Ministry of Economic Affairs and Climate Policy

Integrated National Energy and Climate Plan

2021-2030

The Netherlands

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Contents

Part A
National Plan

1 Overview and procedure for establishing the plan

This is the final version of the Dutch Integrated National Energy and Climate Plan 2021-2030 (NECP). The NECP contains the main priorities of the climate and energy policy for the next 10 years. The contents are largely determined by the Climate Agreement, established in June 2019 involving over a hundred social (public and private) parties[1]. This agreement contains a package of measures, which are actively supported by as many contributing parties as possible and with which the political CO_2 reduction target of 49% will be achieved by 2030.
To supplement the (new, national) measures in the Climate Agreement, the NECP also contains (i) policy arising from European obligations, (ii) ongoing policy and (iii) policy announced in the Coalition Agreement, but which is not part of the Climate Agreement. The recommendations of the European Commission related to the draft NECP have been incorporated in this final version[2]. The NECP contains parts taken from the Climate Plan, which will be presented to Parliament simultaneously.

The figures in the final version of the NECP are based on the Climate and Energy Report (KEV) 2019 by the Netherlands Environmental Assessment Agency (PBL)[3]. The Climate Act stipulates that the KEV must be published annually.
For 2020 and 2030, the KEV 2019 provides an insight into the targets for renewable energy, energy savings and CO_2 reductions. A large part of the Climate Agreement could not yet be incorporated in the KEV 2019. Therefore, the Climate Agreement memorandum supplements the KEV 2019 in indicating the impact of the Climate Agreement on the capacity to achieve a 49% CO_2 reduction by 2030.

1.1 Summary

i. Political, economic and social context

Summary of the political and policy context

The Netherlands aims to make a substantial contribution to the Paris Agreement and therefore the government is taking measures that contribute to a 49 % reduction in greenhouse gases in 2030, compared with 1990. In Europe the Netherlands advocates a 55 % reduction in emissions by 2030. One of the agreements in the 2017 Coalition Agreement was the announcement of a Climate Agreement, which would, following the Energy Agreement concluded in 2013, enable us to take the next step towards a climate-neutral society and a reliable, affordable, secure and low CO_2 energy supply by 2050.

It has also been agreed that the broad lines of the agreements in the field of climate and energy in the Coalition Agreement will be anchored in a Climate Act (see section 1.2 ii). Lastly, the Coalition Agreement states that, as part of the climate challenge, agreements in the government-wide programme for the circular economy and the transition agendas in the Raw Materials Agreement will be implemented.

The Senate approved the Climate Act on 28 May 2019. This Act enshrines in law the (long-term) objectives of the climate policy for 2030 and 2050.

The Climate Act stipulates that a Climate Plan is to be compiled every five years. This Climate Plan contains the main priorities of the climate policy to be implemented for the next 10 years. Thus the Climate Act connects the

[1] https://www.klimaatakkoord.nl/ and Letter to Parliament on the Proposal for a Climate Agreement, Parliamentary document 32 813, no. 342
[2] See Appendix 2
[3] https://www.pbl.nl/publicaties/klimaat-en-energieverkenning-2019 and Parliamentary document 32 813 no. 400

long-term goals with medium and short-term policy. The Act also stipulates that every year - on the fourth Thursday of October - the Climate and Energy Report (KEV) and the climate memorandum are to be submitted to the House of Representatives.

In addition to creating this legal framework, the period starting 23 February 2018 was dedicated to a broad social dialogue about the Climate Agreement. The Climate Agreement was presented on 28 June 2019.

The government opted for an inclusive approach by involving many organisations and businesses in developing the Climate Agreement. This became apparent in the five sectoral climate round table discussions and the overarching climate debate. The government has asked fellow governments, businesses, nature and environmental organisations, trade unions and other social parties, to respond to the following question: How can the Netherlands reduce its greenhouse gas emissions by almost half (49%) by 2030 compared with 1990? Therefore, it concerns national agreements to which the parties also want to adhere.

The Climate Agreement contains agreements on the measures required to achieve a 49% reduction in greenhouse gas emissions by 2030 and that prepare us for the challenge up to 2050. The Agreement contains measures the government itself is taking or actively facilitating. It also includes the agreements between parties in which the government does not have an active role. Both are important in order to achieve the common goal. The long-term perspective of the Climate Agreement makes a gradual transition possible, prevents shock effects and ensures we can seize economic opportunities.
The Climate Agreement forms the basis of the NECP.

Summary of the economic and social context

With over 17 million inhabitants the Netherlands is a densely populated country and has a growing economy. In 2018, the Dutch economy grew by 2.6%. Moreover, the Netherlands is one of the most competitive economies in the world. This has, for example, earned it sixth place in the Global Competitiveness Report 2019.4 We are also one of the most innovative countries, occupying fourth place in the Global Innovation Index5.

Climate and sustainability receive a lot of attention in both the political and social debate. There has been a climate court case between the Urgenda Foundation and the Staat der Nederlanden (State of the Netherlands), on which the court of appeal ruled in October 2018. The court ruled that the Netherlands must reduce greenhouse gas emissions by at least 25% by 2020 compared with 1990 levels.

In society, attention for climate is growing as a result of the many sustainability initiatives launched by citizens, businesses, NGOs and authorities, and due to media attention. Multiple climate marches and protests have been organised too, in a number of cities, in which many citizens participated. Despite the positive attitude towards increased sustainability, in some areas of the Netherlands there is also opposition to the emergence of, for example, wind farms. This shows a division in society: some people are calling for more ambitious climate policy, while others warn of rising costs and change occurring too quickly.

Besides the climate ambition the earthquake issue in Groningen is also decisive with regard to climate and energy policy. The earthquake issue has led to the decision to halt the extraction of gas from the Groningen field, for the safety of residents (see section 1.2 i).6

ii. The European Energy Union

The effects of global warming are visible worldwide and to everyone. Significant steps are required to limit global warming and the impact of climate change. Therefore the transition to a CO_2-neutral economy is a major priority. In the Paris Agreement governments agreed to limit the average global warming to well below 2°C, pursuing efforts to

4 https://worldcompetitiveness.imd.org/rankings/wcy
5 https://www.globalinnovationindex.org/home
6 Letter to Parliament on Gas Extraction in Groningen, 29 March 2018, Parliamentary document 33 529, no. 457

limit it to below 1.5°C. On behalf of Member States the European Union made firm commitments to reduce greenhouse gas emissions by at least 40% by 2030, compared with 1990. The Netherlands supports this commitment, but at the same time finds that it is not sufficient in limiting the increase in global average temperature to well below 2°C. Therefore the Netherlands is raising the bar higher than the commitment made by the European Union: The Netherlands is taking national measures that prepare us for a greenhouse gas reduction of 49% by 2030, compared with 1990. In Europe we advocate a more ambitious emissions reduction. The Netherlands is aiming to be climate neutral by 2050 and to increase the European contribution of 40% by 2030, to a 55% reduction by 2030. If a more stringent target proves unfeasible in the EU the Netherlands will strive to make more ambitious agreements with like-minded European countries.

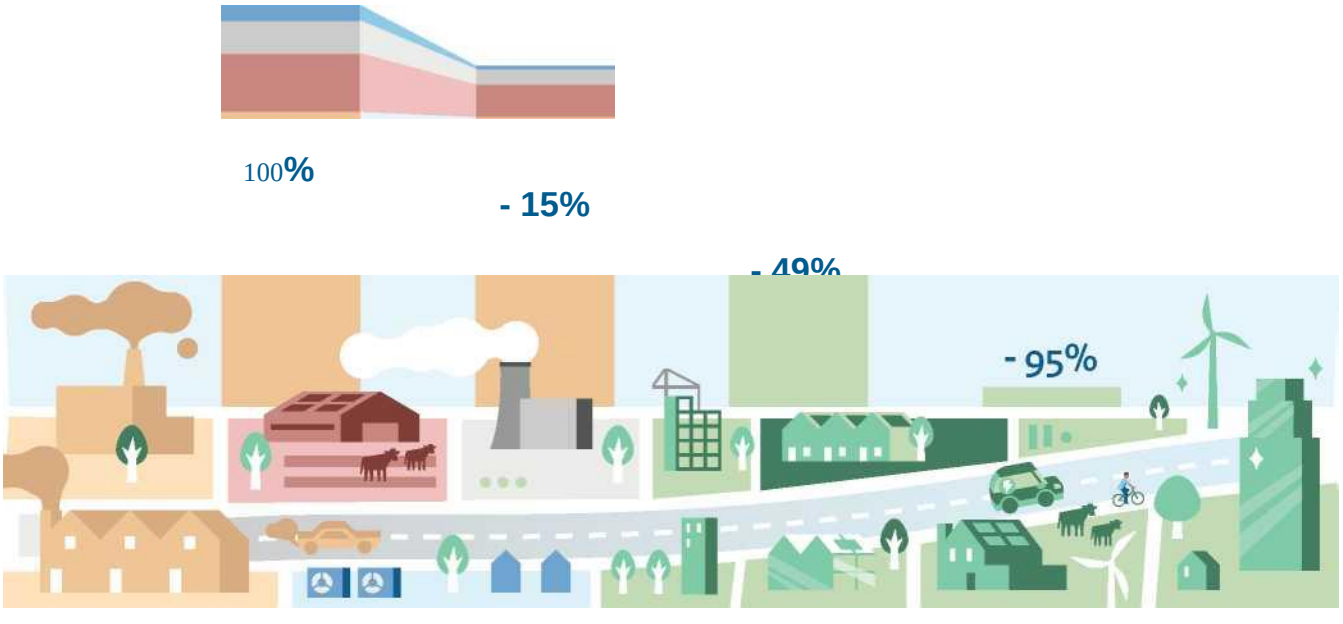
As described in the last paragraph, the national strategy for achieving the long-term reduction targets is established in the Climate Agreement. Due to the integrated character of the Climate Agreement, it addresses the five dimensions of the Energy Union (decarbonisation, energy efficiency, energy security, internal energy market and research and innovation). These are subdivided into five sectors, which are: electricity, industry, mobility, agriculture and land use, the built-up environment, and into a number of cross-sectoral areas, which are electrification, hydrogen, biomass, innovation, the labour market and education, finance, civic participation, spatial integration and the regional energy strategy (RES).

iii. National CO_2 target

The greenhouse gas emission target of 49% by 2030 compared with 1990, proposed in the Coalition Agreement, means a reduction of approximately 49 Mton of CO_2 equivalents by 2030 compared with an unchanged policy. This includes the effects of the circular economy policy.

The following (long-term) objectives for 2030 and 2050 arise from the Climate Act:
- In 2050, the Netherlands must have reduced greenhouse gas emissions by 95% compared with 1990;
- An intermediate target of a 49% reduction in greenhouse gas emissions has been established for 2030; and
- Another target stipulates that electricity generation must be 100% CO_2 neutral by 2050.

Emissions 1990, 2017 and targets 2030-2050



For the discussions about the Climate Agreement indicative, CO_2 reduction challenges for the five sectors comprising industry, mobility, the built-up environment, electricity, agriculture and land use were formulated, based on national cost-effectiveness.[7]

Based on a cost-effective greenhouse gas emissions reduction package of 49% by 2030, the anticipated contributions that the Netherlands will make to the targets applicable to renewable energy and energy savings are respectively at least 27% and a maximum of 1,950 petajoules in primary energy consumption. In relation to measures announced later and that are not included in the KEV 2019, the contribution to the European target for renewable energy could be higher than 27%. This means the Netherlands will provide an adequate contribution to the European targets for renewable energy (32%) and energy savings (32.5%).[8] With regard to the interconnection target, the Netherlands already far exceeds the European target of 15% by 2030.[9]

1.2 Overview of the current policy context

i. Energy system and policy context

Energy system

In this section we address the main characteristics of energy management in the Netherlands.
Chapter 4 contains a more detailed explanation.

Greenhouse gas emissions

As a result of the Climate Plan, the government is aiming for a 49% CO_2 reduction by 2030 compared with 1990. In the calculation of the draft Climate Agreement in early 2019, the PBL found that the instruments proposed for the implementation could produce a reduction in emissions amounting to between 31 and 52 Mton compared with the base path in the National Energy Report (NEV) 2017. The PBL concluded that while the desired target of a 48.7 Mton emissions reduction falls within this bandwidth, it will probably not be achieved. In response to the calculation, parts of the draft Climate Agreement were adjusted to produce the Climate Agreement that was presented to the House of Representatives on 28 June 2019, and is included in this Climate Plan. Simultaneously with the Climate and Energy Report 2019 (KEV - successor to the NEV), the PBL has issued a memorandum that provides insight into how the adjustments in the Climate Agreement compared to the draft Climate Agreement translate into the target range compared to an updated base path in the KEV 2019. PBL concludes in the memorandum that the package of policy instruments in the Climate Agreement could potentially lead to greater emission reductions than the package in the draft agreement, but that it is unlikely that the 2030 climate target of a 49% reduction compared with 1990 will be achieved with this package. Current insights into expected developments as described in KEV 2019 are less favourable from the perspective of greenhouse gas reduction than the expectation based on the NEV from 2017.

Energy savings

The Netherlands has opted to make its contribution to the European objective for energy savings based on primary energy consumption in 2030. In this regard, the Netherlands aims to achieve primary energy consumption of 1,950 petajoules by 2030 (excluding use for non-energy purposes). This contribution translates into an expected final energy consumption of 1,837 petajoules by 2030. According to the European Commission this is a reasonable contribution by the Netherlands. As a result the Netherlands is expected to meet the indicative national contribution to the European target (see Chapter 2.2). The mandatory energy savings for the Netherlands during the period 2021 up to and including 2030, in accordance with Article 7 of the Energy Efficiency Directive, is expected to amount to 925 petajoules. The Dutch contributions will be achieved by implementing the package of policy measures in the Climate Agreement, such as the district-oriented approach in the built-up environment, the CO_2 tax in industry and the expansion of the SDE+ (see chapter 3.2).

[7] https://www.pbl.nl/publicaties/nationale-kosten-klimaat-en-energietransitie-in-2030-update-2018
[8] Parliamentary document 21 501-33-700
[9] Parliamentary document 21 501-20-968

Renewable energy

With regard to the EU target for renewable energy of 32%, the European Commission has indicated that it deems a contribution of 26% by the Netherlands to be reasonable. The Netherlands is demonstrating its ambition and is focusing on achieving a 27% share of renewable energy by 2030. The KEV 2019 forecast is that by 2030, the Netherlands will achieve a 25% share of renewable energy (bandwidth 21%-26%). However, the KEV 2019 does not yet include all measures that contribute to this goal, such as one of the planned offshore wind farms, making heat generation more sustainable and a number of measures in the Climate Agreement that lead to energy savings. Based on the mid-term estimate of 24.9% in the KEV 2019, the PBL estimates that the share of renewable energy in 2030, including the measures of the Climate Agreement, will amount to 30% - 32%. As a result, the 27% contribution will be achieved.

The energy mix is gradually changing

Consumption of natural gas will decrease due to continued reduction of the use of natural gas in (primarily decentralised) production of electricity through cogeneration and reduced demand for natural gas for the heating of buildings. Although the opening of three new coal-fired power plants and low coal prices have led to an increase in coal consumption in recent years, the closure of five coal-fired power plants that has taken place in recent years will result in coal consumption being lower than in 2017 by 2020. The contribution of renewable sources is expected to increase significantly in the years to come, primarily due to the growth of renewable electricity production (see Section 4.2.2).

For the time being, crude oil will maintain its dominant position as a fuel in transport and as a raw material in the chemical industry. Consumption of crude oil will remain roughly the same, at the level of 2005. It is expected that, in the years to come, crude oil will overtake natural gas as the principal energy carrier in the energy mix. Without new investments, the closure of the nuclear power plant in Borssele in 2033 will bring an end to the contribution of nuclear energy to the energy mix.

Energy market

Lots of parties operate in the Dutch energy market and it has strong links abroad. With regard to the supply of gas and electricity these are, on the one hand, producers and suppliers that operate on the market, and grid operators on the other. The Netherlands has implemented a division of the energy companies, in which the grid operators must be independent and financially robust.

The high-voltage grids (electricity) and high pressure grids (gas) each have one grid operator, respectively TenneT and GTS. There are multiple parties involved in the distribution networks, each of which operates in a particular region.

Gas extraction in Groningen

In March 2018, a decision was taken by the government to end gas extraction in the Groningen field, to ensure the safety of Groningen's inhabitants. This involves major steps, due, among other things, to the construction of an extra nitrogen plant and the intended conversion of the nine largest industrial users. As of 2022, it is expected that only a limited volume will be needed from the Groningen field. This will be reduced to zero over the course of the following years. In the meantime, additional measures have been developed, which this year will already ensure an additional decrease in gas extraction in Groningen by 4.1 billion Nm³ (compared with GTS' estimate of 31 January 2019) to a total of 11.8 billion Nm³ for the current 2019/2020 gas year, assuming an average year in terms of temperature. This brings the extraction below the level recommended by the Dutch State Supervision of Mines of 12 billion Nm³. Gas extraction in Groningen is expected to be zero from mid-2022 onwards[10].

Developments in other countries related to the energy supply in the Netherlands

Developments in neighbouring countries have a major impact on those in the Netherlands. In recent years, the Netherlands was, on balance, an importer of electricity. Greenhouse gas emissions from generating the imported electricity were discharged abroad. It is expected that imports and exports will increase in the period leading up to 2050, due to the strong growth in production capacity based on wind and solar energy. The import balance in the period leading up to 2030 is expected to increase significantly. Fluctuations in electricity generated from solar and wind energy can be absorbed due to the increase in connection with foreign countries.

[10] Letter to Parliament on Gas Extraction in Groningen in 2019-2020, Parliamentary document 33 529, no. 678

Policy context

In 2018, the Dutch economy grew by 2.6%. That was the second highest growth after 2007. In 2018, growth relied heavily on consumption and investments in fixed assets. For the first time in years, household consumption grew almost as fast as gross domestic product (GDP). This is partly due to the fact that the real disposable income of households grew at approximately the same rate as GDP. The business sector achieved record profits once more in 2018. 2018 was another record year on the labour market. The boom in 2017 continued in 2018 and reached a peak in August. The Netherlands is one of the most competitive economies in the world. The Netherlands occupies sixth place in the IMD's World Competitiveness Yearbook11 and sixth place in the World Economic Forum's Global Competitiveness Report.12 The Netherlands' strengths include its macroeconomic policy, the relatively low government debt and its infrastructure. The Netherlands is also one of the most innovative countries, occupying fourth place in the Global Innovation Index13.

The Netherlands is a densely populated country. It is home to 17,282,163 inhabitants (24 September 2019) and the density is 513 pop/km². Statistics Netherlands expects the population to increase to 18 million in 2029 due to both a birth surplus and immigration. After 2037, the population will only grow as a result of immigration.14

In recent decades, quality of life in the Netherlands has improved in many respects.15 The air and water are cleaner, there is a wide range of safe and cheap food, the energy efficiency of new homes and appliances is better and the structure of the road network has improved and is now safer. At the same time, persistent challenges still exist. Excessively high greenhouse gas emissions cause climate change; livestock farming is reaching its ecological and social limits; biodiversity is under serious pressure; the consumption of raw materials produces high environmental pressure; and the differences between and within regions and groups of people are increasing, such as accessibility to the housing market and the number of years people can expect to live in good health.

In May 2019, the Council of State ruled the Nitrogen Action Programme (PAS) invalid. The PAS permitted activities that release nitrogen (such as agriculture, housing and road construction, or industry), as long as measures were taken that provided for a future reduction in nitrogen deposition. The government is working on a new approach to nitrogen.

The public debate is highly focused on climate policy. For example, the Urgenda Foundation filed a climate case against the State of the Netherlands and the latter was instructed to reduce greenhouse gas emissions in the Netherlands by at least 25% by 2020 compared with 1990 levels. On 24 June 2015, the court ruled in favour of the Urgenda Foundation and the Court of Appeal upheld the ruling on 9 October 2018. The State has appealed; the ruling by the Supreme Court is expected on 20 December 2019.

The KEV 2019 indicates that the expected emission reduction by 2020 compared to 1990 is expected to be 23%. To implement the Urgenda judgement, a 25% CO_2 reduction must be achieved by 2020. In June and November 2019, the government announced additional measures. These additional measures allow a quick start in the reduction of CO_2 in the short term, while the measures also contribute to an effective transition in the longer term.[16]

Attention in society for climate change, increased sustainability and the circular economy is growing as a result of the many sustainability initiatives launched by citizens, businesses, NGOs and authorities. The media also devotes considerable attention to these themes. Moreover, a number of climate marches and protests have been organised in various cities in the Netherlands that are consistent with the broader global movement of climate action.

A study among citizens shows that, although increased sustainability is relatively low on their agenda, the majority of them hold a positive view when it comes to making the energy supply more sustainable. However, they estimate the share

11 https://www.imd.org/wcc/world-competitiveness-center-rankings/world-competitiveness-ranking-2018/.
12 https://www.weforum.org/reports/the-global-competitveness-report-2018.
13 https://www.globalinnovationindex.org/Home.
14 https://www.cbs.nl/nl-nl/nieuws/2018/51/prognose-18-miljoen-inwoners-in-2029
15 Read more in Balans van de Leefomgeving: http://themasites.pbl.nl/balansvandeleefomgeving/wp-content/uploads/pbl-2018-balans-van-de-leefomgeving-2018-3160.pdf.
16 Letter to Parliament on the Implementation of the Urgenda judgement, 28 June 2019, 32 813 no. 341

of renewable energy to be higher than it is in reality and also believe the government (central and local authorities) should play a major role in the climate and energy transition.17

Despite the positive attitude towards increased sustainability, in certain parts of the Netherlands there is opposition to the emergence of projects including infrastructure, solar farms and wind farms. This is because some local residents consider that these types of projects encroach on their living environment. The spatial integration of the climate and energy transition is a difficult one.

ii. Description of current polices and measures

Current policies

The current energy and climate policy is anchored in the 2017 Coalition Agreement, the Climate Act, the recently published Climate Agreement and the 2013 Energy Agreement. Below is a brief description of the major building blocks of the energy and climate policy. In addition, the draft national environmental vision (NOVI), which provides frameworks for the spatial development of measures, is discussed.

Coalition Agreement "Confidence in the Future"

On 26 October 2017, the Rutte III Cabinet (VVD, CDA, D66, ChristenUnie) was sworn in. Political basic principles are outlined in the Coalition Agreement "Confidence in the Future", published on 26 October 2017.18 The Netherlands is resolved to make a substantial contribution to the Paris Agreement and therefore we are taking measures that prepare us for a 49% reduction in greenhouse gas emissions by 2030, in which the effects of the circular economy policy will also be included. As the State Secretary for Infrastructure and Water Management underlined in the Cabinet's response to the transition agenda's circular economy, the transition to a circular economy could make a significant contribution to fulfilling the requirement related to the Climate Agreement.19 In Europe, the Netherlands advocates a 55 % reduction in emissions by 2030. If a more stringent target proves unfeasible in the EU, the Netherlands will strive to make more ambitious agreements with like-minded European countries than the country allocation designated by the EU; but without this resulting in high emissions elsewhere.

At the national level in the Coalition Agreement, it was agreed that there would be a Climate Agreement. It was also agreed that the climate and energy policy objectives would be anchored in a Climate Act, to provide certainty about the long-term goals.

Several measures in the Coalition Agreement include the greening of the tax system, closing down coal-powered plants by 2030 at the latest, recycling raw materials in industry, increasing parcels for offshore wind energy, making new homes natural gas-free and existing homes more sustainable, and replacing the duty of connection to gas by a right to heating and the pursuit of 100% zero emissions for newly sold cars as of 2030.

The Coalition Agreement served as the basis for the development of the Climate Agreement. In addition to the required 49% reduction and agreements related to ending coal-powered electricity generation and the CO_2 minimum price (see section 1.1.iii)), the Coalition Agreement also states that agreements in the state-wide programme for the circular economy and the transition agendas in the Raw Materials Agreement will be implemented as part of the climate challenge.20

Climate Act

The Senate approved the Climate Act on 28 May. This Act legally enshrines the (long-term) objectives of the climate policy for 2030 and 2050.

- In 2050, the Netherlands must have reduced greenhouse gas emissions by 95% compared with 1990;
- An intermediate target of a 49% reduction in greenhouse gas emissions has been established for 2030; and
- Another target stipulates that electricity generation must be 100% CO_2 neutral by 2050.

17 Motivaction, Publieksmonitor Energie, 2017
18 Confidence in the future, Coalition Agreement 2017 - 2021, VVD, CDA, D66 and ChristenUnie.
19 Parliamentary document 32 852, no. 59.
20 Letter to Parliament on the Government Strategy for Climate Policy, 23 February 2018, Parliamentary document 32 813, no. 163.

In addition, the law stipulates that a Climate Plan is to be compiled every five years. The Climate Plan outlines the main priorities of the climate policy to be implemented over the next 10 years. This corresponds to the approach established in the NECP. The Climate Act connects the long-term goals with medium and short-term policy.
The law also stipulates that every year - on the fourth Thursday of October - the Climate and Energy Report (KEV) and the climate memorandum are submitted to the House of Representatives. The annual Climate Memorandum reports the progress of the policy in the Climate Plan. This ensures the House is informed about the progress made in climate policy. This monitoring system is consistent with that of the NECP.

Climate Agreement

The starting shot was given for the Climate Agreement on 23 February 2018 and it was published on 28 June 2019. The Climate Agreement contains agreements on the measures required to achieve a 49% reduction in greenhouse gas emissions by 2030 and that prepare us for the challenge up to 2050. It thus has a more distant horizon than the Energy Agreement. The long-term perspective of the Climate Agreement makes a gradual transition possible, prevents shock effects and ensures we can seize economic opportunities.

The government predefined the political frameworks with which the Climate Agreement must comply: the reduction target of 49% must be achieved in a way that is feasible and affordable for everyone. This means that we reduce the burden on the household purse as much as possible and that we ensure a fair distribution of burdens between households and businesses, taking into account the level playing field for our business community. We take the time available to us in the run up to 2030 and 2050 and opt for the most cost-effective and future-proof approach. At the same time we work towards an appealing business climate in which we encourage business to invest in sustainable, innovative activities in the Netherlands. After all, an ambitious climate policy can offer opportunities for our economy, our prosperity and our sustainable earning power.

The 49% greenhouse gas reduction target by 2030 proposed in the Coalition Agreement means a reduction of approximately 49 Mton of CO_2.

This past year, over a hundred parties have worked on a coherent package of proposals with which the CO_2 reduction target can be achieved by 2030. On 21 December 2018, this resulted in a draft Climate Agreement[21] and the publication of the Climate Agreement on 28 June 2019[22]. Businesses and social organisations developed measures in sectoral platforms in the fields of electricity, mobility, agriculture and land use, industry and the built-up environment with which the reduction target can be achieved. They did so under the leadership of five independent chairs of the sectoral platforms, the chairs of the two task groups and the chair of the Climate Council. This result would not have been possible without the efforts and commitment of all parties involved.

The Agreement contains measures the government itself is taking or actively facilitating. It also includes the agreements between parties in which the government does not have an active role. Both are important in order to achieve the common goal.

The Energy Agreement for sustainable growth

The Energy Agreement for sustainable growth was concluded in September 2013 and runs until 2023. In the Energy Agreement over 40 organisations (including the government, employers, trade unions, nature and environmental organisations, social organisations and financial institutions) established their shared ambitions for sustainable growth, and made specific agreements to achieve these ambitions. In this context parties will strive to achieve the following objectives:23

- A saving on final energy consumption of on average 1.5% a year.
- Energy savings of 100 petajoules in the Netherlands' final energy consumption as of 2020 compared with 2012.
- An increase in the share of renewable energy generation (over 4 % in 2013) to 14 % in 2020.

21 Parliamentary document 32 813, no. 263
22 Parliamentary document 32 813, no. 342
23 Energy Agreement for Sustainable Growth, SER (Social and Economic Council), September 2013;

- A further increase of this share to 16% in 2023.
- At least 15,000 full-time jobs, a large number to be created over the next few years.

In 2016, the Energy Agreement intensification package was agreed by the Guarantee Committee. Moreover in 2018, the 2018 Implementation Agenda was agreed, which contains a response from the Energy Agreement parties regarding the outcomes of NEV 2017 and a number of focal points for implementing the Energy Agreement over the coming year.[24] The Implementation Agenda 2018 also refers to the Climate Agreement.

Implementing the agreements in the Energy Agreement must result in an affordable and clean energy supply, employment and opportunities for the Netherlands on the clean technology market. With the Energy Agreement the Netherlands has taken an irreversible step towards the energy transition. This will result in a substantial increase in the share of renewable energy and energy savings.

The Climate Agreement (see above) builds on the results of the Energy Agreement and focuses on the period up to 2030 and beyond. The required continuity is adequately guaranteed if the goals of the Energy Agreement for 2020 and 2023 are fully integrated in the implementation and safeguarding of the Climate Agreement.

Top sectors

Top sectors are fields in which the Dutch business community and research centres excel worldwide: agriculture and food, chemical industry, creative industries, energy, high tech systems and materials, life science and health, logistics, horticulture and starting materials and water and maritime The business community, universities, research centres and the government work together on knowledge and innovation to further strengthen this position. Within each top sector the parties have joined forces in Top Consortia for Knowledge and Innovation (TKIs). The TKIs have established research agendas and goals for the coming years.

The Top Sector Energy (TSE) is the driving force behind innovations necessary for the transition to an affordable, reliable and renewable energy system. The TSE helps businesses, knowledge institutions, authorities and social organisations to work together on the energy system of the future. The TSE also stimulates new initiatives that accelerate the transition towards renewable energy. This allows the TSE to create new activities and us to boost our international competitiveness.

In July 2018, the government outlined the new approach to the top sectors policy.[25] The focus is on the economic opportunities offered by social challenges, including the energy transition and sustainability. Newcomers are expressly invited to participate.

Draft national environmental vision (Nationale Omgevingsvisie - NOVI)

The government adopts the assessment principles and spatial elaboration of the climate and energy transition from the draft NOVI as a framework for policy implementation. The draft NOVI is characterised by a preference for offshore wind energy. Energy generated offshore will come ashore at a limited number of sites. Where possible, energy-intensive industry will be concentrated at these sites. This avoids the unnecessary transportation of energy inland and the corresponding new infrastructure and spatial consumption.

A combination of functions takes precedence over single functions; the characteristics and identity of a region is key and any deviations are prevented. These principles help in taking decentralised spatial policy decisions so that balanced space can be provided for the climate and energy transition. The draft NOVI stipulates a preference for offshore wind energy, but it is also necessary to integrate renewable energy generation on land. To this end the draft NOVI addresses the Principal Energy Structure Programme and provides direction for the Regional Energy Strategies (RES). With regard to the construction of the vital energy infrastructure, the draft NOVI indicates that it will be carried out in a climate-proof manner and must be flood-proof. In the Principal Energy Structure Programme, the quality of the environment and cost reduction play a major role. This national programme will be aligned with the National Programme for Regional Energy Strategies(NP RES).

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24 Parliamentary document 30 196, no. 559.
25 Letter to Parliament "Towards mission-driven innovation policy with impact", 13 July 2018, Parliamentary document 33 009, no. 63.

Directions provided to the RESes include the preference for large-scale clustering of renewable energy generation, to prevent fragmentation over the landscape and to use space as efficiently as possible. The option for an alternative heat facility for the heat transition in the built-up environment relies on many aspects, including spatial ones. This is why heat grids must be examined in detail and explicitly weighed against other options. Large-scale clustering (which reduces spatial transfer and contributes to cost reduction) and a preferential order for solar PV (with the first preference for solar PV on roofs and façades and, in the last resort, in rural areas). The option for an alternative heat facility for the heat transition in the built-up environment relies on many aspects, including spatial ones. This is why heat grids must be examined in detail and explicitly weighed against other options.

Collaboration with other authorities

Launch of the Inter-administrative Programme

The climate and energy transition is not only a matter for the government and the State. Translation of national targets in the Climate Act into their practical implementation often takes place at the regional or local level. Typical issues that occur at the regional or local level are, for example, spatial integration of renewable energy options, and the storage of and infrastructure for heat and electricity. The responsibilities of all levels of government come together particularly at the interface of energy policy and spatial policy. In the Spatial Planning Act (WRO) and in the future Environment and Planning Act municipalities and provinces bear primary responsibility for spatial policy and the development of the physical environment. Municipalities take care of the public space and bear front line responsibility for weighing up interests in use of the scarce space. Provinces play an important role in connecting and directing the challenges in the physical environment when there are supralocal and regional interests. Central government formulates the long-term policy goals and the desired coherence between the goals, thus bearing responsibility for considerations at the strategic level.

In February 2018, central government and local and regional authorities signed the Inter-administrative Programme26, which includes Climate and Energy, as well as the circular economy and climate adaptation. Central government and local and regional authorities agreed to jointly commit to climate mitigation (central government and local and regional authorities will jointly strive to achieve the target of a 49% reduction in CO_2 by 2030); climate adaptation (the Netherlands is to be climate-proof and water-resilient by 2050); and a circular economy (the Netherlands will be a circular entity by 2050). The joint ambition of the authorities is to achieve substantive results related to these three themes, supported by all the authorities. Substantive agreements in which the business community and social parties also bear responsibility will be included in the Climate Agreement.

Regional Energy Strategies (RES)

One component of the Inter-administrative Programme is the agreement on a multi-annual programmatic national approach with nationwide integral Regional Energy Strategies (RES), combined with regional circular economy strategies. In many cases, the region is the right level of scale for linking the energy transition challenge with other challenges in the physical environment, and thus comparatively weighing up the various interests. Aligning the supply and demand of electricity and heat, and the spatial weighting of renewable energy and heat generation cannot be tackled on a single administrative level. The RES offers a new instrument in which municipalities, provinces and water boards work together at the regional level and assess renewable electricity generation, the heat transition in the built-up environment and the related storage and infrastructure needed. They do this together with grid operators, businesses and social parties. The focus is on the successful generation of 35 TWh of renewable energy on land by 2030 and developing a Regional Heat Structure. In line with the assessment principles in the draft NOVI, the RES also includes preferred pathways.

The RES is established by the municipal councils, provincial states and the water boards' general administrative bodies. Elected representatives and day-to-day administrators are usually involved from the beginning of the RES process. However, the way in which this happens may vary from one region to the next.

Therefore, the RES does not lead to changes in existing government tasks and competences. The outcomes of the RES process are established by the respective, responsible bodies of municipalities, provinces and water boards, in the municipal and provincial Environmental Vision, Environmental Plan and Environmental Regulation and Water Board

26 Programmastart IBP (Launch of the Inter-administrative Programme), 14 February 2018

Regulation. This means that assessments performed at the regional level are anchored in existing structures and instruments.

The implementation of the RES is supported by the Inter-administrative National Programme for Regional Energy Strategies (NP RES). The NP RES has five commissioning parties: the Ministry of the Interior and Kingdom Relations, the Ministry of Economic Affairs and Climate Policy, the Association of Provinces of the Netherlands, the Association of Dutch Municipalities and the Union of Water Boards. The NP RES provides a platform for learning and coordination, and supports the regions in achieving the target and developing a robust and socially supported process to this effect. In view of this, parties such as grid operators and the participation coalition are also actively involved[27].

Mobility: MIRT (The Dutch Multi-Year Programme for Infrastructure, Spatial Planning and Transport)
Inter-administrative consultation on mobility takes place in the Administrative Consultations for the Dutch Multi-Year Programme for Infrastructure, Spatial Planning and Transport.

iii. Key aspects of cross-border relevance

The Netherlands is aiming to be climate neutral by 2050 and to increase the European contribution of 40% by 2030, to a 55% reduction by 2030. The Netherlands aims to make ambitious agreements with all European countries to jointly develop policy instruments and practical measures and thus achieve a higher climate target within the lead group. The Netherlands is working with other Member States to achieve a coordinated phasing out of coal, to make the EU budget Paris-proof, far-reaching carbon pricing in addition to ETS, the roll-out of renewable energy and faster growth in the share of electric cars. As well as the joint development of CCU/CCS ("Carbon Capture and Utilisation/Carbon Capture and Storage") and green hydrogen. In this endeavour, collaboration within the leading group of like-minded European countries is crucial. The Netherlands supports the plans for the new Commission to come up with an integral package of measures: the Green Deal. The Green Deal covers relevant sectors such as transport, energy and agriculture, and presents ambitious plans for cross-sectoral strategies, such as the commitment to the circular economy, biodiversity and hydrogen. In this regard the Netherlands considers it important that industry and funding are linked to the plans for the Green Deal. The Netherlands supports the call on the Commission by many Member States to produce a second plan of action and a long-term strategy for the circular economy with quantitative targets that also contribute to achieving the climate goals.

By joining forces with neighbouring countries we can prevent any leakage effects of the greenhouse gas reductions and major competitive disadvantages to the Dutch economy. The regional alignment of strategies is also important for supply security. European directives that establish CO_2 norms for vehicles (cars, delivery vans and trucks) are extremely important for reducing CO_2 emissions from new vehicles. The Netherlands is working closely with like-minded Member States on this matter to ensure strict EU norms. The same applies to strict EU norms for mobile machinery not intended for road use (e.g. excavators, cranes and marine engines). With regard to implementation of the EU directive on laying infrastructure for alternative fuels, the Netherlands has set up an informal collaboration partnership with Germany, in which ten European Member States are participating. The Netherlands is also working in the Benelux context on rolling out alternative fuels for mobility. Furthermore, there are joint efforts with neighbouring countries to enable electric driving and electric cars to cross borders. These efforts relate to the standardisation of protocols and charging infrastructure.

The coalition for each theme may differ, depending on the joint challenges and interests in neighbouring countries. This will build on existing cooperation partnerships in the field of energy, industry and climate (such as the Pentalateral Energy Forum and the North Seas Energy Forum), and cooperation in agriculture, mobility, the circular economy and the built-up environment will be sought with like-minded countries in these areas.

iv. Administrative structure of national energy and climate policy

Since October 2017, climate and energy policy has fallen under a single ministry, i.e. the Ministry of Economic Affairs and Climate Policy (EZK). The responsibility of the EZK includes implementation of the Energy Agreement,

[27] The Participation Coalition, a national collaboration partnership involving Energie Samen, HIER opgewekt, de Natuur en Milieufederaties, LSA bewoners and Buurkracht, will ensure that all parties involved at the regional level have participated in shaping the RESes.

implementation of the Climate Agreement, and drafting the Climate Plan and NECP. The Ministry of the Interior and Kingdom Relations is responsible for policy to increase the sustainability of the built-up environment. The Ministry of Agriculture, Nature and Food Quality is responsible for the targets with regard to agriculture and land use and the Ministry of Infrastructure and Water Management for mobility, the circular economy and climate adaptation. Consultation and alignment between the ministries concerned is necessary and therefore takes place on a regular basis.

Local and regional authorities are responsible for developing measures in the physical environment, spatial policy and for achieving nature-related objectives. They also play a leading role in the Regional Energy Strategies (RES): regional developments primarily for the challenges related to generating electricity onshore (locations and grids) and the heat transition in the built-up environment. They serve as the link with the regional circular economy strategies in the IBP and translate them into provincial and municipal environmental visions, environmental regulations and environmental plans.

Governments play an important role, but the success of the transition ultimately depends on the joint efforts of many parties in society. In the Coalition Agreement, the government has focused on climate policy with the broadest possible support. Over 100 parties participated in debates on the Climate Agreement. Each of these parties will interpret the agreements made on the basis of their particular responsibility. As part of the Climate Agreement it was agreed that in relation to the implementation of agreements per sector, (regular) implementation meetings will take place, in which the progress of agreements will be discussed based on sectoral implementation programmes. The implementation meetings fall under the responsibility of the relevant sectoral ministers at the Ministry of Economic Affairs and Climate Policy (EZK), the Ministry of the Interior and Kingdom Relations (BZK), the Ministry of Infrastructure and Water Management (I&W) and the Ministry of Agriculture, Nature and Food Quality (LNV).[28]
In addition to the implementation meetings, the (coordinating) minister from the EZK will organise progress meetings, during which overall progress will be discussed on a regular basis.

The Netherlands Environmental Assessment Agency (PBL) is one of the most important independent advisers to the government in the field of the quality of life, the environment, climate and energy. Every year, the PBL publishes the Climate and Energy Report (KEV). The KEV, which is the successor of the former National Energy Report (NEV) provides an overview of emissions achieved and an estimate of greenhouse gas emissions in the Netherlands broken down into sectors. The KEV also provides insight into the developments and measures that had an impact on greenhouse gas emissions. The KEV is sent to both chambers of the States General by 1 November at the latest.

