissions, the sector is directly involved on issues about climate change. The DOE represents the energy sector in providing technical and expert views on what climate change mitigation pathways and adaptation strategies the country needs to take.

The COP is the "Supreme Body" of the UNFCCC, the highest decision-making authority. It is an association of all the countries that are Parties to the Convention. The COP is responsible for keeping international efforts to address climate change on track. It reviews the implementation of the UNFCCC and examines the commitments of Parties in light of the Convention's objective, new scientific findings and experiences gained in implementing climate change policies. A key task for the COP is to review the progress made by Parties as reported in their submitted national communications and GHG emission inventories.

The Philippines, along with the other 194 UN member nations, signed the historic Paris Agreement during France's hosting of COP in December 2015. The universal agreement's main aim is to keep a global temperature rise this century well below 2 degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. Following the Agreement, the next step is for the country to develop its first Nationally Determined Contributions (NDC) building from its submitted Intended Nationally Determined Contributions (INDC) to the UNFCCC.

### **2. Sharing of best practices in international fora**

The DOE continues to gather best practices from other countries through the international fora. Policies and programs are normally shared during energy fora, seminars and meetings for participating countries' appreciation and possible duplication or adoption. A classic example is the Policy Dialogue Agenda during EWG meetings where each country presents its current policies, laws and regulations. Likewise, there is also the Notable Energy Development Agenda in EWG where member economies present the most recent notable energy development in their respective countries.

The DOE may always replicate initiatives from other countries and tailor fit based on the domestic situation and requirements. On the other hand, confidential documents may be requested from the reporting country through diplomatic channels or through Foreign Affairs' Ministries. Diplomatic or study mission may be undertaken to formally request and solicit detailed information.

### **3. Forging International Agreements with Other Countries and International Organizations**

International agreements like Memorandum of Agreement or Understanding (MOA/MOU), Letter of Intent (LOI), among others, are forged to bind both parties on its obligations and responsibilities as agreed and stipulated in the agreement. The general intent is to undertake collaborative projects and programs that would be beneficial for both countries or organizations. Normally, exchange of drafts is done through diplomatic channel.

The DOE has a compendium of international agreements that are regularly monitored. Some of these agreements are active with numerous ongoing activities, but some remain dormant with a shorter cooperation period, usually three years. These agreements shall be revisited and



prioritized to fill gaps in attaining the targets and overall goals of the energy sub sectors in this Plan Update.

An ideal agreement is done with countries with diplomatic ties. Otherwise, disputes and disagreements would be difficult to settle amicably by both parties. As such, the DOE shall ensure that the country being dealt with has the competency in terms of resources and technology, coupled with good bilateral record and engagement, and has value added to the energy sector or to other sectors of the government.

#### **4. Seeking Funding Assistance from External Sources**

The DOE will explore funding from various sources to finance important projects and undertakings. The sources may come from development partners (e.g., World Bank, ADB, UN-system, JICA, KOICA, USAID), and the available funds from ASEAN and APEC.

The development partners normally have priority thrusts in funding programs and projects. The DOE presents energy programs and projects requiring funding support in a Donors' Forum or the Development Partners Forum. During the forum, prepared concept notes are presented and matching is done based on the thrusts of the development partners. The DOE prioritizes the proposals to be offered to willing donors.

The DOE has also been exploring funding from APEC and ASEAN that usually course through call for proposals of the ASEAN the Sub sector Networks, the EWG Experts Groups and ASEAN/APEC Secretariat. The DOE shall implement firmer schedule on call for proposals from all possible funding sources to increase and improve batting average of approval.

#### **5. Addressing Emerging Issues at the Regional and International Level**

One of the recent and major concerns globally is the energy sector's resiliency from unexpected natural and man-made calamities that would affect continuous supply of energy (e.g. pandemic, market and climate).

As Co-Chair of the APEC Energy Resiliency Task Force (ERTF) together with the US Department of Energy, the 10th Meeting of the APEC ERTF was recently convened virtually on 25 August 2020 at the margin of the 59th Meeting of the APEC EWG (EWG59). Best practices of APEC-member economies were presented and future collaboration under the current situation were tabled for discussion. Update report of activities of the Workstreams on Grid Resilience, Strengthening Infrastructure, Energy Water-Nexus and Energy Access were presented.

During the Policy Dialogue Agenda of the EWG59, economies were requested to share their policies on the topic "Renewable Energy Transition for Sustainable Growth." All economies were requested to submit to EWG Secretariat their respective contributions or written reports to the said thematic agenda discussion.

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## Annex 1. METHODOLOGY USED FOR THE ENERGY OUTLOOK 2018-2040

In formulating the Energy Outlook, various energy modeling methodologies and tools were used to come up with energy demand and supply projections for the 2018-2040 period.

Final energy consumption was projected using (a) Simple Econometric Simulation System, Expanded (Simple E<sup>2</sup> version 14), an add-in application in Microsoft Excel developed by the Institute of Energy Economics, Japan (IEEJ); and (b) transport energy demand model developed by the Economic Consulting Associates (ECA)<sup>86</sup>, with data support from the DOE<sup>87</sup>. To further improve the energy demand forecasts, sectoral roadmaps including relevant factors and information that impact the energy consumption by sector were considered in the simulation, specifically:

- Demand levels for **Transport**, the most energy-intensive sector, were derived separately for each of the four (4) modes of transportation – road, rail, air and water. For road transport, the number of vehicles was modeled as a function of GDP, while estimation of vehicle fleet made use of the Winfrey Survival Model combined with average passenger and vehicle-kilometer traveled and fuel economy to derive energy consumption. The model for rail transport utilized the number of passengers for the Philippine National Railways (PNR) and Metro Rail Transit/Light Rail Transit (MRT/LRT) lines and urban population as indicators. On the other hand, the indicators for water and air transport include the number of passengers, kilometer/ton-kilometer flown, cargo throughput and sub-sectoral value-added. The Outlook also incorporated expansion plans and new projects/programs of the Department of Transportation (DOTr) with the development in other related sectors, notably local tourism.
- The **Industry** sector's aggregate demand was divided into energy-intensive and less-energy intensive industries. The energy-intensive industries cover food processing, sugar, paper and pulp industries, cement manufacturing, chemicals, basic metal and machinery and equipment. Meanwhile, other manufacturing activities, mining and construction fall under less-energy intensive industries. Other variables used as indicators were gross value added (GVA), commodity prices, production targets and population were used as indicators for the energy demand model of these sub-sectors. Sectoral roadmaps were likewise considered in modeling energy consumption.
- For the **Residential** sector, socio-economic indicators, such as household final consumption expenditure (HFCE) and household population, were considered in projecting energy consumption. Both data were sourced from the Philippine Statistics Authority (PSA). Also, the results of the 2011 Household Energy Consumption Survey (HECS) were used extensively in the projection of the sector's energy consumption, particularly in determining the level of biomass demand.
- For **Commercial** and **Agriculture** sectors, GVA for trade and services, and agriculture, fishery and forestry (AFF) were utilized, respectively.

On the other hand, the baseline data for power demand was obtained from the Monthly Operations Report (MOR) of the distribution utilities (DUs) and power delivery and energy exchange data of the National Grid Corporation of the Philippines (NGCP). Supplemental data was likewise taken from the Distribution Development Plan 2019-2028 and Non-Utility Forecast of the NGCP for 2019-2040. From these data sets, electricity purchased was projected based on the ratio

<sup>86</sup> Led by Prof. Ronwaldo del Mundo of the University of the Philippines' (UP) College of Engineering

<sup>87</sup> Through the Energy Policy and Planning Bureau

of historical electricity demand growth rates vis-à-vis GDP growth (*elasticity*). From here, power demand was derived using the load factor (LF) approach, with around 70 percent LF for the total Philippines. To come up with the gross generation, the power plant's own-use and transmission losses (TL) were applied to gross up the electricity purchased forecast. Electricity generation and sales forecast and the final energy consumption projections were consolidated into the Long-range Energy Alternatives Planning System (LEAP) software to come up with the overall Energy Outlook. LEAP is a widely used software tool for energy policy analysis and climate change mitigation assessment developed at the Stockholm Environment Institute.

Annex 2. TOTAL FINAL ENERGY CONSUMPTION, By Sector, Reference Scenario (in Million Tons of Oil Equivalent, MTOE)

Sector	Actual																			Outlook											Average Annual Growth Rates (%)	
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	'18-'30	'18-'40			
Agriculture	0.35	0.40	0.45	0.52	0.44	0.50	0.54	0.58	0.61	0.65	0.70	0.74	0.79	0.83	0.89	0.94	1.00	1.06	1.13	1.20	1.27	1.34	1.42	1.50	1.59	1.68	1.77	1.63	7.09	6.55		
Industry	6.53	6.75	7.45	7.93	7.52	8.17	8.59	9.03	9.51	10.01	10.53	11.09	11.69	12.34	13.03	13.77	14.57	15.42	16.33	17.30	18.34	19.45	20.64	21.92	23.29	24.76	26.34	24.33	5.66	5.86		
Services (exc Transport)	3.40	3.37	3.86	4.40	4.67	4.65	4.89	5.14	5.41	5.69	6.00	6.31	6.65	7.02	7.40	7.82	8.26	8.72	9.20	9.71	10.25	10.81	11.40	12.02	12.67	13.36	14.07	13.70	4.87	5.14		
Households	8.49	8.73	9.03	9.19	9.43	9.61	9.80	9.99	10.22	10.47	10.75	11.06	11.39	11.76	12.15	12.57	13.03	13.51	14.03	14.59	15.12	15.71	16.32	16.96	17.61	18.29	18.99	21.89	2.43	3.06		
Transport	9.13	10.56	11.42	11.82	12.24	13.26	14.06	14.78	15.55	16.50	17.45	18.28	19.20	20.24	21.33	22.48	23.68	24.91	26.14	27.39	28.65	29.92	31.18	32.46	33.72	34.99	36.24	38.44	5.66	5.06		
<b>Total</b>	<b>27.90</b>	<b>29.81</b>	<b>32.22</b>	<b>33.86</b>	<b>34.30</b>	<b>36.30</b>	<b>37.71</b>	<b>39.34</b>	<b>41.08</b>	<b>43.07</b>	<b>45.14</b>	<b>47.18</b>	<b>49.39</b>	<b>51.82</b>	<b>54.40</b>	<b>57.16</b>	<b>60.08</b>	<b>63.14</b>	<b>66.32</b>	<b>69.63</b>	<b>73.07</b>	<b>76.64</b>	<b>80.35</b>	<b>84.22</b>	<b>88.22</b>	<b>92.39</b>	<b>96.72</b>	<b>100</b>	<b>4.78</b>	<b>4.82</b>		

Annex 3. TOTAL FINAL ENERGY CONSUMPTION, By Sector, Clean Energy Scenario (in Million Tons of Oil Equivalent, MTOE)

Sector	Actual																			Outlook											Average Annual Growth Rates (%)	
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	'18-'30	'18-'40			
Agriculture	0.35	0.40	0.45	0.52	0.44	0.50	0.53	0.57	0.60	0.64	0.68	0.72	0.76	0.80	0.85	0.90	0.96	1.01	1.07	1.14	1.20	1.27	1.35	1.42	1.50	1.59	1.67	1.68	6.70	6.27		
Industry	6.53	6.75	7.45	7.93	7.52	8.17	8.54	8.74	9.16	9.62	10.10	10.62	11.18	11.78	12.42	13.11	13.86	14.66	15.51	16.42	17.40	18.44	19.54	20.73	22.00	23.35	24.80	25.00	5.22	5.57		
Services (exc Transport)	3.40	3.37	3.86	4.40	4.67	4.65	4.79	5.00	5.23	5.47	5.73	6.02	6.34	6.64	6.98	7.35	7.75	8.16	8.59	9.05	9.53	10.03	10.56	11.12	11.70	12.32	12.96	13.92	4.31	4.75		
Households	8.49	8.73	9.03	9.19	9.43	9.61	9.78	9.97	10.18	10.42	10.69	10.98	11.30	11.65	12.03	12.43	12.86	13.32	13.81	14.31	14.84	15.39	15.96	16.55	17.16	17.79	18.20	23.33	2.93	2.93		
Transport	9.13	10.56	11.42	11.82	12.24	13.26	13.90	14.67	15.43	16.22	17.04	17.90	18.82	19.78	20.82	21.91	23.04	24.21	25.42	26.66	27.93	29.24	30.59	31.98	33.41	34.88	36.39	39.85	4.24	4.24		
<b>Total</b>	<b>27.90</b>	<b>29.81</b>	<b>32.22</b>	<b>33.86</b>	<b>34.30</b>	<b>35.98</b>	<b>36.57</b>	<b>37.98</b>	<b>39.15</b>	<b>40.57</b>	<b>42.36</b>	<b>43.96</b>	<b>45.86</b>	<b>47.90</b>	<b>50.13</b>	<b>52.54</b>	<b>55.13</b>	<b>57.85</b>	<b>60.71</b>	<b>63.70</b>	<b>66.79</b>	<b>69.92</b>	<b>73.22</b>	<b>76.76</b>	<b>80.31</b>	<b>83.98</b>	<b>87.74</b>	<b>100</b>	<b>4.03</b>	<b>4.36</b>		

Annex 4. TOTAL FINAL ENERGY CONSUMPTION, By Fuel, Reference Scenario (in Million Tons of Oil Equivalent, MTOE)

Fuel	Actual																			Outlook											Average Annual Growth Rates (%)	
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	'18-'30	'18-'40			
Coal	2.26	2.22	2.68	3.01	2.41	2.41	2.49	2.57	2.65	2.74	2.85	2.96	3.09	3.23	3.37	3.53	3.71	3.89	4.09	4.30	4.53	4.77	5.03	5.30	5.60	5.91	6.24	6.35	3.65	4.42		
Natural Gas	0.08	0.05	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.11	0.40	0.40		
Oil Products	12.45	13.99	15.43	16.35	16.91	18.13	19.12	20.15	21.24	22.51	23.79	24.97	26.25	27.68	29.16	30.73	32.38	34.08	35.82	37.61	39.45	41.33	43.26	45.25	47.27	49.36	51.50	52.89	5.96	5.19		
Biodiesel	0.13	0.15	0.16	0.17	0.17	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.29	0.30	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.46	0.51	5.93	4.56		
Bioethanol	0.25	0.28	0.31	0.34	0.34	0.36	0.38	0.41	0.43	0.46	0.49	0.52	0.55	0.58	0.62	0.66	0.70	0.74	0.78	0.82	0.86	0.90	0.94	0.98	1.03	1.07	1.11	1.12	5.89	5.38		
Electricity	5.45	5.83	6.38	6.69	7.10	7.64	8.15	8.67	9.22	9.81	10.45	11.14	11.89	12.69	13.56	14.51	15.53	16.61	17.75	18.95	20.23	21.58	23.00	24.51	26.10	27.77	29.54	25.49	6.73	6.69		
Biomass	7.29	7.29	7.21	7.26	7.29	7.50	7.31	7.28	7.26	7.25	7.26	7.27	7.28	7.31	7.33	7.36	7.40	7.43	7.48	7.52	7.57	7.61	7.65	7.69	7.73	7.77	7.79	13.54	0.12	0.30		
<b>Total</b>	<b>27.90</b>	<b>29.81</b>	<b>32.22</b>	<b>33.86</b>	<b>34.30</b>	<b>36.30</b>	<b>37.71</b>	<b>39.34</b>	<b>41.08</b>	<b>43.07</b>	<b>45.14</b>	<b>47.18</b>	<b>49.39</b>	<b>51.82</b>	<b>54.40</b>	<b>57.16</b>	<b>60.08</b>	<b>63.14</b>	<b>66.32</b>	<b>69.63</b>	<b>73.07</b>	<b>76.64</b>	<b>80.35</b>	<b>84.22</b>	<b>88.22</b>	<b>92.39</b>	<b>96.72</b>	<b>100</b>	<b>4.78</b>	<b>4.82</b>		

Annex 5. TOTAL FINAL ENERGY CONSUMPTION, By Fuel, Clean Energy Scenario (in Million Tons of Oil Equivalent, MTOE)

Fuel	Actual																			Outlook											Average Annual Growth Rates (%)	
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	'18-'30	'18-'40			
Coal	2.26	2.22	2.68	3.01	2.41	2.41	2.49	2.57	2.65	2.74	2.85	2.96	3.09	3.23	3.37	3.53	3.71	3.89	4.09	4.30	4.53	4.77	5.03	5.30	5.60	5.91	6.24	6.81	3.65	4.42		
Natural Gas	0.08	0.05	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.16	4.07	3.52		
Oil Products	12.45	13.99	15.43	16.35	16.91	17.82	18.04	18.87	19.43	20.18	21.21	21.98	22.99	24.07	25.25	26.53	27.89	29.31	30.81	32.35	33.92	35.45	37.15	38.81	40.49	42.20	43.90	50.21	4.26	4.43		
Biodiesel	0.13	0.15	0.16	0.17	0.17	0.19	0.19	0.19	0.20	0.21	0.22	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.31	0.32	0.33	0.34	0.36	0.37	0.38	0.40	0.49	3.73	3.80		
Bioethanol	0.25	0.28	0.31	0.34	0.34	0.36	0.37	0.39	0.40	0.40	0.43	0.45	0.48	0.50	0.53	0.56	0.60	0.63	0.67	0.70	0.74	0.77	0.80	0.84	0.87	0.89	0.92	1.06	4.56	4.48		
Electricity	5.45	5.83	6.38	6.69	7.10	7.64	8.12	8.62	9.15	9.72	10.33	10.99	11.70	12.47	13.30	14.20	15.17	16.19	17.27	18.41	19.61	20.88	22.22	23.64	25.13	26.70	28.36	26.84	6.53	6.49		
Biomass	7.29	7.29	7.21	7.26	7.29	7.50	7.31	7.28	7.26	7.26	7.26	7.27	7.28	7.31	7.33	7.36	7.40	7.43	7.48	7.52	7.57	7.61	7.65	7.69	7.73	7.77	7.79	14.43	0.12	0.30		
<b>Total</b>	<b>27.90</b>	<b>29.81</b>	<b>32.22</b>	<b>33.86</b>	<b>34.30</b>	<b>35.98</b>	<b>36.57</b>	<b>37.98</b>	<b>39.15</b>	<b>40.57</b>	<b>42.36</b>	<b>43.96</b>	<b>45.86</b>	<b>47.90</b>	<b>50.13</b>	<b>52.54</b>	<b>55.13</b>	<b>57.85</b>	<b>60.71</b>	<b>63.70</b>	<b>66.79</b>	<b>69.92</b>	<b>73.22</b>	<b>76.76</b>	<b>80.31</b>	<b>83.98</b>	<b>87.74</b>	<b>100</b>	<b>4.03</b>	<b>4.36</b>		

Annex 6. INSTALLED GENERATING CAPACITY, Reference Scenario (in Gigawatt, GW)

Energy Source	Actual											Outlook											Average Annual Growth Rates (%)								
	2018-2040											2018-2040											18-'50		18-'40						
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average Shares %	Average Annual Growth Rates (%)		
Oil	3.48	3.61	3.62	4.15	4.29	2.72	2.75	2.77	2.80	2.36	2.40	2.25	2.25	2.25	2.25	2.25	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	5.76	-6.19	-3.43	
Natural Gas	2.86	2.86	3.43	3.45	3.78	3.79	3.80	3.80	3.80	3.80	3.80	4.10	4.38	4.38	4.70	4.74	4.76	5.28	6.18	7.84	9.34	10.78	12.16	12.80	14.44	16.20	18.24	13.52	2.71	7.86	
Coal	5.71	5.96	7.42	8.05	8.84	9.80	13.05	13.50	15.60	15.75	15.75	15.75	16.05	16.65	17.40	17.85	18.90	19.20	20.85	21.80	22.45	23.20	24.85	26.50	28.15	29.80	31.47	39.55	6.53	5.94	
Renewable	5.90	6.33	6.96	7.08	7.23	7.47	7.76	9.06	10.21	11.56	12.71	14.00	15.93	17.24	18.85	20.94	25.37	26.75	27.30	28.13	29.23	31.43	34.83	34.38	35.88	37.38	38.88	41.17	10.99	7.95	
Geothermal	1.92	1.92	1.92	1.92	1.82	1.19	1.21	1.30	1.30	1.50	1.60	1.75	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	3.93	-0.23	-0.43	
Hydro	3.54	3.60	3.62	3.63	3.70	3.50	3.42	3.43	3.16	3.22	3.55	3.72	4.36	4.52	4.98	6.07	9.25	9.49	8.79	8.39	8.39	9.19	9.14	9.63	9.63	9.63	9.63	12.67	7.93	4.44	
Wind	0.28	0.43	0.43	0.43	0.43	0.52	0.61	0.61	0.61	0.61	0.61	0.58	0.88	1.18	1.48	1.78	2.08	2.38	2.68	2.98	3.03	3.27	3.57	3.87	4.17	4.47	4.77	3.54	14.09	11.60	
Solar	0.02	0.17	0.77	0.89	0.90	1.37	2.49	3.68	4.67	5.57	6.29	7.29	8.14	8.99	9.84	10.54	11.39	12.34	13.29	14.34	15.39	16.54	17.69	18.45	19.65	20.85	22.05	19.75	23.60	15.67	
Biomass	0.13	0.22	0.23	0.22	0.26	0.27	0.35	0.44	0.47	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	1.28	8.14	4.36	
Other Technologies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-
Total	17.94	18.77	21.43	22.73	23.82	23.78	27.35	29.14	32.41	33.47	34.66	36.10	38.51	40.52	43.20	45.78	50.92	53.23	56.33	59.77	63.02	67.40	71.83	75.67	80.46	85.37	90.58	100	6.54	6.26	

Annex 7. INSTALLED GENERATING CAPACITY, Clean Energy Scenario (in Gigawatt, GW)

Energy Source	Actual											Outlook											Average Annual Growth Rates (%)								
	2018-2040											2018-2040											18-'50		18-'40						
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average Shares %	Average Annual Growth Rates (%)		
Oil	3.5	3.6	3.62	4.2	4.3	2.7	2.7	2.8	2.8	2.4	2.4	2.2	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.76	-6.19	-3.43	
Natural Gas	2.86	2.86	3.43	3.45	3.78	3.79	3.80	3.80	3.80	3.80	3.80	4.10	4.28	4.36	4.58	4.62	4.62	4.74	5.62	7.36	9.30	10.40	12.26	13.88	16.16	18.88	21.66	19.73	24.6	8.70	
Coal	5.71	5.96	7.42	8.05	8.84	9.80	13.05	13.50	15.60	15.75	15.75	15.75	16.05	16.65	17.25	17.55	17.85	18.5	19.05	19.35	18.75	18.15	18.15	18.15	18.15	18.15	18.15	35.72	6.03	3.32	
Renewable	5.90	6.33	6.96	7.08	7.23	7.47	7.76	9.06	10.21	11.56	12.71	14.00	15.93	17.55	19.43	21.60	26.26	28.18	29.31	30.80	32.60	35.55	37.76	40.90	43.88	47.13	50.48	44.39	11.35	9.24	
Geothermal	1.92	1.92	1.92	1.92	1.82	1.19	1.21	1.30	1.30	1.50	1.60	1.75	1.89	1.89	1.89	1.89	1.89	1.89	1.89	2.09	2.07	2.17	2.27	2.47	2.57	2.67	2.77	4.24	-0.23	1.62	
Hydro	3.54	3.60	3.62	3.63	3.70	3.50	3.42	3.43	3.16	3.22	3.55	3.72	4.36	4.79	5.45	6.54	9.92	10.36	9.86	9.66	9.66	10.86	11.01	11.70	11.90	12.10	12.30	13.88	8.56	5.61	
Wind	0.28	0.43	0.43	0.43	0.43	0.52	0.61	0.61	0.61	0.61	0.61	0.58	0.88	1.22	1.59	1.97	2.40	2.83	3.32	3.88	4.23	4.83	5.54	6.37	7.20	8.05	8.90	4.72	15.46	14.80	
Solar	0.02	0.17	0.77	0.89	0.90	1.37	2.49	3.68	4.67	5.57	6.29	7.29	8.14	8.99	9.84	10.54	11.39	12.34	13.29	14.34	15.39	16.54	17.69	19.11	20.86	22.86	24.96	20.02	23.60	16.33	
Biomass	0.13	0.22	0.23	0.22	0.26	0.27	0.35	0.44	0.47	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.75	0.85	0.95	1.05	1.15	1.25	1.35	1.45	1.55	1.52	8.14	8.49	
Other Technologies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.40	-	-	-
Total	17.94	18.77	21.43	22.73	23.82	23.78	27.35	29.14	32.41	33.51	34.66	36.10	38.51	40.81	43.51	46.02	50.72	53.06	55.97	59.51	62.65	67.29	71.36	76.12	81.38	87.35	93.48	100	6.50	6.41	

Annex 8. POWER GENERATION, Reference Scenario (in Terawatt-hour, TWh)

Energy Source	Actual														Outlook														Average Annual Growth Rate (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041		2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969	2970	2971	2972	2973	2974	2975	2976	2977	2978	2979	2980	2981	2982	2983	2984	2985	2986	2987	2988	2989	2990	2991	2992	2993	2994	2995	2996	2997	2998	2999	3000	3001	3002	3003	3004	3005	3006	3007	3008	3009	3010	3011	3012	3013	3014	3015	3016	3017	3018	3019	3020	3021	3022	3023	3024	3025	3026	3027	3028	3029	3030	3031	3032	3033	3034	3035	3036	3037	3038	3039	3040	3041	3042	3043	3044	3045	3046	3047	3048	3049	3050	3051	3052	3053	3054	3055	3056	3057	3058	3059	3060	3061	3062	3063	3064	3065	3066	3067	3068	3069	3070	3071	3072	3073	3074	3075	3076	3077	3078	3079	3080	3081	3082	3083	3084	3085	3086	3087	3088	3089	3090	3091	3092	3093	3094	3095	3096	3097	3098	3099	3100	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	3112	3113	3114	3115	3116	3117	3118	3119	3120	3121	3122	3123	3124	3125	3126	3127	3128	3129	3130	3131	3132	3133	3134	3135	3136	3137	3138	3139	3140	3141	3142	3143	3144	3145	3146	3147	3148	3149	3150	3151	3152	3153	3154	3155	3156	3157	3158	3159	3160	3161	3162	3163	3164	3165	3166	3167	3168	3169	3170	3171	3172	3173	3174	3175	3176	3177	3178	3179	3180	3181	3182	3183	3184	3185	3186	3187	3188	3189	3190	3191	3192	3193	3194	3195	3196	3197	3198	3199	3200	3201	3202	3203	3204	3205	3206	3207	3208	3209	3210	3211	3212	3213	3214	3215	3216	3217	3218	3219	3220	3221	3222	3223	3224	3225	3226	3227	3228	3229	3230	3231	3232	3233	3234	3235	3236	3237	3238	3239	3240	3241	3242	3243	3244	3245	3246	3247	3248	3249	3250	3251	3252	3253	3254	3255	3256	3257	3258	3259	3260	3261	3262	3263	3264	3265	3266	3267	3268	3269	3270	3271	3272	3273	3274	3275	3276	3277	3278	3279	3280	3281	3282	3283	3284	3285	3286	3287	3288	3289	3290	3291	3292	3293	3294	3295	3296	3297	3298	3299	3300	3301	3302	3303	3304	3305	3306	3307	3308	3309	3310	3311	3312	3313	3314	3315	3316	3317	3318	3319	3320	3321	3322	3323	3324	3325	3326	3327	3328	3329	3330	3331	3332	3333	3334	3335	3336	3337	3338	3339	3340	3341	3342	3343	3344	3345	3346	3347	3348	3349	3350	3351	3352	3353	3354	3355	3356	3357	3358	3359	3360	3361	3362	3363	3364	3365	3366	3367	3368	3369	3370

Annex 12. TOTAL PRIMARY ENERGY SUPPLY, Reference Scenario (in Million Tons of Oil Equivalent, MTOE)

Energy Source	Actual																	Outlook																	Average Annual Growth Rates (%)	
																																			Average Shares % (2018-2040)	
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2018-'30	18-'40							
Oil	14.42	17.21	18.55	19.67	19.99	19.31	19.47	20.51	21.60	22.86	24.14	25.36	26.62	28.03	29.50	31.06	32.69	34.38	36.10	37.90	39.73	41.62	43.54	45.53	47.56	49.65	51.78	32.12	4.18	4.42						
Natural Gas	3.04	2.85	3.27	3.33	3.60	3.63	3.32	3.30	3.28	3.26	3.24	2.74	2.78	2.81	2.85	2.88	2.92	2.96	3.52	4.08	5.81	6.67	7.29	7.92	8.87	10.01	11.19	4.57	-1.73	5.29						
Coal	10.64	11.61	13.09	15.47	16.35	17.48	20.59	22.00	23.94	25.88	27.84	29.80	31.43	33.07	34.72	36.40	38.10	39.81	41.53	43.71	44.94	46.92	50.30	53.72	57.14	60.57	64.17	36.30	7.30	6.41						
Renewable	18.89	19.59	19.69	19.59	19.72	19.69	17.50	17.88	18.57	20.22	21.28	22.67	24.26	25.68	27.11	28.52	29.95	30.50	30.46	30.03	30.30	31.37	31.76	32.45	32.80	33.15	33.57	27.02	3.55	2.45						
Geothermal	8.86	9.50	9.52	8.83	8.97	9.19	6.49	6.59	7.06	8.30	8.94	9.84	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.15	10.15	10.15	10.15	10.15	10.15	10.18	10.14	1.41	0.57						
Hydro	2.27	2.16	2.02	2.39	2.34	2.00	2.29	2.29	2.31	2.36	2.59	2.84	3.43	4.56	5.69	6.82	7.95	8.16	7.76	7.49	7.49	8.22	8.22	8.22	8.64	8.64	8.67	5.26	10.74	6.14						
Wind	0.01	0.06	0.08	0.09	0.10	0.09	0.15	0.15	0.15	0.15	0.19	0.22	0.30	0.39	0.47	0.55	0.63	0.72	0.80	0.81	0.88	0.96	1.04	1.12	1.20	1.29	1.39	0.47	15.34	12.37						
Solar	0.00	0.01	0.09	0.10	0.11	0.11	0.37	0.57	0.73	0.88	1.01	1.16	1.30	1.44	1.58	1.70	1.84	1.99	2.15	2.30	2.46	2.63	2.81	2.93	3.10	3.28	3.47	1.55	26.71	17.11						
Biomass	7.36	7.43	7.49	7.65	7.67	7.74	7.62	7.66	7.67	7.84	7.85	7.86	7.87	7.90	7.92	7.95	7.99	8.02	8.07	8.11	8.16	8.20	8.24	8.28	8.32	8.35	8.38	8.62	0.34	0.41						
Biofuels	0.38	0.43	0.48	0.52	0.53	0.57	0.58	0.62	0.65	0.70	0.74	0.78	0.82	0.86	0.91	0.96	1.02	1.07	1.12	1.18	1.24	1.29	1.35	1.41	1.46	1.52	1.58	0.98	5.53	5.07						
Other Technologies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Total	46.99	51.27	54.59	57.96	59.66	60.10	60.88	63.68	67.38	72.22	76.49	80.57	85.09	89.59	94.17	98.86	103.66	107.64	111.61	115.71	120.78	126.58	132.89	139.62	146.37	153.38	160.71	100	4.71	4.61						

Annex 13. TOTAL PRIMARY ENERGY SUPPLY, Clean Energy Scenario (in Million Tons of Oil Equivalent, MTOE)

Energy Source	Actual																	Outlook																	Average Annual Growth Rates (%)	
																																			Average Shares % (2018-2040)	
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2018-'30	18-'40							
Oil	14.42	17.21	18.55	19.67	19.99	19.31	18.38	19.21	19.79	20.50	21.57	22.34	23.32	24.39	25.57	26.85	28.20	29.61	31.10	32.64	34.20	35.73	37.43	39.10	40.78	42.48	44.19	30.04	2.91	3.67						
Natural Gas	3.04	2.85	3.27	3.33	3.60	3.63	3.01	3.15	3.19	3.22	3.27	3.39	3.49	3.60	3.70	3.81	3.91	4.01	4.79	5.57	6.35	6.65	6.65	6.65	6.65	6.65	6.65	5.66	0.69	6.98						
Coal	10.64	11.61	13.09	15.47	16.35	17.48	20.39	21.59	23.54	25.51	27.49	29.08	30.69	32.81	34.17	35.12	35.84	36.38	37.33	38.08	38.14	38.34	38.56	38.83	39.13	39.44	39.77	34.00	6.76	4.12						
Renewable	18.89	19.59	19.69	19.59	19.72	19.69	17.14	17.58	18.19	19.76	20.95	22.16	23.77	24.41	25.38	26.88	29.19	31.63	32.53	33.09	34.62	36.22	37.93	39.74	41.88	42.67	44.26	29.96	3.33	3.74						
Geothermal	8.86	9.50	9.52	8.83	8.97	9.19	6.30	6.59	7.06	8.30	8.94	9.84	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.15	10.15	10.15	10.15	10.15	10.15	10.18	11.82	1.74	2.77						
Hydro	2.27	2.16	2.02	2.39	2.34	2.00	2.29	2.29	2.31	2.36	2.75	2.91	3.50	3.82	4.44	5.43	7.19	8.96	8.74	8.65	9.08	9.50	9.93	10.53	10.71	10.90	11.11	5.95	9.82	7.35						
Wind	0.01	0.06	0.08	0.09	0.10	0.09	0.15	0.15	0.15	0.15	0.14	0.21	0.21	0.31	0.42	0.52	0.64	0.75	0.89	1.03	1.12	1.28	1.46	1.67	1.88	2.10	2.32	0.67	16.77	15.41						
Solar	0.00	0.01	0.09	0.10	0.11	0.11	0.29	0.40	0.51	0.61	0.72	0.83	0.97	1.11	1.26	1.41	1.56	1.74	1.90	2.11	2.32	2.56	2.81	3.06	3.32	3.63	3.96	1.49	25.00	17.82						
Biomass	7.36	7.43	7.49	7.65	7.67	7.74	7.56	7.56	7.57	7.74	7.74	7.75	7.77	7.80	7.83	7.86	7.89	8.01	8.14	8.27	8.41	8.54	8.67	8.80	8.92	9.04	9.16	9.10	0.24	0.81						
Biofuels	0.38	0.43	0.48	0.52	0.53	0.57	0.56	0.59	0.60	0.62	0.65	0.68	0.71	0.75	0.79	0.83	0.87	0.92	0.97	1.01	1.06	1.10	1.15	1.20	1.24	1.28	1.32	0.91	4.22	4.22						
Other Technologies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Total	46.99	51.27	54.59	57.96	59.66	60.10	58.91	61.53	64.71	68.99	73.28	76.97	81.28	85.21	88.82	92.66	97.15	101.83	105.75	109.39	113.31	118.72	123.95	129.29	134.61	140.10	145.74	100	4.15	4.14						