The Climate Act requires the government to periodically account for achieving the targets established in the Act.
The government sends the Climate Memorandum to both chambers of the States General at the same time as the KEV.
The Climate Memorandum contains:

a. The overall picture of the achievement of the climate policy as included in the Climate Plan;
b. A presentation per ministry of the main aspects of the achievements of climate policy;
c. A presentation of the impact on the departmental budgets of climate policy;
d. The financial impact on households, businesses and governments of significant developments in climate policy that deviate from the Climate Plan;
e. The way in which the Climate and Energy Report is involved in the next review or evaluation of the progress made by the Climate Plan, and
f. insofar as it is relevant, the progress report of the implementation of the Climate Plan.

In order to effectively monitor policy progress a Climate Policy Progress Monitor has been developed. The monitor appears annually with the Climate Memorandum and examines policy progress on four levels:

1. Implementation of agreements or measures;
2. Changes in the preconditions for the transition;
3. Change in (attitude and) behaviour;
4. Policy results.

Systematically developing the monitor in this way enables early detection of any bottlenecks.

[28] The implementation programmes per sector will be appended to the final Climate Plan.

The Climate Policy Progress Monitor ties in as much as possible with existing monitoring instruments within the different sectors, and will appear annually as of 2020. Insights from the Climate Policy Progress Monitor will be used to adjust policy in the meantime, along with insights into CO_2 target achievement in the KEV.
The Council of State provides an annual review of the Climate Memorandum. In the review the Council of State primarily focuses on administrative aspects of the policy, such as the relationship between central government and other authorities, the feasibility and enforceability of measures and their financial consequences.

The national guarantee cycle is aligned with the NECP cycle in accordance with the Climate Act.

1.3 Stakeholder consultation and involvement

Broad social involvement in formulating policy: Climate Agreement
The government is striving for the broadest possible support for the transition to a low CO_2 society and the policy required to achieve it. Therefore, the Coalition Agreement focuses on broad social agreement as the basis for the policy approach. The Climate Agreement established on 28 June is the successor to the Energy Agreement.

Over a hundred stakeholders participated in discussions about the Climate Agreement, organised in five sectoral platforms and three task forces in the fields of finance, innovation and labour market and education. They included organisations and businesses that can make a specific contribution to the transition within sectors, from the environmental movement to businesses and sectoral organisations. The five sectoral platforms were presided over by independent chairs who regularly convened in a Climate Council that monitored coordination and cohesion with regard to cross-cutting themes such as the labour market & education, spatial integration, finance and innovation.

Citizens were asked to make a contribution to the Climate Agreement. They were able to submit plans, ideas, suggestions and questions online. A Climate Council delegation also toured the country. At the end of May and beginning of June 2018, meetings were organised at five locations, during which citizens could participate. In October, the Climate Council organised a meeting in each province to engage in dialogue about subjects that are broadly mentioned in the Climate Agreement. The Dutch Citizen Participation and Government Policy Platform (NPBO) organised a series of meetings.

At the end of August 2019, an online public consultation was launched to give the public the opportunity to respond to the draft versions of the NECP, the Climate Plan and the Long-term Strategy. Individual citizens and professional organisations had the chance to present their response to the plans by means of open questions over a period of six weeks. A list of public reactions and the way in which they were incorporated in the Climate Plan and the NECP was recently published.[29]

Participation and the involvement of citizens in the implementation
The broad and active involvement of citizens is vital for the success of the transition and must also be afforded a major role in implementing policy. This constituted an important part of the debates on the Climate Agreement, which resulted in a focus on participation in the context of the RES, the district-oriented approach and renewable energy generation. This commitment is summarised below. Another focal point is the way in which central government would like to use the insights of the SCP, which monitors the citizen's perspective of the energy transition, so that it can be enhanced with the citizen's perspective. Lastly, the broad public approach is described, which was launched in September 2019 to create awareness among citizens of their personal role in the transition and encourage them to take steps.

Participation in the Regional Energy Strategies
When developing the RES, governments elaborate regionally-supported decisions with grid operators and social stakeholders, related to generating renewable electricity, the heat transition in the built-up environment and the required storage and energy infrastructure. These decisions are translated into areas, projects and the implementation and execution of the projects concerned.

[29] The report was published on www.internetconsultatie.nl.

In each region the broad lines of the process to develop a RES are established using an administrative initiation document (project initiation documentation or similar). It sets out the objective and the method of democratic and spatial safeguarding. The process must lead to an energy strategy that elaborates the specific areas sought that are suitable for power generated by the sun, wind, soil or water, taking into account spatial quality and social support.

Process participation in the development of the RES leads to better quality substantiated choices and decisions that contribute to successful implementation. Citizens are also involved in reflecting on the RES. At the regional level municipalities, water boards and provinces ensure effective and timely provision of information to citizens and develop local facilities to enable citizens to reflect on strategy formation more effectively. It is the region's responsibility to determine the necessary facilitation. Depending on the regional circumstances it could involve access to knowledge, independent process guidance, financial support or something else. The form of facilitation chosen is established in the initiation document cited above.

When implementing the RES, regional governments must adhere to the agreements set out in the Climate Agreement related to citizen participation in the district-oriented approach and project participation in renewable energy generation.

Participation in the district-oriented approach

Municipalities assume the directive role in the transition to gas-free districts. In a diligent process they will have to weigh up the best solution per district, if houses are no longer heated using a traditional central heating boiler. The solution may differ per district. All practical examples to date show that this process is more successful the more citizens act collectively and with the authorities (including local authorities).

When choosing a suitable form of participation - information provision, allowing citizens to have a say, consultation or co-production - it is important to be aware of the district's socio-cultural profile. Various district profiles are being developed and assessed in testing grounds of the Inter-administrative Programme for Gas-free Districts. It is a joint programme involving the Ministries of BZK and EZK and the umbrella organisations of municipalities (VNG), provinces (IPO) and water boards (UvW).

A knowledge and educational programme forms part of the Gas-free Districts Programme and aims to boost the directive role of municipalities and bundle the learning experiences of municipalities and other stakeholders. The testing grounds are used, for example, to assess participation principles. In association with the VNG and other stakeholders, central government is compiling a guide to participation, partly based on the experiences acquired in the gas-free districts testing grounds.29

Participation in renewable energy generation

Participation and acceptance are vital for the spatial integration and exploitation of energy projects, including ones on a large-scale. Agreements have been made on this matter at the Electricity sectoral platform related to the Climate Agreement. Authorities bear primary responsibility for communication regarding the benefit and necessity of the transition. Participation guides are compiled as part of the Green Deal, Participation of the Environment in Renewable Energy Projects (process participation during project development) and the national RES programme (process participation during the RES). They provide developers, authorities and funding agencies with guidelines for adopting a participative approach. These guidelines can be used to explicitly afford the desired working method for participation a place in sectoral codes of conduct and spatial frameworks such as environmental visions, environmental plans and project decisions.

The initiator of an energy project runs through a process to arrive at a desirable and feasible form of participation. The competent authority verifies that market parties and the environment engage in dialogue on this matter. Agreements made with the environment are established in an environment agreement. It forms the basis for a project plan, which describes how participation will be optimally addressed within the project.

To ensure that the projects for developing and operating renewable energy on land in the energy transition succeed, in areas with possibilities and ambitions for renewable generation, the environment and market parties will work together in their development, construction and operation. This translates into a balanced distribution of ownership in an area where the aim is to have 50% ownership of generation locally (citizens and businesses). The ownership ratio target is a general

target for 2030. Locally there is scope to deviate from this for local project-related reasons. This also takes into account the special position of the water boards that are both a local developer and decentralised authority tasked with making their operational processes more sustainable.

Better view of the citizen's perspective
In the debates on the Climate Agreement it was found that there is currently insufficient knowledge of how citizens feel about this issue.

In 2018, the Netherlands Institute for Social Research (SCP) launched the Sustainable Societies programme. With this programme the SCP provides a socio-cultural perspective on the transitions that should result in a sustainable society. The research programme focuses on the relationship between the citizen (individual or collective) and the authorities in the context of these transitions, on processes of the inclusion and exclusion of Dutch people (both individually and in groups) during and as a result of these transitions and on the consequences of these transitions on the quality of life.

The SCP will use this programme to map out the citizen's perspective. Doing this periodically will mean that substantiated statements can be made about developments over the years.

The aim is to monitor the sustainability transition from the citizen's perspective by assigning the SCP a permanent role in the guarantee cycle to promote progress of the Climate Agreement (in association with the progress monitor). Based on periodic reports by the SCP, the development of support and citizen participation can be monitored as the Climate Agreement progresses. Insights acquired by the SCP regarding the citizen's perspective can be used to improve the quality and implementation of the Climate Agreement and adjust its implementation where necessary.

Communication: a broad public approach
In September 2019, central government initiated a broad public approach to create awareness among citizens of their personal role in the transition and encourage them to change their behaviour. The broad public approach consists of two elements: a public campaign and a network approach. The public campaign appeals to the citizen via targeted communication at times to which he or she is most receptive to it. The umbrella campaign links all efforts being developed in this field by central government, private and public stakeholders. Within this overarching theme, sub-campaigns, which highlight certain matters pertaining to the Climate Agreement, are developed and implemented under the responsibility of the departments.
Besides a mass media component the public campaign is characterised by an approach in which citizens are continuously offered an action perspective so they can make a contribution at a time that is most convenient for them.
In the network approach central government and stakeholders (public/private parties) develop specific, appealing options through which citizens can contribute.

i. Consultation and alignment with other Member States

Dutch energy and climate policy is regularly shared with other Member States through various consultative bodies. The Netherlands participates in, for example, the Pentalateral Energy Forum, the North Seas Energy Forum, the Green Growth Group and the Climate Adaptation working group of the Climate Change Committee. The NECP is coordinated through the Pentalateral Energy Forum and the North Seas Energy Forum.

The *Pentalateral Energy Forum* was co-founded by the Netherlands in 2005, first with the Benelux, France and Germany as the initial members, and Austria and Switzerland at a later date. The Benelux provides the secretariat and the presidency rotates. The ministers provide political direction for the regional partnership of the Penta countries, with a particular focus on market coupling, security of supply and improving the flexibility of services. The ministers convene once every two years. The Penta region is the largest EU market and participating countries have identified a new role for the Pentalateral Energy Forum with regard to the coordination of the Integrated National Energy and Climate Plans. To this end, a political declaration was signed in the margins of the Energy Council in February 2019. In the declaration, the countries state that the Pentalateral Forum will focus on greater regional cooperation in the context of the Integrated National Energy and Climate Plans.

Belgium, Luxembourg, Germany, France, Denmark, the United Kingdom, Ireland, Sweden and Norway signed the North

Seas Declaration with the Netherlands and the European Commission, on the development of offshore wind energy and improvements to the grid. These countries will be involved in elaborating a package of specific measures to achieve additional CO2 reductions, since any additional efforts must also be consistent with the other ambitions that have been jointly formulated with these countries. The agreements of the *North Seas Energy Forum* are summarised in a section of the NECP (1.4 ii).

The *Green Growth Group* (GGG) consists of 16 EU Member States (AT, BE, DE, DK, EE, ES, FI, FR, IE, IT, LU, NL, PT, SE, SI and UK) and Norway, which collaborate on strengthening EU climate ambitions.

In the *Climate Adaptation working group* (part of the CC Committee), EU Member States and the Commission collaborate on implementing the EU Climate Adaptation Strategy. The evaluation of this strategy will be published at the end of 2018. In addition, the Netherlands is working with a group of like-minded countries, which regularly meet in the margins of the Environmental Councils, on increasing the EU's climate targets.

Bilateral consultation also takes place with neighbouring countries. This includes issues such as phasing out (low-calorific) natural gas, phasing out coal, measures for reducing greenhouse gases, the introduction of a minimum CO_2 price and the effects of capacity market mechanisms.

ii. Iterative process with the European Commission

Consultation with the European Commission takes place in the regular Technical NECP Working Groups, the NECP online platform and the Energy and Climate Council Working Groups. There is also bilateral consultation with staff from DG ENER and DG CLIMA. In June 2019, the Commission presented recommendations based on the draft NECP[30]. The Netherlands processed these recommendations in this final version of the NECP[31].

1.4 Regional cooperation in preparing the plan

i. Elements subject to joint or coordinated planning involving other Member States

In June 2018, Belgium, along with the Benelux Secretariat, organised a dialogue consultation to discuss how we would be jointly drafting our NECPs, and the elements subject to coordination, in the Pentalateral context (Austria, Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland). In February 2019, this resulted in a political declaration signed during the Energy Council. In the declaration, the countries state that the Pentalateral Forum will focus on greater regional cooperation in the context of the NECPs. The English text of this declaration is included under 1.4.ii. The Netherlands will address the elaboration of the political declaration and enhanced regional collaboration with regard to the NECPs in the Pentalateral context during the Dutch Presidency of the Benelux (and of Penta) in 2020.

It was agreed with the countries involved in the North Seas Energy Forum that a joint North Seas paragraph would be added to the NECP. This English text is also included under 1.4.ii.

In addition the Ministry of EZK organised a consultation for neighbouring countries in September, to which all Member States plus Norway, Switzerland and Iceland were invited. During the consultation, colleagues from the other Member States were informed about the Dutch Climate Agreement that forms the basis of the Netherlands' NECP. A significant part of the consultation concerned the debate on the components of cross-border importance in the Dutch Climate Agreement, including joint innovation projects, phasing out coal and the CO_2 tax.

[30] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans
31 See Appendix 2

ii. Explanation about the way in which the results of regional cooperation are incorporated in the plan.

NECPs and regional cooperation - common penta chapter for NECPs [32]

Introduction

The Pentalateral Energy Forum is a voluntary regional cooperation, since 2005, between Belgium, France, Germany, Luxembourg, the Netherlands and, since 2011, Austria, counting for more than one third of EU population and covering more than 40% of the electricity generation in the EU. Switzerland joined as a permanent observer in 2011 and contributes actively to the technical work and decision shaping. In close cooperation with the European Commission (on invitation), the Pentalateral Energy Forum enhances the cooperation between all relevant parties in order to create a regional electricity market as an intermediate step towards one common European electricity market.

The cooperation is led by the Ministers responsible for energy policy, who meet on a regular basis. The follow-up of the activities is ensured by the Penta Coordinators' and the Penta NECP Committee under the direction of the respective Directors General of the Pentalateral countries. The work programme is carried out by Transmission System Operators (TSOs), ministries, regulatory authorities (NRAs), the European Commission and market parties who meet on a regular basis in 3 Support Groups.

The major success over the past 15 years is that Penta countries have evolved from a purely national policy perspective on energy markets to the adoption of a regional approach. Concrete regional milestones are put in place in several dimensions which remain relevant today:

Internal electricity market/market integration

The Penta Support Group 1 (SG1) focuses on the coupling of the electricity markets in the region. The SG1 fostered the flow-based market coupling (FBMC) of the day-ahead markets as an objective, and in May 2015 the FBMC was officially launched in the Penta region, as first of its kind in the European Union. Since then, the FBMC has been continuously improved to further increase its welfare gains and serves now as the basis for a fully EU entrenched FBMC for the day-ahead markets.

Moreover, in order to increase the available transmission capacity for cross-border trade on the intraday market, the SG1 fostered a coordinated intraday capacity calculation process after day-ahead flow-based market coupling for all borders in the region which has been implemented in March 2016 as a first step of the coupling of European intraday markets.

The Support Group has been a privileged witness of the drastic change in the electricity landscape and the governance of the electricity markets. Whereas in 2005 electricity operators still worked rather separately, the group has actively stimulated over the years the cooperation between stakeholders, which contributed e.g. to the regional grouping of TSOs in their associations, the merger of Power Exchanges or TSOs, and the emergence of new regional actors (TSCNet, Coreso, former CASC-CWE, SSC).
With a view to the new implementation plans that have to be prepared according to the Clean Energy Package, Penta countries will closely coordinate and explore joint action.

Internal electricity market/flexibility

The Support Group 3 (SG 3) focuses on flexibility issues in the region. The work in the SG3 has until now been concentrated on balancing, intraday and the role of demand side response as three major fields for regional cooperation to improve the flexibility of our electricity markets. Various technical background papers have been delivered summing up the main barriers and obstacles towards an enhanced use of flexibility in the Penta region. The participation of SG3 has been open to traditional participants

[32] As this joint paragraph was drafted by the countries involved in the Pentalateral Energy Forum this text is in English.

(NRAs/TSOs) as well as other stakeholders like Distribution System Operators (DSOs), large consumer organizations and renewable producers.

Regarding balancing, assessments of current approaches and an exchange on good practices have been taken place within the Penta forum. In addition, Penta is playing an important role in the implementation process of the European Union Guidelines on Electricity Balancing. Regarding Demand Side Response (DSR) a separate expert group has worked on a report describing the actual situation in the Penta region with a focus on the rules and responsibilities of new market players in each country of the region. Regarding the further cooperation of Penta countries on hydrogen, a workshop has taken place, in order to define possible cooperation topics on this issue.

Security of supply

The 1st regional generation adequacy assessment (GAA) performed by the Penta TSOs and published in March 2015 constituted an important milestone. The methodology for the assessment used a probabilistic and chronological approach with an hourly resolution for the years 2015/2016 and 2020/2021 which represented a significant improvement in comparison to the existing deterministic approaches. Furthermore, the Penta TSOs used a common regional dataset based on the same scenarios and assumptions, such as a regional-wide temperature-sensitive load model and harmonised probabilistic hydrological data.

The governments of the Penta countries are convinced that these dimensions remain relevant. Next to a continuation on the above-mentioned areas, Penta countries will in the upcoming years use the Pentalateral Energy Forum to work on the following priorities:

Decarbonisation of the electricity sector

Common vision on decarbonised electricity in Penta by 2050

Penta countries will exchange their visions for a decarbonised electricity system by 2050 (with intermediate steps for 2030 and 2040) as part of a highly energy efficient and highly renewables-based energy system, a stepwise phasing out of fossil generated power and by an efficient end-use of electricity. As a first step a comparison of national scenarios on how the electricity system 2050 could look like will be performed as well as the identification of common and diverging aspects across the scenarios and how security of supply would be guaranteed in these scenarios. This will create the basis for a common understanding of the expectations and challenges for building a future electricity system.

Start cross-border cooperation on renewable electricity

Penta countries will work on voluntary basis towards developing a menu of common concepts covering different levels of cooperation, including exploring the possibilities for opening of national tendering schemes/cross- border tendering, common tenders for those Penta-countries which are interested and making increased use of the EU enabling framework for renewable energy and the existing cooperation mechanisms, such as joint projects and statistical transfers ("cluster menu") for those Penta-countries which are interested.
The Penta countries also support the ongoing work of the European Commission and the Member States on developing a European Union Renewables Financing Mechanism.

Integration of electro-mobility options and services without regional restrictions

Penta countries will contribute to increasing the share of renewable energy in transport by promoting electro- mobility (including fuel cell options). They facilitate the integration/implementation of electro-mobility options and services without restrictions within the Penta region, by identifying and if needed removing barriers for the cross-border deployment of electro-mobility and charging services and by assuring interoperability.

Explore the options for carbon pricing and their cross-border impact on electricity prices

Penta countries that plan or consider to introduce a carbon price will on a voluntary basis exchange views on policy approaches for the introduction of a carbon price, its advantages and disadvantages in terms of CO_2 reduction, security of supply, price developments and a level playing field of their industries.

Internal electricity market

Market integration

Penta countries will further improve the monitoring of FBMC with a view to increase cross-border trade and social welfare and to optimize consumer benefit. Penta countries will make the monitoring more innovative, in view of translating it into the key common indicators to assess the evolution towards a fully decarbonized Pentalateral electricity market in 2050.

Penta countries will work together in the swift implementation of the Clean Energy Package and possible cross-border impacts for the energy market (e.g. further development and improvement of redispatch cooperation in the Penta-region).

Flexibility

Penta countries will focus on the impact of the implementation of flexibility options such as the role of demand side management, PtX and hydrogen, the role of storage, electric mobility and analyse concrete electricity related barriers for sector coupling.

Regarding the potential future role of increasingly renewables based hydrogen as an energy carrier in their energy system, Penta countries will examine possible common approaches for guarantees of origin, cross- border infrastructure, the respective role of TSOs and DSOs and standards for hydrogen blending, as well as exchange information and best practices on support schemes for hydrogen and innovation projects and the future role of hydrogen in general.

Security of supply

Penta countries will continuously improve the Pentalateral Generation Adequacy Assessment by taking into account improved weather data, the latest figures and targets from the NECPs of Penta countries when determining the future energy mixes and some other sensitivity analysis. The third assessment is currently being elaborated by the Penta TSOs for the horizons 2021 and 2025 taking into account regional (based on national) storylines, improved Flow Based calculations and Demand Side Flexibility sensitivities.

In the frame of the Clean Energy Package (CEP), and more specifically in the context of regional cooperation and the risk preparedness regulation, discussions have been started with ENTSO-E, the Commission and other stakeholders to define rules for the cooperation between Member States in view of identifying potential regional crisis scenarios and of preventing, preparing for and handling electricity crises in a spirit of solidarity and transparency and in full regard for the requirements of a competitive internal market for electricity. Penta countries will work together to develop concrete regional measures in crisis situations.

Financing Instruments for the energy transition

The Pentalateral Energy Forum will start to exchange on possible regional approaches to increase energy efficiency and the roll out of renewables for example by looking together with financial institutions such as EIB for joint approaches to reduce risks in both sectors and hence facilitate the achievement of Penta members' objectives.

Joint chapter for the North Seas Energy Cooperation [33]

The Netherlands is part of the wider North Seas region, which has a large renewable energy potential. The European Commission has estimated that offshore wind from the North Seas can cover up to 12 pct. of the electric power consumption in the EU by 2030. Offshore wind generation and grid infrastructure projects may have cross-border effects on energy prices, security of supply and the environment, including availability of marine space as well as the pace of innovation. The North Seas countries therefore have great benefits to gain from cooperation.

The North Seas Energy Cooperation (NSEC) is a voluntary, bottom up, market-oriented, regional cooperation initiative established in 2016, which seeks to create synergies and to avoid incompatibilities between national policies and to share knowledge on international best practices and foster joint strategies where possible and beneficial. The aim is to coordinate and facilitate further cost-effective deployment of offshore renewable energy, in particular wind, ensuring a sustainable, secure and affordable energy supply in the North Seas countries through increased and better coordinated offshore wind deployment as well as potential joint projects or cluster projects. The NSEC focuses on a step-by-step approach with the perspective of further integration and increased efficiency of wholesale electricity markets in the longer term, while contributing to a reduction of greenhouse gas emissions, in average wholesale price spreads and enhancing security supply in the region.

The North Seas Energy Cooperation consists of 10 countries with participation from the European Commission: Belgium, the Netherlands, Luxembourg, France, Germany, UK, Ireland, Norway, Sweden and Denmark.

Regional cooperation

As regards to preparing this plan, the Netherlands made use of the NSEC, in which experts in the support groups shared information and experiences on specific aspects, for example on barriers and best practices of national offshore wind development and in particular on aggregation of national renewable energy trajectories for offshore wind until 2030 and market integration.

The Netherlands furthermore consulted on its National Energy and Climate Plan in the area of planned offshore wind deployment until 2030 and related grid planning aspects with the other North Seas countries.

The support groups under the cooperation focus on the following subjects:
Support group 1: Maritime Spatial Planning and environmental assessment
Support group 2: Development and regulation of offshore grids and other offshore infrastructure
Support group 3: Support framework and finance for offshore wind projects
Support group 4: Standards, technical rules and regulations in the offshore wind sector

Maritime Spatial Planning and environmental assessment

Within the North Seas Energy Cooperation, the Netherlands contribute to the work on establishing common environmental impact assessment methodology. In order to reach our energy and climate targets within the EU, there is a need to better understand the possible ecological limits of large scale wind development in the North Seas. Further work is needed on maritime spatial planning and environmental assessment to be able to utilise the potential of the North Seas. To increase knowledge and support the deployment of offshore wind in the North Seas, the North Seas countries will continue to cooperate closely on maritime spatial planning, environmental research, cumulative impact assessment of wind farms between responsible authorities for energy, maritime spatial planning and environment.

Offshore Grids and other Offshore Infrastructure

[33] As this joint paragraph was drafted by the countries involved in the North Seas Energy Forum this text is in English.

The NSEC serves as a platform to jointly work on concepts for potential joint wind offshore projects and for coordinated electricity infrastructure including transmission infrastructure.

The Netherlands works together with the other North Seas Energy Cooperation countries on the possibilities for concrete cooperation projects. Besides joint offshore wind projects that would be connected to and supported by several Member States, this includes the work on possible "hybrid" solutions that would use cross-border solutions for connecting offshore wind farms to the grid and seek synergies with interconnection capacity between countries, and on the corresponding market arrangements.

The Netherlands is therefore contributing to the development of possibilities for cooperation on hybrid projects and identifying and addressing possible legal, regulatory and commercial barriers. By coordinating on increased interconnection among the countries in the NSEC, an increasing amount of excess production of energy could flow across borders to meet demand in a well-functioning internal energy market.

The NSEC has identified a list of potential areas and projects in the region, where joint projects could be particularly beneficial. These include: (1) IJmuiden Ver offshore wind farm to UK, (2) CGS IJmuiden Ver - Norfolk, (3) COBRA Cable, (4) DE offshore wind farm connected to NL and (5) North Seas Wind Power Hub.

The NSEC is working on developing concrete concepts for the implementation of selected projects from the above list.

The NSEC will continue to work on the actions plans for the specific hybrid projects which can also be taken further at a national and regional level. Furthermore, the cooperation will continue to work as a forum to reflect on how to deal with the uncertainties about the regulatory treatment of hybrid projects at EU and national level and as a forum to discuss options for addressing these issues.

Support Framework and Finance of Offshore Wind Projects

As regards to measures, the Netherlands benefits from the NSEC in several ways. The work in the NSEC provides a platform for exchange of best practice regarding the design of support schemes and to develop and work on new concepts tackling new challenges concerning support for offshore wind as well as to develop possible options for future joint offshore wind projects.

The Netherlands works in the NSEC to coordinate the timing of tenders, to exchange best practices on the design for offshore wind support schemes and to identify, where possible, common principles as well as possible options for alignment of support.

As regards to coordination of tenders, the Netherlands regularly shares information regarding its national tender schedule with the other NSEC countries with the aim of identifying possible overlaps in time and enabling the most continuous tender pipeline across the North Seas region to ensure that tender processes maximize competition and deliver most value for money to consumers. The Netherlands is ready to take into account, amongst other criteria and where possible, this overview of tender schedules in its future tender planning to avoid unnecessary bottlenecks and to provide a steady capacity pipeline to involved stakeholders without stop and go cycles.

The Netherlands shares and discusses in the NSEC the estimated national offshore renewable trajectory, information on its national offshore deployment plans and best practices in the design of offshore wind tenders.

At the Ministerial meeting in Esbjerg on the 20th of June 2019, North Seas countries agreed to work together to achieve an indicative aggregated installed offshore wind capacity of Member States of the NSEC of at least 70 GW by 2030 based on national planning. The indicative contribution of the

Netherlands to this aggregate capacity in 2030 is 11 GW (see also section 2.1.2).
In order to reflect the dynamics of offshore wind deployment in the region, this aggregate planned capacity of at least 70 GW for 2030 can be translated into an overall trajectory with indicative milestones for the region of approximately 25 GW in 2020 and 54 GW in 2025.

In the NSEC, the Netherlands also contributes to the work of analysing and developing options for further mobilisation of investment capital for joint projects, for instance through EU funds such as European Fund for Strategic Investments (EFSI) and Connecting Europe Facility (CEF) as well as institutional investors. Such future joint projects could be cross-border projects for renewable energy in accordance with the CEF proposal.

Harmonisation of rules, regulation and technical standards

The North Seas Energy Cooperation is working on aligning standards and technical requirements that could contribute to further reducing costs of offshore wind deployment. The focus is on aligning rules, regulation and technical standards within five identified areas. These include: (1) Aviation, marking and lights, (2) Health and safety, (3) Certification of regulatory requirements, (4) Park layout and site investigation and (5) Approaches to research. The NSEC works to develop proposals and recommendations for implementation in close cooperation with industry. The aim of those recommendations is to achieve cost reductions whilst at the same time be achievable. The cooperation will continue to work on aligning standards and technical requirements as well as exchange of best practices to reduce unnecessary regulation and costs for the industry.

2 National objectives and targets

2.1 Decarbonisation dimension

2.1.1 Greenhouse gas emissions and removals

i. Greenhouse gas emission reduction target, ESR and LULUCF

National targets consist of targets the government has established for the Netherlands and targets that constitute a national interpretation of European policy.

National targets in the Climate Act

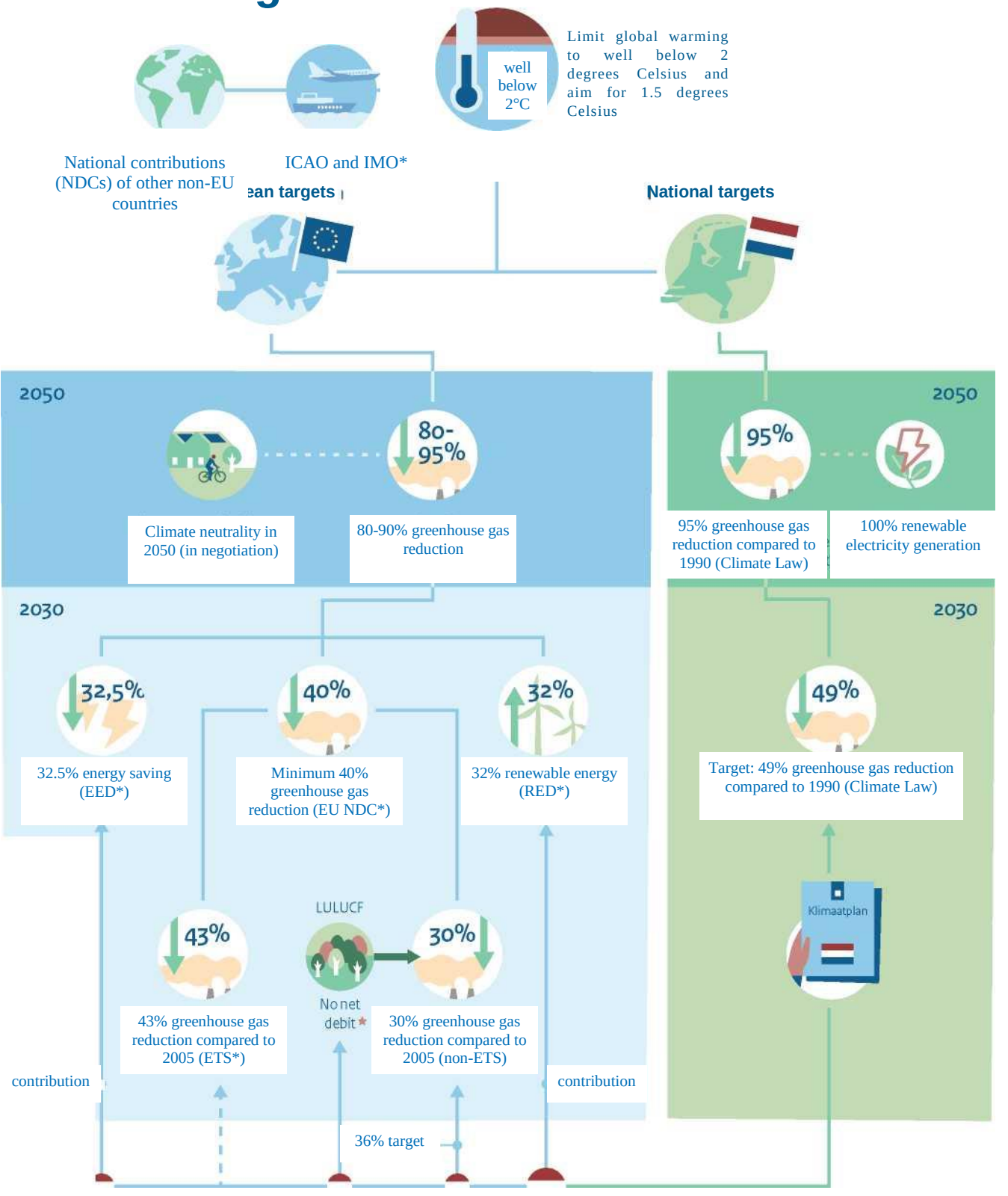
The national climate targets are established in the Climate Act (see Chapter 1.2 ii). The Climate Act focuses on CO_2. This means that it is not based on sub-targets such as the share of renewable energy and energy savings. The focus on CO_2 strives to base policy on the most efficient solutions. Renewable energy and energy savings are part of these solutions, but the final scenario is left open, in line with the principles of technology neutrality and cost efficiency.

Focusing on the national target of a 49% CO_2 reduction means that sectors that participate in the European ETS system (mainly industry and electricity) make a contribution to the national target.
A 49% reduction by 2030 is consistent with a gradual emissions reduction pathway to achieve a 95% reduction in emissions by 2050. This long-term perspective makes a gradual transition possible, prevents shock effects and ensures that we can take advantage of economic opportunities. Since the outcome of international talks is not yet known, the ultimate 2030 national target may differ from the 49% emissions reduction currently assumed by the government.

Obligations arising from the translation of European policy

The European target of a 40% reduction by 2030 compared with 1990 has also been translated into obligations for national Member States for the non-ETS sectors. For the Netherlands, this means a national reduction requirement of 36% by 2030 compared with 2005 in non-ETS sectors. The "no net-debit" rule applies to the LULUCF target, which means that under the application of the accounting rules of the LULUCF Regulation, the Netherlands may not have any net emissions for the cumulation of all LULUCF accounting categories. It is expected that the package of measures used to achieve the national target will also suffice to comply with national targets arising from these European obligations.
If the European target is increased to 55% in accordance with Dutch policy, this will also be translated into targets for the European ETS and national non-ETS targets. It is not yet possible to determine how this will relate to the national target of 49% and the current non-ETS target.

Global targets



Sectoral approach

The greenhouse gas emission target of 49% by 2030 compared with 1990, proposed in the Coalition Agreement, means a reduction of approximately 49 Mton of CO_2 equivalents by 2030 compared with an unchanged policy. This includes the effects of the circular economy policy. For the discussions about the Climate Agreement, indicative CO_2 reduction challenges for the five sectors comprising industry, mobility, the built-up environment, electricity, agriculture and land use were formulated, based on national cost-effectiveness. Below we discuss the targets in these five sectors.

Electricity

Combating climate change requires a climate-neutral electricity system. It must take into account increasing demand for electricity that exists because other sectors, such as industry and mobility, are switching from fossil fuels to electricity, partly due to climate policy.

The limited availability of renewable sources in the Netherlands is an important point of concern. The technical possibilities for generating climate-neutral electricity are limited. Since the Netherlands is located along the coast and the wind is relatively strong, this offers potential for wind energy on land and offshore. The approach thus focuses on these sources:

i. Generating circa 49 TWh wind energy offshore by 2030;
ii. Generating 35 TWh of renewable energy (wind energy and solar power) on land;
iii. Small-scale generation of renewable electricity from, for example, private solar panels, good for circa 10 TWh.

With this commitment, the share of renewable electricity of total electricity generated in 2030 is expected to amount to 70 percent.

Due to the transition to renewable sources, electricity generation will be more dependent on weather conditions. In order to be able to guarantee supply security with an energy mix largely consisting of wind and solar power, a growing need for flexibility is required, which will be achieved via the market. It is also relevant from the point of view of security of supply that sufficient controllable power is provided, which will increasingly have to be CO_2 free.

Mobility

In the future mobility system all modes will ultimately be clean. This requires a fundamental change in the way we approach mobility and transport and our goods.

An approach aiming to set this change in motion must also include all aspects of our current mobility. For the transition to an emission-free mobility system, the fuels used are crucial. The concern involves adequate availability of sustainable energy carriers, such as electricity, biofuels and green hydrogen. Electric cars will become competitive and charging infrastructure will be optimised. Using public transport and the bicycle will be more appealing, use of shared mobility will increase and people will work in a more flexible manner (and increasingly from home). This will reduce the need for work-related traffic and thus the daily pressure of traffic jams on the infrastructure and the environment.

Because not all the necessary technology is available immediately in an intermediate phase, heavier road transport in logistics will use sustainable biofuels. Afterwards, this sector will also make the transition to electricity or green hydrogen as an energy carrier. Multi-modal hubs, where different forms of transport come together, play a key role in an alternative logistics system that is more efficient and more sustainable. In inland waterways, shipping agreements have been made on accelerating sustainability[34], and aviation will also have to gradually change.

Collaboration partnerships in the field of sustainable mobility will also take a different form. Central and regional governments will jointly compile mobility plans in which collective efforts will be made to work towards an integrated mobility system.

Industry

By 2050, the Netherlands will be home to a flourishing circular and world-leading industry where greenhouse gas emissions are virtually zero.

The challenge for industry requires a future-oriented public-private approach in which the business community invests in a sustainable future, which the authorities facilitate and support in a targeted manner and in which the focus is on creating value (some of it new value). The emissions reduction target plays a key role. To achieve this while retaining our prosperity, a transition is

[34] https://www.rijksoverheid.nl/documenten/kamerstukken/2019/06/11/green-deal-zeevaart-binnenvaart-en-havens

needed with the development of new activities, the conversion of existing ones and the reduction of activities that are no longer consistent with a climate-neutral and circular economy in 2050. The transition to a new climate-neutral industry is a system change that requires coordination and collaboration between national actors: the basic and manufacturing industries, other actors in the chain, governments and knowledge institutions.

Industry can shape the transition with measures such as process efficiency, energy savings, CCS, electrification, the use of blue and green hydrogen and the acceleration of circularity (such as plastics recycling, bio-based raw materials or basic chemicals). Blue hydrogen (a combination of electricity generated using fossil fuels and CCS), green hydrogen (based on electricity generated from renewable sources) and the circular economy are the ultimate themes with which the Netherlands can distinguish itself internationally.

Transformation processes take place in the region. This is where the synergy between businesses must be organised; where the connection to, for example, the demand for heat in the built-up environment is established. A large share of industrial emissions originates from regional clusters. It concerns Rotterdam/Moerdijk, Zeeland (Terneuzen and the surrounding area), North Sea canal area, Noord-Nederland (Eemshaven-Delfzijl and Emmen) and Chemelot (Geleen region). The twelve large energy-intensive companies, which are collectively responsible for over 60% of industrial CO_2 emissions in the Netherlands, occupy key positions in these five industrial clusters. In each of the five industrial regions, a multi-year industrial frontrunner programme is being developed, partly with the support of central government, in which efficiency improvements go hand in hand with increased sustainability of raw material consumption and CO_2 reductions. Many of the reduction options are found in the demonstration and innovation phase and will only have an effect over time. It is expected that industry will have to invest between nine and fifteen billion euros to actually implement these projects.

Built-up environment

The Netherlands is shifting away from using natural gas. Homes and other buildings in the Netherlands will be made more energy-efficient and more comfortable in a gradual, sustainable transformation of the built-up environment. There will be a shift from fossil heat sources, such as the traditional central heating boiler, to natural gas-free alternatives such as heat pumps, residual heat or geothermal energy. This helps achieve the established climate targets and makes it possible to speed up the rate at which gas extraction is reduced in Groningen.

The greatest challenge in the built-up environment lies in insulating existing buildings and making them natural gas-free, with over 1.5 million homes and other buildings by 2030. These include privately owned homes, rented homes and non-residential buildings. By 2050, all seven million-plus homes and one million other buildings must be more sustainable. The approach to make the built-up environment more sustainable follows two tracks: supporting and unburdening individual homeowners and a district-oriented approach.

An insight into the (technical) possibilities and effective forms of funding are important to support individual homeowners and unburden them with regard to making their homes more sustainable. A standard per housing type which includes sustainability requirements will provide people with an idea of the efforts involved in making their home more sustainable. This standard will be translated into target values per insulation measure. The latter will indicate whether a measure is appropriate for a "no regrets" conversion; this means the measure concerned will, in any case, pay for itself. A wide range of appealing, applicable and responsible funding options will be developed. They will provide all groups of homeowners with an action perspective to start work on their home.

There will also be a district-oriented approach. Each district is unique, and the challenge goes further than homes alone: entrepreneurs, such as the baker on the corner, must be supported in making their business more sustainable. Some alternative heat sources - such as a heat grid - can best be applied at the district level. A district-oriented approach makes it possible to bundle demand, which enables (possibly consortia of) builders, installers and other providers of energy-saving measures to offer concepts and scale-ups that unburden the customer. Therefore, it is obvious that a city-centre district that is densely built-up and also has many businesses requires a different approach to a green, newly-built district on the edge of a municipality. Municipalities will manage the district approach and provide local customisation. Municipalities assume the directive role in the transition to gas-free districts. In a diligent process that involves district residents they will have to weigh up the best solution per district, if houses are no longer heated using natural gas. The solution may differ per district.