Annex 14. Greenhouse Gas Emission (GHG), By Fuel, Reference Scenario (in Million Tons of CO<sub>2</sub> equivalent, MTCO<sub>2</sub>e)

Fuel	Actual												Outlook												Average Annual Growth Rates (%)				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average Shares % (2018-2040)	Average Annual Growth Rates (%)
Coal	40.93	44.81	50.37	59.78	63.16	71.99	82.56	88.22	95.98	103.79	111.63	119.52	126.04	132.61	139.23	145.98	152.78	159.64	166.55	175.28	180.23	188.16	201.70	215.44	229.17	242.90	257.34	56.93	6.59
Natural Gas	7.11	6.68	7.66	7.55	8.43	7.84	7.80	7.75	7.70	7.65	7.60	6.44	6.52	6.61	6.69	6.78	6.86	6.95	8.27	9.59	13.64	15.68	17.13	18.60	20.84	23.52	26.28	4.20	-1.70
Oil	41.50	45.97	49.22	51.15	51.73	57.69	60.79	64.01	67.39	71.32	75.30	79.07	82.99	87.34	91.89	96.72	101.77	106.98	112.33	117.88	123.55	129.39	135.35	141.49	147.77	154.23	160.85	38.87	5.29
<b>Total</b>	<b>89.53</b>	<b>97.46</b>	<b>107.25</b>	<b>118.48</b>	<b>123.32</b>	<b>137.52</b>	<b>151.15</b>	<b>159.97</b>	<b>171.07</b>	<b>182.76</b>	<b>194.54</b>	<b>205.03</b>	<b>215.55</b>	<b>226.56</b>	<b>237.81</b>	<b>249.47</b>	<b>261.41</b>	<b>273.57</b>	<b>287.15</b>	<b>302.75</b>	<b>317.43</b>	<b>333.22</b>	<b>354.18</b>	<b>375.53</b>	<b>397.78</b>	<b>420.65</b>	<b>444.47</b>	<b>100</b>	<b>6.46</b>

Annex 15. Greenhouse Gas Emission (GHG), By Fuel, Clean Energy Scenario (in Million Tons of CO<sub>2</sub> equivalent, MTCO<sub>2</sub>e)

Fuel	Actual												Outlook												Average Annual Growth Rates (%)				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average Shares % (2018-2040)	Average Annual Growth Rates (%)
Coal	40.93	44.81	50.37	59.78	63.16	71.99	81.75	86.56	94.41	102.30	110.23	116.64	123.09	131.57	137.02	140.83	143.74	146.69	149.68	152.72	152.93	153.74	154.60	155.70	156.87	158.11	159.44	56.81	7.09
Natural Gas	7.11	6.68	7.66	7.55	8.43	7.68	7.06	7.40	7.49	7.58	7.68	7.93	8.17	8.41	8.65	8.89	9.13	9.37	11.20	13.03	14.85	15.54	19.37	23.19	27.73	32.45	37.21	5.59	0.67
Oil	41.50	45.97	49.22	51.15	51.73	54.98	55.61	58.12	59.88	62.04	65.28	67.55	70.48	73.70	77.23	81.04	85.09	89.28	93.72	98.30	102.97	107.50	112.55	117.48	122.45	127.46	132.48	37.60	4.23
<b>Total</b>	<b>89.53</b>	<b>97.46</b>	<b>107.25</b>	<b>118.48</b>	<b>123.32</b>	<b>134.65</b>	<b>144.42</b>	<b>152.68</b>	<b>161.78</b>	<b>171.92</b>	<b>183.19</b>	<b>193.12</b>	<b>201.74</b>	<b>213.68</b>	<b>222.90</b>	<b>230.77</b>	<b>237.96</b>	<b>245.35</b>	<b>254.59</b>	<b>264.05</b>	<b>270.76</b>	<b>276.77</b>	<b>286.53</b>	<b>296.36</b>	<b>307.04</b>	<b>318.02</b>	<b>329.13</b>	<b>100</b>	<b>5.63</b>

Annex 16. Greenhouse Gas Emission (GHG), By Sector, Reference Scenario (in Million Tons of CO<sub>2</sub> equivalent, MTCO<sub>2</sub>e)

Sector	Actual												Outlook												Average Annual Growth Rates (%)				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average Shares % (2018-2040)	Average Annual Growth Rates (%)
Transformation*	44.12	47.80	51.58	58.92	64.50	71.14	81.39	86.71	94.10	101.46	108.84	115.19	121.25	127.31	133.37	139.53	145.69	151.85	159.25	168.45	176.55	185.55	199.52	213.63	228.43	243.59	259.48	55.10	7.03
Industry	12.68	12.99	15.05	16.39	13.99	15.20	15.99	16.82	17.69	18.61	19.59	20.63	21.74	22.92	24.18	25.54	27.00	28.59	30.29	32.13	34.12	36.26	38.58	41.10	43.84	46.82	50.08	10.86	5.63
Transport	25.69	29.71	34.15	33.20	34.36	39.22	41.25	43.37	45.60	48.37	51.12	53.53	56.18	59.20	62.35	65.68	69.15	72.69	76.24	79.84	83.44	87.07	90.69	94.32	97.90	101.48	104.99	26.42	6.00
Others	7.04	6.96	8.47	9.98	10.47	11.97	12.51	13.08	13.69	14.32	14.98	15.67	16.38	17.13	17.91	18.72	19.56	20.44	21.36	22.33	23.32	24.34	25.39	26.48	27.60	28.75	29.93	7.63	5.35
<b>Total</b>	<b>89.53</b>	<b>97.46</b>	<b>107.25</b>	<b>118.48</b>	<b>123.32</b>	<b>137.52</b>	<b>151.15</b>	<b>159.97</b>	<b>171.07</b>	<b>182.76</b>	<b>194.54</b>	<b>205.03</b>	<b>215.55</b>	<b>226.56</b>	<b>237.81</b>	<b>249.47</b>	<b>261.41</b>	<b>273.57</b>	<b>287.15</b>	<b>302.75</b>	<b>317.43</b>	<b>333.22</b>	<b>354.18</b>	<b>375.53</b>	<b>397.78</b>	<b>420.65</b>	<b>444.47</b>	<b>100</b>	<b>6.46</b>

Annex 17. Greenhouse Gas Emission (GHG), By Sector, Clean Energy Scenario (in Million Tons of CO<sub>2</sub> equivalent, MTCO<sub>2</sub>e)

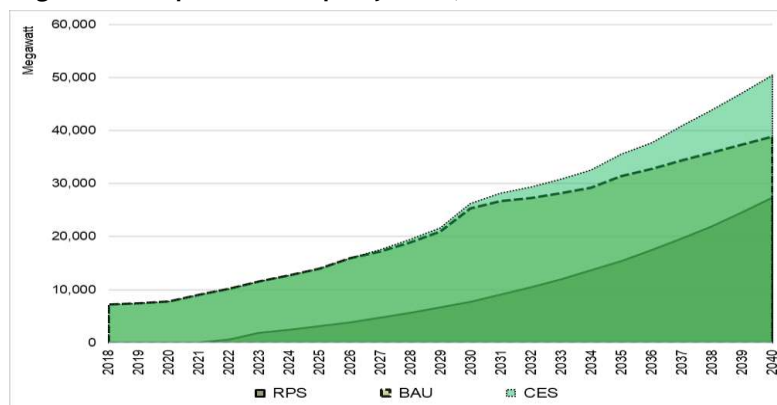
Sector	Actual												Outlook												Average Annual Growth Rates (%)				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Average Shares % (2018-2040)	Average Annual Growth Rates (%)
Transformation*	44.12	47.80	51.58	58.92	64.50	70.95	79.82	84.65	92.31	99.77	107.52	113.71	119.79	127.96	133.06	136.48	138.89	141.30	145.28	149.30	150.44	150.97	154.64	158.45	162.99	167.71	172.47	55.61	6.60
Industry	12.68	12.99	15.05	16.39	13.99	14.52	15.20	15.90	16.65	17.46	18.32	19.24	20.23	21.29	22.43	23.67	25.01	26.48	28.06	29.79	31.65	33.67	35.87	38.28	40.90	43.76	46.89	11.44	4.96
Transport	25.69	29.71	34.15	33.20	34.36	37.43	37.24	38.89	39.68	41.03	43.14	44.39	46.34	48.40	50.71	53.22	55.93	58.67	61.54	64.40	67.23	69.78	72.72	75.37	77.88	80.23	82.38	24.96	4.14
Others	7.04	6.96	8.47	9.98	10.47	11.75	12.18	12.64	13.13	13.66	14.21	14.79	15.39	16.03	16.70	17.40	18.13	18.89	19.71	20.56	21.44	22.35	23.29	24.27	25.28	26.32	27.39	8.00	4.68
<b>Total</b>	<b>89.53</b>	<b>97.46</b>	<b>107.25</b>	<b>118.48</b>	<b>123.32</b>	<b>134.65</b>	<b>144.42</b>	<b>152.68</b>	<b>161.78</b>	<b>171.92</b>	<b>183.19</b>	<b>193.12</b>	<b>201.74</b>	<b>213.68</b>	<b>222.90</b>	<b>230.77</b>	<b>237.96</b>	<b>245.35</b>	<b>254.59</b>	<b>264.05</b>	<b>270.76</b>	<b>276.77</b>	<b>286.53</b>	<b>296.36</b>	<b>307.04</b>	<b>318.02</b>	<b>329.13</b>	<b>100</b>	<b>5.63</b>

\*power generation, oil refining

## Annex 18. IMPACT ANALYSIS ON RENEWABLE ENERGY PORTFOLIO STANDARDS (RPS): Renewable Energy (RE) Targets vis-à-vis Total Energy Supply

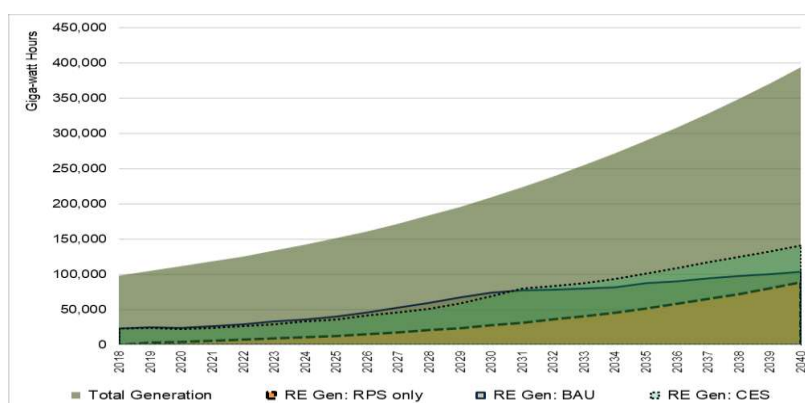
The level of RE generation from RPS is supported by 27,325 MW of RE capacity by 2040. This would mean that RPS alone can supply the needed capacity to meet the NREP target of an additional 20,000 MW RE capacity by 2040 from the 2018 level of 7,226 MW. However, RPS-based capacity is still lower compared to that of the Reference and CES. This would mean that other RE policy mechanisms have the potential to push RE capacity further beyond the RPS level – as can be seen in the Reference and CES. (Figure A.1)

Figure A.1. Comparative RE Capacity Levels, 2018-2040



The RE transition in 2019 brings the RE generation level to reach 89.1 TWh by 2040 from 3.9 TWh in 2020 – representing a 16.9 percent average annual rate of increase across the planning period. This also represents 22.6 percent of the projected 394.5 TWh total generation of all technologies by 2040. As can be seen in Figure A.2.2, RPS generation output already represents a significant chunk of the aggregate RE under both Reference (85.8 percent share) and CES (73.7 percent share). Under these two (2) scenarios, the projected RE share to total generation by 2040 is 26.3 percent and 37.2 percent, respectively. During the first decade, Figure 2.2 shows some episodes that RE generation is lower than the Reference due to lower demand for electricity vis-a-vis peak demand as an impact of the energy efficiency measures in the power sector. Variable REs or VREs such as solar which has a big chunk in the capacity mix of RE in CES gives way for oil-based power plants during peak demand to balance the reliability of the grid. Generation from oil-based power plants accounts for only 3% of the mix throughout the planning horizon.

Figure A.2.2 RE Generation Levels, 2018-2040



Annex 19. LIST OF COMMITTED POWER PROJECTS IN LUZON (as of 31 December 2018)

Name of Project	Proponent	Location	Rated Capacity (MW)	Target Commercial Operation
<b>Coal</b>				
Limay Power Plant Project Phase II*	SMC Consolidated Power Corporation	Brgy. Lamao, Limay, Bataan	3,950.0	---
Masinloc Expansion Project	AES Masinloc Power Partners Co., Inc.	Zambales	150.0	---
San Buenaventura Power Ltd. Co. (SBPL) Project *	San Buenaventura Power Ltd. Co. (SBPL)	Brgy. Cagsiay 1, Mauban, Quezon	300.0	December 2020
RPEI Coal-Fired Power Plant	Redondo Peninsula Energy, Inc.	Sitio Naglatore, Cawag, Subic Bay Freeport Zone	500.0	---
GNPower Dinginin 2x660 MW Supercritical Coal-Fired Power Plant	GNPower Dinginin Coal Plant Ltd. Co.	Mariveles, Bataan	1,200.0	June 2021
AOE Coal-Fired Power Plant	Atimonan One Energy	Atimonan, Quezon	1,200.0	Unit 1 - 2Q 2024 Unit 2 - TBD
<b>Natural Gas</b>				
Pagbilao Combined Cycle Gas Fired Power Plant Proposed 3x200 MW CCGT Power Plant	Energy World Corporation	Brgy. Ibabang Polo, Grande Island, Pagbilao, Quezon	650.0	2022
<b>Hydropower</b>				
Majajjay*	Majajjay Hydro Power Company, Inc.	Majajjay, Laguna	22.6	---
Man-Asok	Benguet Electric Cooperative	Buguias, Benguet	3.0	December 2020
Laguio Malaki 1	Enervantage Suppliers Co., Inc.	Mauban, Quezon	1.6	December 2020
Labayat River (Upper Cascade)	Repower Energy Development Corp.	Real, Quezon	3.0	TBD
Matuno	Epower Technologies Corporation	Bambang, Nueva Ecija	8.0	TBD
Tubao	Tubao Mini-Hydro Electric Corporation	Tubao, La Union	1.5	TBD
Colasi	Colasi Mini Hydro Electric Power Plant Corp.	Mercedes, Camarines Norte	1.0	TBD
Rangas	Clean and Green Energy Solutions, Inc.	Goa & Tigaon, Camarines Sur	1.5	TBD
<b>Solar</b>				
Concepcion 1 Solar Power Project	Solar Philippines Tarlac Corporation	Concepcion, Tarlac	115.0	December 2021
<b>Geothermal</b>				
Bacman 3 (Tanawon) Geothermal Project	Energy Development Corporation	Guinlajon, Sorsogon	31.0	December 2022
<b>Biomass</b>				
Isabela La Suerte Rice Husk-Fired Power Project	Isabela La Suerte Rice Mill Corporation	Camarines Sur	6.2	September 2020
FQBC Biogas Power Plant Project	First Quezon Biogas Corporation	Quezon	5.0	December 2020
	<b>TOTAL</b>		<b>4,774.8</b>	

Note:

\*Newly Commissioned Power Plant in 2019.

Annex 20. LIST OF COMMITTED POWER PROJECTS IN VISAYAS (as of 31 December 2018)

Name of Project	Proponent	Location	Rated Capacity (MW)	Target Commercial Operation
<b>Coal</b>				
Therma Visayas Energy Project*	Therma Visayas Inc.	Brgy. Bato, Toledo City, Cebu	435.0	---
Palm Concepcion Coal-Fired Power Plant	Palm Concepcion Power Corp. (Formerly DMCI Concepcion Power Corp.)	Brgy. Nipa, Concepcion, Iloilo	300.0	December 2021
<b>Oil-Based</b>				
CENPRI Diesel Power Plant*	Central Negros Power Reliability, Inc.	Brgy. Calumangan, Bago City, Negros Occidental	78.0	---
Modular Diesel Ancillary Service Power Plant	Isabel Ancillary Services Co. Ltd. (Formerly Marubeni Diesel Genset Facility)	Isabel, Leyte	8.0	March 2021
<b>Hydropower</b>				
Igbulo (Bais) Hydroelectric Power Project	Century Peak Energy Corporation	Igaras, Iloilo	23.1	2020
Timbaban	Oriental Energy and Power Generation Corp.	Madalag, Aklan	5.1	2020
<b>Solar</b>				
Kalibo Solar Power Project	Solar Pacific Citysun Corporation	Kalibo, Aklan	1.2	TBD
Kabankalan Solar Power Project	Solar Pacific Citysun Corporation	Kabankalan City, Negros Occidental	0.2	TBD
Boracay Solar Power Project	Solar Pacific Citysun Corporation	Malay, Aklan	0.6	TBD
<b>Geothermal</b>				
Biliran Geothermal Plant Project	Biliran Geothermal Incorporated	Malay, Aklan	0.4	TBD
			<b>50.0</b>	Unit 1 (3.5 MW) - 2022 Unit 2 (4.5 MW) - 2024 Unit 3 (10 MW) - 2025 Unit 4 (10 MW) - 2026 Unit 5 (22 MW) - 2027 Unit 6 (10 MW) - TBD
<b>Biomass</b>				
VMC Cogeneration Power Plant Project	Victorias Milling Company, Inc.	Biliran	178.6	January 2021
SCBI Multi-Feedstock Biomass Power Plant Project	San Carlos Biopower, Inc.	Victoria, Negros Occidental	40.0	100% Complete (waiting for Cebu-Negros-Panay TL Project completion)
HPC Cogeneration Power Plant Project	Hawaiian-Philippine Company	Negros Occidental	20.0	100% Complete (waiting for Cebu-Negros-Panay TL Project completion)
Bais Bagasse-Fired Cogeneration Power Plant Project*	Central Azucarera de Bais	Negros Occidental	20.6	100% Complete (waiting for Cebu-Negros-Panay TL Project completion)
SNBI Cane trash-Fired Biomass Power Plant Project	South Negros BioPower, Inc.	Calasagan, Bais City, Negros Occidental	25.0	---
BISCOM Cogeneration Power Plant Project	BISCOM, Inc.	Negros Occidental	25.0	100% Complete (waiting for Cebu-Negros-Panay TL Project completion)
	<b>TOTAL</b>	Binalbagan, Negros Occidental	<b>48.0</b>	9
			<b>765.9</b>	

**Note:**

\* Newly Commissioned Power Plant in 2019.

Annex 21. LIST OF COMMITTED POWER PROJECTS IN MINDANAO (as of 31 December 2018)

Name of Project	Proponent	Location	Rated Capacity (MW)	Target Commercial Operation
<b>Coal</b>			<b>700.0</b>	
GNPower Kauswagan Clean Coal-Fired Power Plant**	GN Power Kauswagan Ltd. Co.	Kauswagan, Lanao del Norte	600.0	Unit 1 - March 2019 Unit 2 - May 2019 Unit 3 - June 2019 Unit 4 - December 2020
Southern Mindanao Coal Fired Power Station Phase 2	Sarangani Energy Corporation	Brgy. Kamanga, Maasim, Sarangani	100.0	TBD
<b>Hydropower</b>			<b>33.0</b>	
Asiga*	Asiga Green Energy Corp.	Pangaylan, Santiago, Agusan del Norte	8.0	---
Lake Mainit	Agusan Power Corporation	Jabonga, Agusan del Norte	25.0	December 2020
<b>Solar</b>			<b>25.0</b>	
GenSan Solar Power Project*	Astronergy Development GenSan Inc.	General Santos City, South Cotabato	25.0	---
<b>Biomass</b>			<b>30.4</b>	
GEEC Biomass Cogeneration System	Green Earth Enersource Corporation	Maguindanao	3-5	TBD
LPC Rice Husk-Fired Biomass Power Plant Project	Lamsan Power Corporation	Sultan Kudarat, Maguindanao	5-5	TBD
Biogas Power Plant Project	Biotech Farms, Inc.	Banga, South Cotabato	12.4	TBD
Biomass Power Plant Project	Biotech Farms, Inc.	Tantangan, South Cotabato	6.0	TBD
PTCI Rice Husk-Fired Biomass Cogeneration Facility	Philippine Trade Center, Inc.	Sultan Kudarat, Maguindanao	3.0	TBD
<b>Note:</b>	<b>TOTAL</b>		<b>788.3</b>	

\*Newly Commissioned Power Plant in 2019.

\*\*Newly Commissioned Power Plant in 2019 except for Unit No. 4.

Annex 22. LIST OF INDICATIVE POWER PROJECTS IN LUZON (as of 31 December 2018)

Name of Project	Proponent	Location	Rated Capacity (MW)	Target Commercial Operation
			<b>8,935.0</b>	
<b>Coal</b>				
H & WB PCB Supercritical Coal-Fired Power Plant	H & WB Asia Pacific (PTE LTD) Corporation	Jose Panganiban, Camarines Norte	700.0	Unit 1 - 2023 Unit 2 - (subject to the completion of the proposed 500 kV Tagkawayan Substation, and to the demand and supply status in Luzon Grid) under evaluation, schedule wise)
2x500 MW KEPCO Pangasinan Coal-Fired Power Plant	KEPCO Philippines Corporation	Sual, Pangasinan	1,000.0	March 2024
Quezon Coal Fired Thermal Plant Project	Orion Pacific Prime Energy, Inc.	Tagkawayan, Quezon	1,200.0	March 2024
SRPGC 2x350MW Coal-Fired Power Plant Project	St. Raphael Power Generation Corporation	Brgy. San Rafael, Calaca, Batangas	700.0	2025
Global Luzon Coal-Fired Power Plant	Global Luzon Energy Development Corporation	Brgys. Carisquis and Nalvo Sur, Luna, La Union	670.0	TBD
Merbau Coal Fired Thermal Power Plant	Merbau Corporation	Brgy. Pinamukan Ibaba, Batangas City	600.0	TBD
SMC Circulating Fluidized Bed Coal-Fired Power Plant	SMC Global Power	Brgy. Ibabang Polo, Pagbilao, Quezon	600.0	TBD
SMC Circulating Fluidized Bed Coal-Fired Power Plant	SMC Global Power Holdings Corp.	Sariaya, Quezon	600.0	TBD
Zestpower Coal Thermal Plant	Zestpower Corporation	Mariveles, Bataan	660.0	TBD
SMC Mariveles Coal-Fired Power Plant	SMC Global Power Holdings Corp.	Mariveles, Bataan	1,200.0	TBD
Supercritical Pulverized Coal Thermal	Masinloc Power Partners Co, Ltd.	Masinloc, Zambales	1,005.0	TBD
			<b>346.0</b>	
<b>Oil-Based</b>				
Ingrid Pillilla (Diesel) Power Plant	Ingrid Power Holdings, Inc. (Formerly AC Energy Devco, Inc.)	Pillilla, Rizal	300.0	March 2021
SPC - Tarlac Bunker Fired Power Plant	Supreme Power Corp.	Capas, Tarlac	11.0	August 2021
Isla del Fuego Bunker Fired Diesel Power Generating Facility	Isla del Fuego Power Utilities	Redondo Peninsula, Subic, Zambales	35.0	TBD
			<b>4,060.0</b>	
<b>Natural Gas</b>				
500 MW Vires LNG-Fired Power Barge Project	VIRE Energy Corporation	Batangas Bay area, Batangas	500.0	TBD
1x450 Sta. Maria Power Plant (Phase II)	First Gen Ecopower Solutions Inc.	Santa Rita, Batangas	450.0	TBD
SMC Iljan LNG Power Plant	SMC Global Power Holdings Corp.	Batangas	1,800.0	TBD
Combined Cycle Gas Turbine Project	Limay LNG Power Corporation	Limay, Bataan	1,100.0	TBD
Gas Turbine Power Plant	Millennium Energy Inc.	Navotas Fish Port	210.0	TBD
			<b>3,344.2</b>	
<b>Hydropower</b>				
Ibulao Hydroelectric Power Project	Hydrocore, Inc.	Lagawe, Ifugao	4.5	December 2020
Ibulao 1	Kiangnan Mini Hydro Corporation	Kiangnan, Ifugao	6.8	December 2020
Ibulao I Hydroelectric Power Project	Kiangnan Mini-Hydro Corporation	Kiangnan, Ifugao	6.0	December 2020
Dupinga Hydroelectric Power Project	Constellation Energy Corporation	Gabaldon, Nueva Ecija	3.0	December 2022
Lamut Hydroelectric Power Project	Lamut - Asipulo Mini Hydro Corp.	Lamut/Asipulo, Ifugao	6.0	2022
Gened - 1 Hydroelectric Power Project	Pan Pacific Renewable Power Phils. Corp.	Pudtol, Apayaw	150.0	2nd Quarter 2023
Kibungan Hydroelectric Power Project	Hedcor, Inc.	Kibungan, Benguet	40.0	2023
Didipio 1	AT Dinum Company	Kasibu, Nueva Vizcaya	2.1	December 2024
Kabayang 2 (Natalang HEP)	Hedcor Cordillera, Inc.	Kabayang, Benguet	38.0	December 2024
Ilaguen 3	Isabela Power Corporation	Echague, Isabela	11.0	December 2024
Kapangan	Cordillera Hydro Electric Power Corporation	Kapangan & Kibungan, Benguet	60.0	December 2025
Tumauni (Lower Cascade)	Quadriver Energy Corp.	Tumauni, Isabela	7.8	December 2025
Abdao HEP	AV Garcia Power Systems Corp.	Tabaan Sur, Tuba, Benguet	2.0	December 2025
Barit (Irrigation Discharge) Hydroelectric Power Project	Nascent Technologies	Buhi, Camarines Sur	0.4	December 2025
Talubin Hydropower Project	Mountain Province Electric Cooperative, Inc.	Bontoc, Mountain Province	4.9	December 2025
Ilaguen 4	Isabela Power Corporation	Echague, Isabela	10.0	December 2025
Matuno 1	Smith Bell Mini Hydro Corporation	Ambaguio, Nueva Vizcaya	7.4	December 2025
Hungduan	Kiangnan Mini Hydro Corporation	Kiangnan, Ifugao	4.0	December 2025
Asin	Kiangnan Mini Hydro Corporation	Kiangnan, Ifugao	7.0	December 2025
Ilaguen	Isabela Power Corporation	San Mariano & San Guillermo	19.0	December 2025
Piapi	Repower Energy Development	Mauban, Quezon	3.3	December 2025
Lower Labayat	Repower Energy Development	Real, Quezon	1.4	December 2026
Ilaguen 2	Isabela Power Corporation	Dinapigue, Isabela	14.0	December 2026
Biyao	AV Garcia Power Systems Corp.	Balbalan, Kalinga	0.8	For validation
Matuno 2	Smith Bell Mini Hydro Corporation	Bambang, Nueva Ecija	7.9	TBD
Lalawinan Mini-Hydro Power Project	Repower Energy Development	Real, Quezon	3.0	TBD
Pinacanauan	Sunwest Water & Electric Co., Inc.	Peñablanca, Cagayan	6.0	TBD
Matibuey	Sta. Clara Power Corporation	Matibuey, Ilocos Sur	16.0	TBD
Tibag	Repower Energy Development	Real, Quezon	4.4	TBD
Tignoan River (Upper Cascade) HEP	Repower Energy Development Corp.	Real, Quezon	1.5	TBD
Ibulao 2	Enerhighland Corporation	Municipalities of Kiangnan, Lamut and Lagawe, Province of Ifugao	7.4	TBD
Tinoc 1	Quadriver Energy Corp.	Tinoc, Ifugao	4.1	TBD
Tinoc 2	Philnew Hydro Power Corporation	Tinoc, Ifugao	11.0	TBD
Tinoc 3	Quadriver Energy Corp.	Tinoc, Ifugao	8.0	TBD
Tinoc 4	Philnew Hydro Power Corporation	Tinoc, Ifugao	5.0	TBD
Tumauni (Upper Cascade)	Philnew Hydro Power Corporation	Tumauni, Isabela	14.0	TBD
Kabayang 1	Hedcor Benguet, Inc.	Kabayang, Benguet	20.0	TBD
Kabayang 3	Hedcor Benguet, Inc.	Kabayang, Benguet	27.0	TBD
Bineng 1-2b Combination HEPP	Hedcor, Inc.	La Trinidad, Benguet	19.0	TBD
Tignoan HEP	Aurora All Asia Energy Corp.	Real, Quezon	20.0	TBD
Maris Main Canal HEP	SN Aboitiz Power Generation	Alfonso Lista, Ifugao	1.8	TBD
100 MW Alimit	SN Aboitiz Power-Ifugao	Lagawe, Ifugao	100.0	TBD
240 MW Alimit	SN Aboitiz Power-Ifugao	Lagawe, Ifugao	240.0	TBD
Oilicon HEPP	SN Aboitiz Power-Ifugao	Lagawe, Ifugao	10.0	TBD
Cervantes-Mankayan-Bakun HEPP	Hedcor, Inc.	Benguet	27.0	TBD
Chico Hydroelectric Power Project	San Lorenzo Ruiz Piat & Water	Tabuk, Kalinga	150.0	TBD
Kibungan Pumped-Storage HEPP	COHECO Badeo Corporation	Kibungan, Benguet	500.0	TBD
Ilaguen 4 Hydropower Project	Isabela Power Corporation	Echague, Isabela	10.0	TBD
Wawa Pumped Storage 1 HEP	Olympia Viologo Water and Power, Inc.	San Mateo, Antipolo, and Rodriguez, Rizal	500.0	TBD
Wawa Pumped Storage 2 HEP	Olympia Viologo Water and Power, Inc.	San Mateo, Antipolo, and Rodriguez, Rizal	100.0	TBD
Wawa Pumped Storage 3 HEP	Olympia Viologo Water and Power, Inc.	San Mateo, Antipolo, and Rodriguez, Rizal	50.0	TBD
Nabuangan Run-of-River HEP	Strategic Power Development Corp.	Apayao	10.0	TBD
Dingalan Pumped Storage HEP	Strategic Power Development Corp.	Dingalan, Aurora	500.0	TBD
San Roque Lower East Pumped Storage	Strategic Power Development Corp.	Pangasinan	400.0	TBD
Ilaguen HEPP	Isabela Power Corporation	San Mariano and San Guillermo, Isabela	19.0	TBD
Ibulao 2 Hydroelectric Power Project	Kiangnan Mini-Hydro Corporation	Kiangnan, Ifugao	7.4	TBD
Matuno 2 HEPP	Smith Bell Mini-Hydro Corporation	Bambang, Nueva Vizcaya	7.9	TBD
Sablan 1 Hydroelectric Power Project	Hedcor, Inc.	Sablan, Benguet	20.0	TBD
Sablan 2 Hydroelectric Power Project	Hedcor, Inc.	Sablan, Benguet	30.0	TBD
Santol-Sugpon Hydroelectric Power Project	Hedcor, Inc.	Sugpon, Ilocos Sur / Kibungan Benguet	52.0	TBD
Pasil B Hydroelectric Power Project	I-Magat Renewable Energy Corporation	Pasil, Kalinga	15.7	TBD
Pasil C Hydroelectric Power Project	I-Magat Renewable Energy Corporation	Pasil, Kalinga	9.8	TBD

Annex 22. LIST OF INDICATIVE POWER PROJECTS IN LUZON (as of 31 December 2018)