By 2020 at the latest, central government and local and regional authorities will draft a procedure related to the way in which adjustments will be made if the plans in the context of the transition visions for heat collectively appear to be insufficient in making

1.5 million homes and other buildings natural gas-free by 2030.

Two preconditions are essential to make over 1.5 million homes and other buildings more sustainable by 2030: the speed at which the process to make the built-up environment more sustainable can be implemented and the related costs. The aim to bring housing cost neutrality within reach for an increasing number of households: this means the costs of measures to increase sustainability can be recouped via the energy bill. This can be achieved through cost reduction, an affordable energy bill, grants and attractive funding.

The Climate Agreement includes an indicative allocation of CO_2 targets for sectors. For the built-up environment this is 3.4 Mton of additional CO_2 reduction by 2030[35]. According to this indicative allocation, maximum CO_2 emissions in 2030 amount to 15.3 Mton for the built-up environment. For the other indicative milestones related to the built-up environment we refer the reader to 2.2.ii.

Agriculture and land use

Sustainable agriculture is important for a good food supply, a healthy environment and a robust business model for entrepreneurs. Current greenhouse gas emissions are primarily caused by the release of the so-called other greenhouse gases, methane and nitrous oxide, in livestock farming and CO_2 from burning fossil fuels in greenhouse horticulture. Methane and nitrous oxide, the so-called other greenhouse gases, are converted into CO_2 equivalents. In livestock farming reductions can be achieved by adapting livestock housing (including manure storage), feeding and breeding animals, and effective processing of the manure. This is possible, for example, through methane oxidation or mono-manure fermentation. Emissions can be reduced in greenhouse horticulture through energy savings, generating renewable energy and using residual heat and CO_2 supplied by third parties.

In this sector, emissions and capture through land use are also examined, in addition to emissions from agricultural activities. Examples include the release of CO_2 as a result of the oxidation of peat meadow areas and organic matter from agricultural soil, as well as CO_2 capture in the soil and in forests and other biomass. This means it is important that trees are planted, deforestation and the oxidisation of peatland due to drainage are reduced and that forest and agricultural land are managed using a climate-smart approach. What's more, the agricultural and forestry sector plays a major role in expanding the range of sustainable biomass that can be used as food or as a raw material in other sectors. Therefore, it is important that the biomass chain is extended where possible. In addition we must bear in mind that biomass is also important in agriculture for soil fertility and the carbon stock in the soil.

The government's vision on circular farming and the implementation plan focuses on robust and sustainable agriculture, which adopts a more efficient approach to raw materials and the environment, and that is valued more from a social and ecological perspective. The success of circular farming requires radical transitions in all agricultural sectors.

i. Other national objectives and targets, including sectoral objectives and climate adaptation

National Climate Adaptation Strategy (NAS)

In December 2016, the government adopted the National Climate Adaptation Strategy (NAS).36 The NAS comprises all climate adaptation policies and supplements the Delta Programme. The Delta Programme focuses on mitigating the effects of climate change related to the water system, such as a rise in sea levels, the increase of prolonged rainfall and the resulting increase in river discharge and flooding in regional water systems, peak rainfall, drought and heat (as well as a combination of these elements). The Delta Programme is a large-scale, inter-administrative programme in which central government, the provinces, water boards and municipalities work together under the leadership of the Delta Commissioner.

The Implementation Programme for the NAS (UP NAS 2018-2019) was completed in April 2018.37 The UP NAS contains a number of priorities that focus on those sectors and themes that have not yet been sufficiently mapped out, including heat stress, agriculture, nature and the built-up environment.

The Delta Programme

The Delta Programme is by far the Netherlands' largest national climate adaptation programme and covers a significant share of the impacts of climate change for the Netherlands. Every year, led by the Delta Commissioner, a Delta Programme is compiled and presented by the government to parliament as part of the IenW (Ministry of Infrastructure and Water Management) budget. The

35 This is based on the National Energy Report 2017
36 For more information see: https://ruimtelijkeadaptatie.nl/nas/.
37 See: https://ruimtelijkeadaptatie.nl/nas/

Delta Programme contains an overview of new scientific insights, reports on the progress and proposals for new policy agreements and implementation programmes for the themes of water security, freshwater supply and spatial adaptation.[38]

One important milestone in the Delta Programme takes the form of the Delta Plan on Spatial Adaptation (September 2017), which aims to ensure the Netherlands is climate-proof and water-resilient in spatial terms by 2050.39 To achieve this, central government, provinces, municipalities and water boards must act in a climate-proof and water-resilient manner as of 2020.

Circular Economy

The Coalition Agreement states that agreements in the state-wide programme for the circular economy and the transition agendas in the Raw Materials Agreement will be implemented as part of the climate challenge. The aim of these agreements is to achieve a fully circular economy in the Netherlands by 2050, with the intermediate target of a reduction of 50% of primary raw materials consumption by 2030.

Hydrogen Programme

It was agreed in the Climate Agreement that the Netherlands would start a hydrogen programme. This programme will focus primarily on unlocking the supply of green hydrogen, developing the necessary infrastructure and cooperating with various sector programmes, and facilitating ongoing initiatives and projects. This programme also promotes synergy between infrastructure and the use of sustainable (both blue and green) hydrogen.

It is crucial that already in the short term this programme focuses on gradually scaling up the generation of green hydrogen from renewable electricity. The reasons for this are:

- The necessary large-scale generation of green hydrogen requires a rapid price reduction of electrolysers and the price of renewable electricity. For the electrolysers it is expected that by 2030 the market parties involved can achieve a reduction of 65% on the capex of electrolysers by scaling up, from around €100 million per 100 MW today, to €35 million per 100 MW when scaling up to 3-4 GW of installed electrolysis capability.[40] Linked to expectations regarding the cost of renewable electricity generation, green hydrogen can be competitive over time.
- Sufficient supplies of renewable electricity are needed to satisfy the growing demand for green hydrogen. Attention also needs to be devoted to a certain link between the growth of electrolysis capacity and the growth of offshore wind energy. In this context, consideration must be given to how the capacity, deployment and locations of electrolysis installations can contribute to the integration of renewable electricity in the energy system. The consequences related to infrastructure will be included in the Integrated Infrastructure Outlook 2030-2050 that Gasunie and TenneT will conduct in 2020.
- Given the Netherlands' excellent starting position with regard to the generation and deployment of green hydrogen, the Netherlands can assume a prominent position in this field if our country leads the way in this development.

The ambition of this programme is to have achieved 3-4 GW installed electrolyser capacity by 2030, in which the development must be consistent with the additional growth in the share of renewable electricity.

Moreover, the programme will focus on developing optimal hydrogen infrastructure. During the period up to 2025, it is expected that there will be a need for regional infrastructure for green hydrogen in the different industrial clusters and energy clusters. With an installed capacity of 3-4 GW, there will also be a need for hydrogen storage and a connection to several clusters. This is largely possible with (adapted) existing natural gas infrastructure. On this basis over the coming years, preparations will be made to achieve nationwide basic infrastructure for green hydrogen (transport and storage).

Leading up to 2030 this programme will consist of the following distinctive phases and objectives:

- 2019-2021: Preparatory programme for rolling out green hydrogen, including the many ongoing initiatives and projects as the basis, ending with an evaluation to optimise the continued development and targets of the subsequent phases;
- 2022-2025: Based on the results of the first phase, especially if the electrolysis cost reduction and the commitment of the parties involved provide an adequate basis, scaling up to a potential 500 MW of installed electrolysis capacity,

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38 The annual Delta Programme can be found on the website of the Delta Commissioner, www.deltacommissaris.nl. For the 2019 Delta Programme, see https://www.deltacommissaris.nl/deltaprogramma/deltaprogramma-2019

39 Also see: https://deltaprogramma2018.deltacommissaris.nl/viewer/chapter/1/2-deltaprogramma-/chapter/deltaplan-ruimtelijke-adaptatie.

40 The capex currently covers around 30-35% of the cost of electrolysis.

combined with the development of the demand for hydrogen and regional infrastructure, and a connection to the different clusters;
- 2026-2030: Scaling up to 3-4 GW of installed electrolysis capacity, connection to storage locations, expansion of infrastructure, including subject to the extra growth of renewable electricity.

The government contributes circa €30-40 million a year extra for demo facilities and pilots, from the funds in the climate envelope, for industry and electricity, where possible via existing schemes and funding options. Synergy with the focus on electrochemical conversion is also sought for innovation programmes. Inclusion in the SDE++ will apply when hydrogen is competitive in terms of price with other options in the scheme. The price development of hydrogen will be examined annually.

Clean Air Agreement

The government's ambition is to bring about a continuous improvement of air quality together with local and regional authorities in order to achieve health benefits for everyone in the Netherlands. This ambition is outlined in the Clean Air Agreement, which will be established by the government in association with local and regional authorities. Citizens and businesses will also be involved in its implementation. Therefore, the government will reserve funds for implementing the measures in the draft budget 2020.[41] The Clean Air Agreement strives for a downward trend in emissions to the air in all sectors to achieve health gains of 50% by 2030 from emissions originating from Dutch sources compared with 2016. This contributes to achieving the WHO recommended values in 2030.

2.1.2 Renewable energy

i. Contribution to the binding EU target of at least 32% renewable energy by 2030

In the European context, with the Netherlands' support, European targets have been agreed for renewable energy (32%) and energy savings (32.5%). The reduction of greenhouse gas emissions plays a major role in the Netherlands' climate and energy policy. Renewable energy and energy savings are important possibilities for achieving the CO_2 reduction targets.

Expected share of renewable energy

The expectation according to the KEV 2019 forecast is that by 2030, the Netherlands will achieve a 24.9% share of renewable energy (bandwidth 20.2%-26.7%). However, not all measures in this field are included in the KEV 2019, such as one of the planned offshore wind farms, increasing the sustainability of heat supplies and a large number of measures in the Climate Agreement focusing on energy savings. Consequently, the expectation is that the share of renewable energy will ultimately be higher than estimated in the KEV 2019. Based on the mid-term estimate of 24.9% in the KEV 2019, the PBL estimates that the share of renewable energy in 2030, including the measures of the Climate Agreement, will amount to 30% - 32%. The European Commission has indicated that a contribution of 26% by the Netherlands is considered reasonable. In any case, the Netherlands is focusing on achieving 27% as a contribution to the European target in the field of renewable energy.

The intention is to achieve this contribution through the indicative process agreed at a European level in which the contribution in 2022 is at least 16.3%, 19.6% in 2025 and 22.5% in 2027.

For 2020, an expected renewable energy share of 11.4% will result from the KEV 2019; this means that the European renewable energy target of 14% is out of reach. The government is doing everything it can to achieve the target of 14%. For this purpose, the government announced an additional package of measures on 1 November 2019.[42] The government is also examining all possible measures that could make up the deficit in 2020, which does not exclude foreign options. These measures are in addition to the extra measures the government took recently in the context of Urgenda and measures like an extension of the net-metering scheme[43] and the approach to bottlenecks in the electricity grid.

[41] It implements the agreement in the Coalition Agreement to arrive at a national air quality action plan and the Veldhoven motion (Parliamentary document 34 550 XII, no. 46)
[42] Parliamentary document 32 813, no. 400
[43] Letter to Parliament on the Further elaboration of phasing out the net-metering scheme, Parliamentary document 31 239, no. 305

ii. Estimated trajectories for the share of renewable energy in the electricity, heating and cooling, and transport sectors

The government is committed to increasing the share of renewable energy in the energy mix between 2020 and 2030. The indicative trajectory of the Dutch contribution to the EU renewable energy target between 2021 and 2030 is non-linear due to the nature of large-scale renewable energy projects, which are completed intermittently.

Electricity

The indicative challenge in the Climate Agreement for the electricity sector is first and foremost to reduce CO_2 emissions by at least 20.2 Mton by 2030. This will specifically involve scaling up electricity generation using renewable sources to 84 TWh. The measures and actions required to achieve this are detailed in specific agreements on renewable on land and offshore wind energy (see 3.1.2). The intended transition to increase generation using renewable sources requires a close link to the increased sustainability of the other sectors. See below the intended distribution between electricity generation techniques:

	49% basic package	55%
Offshore wind energy	49 TWh	120 TWh
Renewable on land (>15 kW)	35 TWh	
Other renewable options (incl. CO2-free adjustable capacity)	Not quantified	
Total	84 TWh	

Table 1 Ambitions for generating electricity from renewable sources in 2030

Heating and cooling

The Climate Agreement cites the following main tracks for heating and cooling:

i. *Built-up environment*

In the context of making the built-up environment more sustainable, it has been agreed that a gradual, sustainable transformation of the built-up environment will be implemented. There will be a shift from fossil heat sources, such as the traditional central heating boiler, to natural gas-free alternatives such as heat pumps, residual heat or geothermal energy. First of all, new homes will no longer be connected to the natural gas network. The objective is to make 1.5 million existing homes and other buildings natural gas-free by 2030. In addition a district-oriented approach will be adopted as a result of which, in 2021 municipalities will have a heat plan that provides direction for the transition.
The Heat Act will impose renewable source requirements on the heat supplied to homes.
The requirements will be periodically tightened so that the heat supplied will be generated entirely by renewable sources by 2050. In the Climate Agreement it was agreed that by 2030, CO_2 intensity of the heat supplied will be reduced by 70% compared with the current central heating boiler.

2. *Industry*

Industry can bring about the transition using measures such as process efficiency, energy savings, electrification, and the use of blue and green hydrogen. Transformation processes take place in the region. This is where the synergy between businesses must be organised and where the link with, for example, the demand for heat in the built-up environment must also be established. The quantity of residual heat available from industry is estimated at 50 petajoules. The elaboration of the regional energy strategies must reveal whether this residual heat can be used.

3. *Agriculture*

Emissions could be reduced in greenhouse horticulture through energy savings, generating renewable energy, using residual heat and CO_2 supplied by third parties. In the Climate Agreement it was agreed that by 2030 at the latest, parties will endeavour to supply 10 petajoules of external heat to the greenhouse horticulture sector on an annual basis.
The geothermal energy sector has already committed to scaling up geothermal energy in greenhouse horticulture as well as the built-up environment via the Geothermal Heat Master Plan. There are currently 17 such projects in which geothermal energy is used by greenhouse horticultural businesses. Funding is available from the SDE++ for this purpose. The target is to achieve 35 additional projects in the period up to and including 2030.

Transport

People want to be able to travel from A to B safely, quickly and easily. Businesses want their goods to reach their destination quickly and reliably. This will not change, but the way it happens will. Our transport produces a quarter of CO_2 emissions. The aim is for all new cars to be emissions free by 2030 at the latest. Consider hydrogen-powered and electric cars. When used, these cars do not emit any greenhouse gases, they keep our air clean and they produce less noise pollution. In the future, the government envisages an important role for hydrogen as the energy carrier in heavy transport, such as trucks, public transport buses and potentially to replace diesel-powered trains, as well as for passenger transport.

On the path to zero emissions in 2050, emissions from existing vehicle (including logistics) fleets will be reduced through innovative biofuels. Much biofuel is already being produced from waste products and residual waste. The increase in biofuels must largely be obtained from renewable residual waste (including cascading). This is consistent with the government's objective to use biomass as qualitatively as possible and in developing the circular economy. Therefore, it has been agreed that to achieve this renewable energy target for transport (including the 27 petajoules), no additional biofuel from food and livestock fodder will be used in the Netherlands above the 2020 levels.[44]

iii.Estimated trajectories for each renewable energy technology

Offshore wind energy approach

The 2013 Energy Agreement included the ambition to increase the capacity of offshore wind energy to 4.5 GW of installed capacity by 2023. The Offshore Wind Energy Road Map 2030 strives to achieve this at a faster pace. In the coming years, new offshore areas will be designated as potential future parcels for offshore wind energy. In 2018 and 2019, permits were granted for the construction of two new wind farms, both without grants. The Offshore Wind Energy Act is currently being amended to allow the permits for offshore wind energy to be tendered more effectively without a subsidy. There will be improved criteria for granting permits by means of a comparative assessment. It will also be possible to auction permits. In addition, energy - in anticipation of system integration - can be brought ashore in ways other than using electricity cables.
The following diagram shows the timetable for future offshore wind farms:[45]

Table 2 Timetable and proposed offshore wind energy tendering scheme

Capacity (GW)	Wind energy area parcel(s)	Parcels tender	Expected commissioning of the wind farm
0.7	Borssele, parcels I and II	Achieved in 2016	2020
0.7	Borssele, parcels III, IV and V	Achieved in 2016	2020
0.7	Hollandse Kust (zuid), parcels I and II	Achieved in 2017	2022
0.7	Hollandse Kust (zuid), parcels III and IV	First quarter 2019	2022
0.7	Hollandse Kust (noord), parcel V	Fourth quarter 2019	2023
0.7	Hollandse Kust (west), parcel VI	Second quarter 2021	2024 to 2025 inclusive
0.7	Hollandse Kust (west), parcel VII		2024 to 2025 inclusive
0.7	To the north of the Wadden Islands, parcel I	Fourth quarter 2022	2026
1.0	IJmuiden Ver, parcel I	Fourth quarter 2023	2027 to 2028 inclusive
1.0	IJmuiden Ver, parcel II		2027 to 2028 inclusive
1.0	IJmuiden Ver, parcel III	Fourth quarter 2025	2029 to 2030 inclusive
1.0	IJmuiden Ver, parcel IV		2029 to 2030 inclusive

Renewable on land approach

Locations for the small-scale generation of wind energy and solar power give the energy system a strong decentralised character. Electricity generation is shifting from a few central locations to dozens of locations spread throughout the Netherlands. This may require the existing electricity grid to be expanded locally; after all, the electricity grid has a lower capacity in sparsely populated areas. What's more these energy-generating locations consume (scarce) space: this means the effective spatial integration of new energy applications is also important. Municipalities, provinces and water boards

[44] Letter to Parliament dated 28 June 2019 on the proposal for a Climate Agreement - Parliamentary document 32813-342
[45] Letter to Parliament 33561 no. 48

use the RES to involve social parties and local residents in developing local plans and to increase support.

The common goal is for, no later than 1 January 2025, all requested permits required to have been issued and for tenders for issuing projects to have been completed with a view to the timely achievement of the related challenge. To ensure adequate volume and to compensate for failed projects greater scope will be sought and planned in the RESes and environmental visions. With regard to cost reduction it is essential that a continuous, stable and predictable pipeline of projects exists for solar and wind energy on land. The basic principle is that in 2025, an SDE+- subsidy will be requested for 35 TWh.

iv. Estimated trajectories for bioenergy demand and for biomass supply, including the impact of forest biomass on the LULUCF sink

The use of biomass today and leading up to 2030 and 2050 is necessary to make our economy more sustainable and to achieve the climate target. Biomass is used as an energy source in all climate sectors. Biomass is important in agriculture for soil fertility and the carbon stock in the soil. Over time biomass can increasingly serve as a material/raw material. The optimal and thus most efficient use of the available quantity of biomass is desirable to maximise climate gains and increase the economic value of biomass. The basic principle is that only renewable biomass actually contributes to making the economy more sustainable and that renewable biomass on a global level will be scarce in the long term. See Chapter 3.1.2. for more information.

v. Other national trajectories and objectives, also in the long term or per sector

The Netherlands has decided to completely halt natural gas extraction from the Groningen field. As of 2022, it is expected that only a limited volume will be needed from the Groningen field. This will be reduced to zero over the course of the following years. In the meantime, additional measures have been developed, which in 2020 will already ensure an additional decrease in gas extraction in Groningen by 4.1 billion Nm³ (compared with GTS' estimate of 31 January 2019) to a total of 11.8 billion Nm³ for the coming 2019/2020 gas year, assuming an average year in terms of temperature. This brings the extraction below the level recommended by the Dutch State Supervision of Mines of 12 billion Nm³. Gas extraction in Groningen is expected to decrease to zero from mid-2022 onwards[46].

2.2 Energy-efficiency dimension

i. Indicative national energy-efficiency contribution to achieving the energy-efficiency target of the European Union of at least 32.5% by 2030, including cumulative energy savings in final consumption (Art. 7 of the EED) and total floor area that must be renovated (Art. 5 of the EED)

Indicative national energy-efficiency contribution to achieving the energy-efficiency targets of the European Union of at least 32.5% by 2030

The indicative national contribution of the Netherlands to the European energy-efficiency target of 32.5 % is based on the expected primary energy consumption of the Netherlands in 2030, in the event of a cost-efficient package of measures capable of achieving a 49 % reduction in greenhouse gas emissions by 2030 compared with 1990. In the PBL Outlook from 2018, a number of packages of measures have been analysed to reduce greenhouse gas emissions by 49% in 2030.[47] In 2018, the PBL calculated the corresponding energy consumption for each package of measures.[48] The national energy-efficiency contribution assumes the most cost-efficient package of measures.[49] Measures that result in energy savings are included herein, insofar as the measures were deemed cost-efficient by the PBL. The "energy-efficiency first" principle is included as part of the cost-effective reduction of greenhouse gas emissions.

[46] Letter to Parliament on the Gas extraction level in Groningen in 2019-2020 33529 no. 678
[47] https://www.pbl.nl/publicaties/nationale-kosten-klimaat-en-energietransitie-in-2030-update-2018
[48] https://www.rijksoverheid.nl/documenten/rapporten/2018/04/19/het-effect-op-het-nederlandse-energieverbruik-van-maatregel- pakketten-voor-49-emissiereductie-van-broeikasgassen
[49] https://www.rijksoverheid.nl/documenten/kamerstukken/2018/05/14/kamerbrief-bij-verslag-informele-energieraad-19-april-2018-en-uitkomsten-studies-naar-eu-doelen-voor-hernieuwbare-energie-en-energie-efficientie-voor-2030.

The Netherlands has opted to make its contribution based on primary energy consumption in 2030. The Netherlands aims to achieve primary energy consumption of 1,950 petajoules by 2030 (excluding use for non-energy purposes). In terms of final energy consumption, this contribution is translated into an expected final energy consumption of 1,837 petajoules by 2030. According to the European Commission this is a reasonable contribution by the Netherlands. These contributions are based on the definitions adopted in Eurostat in the context of the 2020-2030 energy targets. As a result, the Netherlands is expected to meet the indicative national contribution to the European target. The Dutch contributions will be achieved by implementing the package of policy measures specified in the Climate Agreement (see Chapter 3.2).

The KEV 2019 includes the annual prognoses of Dutch CO_2 emissions and energy consumption in 2030 (see 4.3.2). As indicated this does not yet include the measures proposed in the Climate Agreement. This is why no indicative trajectory has been defined as of 2021. The next KEV (October 2020), will include an integrated prognosis and contain the policy measures specified in the Climate Agreement. An indicative trajectory will subsequently be established as of 2021.

Cumulative energy savings of final consumption during the period 2021-2030 (Article 7 of Directive 2012/27/EU)
The mandatory energy savings during the period 2021 up to and including 2030 amount to 925 petajoules. The Netherlands has determined cumulative energy savings in the 2021-2030 period based on 0.8 % savings per year of average final energy consumption in the years 2016, 2017 and 2018 (the reference consumption).[50] Annual energy savings, based on the estimated reference consumption, amount to 16.8 petajoules. For each year from 2021 to 2030 inclusive, the annual savings are multiplied by the relative multiplier for that year (see table below). The sum results in cumulative energy savings for the period from 2021 to 2030 inclusive.
See also Appendix 3 for more details.

Table 3 Estimated cumulative energy savings for the period from 2021 to 2030 inclusive

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Multiplier	10	9	8	7	6	5	4	3	2	1	55
Cumulative energy savings (petajoules)	168	151	135	118	101	84	67	50	34	17	925

The mandatory energy savings for the period 2014 to 2020 inclusive amount to 482 petajoules, in accordance with the fourth National Energy-Efficiency Action Plan.

Total floor area that must be renovated or the equivalent in annual energy savings (Article 5 of Directive 2012/27/EU)
Article 5 of the Energy Efficiency Directive (EED) contains a requirement to renovate 3% of central government's building stock on an annual basis. Following renovation, the 3% of the building stock must comply with the minimum energy performance requirements established by the Member State in question in the context of Article 4 of the Energy Performance of Buildings Directive (EPBD). The requirement relates to buildings owned and used by central government with an area of use greater than 250 m². The directive provides the scope for achieving the same savings effect using an alternative approach. The Netherlands aims to make use of this option for the 2021-2030 period. The Netherlands aims to adopt the Sectoral Road Map of the Central Government Real Estate Agency as an alternative approach. The road map was produced in the context of the Climate Agreement and outlines the route to achieve a low CO_2 real estate portfolio for central government by 2050. The desired savings in the road map are 1.3 petajoules in 2030. This is much higher than the expected savings of 0.2 petajoules if 3% of the buildings with an area of use greater than 250 m² owned and used by central government are renovated annually[51].

ii. The indicative milestones for 2030, 2040 and 2050, the national established measurable progress indicators and their contributions to the energy-efficiency targets of the European Union

The built-up environment accounts for at least 30% of total energy consumption in the Netherlands. In order to meet the long-term energy and climate targets, it is also essential that efforts continue to make the national building stock more

[50] For 2018, energy consumption is based on expectations in accordance with the KEV (PBL, 2019). As soon as Eurostat has the final figures for 2018, the amount of the mandatory energy savings can be confirmed.
51 The alternative approach and expected savings effects are further substantiated in the "Energy savings resulting from renovation of central government buildings in the context of Article 5 EED" report, compiled by ECN, part of TNO.

sustainable in the run-up to 2050. In line with the Netherlands' broader energy and climate policy, any further efforts aimed at making the built-up environment more sustainable will primarily be driven by CO_2 reductions. This means that CO_2 emission ceilings are chosen as indicative milestones for increasing the sustainability of the built-up environment and that progress will be measured as Mton of CO_2 emissions.

Indicative milestone 2030

Based on the target of a 49% CO_2 reduction and the draft Climate Agreement, the PBL examined the extent to which the Netherlands can contribute to the European Union's energy-efficiency target figures. The Netherlands' indicative contribution to the European energy-efficiency target is primary energy consumption of 1,950 petajoules in 2030 and final energy consumption of 1,837 petajoules. These contributions are not translated into sectoral target figures.
However, the Climate Agreement does include an indicative allocation of CO_2 targets for sectors. For the built-up environment this is 3.4 Mton of additional CO_2 reduction by 2030 compared with existing and proposed policy.[52]
According to this indicative allocation maximum CO_2 emissions in 2030 amount to 15.3 Mton for the built-up environment. This is an indicative milestone that the Netherlands aims to adopt for the built-up environment for 2030. The Netherlands aims to achieve the proposed CO_2 reduction of 3.4 Mton using a wide range of measures. These measures and the underlying strategy will be described in the long-term renovation strategy to support the renovation of the national building stock. The measures are focused on reducing energy consumption and increasing the share of renewable energy in the built-up environment.

Indicative milestones for 2040 and 2050

A 95% reduction of greenhouse gases in the Netherlands by 2050 is anchored in the Climate Agreement.
The Netherlands does not have an indicative allocation of CO_2 targets for sectors for 2050. This is why the indicative milestone for the built-up environment for 2050 is based on a direct translation of the general 95% CO_2 reduction target to the built-up environment. A 95% CO_2 reduction by 2050 in the built-up environment compared with 1990 is equal to maximum emissions of 1.5 Mton CO_2 equivalents. This is the indicative milestone that the Netherlands has adopted for 2050. The Netherlands has not established any CO_2 reduction targets for 2040 either. Therefore, determining the indicative milestone for 2040 for the built-up environment was based on a linear reduction of greenhouse gas emissions between the indicative milestones for 2030 and 2050. Consequently, the indicative milestone amounts to maximum emissions of 8.4 Mton of CO_2 equivalents.

The Netherlands emphasises that this concerns indicative targets, which may be adjusted upwards or downwards in the next version of the NECP if developments (such as those related to the cost effectiveness of the energy transition or innovation) provide the rationale for doing so.

Table 4 Indicative milestones and progress indicators for the built-up environment

	2030	2040	2050
Indicative milestones (maximum greenhouse gas emissions in Mton CO_2 equivalents)	15.3 Mton	8.4 Mton	1.5 Mton
Progress indicators	Amount of CO2 emissions	Amount of CO2 emissions	Amount of CO2 emissions

iii.Other national objectives in areas such as energy efficiency in the transport sector

Efforts are under way in association with employers and public transport companies to reduce emissions resulting from people commuting to work, including establishing specific agreements in the Environment and Planning Act and by focusing more on fully accessible travel via shared cars, public transport and by bicycle.[53]

Logistics represents an important cornerstone of the economy and society (Holland International Distribution Council). At the same time, logistic operations are a major source of CO_2 and other emissions. Apart from the energy carriers trajectory, other approaches are also being pursued to accelerate the transition to zero emissions.
These involve medium-sized zero-emission zones in 30-40 larger municipalities, zero-emission construction traffic and

52 This is based on the National Energy Report 2017.
53 Letter to Parliament dated 28 June 2019 on the proposal for a Climate Agreement - Parliamentary document 32813-342

mobile construction machinery, climate-neutral and circular ground, road and hydraulic engineering work (GWW), logistical efficiency improvements and a Green Deal for Inland Waterway Shipping.[54]

2.3 Energy security dimension

i. Increasing the diversification of energy sources and supply from third countries, increasing the flexibility of the national energy system and coping with an interrupted or limited supply of an energy source

Natural gas

The national target for natural gas is an uninterrupted, secure supply of natural gas to end consumers (households, institutions and companies) by way of an effective gas market. Given that the earthquakes in the Groningen field are an increasing source of concern and attention in relation to the safety of Groningen residents, the focus is on achieving security of the supply to end users (namely households and institutes). In addition, it concerns (low-calorific) natural gas with a special quality, which is not available elsewhere (but can be converted using nitrogen from high-calorific gas). Action is currently being taken to reduce natural gas extraction from the Groningen field from circa 17.5 billion m³ in 2018/2019 to zero by 2030 at the latest.[55] For 2019/2020, the permitted amount of natural gas extraction from Groningen has been reduced to 11.8 billion m³, assuming an average yearly temperature.[56]

Oil

Oil is, in itself, already a diversified product. The origin of oil processed in the Netherlands can be traced back to a number of sources. The oil market is a global market that is not formally regulated by state actors. The security of the oil supply mainly depends on the stability of net export countries and unimpeded passage along the major oil routes throughout the world. In spite of everything, oil will continue to be a key component of the energy mix and the raw materials market over the coming years.57 The market is created by the interplay between supply and demand, in which both the use of oil for energy and feedstock compete. Disrupted supply will result, almost immediately, in unrest on the market and a rapid increase in prices, and will have a major economic impact. In order to prevent any negative economic consequences, Member States of the EU and the IEA keep emergency oil stocks that can be used collectively by Member States to mitigate any unrest on the oil market. Merely possessing these stocks means that use of the oil embargo as a weapon - as in the 1970s - is far less effective. Consequently, the stocks themselves contribute to stabilisation without the need to actually use them.

Electricity

As a result of decarbonisation of the energy system and the growth of energy from renewable sources, the share of weather-dependent electricity being generated is increasing. In order to continue to guarantee supply security of electricity and energy in general, the energy system must be more flexible. This can be achieved by developing more demand response, energy storage and contributing to interconnection. The large-scale conversion of electricity to hydrogen is an important part of this challenge. After it is converted, the energy can be stored more effectively and for longer, and end use can also be decarbonised, for which existing technology offers few alternative options, such as heavy transport and high temperatures in industry. Security of the electricity supply continues to be monitored in a quantitative manner by TenneT TSO.

An electricity supply that is reliable as well as affordable and sustainable is an important objective of Dutch policy. The competitive electricity market contributes to this, including through the system of programme responsibility and the imbalance market. The growth in the share of intermittent sources will result in an increase in the demand for flexibility on the market. The Netherlands already has a high degree of flexibility, which allows it to respond to the elimination of supply and demand in a way that is in line with market conditions. The Netherlands does not have separate targets related to increasing flexibility in the system. Flexibility in the form of demand response, storage or adjustable capacity is interwoven in the electricity market and is traded across the various markets without flexibility being a clearly identifiable

54 Letter to Parliament dated 28 June 2019 on the proposal for a Climate Agreement - Parliamentary document 32813-342
55 Letter to Parliament on Gas Extraction in Groningen, 29 March 2018, Parliamentary document 33 529, no. 457
56 Letter to Parliament on the Gas extraction level in Groningen in 2019-2020 33 529 no. 678
57 Rules related to holding petroleum products – Parliamentary document 33 357, no. 6

factor.58

ii. Increasing the diversification of energy sources and suppliers based in third countries

In the field of natural gas, efforts focus on significantly reducing the production of low-calorific natural gas from Groningen in the short term (see also Chapter 1). In addition, users of low-calorific natural gas are being encouraged to switch to renewable energy sources, or to high-calorific gas if there is no alternative.59 For years, annual natural gas production from the Groningen field and the small fields has fluctuated around 80 BCM, but decreased sharply as of 2015, due to restrictions at the Groningen field and the reduced supply from the small fields.

There is no specific policy aimed at the diversification of suppliers of natural gas from third countries, given that the Netherlands has a very open and liquid gas market (the Title Transfer Facility, TTF) on which a large number of parties operate. On the TTF, natural gas is traded based on energy content and not quality (high-calorific or low-calorific natural gas). With regard to diversification, the Netherlands believes it is important to maintain the required infrastructure (including with regard to the rise of LNG). Apart from that the Dutch natural gas network has an excellent connection to networks in surrounding countries and gas from a large number of countries reaches the Netherlands. Given this situation and the ambition arising from the Paris Climate Agreement to phase out natural gas by 2050, there is no specific policy focusing on the diversification of natural gas suppliers and/or reducing dependence on third countries. The latter apart from the measures that are being taken to stimulate gas extraction from small Dutch fields offshore.
The Netherlands also has sufficient transport and storage capacity of natural gas, which has enabled it to prepare for the decline in domestic production. Gas storage facilities in the Netherlands currently offer approximately 14 billion m^3 in storage capacity (working volume), allowing coverage of seasonal fluctuations and peaks in gas demand.

A large number of small consumers in the Netherlands depend on natural gas. In order to prevent small consumers from being cut off from natural gas during an extremely cold spell as a result of a shortage in production and transport capacity, the grid operator GTS has a statutory obligation to reserve volume and capacity, which enables it to supply small consumers with natural gas. GTS is responsible for peak supply to small consumers when temperatures fall in the range of -9°C to -17°C. The transport infrastructure takes into account a temperature of -17°C, enabling GTS to transport the required volumes in these situations.60

There are no objectives to increase the diversification of energy sources and suppliers from third countries for electricity. The targets for decarbonisation and expansion of the share of energy generated from renewable sources will lead to a further diversification of generation techniques on the electricity market. See Sections 2.1.1 and 2.1.2 on this matter.

In addition, the government is committed to increasing the security of supply of raw materials for the energy transition under its circular economy policy, especially for critical metals (such as for solar PV panels, wind turbines and batteries for electric cars). Innovative design, recycling and materials substitution are being promoted in order to achieve this.61

iii. Reducing dependence on energy imports from third countries

At the European level, the Netherlands is committed to the use of sustainable biofuels and this enables a reduction of energy imports from developing countries to be achieved. The government also intends to increase the production of so-called more advanced sustainable biofuels in the Netherlands.62

Natural gas extraction from the small Dutch fields, where safe and responsible, is preferred over gas imports, partly to limit dependence on third countries. However, no other measures are being taken to reduce dependence on third countries.

58 Energy Agenda - Parliamentary document 31 510 no. 64.
59 Letter to Parliament on Gas Extraction in Groningen, Parliamentary document 33 529, no. 457.
60 Security of Supply Gas Act Decree, Bulletin of Acts and Decrees 2004, 170.
61 Letter to Parliament on the Government's response to the transition agendas for the circular economy – Parliamentary document 32 852, no. 59.
62 Government assessment of the Climate Agreement Mobility sectoral platform, 5 October 2018, Appendix to Parliamentary document 32 813, no. 220.

The Netherlands relies on the effective operation of the Dutch gas market, the TTF. The TTF has recently demonstrated that it can cope without any problems with the substantial decrease in gas extraction from Groningen (of over 50 billion Nm^3 in 2013 to 17.5 billion Nm^3 in 2018/2019).

The Netherlands has no specific policy aimed at reducing dependence on oil imports from third countries either. As explained above, the oil market is an unregulated global market that in itself is highly diversified in terms of sources. As long as the market continues to operate, security of supply is guaranteed and the market determines the price and allocation of the available oil around the world.
It is expected that, despite the reduction of greenhouse gases and efforts to make the energy mix more sustainable, oil and the products refined from it will remain a key component of the energy and raw material mix for the foreseeable future. Therefore, the Netherlands, being a Member State of the EU and the IEA, takes the security of the supply of oil and the stability of the oil market extremely seriously. If called on to do so by the EU or IEA, the Netherlands will use a share of its strategic oil stocks in a joint effort to maintain the stability of the oil market. The Netherlands is already prepared to do so and is able to implement the measure immediately, if required.

Lastly, the Netherlands has no specific policy for reducing imports of electricity from third countries.

iv. Increasing the flexibility of the national energy system, by means of domestic energy sources, demand response and energy storage

As long as, and in so far as the built-up environment and businesses are still dependent on natural gas, domestic gas extraction or imports are necessary. In addition the preference is for gas extraction from small fields due to the climate benefits and because it is better for the economy. High-calorific gas is extracted from the small gas fields, a large share of which is converted into low-calorific gas through quality conversion. The Netherlands intends to boost gas extraction from small gas fields in the Dutch part of the North Sea.

There is no direct link between the amount of gas extracted from the Groningen field and the amount of gas extracted from the small fields. Reduced gas extraction from the Groningen field can - if the demand for low-calorific gas remains constant, which means that more high-calorific gas must be mixed with nitrogen, or the conversion of large-scale consumers from low-calorific gas to high-calorific gas - lead to a higher demand from the Netherlands for high-calorific gas. This additional demand for gas must be satisfied via the international market for high-calorific gas. It is only possible to extract gas from existing small fields faster on a very limited scale and temporary basis.[63]

Regulation of the electricity market will be organised over the next few years by the legislative agenda so that investments in the use of flexibility (also by/from small consumers) will be rewarded in accordance with the market. With the increase in the number of smart meters consumers could also, if they wish, respond to real-time prices, whether or not assisted by aggregators. Furthermore, any obstacles to storage will be eradicated.64 The transition to electric vehicles can contribute in this regard.

63 Letter to Parliament on gas extraction from small fields dated 30 May 2018, Parliamentary document 33 529, no. 469.
64 Legislative agenda, Parliamentary document II, 2017-2018, 30 196, no. 566.

2.4 Internal energy market dimension

2.4.1 **Electricity interconnection**: the level of electricity interconnection the Member State wishes to achieve by 2030, related to the interconnection target for electricity of at least 15% by 2030

An indicative interconnection target of 15% was agreed in the European Council for 2030. The Netherlands has already had an interconnection percentage in excess of 15 % for some time. In the next ten years, interconnection capacity is expected to double from a nominal 5.9 GW in 2017 to 9.8 GW in 2025.

The Netherlands does not have a specific quantitative target for interconnection. In the event of any plans for new interconnectors, the welfare effects (including effects on the supply security of electricity) will be examined for each interconnector, as will the projected costs.

2.4.2 **Infrastructure for energy transmission**: most important projects for electricity and gas transmission infrastructure and projects for its modernisation

In order to accommodate the growth in the number of renewable energy generating plants (both on land and offshore), sufficient capacity must be created on the electricity network of regional and national grid operators in a timely manner. Timely and integral spatial planning, in which energy infrastructure is taken into consideration from the start, is more important than ever. Infrastructure for transporting, converting and storing electricity, natural gas, biogas, hydrogen, CO_2 and heat will also have to be coordinated so that the spatial impact and the total investment required are kept to a minimum.

To this end, regional and national grid operators will work on an integrated Energy Infrastructure Outlook 2030-2050 and Investment Plans will be drawn up detailing the investments needed to achieve the objectives and to continue to guarantee affordability, security of supply and reliability. In parallel, it will be explored whether, and if so how, scope and incentives should be created for grid operators regarding anticipatory investments in network infrastructure that support the energy transition and the timely achievement of the targets. We will also look at how new possibilities such as the use of flexibility, energy storage, supply and demand coordination and congestion management can make the best possible use of the available space on the network at the lowest social costs. In addition, consideration will be given to the way in which the costs of the energy infrastructure are charged and, where necessary, proposals for adjustments will be made.