Name of Project	Proponent	Location	Rated Capacity (MW)	Target Commercial Operation
<b>Geothermal</b>				
Bacon-Manito Geothermal Power Project	Energy Development Corporation	Bacon-Manito, Sorsogon	130.0	
Bacman 4 Botong - Rangas Geothermal Project	Energy Development Corporation	Bacon District, Sorsogon, Sorsogon City	80.0	December 2022
Kayabon Geothermal Project	Energy Development Corporation	Manito, Albay	20.0	December 2022
			30.0	2026
<b>Solar</b>				
			<b>8,450.0</b>	
Cabanatuan Solar Power Plant	Greentech Solar Energy Inc.	Cabanatuan, Nueva Ecija	6.3	June 2020
Clark Solar Power Project	Engerence Renewable Energy Corporation	Northern Runway Approach of Clark International Airport, Clark Pampanga	35.0	September 2020
Sta. Rita Solar Power Project - Phase II	Jobin-Sqm Inc. (JOBIN)	Mt. Sta. Rita, Morong and Hermosa, Bataan	67.9	2021
Bongabon Solar Power Plant	Greentech Solar Energy Inc.	Bongabon, Nueva Ecija	18.8	April 2022
Santa Solar Power Project	Satrap Power Corporation	Brgy. Nagpanaoan, Santa, Ilocos Sur	20.0	For validation
Talugtug Solar PV Power Project	Greenenergy Solutions, Inc.	Talugtug, Nueva Ecija	125.0	For validation
Greenenergy Capas Solar Power Project	Greenenergy Solutions, Inc.	Capas, Tarlac	50.0	For validation
Ilagan II Solar PV Power Project	Greenenergy Solutions, Inc.	Ilagan City, Isabela	100.0	For validation
Botolan Solar Power Project	Solar Power Utilities Generator Corporation	Brgy. San Juan, Botolan, Zambales	39.3	TBD
Macabud Solar Photovoltaic Power Project	ATN Philippines Solar Energy Group, Inc.	Brgy. Macabud, Rodriguez, Rizal	30.0	TBD
Concepcion Solar Power Project	Infinity Philippines Renewable Resources, Inc.	Brgy. Sta. Rosa, Concepcion Tarlac	50.6	TBD
Cavite Solar Power Project	Infinity Philippines Renewable Resources, Inc.	Cavite Economic Zone, Rosario Cavite	3.0	TBD
Cordon Solar PV Power Project	Greenenergy Solutions, Inc.	Cordon, Isabela	50.0	TBD
Earthenergy Solar Power Plant	Earthenergy Corp.	Balayon, Batangas	30.0	TBD
V-Mars Solar Power Project	V-Mars Solar Energy Corporation	San Jose/Lupao, Nueva Ecija	10.0	TBD
SJC Solar Power Project	SJC Solar Power Corporation	San Jose City, Nueva Ecija	10.0	TBD
RGEC Solar Power Project	Roxas Green Energy Corporation	Nasugbu and Tuy, Province of Batangas	30.0	TBD
Calabanga Solar Power Project	Calabanga Renewable Energy Inc.	Calabanga, Camarines Sur	50.0	TBD
FPI Solar PV Power Project	Firmgreen Phils. Inc.	Tarlac City, Tarlac	50.0	TBD
Nueva Ecija Solar Power Project	Firmgreen Phils. Inc.	Pantabangan, Nueva Ecija	100.0	TBD
Sta. Maria Solar PV Power Project	Greenenergy Solutions, Inc.	Sta. Maria, Isabela	125.0	TBD
Solana Solar Photovoltaic (PV) Plant Phase I	Solana Solar Alpha, Inc.	Hermosa, Bataan	24.0	TBD
Solana Solar Photovoltaic (PV) Plant Phase II	Solana Solar Alpha, Inc.	Hermosa, Bataan	14.0	TBD
Sta. Maria Solar Power Project	East Coast Fas Renewable Energy and Industrial Corporation	Sta. Maria, Isabela	30.0	TBD
Magsingal Solar Power Plant	Neoenergy Corporation	Magsingal, Ilocos Sur	100.0	TBD
Calamba and Tanauan Solar Power Project	Solar Philippines Tanauan Corporation	Tanauan, Batangas	100.0	TBD
Capas Solar PV Power Project	Sindicatum C-Solar Power Inc.	Capas, Tarlac	22.0	TBD
San Manuel 1 Solar Power Project	Pilipinas Newton Energy Corp.	San Manuel, Pangasinan	70.0	TBD
San Manuel 2 Solar Power Project	Pilipinas Einstein Energy Corp.	San Manuel, Pangasinan	70.0	TBD
Horus Solar Power Plant Project	Horus Solar Energy Corporation	Morong, Bataan	45.0	TBD
Tanauan Batangas Solar I Power Project	Solar Philippines Tanauan Corporation	Tanauan, Batangas	100.0	TBD
Bugallon Solar Power Plant	Phinma Energy Corporation	Brgy. Salomague North, Bugallon, Pangasinan	45.0	TBD
Laguna Lake Bangyas Solar Power Plant	Nuevo Solar Energy Corporation	Calacan and Victoria, Laguna	25.0	TBD
Lumban Solar Power Plant	Nuevo Solar Energy Corporation	Lumban, Laguna	37.0	TBD
San Miguel Solar Power Plant	Powersource First Bulacan Solar Inc.	San Miguel, Bulacan	50.0	TBD
Bawi Solar Power Plant	Phinma Energy Corporation	Lipa City & Padre Garcia, Batangas	45.0	TBD
Iba Palauig 1 Solar Power Project	Solar Philippines Commercial Rooftop Projects, Inc.	Iba, Zambales	1,200.0	TBD
Iba Palauig 2 Solar Power Project	Solar Philippines Commercial Rooftop Projects, Inc.	Iba, Zambales	1,200.0	TBD
Balayon Solar Power Project	Solar Philippines Commercial Rooftop Projects, Inc.	Balayon & Calaca, Batangas	600.0	TBD
Sta. Rosa Nueva Ecija 2 Solar	Solar Philippines Commercial Rooftop Projects, Inc.	Sta. Rosa, Peñaranda, San Leonardo, Nueva Ecija	1,200.0	TBD
Concepcion Tarlac 2 Solar	Solar Philippines Commercial Rooftop Projects, Inc.	Concepcion City, Tarlac	200.0	TBD
Laguna Lake-Balibago SPP	Barracuda Energy Corporation	Laguna de Bay and Santa Rosa, Laguna	126.0	TBD
Laguna Lake-Bay SPP	Barracuda Energy Corporation	Bay-Calaunan and Victoria, Laguna and Laguna de Bay	126.0	TBD
Laguna Lake-Cabuyao SPP	Barracuda Energy Corporation	Cabuyao, Sta. Rosa and Calamba Laguna and Laguna de Bay	100.8	TBD
Laguna Lake-Calamba SPP	Barracuda Energy Corporation	Calamba City, Laguna and Laguna de Bay	100.8	TBD
Laguna Lake-Los Baños SPP	Barracuda Energy Corporation	Los Baños, Laguna	100.8	TBD
Laguna Lake-Lumban SPP	Barracuda Energy Corporation	Cabuyao, Laguna	65.5	TBD
Laguna Lake-UPLB SPP	Barracuda Energy Corporation	UPLB, Los Baños, Laguna	30.0	TBD
Gamu Solar Power Project	Pilipinas Faraday Energy Corp.	Gamu, Isabela	100.0	TBD
San Rafael Solar Power Project	Solar Philippines Commercial Rooftop Projects Inc.	San Rafael, Bulacan	421.2	TBD
San Ildefonso Solar Power Project	Solar Philippines Commercial Rooftop Projects Inc.	San Ildefonso, Bulacan	421.2	TBD
Tarlac Solar Power Project	Solar Philippines Commercial Rooftop Projects Inc.	Tarlac City, Tarlac	150.0	TBD
San Jose Del Monte SPP	MANRESA Power Corporation	San Jose Del Monte, Bulacan	80.0	TBD
Maragondon-Naic-Tanza 2 Solar Power Project	Solar Philippines Commercial Rooftop Projects Inc.	Maragondon-Naic-Tanza, Cavite	200.0	TBD
Sunray Tarlac Solar Power Project	Sunray Power Inc.	Capas and Bamban, Tarlac	100.0	TBD
Currimao Solar Power Project	Island Wind Energy Corp.	Currimao, Ilocos Sur	30.0	TBD
Sulvec Solar Power Plant	Neoenergy Corporation	Narvacan, Ilocos Sur	20.0	TBD
San Miguel Solar Power Plant	Neoenergy Corporation	San Miguel, Bulacan	100.0	TBD
<b>Wind</b>				
			<b>1,275.4</b>	
Matnog 1 Wind Power Project	Energy Development Corporation	Matnog, Sorsogon	153.0	For validation
Matnog 2 Wind Power Project	Energy Development Corporation	Matnog, Sorsogon	206.0	For validation
Matnog 3 Wind Power Project	Energy Development Corporation	Matnog, Sorsogon	206.0	For validation
Sembrano Wind Power Project (Formerly: Phase 2: Mabitac Wind Power Project)	Alternergy Sembrano Wind Corporation	Mt. Sembrano, Mabitac, Laguna	80.4	TBD
Pagudpud Wind Power Project	EDC Pagudpud Wind Power Corporation	Brgy. Balaio and Caunayan, Pagudpud, Ilocos Norte	84.0	TBD
Burgos 2 Wind Power Project	Energy Development Corporation Pagali Burgos Wind Power Corporation	Burgos, Ilocos Norte	183.0	TBD
Phase 1:				
Pasquin East Wind Power Project	Energy Logics Philippines, Inc.	Pasquin, Ilocos Norte	48.0	TBD
Balaio Wind Power Project	Northern Luzon UPC Asia Corporation	Brgy. Balaio, Pagudpud, Ilocos Norte	45.0	TBD
Talisay Wind Power Project	Currimao Solar Energy Corp.	Camarines Norte	50.0	TBD
Talim Wind Power Project	Currimao Solar Energy Corp.	Rizal	140.0	TBD
Calatagan Wind Power Project	Currimao Solar Energy Corp.	Batangas	80.0	TBD
<b>Biomass</b>				
			<b>164.0</b>	
HEC Rice Husk-Fired Biomass Power Plant Project	Hypergreen Energy Corporation	Bulacan	12.0	September 2020
Polillo Biomass Power Plant Project	Renesons Energy Polillo, Inc.	Quezon	1.5	December 2020
NREDC Biomass Power Plant Project	Natures Renewable Energy Development Corp.	Cagayan	24.0	December 2020
EcoMarket Solutions Coconut Waste-Fired Biomass Power Project	EcoMarket Solutions, Inc.	Aurora	2.5	December 2020
CJ Global Waste-to-Energy Power Project	CJ Global Green Energy Philippines Corp.	Camarines Sur	20.0	December 2020
Green Atom Pampanga Waste to Energy Project	Green Atom Renewable Energy Corp	Mabalacat City, Pampanga	6.0	2021
Green Atom Pangasinan Waste to Energy Project	Green Atom Renewable Energy Corp	Laoac, Pangasinan	6.0	2021
Green Atom Batangas Waste to Energy Project	Green Atom Renewable Energy Corp	Brgy. Aya, San Jose, Batangas	6.0	2021
Santa Biomass Power Project	Satrap Power Corporation	Brgy. Nagpanaoan, Santa, Ilocos Sur	10.0	2022
Napier Grass-Fired Biomass Power Plant*	Grass Gold Renewable Energy Corp.	Nueva Ecija	12.0	---
CBEC*	Cagayan Biomass Energy Corporation	Brgy. Raniag, Burgos, Isabela	15.0	---
Bataan 2020 Multi-Feedstock Cogeneration Power Plant	Bataan 2020, Inc.	Mariveles, Bataan	25.0	TBD
VSGPC Multi-Feedstock Biomass Power Plant Project	V.S. Grial Power Corporation	Nueva Ecija	6.0	TBD
Biomass Power Plant	Green Innovations for Tomorrow Corp.	Bacal 2, Talavera, Nueva Ecija	18.0	TBD
<b>Battery Energy Storage System (BESS)</b>				
			<b>200.0</b>	
Mexico Battery Energy Project	ISOC Energy, Inc.	Mexico, Pampanga	40.0	TBD
Angat Battery Energy Project	SMCGP Philippines Energy Storage Co. Ltd.	Angat, Bulacan	20.0	TBD
Isabela Battery Energy Project	SMCGP Philippines Energy Storage Co. Ltd.	Isabela	20.0	TBD
Laoag Battery Energy Project	SMCGP Philippines Energy Storage Co. Ltd.	Laoag, Ilocos Norte	20.0	TBD
Albay Battery Energy Project	SMCGP Philippines Energy Storage Co. Ltd.	Legazpi, Albay	20.0	TBD
Limay Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Limay, Bataan	40.0	TBD
Pampanga Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Mexico, Pampanga	20.0	TBD
San Manuel / San Roque Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	San Roque / San Manuel	20.0	TBD
<b>TOTAL</b>			<b>26,704.7</b>	

**Note:**

\*Newly Commissioned Power Plant in 2019.

Annex 23. LIST OF INDICATIVE POWER PROJECTS IN VISAYAS (as of 31 December 2018)

Name of Project	Proponent	Location	Rated Capacity (MW)	Target Commercial Operation
<b>Coal</b>			<b>600.0</b>	
SMC Loboc Malabuyoc Coal-Fired Power Plant Project	SMC Global Power Holdings Corp.	Mactan, Cebu	300.0	TBD
SMC Loboc Malabuyoc Coal-Fired Power Plant Project	SMC Global Power Holdings Corp.	San Carlos, Negros Occidental	300.0	TBD
<b>Oil-Based</b>			<b>63.5</b>	
Sulzer Diesel Power Plant	General Milling Corporation	GMC Complex, Lapu-Lapu City, Cebu	5.5	TBD
Caterpillar Diesel Power Plant	General Milling Corporation	GMC Complex, Lapu-Lapu City, Cebu	2.0	TBD
Cummins Diesel Power Plant	General Milling Corporation	GMC Complex, Lapu-Lapu City, Cebu	1.0	TBD
Bunker C Fired Power Plant	Alsons Energy Development Corp.	Calbayog, Samar	55.0	TBD
<b>Hydropower</b>			<b>728.2</b>	
Loboc Hydroelectric Power Project	Sta. Clara Power Corporation	Loboc, Bohol	1.2	December 2020
Aklan Pumped-Storage Hydropower	Strategic Power Development Corp.	Malay, Aklan	300.0	February 2024
Amlan (Plant A)	Natural Power Sources Integration, Inc.	Amlan, Negros Oriental	3.2	December 2025
Malago	Vivant-Malogo Hydropower, Inc.	Silay City, Negros	6.0	December 2025
Amlan (Plant C)	Natural Power Sources Integration, Inc.	Amlan, Negros Oriental	0.8	December 2026
Main Aklan River Hydroelectric Power Project	Sunwest Water & Electric Company, Inc.	Libacao, Aklan	15.0	December 2026
Lower Himogagan	LGU Sagay	Sagay, Negros Occidental	4.0	December 2026
Amlan (Plant B)	Natural Power Sources Integration, Inc.	Amlan, Negros Oriental	1.5	December 2026
Cantakoy	Quadriver Energy Corp.	Danao, Bohol	8.0	TBD
Hilabangan (Lower Cascade)	Century Peak Energy Corporation	Kabankalan, Negros Occidental	3.0	TBD
Hilabangan (Upper Cascade)	Century Peak Energy Corporation	Kabankalan, Negros Occidental	4.8	TBD
Maninila (Lower Cascade)	Century Peak Energy Corporation	San Remigio, Antique	4.5	TBD
Maninila (Upper Cascade)	Century Peak Energy Corporation	San Remigio, Antique	3.1	TBD
Sibalom (Upper Cascade)	Century Peak Energy Corporation	San Remigio, Antique	4.2	TBD
Sibalom (Middle Cascade)	Century Peak Energy Corporation	San Remigio, Antique	4.0	TBD
Sibalom (Lower Cascade)	Century Peak Energy Corporation	San Remigio, Antique	3.3	TBD
Bolusao Pumped Storage	San Lorenzo Samar and Water, Inc.	Lawaan, Eastern Samar	300.0	TBD
Ilog Hydroelectric Power Plant	PHINMA Energy Corporation	Mabinay, Negros Occidental	21.6	TBD
Maslog Hydroelectric Power Project	Iraya Energy Corporation	Maslog, Eastern Samar	40.0	TBD
<b>Geothermal</b>			<b>40.0</b>	
Dauin Geothermal Project	Energy Development Corporation	Dauin, Negros Oriental	40.0	December 2025
<b>Solar</b>			<b>843.7</b>	
Sanpalo Solar Power Plant	Sunpalo Solar Energy, Inc.	San Miguel, Leyte	100.0	September 2020
Medellin Solar Power Plant	Solar Philippines, Inc.	Medellin, Cebu	300.0	TBD
Puente Al Sol Solar Power Plant	Puente Al Sol, Inc.	Cadiz City, Negros Occidental	70.0	TBD
Roxas City Solar Power Project	Solar Philippines Commercial Rooftop Projects, Inc.	Roxas City, Capiz	0.7	TBD
Grid Tied Solar Farm	E & P Green Energy, Inc.	Biliran, Biliran	25.0	TBD
Tigbauan Solar Power Project	Solexar Energy International, Inc.	Brgy. Cordova Norte and Bantud, Tigbauan, Iloilo	34.3	TBD
Victorias Solar Power Project	VictoriaSolar Energy Corp.	Brgy. XII, Victorias City, Negros Occidental	30.6	TBD
Ceko Solar PV Project (Daanbantayan Solar PV Power Project)	CEKO Solar Farm Systems Corp.	Brgy. Tominjao, Daan Bantayan, Cebu	100.0	TBD
Silay Phase II Solar Power Project	Silay Solar Power Inc.	Silay City, Negros Occidental	10.0	TBD
Bogo V Solar Power Project	Sun Premier Bogo Philippine Corporation	Bogo, Cebu	16.7	TBD
Bogo 3 Solar Power Plant	Sun Premier Bogo Philippine Corporation	Bogo, Cebu	15.9	TBD
Mabinay Solar Power Project	Lohas and Soul Lighting, Inc.	Mabinay, Negros Oriental	90.0	TBD
Bacolod City Solar Power Project II	Negros PH Solar Inc.	Bacolod City, Negros Occidental	50.0	TBD
Dumaguete Solar Power Project	Solar Pacific Citysun Corporation	Dumaguete City, Negros Oriental	0.3	TBD
Gaisano Iloilo Solar Rooftop Project	EDC Siklab Power Corporation (Formerly: EDC Bago Solar Power Corporation)	Iloilo City, Iloilo	1.0	TBD
<b>Wind</b>			<b>1,568.0</b>	
Bronzeoak Wind Power Project	Bronzeoak Philippines, Inc.	Calatrava, Salvador Benedicto and San Carlos, Negros Occidental	100.0	February 2020
Nabas Wind Power Project Phase II	PetroWind Energy Corporation	Brgy. Pawa, Nabas, Aklan	14.0	Phase 2 (14 MW) - September 2021
Montesol Wind Power Project	Monte Solar Energy, Inc.	Bais City, Manjuyod and Mabinay, Negros Oriental	54.0	June 2022
Iloilo 1 Wind Power Project	Energy Development Corporation	Batad & San Dionisio, Iloilo	213.0	For validation
Ivisan Wind Power Project	Tri-Conti ECC Renewables Corporation	Ivisan, Capiz	50.0	TBD
Batan Wind Power Project	Tri-Conti Elements Corporation	Batan, Aklan	50.0	TBD
Iloilo 2 Wind Power Project	Energy Development Corporation	Concepcion, Iloilo	500.0	TBD
Negros Wind Power Project	Energy Development Corporation	Manapla & Cadiz, Negros Occidental	262.0	TBD
Bohol I (Ubay) Wind Power Project	Tri-Conti Elements Corporation	Ubay, Alicia, Mabini, Bohol	100.0	TBD
Tanjay Wind Power Project	Constellation Energy Corporation	Bais, Negros Oriental	50.0	TBD
Pulupandan Wind Power Project	First Maxpower International Corporation	Pulupandan, Negros Occidental	50.0	TBD
Aklan I Wind Power Project Phase 1-3	Tri-Conti Elements Corporation	Nabas-Malay, Aklan	75.0	TBD
Anda Wind Power Project	Tri-Conti ECC Renewables Corporation	Anda, Candijay & Guindalman, Bohol	50.0	TBD
<b>Biomass</b>			<b>60.0</b>	
Biomass Power Plant Project	HDJ Bayawan Agri-Venture Corporation	Himamaylan City, Negros Occidental	3.0	December 2020
MCEI Multi-Feedstock Biomass Power Plant Project	Megawatt Clean Energy, Inc.	Negros Occidental	12.0	December 2020
UGEP Rice Husk-Fired Biomass Power Plant Project	UGEP Ormoc Biomass Power	Leyte	2.5	December 2020
Biomass Power Plant Project	North Negros Biopower, Inc.	Manapla, Negros Occidental	25.0	100% Complete (waiting for Cebu-Negros-Panay TL Project completion)
Biomass Power Plant Project	Green Power Panay Philippines, Inc.	Mina, Iloilo	17.5	December 2022
<b>Battery Energy Storage System (BESS)</b>			<b>80.0</b>	
Caticlan Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Caticlan	20.0	TBD
Iloilo Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Iloilo	20.0	TBD
Ormoc Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Ormoc, Leyte	20.0	TBD
Mactan Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Mactan, Cebu	20.0	TBD
<b>TOTAL</b>			<b>3,903.4</b>	