In the field of electricity, investments are being made to increase the domestic capacity of the national grid. The Randstad 380 kV Noordring grid project will be completed in 2019. Various related sub-projects have already been completed. Furthermore, expansion of the grid capacity in the north-west of the Netherlands is being prepared (the Noord-West 380 kV project), because the Eemshaven region is an important production location and has also become a major switch point in the international electricity network. In addition, the Zuid-West 380 kV grid project aims to resolve existing bottlenecks in this part of the country.

The Dutch electricity market is linked to four (five as from 2019) neighbouring countries. In the next ten years, interconnection capacity is expected to double from 5.55 GW in 2016 to 10.8 GW in 2025.

With regard to the connection of the offshore wind farms, TenneT's approach includes standard platforms whereby 700 MW of wind energy capacity can be connected per platform. The five projects of Borssele Alpha, Borssele Beta, Hollandse Kust (zuid) Alpha, Hollandse Kust (zuid) Beta and Hollandse Kust (noord) will be connected between 2019 and 2023.

The Netherlands' gas transmission and distribution infrastructure is mature and robust and therefore no major projects are planned. The only exception is the construction of a new, large-scale nitrogen plant that will allow 5 to 7 billion m^3 of high-calorific gas to be converted into low-calorific gas every year. Furthermore, a survey is being conducted into the extent to which industry that still currently uses low-calorific gas can switch to another, wherever possible sustainable, form of energy. If this leads to a transition to the use of high-calorific gas, then investments in the high-calorific gas

transport network will be required. The size of these investments can only be estimated once it is clear which companies are to make this transition and how they are situated in relation to the existing high-calorific transport network.65

The government has also announced its work on the National Agenda for Charging Infrastructure (Nationale Agenda Laadinfrastructuur).66 The agenda provides an overview of the required charging infrastructure and outlines the frameworks within which this infrastructure is to be rolled out. This also applies to other fuel types, such as LNG, hydrogen and biofuels, within the context of the recalibration of the Alternative Fuels Infrastructure Directive (AFID).

2.4.3 Market integration

i. Increasing the system's flexibility

The Netherlands considers additional flexibility to be necessary in the system as a result of the continued increase of intermittent sources in the electricity system. The Netherlands will organise market regulation in the coming years via the legislative agenda, so that flexibility (also for small consumers) can be increased even further and small consumers get better access to the market and are rewarded in accordance with the market. To this end small consumers could be supplied with an aggregator. The Netherlands is focusing on rolling out smart meters, to allow consumers to respond more effectively to real-time prices.67

Further flexibility will be created by the introduction of dynamic tariffs on the retail market. There is already a high degree of flexibility in the system, thanks, for example, to large-scale consumers, which are flexible and can respond to real-time prices by connecting, calibrating or disconnecting, and parties with storage assets that offer them on the different markets. Where necessary, any obstacles to storage will be eradicated.68

The Independent Grid Management Act (Wet Onafhankelijk Netbeheer) guarantees the independence of grid management, to facilitate fair competition on supply and wholesale markets, and to increase the systems' reliability. Competition between various providers on the energy market benefits the degree of affordability.

In addition, the system of "programme responsibility" or balance responsibility ensures that suppliers and consumers themselves maintain the balance of supply and demand on the energy market. They receive an economic incentive to implement the deliveries and purchases agreed.69

ii. Non-discriminatory participation of renewable energy, demand response and storage in all energy markets

In general, the Dutch government strives for frameworks for the electricity market that encourage fair competition between market parties and do not discriminate against any one party. This includes parties that provide renewable energy, demand response and storage, including through aggregation. No separate, national objectives have been formulated for this purpose.

iii. Consumer participation in the energy system, self-generation and new technologies, including smart meters

No specific targets apply in this regard, except the target for 80% of Dutch small consumers of electricity and gas to be supplied with a smart meter by 2020. Overall the Netherlands' aim is to ensure that consumers are able to optimally benefit from competition on the energy market, to make conscious choices and receive fair remuneration for investments in self-

65 Letter to Parliament on Gas Extraction in Groningen, Parliamentary document 33 529, no. 457.
66 Government assessment of the Climate Agreement Mobility sectoral platform, 5 October 2018, Appendix to Parliamentary document 32 813, no. 220.
67 Stimulating Renewable Energy Production - Parliamentary document 31 239, no. 263.
68 Legislative agenda, Parliamentary document II, 2017-2018, 30 196, no. 566.
69 Memorandum following the report – Amendment to the Gas Act (Gaswet) and the Electricity Act 1998 (Elektriciteitswet 1998) concerning strengthening the operation of the gas market, improving the security of supply and establishing rules on the priority of sustainable electricity, as well as a number of other amendments to these Acts – Parliamentary document 31 904, no. 7.

generation. No separate, national objectives have been formulated for this purpose.

Furthermore, consumers in a competitive Dutch market are able to choose from an abundance of diverse types of providers. Suppliers offer different types of contracts, such as contracts for the supply of 100% renewable energy, the supply of 100% renewable electricity of Dutch origin, etc. There are currently 58 different licensed providers who often offer multiple options operating on the Dutch retail market. The Netherlands also has a relatively high percentage of annual switchers (16% in 2017), with half of all consumers having switched supplier at least once in the last three years.

In addition, a growing number of consumers have begun feeding in electricity to the grid, for which they are remunerated through the net-metering scheme. This scheme will eventually be replaced by a feed-in grant (after 2020).70

iv. Safeguarding the adequacy of the electricity system and the flexibility of the energy system with regard to renewable energy generation

The Netherlands expects an efficient and effective electricity market to provide the market parties with the right incentives to invest in production capacity where and when needed - in other words, an energy-only market. In addition, the Netherlands has a large number of interconnectors with neighbouring countries, which also allow Dutch electricity demand to be satisfied.

In addition to affordability and sustainability, reliability is also an important objective of Dutch policy. The competitive electricity market contributes to this, including through the system of programme responsibility and the imbalance market. Stimulating renewable electricity could have an effect on the level of security of supply. The energy supply is becoming increasingly dependent on weather conditions. The growth in the share of intermittent sources will result in an increase in the demand for flexibility on the market. The Netherlands already has a high degree of flexibility, which allows it to respond to the elimination of supply and demand in a way that is in line with market conditions. The Netherlands does not have separate targets related to increasing flexibility in the system.

The required flexibility could take the form of interconnection, demand side response (including hybridisation), storage and adjustable generation. The analysis and inventory of options demonstrates that developments in the energy system potentially offer enough options in the short term to cope with the demand for flexibility.
A mix of different sources of flexibility is needed to cope with long-term flexibility, including adjustable capacity. The adjustable capacity will increasingly have to be CO_2-free as of 2030. There are several potential options available in this regard: CO_2-free hydrogen, renewable sources such as biomass and green gas, nuclear power and the use of fossil sources in which the CO_2 is captured.

As the government indicated in its letter dated 6 November 2018[71], nuclear power is one of the options for the future energy mix. A number of studies reveal that for 2050, nuclear power could be a cost-effective option and that a positive business case could be one of the long-term options. Given the lead times, additional nuclear power for 2030 does not seem likely in the Netherlands. Specifically with regard to thorium, research in this area is still at a fundamental phase and introduction to the market is not yet expected over the next few decades. The use of biomass is viewed within a broader sustainability framework, which is discussed in more detail in section 2.3.3.

Although the electricity market is adequately equipped to achieve the required flexibility, it is important to continue to properly monitor the development of flexibility, including adjustable power. The annual monitoring of supply security is being fine-tuned by TenneT for this purpose[72].

70 Further elaboration of phasing out the net-metering scheme - Letter to Parliamentary document 31 239, no. 305.
71 Parliamentary document 32 645, no. 89.
72 Monitoring Leveringszekerheid (Monitoring Security of Supply), 2017, TenneT, https://www.tennet.eu/fileadmin/user_upload/Company/Publications/Technical_Publications/Dutch/Rapport_Monitoring_Leveringszekerheid_2017_web.pdf

v. Consumer protection and the competitiveness of the retail energy sector

No specific objectives have been formulated in this regard. The Dutch government strives to establish frameworks for the electricity market that encourage fair competition between market parties and do not discriminate against any one party, including parties that offer renewable energy, demand response and storage, including through aggregation.
The regulatory authority monitors developments on the small consumer market on an annual basis. The Dutch retail market is highly competitive with relatively high switch percentages (16%). Last year, some 1.3 million households switched to a new supplier. A supply licence must be requested to supply small consumers. The NRA monitors these licences. The licence obligations are regulated, for example, by Chapter 8 of the Electricity Act 1998 and include an assessment of how reasonable the tariffs are. Since mid-2018, 59 providers operate on the Dutch retail market with a licence to supply electricity and/or gas to small consumers.

Dutch consumers are also protected against disconnection in the winter months and in the event a supplier goes bankrupt. As described above, the Netherlands has a licence system for supplying energy to small consumers. If a supply licence is revoked, for example, due to bankruptcy, the customers of the supplier concerned would theoretically have to be disconnected immediately if they had not taken any action themselves. After all, these customers would no longer have a valid supply contract because they may only be supplied by a licence holder. In practice, these types of quick disconnections are socially undesirable. Therefore, first and foremost, rules and regulations on this matter include the possibility for the licence holder to sell part or the entire customer base to one or more other licence holders prior to the actual withdrawal of the supply licence. If the licence holder is unsuccessful, in part or otherwise, the remaining small consumers who stand to lose their provider upon the withdrawal of the supply licence will be divided between the other licensed providers. As such, all providers who supply small consumers on the market collectively function as an emergency supplier. This scheme applies both to electricity73 and to gas74. The national grid operators for electricity (TenneT) and gas (GTS) respectively play a major and coordinating role in this regard.

2.4.4 Energy poverty

i. Policy objectives in the field of general energy poverty

The Netherlands has no specific objectives related to energy poverty. Support for households with a lower income forms part of policy to combat poverty, which is ultimately part of general social policy.

Central government as well as municipalities take measures to prevent poverty as much as possible. This is achieved by central government through, for example, compensating healthcare costs for people with a low income. And through measures to maintain the purchasing power of people with a low income. Efforts made by municipalities focus on preventing or eradicating problems related to poverty and debt among people as much as possible. The municipality can help people on a low income in different ways. For example, via:

- General benefits and special benefits (welfare);
- Discounts for people on the minimum wage, such as city passes that entitle the holder to discounts for sport and culture-related activities;
- Exemption from municipal taxes;
- Minimum collective healthcare insurance (CZM);
- The individual study allowance;
- The individual income allowance;
- Schemes for children, such as the child package and facilities for sport or culture, so that all children can participate regardless of their family circumstances;
- The prevention of debt and debt assistance.

Together with the VNG, the government has formulated four ambitions related to child poverty. For example, the aim of all parties is to reach virtually every child in poverty by 2021, so that every child growing up in a low-income family can participate. Extra attention is devoted to employed people with children, living in poverty. This represents a large group

73 Security of Supply for Electricity Decree, Bulletin of Acts and Decrees 2006, 104.
74 Security of Supply for Gas Act Decree, Bulletin of Acts and Decrees 2004, 170.

that has not been adequately reached. Moreover, in the next few years the government is focusing on reducing the number of households with children having to cope with a low income. To achieve this we are increasing the disposable income of parents on a low wage. Working, and working more hours, will also be more rewarding. This will be achieved by increasing the general tax exemption, the employed person's tax credit and child allowance. Growing up with prospects involves more than income alone, and this is why we want to regularly gather information about children living in poverty. What is it like for a child living in poverty? And how can we better support these children? We see many initiatives throughout the country. We are going to bundle good examples so we can learn from each other. Based on the above ambitions, the government aims to obtain an insight into child poverty every two years. The government will discuss the outcomes with the ministers involved, with children, the VNG and other relevant parties.

Although there is no specific policy in the field of energy poverty, there is a scheme that prevents people who cannot pay their energy bill (or pay it on time) from being disconnected (Rules Governing the Disconnection Policy for Small Consumers of Electricity and Gas).[75] To prevent payment arrears accruing without finding a solution, the regulation stipulates that energy companies must actively point out the possibility of debt assistance. Payment arrears related to the energy bill can be an early sign of (possibly imminent) problematic debts.
This is in line with the intended amendment of the Municipal Debt Assistance Act, which aims, among other things, to make the exchange of personal data easier so that timely detection is possible. Payment arrears on fixed costs in particular, including energy, are examined, because practical experience shows that these are effective predictors for the early identification of debts.

2.5 Research, innovation and competitiveness dimension

i. Public and, if available, private funding for research and innovation

Innovation objectives - Generic

The objective of business policy is sustainable economic growth. We aim to achieve this through strengthening Dutch earning power and by tackling social challenges. Business policy is primarily generic in nature. This is to encourage innovation and entrepreneurship. The Netherlands considers investments in R&D to be an important means of achieving innovation, productivity and solutions to challenges in society, by developing and absorbing knowledge and technology. R&D is a fundamental source of innovation and has major spillover effects on the economy in the form of knowledge spillovers, through which it contributes to Dutch prosperity.

The Netherlands aims to invest 2.5% of GDP in R&D, in which the share of private funding will be increased. This is not a goal for 2020, but more of a medium to long-term objective. The government particularly wants to encourage private spending on research and development. Therefore, it is important to use public resources in such a way that they generate additional private R&D. To this end, the government is focusing, among other things, on further strengthening public-private partnerships, including by focusing more on the economic opportunities of social challenges within the Mission-oriented Top Sectors and Innovation policy. Innovation is encouraged through the Public-Private Partnership Allowance (PPS), Research & Development Tax Credit (Wet Bevordering Speur- en Ontwikkelingswerk, WBSO) and innovation credit, among other things. The policy also increases access to capital market funding, ensures a healthy business climate and attracts foreign investment, alleviates regulatory burden and helps parties make use of the opportunities provided by digitisation and increased sustainability.
The Netherlands will gradually increase the budget for both fundamental and applied research to €200 million a year by 2020. The main objectives will concern alignment with the needs of the market, public-private partnerships and strengthening SMEs in innovation policy. In addition the focus is on economic opportunities offered by social challenges.

Consequently Dutch innovation policy aims to increase prosperity and maintain the Netherlands' competitive position. Expenditure on research, development and the demonstration of new technologies should partly form the basis of new economic activities. The decrease in the cost of technology plays a key role in this regard.

[75] https://wetten.overheid.nl/BWBR0030164/2018-05-01

Innovation objectives - Top sector policy

Specific innovation policy focuses on nine so-called "top sectors". These are clusters of companies and knowledge institutions in which entrepreneurs, researchers and public authorities collaborate on international competition strategies, earning power and innovation. The Letter to Parliament on the revision of top sector policy[76] indicated that the Dutch Top Sectors intend to focus more on the economic opportunities of four social themes (in addition to the focus on the formulated key technologies). See list below:

	Key technologies		
	Agriculture, water & food	Health & care	Safety (including cyber security, defence and water security)
Energy transition & sustainability			

"Energy transition and sustainability" is one of the four social themes. Two sub-themes fall under this theme: climate & energy and the circular economy.

Missions were formulated and adopted by the government for these four social themes in a broad stakeholder process. The top sectors then compiled five thematic knowledge and innovation agendas on the basis of these missions and an overarching sector-specific knowledge and innovation agenda. This is an important step towards mission-oriented innovation policy, which means that knowledge and innovation questions are explicitly expressed in relation to the missions and are also placed in a broader perspective of public and private deployment (more than just innovation, but also, for example, market creation, legislation and regulations, etc.). In many cases this demands an integral approach and cooperation across the different sectors. The missions and the knowledge and innovation agendas drafted will define the innovation approach and the deployment of resources by research institutes, top sectors and departments.

Innovation targets - Energy and Climate

The challenge to achieve a climate-neutral society and a reliable, affordable, secure and low CO_2 energy supply by 2050 is very extensive. Innovation is essential to implement this transition in a responsible and affordable manner. Investments in innovation could result in new knowledge that allows the target of 95% CO_2 reduction by 2050 to be achieved more economically than with existing technologies. Low CO_2 options are often more expensive than the fossil options available and require major system changes to allow the transition to a low CO_2 economy. This requires the integration of many different technologies, changes to the necessary infrastructure and knowledge, changes to the corresponding business models and other roles for the parties involved. For these reasons, investments in low CO_2 innovations cannot be taken for granted. Targeted energy and innovation policy encourages the necessary innovations for the energy and climate targets and offer economic opportunities.

As described in Chapter 1, an important step is taken as a result of the Climate Agreement in shaping Dutch energy and climate policy for 2030 up to 2050. Mission-oriented innovation policy has been implemented with the accompanying Integrated Knowledge and Innovation Agenda for Climate and Energy (March 2019). Based on the missions formulated by the sectoral platforms for 2050 and the specific targets for 2030, the agenda describes the knowledge and innovation tasks these challenges involve. These knowledge and innovation tasks have been bundled in the Integrated Knowledge and Innovation Agenda (IKIA), in which a good balance has been achieved between a focus on the short term (development, demonstration and roll-out) and on the medium and long term (research and development). The agenda thus also makes it possible to achieve the targets (including intermediate) in 2030 and at the same time provides the necessary basis for achieving the missions for 2050. The knowledge and innovation tasks to help achieve a mission usually require a long-term commitment to a programmatic approach. In the agenda this resulted in 13 Multi-annual Mission-oriented Innovation Programmes, in which a connection is made to international developments and commitment at the European level with the SET plan and at the global level with the IEA and the technology cooperation partnerships as well as Mission Innovation. The IKIA with the 13 MMIPs thus determines the course for the required knowledge and innovation commitment in the field of climate and energy. Therefore, the IKIA implements government policy to focus on societal challenges in innovation policy (mission-oriented top sector and innovation policy)[7677] and the development at European level with Horizon Europe.

[76] Letter to Parliament on "Mission-oriented innovation policy with impact", 13 July 2018, "Mission-oriented Top Sectors and innovation policy", 26 April 2019.

[77] Letters to Parliament: "Mission-oriented innovation policy with impact", 13 July 2018, "Mission-oriented Top Sectors and innovation policy", 26 April 2019.

The following figure describes the missions for 2050, the specific targets for 2030 and the tasks for the 13 MMIPs.

C	D	E
In 2050, raw materials, products and processes in industry are net climate neutral and at least 80% circular	**Emission-free mobility for people and goods in 2050**	**In 2050, the agriculture and nature system is net climate neutral**
In 2030: • 50% fewer primary raw materials are consumed; • Greenhouse gas emissions from production processes and the waste sector are reduced to circa 36 Mton of CO_2 equivalent; • Increased sustainability of industry's heat system is achieved up to 300°C; • Electrification and CO/CO_2 reuse is effected; • CCS is used cost effectively; • Renewable hydrogen production is on course for implementation; • Organic raw materials are considered standard.	In 2030: • There are 1.9 million electric vehicles; • 1/3 of energy consumption in mobility is renewable; • We travel eight billion fewer kilometres for business (including by car); • At least the 32 largest municipalities have zero-emission zones for urban logistics.	In 2030: • An extra reduction has been reached of at least 1 Mton CO_2eq. methane, 1 Mton CO_2eq. reduction in energy consumption by greenhouse horticulture and 1.5 Mton CO_2eq. reduction through smarter land use.
6 **Completing industrial circles** • Circular raw materials and products • Bio-based raw materials and products • Design and embedding of new circular chains • Application of CCS and social acceptance	9 **Innovative transmission and use of sustainable energy carriers for mobility** • Zero Emission propulsion technology and vehicles • Energy distribution for electric vehicles • Distribution of hydrogen and other energy carriers for fuel cell vehicles • Innovative renewable fuels • Energy-efficient vehicles	11 **Climate-neutral production of food and non-food** • Reduction of methane emissions by rumen and intestinal fermentation • Reduction in emissions from housing and manure storage • Carbon sequestration and the reduction of emissions from agricultural soil and fertilisers from peat meadow areas
7 **CO2-free industrial heat system** • Heat recycling, upgrading and storage • Deep and ultra-deep geothermal energy for industry • Application of climate-neutral fuels • System concepts for heat and cooling • Maximising process-efficiency	10 **Targeted transport movements for people and goods** • Knowing what moves people • CO_2 reduction through new mobility concepts for passenger transport • CO_2 reduction through innovations in logistics • Transition-supporting knowledge and tools	12 **Land and water optimally oriented in terms of CO_2 sequestration and use** • Seaweed processing, cultivation and post-harvest • Doubled photosynthesis • Protein for human consumption • Climate-proof nature • Climate-friendly choice when purchasing products • Healthy food choice • Consumption reduction to zero emissions
8 **Electrification and radically renewed processes** • Production of hydrogen, molecules and innovative renewable fuels • Electric machines and electrically powered processes • Increased flexibility and digitisation • Radically renewed processes • Social implications of industrial electrification		
13 **A robust and socially supported energy system** • Joint fact-based decision-making and design, including earning models • Spatial integration • Infrastructure design, flexibility, market mechanisms and digitisation • Power-to-molecules • Large-scale energy storage, energy transport and hybridisation of the energy demand		

Firstly, Dutch climate and energy innovation policy aims to make a contribution in respect of the climate and energy targets that have been proposed by the Coalition Agreement and form the basis of the Climate Agreement (see Chapter 1). This means that the potential contribution to the established tasks and cost effectiveness (over time) are key when formulating the 13 MMIPs as well as for the specific related commitment. Naturally, the international position the Netherlands occupies (knowledge institutions, business community) in these fields is also relevant in determining the specific commitment within the MMIPs and the use of economic opportunities (make or buy). The involvement of the business community is crucial, given that it ultimately concerns the production of new technologies, goods and services, which companies can use to do business. Depending on the phase in the innovation process, this will mean more in-kind commitment and marginal financial contribution in fundamental research and development, increasing to greater financial contributions for pilots and demonstrations. The private contribution will lag behind, particularly with regard to system issues. This translates into a target figure of on average 40% of private contributions to the IKIA and MMIPs.
The mission-orientated top sectors and innovation policy primarily focuses on the economic opportunities of the social challenges, including the energy transition and sustainability.

The annual available resources for all MMIPs are:
- Public: €570,627,000
- Private: €572,880,000

The estimate of the available resources for 2020 is based on the KIC, the Knowledge and Innovation Covenant. The needs assessment comes from the above-mentioned Multi-annual Mission-oriented Innovation Programmes that have been drawn up together with knowledge institutions and companies. Establishing the investment required is complicated. The requirement mentioned above has not been validated, but there are signs that the requirement exceeds the resources available.

ii. Promoting technology in the field of clean energy, the long-term roll-out of low-carbon technologies and the corresponding infrastructure for transporting and storing carbon

Innovation target for transporting and storing carbon, and carbon conservation in the chain

The government regards CCS as an inevitable transition technology for reducing CO_2 emissions in sectors where no cost-effective alternative is available in the short term.78 In addition to the use of CCS for emission reductions in industry, CCS could, in the future, play an important role in achieving negative emissions and pave the way for the development of green hydrogen and CCU. CCS policy is currently being developed using the Climate Agreement as a basis.

Biomass and bio-based products play a major role with regard to carbon conservation in the chain, particularly in industry and agriculture. For industry, an MMIP has been formulated that focuses on closing industrial cycles. Knowledge and innovation issues recur in the field of circular and bio-based raw materials and products, the design and embedding of new circular chains as well as the application of CCS and social acceptance. The circular economy policy formulated in the state-wide programme for a "Circular Economy by 2050" and the Raw Materials Agreement focuses on reusing raw materials, including biomass, and contributes to a low CO_2 industry by 2050. In addition, within the mission-oriented top sectors and innovation policy, a separate mission and a knowledge and innovation agenda have been compiled for the Circular Economy under the social theme of the energy transition & sustainability. The mission defined by the government for the Circular Economy is: "A sustainably-oriented, fully circular economy in 2050. The target for 2030 is to halve raw material consumption."

iii. Competitiveness

The competitiveness of the Dutch economy is an important focal point for the Dutch government. With its ambitious climate and energy policy, the Netherlands assumes responsibility for combating climate change as much as possible. But also views it as a necessity and an opportunity to make our economy more sustainable and to safeguard our prosperity and earning capacity. By starting the ball rolling earlier, we can build up a lead compared to other countries. It means we will have more time and can develop new ideas and technologies that we can subsequently export. Consequently, we are simultaneously working on a more attractive business climate. In particular the Netherlands, as a prosperous and innovative country, can succeed in increasing prosperity and reducing greenhouse gas emissions at the same time.
This is being implemented on several levels. Firstly, by focusing top sector and innovation policy on the social challenges and the

78 Letter to Parliament on the proposal for a Climate Agreement, 28 June 2019, Parliamentary document 32 813 no. 342

economic opportunities that these challenges entail. The choice of the required knowledge and innovation, the formulation of the 13 MMIPs as well as the specific related commitment take into account the international position of the Netherlands, as well as the opportunities that the commitment offers for earning capacity. As yet, however, no specific national objectives have been formulated in this regard. At the forefront of this commitment are the potential contribution to the missions and the cost effectiveness (over time).

Secondly, with regard to competitiveness, the focus on the labour market, education and employment is important. Boosting the labour market and education policy, as formulated in the advice issued by the Social and Economic Council (SER) from 2018, is[79] an important pillar for achieving a successful transition to a sustainable economy and is necessary for capitalising on opportunities for the economy and employment, and for absorbing social risks such as job losses in fossil-oriented sectors.

In discussions on the Climate Agreement, a specific task group was appointed for this topic including representatives from the social partners. Policy commitments included in the Climate Agreement (and the Climate Plan) are described in section 3.5.

[79] SER (2018), Energy transition and employment. Opportunities for a sustainable future

3 Policies and measures

In line with that described in Chapter 1 on the current state of affairs, established in the Climate Agreement and the Climate Plan, and the targets described in Chapter 2, this chapter contains the specific related policies and measures. The policies and measures are cited in the context of a certain dimension, but often have an impact on several dimensions. For example, the policies and measures in section 3.2 also contribute to decarbonisation. An overview and description of the policy measures can also be found in Appendix 4.

3.1 Decarbonisation dimension

3.1.1 Greenhouse gas emissions and removals

i. Greenhouse gas emission reduction target, ESR and LULUCF

As already mentioned, the greenhouse gas emission target of 49% by 2030 compared with 1990, proposed in the Coalition Agreement, means a reduction of approximately 49 Mton of CO_2 equivalents by 2030 compared with an unchanged policy. This includes the effects of the circular economy policy. The Climate Agreement used an indicative allocation of CO_2 targets to the five sectors: (i) electricity, (ii) industry, (iii) mobility, (iv) built-up environment, (v) agriculture and land use. The main policy measures are outlined below for each sector.

Electricity

The policy primarily focuses on replacing generation from fossil fuels with generation from renewable sources. The following instruments contribute to this:

- From 2030, the use of coal to generate electricity will be prohibited by law. The bill offers companies the option of switching to alternative fuels.
- In addition to the ETS, the Netherlands is introducing a national and gradually increasing minimum price for CO_2 emissions in electricity generation. This minimum price contributes to increased sustainability and investment security.
- The SDE++ is available up to and including 2025 for grants for renewable energy projects. It is expected that renewable electricity can be achieved without grants after 2025.

Energy savings will be encouraged based on the Ecodesign directive, the Environmental Management Act (Wet Milieubeheer) and, for example, the Energy Investment Allowance (EIA).
The following policies and measures will be applied:

(a) Encouraging offshore wind energy up to 49 TWh in 2030

We see great potential for offshore wind energy in reaching the 2030 and 2050 climate targets. The target for 2030 is circa 49 TWh. To this end, central government will take the plot decisions, carry out preliminary research, issue the licence and tenders and instruct TenneT to construct the offshore network (as long as wind farms are electrically accessible). In order to carefully integrate this into the current use of the Dutch part of the North Sea, agreements will be made in a North Sea agreement.

(b) Encouraging renewable energy on land up to 35 TWh in 2030

The basic principle is that in 2025, an SDE++- grant is requested for 35 TWh for solar power and wind energy on land. Together, the provinces, municipalities and water boards will ensure that all requested permits will be issued no later than 1 January 2025, with a view to the timely achievement of the task.

(c) Encouraging small-scale renewable generation up to circa 10 TWh *in 2030*

Small-scale renewable generation of electricity, such as solar power generation by private homeowners, represents a third policy. The current net-metering scheme for solar PV will be converted and phased out leading up to 2030, because the price of solar PV is decreasing.

(d) Safeguarding the security of supply

Stimulating renewable electricity could have an effect on the level of security of supply. The energy supply is becoming

increasingly dependent on weather conditions. The growth in the share of intermittent sources will result in an increase in the demand for flexibility on the market. Flexibility in the form of demand response, storage or adjustable capacity is interwoven in the electricity market and is traded across the various markets without flexibility being a clearly identifiable factor.[80]
Although the electricity market is adequately equipped to achieve the required flexibility, it is important to continue to properly monitor the development of flexibility, including adjustable power. The annual monitoring of supply security is being fine-tuned by TenneT for this purpose.

Industry
Energy-intensive industry is largely covered by the EU emissions trading system (ETS).
In addition, the following national instruments will be used:

(a) Amendment to the Environmental Management Act (Wet Milieubeheer)
The Environmental Management Act (Wet Milieubeheer) will be amended. The Environmental Management Act (Wet Milieubeheer) currently stipulates that companies must take energy-saving measures that can be recouped in five years or less. In updating the Environmental Management Act (Wet Milieubeheer), the government is focusing on an integrated climate approach, in which both energy-saving measures and sustainable energy generation are possible.

(b) National CO_2 tax
A national CO_2 tax will be introduced from 2021 to ensure that a 14.3 Mton reduction in emissions compared with the base path is achieved in 2030 and that a reduction of 14.3 Mton is achieved. This is an objective CO_2 tax established by the government on the basis of verifiable criteria that is fully in line with the European ETS benchmarks already applied by the NEa.

In 2020 and 2025, when the new European ETS benchmarks become available, the government will again ask the PBL to review the required level of the CO_2 tax in an objective and verifiable manner, within the established preconditions. The purpose of the tax is not to generate revenue, but to encourage companies to make investments in the Netherlands. If the tax does generate revenue, the latter will be used by channelling it back into greening industry.

(c) Grant for CO_2-reducing measures
The roll-out of CO_2-reducing measures will be supported using the SDE++. To ensure that the deployment of CCS does not happen at the expense of techniques required for the long-term transition, the SDE++ grant for CCS is limited to techniques, processes and sectors without a cost-effective alternative and there is a ceiling for subsidising industrial CCS of 7.2 Mton. From 2035 onwards, no new SDE++ rounds will be issued for CCS applications (excluding negative emissions). The share that companies contribute to the Surcharge for Sustainable Energy (ODE) will be increased from 1/2 to 2/3 by 2020. This increase applies to large consumers, including those in industry. The other 1/3 will be funded by households.

Mobility
The policy aimed at accelerating and supporting the increased sustainability of the mobility system is structured along the following lines:

(a) Stimulating the use of sustainable energy carriers
Based on European guidelines[81], biofuels are blended. In addition, a Hydrogen Agreement will be concluded (as well as various green deals that have already been agreed) and (via the SDE++) efforts are being made to increase the production and use of sustainable advanced biofuels and renewable synthetic fuels to achieve cost-effective CO_2 reductions.

(b) The stimulation of electric transport (including passenger transport) aimed at 100% emission-free new sales of passenger cars in 2030
Based on European standards[82] there is already an incentive to electrify part of the fleet. To accelerate this at the national level, a package of measures is being implemented to encourage the purchase and use of electric cars. There is a specific focus on the second-hand market for electric vehicles. Since an alternative structure of car taxation will be necessary in the

[80] Energy Agenda - Parliamentary document 31 510 no. 64.
[81] The Fuel Quality Directive and Renewable Energy Directive (RED and RED II)
[82] CO_2 standards for passenger cars and light utility vans 2020/2025/2030, CO_2 standards for freight transport

long term, the government will investigate three variants of payment, outline the necessary preparations and, where possible or necessary, make these preparations for the next government. This includes the aspect of the desired stimulation of EV, in line with the government's aim for 100% new sales by 2030. In addition, the National Agenda for Charging Infrastructure will be implemented, which aims to provide national coverage of charging points and fast charging points for electric passenger cars. To this end, efforts are being made, for example, to accelerate the roll-out of charging infrastructure and with regard to innovations with the aim of making electric charging as easy as charging your phone.

(c) Reducing the kilometres travelled for business (including by car) by 8 billion by 2030

As more than half of the total kilometres driven in the Netherlands are work-related, employers play a major role in making mobility more sustainable. In the Climate Agreement (2019) it was agreed that at least 1,000 employers would commit before 2030 to at least a 50% CO_2 reduction of business mobility in 2030 compared to 2016. We are also aiming for 200,000 extra bicycle commuters. From the beginning of 2022, there will be standardisation in legislation for employers with more than 100 employees. Furthermore, various measures are aimed at making alternatives (such as bicycles and public transport) more appealing compared to cars, for example by making co-financing available to increase the number of bicycle parking facilities at train stations. In the long term, work is under way on the transformation of the Infrastructure Fund, so that mobility rather than modality is central when considering investments.

(d) Making logistics more sustainable

Apart from sustainable energy carriers, other approaches are also being pursued to accelerate the transition to emission-free logistics. For example, a tax for freight traffic will be introduced from 2023. With regard to urban logistics, agreements have been made in the Climate Agreement about the establishment of medium-sized zero-emission zones in 30 to 40 larger municipalities in 2025. In addition, the Climate Agreement contains agreements about emission-free construction traffic.
The government will pay special attention to climate neutrality and circularity when it comes to tenders for earthworks and waterworks (GWW). To make water-related logistics (inland waterways shipping) more sustainable, agreements have been made with the sector in a green deal.

(e) National policy for the shipping and aviation sectors

Shipping and aviation are international sectors: this means the solution for emissions in these sectors lies primarily in an international approach. Therefore, the Netherlands strives for measures at least at the European level. However, the Netherlands will take national measures as long as this has not yet been achieved. For example, a flight tax will be introduced on 1 January 2021. Agreements have been made in the Green Deal on Maritime Shipping, Inland Waterways Shipping and Ports and in the sustainable aviation platform about increasing the sustainability of (national) shipping and aviation.

Built-up environment

Policy for the built-up environment sector follows the broad lines described below:

(a) Sliding-scale energy taxation
(b) Funding
(c) Making homes more sustainable
(d) Making non-residential buildings more sustainable
(e) Sufficient renewable heat supply.

See 3.2i

Agriculture and land use

National policy aimed at reducing CO_2 emissions and CO_2 equivalents is structured according to the following four broad lines. When developing policy, European directives, such as the Birds and Habitats Directives, influence the way in which nature (including conservation), landscape and biodiversity are managed in the Netherlands. This can have both positive and negative consequences for climate policy. The future Common Agricultural Policy (CAP), the European agricultural policy that focuses on supporting and making the agricultural sector more sustainable, is expected to make climate one of the priorities. The CAP can subsequently be used to promote climate activities in the agriculture and land use sector.

(a) Reducing emissions in livestock farming

The main focus in reducing emissions in livestock farming is the source: the emissions produced by the animals and emissions produced by manure, including from cows, calves, chickens and pigs. Manure is responsible for the emission of the powerful greenhouse gas methane. Reducing these emissions also helps limit odour nuisance and the emission of ammonia and particulate matter. Therefore, in the Climate Agreement the sector has made agreements about optimising animal feed and improving manure processing and storage methods. To promote this, via the SDE+, the subsidy scheme for the generation of sustainable energy, mono-manure fermentation may also be eligible for subsidy, whereby the reduction of greenhouse gases will also be included in the assessment. In addition to an integrated approach to methane and ammonia through feed and animal-oriented measures, farmers will also take the necessary measures at the housing level, such as using low-emission housing systems. Central government will facilitate entrepreneurs in this endeavour. In addition, central government supports entrepreneurs who want to stop pig farming, with "thermal remediation". This will lead to a decrease in the number of pigs in the Netherlands.

(b) Emission reduction and CO_2 storage through smart land use

CO_2 is released from peat meadow areas as a result of oxidation. Pilots using an area-based approach, including raising the water level in these areas, should demonstrate whether this can reduce these emissions. On the basis of the results of the research, the optimal mix of measures is determined for each area. Afforestation and the prevention of deforestation can help capture CO_2 from the air. Therefore, the Climate Agreement also contains agreements on expanding the natural areas and restoring landscape structures in the Netherlands, limiting deforestation and planting new trees. Carbon capture can also be increased through the smart and sustainable use of agricultural soils. Central government is focusing on the sustainable management of all Dutch agricultural soils in 2030.

(c) Food consumption and food waste

Food consumption and food waste both indirectly contribute to CO_2 emissions. This is why companies and organisations have made agreements in the Climate Agreement about how they will reduce waste in the chain and help consumers throw away less food. In the Climate Agreement it was also agreed that the parties will strive to achieve a good balance between sustainable, healthy, safe and affordable food, and a healthy balance between animal and vegetable proteins in our diet.

(d) Making greenhouse horticulture more sustainable See 3.2i

ii. Regional cooperation in this field

See Chapter 1.3

iii. Applicability of the rules on state aid, funding measures in this field at the national level, including support from the European Union and the use of EU funds

The provision of state aid is established by the conditions of the General Block Exemption Regulation (GBER; reference: Commission Regulation (EU) No. 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty). In cases where this is not possible, for example because a scheme or individual state aid decision crosses a GBER threshold due to the amount of aid or the size of the project, the proposed aid will be assessed by the European Commission in relation to the applicable guidelines, frameworks or decisions, of which - for climate and energy measures - the Guidelines for state aid for environmental protection and energy 2014-2020 (2014/C 200/01) and the framework for state aid for research, development and innovation (OJ C 323, 30.12.2006) , p. 1.) are the most important.

3.1.2 Renewable energy

i. Policies and measures to achieve the national contribution to the binding EU target of at least 32% renewable energy by 2030

Expected share of renewable energy

The Netherlands is focusing on achieving 27% as a contribution to the European target in the field of renewable energy.

Policies

The following policies will be applied:

- Encouraging offshore wind energy up to 49 TWh in 2030
- Encouraging renewable energy on land up to 35 TWh in 2030
- Encouraging small-scale renewable generation up to circa 10 TWh in 2030

See Chapter 3.1.1 Electricity

ii. Specific measures for regional cooperation

See Chapter 1.4

iii. Specific measures on financial support for promoting the generation and use of energy from renewable sources in electricity, heating and cooling, and transport

Incentive schemes for renewable energy

The Netherlands has various mechanisms to stimulate renewable energy. Some key schemes include:

The Sustainable Energy Production Incentive Scheme (SDE+):

- The SDE+ is currently the most important instrument for stimulating the generation of renewable energy. This subsidy instrument contains a number of characteristics, which mean the scheme works effectively in accordance with international standards. This concerns the characteristics of technology neutrality, mutual competition and multi-annual security for investors.
- In line with the coalition agreement, the SDE+ is being extended in the SDE++, so that other CO_2 reducing techniques are eligible for a grant, in addition to sustainable energy. This also applies in principle to greenhouse gases other than CO_2, such as methane. The positive elements of the current SDE+ will be retained and it will be possible to achieve the climate target in 2030 cost-effectively.
- In the SDE++, the 49% CO_2 reduction target by 2030 and cost effectiveness to achieve this goal are key. Therefore, the SDE++ focuses on emission reduction on Dutch territory. The SDE++ will encourage the roll-out of market-ready and relatively large-scale CO_2 reducing techniques by covering the unprofitable top margin of these technologies by means of an operating grant.
- Despite the expansion, it is expected that sufficient grant resources will be available to achieve the renewable energy targets. This will also be monitored.

Renewable Energy Scheme (HER):

The aim of the HER is to achieve the energy targets for 2030 in a more cost-effective manner through innovative projects. Renewable energy projects should lead to renewable energy generation by 2030 and to savings on future expenditure on grants under the SDE+ scheme. These savings must be greater than the subsidy that is requested for the project.

Climate and Energy Innovation Demonstration Scheme (DEI+):

The DEI+ is aimed at supporting pilot and demonstration projects that contribute to the cost-effective reduction of CO_2 emissions by 2030.

The scheme (with budget from the 2019 climate envelope and the Urgenda package of measures) has recently been expanded from DEI to DEI+ to also be able to support climate and circular projects.