Annex 24. LIST OF INDICATIVE POWER PROJECTS IN MINDANAO (as of 31 December 2018)

Name of Project	Proponent	Location	Rated Capacity (MW)	Target Commercial Operation
<b>Coal</b>			<b>928.0</b>	
Ozamiz Coal Fired Power Plant Phase 1 - 1 x 150 MW Phase 2 - 1 x 150 MW	Ozamiz Power Generation, Inc. (wholly owned subsidiary of Avesco Marketing Corporation)	Brgy. Pulot, Ozamiz City, Misamis Occidental	300.0	2023
SMC Davao Power Plant Project Phase II SMC Global Power (4 x 82 MW)	San Miguel Consolidated Power Corporation SMC Global Power	Brgy. Culaman, Malita, Davao Occidental Brgy. Darong, Santa Cruz, Davao del Sur	300.0 328.0	TBD TBD
<b>Oil-Based</b>			<b>5.9</b>	
TPI Diesel Power Plant	Total Power Incorporated	Mati, Davao Oriental	5.9	December 2020
<b>Hydropower</b>			<b>603.2</b>	
Bubunawan Hydroelectric Power Project	First Gen Mindanao Hydropower Corp.	Baungon and Libona, Bukidnon	23.0	December 2021
Pulanai	Repower Energy Development	Valencia, Bukidnon	10.6	December 2022
Tagum	Sta. Clara Power Corp.	Maco, Compostela Valley	2.6	December 2024
Tagoloan	First Gen Mindanao Hydropower Corp.	Impasugong & Sumilao, Bukidnon	39.0	December 2025
Culaman Hydroelectric Power Project	Oriental Energy and Power Generation Corp.	Manolo Fortich, Bukidnon	10.0	December 2025
Katipunan River Mini Hydro Power Project	Repower Energy Development	Cabanglasan, Bukidnon	6.2	December 2025
Cabadbaran Hydroelectric Power Project	First Gen Mindanao Hydropower Corp.	Cabadbaran, Agusan del Norte	9.8	December 2025
Lower Maladugao River Mini-Hydropower Project	Bukidnon Maladugao Hydro Power Corporation	Kallilangan and Wao, Bukidnon	15.7	December 2025
Maladugao (Upper Cascade) Hydroelectric Power Project	UHPC Bukidnon Hydro Power I Corporation	Kallilangan, Bukidnon	8.4	December 2026
Sawaga River Mini Hydro Power Project	Repower Energy Development	Malaybalay, Bukidnon	4.5	December 2026
Liangnan Hydropower Project	Liangnan Power Corp.	Bacolod, Lanao del Norte	11.9	December 2026
Malitbog	Philnewriver Power Corp.	Malitbog, Bukidnon	3.4	TBD
Clarín	Philnew Hydro Power Corporation	Clarín, Misamis Occidental	5.0	TBD
Mat-i-i	Philnew Hydro Power Corporation	Claveria, Cagayan de Oro	4.9	TBD
Silo-o	Philnewriver Power Corp.	Malitbog, Bukidnon	3.3	TBD
Agus III	Maranao Energy Corporation	Pantar & Balo-I, Lanao del Sur & Lanao del Norte	225.0	TBD
Kitaotao 1	Hedcor Bukidnon, Inc.	Bukidnon	70.0	TBD
10 MW Cabulig-2 Hydroelectric Power Plant Project	Mindanao Energy Systems, Inc.	Jasaan, Misamis Oriental	10.0	TBD
Davao Hydroelectric Power Project	San Lorenzo Ruiz Olympia	Davao City	140.0	TBD
<b>Geothermal</b>			<b>30.0</b>	
Mindanao 3 Geothermal Power Project	Energy Development Corporation	Kidapawan, North Cotabato	30.0	December 2021
<b>Solar</b>			<b>805.0</b>	
Greenlight Solar Power Project	Greenlight Solar Farm Tapian Corporation	Datu Odin, Sinsuat, Maguindanao	50.0	Q4 2020
Sarangani Solar PV Power Plant	Total Power Incorporated	Alabel, Sarangani	100.0	December 2020
Laguindingan Solar Power Project	Liberty Solar Energy Corporation (formerly Cagayan Electric Power & Light Company, Inc.)	Laguindingan, Misamis Oriental	20.0	March 2021
Conel Solar Power Project	Embrace Nature Power 1 Corporation	General Santos City, South Cotabato	16.0	June 2021
Mabuhay Solar Power Project	Embrace Nature Power 1 Corporation	General Santos City, South Cotabato	44.0	June 2021
Tagum Solar Power Project	Solar Pacific Citysun Corporation	Tagum City, Davao del Norte	1.0	TBD
Sumilao Solar Power Project	Sunasia Energy, Inc.	San Vicente, Sumilao, Bukidnon	2.0	TBD
GenSan Solar Power Project Phase I	Del Sol Energy CGS, Inc.	Brgy. Conel, General Santos City, South Cotabato	48.0	TBD
GenSan Solar Power Project Phase II	Del Sol Energy CGS, Inc.	Brgy. Tumbler, General Santos City, South Cotabato	48.0	TBD
60 MW General Santos City Solar Power Project	Astroenergy Gensan Inc.	General Santos City, South Cotabato	60.0	TBD
San Francisco Solar Power Project	Gpower Inc.	San Francisco, Agusan del Sur	10.0	TBD
Jasaan Solar Power Project	Lohas and Soul Lighting, Inc.	Jasaan, Misamis Oriental	60.0	TBD
Lal-Lo Solar PV Power Plant	Natures Renewable Energy & Development (NAREDCO) Corp.	Maasim, Sarangani	100.0	TBD
Solar Power Plant	Ecoglobal, Inc	Zamboanga City Special Economic Zone	30.0	TBD
Hayes Solar Power Project	Hayes Solar Energy Corporation	Villanueva, Misamis Oriental	27.0	TBD
Opol Solar Power Project	Electra Ecoenergy Corporation	Brgy. Patag, Opol, Misamis Oriental	25.0	TBD
Tantangan Solar Power Project	NWPSE Five Inc.	Tantangan, South Cotabato	65.0	TBD
Claveria Solar Power Project	The Ark Green Dynamic Resources Corp.	Claveria, Misamis Oriental	60.0	TBD
Banale Solar Power Project	Astronergy Development Pagadian, Inc.	Brgy. Banale, Pagadian	14.0	TBD
South Cotabato Solar Power Project	Astronergy Development Gensan, Inc.	Lanao del Norte/Lanao del Sur	25.0	TBD
<b>Biomass</b>			<b>119.4</b>	
Biomass Power Plant Project	Surallah Power Generation Inc.	Surallah, South Cotabato	6.0	September 2020
10MW Malay-balay Bio-Energy Corporation Multi Feedstock Generating Facility	Malaybalay Bio-Energy Corporation	Bukidnon	10.0	December 2020
NAREDCO Biogas Power Plant	Natures Renewable Energy Development Corp.	Lal-Lo, Cagayan	24.0	December 2020
Napier Grass-Fired Biomass Power Plant Project	Pilipinas Joule Energy Corporation	Bukidnon	5.0	December 2020
Biogas Power Plant Project	Natures Renewable Energy Development Corp.	Maasim, Sarangani	24.0	December 2020
23.5 MW Woody Biomass Power Plant Project	CARAGA Renewable Energy Corporation	Agusan del Norte	23.5	2022
12 MW Napier Grass-Fired Biomass Power Plant Project	Manolo Fortich Biomass Energy Corporation	Bukidnon	12.0	TBD
Bagasse-Fired Co-generation Power Plant	Crystal Sugar, Inc.	Maramag, Bukidnon	14.9	TBD
<b>Battery Energy Storage System (BESS)</b>			<b>220.0</b>	
Surigao / Butuan Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Surigao / Butuan	20.0	TBD
Zamboanga Battery Energy Storage	SMCGP Philippines Energy Storage Co. Ltd.	Zamboanga	200.0	TBD
<b>Total</b>			<b>2,491.4</b>	

<b>Annex 25. LIST OF NGCP'S TRANSMISSION PROJECTS WITH CEPNS</b>			
	<b>Project Name</b>		<b>Project Name</b>
1	Mindanao-Visayas Interconnection Project	25	Clark-Mabiga 69 kV Transmission Line
2	San Jose-Angat 115 kV Transmission Line Upgrading	26	Tanauan 230 kV Substation
3	San Jose-Quezon (Balintawak) 230 kV Transmission Line	27	Concepcion-Sta Ignacia 69 kV Transmission Line
4	Manila (Navotas) 230 kV Substation	28	Nagsaag-Tumana 69 kV Transmission Line
5	Pasay 230 kV Substation	29	San Simon 230 kV Substation
6	Taguig EHV Substation	30	Pinili 230 kV Substation
7	Taguig-Taytay 230 kV Transmission Line	31	La Trinidad-Calot 69 kV Transmission Line Project
8	Marilao EHV Substation	32	Cebu-LapuLapu 230 kV Transmission Line Project
9	Manila (Navotas)- Doña Imelda 230 kV Transmission Line	33	Nabas-Caticlan-Boracay 230 kV Transmission Line Project
10	Bataan 230 kV Grid Reinforcement	34	Amlan-Dumaguete 138 kV Transmission Line Project
11	Mariveles-Hermosa 500 kV Transmission Line	35	Babatngon-Palo 138 kV Transmission Line Project
12	Pagbilao EHV Substation	36	Nasipit Substation Bus-In
13	Hermosa-San Jose 500 kV Transmission Line	37	Tacurong-Kalamansig 69 kV Transmission Line Project
14	Tuguegarao-Magapit 230 kV Transmission Line	38	Kabacan Substation
15	Calaca-Dasmariñas 230 kV Transmission Line	39	San Francisco Tandag 138 kV Transmission Line Project
16	Tuy 500/230 kV Substation Project Stage 1	40	Maco-Mati 138 kV Transmission Line Project
17	Western 500 kV Backbone (Stage 1)	41	Cebu-Negros-Panay 230 kV Backbone Stage 2
18	Batangas-Mindoro Interconnection	42	Cebu-Negros-Panay 230 kV Backbone Stage 3
19	Ambuklao-Binga 230 kV Transmission Line Upgrading	43	Cebu-Negros-Panay 230 kV Backbone Stage 1
20	Binga-San Manuel 230 kV Transmission Line	44	Laray 230 kV Substation Project
21	San Manuel-Nagsaag 230 kV Transmission Line	45	Cebu-Bohol 230 kV Interconnection Project
22	Pagbilao-Tayabas 500 kV Transmission Line	46	Balo-I-Kauswagan 230 kV Transmission Line (Formerly Balo-I-Kauswagan-Aurora 230 kV Transmission Line Phase I)
23	Hermosa-Floridablanca 69 kV Transmission Line	47	Mindanao-Backbone 230 kV Transmission Project
24	Calamba 230 kV Substation	48	Balo-I-Kauswagan 230 kV Transmission Line (Formerly Balo-I-Kauswagan-Aurora 230 kV Transmission Line Phase II)

<b>Annex 26. NGCP's ONGOING TRANSMISSION PROJECTS</b>	
<b>Project Name</b>	<b>Estimated Time of Completion</b>
<b>Luzon</b>	
Bataan–Cavite Transmission Line FS	Jun 2020
San Jose–Quezon 230 kV Line 3	Mar 2020
San Jose–Angat 115 kV Line Upgrading	Jun 2020
Tiwi Substation Upgrading	Dec 2020
Calamba 230 kV Substation	Jun 2020
Pasay 230 kV Substation	Jun 2024
Tower Structure Upgrading of Bicol Transmission Facilities	Jun 2020
Mariveles–Hermosa 500 kV Transmission Line	Aug 2020
North Luzon Substation Upgrading Project	Mar 2020
Luzon PCB Replacement	Dec 2020
Luzon Voltage Improvement Project – 3	Mar 2021
Clark–Mabiga 69 kV Transmission Line	Dec 2021
Hermosa–San Jose 500 kV Transmission Line	Dec 2021
Pagbilao 500 kV Substation	Mar 2021
Navotas 230 kV Substation	Jun 2021
Tuguegarao– La-Ilo 230 kV Transmission Line	May 2021
Relocation of Steel Poles along Hermosa–Duhat 230 kV Transmission Line	Jun 2021
Western Luzon 500 kV Backbone (Stage 1)	Jun 2021
Taguig 500 kV Substation	Sep 2022
Antipolo 230 kV Substation	Apr 2022
Ambuklao–Binga 230 kV Transmission Line Upgrading	Jun 2022
Binga–San Manuel 230 kV Transmission Line Stage 1 & 2	Jun 2022
Tuy 500/230 kV Substation Project (Stage 1)	Dec 2021
South Luzon Substation Upgrading Project	Dec 2021
Eastern Albay 69 kV Line Stage 2	Sep 2022
La Trinidad- Calot 69 kV Transmission Line	Jan 2023
Luzon Voltage Improvement Project -4	Feb 2023
<b>Visayas</b>	
Visayas Substation Reliability Project I	Mar 2021
Visayas Substation Reliability Project II	Jun 2021
New Naga (Colon) Substation Project (Remaining Works)	Dec 2020
San Carlos–Guihulngan 69 kV Transmission Line	Aug 2020
Sta. Rita–Quinapondan 69 kV Transmission Line	Jun 2021
Cebu–Negros–Panay 230 kV Backbone Project - Stage 1	Apr 2021
Naga (Visayas) Substation Upgrading Project	Dec 2021
Panitan–Nabas 138 kV Transmission Line 2 Project	Dec 2020
Tagbilaran 69 kV Substation Project	Jun 2021
Cebu–Lapu-Lapu 230 kV Transmission Line Project	Dec 2021
Cebu–Negros–Panay 230 kV Backbone Project - Stage 3	Dec 2022
Visayas Voltage Improvement Project	S1- Mar 2020 / S2-May 2022
<b>Mindanao</b>	
Mindanao 230 kV Transmission Backbone	Dec 2020
Sultan Kudarat (Nuling) Capacitor Project	Jun 2020
Butuan–Placer 138 kV Transmission Line	Sep 2020
Kauswagan–Lala 230 kV Transmission Line (Formerly Balo-i–Kauswagan–Aurora 230 kV Transmission Line (Phase 2))	Dec 2021
Mindanao Substation Upgrading Project (MSUP)	Sep 2021
Agus 2 Switchyard Upgrading Project	Feb 2022
Mindanao–Visayas Interconnection Project	Dec 2021
Mindanao Substation Rehabilitation Project (MSRP)	Jun 2022
Tacurong–Kalamansig 69 kV Transmission Line	Mar 2023