In addition to national public and private funding, it may be relevant to use aid provided by the European Union and/or EU funds to further encourage the generation of renewable energy. European resources are however considered for individual projects. These include funds such as the Connecting Europe Facility (CEF), the European Fund for Strategic Investments (EFSI) and Horizon 2020.

iv. Assessing support for electricity from renewable sources

The Netherlands regularly evaluates the relevant support mechanisms aimed at boosting renewable energy generation, including electricity. The largest incentive scheme (SDE+) was evaluated in 2016. This scheme is currently being

expanded to the SDE++. The new scheme, which will take effect from 2020, stimulates renewable energy generation as well as other techniques that reduce greenhouse gas emissions. These adjustments to the scheme are being discussed in detail with the European Commission (DG Competition). The expanded scheme will be evaluated again after several years. Each year there is an independent consultation process related to the categories of technologies, levels of stimulation grants and their effectiveness: the extent to which projects have actually been implemented. This independent consultation process also involves an extensive market consultation.
In addition parliament is informed twice a year on the outcome of the applications and the projects that were funded, including the cost impacts of those projects. This demonstrates the distributional effects (what the grant is spent on) of the returns provided by the incentive. The distributional effects are regularly mapped out and evaluated. The next evaluation will be carried out in 2020 or 2021.

v. Specific measures for introducing one or more contact points, streamlining administrative procedures, providing information and training, and promoting the use of purchase agreements for power

Specific measures arising from the revised Renewable Energy Directive. They must be implemented by 30 June 2021 at the latest. The Netherlands does not currently have a specific policy for this, but will review the policy changes the relevant articles require in good time.

vi. Summary of the policies and measures to develop renewable self-consumption and promote renewable energy communities

The Netherlands currently encourages renewable self-consumption through a fiscal measure for solar panels among small consumers. In addition to a VAT reimbursement on the purchase, owners of solar panels with a small-consumer connection can use the so-called "net-metering scheme". The electricity from renewable energy generation fed back into the grid is deducted from the electricity purchased from the grid. As a result, small consumers are not required to pay supply costs, energy tax, the surcharge for sustainable energy (ODE) or VAT for the electricity purchased from the grid, insofar as this is offset by electricity fed back into the grid. The net-metering scheme will gradually be phased out from 2023 to 2030. The sustainability requirements for homes are also an incentive for homeowners to purchase solar panels, and in the case of landlords, to create opportunities for self-consumption for their tenants. In addition, renewable self-consumption is promoted through subsidies and credit facilities at various levels of government.

Furthermore, there is a fiscal incentive scheme for energy cooperatives, the reduced tariff or postcode scheme, which stimulates regional renewable energy communities (energy cooperatives). In the first energy tax bracket members of these cooperatives are no longer required to pay tax on the share of the jointly generated renewable electricity allocated to them. It is currently being examined how this scheme could be structured in the future when the net-metering scheme is phased out. There is an explicit focus on the simplicity of the procedures. The government is also examining whether a development facility could be set up that allows energy cooperatives to fund development costs[83].

vii. Assessment of the need to build new infrastructure for district heating and cooling generated from renewable energy sources

With regard to making the built-up environment more sustainable, the government is committed to ensuring a substantial percentage of buildings are no longer heated using natural gas. This requires major investments in the energy infrastructure as a whole in the Netherlands. As part of efforts to increase the sustainability of the built-up environment, municipalities will first have to determine how increased sustainability will be achieved per district, and the infrastructure required to do so.

viii. Specific measures to promote the use of energy from biomass, especially new biomass sources

The use of biomass today and leading up to 2030 and 2050 is necessary to make our economy more sustainable and to

[83] Parliamentary document 31 239, no. 287.

achieve the climate target. Biomass is used as an energy source in all climate sectors. Biomass is important in agriculture for soil fertility, the food supply and carbon stock in the soil. Biomass is also increasingly being used as an organic raw material to replace fossil raw materials in other sectors (chemicals, materials and construction). The optimal and thus most efficient use of the available quantity of biomass is desirable to maximise climate gains and increase the economic value of biomass. The basic principle is that only renewable biomass actually contributes to making the economy more sustainable and that renewable biomass on a global level will be scarce in the long term.

Statutory sustainability criteria currently apply to specific biomass flows that are stimulated via the government instruments, in particular for co-fuelling and co-firing biomass in coal-fired power stations.[84] Since 2009, the European sustainability framework of the Renewable Energy Directive (RED) has applied to biofuel used for transport. The amended directive (RED2) also makes this framework mandatory for other large-scale energy applications of biomass in order to count it as renewable energy.
In addition to the statutory applicable sustainability criteria for biomass, many parties make voluntary use of private certification programmes to demonstrate the sustainability of biomass.

The government aims to develop a framework for sustainable biomass. The sustainability criteria that still have to be developed are intended to apply to all biomass and all applications (regardless of whether stimulated or not), insofar as existing legal frameworks do not yet provide for this. As a first step in the process of establishing a sustainability framework, the Netherlands Environmental Assessment Agency (PBL) was asked to draft two opinions: 1) an opinion related to the available amount of biomass per biomass flow, taking into account different interpretations of the fair-share principle and sustainability levels, and 2) an opinion related to the possibilities for the application of sustainable biomass, based on a cascaded use of biomass. Parallel to and in connection with the trajectory of the PBL, an external agency will work on concrete sustainability criteria for the different types of biomass, originating from both national and international sources.

The outcome of these processes will serve as input for a SER recommendation about support for and the feasibility of the sustainability framework. The SER recommendation is expected to be available in the first quarter of 2020, after which the government will take a decision and interpret it for the different sectors.[85]

In relation to uncertainties in the supply and demand forecasts for sustainable biomass, additional assurance is required in the intervening period. During this period, the government commits to caution in issuing new subsidy decisions to stimulate the use and deployment of sustainable biomass, as soon as parties expect bottlenecks in the availability of sustainable biomass for 2030 on the basis of annual monitoring.
In addition, a road map will be developed in 2019 and across the various sectors, with the required parties, aimed at increasing the domestic supply of sustainable biomass. Regional developments of the Climate Agreement could possibly play a role in this regard. Knowledge development and innovation for devising new forms of biomass production and the processing thereof as a raw material or fuel form part of this.

3.1.3 Other elements related to the dimension

i. National policy initiatives and measures affecting the EU-ETS sector

CO_2 Minimum price

The government will introduce a CO_2 minimum price for electricity generation as of 2020. This will be established in the law. The government will introduce the national CO_2 minimum price in accordance with the following price path:

[84] https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/duurzame-energie-opwekken/bio-energie/duurzaamheid-van-vaste-biomassa
[85] For more information see: https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2019Z14515&did=2019D29767

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Price path*	12.3	13.5	14.9	16.4	18.0	19.8	21.8	24.0	26.4	29.0	31.9
ETS price**	20.5	21.0	21.5	24.6	27.7	30.8	33.4	36.3	39.3	42.7	46.3

* Euros per tonne of CO_2

** PBL Forecast (Source: Corjan Brink, Forecast of ETS price according to principles draft bill minimum CO_2 price of electricity generation, PBL 2018)

- If agreement is reached on a pentalateral variant, the price path of the pentalateral CO_2 minimum price is decisive. Central government and as many parties as possible are making every effort to achieve this by striving for a pentalateral 95 CO_2 minimum price. This provides a substantial incentive for increasing sustainability, in addition to the ETS, and moreover, prevents effects on the security of supply. Therefore, in the case of a pentalateral variant, the government is focusing on a more ambitious price path.
- Monitoring with regard to security of supply takes place annually. Every year, TenneT examines risks to the security of supply for the following six years, based on objective indicators. This includes new developments in the ETS price.
- The price path is adjusted downwards if the monitoring shows that there are risks to the security of supply in one or more years.
- Upward adjustments to the price path are announced at least 5 years in advance, whereby based on the aforementioned objective indicators (TenneT) it appears that security of supply will be guaranteed.
- The price path for the period after 2030 will be worked out in 2023, in conjunction with the then available insights into the renewable generation forecast after the SDE+ comes to an end.

National CO_2 industry levy

A national CO_2 tax will be introduced from 2021 to ensure that the target of a 14.3 Mton emission reduction in relation to the PBL base path will be achieved in 2030. At the same time, this tax optimally prevents production moving abroad or a decreasing willingness to invest in the Netherlands.

It concerns an objective CO_2 tax set by the government on the basis of verifiable standards as close as possible to the European ETS benchmarks that are already applied by the NEa. In other words, a hefty tax on avoidable tonnes. The PBL analysis shows that the required reduction of 14.3 Mton will be achieved with this tax. This means that the CO_2 tax will start in 2021 at 30 euros per tonne and will increase linearly to 125-150 euros per tonne of CO_2 emitted in 2030 including the ETS price (with current expectations that would be around 75-100 euros per tonne in 2030, on top of the ETS price). It should be noted that, for the effect of a CO_2 tax alone on the expected reduction, the PBL did not include subsidies available from the expanded SDE+. In 2020 and 2025, when the new European ETS benchmarks become available, the government will again ask the PBL to review the required level of the CO_2 tax in an objective and verifiable manner, within the established preconditions. This means that the PBL will be asked in 2020 and 2025 to establish the required starting level of the CO_2 tax and the level of the CO_2 tax in 2030 (and therefore also in the intermediate years) in order to achieve the reduction target. The PBL will subsequently be asked to perform the calculation including the available subsidies from the expanded SDE+. Afterwards, an external party will be asked to elaborate on the effects for Dutch industry on the international playing field and business climate. The government will then proceed to set the price path. The tariffs will be established in or pursuant to the law.

The analysis shows that this variant of CO_2 tax benefits from the least leakage of companies, production and investments abroad. Nevertheless, even with this tax there are risks related to the leakage of employment and CO_2 emissions, as indicated by PwC. Therefore, the government is taking mitigating measures, which have also been included in the PBL's analysis, namely the gradual rise in the tax basis and tax level and creating the possibility of transferring exempt emissions. In drafting the bill it was examined how companies can be enabled to better align their CO_2 reduction measures with their investment cycles. The purpose of the tax is not to generate revenue, but to encourage companies to make investments in the Netherlands. If the tax does generate revenue, that revenue will be used by channelling it back into measures for the greening of industry.

Despite the fact that the government is taking various mitigating measures, it cannot be ruled out in advance that some companies will not run into problems as a result of the cumulation of measures (including the ODE sliding scale, CO_2 tax, expiry of the ETS indirect cost compensation scheme). This risk particularly applies to companies for which making transition investments takes time and is very expensive and/or where there is a danger that the required infrastructure might not become available in time. The majority of the 300 large industrial companies are active in five clusters:

Rijnmond/Moerdijk, North Sea canal area, Noord-Nederland, Chemelot (Geleen region) and Zeeland. The government will actively monitor these risks and will take action if, as a result of the above-mentioned effects, job losses occur in intrinsically healthy companies. To this end, the government will develop guidelines that specify how monitoring will take place, how to objectively assess whether there is a danger of job losses occurring and which instruments it can use to avert this risk. The monitoring will be reported annually in the Climate Policy Progress Monitor. The government will initially make 125 million euros available for this set of instruments in addition to the 75 million euros of compensation for losses, which is already available for switching to low-calorific gas. This could in any case include the allocation of resources for the roll-out of more expensive CO_2-reducing potential that individual companies need to avoid the tax, but for which they are unlikely to be able to be competitive in applying to the expanded SDE+, support where there are infrastructure bottlenecks or compensation for the expiry of the indirect cost compensation scheme, ETS.

ii. Policy initiatives and measures to achieve other national objectives:

Circular economy

As far as the climate issue is concerned, it does not matter whether the emissions and emission reductions take place within or outside the Netherlands. It has been agreed at the international level that greenhouse gas emissions will be monitored at the place where the emissions are produced. This is also called the "smokestack" approach. This approach does not take into account emissions that certain activities elsewhere cause or prevent.

If Dutch consumers buy imported goods, their production abroad leads to emissions, while these do not increase in the Netherlands. Conversely, the export of products from the Netherlands causes extra CO_2 emissions during their production. The footprint concept is used to map these cross-border chain effects.
Therefore, situations may arise where reducing emissions at the smokestack results in higher (or lower) emissions elsewhere in the system. This can also take place within Dutch borders. One example is an electric car to replace a petrol-powered car. The petrol car causes emissions (in addition to the emissions released by transporting and producing the petrol), while the electric car causes no emissions but does use electricity that is generated elsewhere, and if fossil sources are used, does result in (possibly extra) emissions.

To take this effect into account, a distinction is made between scope 1, scope 2 and scope 3 emissions (WRI and WBCSD, 2018). Scope 1 relates to emissions from the smokestack. Scope 2 takes into account the emissions of purchased electricity, heat, cooling, etc. Scope 3 takes into account the greenhouse gas emissions from both purchased products and the use of manufactured products by customers and during waste processing.

One approach that takes into account emissions within all scopes involves closing raw material cycles in the economy. This is also called the circular economy (CE). A circular economy can reduce CO_2 in the chain by decreasing consumption of primary raw materials, by reducing the incineration and dumping of waste, by reusing CO_2 as a raw material and by providing sufficient raw materials for the energy and climate transition leading up to 2050. Consideration for the CE is also important for climate policy because of the new raw materials and materials (some critical) that will play a role in the non-fossil economy because, for example, they are needed for the production of wind turbines or solar cells.

Recycling plastics is an example of a circular economy/closing cycles that contribute to the climate issue, and the measures in them. Potentially, about 1 Mton CO_2 emissions can be reduced by mechanical and chemical recycling, provided the quality of the recycled raw materials is sufficient. The government is focusing on (among other things) the circular design of plastic products and improved collection, sorting and recycling methods for plastic goods to increase recyclability.

In order to stimulate the demand side of the transition to a low CO_2 and circular economy, central government supports local and regional authorities in using the purchasing power of government (around 73 billion euros annually) for purchasing climate-friendly and circular products and services, including renewable energy. Research conducted by RIVM (Netherlands National Institute for Public Health and the Environment) in 2017 reveals that there is a significant effect on CO_2 emissions, in particular, when this plays a role in purchasing: 4.9 Mton cumulative reduction over the duration of the contracts, based on purchases from 2015-2016. Governments can use sustainable procurement to increase their role as a launching customer in the transition and set a good example to other (market) parties. For example, the Province of Zeeland implemented a circular asphalt project that simultaneously reduced CO_2 emissions. For a new cycle path in Zevenaar, asphalt was used with lignin from elephant grass as a bitumen replacement. This means that CO_2 emissions can

already be reduced by 20%, and this approach offers a potential reduction of 50%.

The Coalition Agreement states that agreements in the state-wide programme for the circular economy and the transition agendas in the Raw Materials Agreement will be implemented as part of the climate challenge. The aim of these agreements is to have a fully circular economy in the Netherlands by 2050, with the intermediate target of achieving a reduction of 50% of primary raw materials consumption by 2030.

This translates into the following policy initiatives:

- A circular route for the use of raw materials focuses on reducing CO_2 in 2030, for example by means of 100% high-quality reuse of concrete that becomes available, as included in the Concrete Agreement and the reuse of construction and demolition waste.
- The government's purchasing power is used more effectively to accelerate the use of circular raw materials, including through tenders and contracts aimed at the reuse and substitution of (non-renewable with renewable) raw materials and innovative production methods. The government's own business operations will also be made more sustainable, and must be climate neutral by 2030.
- The government is taking the lead, together with knowledge institutions, to examine how (among other things by means of carbon bookkeeping) the chain effects of circular measures such as recycling and the use of (bio-based) substitution raw materials can be mapped out and how this can be implemented in policy.
- As part of the expansion of the SDE+, research is being conducted into the possible stimulation of the production of bio-based and circular economy options for the roll-out of techniques.

iii. Policy initiatives and measures to facilitate the transition to low-emission mobility

See the section on mobility in Chapter 3.1.

iv. National policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels

There are no direct subsidies for fossil fuels in the Netherlands, in the sense that resources are made available to stimulate the use of fossil fuels. In the Netherlands, fossil fuels are on the contrary heavily taxed by means of, for example, excise duties. However, facilities such as exemptions and differentiated tariffs, for example in energy taxes, lead to missed government revenues that are related to the use of fossil fuels. Such measures could also be viewed as a subsidy if a broad definition of fossil fuel subsidies is applied. A list of such measures will soon be discussed with the IEA and OECD as part of the IEA's periodic In-Depth Review.
The results of the review will be used to formulate Dutch policy on this topic.

3.2 Energy-efficiency dimension

Policies, measures and programmes to achieve the indicative national energy-efficiency contribution for 2030, including planned measures and instruments to promote the energy performance of buildings, specifically with regard to the following:

i. Energy efficiency obligation schemes and alternative policy measures under Article 7a and 7b of Directive 2012/27/EU and to be established in accordance with Appendix III

For the period of 2014-2020, the Netherlands opted to take an alternative approach to meeting the requirements of Article 7 of the Energy Efficiency Directive (EED).86 During the 2021-2030 period, the Netherlands also aims to take an alternative approach and use various policy instruments in order to meet the national energy savings target. This is explained in more detail in Appendix 3, in accordance with Appendix III to the Regulation. Below is a description of the most important policy measures.

A number of existing policy measures will be continued after 2020:

- *Introduction of the Environment and Planning Act as the successor to the Environmental Management Act:* obligation for companies and institutions with an annual consumption as of 50,000 kWh electricity or 25,000 m³ natural gas or equivalent, to take all energy saving measures with a payback period of five years or less. The implementation of the Environment and Planning Act is currently being elaborated as part of the Climate Agreement. In updating the Environmental Management Act (Wet Milieubeheer), the government is focusing on an integrated climate approach, in which both energy-saving measures and other CO_2 reduction measures are possible.
- *Energy tax and the Surcharge for Sustainable Energy (ODE):*tax on electricity and gas consumption within all sectors. The ODE is levied on top of the energy tax.
- *Energy investment deduction: (EIA):*continuous tax scheme for tax deduction of investments in energy efficiency.

Agreement has been reached with the Climate Agreement on the proposed package of measures to achieve a 49% reduction in greenhouse gas emissions by 2030.[87] This concerns both new policy measures and adjustments to existing policy measures, which will be further elaborated in the coming period.
The most important proposed policy measures (in the built-up environment, industry and agriculture and land use sectors) for achieving the energy saving requirement in Article 7 are listed below. Other measures have been included in Chapter 3.1.1.

Built-up environment
Policy for the built-up environment sector follows the broad lines described below:

(a) Sliding-scale energy taxation
The energy tax will be adjusted to create a greater incentive for increased sustainability because investments in sustainability will pay for themselves faster. Tax on natural gas is rising, while tax on electricity is falling. Additional funds collected in this way are returned via the tax reduction and a lower energy tax rate of the first tranche of electricity. Households will benefit more from this than companies, thus providing a reduction in the burden on households. This also applies to households that are not yet able or willing to invest in increased sustainability. In 2023, we will consider whether the proposed increase in the energy tax on natural gas, in view of the autonomous development of market prices, is still necessary to maintain the desired sustainability incentives.

(b) Funding
The availability of appealing financing instruments is an important condition for making the built-up environment more sustainable.

86 https://www.ecn.nl/publications/ECN-E--13-061
87 https://www.rijksoverheid.nl/documenten/kamerstukken/2019/06/28/kamerbrief-voorstel-voor-een-klimaatakkoord
https://www.rijksoverheid.nl/documenten/rapporten/2019/06/28/klimaatakkoord

New instruments are being developed to produce a wide range of financing instruments:

- The Heat Fund and building-related financing: attractive pre-financing for everyone (including those who currently have no financing options). The basic principle is that over-crediting is prevented and the technical lifetime of installation and insulation measures will be taken into account. For this purpose, up to and including 2030, the government will provide 50-80 million euros in (non-revolving) resources annually. The heat fund can, depending on choices made in the implementation, be supplemented with private funds and thus grow to a financing portfolio of more than a billion euros.
- Energy taxation and energy bills: A number of aspects are going to change with regard to the energy tax and Surcharge for Sustainable Energy (ODE) that will have an effect on energy bills. The tax on gas will increase. Additional funds collected in this way are returned via a higher tax reduction and a lower energy tax on electricity. Increased sustainability will be encouraged as a result. In addition, the burden arising from the ODE is distributed differently between households and companies and the government will make resources available to ensure that the tax component of the energy bill for a household with an average consumption level, is reduced by 100 euros in 2020, does not rise in 2021 and rises to a limited extent after 2021. The government is structurally allocating 425 million euros for this purpose.
- Investment Grant for Sustainable Energy: The Investment Grant for Sustainable Energy (ISDE) currently focuses on sustainable installations such as heat pumps. The ISDE is being expanded so that a subsidy can also be requested for insulation. A hundred million euros will be available for the ISDE annually up to 2030.
- Subsidy for Energy Savings at Home (SEEH): In order to facilitate owner-occupiers in the short term in making their home more sustainable, a total of 90 million is available for 2019 and 2020 through the Subsidy for Energy Savings at Home (SEEH). The SEEH merges into the broader Investment Grant for Sustainable Energy (ISDE).
- Programme for small-scale energy-saving measures: With small measures, such as better control of the heating system and application of radiator foil, you can achieve major savings on your energy bill at little cost and immediately reduce CO_2 emissions. An Energy-saving Measures Programme (PRE) will start this autumn in cooperation with municipalities and market parties. 93 million euros are available for this.

Ongoing existing policy:

There is a reduced VAT rate for applying insulation material and (insulation) glass. VAT has been reduced from 21% to 6%.

(c) Making homes more sustainable

A number of measures are aimed at accelerating the increased sustainability of rental homes owned by corporations and private property owners. In addition, an amendment to the Gas Act is relevant for new construction.

District-oriented approach

The district-oriented approach is aimed at making the built-up environment more sustainable district-by-district. As a result, both residents and building owners (such as bakers, schools and others) can be involved in making the district more sustainable. The district is also the easiest scale to apply an alternative to natural gas step by step and at natural moments and to limit costs. The municipality manages the district-based approach. To learn how to implement the district-based approach, testing grounds for natural gas-free districts have already been started in 2018. The testing grounds are intended to provide information in the 2019-2021 start-up period about how the district-based approach works and what preconditions are needed. Leading municipalities in the Natural Gas-Free Districts Programme are working on the testing grounds. A total of 400 million has been made available for this purpose. In addition, the Association of Dutch Municipalities has launched a knowledge and learning programme to support all municipalities in the Netherlands, providing knowledge and sharing experiences.

Rental properties

Within the rental sector, housing associations play an important role in the first step to make their housing stock more sustainable. Other major landlords are also going to make agreements about interim goals.

- Housing associations often own large numbers of similar properties. This makes them a suitable party to act as a starter motor and set the process in motion to make the built-up environment more sustainable. The starter motor is the first scale-up in the process to increase the sustainability of the housing stock. By connecting 100,000 homes to heat in the short term (heat grids or heat pumps), a first step can be made in reducing the cost of renovations and reducing CO_2 emissions. For this purpose among other things 200 million will be made available for the period 2020 up to and including 2023.

- Associations can rapidly take steps due to their large scale and standardisation. Associations can apply for financial resources that support them in making their housing stock more sustainable. For example, there is financial support via the Renovation Accelerator and there is a discount on the Landlord Levy for associations that want to become more sustainable. The renovation accelerator ensures scaling up. The renovation accelerator is an instrument for bundling demand (similar homes and buildings of landlords) and linking it to the supply of construction parties to achieve cheaper renovation on a large scale. 130 million has been made available for this purpose up to 2024.
- The regulation - including the rental points system - will be amended in such a way that it provides the right incentives to renovate homes in accordance with the standard.

Owner-occupiers

An insight into the possibilities (including technical) and financial support are important to support individual homeowners and unburden them with regard to making their homes more sustainable. A standard per housing type which includes sustainability requirements will provide people with an idea of the efforts involved in making their home more sustainable. This standard will be translated into target values per insulation measure. Other measures, such as a digital platform that provides homeowners with information about sustainability measures and the associated indicative energy savings, also contribute to this. For financial support, homeowners can make use of schemes such as the Investment Grant for Sustainable Energy (ISDE) and the Subsidy for Energy Savings at Home (SEEH).

New constructions

The Gas Act was amended on 1 July 2018. It means that most new buildings no longer have a gas connection. The amendment to the law applies to new buildings in the category of small consumers, whose building permits were applied for on or after 1 July 2018. New buildings must also be delivered as Nearly Zero-Energy Buildings (NZEBs).

Ongoing existing policy

- People who implement energy-saving measures in their own home with a mortgage can borrow a higher amount for the investment concerned. An amount can also be disregarded if it concerns the purchase of a house with a valid energy label of at least (A++) issued before 1 January 2015 or a house with an energy index or an energy performance coefficient of at most 0.6. An amount can also be disregarded if a mortgage is provided to finance a "zero-on-the-meter" home (NulopdeMeter-woning). The scheme is updated on an annual basis.
- The Netherlands promotes solar panels among small consumers by means of a VAT refund on the purchase of solar panels and a net-metering scheme (see 3.1.2.vi)
- In the first energy tax bracket, members of these associations are no longer required to pay tax on the share of the jointly generated renewable electricity allocated to them. It is currently being examined how this scheme could be structured in the future when the net-metering scheme is phased out. The government is also examining whether a development facility could be set up that allows energy cooperatives to fund development costs.
- The Energy Performance Fee Bill (EPV) was adopted on 17 May 2016 and entered into force on 1 September 2016. Landlords who renovate their properties so they are zero-energy (or nearly) or "zero-on-the-meter" homes can request an energy performance fee from their tenants to recoup the substantial investments made in the rental property. The landlord and the tenant must agree on the amount of the fee.

(d) Making non-residential buildings more sustainable

- Standardisation: In the case of non-residential buildings, we are looking into making existing commercial and social real estate more sustainable, such as office buildings, schools and care institutions. A coherent package of standards and supporting instruments is used for this in collaboration with umbrella organisations. The most important measure is the setting of a legal energy performance standard for buildings as of 2021. This concerns a target standard for 2030. A statutory final standard will apply for 2050. At that time all non-residential buildings must be low CO_2.
- Road maps: Social sectors use road maps to explain the steps they are going to take towards a low CO_2 real estate portfolio by 2050. The Sustainable Social Real Estate Knowledge and Innovation Platform will support the social sectors.

Ongoing existing policy

As of 1 January 2023, any office larger than 100 m² must have at least an energy label C. If the building does not satisfy the requirements, it may no longer be used as an office from 1 January 2023.

(e) Sufficient renewable heat supply

Agreements will be made with social organisations to ensure that there is a sufficient sustainable heat supply. The Sustainable Energy Production Incentive (SDE) is being expanded so that sustainable heat is also eligible for these resources.

Central government will contribute in a number of ways. In particular by amending the Heat Act, supporting the ambitions of the Green Gas sector (Green Gas Road Map) and focusing on the safe and responsible development of geothermal energy using a coherent package of reinforcement and acceleration measures (in the form of additional technical requirements; financial support assessment; changing mining regulations; continuity of knowledge and experience; increasing knowledge of the subsurface; and focusing on the required innovation).

Industry

In addition to the measures cited in 3.1.1, this concerns the following policies:

Energy savings requirement and information requirement

In 2019, in addition to the energy savings requirement, an information requirement was also introduced. Installations that use 50,000 kWh of electricity or 25,000 m³ of natural gas (or an equivalent thereof) per year or more must not only take all energy-saving measures with a five-year payback period, but must also report before 1 July on the measures they have taken. Businesses subject to the EED audit obligation have an extension to 5 December 2019. The Recognised Lists of Measures (EML) form the basis. This contains sector-specific energy-saving measures with a payback period of 5 years or less. An EML has been drawn up for 19 sectors. If a company has taken all the applicable recognised measures, it is assumed that it complies with the energy saving requirement. The report is submitted electronically to the RVO.nl eLoket, and the competent authority (municipality or authorised environmental service) has access to these reports. This means that not only is the energy saving requirement for entrepreneurs clarified, but the competent authority can also implement information-driven supervision and enforcement. The four-yearly requirement to provide information will continue to exist after 2020 and will be included in the Environment and Planning Act.

The multi-annual agreements (MJA and MEE) will not continue after 2020.

Agriculture and land use

In addition to the measures cited in 3.1.1, this concerns the following policies:

Making greenhouse horticulture more sustainable

In the Energy Agreement, a CO_2 ceiling was agreed with the greenhouse horticulture sector. This system will continue until 2030. It is being investigated whether individualisation of CO_2 emission allocations is possible. The transition is actively supported by the "Greenhouse as an Energy Source" (Kas als Energiebron) programme. This includes a wide range of instruments from knowledge and innovation development and knowledge dissemination to grants. In the Climate Agreement, the greenhouse horticulture sector has set the ambition to be completely climate neutral by 2040. The transition in the greenhouse horticulture sector is partly dependent on external parties who must make it possible to supply captured CO_2 and residual heat to the sector.

ii. Long-term renovation strategy to support the renovation of the national housing stock and non-residential buildings (both public and private) in accordance with Article 2a of Directive 2010/31/EU (EPBD).

In the long-term renovation strategy, the Netherlands will provide a description of the strategy, goals and various measures to improve the energy performance of existing homes and non-residential buildings towards nearly zero-energy and low CO_2 in 2050. This long-term renovation strategy will be based on the Climate Agreement and will include both existing and new policies. The long-term renovation strategy will take into account the requirements of Article 2a of Directive 2010/31/EU. The long-term renovation strategy will also be aligned with this Integrated National Energy and Climate Action Plan. The long-term renovation strategy will be presented to the European Commission by 9 March 2020 at the latest.

iii. Policies and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers to the use of energy performance contracts and other models for energy efficiency services

Energy performance contracts have not yet been widely used in the Netherlands, although the market is growing. Central government encourages EPCs by sharing good examples and it offers, by means of the Guidelines for the Procurement of Energy Performance Contracts, tools for producing an energy performance contract. As part of the European GuarantEE programme, RVO.nl developed an EPC facilitator pool together with 14 European partners.

In collaboration with financial institutions and the installation sector, options for promoting ESCO constructions are also being examined. Clarifying the use of the EIA and any other instruments in ESCO constructions is being considered.

iv. Other planned policies, measures and programmes

Part of the Netherlands' energy efficiency policy focuses on raising awareness and making joint agreements with the sector and fellow governments:

- *Agreements:* In recent years, various agreements and green deals have been concluded between central government and other parties, such as companies, social organisations or other governments. With a green deal, parties strive to find solutions to work in a sustainable manner. The government helps these parties with various bottlenecks such as ambiguous or conflicting regulations. More than 200 green deals have been signed since 2011. Various green deals reinforce energy efficiency such as the zero emission urban logistics green deal, the maritime shipping green deal, the inland waterway shipping and ports green deal, the participation of the environment in sustainable energy projects green deal and "Het Nieuwe Draaien" green deal focusing on mobile machinery. Other agreements (aimed at energy efficiency) between central government and other parties are e.g. the 10 petajoule energy saving built-up environment agreement and the More with Less agreement for energy saving new constructions. The Netherlands will continue to focus on green deals and agreements.
- *Campaigns:* the Dutch government creates energy awareness with public campaigns such as the "Energiebesparing doe je nu", (Now's the time to make energy savings!), "Kies de beste band" (Choose the best tyre) and "Watt je moet weten over de informatieplicht energiebesparing" (Watt you need to know about the energy saving information requirement).
- *Regional approach:* Dutch municipalities, provinces and water boards work together with stakeholders on a Regional Energy Strategy (RES) within the region. The RES is an instrument for jointly arriving at choices for the generation of renewable electricity, the heat transition in the built-up environment and the required storage and energy infrastructure. Among other things, the RES offers insight into the possibilities for regional generation and savings.

A number of energy-saving measures are mandatory under the Energy Performance of Buildings Directive:

- *Energy label:* A valid energy label is mandatory for the sale, rental and delivery of homes and non-residential buildings.
- *Energy performance requirements:* The Building Decree imposes requirements for the energy efficiency of new homes and non-residential buildings. The most important requirement in this regard is the Energy Performance Coefficient (EPC). In addition to energy performance requirements for new constructions, the Building Decree imposes requirements on conversions and renovation.
- *Second revision of the Energy Performance of Buildings Directive (2018/844):* The Netherlands is currently still working on the implementation of the second revision of the Energy Performance of Buildings Directive. This revision also contains new and amended provisions aimed at energy savings for buildings, such as system requirements for technical building systems, documentation of energy performance of technical building systems, self-regulating equipment and inspections of heating and air-conditioning systems.

v. Description of policies and measures to promote the role of local energy communities in implementing policies and measures referred to in points i, ii, iii and iv

Energy communities can contribute to energy efficiency through bottom-up initiatives. The Netherlands encourages knowledge development and dissemination of energy communities. In addition, the development and growth of energy communities is promoted through targeted subsidies (tax benefits), in particular in the field of local energy generation. This policy is namely aimed at promoting support for the energy transition.

vi. Description of measures to develop measures for using the energy-efficiency potential of gas and electricity infrastructure

The Electricity Directive requires the regulation method of electricity grid operators to provide appropriate incentives for energy efficiency. ACM regulates energy tariffs. The costs for grid losses for electricity and gas are part of the total costs that ACM includes in the regulation. Because grid operators achieve more returns if they reduce their costs, they have an incentive to reduce the costs for grid losses. The costs of grid losses are formed by the volumes and the purchase price of the electricity/gas. If a grid operator manages to reduce the volumes of grid losses, this contributes to energy efficiency.

vii. Potential regional cooperation in this field

See Chapters 1.3 and 1.4

viii. Financial measures in this field at the national level, including European Union support and the use of EU funds

Not applicable

3.3 Energy security dimension

i. Policy and measures related to the elements in point 2.3

Natural gas

As previously mentioned, with regard to natural gas, in relation to the phasing out of gas extraction from the Groningen gas field, steps will be taken to reduce the consumption of low-calorific gas:

- Encouraging large-scale industrial users to switch from low-calorific gas to other forms of energy;
- Phasing out natural gas as a heating source from the built-up environment, starting with new construction projects;
- Reducing foreign demand for low-calorific gas in consultation with Belgium, Germany and France.
- The construction of a new, large-scale nitrogen plant that will allow 5 to 7 billion m^3 of high-calorific gas to be converted into low-calorific gas every year.[88]

Independently of the development of gas extraction from the Groningen field, the Netherlands is taking steps to boost the extraction of natural gas from small fields in the North Sea. The intention is to replace the current conditional investment deduction of 25% by a generic investment deduction of 40% for all new investments for the exploration and extraction of small gas fields in the Dutch part of the North Sea.[89] As described in Chapter 2, there is no specific policy aimed at the diversification of gas suppliers from third countries. The Netherlands namely has a very open and liquid gas market (TTF), on which many parties are active and which has absorbed the sharply falling Dutch production in recent years without any problem. Both the traded volume and the physically delivered volume have risen sharply in recent years (source: GTS):

Year	Total traded volume	Net delivered volume	Churn
2003	2.5 bcm	1.5 bcm	1.8
2008	65.2 bcm	20.2 bcm	3.2
2011	6,325 TWh	375 TWh	16.9
2014	13,216 TWh	430 TWh	30.7
2016	21,468 TWh	516 TWh	41.6
2017	20,962 TWh	540 TWh	38.8
2018	27,170 TWh	564 TWh	48.2

[88] Letter to Parliament on Gas Extraction in Groningen, Parliamentary document 33 529, no. 457.

[89] Letter to Parliament on gas extraction from small fields - Parliamentary document 33 529, no. 469.

On the TTF, producers sell their gas to suppliers, with or without the intervention of traders. The suppliers then provide the consumers (businesses and households) with gas. On the TTF, gas is traded based on energy content rather than quality (high-calorific or low-calorific gas). The Dutch grid operator, GTS, ensures that the correct quality is supplied at the exit points. This effective, efficient and very liquid gas market, with the corresponding gas exchange (ICE Endex), combined with an extensive transport network, ensures that international gas flows are attracted, which has a favourable effect on the security of supply, even when domestic gas consumption decreases. With regard to diversification, the Netherlands believes it is important to maintain the required infrastructure (including with regard to the rise of LNG).

The Netherlands also has sufficient gas transport and storage capacity, which has allowed it to prepare for the decline in domestic production. In order to prevent small consumers from having their gas cut off during an extremely cold period as the result of a shortage in production and transport capacity, the grid operator GTS has a statutory obligation to reserve volume and capacity to supply small consumers.90 In October 2019, the Gas Preventive Action Plan was presented to the House of Representatives.[91] The plan outlines the measures taken to prevent any problems occurring with the gas supply. Therefore, the plan precedes the Gas Protection and Recovery Plan (BHG) that has also been presented and that deals with the measures that can be taken if there is a serious disruption of the gas supply.[92] Just like the BHG, this plan also arises from the European Security of Gas Supply Regulation. The Minister of Economic Affairs and Climate Policy is the competent authority under this EU regulation and drafted the plan in collaboration with Gasunie Transport Services (GTS), the operator of the national gas transport grid, and after consultation with stakeholders.

Oil

There are no specific measures for diversification for oil. The oil market is an unregulated global market that in itself is highly diversified in terms of sources. As long as the market continues to operate, security of supply is guaranteed and the market determines the price and allocation of the available oil around the world.

Electricity

The Netherlands has major potential for generating renewable electricity. An important aspect of energy security for the Netherlands involves the possibilities for large-scale and long-term storage of renewable electricity. The development of "power to gas" is crucial to continue to meet a large part of its energy needs and the storage of renewable electricity in the form of a gas thereby offers flexibility for the electricity system and a renewable energy carrier for the sustainability of transport and mobility, industry and the built-up environment. The Netherlands does not intend to reduce electricity imports as such. The Netherlands is of the opinion that the further integration of the European electricity market specifically can contribute to continuing to guarantee security of supply in an energy system that is in transition to a climate-neutral energy supply.

There are no objectives to increase the diversification of energy sources and suppliers from third countries for electricity. The targets for decarbonisation and expansion of the share of energy generated from renewable sources will nevertheless inevitably lead to a further diversification of generation techniques on the electricity market. See Sections 2.1.1 and 2.1.2 on this matter. The analyses of the NEV 2017 (adopted and proposed policies) roughly show a doubling of the number of petajoules of electricity generated by solar power and wind energy.93 [PM CHECK]. In addition, the intended expansion of the interconnection capacity between the Netherlands and other European Member States will lead to the expansion of the supply of electricity from other Member States. In the next ten years, interconnection capacity is expected to double from 5.55 GW in 2016 to 10.8 GW in 2025. See Chapter 4 for more information. As far as increasing the flexibility of the system is concerned, regulation of the electricity market will be organised over the next few years by the legislative agenda, so that investments in the use of flexibility (also by/from small consumers) will be rewarded in accordance with the market. To this end, small consumers must get better access to the short-term electricity market and be supplied with an aggregator.[94]

90 Security of Supply Gas Act Decree, Bulletin of Acts and Decrees 2004, 170.

91 Letter to Parliament on Preventative Action Plan 2019 - Parliamentary document 29023 no. 253

92 Letter to Parliament on the Gas Protection and Recovery Plan - Parliamentary document 29023 no. 252

93 NEV 2017, Table 13, page 230.

94 Legislative agenda, Parliamentary document II, 2017-2018, 30 196, no. 566.

ii. Regional cooperation in this field

In respect of natural gas, the government is working closely with Belgium, Germany, France and Luxembourg through the Pentalateral Gas Platform. This Platform is supported by the Benelux Secretariat and is also home to the risk group for low-calorific gas that was created under Regulation (EU) 2017/1938. In addition, collaboration takes place through and in the following risk groups that were created pursuant to the Regulation cited above: Belarus, Baltic Sea, Norway, Denmark and the UK.
In view of the specific problems related to gas extraction in Groningen and the conversion of low-calorific gas consumption in Belgium, France and Germany, it was recently decided to set up a task force consisting of representatives of the governments, grid operators and energy regulators of these countries who will report semi-annually on the progress of conversion operations.

As far as electricity is concerned, the Netherlands works closely with Belgium, Germany, France, Luxembourg, Austria and Switzerland at the regional level through the Pentalateral Energy Forum, in the field of market coupling, security of supply and market flexibility.

iii. If applicable, financing measures in this area at a national level, including European Union support and the use of EU funds

Not applicable.

3.4 Internal energy market dimension

3.4.1 Electricity infrastructure

i. Policy and measures to achieve the targeted level of interconnection established in Article 4(d)

The 15% interconnection target has already been achieved. Interconnection with Germany, Belgium and Denmark will be expanded between now and 2030.