Source: NGCP

Annex 27. PROPOSED TRANSMISSION PROJECTS UP TO 2025	
Project Name	Estimated Time of Completion
<b>Luzon</b>	
Pagbilao–Tayabas 500 kV Transmission Line	Jul 2023
Pinamukan 500 kV Substation	Jun 2024
Northern Luzon 230 kV Loop	Jun 2024
Santiago–Nagsaag 500 kV Transmission Line	Aug 2024
Luzon–Visayas HVDC Bipolar Operation	Jan 2025
Cabanatuan–Sampaloc–Nagsaag 230 kV Transmission Line	Jul 2025
Tagkawayan 500 kV Substation	Dec 2025
North Luzon Substation Upgrading 2	Dec 2021
Pinili 230 kV Substation	May 2022
Concepcion–Sta. Ignacia 69 kV Transmission Line	Aug 2022
Nagsaag–Tumana 69 kV Transmission Line	Aug 2022
San Simon 230 kV Substation	Dec 2022
Marilao 500 kV Substation	Oct 2022
Luzon Voltage Improvement Project 5	Oct 2021
South Luzon Substation Upgrading 2	Dec 2022
Capas 230 kV Substation	May 2023
Abuyog 230 kV Substation	Nov 2023
Porac 230 kV Substation	Nov 2023
Tanauan 230 kV Substation	Aug 2023
Sampaloc 230 kV Substation	Sep 2023
Plaridel 230 kV Substation	Nov 2023
Daraga–Bitano 69 kV Line	Jun 2023
Castillejos 230 kV Substation	Feb 2024
Tuguegarao–Enrile 69 kV Line	Mar 2024
Silang 500 kV Substation	Mar 2024
Kawit 230 kV Substation	May 2024
Dasol 230 kV Substation	Dec 2025
San Manuel–Nagsaag 230 kV Transmission Line	Mar 2021
Navotas–Dona Imelda 230 kV Transmission Line	May 2022
Taguig–Taytay 230 kV Transmission Line	Apr 2023
Minuyan 115 kV Switching Station	Oct 2023
Olongapo 230 kV Substation Upgrading	Dec 2023
Western Luzon 500 kV Backbone – Stage 2	Aug 2024
Mexico–Marilao 230 kV Transmission Line	Dec 2024
Batangas–Mindoro Interconnection Project	Dec 2023
Palawan–Mindoro Interconnection Project	Dec 2024
<b>Visayas</b>	
Cebu–Negros–Panay 230kV Backbone Project - Stage 2	Dec 2021
Panay–Guimaras 138 kV Interconnection Project	Feb 2022
Negros–Panay 230 kV Interconnection Line 2 Project	Nov 2022
Barotac Viejo–Nabas 230 kV Transmission Line Project	Jun 2023
Nabas–Caticlan–Boracay Transmission Project	Jun 2022
Cebu–Bohol 230 kV Interconnection Project	Dec 2021
Laray 230 kV Substation Project (Initially energized at 138kV)	Dec 2022
Amlan–Dumaguete 138 kV Transmission Project	Mar 2023
Babatngon–Palo 230 kV Transmission Line Project (Initially energized at 138 kV)	Feb 2023
Granada 230 kV Substation Project	Oct 2024
Kalibo 138 kV Substation Project	Dec 2024
La Carlota 138 kV Substation Project	Dec 2024
Sumangaya 138 kV Substation Project	Dec 2024
Tigbauan 138 kV Substation Project	Dec 2023
Bool 138 kV Substation Project	Nov 2023
Carmen 230 kV Substation Project	Jun 2025
Jaro 230 kV Substation Project	Jun 2025
Visayas Voltage Improvement Project 2	Dec 2022
Visayas Substation Upgrading Project - 1	Feb 2022
Calbayog–San Isidro 138 kV Transmission Line Project	Dec 2022
Barotac Viejo–Natividad 69 kV Transmission Line Project	Dec 2022
Visayas Substation Upgrading Project - 2	Jul 2022
Tabango–Biliran 69 kV Transmission Line Project	Jun 2025
Nivel Hills 230 kV Substation Project	Dec 2023
Permanent Restoration of Colon–Samboan 138 kV Lines 1 and 2 affected by landslide	Jun 2021
Permanent Restoration of Panit-an–Nabas 138 kV Line affected by Typhoon Ursula	May 2021
Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project	Mar 2025
Kananga 230 kV Switching Station Project	Mar 2025
Lapu-lapu 230 kV Substation Project	Dec 2022
Upgrading of acquired Transmission Assets	Dec 2023
<b>Mindanao</b>	
Laguindingan 230kV SS Project	Dec 2023
Mindanao Substation Expansion 3 Project	Oct 2023
Tumaga 138 kV Substation Project	Dec 2023
Tigbao 138 kV Substation Bus-in	Dec 2023
Naga Mindanao–Salug 138 kV Transmission Line Project (Energized at 69 kV)	Dec 2023
Koronadal 138 kV Substation Project	Dec 2023
Maco–Tagum 69 kV Transmission Line Project	Jun 2024
Agus 6–Kiwatan–Lugait 69 kV Transmission Line Project	Dec 2024
Mindanao Substation Expansion 4 Project	Dec 2024
Villanueva–Kinamlutan 230 kV Transmission Line	Jan 2025
Nasipit Substation Bus-In (formerly Villanueva–Jasaan–Butuan 138 kV Transmission Line)	Mar 2023
Kabacan 138 kV Substation	Jun 2023
Zamboanga Peninsula Voltage Improvement Project	Dec 2023
Eastern Mindanao Voltage Improvement Project	Dec 2023
Mindanao Substation Upgrading 2 Project (MSU2P)	Dec 2023
San Francisco–Tago 138 kV Transmission Line	May 2024
Maco–Mati 138 kV Transmission Line	May 2024
Oroquieta 69 kV Switching Station Project	Sep 2024
Sultan Kudarat–Tacurong 230 kV Transmission Line	Jan 2025
Eastern Mindanao 230 kV Transmission Line Project	Jan 2025
Opol Substation Bus-in (formerly Balo-i–Tagoloan–Opol 138 kV Transmission Line)	Dec 2025
Lala–Naga–Zamboanga 230 kV Transmission Line Project	Dec 2025
Source: NGCP	

## Annex 28. POTENTIAL SMALL ISLAND INTERCONNECTIONS

Island	Interconnection Point (Town)	Length (kms)		
		Submarine	Overhead	Total
<b>Luzon</b>				
Mindoro	Batangas	25	43	68
Catanduanes	Presentacion	32	8	40
Marinduque	General Luna	23	11	34
Ticao	Abuyog	20	35	55
Masbate	San Jacinto	16	16	32
Tablas	San Jose	61	36	97
Lubang	Calaca	54	20	74
Busuanga	San Jose	84	52	136
<b>Visayas</b>				
Bantayan	Medellin	21	24	45
Siquijor	Bacong	20	24	44
Camotes	Isabel	18	8	26
Semirara	San Jose	33	0	33
<b>Mindanao</b>				
Tawi-Tawi	Pagatpat	84	60	144
Basilan	Pitogo	27	12	39
Sulu	Taberlongan	100	34	134
Samal	Lasang	9	21	30
Dinagat	Canlanipa	30	15	45
Siargao	Cagdiano	13	7	20
Camiguin	Esperanza	30	37	67
Siasi	Parang	43	32	75

Source: TDP 2016-2040

# ABBREVIATIONS AND ACRONYMS

AAGR	Average Annual Growth Rate
ABRECO	Abra Electric Cooperative
ADB	Asian Development Bank
ADO	Automotive Diesel Oil
AEC	ASEAN Economic Community
AERN	ASEAN Energy Regulators Network
AEF	Administrative Expense Fund
AEO	ASEAN Energy Outlook
AFETs	Alternative Fuels and Technologies
AFF	Agriculture, Fishery and Forestry
AFOC	ASEAN Forum on Coal
AFAS	ASEAN Framework Agreement on Services
AFF	Agriculture, fishery and forestry
AFTA	ASEAN Free Trade Agreement
AFVs	Alternative Fuel Vehicles
AGMO	Autonomous Group Market Operator
ALECO	Albay Electric Cooperative, Inc.
AMEM	ASEAN Ministers on Energy Meeting
AMS	ASEAN Member States
ANTECO	Antique Electric Cooperative
AO	Administrative Order
AOCG	Assessment and Operations Coordinating Group
APAEC	ASEAN Plan of Action for Energy Cooperation
APG	ASEAN Power Grid
AOG	Administrative Operating Guidelines
APEC	Albay Power and Energy Corporation
APEC	Asia-Pacific Economic Cooperation
ARECs	Affiliated Renewable Energy Centers
ARTA	Anti-Red Tape Authority
ASEAN	Association of South East Asian Nations
AS	Ancillary Services
ASCOPE	ASEAN Council on Petroleum
ASEP	Access to Sustainable Energy Program
B2	2.0 percent biodiesel
BAC	Bids and Awards Committee
BARMM	Bangsamoro Autonomous Region of Muslim Mindanao
BAU	Business-as-Usual
BBEC	Bicol Biomass Energy Corporation
BCF	Billion Cubic Feet
BEI	Beyond Energy Corporation
BERDE	Building for Ecologically Responsive Design Excellence
BESS	Battery Energy Storage System
BFP	Bureau of Fire Protection
BILECO	Biliran Electric Cooperative, Inc.

BISELCO	Busuanga Island Electric Cooperative, Inc.
BIMP-EAGA	Brunei-Indonesia-Malaysia-Philippines East ASEAN Growth Area
BIR	Bureau of Internal Revenue
BLCI	Bohol Light Company, Inc.
BLEP	Barangay Line Enhancement Program
BMT	Billion Metric Tons
BN	Brunei Darussalam
BNPP	Bataan Nuclear Power Plant
B-LEADERS	Building Low Emission Alternatives to Develop Economic Resilience and Sustainability
BOC	Bureau of Customs
BOHECO I	Bohol I Electric Cooperative, Inc
BOHECO II	Bohol II Electric Cooperative, Inc.
BOT	Build-Operate-Transfer
BP	Batas Pambansa
BPC	Berakas Power Company
BPO	Business Process Outsourcing
BPS	Bureau of Product Standards
BSD	Bilateral Strategic Dialogue
CARS	Comprehensive Automotive Resurgence Strategy
CAS	Consumer Affairs Service
CBK	Caliraya Botocan-Kalayaan
CCC	Climate Change Commission
CCT	Clean Coal Technologies
CCGT	Combined Cycle Gas Turbine
CECO	Certified Energy Conservation Officer
CEM	Capacity Expansion Model
CEM	Certified Energy Manager
CEPNS	Certificate of Energy Project of National Significance
CES	Clean Energy Scenario
CEZA	Cagayan Economic Zone Authority
CFL	Compact Fluorescent Lamp
CFTPP	Mindanao Coal-fired Thermal Power Plant
CHED	Commission on Higher Education
CIMP	China International Mining Petroleum Company Limited
Ckt-Km	Circuit-Kilometer
CM	Cambodia
CMCC	Comelec Monitoring and Command Center
CME	Coco-Methyl-Ester
CNC	Certificate of Non-Coverage
CNG	Compressed Natural Gas
CNO	Certificate of Non-Overlap
COA	Commission on Audit
COC	Certificate of Compliance
COCs	Coal Operating Contracts
COE	Certificate of Endorsements
COMELEC	Commission on Elections
COP	Conference of Parties
COTELCO	Cotabato Electric Cooperative

COVID-19	Coronavirus Disease 2019
CP	Certificate of Precondition
CP/CNO	Certification Precondition/Certificate of Non-Overlap
C-REC	Centralized Review and Evaluation Committee
CREZ	Competitive Renewable Energy Zones
CRSS	Central Registration and Settlement System
CSEE	Contract for the Supply of Electric Energy
CSP	Competitive Selection Process
CSPF	Cooling Seasonal Performance Factor
CvSU	Cavite State University
CWD	Consumer Welfare Desk
CWPO	Consumer Welfare and Promotion Office
DANECO	Davao del Norte Electric Cooperative, Inc.
DAP	Development Academy of the Philippines
DAO	Department Administrative Orders
DAR	Department of Agrarian Reform
DASURECO	Davao Del Sur Electric Cooperative
DBM	Department of Budget and Management
DC	Department Circular
DDP	Distribution Development Plan
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DES	Department of Electrical Department
DFA	Department of Foreign Affairs
DICT	Department of Information and Communications Technology
DILG	Department of Interior and Government
DLF	Development and Livelihood Fund
DLPC	Davao Light and Power Company
DMS	Distribution Management System
DO	Department Order
DOE	Department of Energy
DOF	Department of Finance
DOH	Department of Health
DOJ	Department of Justice
DOLE	Department of Labor and Employment
DORELCO	Don Orestes Romualdez, Electric Cooperative, Inc.
DOST	Department of Science and Technology
DOST-PCIEERD	Department of Science and Technology-Philippine Council for Industry, Energy and Emerging Technology Research and Development
DOTr	Department of Transportation
DREAMS	Development for Renewable Energy Applications Mainstreaming and Market Sustainability
DREC	Direct Connection Review and Evaluation Committee
DRR	Disaster Risk and Reduction
DRRM	Disaster Risk Reduction and Management
DSM	Demand Side Management
DTI	Department of Trade and Industry
DTI-BPS	Department of Trade and Industry-Bureau of Product Standard



DTI-BOI	Department of Trade and Industry-Board of Investment
DU	Distribution Utility
EAC	Electricity Authority of Cambodia
EAS	East Asia Summit
EBT	Energy Balance Table
ECA	Economic Consulting Associates
ECC	Environmental Compliance Certificate
ECQ	Enhanced Community Quarantine
ECs	Electric Cooperatives
ECPs	Environmentally Critical Projects
EDGE	Enhancing Development and Growth through Energy
EE	Energy Efficiency
EE&C	Energy Efficiency and Conservation
EEC	Efficiency in Electricity Consumption
EECO	Energy Efficiency Conservation Office
EECP	Energy Efficiency and Conservation Plans and Programs
EECR	Energy Consumption and Conservation Report
EEF	Energy Efficiency Factor
EER	Energy Efficiency Ratio
EF	Electrification Fund
EFTA	Economic Partnership Agreement, Philippine-European Free Trade Association
EGF	Environmental Guarantee Fund
EGs	Embedded Generators
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EICC	Energy Investment Coordinating Council
EIS	Environmental Impact Statement
EMB	Energy Management Bureau
EMF	Environmental Monitoring Fund
EMM	Energy Ministerial Meeting
EMMOP	Environmental Management and Monitoring Plan
EMP	Environmental Management Plan
ENPAP	Energy Practitioners Association of the Philippines
EO	Executive Order
EODB	Ease of Doing Business
EPIMB	Electric Power Industry Management Bureau
EPIRA	Electric Power Industry Reform Act
EPNS	Energy Projects of National Significance
EPPB	Energy Policy and Planning Bureau
EPRMP	Environmental Performance Report and Management Plan
EPS	Energy Planning Study
ERB	Energy Regulatory Board
ERC	Energy Regulatory Commission's
ERDB	Energy Resource Development Bureau
ERIA	Economic Research Institute for ASEAN and East Asia
ERP	Energy Resiliency Policy
ERTF	Energy Resiliency Task Force
ESAMELCO	Eastern Samar Electric Cooperative, Inc.
ESCOs	Energy Service Companies