We do not consider a higher, generic interconnection target to be of use. The added value of additional interconnection differs per border. Levels of price differences between regions are the most significant indicator of the expected added value of new investments in interconnection. Efforts to make more efficient use of existing interconnection or the achievement of better cross-border agreements are valid alternatives to new, physical interconnection. In this context, the Netherlands, as a participating country in the Pentalateral, has actively contributed to the implementation of the flow-based market coupling system. In principle, the Netherlands is in favour of new interconnectors, on the condition that the socio-economic and ecological cost-benefit analyses indicate positive outcomes.

ii. Regional cooperation in this field

94 Regional cooperation with neighbouring countries is based on the optimisation of flows and capacity through so-called flow-based market coupling. This cooperation takes place between the countries of the Pentalateral Energy Forum. In addition, grid operators collaborate by sharing information through RSCs (Regional Security Coordinators). Grid operators work closely when planning infrastructure projects (through ten-year development plans), including through the European Network of Transmission System Operators (ENTSO-E). In the context of the new market design, there are proposals to expand the role and tasks of the RSCs.

iii. If applicable, financing measures in this area at the national level, including European Union support and the use of EU funds.

Infrastructure projects of common interest may, under certain conditions, be eligible for funds from the Connecting Europe Facility (CEF). In addition, the European Fund for Strategic Investments (EFSI) is available through the European Investment Bank (EIB).

3.4.2 Infrastructure for energy transmission

i. Policies and measures related to the elements set out in point 2.4.2, including any specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects

In the field of electricity, investments are being made to increase the domestic capacity of the national grid. The Randstad 380 kV Noordring grid project will be completed in 2019. Various related sub-projects have already been completed. Furthermore, expansion of the grid capacity in the north-west of the Netherlands is being prepared (the Noord-West 380 kV project), given that the Eemshaven region is an important production location and has also become a major switch point in the international electricity network. In addition, the Zuid-West 380 kV grid project aims to resolve existing bottlenecks in this part of the country.

With regard to the connection of the offshore wind farms, TenneT's approach includes standard platforms whereby 700 MW of wind energy capacity can be connected per platform.

The Dutch electricity market is linked to five neighbouring countries. In the next ten years, interconnection capacity is expected to double from 5.55 GW in 2016 to 10.8 GW in 2025. Key projects in this regard include laying the COBRA cable to Denmark, for 0.7 GW (fully operational by the end of 2020) and an increase in the interconnection capacity with Belgium from 2 GW to 3.4 GW.

A new, large-scale nitrogen plant will be constructed to improve Dutch gas transmission and distribution infrastructure, which will allow five to seven billion m^3 of high-calorific gas to be converted into low-calorific gas each year. The government took the decision to construct the nitrogen plant at the end of March 2018, to allow the decrease in production from the Groningen field to be compensated by importing high-calorific gas. The plan is for the plant to be commissioned in the first quarter of 2022 (Gasunie, 2018).

The energy transition legislative agenda includes the following laws: The Electricity Act 1998 (Elektriciteitswet 1998), the Gas Act (Gaswet), the Heat Act (Warmtewet), the Offshore Wind Energy Act (Wet windenergie op zee) and the Mining Act (Mijnbouwwet). The purpose of this legislative agenda is to prepare these acts for the transition to a low CO_2 energy supply through a series of clear and coherent steps, in which reliability, affordability and security are guaranteed. The Coalition Agreement indicates that the main points of the agreements in the field of climate and energy policy will be embedded in a Climate Agreement.

ii. Regional cooperation in this field

Continuation of existing cooperation through the Pentalateral Energy Forum and the Pentalateral Gas Platform. See Chapter 1.4

iii. If applicable, financing measures in this area at a national level, including European Union support and the use of EU funds

Not applicable.

3.4.3 Market integration

i. Policy and measures related to the elements in point 2.4.3

We recognise the need for greater flexibility in relation to a further increase of intermittent sources in the electricity system. The Netherlands will organise market regulation in the coming years via the legislative agenda, so that flexibility (also for small consumers) can be increased even further and small consumers get better access to the market and are rewarded in accordance with the market. To this end small consumers could be supplied with an aggregator. The Netherlands will focus on rolling out smart meters (target: 80% by 2020) to allow consumers to respond to real-time prices

more effectively.95

Dynamic tariffs are becoming increasingly popular on the retail market as well. There is already a high degree of flexibility in the system, thanks, for example, to large-scale consumers, which are flexible and can respond to real-time prices by connecting, calibrating or disconnecting, and parties with storage assets that offer them on the different markets. With the Top Sector Energy (TSE), systems integration and flexibility are increasingly coming under the spotlight and attracting financial support for research (innovation). What's more, the TSO is running diverse pilots using bundled/aggregated storage of small-scale storage equipment, such as home batteries and electric cars.

The Independent Grid Management Act (Wet Onafhankelijk Netbeheer) guarantees the independence of grid operation, to facilitate fair competition on supply and wholesale markets and to enhance the systems' reliability. Competition between various providers on the energy market benefits the degree of affordability.

In addition, the system of "programme responsibility" or balance responsibility ensures that suppliers and consumers themselves maintain the balance of supply and demand on the energy market. They receive an economic incentive to implement the deliveries and purchases agreed. This system, combined with an effective and efficient market-based imbalance market, guarantees the balance of the system. As such, this system will continue to form the basis of the Dutch market design. Moreover, the Dutch market system has no regulated price ceilings and the technical price limits for the imbalance market are so high that they ensure market parties are optimally encouraged to remain in balance. External studies recognise that this leaves the Netherlands with a highly effective and efficient market system for electricity.96

ii. Measures to increase the flexibility of the energy system with regard to renewable energy generation

A number of areas of improvement have been identified in this area, but the obstacles to the measures referred to here are generally minor. The most significant measure to make the energy system more flexible involves amending the regulatory framework in the proposed legislative agenda.

We recognise the need for greater flexibility in relation to a further increase of intermittent sources in the electricity system. We will organise market regulation in the coming years via our legislative agenda, so that flexibility (also for small consumers) can be increased further and small consumers get better access to the market and are rewarded in accordance with the market. To this end, small consumers get better access to the short-term electricity market and are supplied with an aggregator. This is pursuant to the new Electricity Directive. The possibility of two meters for a single connection currently already exists and allows multiple suppliers to provide a variety of services.97

Dynamic tariffs are expected to become increasingly popular on the retail market; the relevant legislation is not an obstacle in this regard. The system already offers a high degree of flexibility, but this is not earmarked as such (bulk users that are flexible already respond to real-time prices and use their assets to bid on the various markets, but this is not measured separately; this is inherent to the market). Within the Top Sector Energy (TSE), system integration and flexibility are increasingly coming under the spotlight and attracting financial support for research (innovation), as in the case of seasonal storage and conversion.

iii. Measures to ensure non-discriminatory participation of energy from renewable sources, demand response and storage, in all energy markets

There is no discrimination regarding the participation of energy from renewable sources. Priority access and dispatching/redispatching of these sources is determined by law, in accordance with European obligations.

95 Stimulating Renewable Energy Production - Parliamentary document 31 239, no. 263.
96 Frontier Economics (2015) Scenarios for the Dutch electricity supply system; IEA (2014) Energy policies of IEA.
97 Legislative agenda, Parliamentary document II, 2017-2018, 30 196, no. 566.

iv. Policy and measures to protect consumers and to improve the competitiveness and competitive pressure of the energy market

In general, the Dutch government strives to establish frameworks for the electricity market that encourage fair competition between market parties and do not discriminate against any one party, including parties that offer renewable energy, demand response and storage, including through aggregation. The regulatory authority monitors developments on the small consumer market on an annual basis. The Dutch retail market is highly competitive with relatively high switch percentages (16%). Last year, some 1.3 million households switched to a new supplier. A supply licence must be requested to supply small consumers. The NRA monitors these licences. The licence obligations are regulated, for example, by Chapter 8 of the Electricity Act 1998 and include an assessment of how reasonable the tariffs are. Since mid-2018, 59 providers operate on the Dutch retail market with a licence to supply electricity and/or gas to small consumers.

Dutch consumers are also protected against disconnection in the winter months and in the event a supplier goes bankrupt. As described above, the Netherlands has a licence system for supplying energy to small consumers. If a supply licence is revoked, for example, due to bankruptcy, the customers of the supplier concerned would theoretically have to be disconnected immediately if they had not taken any action themselves. After all, these customers would no longer have a valid supply contract because they may only be supplied by a licence holder. In practice, these types of quick disconnections are socially undesirable. Therefore, first and foremost, rules and regulations on this matter include the possibility for the licence holder to sell part or the entire customer base to one or more other licence holders prior to the actual withdrawal of the supply licence. If the licence holder is unsuccessful, in part or otherwise, the remaining small consumers who stand to lose their provider upon the withdrawal of the supply licence will be divided between the other licensed providers. As such, all providers who supply small consumers on the market collectively function as an emergency supplier. This scheme applies both to electricity98 and to gas99. The national grid operators for electricity (TenneT) and gas (GTS) respectively play a major and coordinating role in this regard.

v. Description of measures to enable and develop demand response, including those that support dynamic pricing

We recognise the need for greater flexibility, including through demand response, in relation to a further increase of intermittent sources in the electricity system. The Netherlands will organise market regulation in the coming years via the legislative agenda, so that demand response (also for small consumers) can be increased even further and small consumers get better access to the market and are rewarded in accordance with the market. To this end small consumers could be supplied with an aggregator. The Netherlands will continue rolling out smart meters, to allow consumers to respond more effectively to real-time prices. Dynamic tariffs are expected to become increasingly popular on the retail market; the legislation is not an obstacle in this regard.100

3.4.4 Energy poverty

A fair sharing of the burden

Citizens and companies are confronted in various ways with the burdens and benefits that come from energy and climate policy. Citizens can observe the effects if they take measures in their house or when purchasing a car. They notice the effects of increased or reduced energy and car taxes or, if they make use of subsidies. Indirectly, they notice the effects through charges passed on in product prices of the costs that companies incur and the required tax revenue for the purpose of paying out subsidies. For many companies, the emission of CO_2, due to pricing both nationally and via the ETS, becomes more expensive. On the other hand, the option of clean technology, encouraged by subsidies, is made more appealing.

Climate policy is accompanied by burdens for citizens and businesses. The government wants the transition to be feasible and affordable for everyone. This begins with keeping the total costs of the transition as low as possible. The national costs do not provide insight into which costs are borne by whom or demonstrate the ultimate burden implications.

98 Security of Supply for Electricity Decree, Bulletin of Acts and Decrees 2006, 104.
99 Security of Supply for Gas Act Decree, Bulletin of Acts and Decrees 2004, 170.
100 Stimulating Renewable Energy Production - Parliamentary document 31 239, no. 263.

When analysing the draft climate agreement, the CPB provided the first comprehensive insight into the burden implications (collective and non-EMU relevant costs) and the income implications of the total climate and energy policy for households based on all the policy instruments used. This analysis revealed that the main driver of the rise in burdens (including collective) as a result of climate and energy policy is caused by the increasing ODE (Surcharge for Sustainable Energy) tax for citizens and companies, used to fund the subsidisation of CO_2-reducing techniques.

In order to achieve a fair distribution of burdens between citizens and businesses, the government has opted to take measures that spare households in relative terms compared to businesses. From 1 January 2020, the distribution of the Surcharge for Sustainable Energy (ODE) will be adjusted from 50/50 to one third/two thirds, in favour of households. As a result, companies will contribute more to the subsidies for sustainability than in the past. With the design of the ODE sliding-scale, companies with relatively low consumption are relatively spared. It usually concerns SMEs with an energy consumption up to the first and second brackets of the energy tax.
Due to the measures, the larger business community will bear a greater share of the burden of energy and climate policy. At the same time, the government does not want business and jobs to disappear from the Netherlands without global CO_2 reduction being achieved (due to "leakage" of activities and therefore of CO_2 abroad). The national CO_2 levy for industry is designed as a sensible levy by applying the levy to the avoidable part of the CO_2 emission. This achieves a balance between reaching the target in the industry and maintaining an attractive business climate, in which industry can become the most CO_2 efficient in Europe.

Income implications for households

The income implications for households resulting from climate policy are limited, but if policy were to remain unchanged, they would follow a negative trajectory, as the CPB analysis revealed in March 2019. In response to the CPB analysis of the budgetary effects, the burden and income implications and the burden sharing of the draft Climate Agreement, the government has taken a number of measures that relate to an adjustment in the burden sharing of energy and climate policy. As a result of the ODE sliding-scale, the burden sharing between households and companies in the ODE has been adjusted in favour of households. This provides a substantial reduction in the burden on households compared to the previous analysis by the CPB. Household burdens are further limited by a higher tax reduction on the energy bill. The government is structurally allocating funds for this purpose. The reduction in the tax component of the energy bill is designed in such a way that the lowest income groups benefit most. With the announced measures, the tax component of the energy bill for a household with average consumption[101] decreases by 100 euros in 2020 compared to 2019, the tax component of the energy bill does not rise in 2021 and the increase after 2021 is limited. Measures in the mobility sphere have also been adjusted. Anyone who is currently unable or unwilling to make the transition to an electric vehicle will not end up paying for this incentive.

The government examines the development of the purchasing power of households every year in August. In the event there are major policy changes, attention is paid to income implications (including partial) resulting from policy. Insofar as this concerns climate policy, this will (also) be reported in the Climate Memorandum.

[101] 1,179 m^3 natural gas and 2,525 kWh electricity (in accordance with the Analysis of energy bill development (PBL), 18 March 2019).

3.5 Research, innovation and competitiveness dimension

i. Policy and measures related to the elements in point 2.5

Policy approach to innovation

The Dutch government encourages innovation both in generic and in specific terms. The generic pathway of Dutch business policy is aimed at entrepreneurs by stimulating innovation, reducing regulatory and administrative burden, increasing access to capital market funding, good public services for businesses and fiscal and other support for entrepreneurs. This is achieved, for example, through tax measures such as the Research and Development (Promotion) Act (Wet bevordering speur- en ontwikkelingswerk, WBSO), Innovatiebox and innovation credit.

Specific innovation policy focuses on nine top sectors. As described in section 2.5, the focus of the top sectors has shifted to the economic opportunities of four social themes and key technologies. The essence of the top sector policy is public-private cooperation. The Netherlands has a strong tradition of public-private partnerships, in which the government, the private sector and knowledge institutions work closely together in the "triple helix".[102] [102] Within clusters of companies and knowledge institutions, entrepreneurs, researchers and public authorities collaborate on research & innovation focused on societal challenges, international competition strategies and earning power. The knowledge and innovation agendas drafted on the basis of the formulated missions and the key technologies action plan define the innovation approach and the deployment of resources by research institutes, top sectors, regions and departments. In November a Knowledge and Innovation Agreement will be agreed to this effect, in which public and private funding will be included that will be used in the coming years for the mission-oriented top sectors and innovation policy.

The nine top sectors will work more closely with the mission-oriented top sectors and innovation policy. With regard to climate and energy, the collaboration primarily concerns the top sectors of Energy, the Chemical Industry, Agriculture & Food, High Tech Systems & Materials, Logistics, Water and Creative Industries.

Policies within energy and climate innovation policy

The Climate Agreement and the Integrated Knowledge and Innovation Agenda for climate and energy determine the course and commitment to knowledge and innovation. There are thirteen Multi-annual Mission-oriented Innovation Programmes (MMIPs) that interpret the required multi-annual programmatic approach to knowledge and innovation in order to contribute to the missions in 2050 and specific targets for 2030.

MMIP1 Renewable offshore electricity: the specific objectives for this MMIP are to apply research and innovation to enable the development of 10.6 GW (49 TWh) or more of offshore wind energy by 2030 and between 35 GW (150 TWh) and 75 GW (320 TWh) of renewable offshore electricity by 2050, at the lowest possible social costs. This is a huge leap in scale for which innovation and research are indispensable. The challenge for the electricity sector is to reduce CO_2 emissions by at least 20.2 Mton in 2030. To achieve these targets, the focus will be on resolving a number of bottlenecks that will be elaborated in sub-programmes: 1. Cost reduction and optimisation (secure and affordable upscaling); 2. Integration in the energy system (including storage and conversion); 3. Integration in the environment (ecology and multi-use)

MMIP 2 Renewable electricity generation on land and in the built-up environment: The target for this MMIP amounts to generating at least 42 TWh by 2030. Strong further growth is expected for the period up to 2050 and beyond. Generation must take place at the lowest possible cost (30 to 60 euros/MWh by 2030 with a goal of 20 euros/MWh by 2050), and on the basis of optimum spatial, ecological and functional integration of the system in its environment. The sub-programmes that will be developed for this MMIP are: 1. Human Capital Agenda (training enough highly-skilled personnel at all levels); 2. Space and ecology (combining electricity generation and preserving or improving spatial and ecological quality); 3. Implementation and innovation (large-scale implementation of currently available technologies, their continued development and making new technologies available); 4.Sustainability and circularity (from renewable to fully sustainable); 5. Incentives (public and private funding and appropriate incentive instruments).

MMIP 3 Accelerating energy renovation in the built-up environment:CO_2 emissions from the built-up environment must be reduced by 3.4 Mton by 2030 compared with 1990. The challenge is to transform more than 7 million homes and 570,000 non-residential

[102] http://mission-innovation.net/participating-countries/netherlands/.

buildings by 2050 into well-insulated properties that are heated with renewable heat and in which clean electricity is consumed/generated. To achieve this mission, technical, process-based and social innovations are needed. This will be pursued via the following three aspects: 1. the development of integral renovation concepts; 2. industrialisation and digitisation of the renovation process; 3. placing property owners and users at the centre of energy renovations.

MMIP 4 Renewable heat and cooling in the built-up environment (including greenhouse horticulture): The mission involved in this MMIP focuses on developing an appealing alternative to natural-gas free, with the following intermediate targets by 2030: 1.5 million existing homes and 15% of non-residential and social real estate natural gas-free, making the heat demand more sustainable for greenhouse horticulture using geothermal energy, seasonal storage and low temperature sources (1 Mton CO_2 saving in 2030). These targets should collectively achieve CO_2 savings of 3.5 Mton by 2030. By 2050, the built-up environment must be completely CO_2-free and no longer use fossil fuels to heat buildings. The following sub-programmes have been formulated to achieve these targets: 1. Silent, compact, smart, cost-efficient heat pumps; 2. Delivery, ventilation and tap water systems; 3. Smart compact heat-battery; 4. Renewable heat grids; 5. Large-scale thermal storage; 6. Geothermal energy; 7. Low temperature (LT) sources such as aquathermal and solar thermal.

MMIP 5 Electrification of the energy system in the built-up environment: in this MMIP the emphasis lies on the electricity supply in the built-up environment. System innovations are needed to facilitate the distributed generation of electricity, to smooth out peaks and troughs, to better balance supply and demand and to consume electricity more intelligently, through conversion with other energy carriers and infrastructures. The following four sub-programmes have been formulated to bring about these system innovations; 1. Smart energy consumption in/between buildings and their users; 2. Flexibility of/for the energy system (in the built-up environment); 3. System design for the electricity system in the built-up environment; 4. Trade in/exchange of energy in the built-up environment.

MMIP 6 Closing industrial chains: in 2050, raw materials, products and processes in industry are net climate neutral and at least 80% circular. In 2030, 50 percent fewer primary raw materials are consumed in the Netherlands and greenhouse gas emissions from production processes and the waste sector are reduced to approximately 36 Mton of CO_2 equivalent. The aim is also to use CCS in a cost-effective way, to ensure that sustainable hydrogen production is on its way to implementation and to make bio-based raw materials the norm. The following five sub-programmes have been established to achieve this: 1. Circular plastics; 2. Bio-based raw materials for products and transport fuels; 3. CCU (Carbon Capture and Usage - the use of CO_2 as a raw material); 4. Circular non-ferrous metals; 5. CCS

MMIP 7 A CO_2 free industrial heat system: in 2030, power-to-heat solutions and the use of renewable heat sources result in an emission reduction of at least 5.3 Mton CO_2 and energy savings of 93 petajoules. This means the industrial heat system is sustainable up to 300°C, in particular through efficiency and heat reuse and storage, and through the roll-out of ultra-deep geothermal energy. The goal for 2050 is to make the heat supply completely CO_2-free for all temperature levels. Consequently the demand for heat is drastically reduced through the application of efficient processes and is achieved using renewable sources. The following sub-programmes have been formulated to achieve these targets:
1. Maximising process-efficiency; 2. Heat reuse, upgrading and storage; 3. Deep and ultra-deep geothermal energy for industry; 4. The application of climate-neutral fuels; 5. System concepts for heating and cooling.

MMIP 8 Electrification and radically renewed processes: this MMIP strives for the following five goals focusing on five sub-programmes; 1. Production of hydrogen, molecules and innovative renewable fuels: investment costs for large-scale water electrolysis have fallen to €350/kW by 2030, bringing a hydrogen price of €2/kg in 2030 and €1/ kg in 2050 within reach; 2. Electrical appliances and electric-powered processes: cost-effective electrochemical production processes for basic chemicals and fuels have been developed by 2030 and are ready for upscaling to bulk processes; energy-efficient electric-powered processes are standard technology by 2025; 3. Increased flexibility and digitisation: process digitisation is accepted as best practice and widely rolled out by 2025; 4. (Radically) renewed processes: at least three radical breakthroughs in CO_2-intensive processes have been proven at the pilot level. 5. Social implications of industrial electrification: by 2050, production processes will also be fully climate neutral and optimally electrified.

MMIP 9 Innovative propulsion and use of sustainable energy carriers for mobility and MMIP10 Efficient transport movements for people and goods: MMIP 9 and 10 must jointly ensure that the climate targets for mobility are within reach[103] by accelerating the development of and

[103] Reduce CO_2 emissions to no more than 25 Mton (7 Mton lower than at present) and to virtually zero by 2050.

scaling sustainable mobility solutions and optimising solutions in relation to the overall mobility system. Furthermore, it must stimulate economic green growth and future-proof employment by; 1. connecting to proven expertise from the Dutch business community and knowledge institutions; 2. by focusing on areas in which a market is still under development worldwide; 3. by connecting to other mobility functions in the Dutch economy, for example, with regard to the trade and production of fuels. Lastly, these MMIPs must connect the climate challenge to other social challenges within mobility, including security, health and accessibility. The related sub-programmes formulated to achieve this are; 9.1. Zero-emission propulsion technology and vehicles; 9.2. Energy distribution for electric vehicles and vessels; 9.3. Distribution of hydrogen and other energy carriers for fuel cell vehicles and vessels; 9.4. Distribution and use of renewable fuels containing carbon; 9.5. energy-efficient vehicles. 10.1 Knowing what moves people; 10.2 CO_2 reduction through new mobility concepts for passenger transport; 10.3 CO_2 reduction through innovations in logistics; 10.4 Knowledge and tools to support the transition (public perspective) for adaptive programming.

MMIP 11 Climate-neutral production of food and non-food: The target related to MMIP 11 is to optimally reduce greenhouse gas emissions produced by the agriculture and land-use sector. For 2030 this means that all current technical options have been implemented and for 2050 that technical potential is available to reduce rumen fermentation by 95% and that housing and storage no longer produce methane emissions. There is a reduction target for nitrous oxide emissions amounting to a reduction of 0.3 Mton of nitrous oxide emissions by 2050. The focus is on two themes, which are: 1. emission reduction in soil and land use (nitrous oxide and peat meadows); 2. emission reduction for livestock farming (rumen fermentation and manure storage).

MMIP 12 Land and water optimally designed for CO_2 capture and use: In addition to an increasing demand for food and animal feed, the demand for biomass as a raw material and biofuels will increase, as will the capture of carbon in nature. This contributes to emission reductions in agriculture and other sectors. In this MMIP, knowledge and innovation are applied to design land and water for the purpose of increasing biomass production. This objective entails a large number of significant knowledge and innovation tasks. The following sub-goals have been formulated: the development of Blue Space for large-scale, profitable and sustainable seaweed production in 2050; Biomass cultivation with doubled photosynthesis in 2050; Consumer biomass carbon footprint halves in 2050 as a result of purchasing choices; 50% of the protein supply for human consumption will consist of (possibly new) plant-based sources in 2050; Climate-proof nature captures more CO_2 every year, while preserving biodiversity, and increasing biomass harvest in 2050; An energy consumption reduction to zero emissions in 2030 and generation of 100 petajoules in 2050 by scaling-down initial post-harvest treatments.

MMIP 13 A robust and socially supported energy system: we are on the verge of an energy transition that requires a transition process that makes it possible to take adequate, high-quality and efficient decisions from a system perspective, and to implement the design and operation of an affordable and accepted energy system. The level of reliability, security of supply and safety must remain the same as the current level. MMIP 13 develops knowledge and innovation to ensure this is achieved. The six sub-programmes of this MMIP focus on various aspects of the challenge related to the integrated energy system challenge, and concern the following; 1. Knowledge and integrated decision-making; 2. Inclusive energy transition; 3. Integrated energy infrastructure; 4. Flexible energy markets; 5. Storage and conversion; 6. Operational management and digitisation.

Implementation

Implementation of the MMIPs is scheduled to begin in 2020. Incidentally, this does not mean starting from scratch, but building (at least in part) on efforts that were previously set in motion primarily with the Top Sector Energy Policy and energy innovation policy. When implementing the MMIPs, it is important that the research and innovation subsidy schemes (including for energy) are devoted as much as possible to facilitating the MMIPs and

[103] Reducing CO_2 emissions to a maximum of 25 Mton (7 Mton lower than the current situation) and reducing them to practically zero by 2050.

are mutually reinforcing or can naturally overlap. The focus is on facilitating programmes/sub-programmes more than in the past instead of individual innovative projects, involving the users or buyers of the innovation more closely and earlier, as well as shaping the interaction with other transition and implementation policies. After all, to get innovations effectively implemented and scaled up in the market, it is important that the right incentives for this are available. In addition, setting specific preconditions can stimulate innovation without the need for a subsidy scheme. This requires close interdepartmental cooperation, with and between the various knowledge institutions and the business community, but certainly also international cooperation. By focusing on the MMIPs, the Netherlands contributes to the challenge in the SET plan and the underlying implementation plans, the Innovation Challenges within Mission Innovation and the Technology Collaboration Programmes of the IEA.

The government's efforts will focus on building up and boosting the required innovation ecosystems. In addition, the financial subsidy support from climate and energy innovation policy will primarily focus on system innovations that the market cannot generate on its own. Examples include flexibility of the energy system, among other things through the storage and conversion of renewable energy, as well as ecological and spatial integration issues of large-scale electricity generation.

Policy approach to the labour market, training, employment in relation to the transition

The transition has an impact on the labour market. Tens of thousands of extra employees will be needed in the manufacturing industry, by grid operators and energy companies, in the installation and maintenance sector, in the chemical industry and at construction companies. In the traditional industries on the other hand, others may be at risk of losing their jobs. The nature of many current jobs will also change, which means that other skills and thus future-oriented development will be needed. Close cooperation between the organisations involved is needed to increase the number of well-qualified employees and to make the energy transition more inclusive.

On the basis of their models, the CPB and PBL estimate that the overall climate and energy policy has a limited effect on the supply of labour or the total demand for employees. On balance, climate policy does not lead to an increase in the demand for labour, nor does it trigger an extra supply of labour.[104] In the longer term, employment effects on climate and energy policy are estimated to be marginal. There will, however, be shifts in employment, which may also be accompanied by tension on the labour market (temporary shortages). In addition, the policy is accompanied by transition effects. The demand for labour is decreasing in fossil-oriented sectors and is increasing in sustainability-oriented sectors. The extent of the transition effects depends on the extent to which workers and companies adapt to changing circumstances. If such adjustments were not made at all, according to a so-called "matching model" used by the PBL, the demand for labour would increase by 1 to 2% more in 2030 than in the absence of climate policy.[105] The PBL expects that the demand for labour will increase in all provinces, but that the extent to which this occurs will vary considerably per province.

Employees and businesses alike will have to respond to changes on the labour market. A share of the current workforce will have to retrain or upskill. Not only professional knowledge is important, but also the ability to adapt to new tasks in a sector that will continue to develop. Boosting the labour market and education policy, as formulated in the advice issued by the Social and Economic Council (SER) in 2018,[106] is an important pillar for achieving a successful transition to a sustainable economy and is necessary for capitalising on opportunities for the economy and employment, and for absorbing social risks such as job losses in fossil-oriented sectors. In a recent recommendation, the SER states that considerable efforts (including policy efforts) will be needed to prevent this transition from stagnating due to a shortage of qualified personnel.[107] In the context of the Climate Agreement, agreements have been made to establish sectoral educational and labour market agendas. The SER advocates for efforts to develop a proactive labour market policy with sufficient training facilities in the regions. It is obvious that special attention should be devoted to the regions in which the five industrial clusters are located. There are already shortages in the manufacturing industry as well as in the installation and maintenance sector of well-trained personnel. The Labour Market and Training section of the Climate Agreement describes in detail the initiatives aimed at strengthening the labour market and training policy.[108]

First of all, it is necessary to attract more people, with appealing jobs, good working conditions and prospects for career progression and employment. The government and government organisations, including the UWV (Employee Insurance Agency), provide the necessary preconditions to ensure that workers and job seekers, including people with a disadvantage on the labour market, are able to take control of their life and work. This certainly also applies to workers who see their duties/job change. Secondly, for the sake of productivity and high quality of work, it is important that current and future workers and companies continue to develop much more than they do now through responsive, tailor-made learning, in close collaboration with the business community, the authorities and trade unions. Finally, it is necessary to use targeted technological and social innovation to increase productivity and organise work in a smarter way around the available manpower.

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104 Netherlands Bureau for Economic Policy Analysis (CPB) (2019). Draft Climate Agreement analysis.

105 Netherlands Environmental Assessment Agency (PBL) (2018). Effects of the energy transition on the regional labour market - a quick scan.

106 SER (2018) Energy transition and employment. Opportunities for a sustainable future.

107 SER (2019) National climate approach for regional industrial leaders.

108 Climate Agreement (2019)

For the longer term, it is important that all pupils, including those in primary education, receive the right knowledge and skills to be able to cope well with major social transitions, such as the energy transition. This requires a curriculum that prepares pupils accordingly.

In the context of the Climate Agreement, it has been agreed that a special committee will be set up in the SER that will take an integrated approach towards consideration of the labour market and training issues. The SER will promote and connect national, regional and sectoral initiatives and facilitate the development of sectoral training and labour market agendas. It has been agreed in the Climate Agreement that sectoral education and labour market agendas will be developed (and updated periodically) to include an implementation agenda for the coming five years and an action agenda for the coming year. Depending on the nature and scope of the tasks and the existing sectoral agreements and structures, the approach and the level of ambition may differ per sector.
To address the employment effects of the energy transition, the government is creating a facility for employment effects of the energy transition; it is intended to provide "from-work-to-work" guidance and upskilling and reskilling. The government has reserved €22 million for this up to and including 2030, of which €11 million is for the period up to 2024.[109]

ii. Cooperation with other Member States in this area, including information on how the SET plan objectives and policies are being translated to a national context

In terms of energy innovation, especially for a relatively small country like the Netherlands, establishing close cooperation on the international playing field is crucial. This can strengthen the knowledge base, lead to economies of scale, accelerate the innovation process and provide economic opportunities. In addition, it may be attractive to apply any innovations that have been developed abroad first, as a testing ground. By collaborating (or reinforcing collaboration) on a number of strategically chosen subjects at an international level, we will be able to realise our ambitions in the field of energy and climate change in a cost-effective manner, strengthen our knowledge base and competitive position and give prominence to Dutch solutions in a highly globalised energy market. The starting point for this international cooperation is the Climate Agreement, the associated Integrated Knowledge and Innovation Agenda for climate and energy and the 13 Multi-annual Mission-oriented Innovation Programmes that have been elaborated.
The Netherlands participates in targeted partnerships on energy innovation at an international level, including through the European Strategic Energy & Technology (SET) plan, the European Research Area network and Horizon 2020, the International Energy Agency, Mission Innovation and the Clean Energy Ministerial. This ensures the climate and energy innovation policy contributes to the missions and objectives in the national Climate Agreement and the energy and climate targets at EU level.[110] The following table shows how the MMIPs contribute to efforts at the international level, including the Implementation Plans of the SET plan. In general, the Netherlands is involved in all IWGs with Dutch representation, but with regard to Consumers, Concentrated Solar Power, Ocean Energy and Batteries & e-mobility, the Netherlands does not participate with its own budget. With regard to Mission Innovation, the Netherlands has not joined the Converting Sunlight, Clean Energy Materials and Smart Grids challenges.

[109] Letter to Parliament on the employment implications of the bill to ban coal in electricity generation of 13 June 2019 – Parliamentary document 35167 no. 7.
110 Letter to Parliament, "State of affairs related to activities in the field of energy innovation" (30 September 2016).

Schematic overview of interfaces with MMIPs with international connections

Multi-annual Mission-oriented Innovation programmes (MMIPs)	SET Plan (IWGs)	European Research Area Network (ERA-NET)	Mission Innovation (ICs)	Technology Collaboration Programmes (IEA - TCPs)
1. Renewable electricity offshore	Offshore Wind	Demowind I and II Ocean Eranet		Wind TCP
2. Renewable electricity generation on land and in the built-up environment	Smart Cities, Solar PV, Consumers, Energy Efficiency for Buildings	ERA-Net Solar and ERA-Net Solar Co-Fund	Converting Sunlight	PVPS and Building and Communities, Smart Grids (ISGAN TCP), DSM (TCP)
3. Acceleration of energy renovation in the built-up environment	Energy Efficiency for Buildings		Clean Energy Materials, Smart Grids	Building and Communities
4. Renewable heat (and cooling) in the built-up environment	Geothermal	Geothermal / Geothermica ERA-net Biomass Sustaining the Future BESTF II and BESTFIII ERA-Net Co-Funds	Affordable Heating and Cooling of Buildings	Heat Pump Technologies, Geothermal
5. The new energy system in the built-up environment in balance	Energy Systems		Smart Grids	Energy Storage through Energy Conservation, Smart Grids
6. Closing industrial chains	CCUS	ACT ("Accelerating CCS Technologies")	Carbon Capture	
7. A 100% CO2-free industrial heat system	Industrial Energy Efficiency			Industrial Energy Technology and Systems
8. Maximum electrification and radically renewed processes			Renewable Clean Hydrogen	Hydrogen
9. Innovative transmission and use of sustainable energy carriers for mobility	Bioenergy and Renewable Fuels for Transport	Electric Mobility Europe ERA-Net Co-Fund Electromobility + ERA-Net	Sustainable Biofuels	Bioenergy
10. Targeted transport movements for people and goods		Electric Mobility Europe ERA-NetCo-Fund/ Electromobility + ERA-Net		Hybrid and Electric Vehicles
11. Climate-neutral production of food and non-food	Biofuels		Sustainable Biofuels	Bioenergy
12. Land and water optimally designed for CO2 capture and use	Biofuels		Sustainable Biofuels	Bioenergy
13. A robust and socially supported energy system	all			Energy Storage through Energy Conservation

Cooperating with European Member States

Strategy Energy and Technology Plan[111]

The Netherlands is actively involved in the implementation of the identified activities of the implementation plans of the various working groups of the SET plan of the Energy Union. For example, the Netherlands chairs the working group on the theme of offshore wind energy. After all, offshore wind energy plays an important role in achieving the targets in the Climate Agreement. The Netherlands is one of the leaders in the field of offshore wind energy and is highly ambitious within the framework of the national Climate Agreement. In addition, the Netherlands plays a leading role in the strengthened international collaboration on the North Sea and shares the Presidency of the CCUS working group with Norway. This allows the Netherlands to help direct and supervise the activities that are crucial to the ongoing development of CCUS and provide concrete projects from Dutch research institutes and businesses. In addition, the Netherlands takes part in all SET IWGs with the exception of Consumers, Concentrated Solar Power, Ocean Energy and Batteries & e-mobility, as mentioned above.

In this way, the Netherlands' focus within the context of the SET plan aligns effectively with the national focus in the IKIA and the MMIPs. Within the occasionally broader SET plan programmes as well, the focus of the Netherlands is on comparable priorities.
Within the SET programme on energy efficiency in industry, for example, the Netherlands' participation is mainly focused on alternative, more sustainable high-temperature processes (through the electrification of processes, new separation processes and new processes for the steel industry, such as Hisarna). Within the programme, the Netherlands additionally focuses on HT heat recovery techniques and systems.

The Netherlands does not have a separate subsidy pot for the SET plan or other international cooperation partnerships. We do, however, actively promote SET topics in the ERA-net co-fund context (for example ACT and Solar). The Dutch schemes are also open to foreign participants (company or knowledge institution), provided that the activities benefit the Dutch economy or other Dutch interests. Furthermore, companies must have a permanent base or a subsidiary in the Netherlands.

European Research Area Network (ERA-NET)

The Netherlands also takes part in the networks of the European Research Area Network (ERA-NET). The ERA-NETs serve to coordinate the research programmes within the individual Member States and to encourage collaboration between national research councils and research funding agencies. The principal activity of the ERA-NETs is usually the organisation of joint calls for research proposals. In addition to the above-mentioned networks in which the Netherlands participates, as included in the above table, the Netherlands is also part of the Eco Innovera ERA-Net.

Other international cooperation

Mission Innovation[112]

Through Mission Innovation, the Netherlands works alongside a group of 23 other leading industrialised nations and the European Commission to accelerate energy innovation by striving to double public investment in energy innovation in the period leading up to and including 2020. Accordingly, Mission Innovation contributes to the realisation of the agreements of the Paris Climate Agreement. With the financial impulse from the current government of 300 million euros per year up to and including 2030 for the climate, the Netherlands has satisfied its commitment to doubling public investment as of 1 January 2019[113].

Participation in Mission Innovation provides opportunities for Dutch research institutes and businesses to attract additional private funding for energy innovation. The Netherlands is deliberately focusing on a number of innovation challenges that

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111 Letter to Parliament, “State of affairs related to activities in the field of energy innovation” (30 September 2016).

112 For the Dutch commitment to Mission Innovation, see: http://mission-innovation.net/participating-countries/Netherlands/and the Letter to Parliament "State of affairs related to activities in the field of energy innovation" (30 September 2016) and "Dutch participation in Mission Innovation" (26 May 2016).

113 As a baseline for its participation in Mission Innovation, the Netherlands has boosted 100 million euros in RD&D spending on average per year with an effort to double this commitment by 2020. With spending in 2018, this has risen to 205 million euros.

align with its national commitments. These concern the innovation challenges related to Heating & Cooling, Sustainable Biofuels, Carbon Capture and Off-grid access to electricity. In the spring of 2018, the Netherlands also joined the new innovation challenge in the field of hydrogen.
The amounts for public-private investments are shown in the table below. These figures specifically concern MI-related RD&D.

Technology	MI Baseline (local currency)	MI First-year RD&D Spending (local currency)	MI Second-year RD&D Spending (local currency)	MI Third-year RD&D Spending (local currency)
Time period covered (month/year) e.g. Jan 2015 to Dec 2018		2016	2017	2018
Units e.g. thousand € or million Yen	€ mln	€ mln	€ mln	€ mln
TOTAL BUDGET	118.1	168.0	192.9	242.0
Total private investments (estimated range)	71-87	119-145	174-212	171-209
% private investments	**40%**	**44%**	**50%**	**44%**
Total private investments	**79**	**132**	**193**	**190**

Public-private investments in Mission Innovation related energy RD&D (RVO, 2019)

International Energy Agency

The Netherlands is active within the IEA and the technology network and participates in half of the Technology Collaboration Programmes (TCPs) (20 out of 38). A TCP supports the work of an independent international group of experts, who in turn help governments and companies to manage energy technology programmes and projects and related topics. Through this collaboration, these experts work on promoting research, development and bringing energy technologies to the market. The Netherlands participates in the following TCPs: Buildings and Communities (EBC TCP), Energy Efficient End-Use Equipment (4E TCP), Energy Storage (ECES TCP), Heat Pumping Technologies (HPT TCP), Demand-Side Management (DSM TCP), Smart Grids (ISGAN TCP), Industrial Energy-Related Technologies and Systems (IETS TCP), Hybrid and Electric Vehicles (HEV TCP), Bioenergy TCP, Hydrogen TCP, Ocean Energy Systems (OES TCP), Photovoltaic Power Systems (PVPS TCP), Solar Heating and Cooling (SHC TCP), Wind Energy Systems (Wind TCP), Gas and Oil Technologies (GOTCP), Greenhouse Gas R&D (GHG TCP), Fusion power, Nuclear Technology of Fusion Reactors (NTFR TCP), Stellarator-Heliotron Concept (SH TCP), Energy Technology Systems Analysis (ETSAP TCP).

iii. Financing measures in this area at national level, including European Union support and the use of European Union funds

The Netherlands' commitment to innovation consists of both a specific and a generic approach. Below is an outline of the schemes that can be used for energy and climate innovations.

Generic innovation schemes

Future Fund

This fund makes funding available for innovative and fast-growing SMEs and for fundamental and applied research that will also benefit future generations; through the co-financing of investments in R&D and innovation, the facilitation of access to and funding of (risk) capital for businesses and the co-financing of European and international partnerships in the field of research and innovation. This fund includes:

- Innovation credit
- The Seed Capital Scheme
- Dutch Venture Initiative (DVI-I and II)
- Early-stage Funding (VFF)
- Co-investment venture capital instrument/EIF
- Start-ups/SMEs
- Smart Industry

- Feasibility studies TO2 innovative start-ups

Innovation Box
A special rate box within corporate income tax. Profits falling within this rate box are taxed at a rate of 7% instead of 25%

R&D tax deduction scheme
A scheme under the Salaries Tax and National Insurance Contributions Reduced Remittances Act (Wet vermindering afdracht loonbelasting en premie volksverzekeringen, WVA). The R&D tax deduction is based on wage costs of employees carrying out research and development work and on other costs and expenditure involved in research and development.

Small Business Innovation Research Programme (SBIR)
SBIR is a flexible procurement method through which the government is able to challenge entrepreneurs to solve specific social issues by means of innovative products and services.

Dutch National Research Agenda (NWA)
An investment programme in innovative and socially relevant research via the 25 routes of the National Research Agenda, allowing knowledge to be developed for scientific breakthroughs and social challenges. The research programme covers all disciplines and focuses on the entire chain of fundamental, applied and practice-oriented research. An additional structural investment was announced in the Coalition Agreement for fundamental and applied research. A share of these extra funds is earmarked for the National Science Agenda: an additional 70 million euros will be available in 2018, rising to 108 million in 2019 and 130 million as of 2020.

Ministry of Economic Affairs and Climate Policy co-financing with Horizon 2020 *for public-private partnerships* (JTI) and innovative SMEs (Eurostars)
Horizon 2020 funds a number of multi-annual programmes in which Member States can participate.
The Ministry of Economic Affairs and Climate Policy co-finances a number of those programmes that focus on top sectors and innovative SMEs.

Boosting Horizon 2020
Alongside the Ministry of Education, Culture and Science, the Ministry of Economic Affairs and Climate Policy coordinates Dutch participation in the European Framework Programme for Research and Innovation. The Netherlands Enterprise Agency (RVO) advises and trains potential participants. In order to lower the participation threshold, public knowledge institutes are given an allowance via the Netherlands Organisation for Scientific Research (NWO) for indirect costs that are not covered.

European Regional Development Fund (ERDF)
The Ministry of Economic Affairs and Climate Policy co-finances EU regional structural funding programmes. The main objectives of the programmes are innovation and the low-carbon economy.

Generic top sector policy
In addition to generic innovation schemes, a number of instruments can be used that are aimed at the nine top sectors in the Netherlands. This concerns the following schemes:

Regional and Top Sector Innovation Incentive Scheme for SMEs (MIT)
This scheme provides incentives for innovative projects by SMEs across the regional borders that are consistent with the innovation agenda of the top sectors. The MIT provides a number of different instruments that entrepreneurs can apply for: knowledge vouchers (€2 mln), feasibility projects (€3.91 mln), R&D partnership projects (€8.2 mln), networking activities and innovation brokers (€2.2 mln).

PPP allowance
The PPP allowance is provided for private contributions for public-private partnerships for research and innovation within the Top Sectors. The TKI applies for the allowance and distributes the funds between the public-private partnerships. Large PPPs may also apply for the allowance directly. For every euro that a company pays in a private R&D contribution to a research organisation, the Ministry of Economic Affairs and Climate adds €0.30 to the PPP allowance. That PPP

allowance must be used for R&D.

Specific energy and climate innovation schemes

Finally, energy and climate innovations can also apply for specific energy and climate schemes. As specified above, these schemes will focus as much as possible on facilitating the MMIPs. This concerns the following schemes:

The tender schemes for the Top Sector Energy/MMIPs *(2019 and beyond)*

The tender schemes for the Top Sector Energy are aimed at stimulating specific issues within the programme lines of the Top Consortia for Knowledge and Innovation (TKIs). These schemes are fine-tuned and adjusted each year. From 2020 onwards, these schemes will focus on the MMIPs that fall under the electricity, industry and built-up environment sectors as well as the overarching system integration theme.

Renewable Energy Scheme (HER)

Funding for cost-reducing innovations that could make it cheaper to generate renewable energy in the future.

Climate technologies and innovations in transport demonstration Scheme (DKTI)

The objective is to challenge NGOs, companies and knowledge institutes to formulate new ideas and solutions to help speed up the transition to ultimately achieve zero emissions in transport and mobility. The scheme thus implements agreements from the Energy Agreement (2014), the Climate Agreement (as of 2019) and the Sustainable Fuel Vision, which set the long-term climate objectives for the transport and mobility sector. The subsidy ceiling and the maximum subsidy in this tender varies per project type, per category of transport mode.

Energy Investment Allowance

Tax deduction for investments that provide energy savings (deduction of up to max. 45% of the investment costs from the taxable profit).

Environmental Investment Rebate (MIA) and the Arbitrary depreciation of environmental investments (VAMIL)

Tax deduction for investments in innovative environmental investments in fields including climate, mobility, agriculture, construction and the circular economy.

Part B
Analytical basis

4 Current situation and forecasts with adopted policy

This Chapter describes the developments in the Netherlands related to the five European energy dimensions based on adopted policy as known on 1 May 2019. The National Climate and Energy Outlook (KEV) published by the Netherlands Environmental Assessment Agency (PBL) in 2019 (PBL, 2019a) is the primary source for this chapter References have been provided where sources other than the KEV have been used. For all other instances, this single reference to the KEV 2019 will suffice.

The final NECP contains an updated overview of the developments compared with the draft NECP from 2018, which was based on the National Energy Outlook from 2017. It includes the latest insights into energy consumption, greenhouse gas emissions, market developments and energy prices. The main differences are discussed in text box 1. The measures and agreements announced by the government in June 2019 in the Climate Agreement do not form part of the adopted policy. The effects of the proposed policy as known from 1 May 2019 and the expected effects of the Climate Agreement are discussed in Chapter 5. This chapter addresses the developments based on the adopted policy[114]. Detailed figures and parameters of this policy variant (with existing measures) can be found in Appendixes 5 and 6.

The KEV describes the achievements (as of 2000) as well as the expected developments in the future (up to and including 2030). Unless otherwise indicated, all figures pertaining to the achievements have been provided by Statistics Netherlands (CBS). The forecasts are based on all relevant data available on 1 May 2019, such as expectations with regard to economic and sectoral developments, technological developments, energy and CO_2 prices, and policies (also see Section 4.1). Figures for the years 2017 and 2018, where available, have been used as the base year for the forecasts. Where possible, more recent information has been referred to in the text and has been incorporated in the diagrams, but was not used in the forecast results. This concerns, for example, the new (preliminary) energy and emission statistics, recent economic developments and energy and CO_2 prices.

The KEV provides the developments in the field of energy and greenhouse gas emissions up to and including 2030, that are considered most plausible. However, the outlined developments contain inherent uncertainties, such as regarding the development of the prices of energy carriers and CO_2 emissions rights, uncertainties on the impact of policies and interaction with foreign energy markets. Therefore, bandwidths that reflect those uncertainties have been provided for the key parameters. The KEV does not provide forecasts for after 2030, because the exogenous and policy uncertainties are so great that a scenario study is more appropriate.

[114] A complete overview is given in the appendix to the KEV of which policy measures have been included as adopted or intended policy https://www.pbl.nl/sites/default/files/downloads/pbl-2019-beleidslijst-kev2019-versie-1-0-november-2019_3843.ods

Text box 1 - Main differences between forecasts in the draft and final NECP

The forecast in the draft NECP with "existing policy" was based on the NEV 2017 with "adopted and proposed policies with no new rounds of the SDE+ scheme after 2019". In the final NECP the forecast in Chapter 4 is based exclusively on adopted policies. The forecast with proposed policies is now discussed separately in Chapter 5. In addition, the forecasts in the KEV assume that the SDE+ will also be available after 2019. This has major consequences for the expected energy mix and emissions in the energy sector after 2020.

In the draft NECP emissions of 170 Mton CO_2 equivalents were expected in 2020, while the final NECP assumes emissions of 177 Mton CO_2 equivalents based exclusively on adopted policies. An important explanation for this is that emissions are higher in almost all sectors with the exception of the energy sector. A general explanation is the higher economic growth assumed in the KEV. In addition, there are various sector-specific explanations. For example, a statistical correction has been applied whereby the emissions from industry are 2.7 Mton CO_2 equivalents higher. In the energy sector, projected emissions are just 6 Mton CO_2 equivalents lower, which is explained by higher fuel and CO_2 prices and the closure of the Hemweg power station. Including proposed policies, emissions of 171 Mton of CO_2 equivalents are projected in the KEV, which roughly corresponds to the forecast in the draft NECP.

For 2030, in the draft NECP projected emissions were 158 Mton of CO_2 equivalents. With adopted policies alone, the KEV projects 151 Mton CO_2 equivalents. In particular, emissions in the energy sector are lower (around 10 Mton CO_2 equivalents). In addition to the above explanations, this difference is explained by the ban on using coal in power plants as of 2030 and because it is assumed that there will be new rounds of the SDE+ grant scheme after 2019. Therefore, the share of renewable energy, at 30-32%, is considerably higher than in the draft NECP (around 15%). The differences between the policy variants with adopted and proposed policies in the KEV are discussed in Chapter 5.

4.1 Factors that influence the energy system and greenhouse gas emissions

This section describes the factors important for the expected development of the energy system and greenhouse gas emissions, such as economic developments and energy prices. It is based on the figures and insights as they were assumed in the KEV 2019. More recent insights and/or figures have not been incorporated.

i. Macroeconomic developments

Demographic and economic developments have a major impact on energy consumption. This section discusses the key developments in the Netherlands.

Population growth is decreasing

At the end of 2018, the population consisted of 17.2 million people (see Table 4.1). The population is expected to increase to 18.0 million people by 2030. Due to the ageing population, the potential workforce has stabilised in recent years. The increase in the retirement age will see the potential workforce increase in the years to come, but gradually decrease after 2025.

Increase in the number of small households

In terms of energy consumption by consumers, the number of households is greater than the size of the population. Larger households have economies of scale in comparison to smaller households, so they consume less energy per person. The average size of households has been decreasing in recent decades and this trend is expected to continue in the future (see Table 4.2). The growth of the number of households is therefore greater than the growth of the population.

Table 4.1 Demographic developments (Sources: situation according to Statistics Netherlands and forecasts by PBL, 2019a)

Situation	Forecasts					
	2000	2010	2018	2020	2025	2030
Population (million)	15.9	16.6	17.2	17.4	17.7	18.0
Potential workforce[115] (in millions)		11.1	11.3	11.5	11.7	11.6
Private households (in millions)	6.8	7.4	7.9	8.0	8.3	8.5
Of which single-person households (in millions)	2.3	2.7	3.0	3.1	3.3	3.5
Average household size	2.3	2.2	2.2	2.1	2.1	2.1

Economic activity has recovered from the crisis

Between 2000 and 2018, the Dutch economy (expressed in gross domestic product, GDP, in 2015 prices) grew by an average of 1.6% a year. The economic recession from the autumn of 2008 has left its mark. GDP shrunk by 2.0% from 2008 to 2013 inclusive. During the crisis, production and investments decreased significantly. Recovery subsequently got underway. In 2014, the economy grew by 1.4%, after which growth rose each year, to 2.6% in 2018 (Statistics Netherlands, 2019a).

At the beginning of the recession in 2008, exports shrunk considerably, but already recovered in 2010 and have not experienced a second dip, as observed in domestic consumption and investments. As a result, initially economic recovery was primarily due to exports. However, from the end of 2014, the recovery of the housing market also had a positive impact on economic growth (expressed in the investments made by households), and as of 2015, private consumption and investments by companies contributed to the economic recovery as well.

Expected lower growth mainly due to modest growth of the workforce

Despite the continued economic recovery, it is expected that average economic growth will not reach the level of the 2000-2008 period until 2030; growth averaged 2.3% a year during this period. It is expected that average growth for 2015-2030 will be 1.8% a year.

It is expected that exports will continue to make a significant contribution to economic growth until 2030. Between 2015 and 2030, the growth of exports will remain roughly two percentage points above economic growth. During this period, the growth of exports is expected to remain slightly behind that of imports. The growth in consumption by private individuals and the government is expected to be lower than the economic growth from 2024 onwards.

ii. Sectoral developments

Sectoral development is decisive for energy consumption

This section broadly discusses sector-specific developments. In general, activities in the services sector require far less energy than activities in industry or agriculture. Nevertheless, there may be significant differences within sectors. Basic industry in the heavy industry sector and greenhouse horticulture in the agricultural sector, for example, are relatively energy-intensive.

The services sector dominates the economy

Currently, over three quarters of GDP is achieved by the services sector (see Figure 4.2). In recent decades, the share of the services sector has increased and, despite a decrease in the pace of its growth, it is likely to continue to increase in the future. Commercial services are mainly responsible for this growth. Budget cuts in healthcare, education and public administration have led to lower average growth in these semi-public sectors. However, growth of the commercial services sector is so high that growth of the services sector as a whole is still above average. Industry was the first to benefit from the economic recovery after the crisis.
This resulted in its share of the Dutch economy initially increasing slightly. Industry's share of GDP is subsequently expected to decrease further after 2020.

[115] The potential workforce consists of all persons aged between 15 years and retirement ("old-age pension") age. No data is available for 2000.

Energy consumption mainly influenced by production

In terms of energy consumption, physical production is important rather than the added value. This section will examine the value of production, expressed in euros. The share of the services sector in production is lower than its share in terms of added value or employment. In 2018, the share of the services sector accounted for around 65% of production (in euros). Industry, which uses a relatively high quantity of materials and semi-manufactured products, has a higher share (in euros) in production than in added value or employment. In 2018, industry's share in production (in euros) was around 21%, and it is expected to stay more or less the same in 2020, to subsequently decrease slightly by 2030.

iii. Global energy trends, international fossil fuel prices, the EU-ETS carbon price

This section discusses the price developments of energy carriers that the Netherlands imports entirely or to a large extent from international markets. This section will also address the development of emission allowance prices in the European ETS. These prices are important exogenous parameters for forecasts related to energy consumption, the energy mix and greenhouse gas emissions.

Global energy trends

Sharp rise in global energy demand

The global energy demand will rise significantly in the decades to come as a result of a growing population, economic development and, most importantly, an increase in the prosperity of developing countries. The International Energy Agency (IEA) assumes an increase of 25% of global energy consumption up to 2040 (IEA, 2018). This growth will largely be observed in India and Southeast Asia. The growth in the demand for energy in OECD countries will, by contrast, stagnate as a result of efficiency improvements, despite economic growth. In Europe, energy demand will even decrease by almost 13%.

Growth of renewable energy generation

The global increase in the demand for energy will primarily be absorbed by investments in energy efficiency and renewable energy. Although fossil fuels will still dominate energy consumption in the decades to come, their importance will continue to decrease. By 2040, the IEA, in its New Policies Scenario, expects a 26% share of renewable energy (IEA, 2018). The use of coal is stagnating. However, the consumption of petroleum products is still gradually increasing, mainly due to growing prosperity in South and Southeast Asia. This shift in demand will lead to a large number of investments being made in the refining sector in non-OECD countries. The use of natural gas, as a relatively clean fuel, is also expected to increase. The implementation of the Paris Agreement will see the consumption of fossil energy carriers continue to decline.

International prices of energy carriers

For fossil energy carriers, petroleum, natural gas and coal, prices on the global and regional markets have started to rise again after a sharp decrease from 2016 onwards, influenced by improved economic growth. For the short term, the KEV is based on the futures markets, while the projections of the International Energy Agency (IEA) are followed for longer-term price developments. In addition, the KEV is aligned with the projections in the World Energy Outlook (WEO) 2018 (IEA, 2018). The New Policies Scenario is applied as the central variant. The WEO 2018 also adopts this scenario as the central variant. The energy price forecasts remain highly volatile due to the many uncertainties in the market and therefore have a large bandwidth.

Around the central path bandwidths are provided that are used in the KEV sensitivity analyses. For the bandwidths, just as in the NEV, the Prosperity and Living Environment long-term study (WLO scenarios) (CPB & PBL, 2015) is used, in which long-term price paths have been published for different scenarios. The WLO scenarios include the main uncertainties surrounding energy and the climate, such as the development of global climate policy and the extent of fossil fuel reserves.
The WLO prices, available as of 2030, are used for the fuel prices bandwidth, with interpolation to 2030 from a margin around the price for 2019, the year in which the bandwidths take effect. The margins for 2019 have been chosen such that the average prices in recent years fall within the chosen bandwidth.

The oil price shows a modest increase following a low point at the beginning of 2016

The oil price reached a low at the start of 2016, with prices of around 30 euros a barrel in February. The price on the

futures market subsequently rose again to an average of around 40 euros per barrel (Figure 4.1). For the next few years, the price on the futures markets is between 50 and over 60 euros per barrel. Therefore, the price will remain on the low side in the coming years due to the supply of shale oil in the United States, despite the fact that OPEC, in association with Russia, is trying to control supply. However, there is a great deal of uncertainty surrounding the price. The price of a barrel of oil on the futures market for 2021 has varied the past two years between 41 and 57 euros a barrel (between 53 and 73 dollars a barrel). Due to the low prices, investments in exploration and extraction have fallen in recent years. In order to meet the expected demand, considerable investments are needed in the development of new supply, a large part of which is needed to compensate for the declining supply in existing fields. The rising oil price reflects the need for these investments, with a price that will exceed 80 euros per barrel from 2025. The bandwidths are based on the high and low WLO scenarios (CPB & PBL, 2015).

Figure 4.1 Historical and assumed future oil price (Source: PBL, 2019a)

Key: vat = barrel
Realisatie = Situation
Bandbreedte = Bandwidth
Raming = Estimate
Scheiding realisatie en raming = Cut-off between situation and estimate

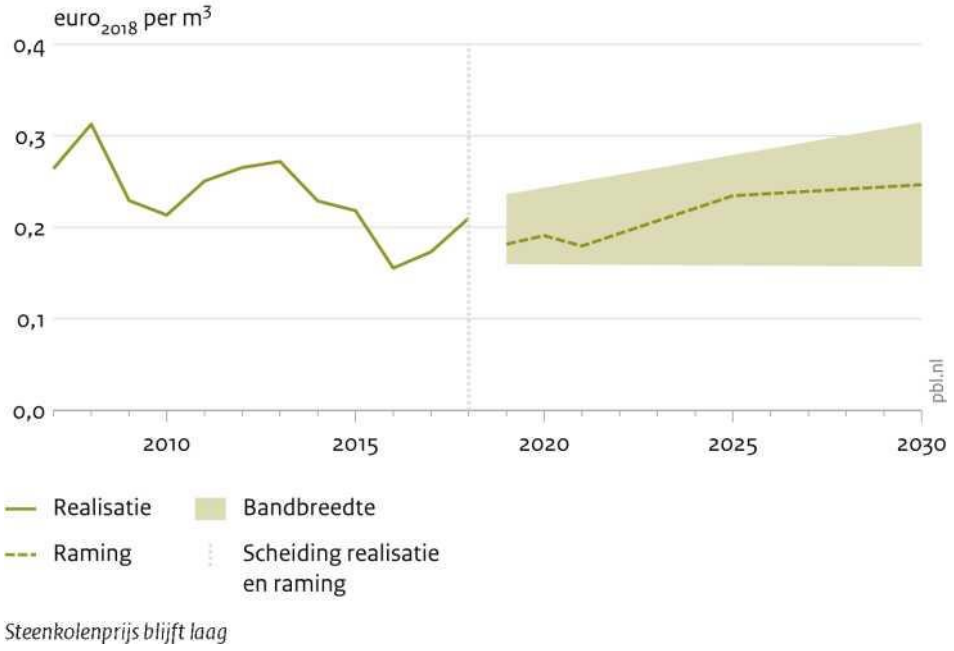
Gas price will increase in the long term

The gas price also reached a low in 2016, with a price of just over 15 euro cents per cubic metre. After that the gas price rose again to a peak of around 21 euro cents per cubic metre in 2018. The futures markets will show a slight decrease in the coming years, but the expectation is uncertain, with an expected gas price for 2021 that has fluctuated between 15 and 23 euro cents per cubic metre in recent years (see Figure 4.2).

The demand for natural gas will increase in the long term. It is the fastest growing fossil fuel in the New Policies scenario of the WEO 2018 with consumption in 2040 45 percent higher than in 2017 (from 3.7 trillion cubic metres (tcm) to 5.4 tcm). Worldwide, the increase in demand for natural gas comes mainly from China and the other Asian markets. In Europe, demand will rise up to 2025, and after 2030, demand will fall due to energy savings and an increase in renewable energy.

Unconventional gas (such as shale gas) will play an increasingly important role in the future global natural gas supply. The production of shale gas will increase to 0.77 tcm in 2040, which exceeds the growth of conventional gas production. The United States will account for 40 percent of the total production growth up to and including 2025. After 2025, additional growth will come from a diverse range of countries, including China, Mozambique and Argentina. Natural gas production in the EU is expected to decrease. Russia remains Europe's most important supplier. Due to the growing role of LNG on the global gas market, regional markets are becoming increasingly integrated. Price differences between these markets will decrease in the future, although there will continue to be a difference between the price of LNG and the pipe-bound supply of natural gas of roughly 20 percent, due to the differences in transport costs.

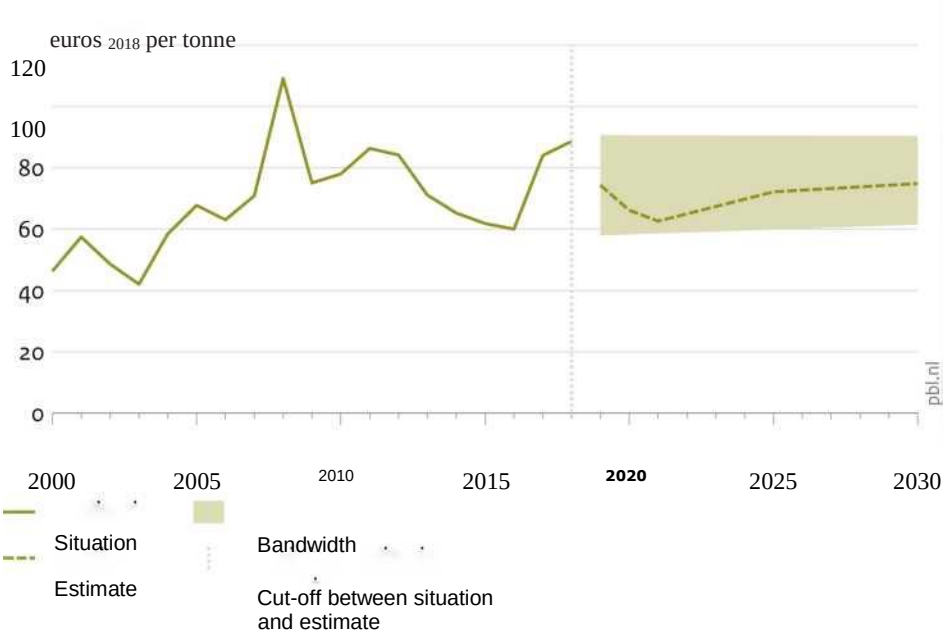
Figure 4.2 Historical and assumed future gas price in the Netherlands (Source: PBL, 2019a)



Coal prices staying low

The same applies to the coal price as for the oil and gas price: after a period of decreasing prices, a low of around 60 euros per tonne was reached in 2016. Afterwards, the price rose to almost 90 euros per tonne in 2018. Partly due to consolidation on the supply side resulting from, among other things, a decrease in capacity in China, the price on the futures markets will once again show lower prices in the coming years. In the longer term, worldwide demand remains fairly stable in the New Policies scenario of the WEO 2018. Only India and other developing countries are still demonstrating growth. In the EU, the US and in China, consumption is falling as a result of climate and air policy and due to competition from gas. The price shows a modest increase to around 75 euros per tonne due to rising production costs at new, more remote mines. The bandwidths are determined in the same way as with oil and gas with one exception: the lower threshold of the bandwidth is not based on the WLO, but on an update of the 450 Scenario in the WEO of the IEA from 2016 (see Figure 4.3).

Figure 4.3 Historical and assumed future coal price (Source: PBL, 2019a)



Biomass prices stable in the long term

Biomass for energy application is often traded on markets where several end-use sectors are active that use biomass for non-energy applications. For example, the prices for fermentable biomass are often linked to the prices for agricultural products. With regard to the price of biomass from woody crops, there is a relatively strong impact of the energy demand for biomass for energy applications. Therefore, this section focuses on the price development of woody biomass.

For biomass in the form of wood pellets we assume industrial wood pellets. These pellets are mainly used for large-scale steam production and for direct applications in industrial installations. The prices of the pellets originating from the Baltic States, Canada and the United States are around 150 euros per tonne, with delivery to the factory gate around 170 euros per tonne (Cremers et al., 2019). There is increasing international demand that will lead to a price increase in the short term. However, a large supply of wood pellets is possible at the same or only slightly higher production cost. Therefore, in the longer term, by 2030, no substantially higher price is expected for purchases for the large-scale use of wood pellets. Wood pellets are sometimes also used for smaller installations. For smaller installations, the costs for delivering wood pellets to the (factory) gate are higher than the prices mentioned above.

There is a more regional or national market for pruning and thinning wood. A change in the subsidy policy in surrounding countries could influence price development in the Netherlands. The prices of this biomass appear to be slightly lower in the short term than prices in recent years, but here too it is expected that in the long term, by 2030, the price will be around the current level of between 50 and 60 euros per tonne.

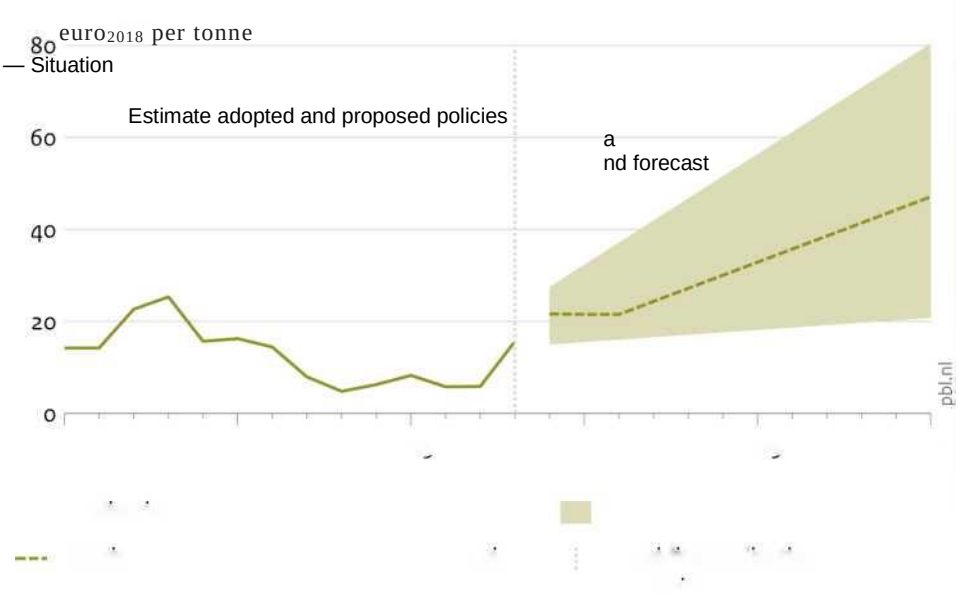
Sharp rise in the price of emission allowances in 2018

Conditions in the European market for emission allowances changed considerably in the course of 2018. Whereas until the beginning of 2018 the price had remained below 10 euros for years, in the fourth quarter of 2018 it doubled to an average price of almost 20 euros per tonne. The main reason for the sharp rise in price is the ETS reforms for the 4th phase of the ETS (2021-2030), which entered into force in April 2018. Part of these reforms include a greater decrease in the number of available emission allowances (the linear reduction factor increases from 1.74 to 2.2 percent) and the Market Stability Reserve with which allowances are withdrawn from the market if the surplus exceeds a certain limit. In addition, economic growth picked up in 2017, which also increased demand for emission allowances. At the beginning of July 2019, the price was around 26 euros per tonne of CO_2.

Forecasts of the price of emission allowances are based on prices observed on the futures market for emission allowances and expectations about the future price development of emission allowances that are modelled with discounted rates for the short and long term. This is the same approach as in previous editions of the NEV (see Brink (2018) for details of the calculation). The price of the emission allowances will thus rise to almost 33 euros in 2025 and more than 47 euros in 2030 (see Figure 4.4).

There is a great deal of uncertainty surrounding the development of the price of emission allowances. Uncertainty about policy in the EU, as well as outside the EU (for example regarding the implementation of the Paris Climate Agreement), has a major impact. Therefore, the KEV applies a broad uncertainty bandwidth for forecasts of the CO2 price; from 21 to 80 euros per tonne of CO2 in 2030.

Figure 4.4Historic and projected future prices of CO2 emission allowances (Source, PBL, 2019a)



Key to original figure:
Realisatie = situation Bandbreedte = Bandwidth
Raming vastgesteld en voorgenomen beleid = Estimate adopted and proposed policies
Scheiding realisatie en raming = cut-off between situation and estimate

iv. Development of technology costs

Forecasts for future developments in the energy system use the calculation system of the National Energy Reports, which is a modelling suite that offers various models for supply and demand sectors. The data and information related to the expected costs, potentials and technical characteristics used are regularly adjusted based on new insights from studies conducted, for example, by the IEA and IRENA, and from scientific literature (see Table 4.2). The forecasts also use detailed studies conducted in the Netherlands to substantiate the grants issued under the SDE+ grant scheme for various renewable energy technologies (see PBL, 2018a).

Table 4.2 Overview of sources used for expected cost developments for wind energy and PV in the KEV (source: PBL)

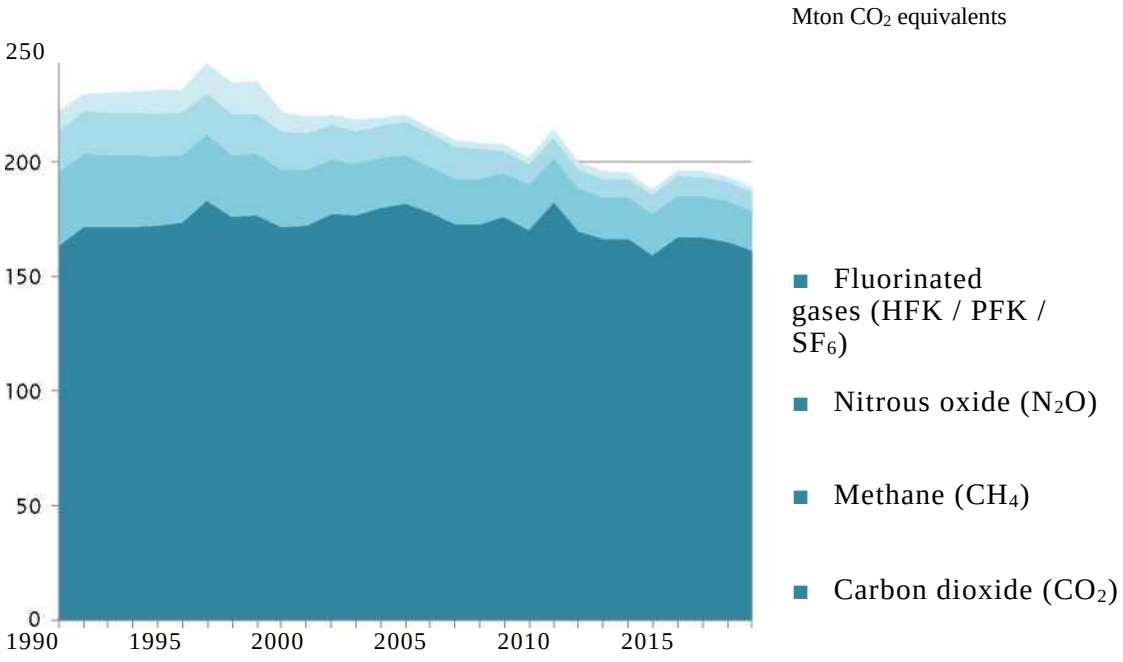
Institute/author	Year	Title
IRENA	2016	The Power To Change: Solar And Wind Cost Reduction Potential to 2025
IEA	2014	Energy Technology Perspectives (PV)
JRC	2014	Energy Technology Reference Indicator projections for 2010-2050
Agora Energiewende/FhG-ISE	2015	Current and Future Cost of Photovoltaics
TKI URBAN ENERGY	2015	Knowledge and Innovation Agenda
Ryan Wiser et al.	2016	Forecasting Wind Energy Costs and Cost Drivers: The Views of the World's Leading Experts
KIC InnoEnergy	2016	Future renewable energy costs: solar photovoltaics
KIC InnoEnergy	2014	Future renewable energy costs: onshore wind
KIC InnoEnergy		Future renewable energy costs: offshore wind
EUPVTP	2015	PV LCOE in Europe 2014-2030
ECN	2017	Wind energy cost study SDE+ 2018
CE Delft and ECN	2016	MKEA solar PV and onshore wind
ECN	2017	Offshore wind energy costs 2017 (version 2 with network costs update)

An overview of the costs of technologies in the various sectors has not yet been included in the KEV 2019. This information is expected to be made available in the short term.

4.2 Decarbonisation dimension

4.2.1 Trends and forecasts for greenhouse gas emissions and capture

Figure 4.5 Emissions of greenhouse gases in the Netherlands from 1990 up to and including 2018* in Mton of CO_2 equivalents (excluding LULUCF) (source: CBS et al, 2019a) * 2018 is based on provisional figures



Historic trend of national greenhouse gas emissions to date

Following an initial increase between 1990 and 1996, greenhouse gas emissions in the Netherlands display a downward trend with a peak in 2010 (due to a relatively cold winter) and a limited increase in 2015 (see Figure 4.5). In 2018, emissions based on preliminary statistics amounted to over 189 megatons of CO_2 equivalents (excluding LULUCF), 15% below the 1990 level. This decrease is largely due to a decrease in non-CO_2 greenhouse gases, to a large extent in industry and to a lesser extent in agriculture. CO_2 emissions decreased between 1990 and 2018 by circa 2 megatons. Where the total emissions of greenhouse gases increased in 2015 and 2016 compared to previous years, a decrease was observed in 2017 and 2018. Compared to 2016, emissions in 2017 were approximately 1% lower, and more than 3% lower in 2018. This decrease is mainly due to a reduction in CO_2 emissions in the electricity sector. In recent years, more natural gas has been used at the expense of coal and more renewable energy generated.

Emissions of LULUCF decreased slightly between 1990 and 2017, from 6.1 in 1990 to 5.6 megatons of CO_2 equivalents in 2016 (see below for a more detailed explanation). These figures were not included in Figures 4.5 and 4.6.

Forecast of national emissions of greenhouse gases (excluding LULUCF)

Greenhouse gases to decrease up to and including 2020

In the policy variant of "adopted policies" national greenhouse gas emissions decrease to 171 [165-180] megatons of CO_2 equivalents in 2020 (see Figure 4.6). This means a decrease of over 22 megatons of CO_2 equivalents between 2017 and 2020. Of this expected decrease, almost 19 megatons of CO_2 equivalents are due to developments in the electricity sector (see Table 4.3). Electricity generation using coal and gas in the Netherlands is expected to decrease sharply between 2017 and 2020 due to four factors:

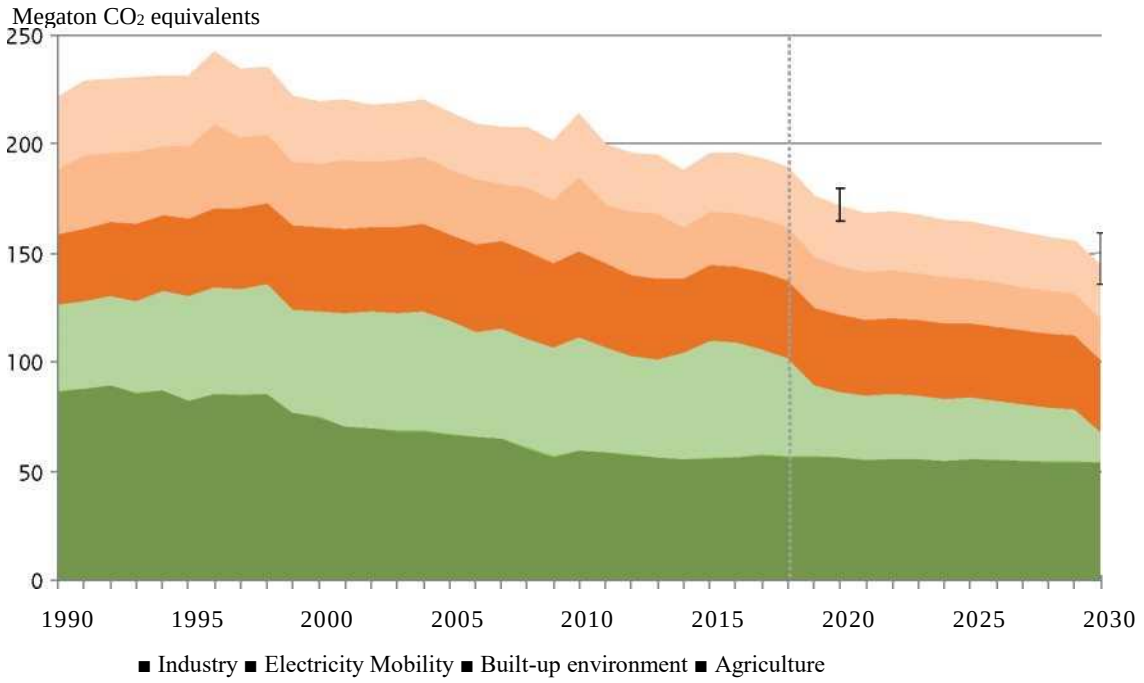
1. The growth of renewable electricity generation in the Netherlands;
2. Increasing electricity imports due to greater interconnection capacity with Germany and Denmark (see section 4.5.1);
3. A declining generation capacity due to closure of the coal-fired power plants on the Maasvlakte (mid-2017) and the Hemweg power plant (before 2020);
4. The use of coal and/or gas-fired power plants affected by falling coal and gas prices between 2017 and 2020 and an increasing CO_2 price during this period.

Greenhouse gas emissions from industry are expected to fall between 2017 and 2020 by less than 1 megaton of CO_2 equivalents. There are various trends within industry. Emissions from refineries are expected to rise slightly up to and including 2020, partly due to an increase in the desulphurisation of marine fuels. In industry, emissions are expected to fall until 2020 due to the effects of energy savings and the use of biomass.

In the built-up environment (households and services), emissions are expected to fall by almost 2 megatons of CO_2 equivalents between 2017 and 2020. The largest decrease is expected to occur within households. This is actually the effect of the additional savings policy such as the "10 petajoule task-setting agreement", the ISDE and measures in the owner-occupier and rental sector. Emissions are falling in the services sector too, due to the effect of a number of saving measures.

In the mobility sector, emission reductions between 2017 and 2020 are limited on balance due to a combination of different developments. Emissions in agriculture also hardly change between 2017 and 2020 (a reduction of <1 Mton CO_2 equivalents during this period applies to both sectors).

Figure 4.6 Historical and expected greenhouse gas emissions for the period 1990-2030 per sector (excl. LULUCF) (Sources: CBS et al 2019a (situation) and KEV (forecasts with adopted policies))



Forecast of greenhouse gas emissions between 2020 and 2030

During the period after 2020, national greenhouse gas emissions are expected to fall even further, with adopted policies. Between 2020 and 2030, emissions are expected to decrease by almost 26 megatons of CO_2 equivalents, to 145 [136-159] megatons. This results in emission reductions for 2030 of 35% compared to 1990. The decrease in emissions after 2020 is mainly explained by the expected developments in the electricity sector. Emissions in this sector will decrease from 30 to 14 megatons of CO_2 equivalents between 2020 and 2030 (see Table 4.3). Until 2029, emissions from the electricity sector are expected to decrease relatively modestly, mainly due to an increase in renewable electricity generation, but also an increase in electricity exports. In 2030, emissions will subsequently fall sharply due to the closure of the last three remaining coal-fired power plants in the Netherlands. Greenhouse gas emissions from all other sectors are also expected to fall until 2030 with the adopted policies. The biggest decrease is anticipated in the built-up environment with almost 4 megatons of CO_2 equivalents due to energy-saving measures. Emissions in industry will fall by almost 3 megatons of CO_2 equivalents during this period. This is due to a limited decrease at refineries and the extraction of oil and natural gas. Industry emissions are expected to remain more or less unchanged because an increase in the chemical sector is offset by a decrease in the food, paper and construction sectors. Furthermore, the expected emissions from agriculture and mobility will each decrease by around 2 megatons of CO_2 equivalents between 2020 and 2030.