ESI	Energy Security Initiative
ESS	Energy Storage System
ETFE	Energy Task Force Election
EU	European Union
EU-ASEP	European Union – Access to Sustainable Energy Programme
EUMB	Energy Utilization Management Bureau
EVAP	Electric Vehicles Association of the Philippines
e-VAT	Expanded Value Added Tax
EVCs	Electric Vehicle Charging Stations
EVOSS	Energy Virtual One-Stop Shop
EVs	Electric Vehicles
EWC	Energy World Corporation
EWRM	Environment and Watershed Rehabilitation and Management
FCL	Fluorescent Circular Lamp
FCRR	Full Cost Recovery Rate
FGD	Focus Group Discussion
FICELCO	First Catanduanes EleCooperative, Inc.
FIT	Feed-in-Tariff
FiT-All	Feed-in-Tariff Allowance
FS	Feasibility Study
FS	Facility Standard
FSRU	Floating Storage Regasification Unit
FTAAP	Free Trade Area of Asia Pacific
FTAs	Free Trade Areas
GATS	General Agreement on Trade and Services
GATT	General Agreement on Tariff and Trade
GBR	Green Building Rating
GDP	Gross Domestic Product
GEAP	Green Energy Auction Program
GEEP	Government Energy Efficiency Project
GEF	Global Environment Facility
GEMP	Government Energy Management Program
GEOP	Green Energy Option Program
GFI	Government Financing Institutions
GHG	Greenhouse Gas
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
GOCCs	Government Owned and Controlled Corporations
GPDP	Gas Policy Development Program
GSLFAP	Gasoline Station Lending and Financial Assistance Program
GVA	Gross Value Added
GW	Gigawatt
GWh	Gigawatt-hour
HAPUA	Heads of ASEAN Power Utilities and Authorities
HEDP	Household Electrification Development Plan
HEVs	Hybrid Electric Vehicles
HFCE	Household Final Consumption Expenditure
HECS	Household Energy Consumption Survey

HIRs	Hotel and Restaurant Industries
HLURB	Housing and Land Use Regulatory Board
HOR	House of Representatives
HSEMS	Health, Safety And Environment Management System
HSSE-IMT	Philippine Inter-Agency Health, Safety, Security and Environment-Inspection Monitoring Team
HUDCC	Housing and Urban Development Coordinating Council
IAEA	International Atomic Energy Agency
IAEECC	Inter-Agency Energy Efficiency and Conservation Committee
IATF-EID	Inter-agency Task Force on Emerging Infectious Diseases
ICE	Internal Combustion Engine
ICT	Information and Communications Technology
ID	Indonesia
IDO	Industrial Diesel Oil
IEC	information, Education and Communication
IEE	Initial Environmental Examination
IEEJ	Institute of Energy Economics, Japan
IEMOP	Independent Electricity Market Operator of the Philippines
IFELCO	Ifugao Electric Cooperative
IIEE	Institute of Integrated Electrical Engineers
ILECO II	Iloilo II Electric Cooperative, Inc.
ILECO III	Iloilo III Electric Cooperative, Inc.
IMEM	Interim Mindanao Electricity Market
IMO	Independent Market Operator
INC	Initial National Communication
INDC	Intended Nationally Determined Contributions
INIR	Integrated Nuclear Infrastructure Review
IP	Indigenous Peoples
IPO	Investment Promotion Office
IPP	Independent Power Producer
IPPA	Independent Power Producer Administrators
IRR	Implementing Rules and Regulation
ISECO	Ilocos Sur Electric Cooperative
ISELCO I	Isabela I Electric Cooperative, Inc.
ISO	International Standards Organization
ITMS	Information Technology and Management Services
IWP	Integrated Work Plan
IWRM	Integrated Water Resource Management
J	Joule
JAO	Joint Administrative Order
JCPC	Joint Congressional Power Commission
JCTEC	Joint Committee on Trade and Economic Cooperation
JICA	Japan International Cooperation Agency
JMC	Joint Memorandum Circular
JVA	Joint Venture Ggreement
KAERI	Korea Atomic Energy Research Institute
K.A.CARE	King Abdullah City for Atomic and Renewable Energy
KEGI	King Energy Generation Incorporated
KHNP	Korea Hydro & Nucler Power

Km <sup>2</sup>	Square kilometers
KOICA	Korea International Cooperation Agency
Kph	Kilometer per hour
Kt	Kilo ton
KTOE	Thousand Tons of Oil Equivalent
kWh	Kilowatt-hour
LAO	Laos PDR
LCOE	Levelized Cost of Energy
LDC	Local Development Committee
LEAP	Long-range Energy Alternatives Planning System
LED	Light Emitting Diode
LEDS	Low Emissions Development Strategies
LEECO	Local Energy Efficiency and Conservation Officer
LEECF	Local Energy Efficiency and Conservation Plan
LEYECO II	Leyte II Electric Cooperative, Inc.
LEYECO IV	Leyte IV Electric Cooperative, Inc.
LEYECO V	Leyte V Electric Cooperative, Inc.
LF	Load Factor
LFL	Linear Fluorescent Lamp
LFP	Locally-Funded Project
LGOU	Local Government Owned Utilities
LGU-OU	LGU-Owned Utilities
LGU	Local Government Unit
LNG	Liquefied Natural Gas
LOLP	Loss of Load Probability
LPA	Low-Pressure Area
LPG	Liquefied Petroleum Gas
LPP	Liquid Petroleum Product
LRT	Light Rail Transit
LS	Legal Services
LTMS-PIP	Lao PDR-Thailand-Malaysia-Singapore Power Integration Project
MAGPP	Mt. Apo's Geothermal Power Plant
MARELCO	Marinduque Electric Cooperative
MARINA	Maritime Industry Authority
MASELCO	Masbate Electric Cooperative, Inc.
MBSD	Thousand barrels/stream per day
MCFTPP	Mindanao Coal-fired Thermal Power Plant
MCs	Memorandum Circulars
MEDP	Missionary Electrification Development Plan
ME	Missionary Electrification
MEP	Minimum Energy Performance
MEPS	Minimum Energy Performance Standards
MERALCO	Manila Electric Company
MGPP	Mindanao Geothermal Power Plant
MinDA	Mindanao Development Authority
MIR	Minimum Inventory Requirement
MJ/m <sup>3</sup>	Megajoules per cubic meter
ML	Million Liters
MM	Myanmar

MMB	Million Barrels
MMBFOE	Million Barrels of Fuel Oil Equivalent
MMBO	Million Barrels of Oil
MMDA	Metro Manila Development Authority
MBD	Thousand Barrels per Day
MMMT	Million Metric Tons
MMSCF	Million Standard Cubic Feet
MMT	Multi-partite Monitoring Team
MO	Market Operator
MOA	Memorandum of Agreement
MOELCI	Misamis Occidental Electric Cooperative
MOR	Monthly Operations Report
MOPS	Mean of Platts Singapore
MORESCO I	Misamis Oriental I Electric Cooperative
MOU	Memorandum of Understanding
MPC	Multi-Purpose Cooperative
MTPY	Million Tons per Year
MRA	Market Readiness and Assessment
MRA	Mutual Recognition Agreement
MRP	Manufacturing Resurgence Program
MRT	Metro Rail Transit
MRT3	Metro Rail Transit Line 3
MtCo2	Million tons of carbon dioxide equivalent
MTPA	million tons per annum
MTOE	Million tons of oil equivalent
MTPP	Malaya Thermal Power Plant
MVA	Mega Volt-Ampere
MVAR	Megavolt Amperes Reactive
MVIP	Mindanao - Visayas Interconnection Project
MW	Megawatts
MWh	Megawatt-hour
MY	Malaysia
NAMAs	Nationally Appropriate Mitigation Actions
NBB	National Biofuels Board
NCCAP	National Climate Change Action Plan
NCIP	National Commission on Indigenous People
NCR	National Capital Region
NDC	Nationally Determined Contribution
NDRRMC	National Disaster Risk Reduction & Management Council
NEA	National Electrification Administration
NECP	National Energy Contingency Plan
NEC-SSB	Nuclear Energy Cooperation Sub-sector Network
NEDA	National Economic Development Authority
NEDA-DBCC	National Economic Development Authority-Development Budget Coordinating Committee
NEECP	National Energy Efficiency and Conservation Plan
NEP-IAC	Nuclear Energy Program-Inter-Agency Committee
NEPIO	Nuclear Energy Program Implementing Organization
NFSCC	National Framework Strategy on Climate Change

NGAs	National Government Agencies
NGCP	National Grid Corporation of the Philippines
NGOs	Non-Government Organizations
NGVPPT	Natural Gas Vehicle Program for Public Transport
NICCDIES	National Integrated Climate Change Database and Information Exchange System
NIDS	Nuclear Infrastructure Development Section
NIHE	Nationwide Intensification of Household Electrification
NMMS	New Market Management System
NNSP	National Nuclear Security Plan
NSP	Network Service Providers
NORSAMELCO	Northern Samar Electric Cooperative, Inc.
NOx	Nitrogen Oxides
NPC	National Power Corporation
NPC-SPUG	NPC-Small Power Utilities Group
NPGA	Non-Project Grant Aid
NPP	Nuclear Power Program
NPPs	New Power Providers
NPTE	NEA Power Task Force Election
NREB	National Renewable Energy Board
NREL	National Renewable Energy Laboratory
NREP	National Renewable Energy Program
NSDUR	National Smart Distribution Utility Roadmap
NTP	Notice to Proceed
NWRB	National Water Resources Board
OCD	Office of Civil Defense
OEM	Original Engine Manufacturer
OIMB	Oil Industry Management Bureau
OLA	Office of Legal Affairs
OMEKO	Occidental Mindoro Electric Cooperative
OMS	Outage Management System
OPEC	Organization of Petroleum Exporting Countries
ORMECO	Oriental Mindoro Electric Cooperative, Inc.
OSG	Office of the Solicitor General
OTEC	Ocean Thermal Energy Conversion
O&M	Operating and Maintenance
PA	Paris Agreement
PAA	Performance Assessment and Audit
PAAT-DSF	Performance Assessment and Audit Team on Distribution System Facilities
PAAT-PGF	Performance Assessment and Audit Team on Power Generation Facilities
PALECO	Palawan Electric Cooperative
PANELCO III	Pangasinan III Electric Cooperative
PBI	Peak Power Bukidnon Inc.
PCBs	Power Circuit Breaker
PCECP	Philippine Conventional Energy Contracting Program
PCG	Philippine Coast Guard
PCSD	Palawan Council for Sustainable Development
PD	Presidential Decree
PDA	Pre-Determined Area
PDC	Philippine Distribution Code
PDNGI	Philippine Downstream Natural Gas Industry

PDNGR	Philippine Downstream Natural Gas Regulation
PDOs	Planning Development Offices
PDP	Philippine Development Plan
PDRF	Philippine Disaster Resilience Foundation, Inc.
PEC	Pagbilao Energy Corporation
PEIC	Power and Energy Infrastructure Cluster
PEISS	Philippines Environmental Impact Statement System
PELP	Philippine Energy Labelling Program
PEMC	Philippine Electricity Market Corporation
PEP	Philippine Energy Plan
PESLP	Philippine Energy Standards and Labelling Program
PGBC	Philippine Green Building Council
PGC	Philippine Grid Code
PGR	Population Growth Rate
PH	Philippines
PHEV	Plug-in Hybrid EVs
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PIA	Philippine Information Agency
PIOUs	Private Investor Owned Utilities
PLC	Peso Landed Cost
PM	Particulate Matter
PMIP	Palawan Mindoro Interconnection Project
PNOC	Philippine National Oil Company
PNOC-EC	Philippine National Oil Company-Exploration Corporation
PNOC-RC	PNOC-Renewables Corporation
PNP	Philippine National Police
PNPPs	Privately-owned New Power Providers
PNR	Philippine National Railways
PNRI	Philippine Nuclear Research Institute
PNS	Philippine National Standards
POs	Peoples' Organizations
PPR	Particular Product Requirements
PREMS	Philippine Renewable Energy Market System
PSA	Power Supply Agreements
PSA	Philippine Statistics Authority
PSALM	Power Sector Assets and Liabilities Management Corporation
PSFI	Peak Power San Francisco
PSI	Peak Power Soccsargen
PSP	Private Sector Participation
PSPC	Pilipinas Shell Petroleum Corporation
PTJEC	Philippines-Taiwan Joint Economic Cooperation
PUVs	Public Utility Vehicles
PV	Photovoltaic
PV-SHS	Photovoltaic – Solar Home Systems
PWC	Price Waterhouse Coopers
QA	Quality Assurance
QS	Quality Standards
QTP	Qualified Third Party
R&D	Research and Development

RA	Republic Act
RC	Renewable Corporation
RCOA	Retail Competition and Open Access
RCEP	Regional Comprehensive Economic Partnership
RCP	Resiliency Compliance Plan
RD&D	Research, Design and Development
RE4RE	Renewable Energy for Rural Electrification
REC	Renewable Energy Certificate
REDAS	Rapid Earthquake Damage Assessment System
REF	Reference Scenario
REM	Renewable Energy Market
REMB	Renewable Energy Management Bureau
REOC	Renewable Energy Operating Contract
REP	Rural Electrification Program
RES	Retail Electricity Suppliers
RESCs	Renewable Energy Service Contracts
RESCUE	Resilient Solar Energy Solution for Calamity Susceptible Areas Project
RESHERR	Renewable Energy Safety Health and Environment Rule and Regulations
RETF	Renewable Energy Trust Fund
REZ	RE zones
RGT	Regasification Terminals
ROMELCO	Romblon Electric Cooperative, Inc.
RPM	Revolution Per Minute
RPS	Renewable Portfolio Standard
RPT	Real Property Tax
RTA	Regional Trade Areas
RTD	Real Time Dispatch
RWMHEEF	Reforestation, Watershed Management, Health and Environment Enhancement Fund
RTO	Recovery Time Objective
SAGR	Subsidized Approved Generation Rate
SAMELCO I	Samar I Electric Cooperative, Inc.
SAMELCO II	Samar II Electric Cooperative, Inc.
SARR	Subsidized Approved Retail Rate
SAWP	Social Amelioration and Welfare Program
SC	Service Contract
SC	Supreme Court
SCC	Stranded Contract Cost
SCOs	Show-Cause Orders
SCPC	SMC Consolidated Power Corporation
SD	Stranded debts
SDG	Sustainable Development Goals
SEC	Securities and Exchange Commission
SEP	Sitio Electrification Program
SEPF	Socio-Economic Project Fund
SER	Self-Evaluation Report
SG	Singapore
SG-TWG	Smart Grid–Technical Working Groups
SHAPES	Safety and Health Association of the Philippine Energy Sector, Inc.



SHS	Solar Home Systems
SIIGs	Small Islands and Isolated Grids
SLPGC	Southwest Luzon Power Generation
SMART	System-Integrated Modular Advanced Reactor Technology
SMPC	Semirara Mining and Power Corporation
SMRs	Small Modular Reactors
SNC	Second National Communication
SO	System Operator
SOC	State of Calamity
SODAR	Sonic Detection and Ranging
SOLECO	Southern Leyte Electric Cooperative, Inc.
SOME	Senior Officials Meeting on Energy
SOSP	Strategic Oil Stockpiling Program
SOx	Sulfur Oxides
SPESS	Solar-Powered Emergency Shelter Solution
SPEX	Shell Philippines Exploration
SPR	Strategic Petroleum Reserve
SPT	Simplified Planning Tool
SPUG	Small Power Utilities Group
SRA	Sugar Regulatory Administration
SSC	Standards Compliance Certificate
SSCMPs	Small-Scale Coal Mining Permits
STEA	Science and Technology on Energy Application
STP	Standard Temperature and Pressure
SUCs	State Universities and Colleges
SURSECO I	Surigao del Sur I Electric Cooperative
SWS	Social Weather Stations
TA	Technical Assistance
TAPG	Trans-ASEAN Gas Pipeline
TC	Technical Cooperation
TCF	Trillion cubic feet
TCGR	True Cost Generation Rate
TCO <sub>2e</sub>	Tons of CO <sub>2</sub> equivalent
TDP	Transmission Development Plan
TEP	Total Electrification Program
TESDA	Technical Education and Skills Development
TIFA	Trade and Investment Framework Agreement
TFBM	Task Force Bangon Marawi
TFEC	Total Final Energy Consumption
TFEM	Task Force E-Power Mo!
TFER	Task Force on Energy Resiliency
TH	Thailand
TL	Transmission losses
TMP	Transmission Master Plan
TNC	Third National Communication
TOE/MPhp	Tonnes of oil equivalent per million pesos of real GDP
TOP	Trial Operations Program
TPA	Third Party Access
TPBAC	Third-Party Bids and Awards Committee

TPES	Total primary energy supply
TPP	Trans-Pacific Partnership
TRAIN	Tax Reform for Acceleration and Inclusion Act
TransCo	National Transmission Corporation
TRO	Temporary Restraining Order
TSI	Therma South Inc.
TSO	Technical Support Organizations
TUP-IRTC	Technological University of the Philippines-Integrated Research and Training Center
TWG	Technical Working Group
TWh	Terawatt-hours
UAE	United Arab Emirates
UC	Universal Charge
UCME	Universal Charge for Missionary Electrification
UK	United Kingdom
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UP-NCTS	University of the Philippines-National Center for Transportation Studies
UPSCRFI	University of the Philippines Statistical Center Research Foundation Inc.
USAID	United States Agency for International Development
USD	United States Dollar
USDA	United State Department of Agriculture
US-DOE	United States-Department of Energy
VN	Vietnam
VRE	Variable Renewable Energy
WESM	Wholesale Electricity Spot Market
WFH	Work-From-Home
WOO	World Oil Outlook
WTO	World Trade Organization
WVF	West Valley Fault
WWF	World Wildlife Fund
ZAMSURECO I	Zamboanga del Sur I Electric Cooperative



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