Table 4.3 Achieved and expected greenhouse gas emissions per climate platform (in Mton CO_2 equivalents) (Sources: Emission registration (situation) and KEV (forecasts with adopted policies)

	Statistic				Forecast	
Sector*	**1990**	**2005**	**2017**	**2018****	**2020**	**2030**
Electricity	39.6	52.1	48.5	45.2	29.8	14.1
Industry	87.0	67.3	57.7	57.2	56.9	54.2
Built-up environment	29.9	29.3	24.6	24.4	22.8	19.2
Agriculture (excl. land use)	32.9	26.1	27.4	26.9	26.9	24.5
Mobility	32.3	40.0	35.5	35.6	34.8	33.1
Total	222	215	194	189	171	145
Reduction from 1990 [%]	-		13%	15%	23%	35%
Land use	6.5	5.7	5.6	_***	5.3	5.6
Total including land use	**228**	**220**	**199**		**177**	**151**

* Sectoral classification based on the Climate Agreement. This differs from the CRF classification. In this table, emissions from mobile equipment all fall under mobility. In Appendix 6 emissions are presented according to the CRF classification.

** Based on preliminary statistics

*** Emissions for land use not yet available for 2018

Emissions forecast uncertain, mainly due to variability in electricity generation

The bandwidth of a 19 to 26% reduction in 2020 and a 28 to 39% reduction in 2030 indicates that there is considerable uncertainty. The biggest uncertainties are in the field of national electricity generation in coal and gas-fired power plants. Developments abroad also have a major impact on the Netherlands and involve considerable uncertainties. Another relevant uncertainty is energy demand trends in end-use sectors. This is partly related to economic growth and the rate of energy savings. The degree to which there may be a relatively cold or indeed warm heating year is also a significant uncertainty impacting emissions in a given year.

Trends and forecast for greenhouse gas emissions in EU ETS sectors

ETS emissions trend

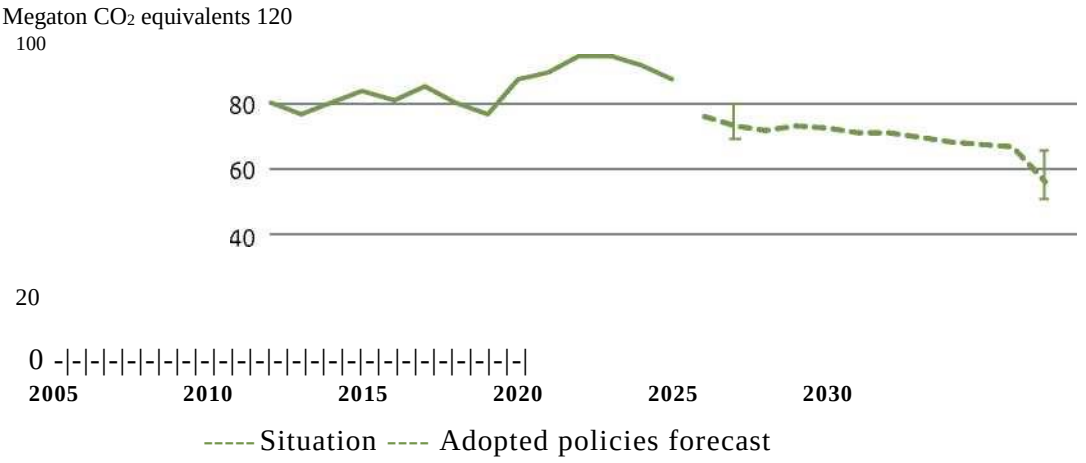
Between 2005 and 2012, emissions produced by Dutch businesses participating in the European emissions trading system fluctuated around 80 megatons of CO_2 equivalents. In 2013, ETS emissions increased sharply, due mainly to an administrative reallocation of activities (with emissions) from non-ETS to ETS. In 2015 and 2016, total ETS emissions increased to around 94 megatons of CO_2 equivalents due to high emissions in the electricity sector. In 2017 and 2018, total ETS emissions subsequently decreased to 91 and 87 megatons of CO_2 equivalents, respectively. This decrease was due to a reduction in emissions from the electricity sector resulting from less electricity generated by coal and more from natural gas. Since 2015, ETS emissions from industry have risen to a limited extent, partly due to favourable economic conditions.

ETS emissions are expected to decrease leading up to 2020 and 2030

It is expected that ETS emissions will fall by 18 megatons of CO_2 equivalents from the 2017 level, to 73 [69-80] megatons in 2020 (see Figure 4.7). This fall is being caused by the reduction in electricity generated using coal and gas (see the explanation provided above).

After 2020, ETS emissions are set to continue to fall to 56 [51-66] megatons of CO_2 equivalents by 2030. This considerable reduction will mainly be due to a decrease of 16 megatons in electricity generation in the 2020-2030 period (closure of coal-fired power plants and a larger share of renewable energy). ETS emissions from industry are expected to fall by one megaton of CO_2 equivalents between 2020 and 2030 (from 43 to 42 megatons).

Figure 4.7 Historical and expected greenhouse gas emissions by ETS sectors in the period 2005-2030 (Sources: Dutch Emissions Authority (NEa) (situation) and PBL, 2019a (forecasts with adopted policies))



Trends and forecast for emissions of greenhouse gases in non-ETS sectors

Cumulative target for non-ETS emissions

In Europe, national targets have been agreed for greenhouse gas emissions that do not fall under the European emissions trading system, hereinafter referred to as N-ETS. This includes emissions from mobility, almost all emissions from the built-up environment, the largest share from agriculture and a limited share from industry (emissions from land use are not covered by the N-ETS targets). For the 2013-2020 period, the N-ETS targets and regulation have been established in the Effort Sharing Decision (ESD). For the Netherlands the ESD emission reduction target is 16% in 2020 compared to 2005. For the period 2021-2030, the Dutch N-ETS challenge is included in the Effort Sharing Regulation (ESR). In the ESR, the Netherlands' emission reduction target is 36% in 2030 compared to 2005. Based on these two reduction challenges, two series (2013-2020 and 2021-2030) were derived with annual ceilings of permitted quantities of emissions. These annual ceilings must then be added up per period, which produces a cumulative target per period. The objective in the ESD relates to a series of annual ceilings of the permitted amount of emissions between 2013 and 2020, which collectively make up the cumulative target for the whole period. The maximum permitted cumulative emissions for the Netherlands under the ESD for the 2013-2020 period amount to 921 megatons in CO_2 equivalents. For the 2021-2030 period, new targets have been agreed upon within the framework of the new ESR. For the Netherlands, this is 36%, which is expected to lead to permitted cumulative emissions of 879 megatons.

Downward trend of non-ETS emissions

Non-ETS emissions have fallen from 134 megatons of CO_2 equivalents in 2005 to 108 megatons in 2013 (see Figure 4.8). The decrease in the period 2005-2013 is mainly due to the fact that N-ETS emissions from industry have fallen by around 20 megatons of CO_2 equivalents. Reductions were also achieved in the electricity generation (3 megatons) and mobility (4 megatons) sectors during that period. In 2013, ETS emissions fell sharply due, for example, to an administrative reallocation of activities (with emissions) from non-ETS to ETS. Between 2015 and 2018, N-ETS emissions stabilised at around 102 megatons of CO_2 equivalents. Emissions of non-CO_2 greenhouse gases also significantly decreased during this period, namely by 8 megatons, primarily due to reduction measures in relation to the production of nitric acid.

EU obligation for non-ETS for 2013-2020 well within reach

A further decrease to 98 megatons of CO_2 equivalents is expected in the 2018-2020 period. This decrease is mainly due to a reduction in the built-up environment (7 megatons) and industry and mobility (both less than 2 megatons) (see Table 4.4). The maximum permitted cumulative emissions for the Netherlands for the 2013-2020 period amount to 921 megatons of CO_2 equivalents. Based on adopted policies, the cumulative estimated emissions for this period amount to 814 megatons of CO_2 equivalents. This means the estimate is well below the mandatory cumulative emission ceiling (Figure 4.8).

Table 4.4 Emissions of non-ETS greenhouse gases 2005 to 2030 inclusive based on adopted policies
(in megatons of CO2 equivalents; excluding LULUCF; scope according to the third ETS trading period from 2013 to 2020 inclusive) (Sources: Emission registration (situation) and KEV (forecasts))

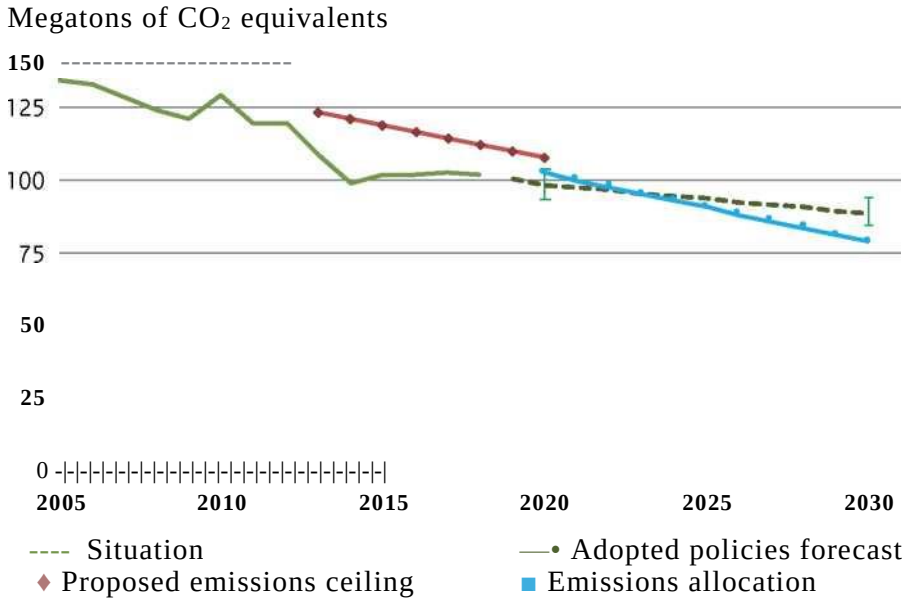
Sector*	2013	2015	2018**	2020	2025	2030
Electricity	0.2	0.8	0.3	0.5	0.5	0.3
Industry	15.8	15.9	15.5	13.9	13.0	12.2
Mobility	36.3	34.7	35.6	34.8	34.4	33.1
Built-up environment	29.7	24.1	24.0	22.4	20.0	18.9
Agriculture and horticulture	26.5	26.5	26.5	26.5	25.5	24.1
Totals	**108.5**	**102.0**	**101.9**	**98.0**	**93.3**	**88.6**

* Sectoral classification based on the Climate Agreement. This differs from the CRF classification. In this table, emissions from mobile equipment all fall under mobility. In the Appendix, emissions are presented according to the CRF classification.
** Based on preliminary statistics

EU obligation for non-ETS for 2021-2030

The maximum permitted cumulative emissions for the Netherlands for the 2021-2030 period are expected to amount to 891 megatons of CO_2 equivalents. Assuming that as a result of adopted policies, the cumulative estimated N-ETS emissions for 2021-2030 amount to 931 megatons of CO_2 equivalents, with a deficit remaining (which poses a policy challenge) for the established period of 39 megatons of CO_2 equivalents. The calculation for the cumulative target above already implicitly takes into account the possibility of compensating deficits with surpluses between the years (banking and borrowing).

Figure 4.8 Historical and projected greenhouse gas emissions from non-ETS sectors in the period 2005-2030
(Sources: Emission registration (situation) and PBL, 2019a (Adopted policies forecast))



Sectoral developments for emissions of greenhouse gases in non-ETS sectors

Built-up environment

Since 1990, emissions in the built-up environment have gradually fallen from 30 megatons of CO_2 equivalents to 24 megatons in 2018 (without temperature correction, of which 0.5 megatons fall under the ETS), despite the fact that the number of households grew from 7.1 to 7.9 million (CBS, statline 2019c) and the floor area of non-residential buildings increased. It is expected that CO_2 emissions will fall to 23 megatons by 2020 and to almost 19 megatons by 2030 (of which 0.3 megatons fall under the ETS).

The decrease among households is the result of a reduction in the consumption of natural gas as a result of insulation measures and the use of more efficient boilers in existing buildings, demolition of existing buildings and the construction of energy-efficient new buildings. The decrease in the services industry is the result of energy savings in existing buildings, demolition, energy-efficient new buildings, reduction in space heating due to global warming, an increase in the use of electric heat pumps instead of boilers fired by natural gas and less use of cogeneration.

Industry

A limited percentage of greenhouse gas emissions from industry does not fall under the ETS (circa 15 megatons of CO_2 equivalents in 2017). The previously cited developments that are significant with regard to the ETS emissions produced by industry are also relevant to the non-ETS emissions. It is expected that the non-ETS CO_2 emissions will decrease to approximately 12 megatons in the period up to 2030. This is primarily the result of declining emissions from methane from landfill sites and F-gases, as a result of the implementation of the European regulation on fluorinated greenhouses gases.

Mobility

Between 1990 and 2008, CO_2 emissions increased by roughly 8 megatons due to an increase in domestic traffic and transport as a result of economic growth. Following the economic crisis of 2008, emissions rapidly fell. Despite the economic recovery, emissions have remained more or less stable at around 35 megatons of CO_2 equivalents since 2015. The relatively strong growth in transport volumes in 2018 was compensated by a more efficient fleet and the increasing use of biofuels for mobility.
Greenhouse gas emissions are expected to fall to 33 megatons of CO_2 equivalents in 2030. This decrease is largely due to the more stringent European source policy for CO_2 emissions from new vehicles, despite growing traffic volumes.

Emissions of greenhouse gases from the combustion of bunker fuels from international aviation and shipping are not included in the national emission totals. Between 2000 and 2006, these emissions increased from 53 to 67 megatons of CO_2 equivalents. After that, emissions fell to around 50 megatons in 2016 and 2017. Provisional figures for 2018 show a further decrease to 48 megatons. With adopted policies, this item is expected to grow to 52 megatons of CO_2 equivalents in 2030. Sales of bunker fuels to international shipping are expected to remain stable in the coming years. In 2030, greenhouse gas emissions are estimated at 34 megatons [27-40 megatons] and are therefore at the same level as in 2018. A slight increase is expected for sales of bunker fuels to inland waterways shipping. In 2030, emissions of greenhouse gases are estimated at 2.7 megatons of CO_2 equivalents [2.1-3.2 megatons]. Total sales of bunker fuels to aviation in 2030 are estimated at 215 petajoules [177-231 petajoules] and the resulting greenhouse gas emissions amount to 15 megatons [13-16 megatons].

Agriculture and horticulture

Most of the CO_2 emissions from the agricultural sector are produced by the greenhouse horticulture sector. The latter consumes a large amount of energy to heat and light the greenhouses and fertilise them with CO_2. Due to an increase in the acreage covered by greenhouses, CO_2 emissions increased from less than 8 megatons in 1990 to almost 10 megatons in 2010 (of which 1.8 megatons fell under the ETS at the time). The acreage occupied by greenhouses subsequently decreased by 12%, and CO_2 emissions are currently around 7-8 megatons (of which approximately 0.4 megatons fall under the ETS). The CO_2 emissions in agriculture and horticulture are expected to remain the same up to 2020, after which they will decrease further to 6 megatons in 2030 (of which 0.3 megatons ETS) due to increasingly more efficient and innovative greenhouses.

During the 1990-2018 period, emissions of other greenhouse gases from agriculture and horticulture decreased by almost 6 megatons of CO_2 equivalents to 19 megatons of CO_2 equivalents. In 2017, emissions of other greenhouse gases from the agriculture sector were still 0.8 megatons of CO_2 equivalents higher than in 2010. This increase was primarily related to the growth of the dairy herd following the abolition of milk quotas at the beginning of 2015 and, to a lesser extent, due to the increased use of fertiliser. This increase is expected to halt once livestock herds shrink as a result of policies from 2017. Provisional figures for 2018 now show a decrease of 0.6 Mton of CO_2 equivalents compared with 2017.

Trends and forecasts for emissions of greenhouse gases in LULUCF sectors

LULUCF emissions are stable

In the Netherlands, grasslands, agricultural land and developed land are the principal sources of the so-called Land Use, Land Use Change and Forestry (LULUCF) emissions. Forests capture net CO_2. Net emissions of all land use categories together show a downward trend from 2000 to 2017 from 6.1 to 5.6 megatons of CO_2 equivalents per year (Figure 4.12). These emissions consist, in addition to a small contribution of nitrous oxide (0.06 megatons of CO_2 equivalents in 2000, increasing to 0.1 megatons of CO_2 equivalents in 2017) almost entirely of CO_2. A gradual decrease in emissions was observed between 2000 and 2010. From 2010 they have remained stable at an annual level of approximately 5.6 megatons of CO_2. The achieved decrease in net emissions in 2000-2017 is the result of decreasing emissions due to changed agricultural land use (smaller acreage, less peatland), an increase as a result of the expansion of the built-up acreage, and a lower net uptake by forests. The uptake by forests gradually decreased in the period 2000-2017, from 2.0 to 1.8 megatons of CO_2 equivalents. This decrease is related to increased deforestation and the gradual ageing of the Dutch forest, which means less carbon is captured in existing forests. Emissions from agricultural land use (arable land and grassland) over the period 2000-2017 show a downward trend, from 6.7 to 5.5 megatons of CO_2 equivalents. This trend is the result of a decrease in the agricultural acreage and the acreage of peatland. Emissions due to an increase in urban acreage (buildings) have increased during this period from 1.2 to 1.5 megatons of CO_2 equivalents.

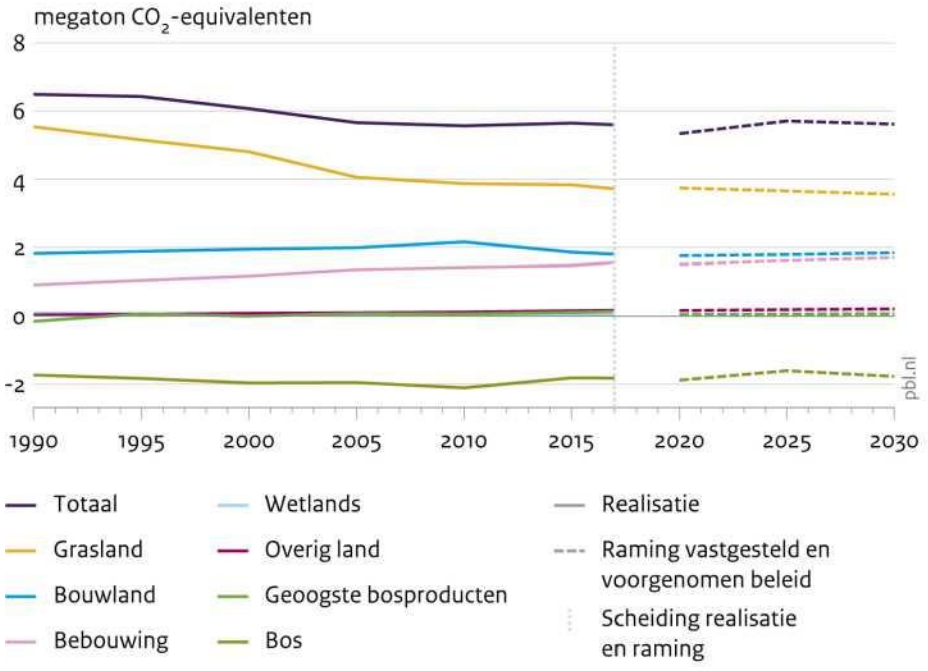
Expected LULUCF emissions

Total LULUCF emissions are expected to decrease from 5.6 megatons of CO_2 equivalents in 2017 to 5.3 Megatons of CO_2 equivalents in 2020. This is due to multiple minor changes. The decrease is mainly caused by: slightly lower emissions from buildings, an increase in carbon capture as a result of afforestation and a decrease in emissions from arable land.

Expected total net land use emissions will increase after 2020 to 5.6 megatons of CO_2 equivalents in 2030. This increase is the balance of various developments. The KEV expects that emissions from buildings will gradually increase between 2020 and 2030: from 1.5 to 1.7 megatons of CO_2 equivalents. This trend is determined by a gradual decrease in the acreage of agricultural land18, a shift from arable land to grassland, and an increase in urban (built-up) acreage. During this period it is also expected that on balance forests will capture 0.1 megatons of CO_2 equivalents fewer of greenhouse gases. Emissions from arable land will increase slightly between 2020 and 2030 from 1.7 to 1.8 megatons of CO_2 equivalents. Emissions from grassland will decrease by almost 0.2 megatons of CO_2 equivalents during this period, and will amount to 3.5 megatons of CO_2 equivalents in 2030. Total net emissions from agricultural land use (arable land, grassland and harvested forest products) will decrease by between 5.5 and 5.4 megatons of CO_2 equivalents between 2020 and 2030.

The analysis of emissions (debits) and removals (credits) of the current estimate until 2030 shows that at the end of both performance periods under the LULUCF Directive, 2025 and 2030 there is an annual net debit of an average of 0.30 Megatons of CO_2 equivalents (2025) and 0.25 Megatons of CO_2 equivalents (2030). Therefore, during the first performance period (2021-2025), the net debit is 1.5 Megatons of CO_2 equivalents. In the second performance period (2026-2030) 24, this is 1.2 Megatons of CO_2 equivalents. It is mainly the "deforested land" category that causes emissions, due to loss of carbon from biomass and humus. The categories "wooded land", "arable land" and "grassland" produce credits.

Figure 4.8 CO2 emissions and capture by LULUCF sectors (Source: PBL, 2019)



4.2.2 Trends and forecasts for renewable energy

Historic trend of the share of renewable energy

Since 2000, the share of renewable energy, according to the European Renewable Energy Directive (Directive 2009/28/EC) has gradually risen from 1.6% to 7.4% in 2018 (see Figure 4.9). The principal causes for this increase were the introduction of the subsidy schemes for renewable energy (MEP in 2003 and SDE in 2008) and the blending requirement for renewable fuels in transport as of 2007. In 2018, total gross final consumption was 2,100 petajoules, of which 157 petajoules come from renewable energy sources (CBS, 2019b).[116] Energy consumption from biomass amounted to 96 petajoules in 2018: 61% of total renewable energy. The contribution of wind energy to the total final consumption of renewable energy in the Netherlands was 23% in 2018 and the contribution of solar power was more than 8%. Geothermal energy and soil energy have demonstrated relatively significant growth in recent years and accounted for more than 5% of final energy consumption from renewable sources in 2018. Outdoor heat accounted for almost 3% of final consumption in 2018.

The consumption of renewable electricity has also increased, with renewable electricity from biomass having stabilised in recent years, while electricity generated from wind and solar power sources has rapidly increased. In 2018, gross normalised domestic generation of renewable electricity was 14.9 percent of electricity consumption (CBS, 2019b).

The share of *renewable heat* in total final consumption of energy for heat has gradually increased since 2000 to 6% in 2018 (Statistics Netherlands, 2019b).

Since 2005, *the share of renewable energy for transport* based on the physical consumption of renewable energy gradually increased to 9.5% in 2018 (Statistics Netherlands, 2019b), particularly in the form of biofuels. The achieved share of renewable energy for transport as a result of differences in definition does not run concurrent to the national obligation for companies that supply biofuels. Fuel suppliers, for example, are able to hold administrative stocks. According to the Dutch Emissions Authority (NEa), fuel suppliers have met their national blending obligation for renewable energy (NEa, 2019).

Forecast of the development in the share of renewable energy

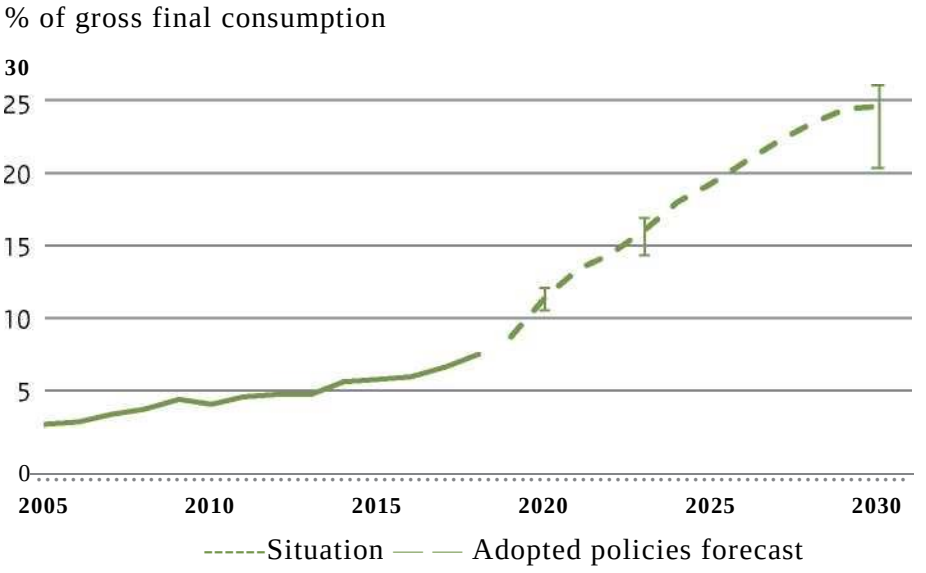
The share of renewable energy will grow substantially in the period up to and including *2030*

In the policy variant of exclusively adopted policies the share of renewable energy is set to increase from 6.6% in 2017 to 11.4 [10.4-12.1]% by 2020 (see Figure 4.13). As a result the European target of 14.0% will not be achieved. The target in the Energy Agreement of 16.0% by 2023 will just be achieved: the forecast is 16.1% [14.3-17.0%]. The forecast for 2030 is 24.7% [20.7-26.4%]. On the one hand, additional measures have been put in place within the framework of the 2013 Energy Agreement, such as a higher budget and an ascending target in the transport sector moving toward 2020, but on the other hand, there are setbacks, such as the resistance to wind energy on land, which is difficult to resolve. In addition,

[116] These figures are preliminary

gross final energy consumption is expected to be higher than estimated in the NEV 2017, while gross renewable energy consumption remains roughly the same. As a result, achieving the targets, which are defined as a ratio between the consumption of renewable energy and the total energy consumption, becomes more difficult.

Figure 4.9 Forecast of the development in the share of renewable energy with adopted policies as a share of gross final consumption between 2000 and 2030 (Source: PBL, 2019a)



Currently, almost 60% of renewable energy consumption comes from biomass (see Figure 4.10). Consumption of energy from biomass will continue to grow in the coming years, for example as a result of co-fuelling and co-firing in coal-fired power plants rising from 3 petajoules in 2018 to 25 petajoules in 2020. Between 2020 and 2030, biomass consumption is expected to remain fairly constant, although a shift is visible in which the use of biomass in boilers at companies compensates for the loss of co-firing and co-fuelling in coal-fired power plants in due course.

The established capacity of wind turbines increased from 4,200 megawatts at the end of 2017 to 4,400 megawatts at the end of 2018. In 2020, the established capacity of onshore wind energy is expected to rise to 4,700 megawatts. By 2023, capacity is expected to increase further to 5,600 megawatts to reach 6,100 megawatts by 2030. The established capacity of offshore wind energy will remain around 1,000 megawatts from 2018 to mid-2020, to subsequently increase tenfold to an expected 10,000 megawatts by 2030.

Solar energy consumption (mainly electricity) grew by 40 percent to 13 petajoules in 2018. The established capacity of solar panels for solar power increased in 2018 with a record quantity of more than 1,500 megawatts to a total of 4,400 megawatts. The established capacity is expected to continue to grow to 9,000 megawatts by 2020, 15,000 megawatts by 2023 and 27,000 megawatts by 2030.

Solar power is stimulated through several policies that focus on different target groups. A major uncertainty for the continued growth of solar power (up to 2020) is the degree of realisation of SDE+ projects. Based on the degree of realisation for solar-PV projects in the past, it is assumed that approximately two-thirds of the SDE+ grants will actually lead to a solar energy project. It will lead to a bandwidth in established capacity by 2030 between 18,000 megawatts and 36,000 megawatts. This growth also assumes continued, uncapped net-metering until 2030 and the availability of the SDE+ subsidy for large solar power projects. The last of the subsidy obligations arising under the SDE+ grant scheme up to 2020 is not set to expire until 2040. After 2023, solar power will grow from 27.8 to 56.2 petajoules during the period up to and including 2035, and heat pumps, from 16.7 to 35.7 petajoules, with each technique more than doubling. These technologies are largely promoted outside of the SDE+ grant scheme, including through the ISDE. In addition, the increase of heat pumps beyond 2020 will also be supported by stricter requirements for new residential properties aiming for nearly zero-energy homes. See Figure 4.14 for a distribution per technology (2000-2030). Further growth of the share

of renewable energy beyond 2023 depends on new policies such as the expansion of the SDE+ grant scheme (see Chapter 3).

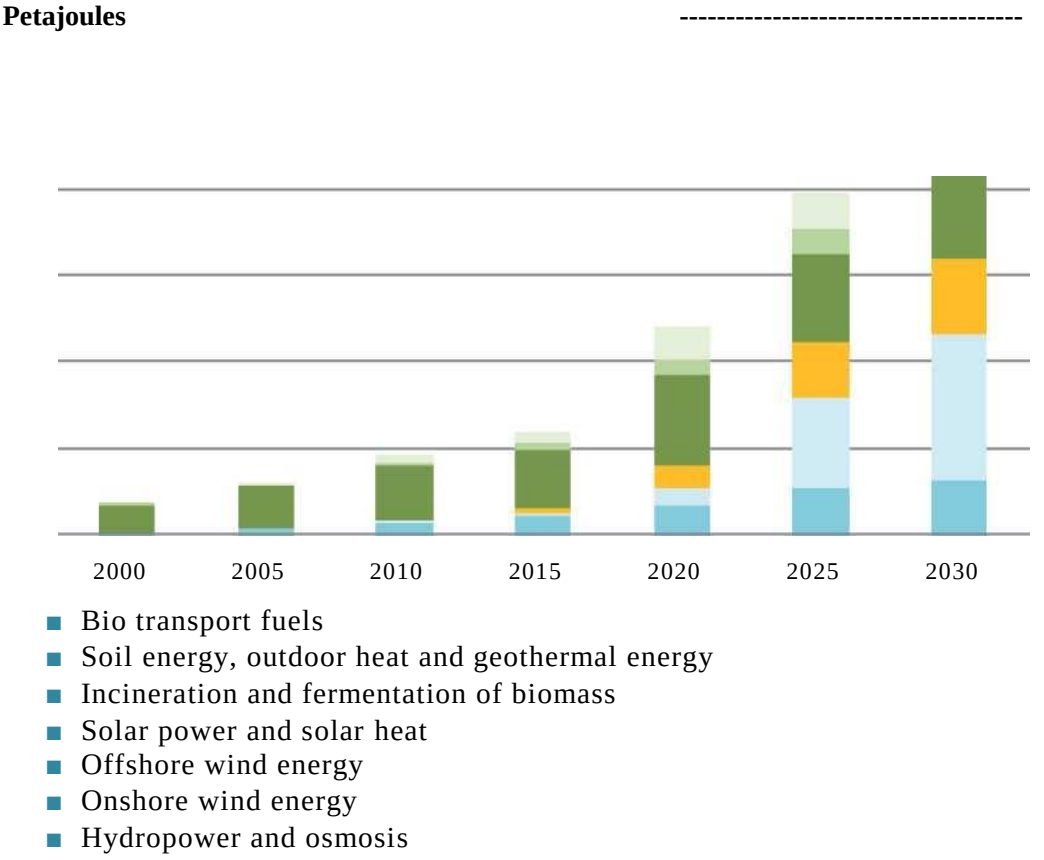
The expected share of renewable energy in gross electricity consumption is expected to almost double from 14.9% in 2018 to over 29.8% by 2020 due to these developments. By 2030, the share of renewable energy in electricity generation is expected to rise to around 73%.

Renewable energy consumption in the built-up environment is expected to rise significantly in the years to come. This is due to the increased use of heat pumps in new buildings as a result of building regulations and more stringent energy performance requirements. In addition, more heat pumps are being installed in existing buildings as a result of the Sustainable Energy Investment Subsidy scheme (ISDE) and the rolling out of "zero on the meter" renovations in rental properties. Outdoor heat and soil energy are expected to double from 12 petajoules in 2020 to 24 petajoules by 2030. Deep geothermal energy from 7 petajoules in 2020 to 24 petajoules in 2030. The least growth is expected to be seen in fermentation techniques, where consumption will rise from 12 petajoules in 2020 to 16 petajoules by 2030.

Renewable heat accounted for 6.3% of the heat supply in 2018. According to the KEV, this share will double and rise to 13 percent by 2030.

The production of *renewable gas* which is fed into the gas network, and used exclusively in the transport sector, is expected to increase from 107 million m³ in 2018 to 190 million m³ by 2020 and 325 million m³ by 2030. This amounts to 1.1% of total gas consumption.

Figure 4.10 Development of renewable energy technologies with adopted policies (Source: PBL, 2019a).



Renewable energy in mobility

The use of biofuels in transport will increase due to the increasingly strict annual obligation for renewable energy for transport up to 2020. The use of biofuels for domestic mobility is expected to grow from 23 petajoules in 2018 to 37 petajoules [30-42 petajoules] in 2020. The use of biofuels between 2021 and 2030 is estimated at around 35 petajoules per year. The growing use of biofuels for transport is partly due to the introduction of E10 on the Dutch market. From October 2019, petrol stations will be obliged to supply E10 if they have at least two petrol refuelling points. E10 is a fuel mixture that contains up to ten percent ethanol. As a result, the use of petrol substitute biofuels should be considerably higher in 2020 than in previous years. However, the use of diesel substitutes must also be considerably higher in order to meet the mandatory 16.4 annual percentage.

Total electricity consumption by mobility amounted to 6.6 petajoules in 2017 and is expected to grow to 8.1 petajoules in 2020 [7.9 to 8.4 petajoules] and 14.3 petajoules [11.3 to 16.2 petajoules] by 2030. Total renewable energy consumption by mobility will grow from 9.5% in 2018 to 13.6% in 2020. No forecast is available for 2030.

4.3 Energy-efficiency dimension

4.3.1 Historic development of energy consumption[117]

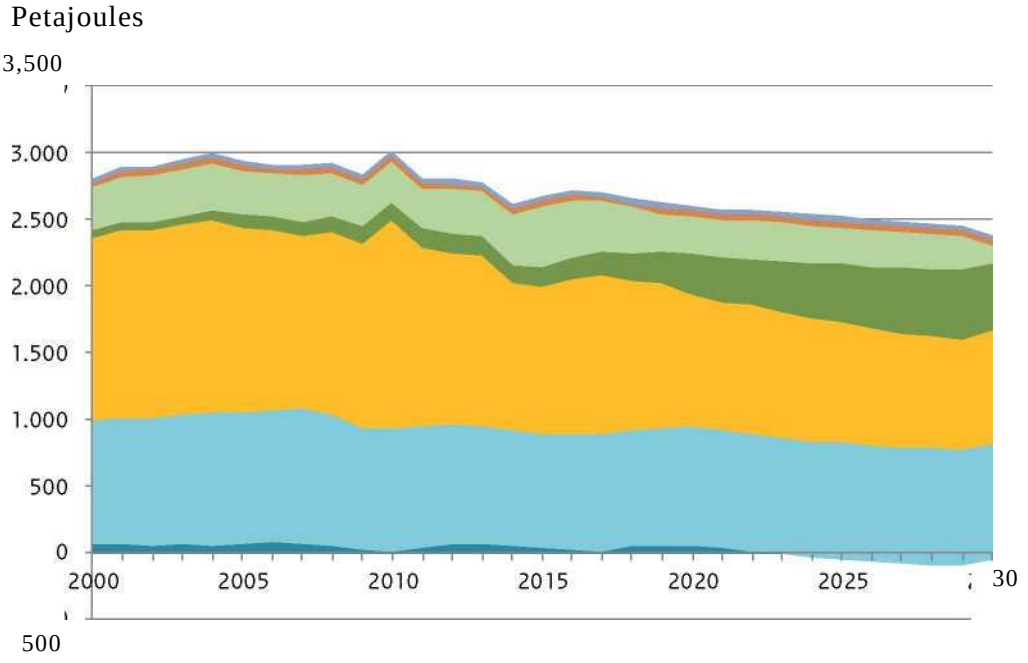
Decrease in primary energy consumption **2000**-2017

Total primary energy consumption in the Netherlands fell from 2,803 petajoules in 2000 to 2,702 petajoules in 2017 (see Figure 4.11). Similar to final energy consumption, primary consumption shows a slight downward trend between 2000 and 2017. Since the oil crisis in the early 1980s, primary energy consumption has increased, and continued to do so up to 2010. At the time consumption was around 3,003 petajoules. Consumption subsequently decreased dramatically. Consumption in 2017 was circa 10% below the 2010 level, while gross national product increased by 15% during this period. Energy intensity also decreased during this period.

Moreover, during this period, consumption of natural gas experienced the sharpest fall, from over 1,364 petajoules in 2000 to over 1,187 petajoules in 2017, a 13% reduction. This decrease was primarily caused by declining final consumption of natural gas for heating purposes. Natural gas is the principal energy source for heat consumption. The contribution of natural gas to electricity generation has also declined. In contrast, consumption of both renewable energy sources and coal showed an increase during this period. Consumption of renewable sources increased by 81%, with coal consumption increasing by 20% between 2000 and 2017 as a result of the commissioning of three new coal-fired power plants. The rise in coal consumption at the expense of natural gas consumption was also the result of price developments. The consumption of crude oil and nuclear fuels in 2017 were slightly lower than the level in 2000.

Between 2000 and 2017, non-energy consumption increased from 474 to 568 petajoules.

Figure 4.11 Situation and projection for primary energy consumption per energy carrier (including non-energy consumption) (Sources: Eurostat (situation) and PBL, 2019a (Forecasts with adopted policies))



[117] In these sections, primary energy consumption and final energy consumption are based on the Eurostat "2020-2030" definition (both excluding non-energy consumption). The draft NECP still applied the national definition, according to CBS, which is largely consistent with the new Eurostat definition.

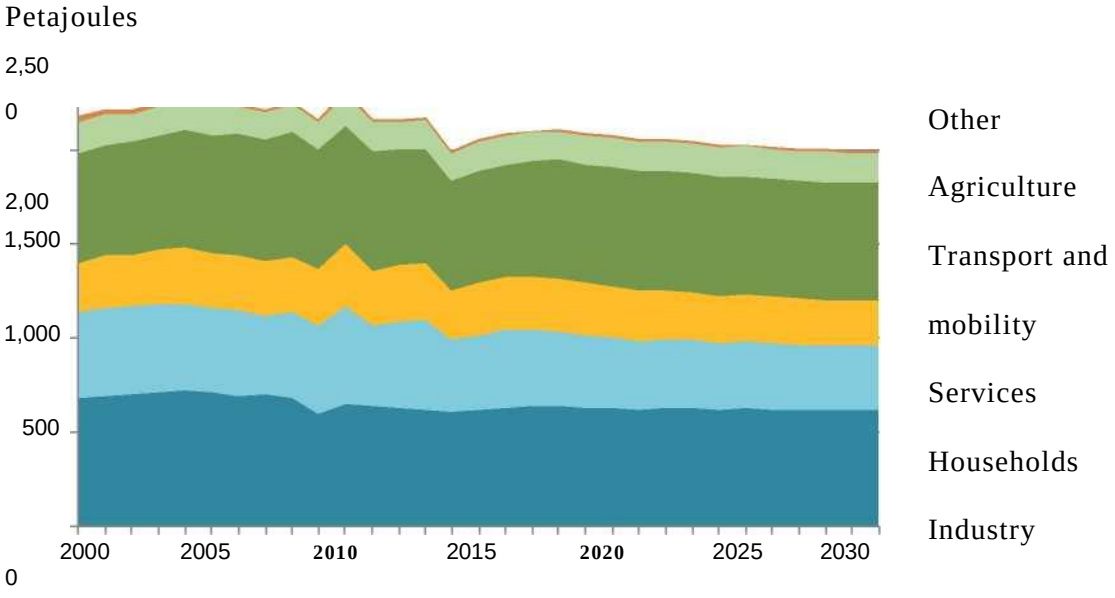
Waste ■ Nuclear ■ Coal ■ Renewable ■ Natural gas ■ Oil ■ Import balance for electricity

Decrease in final energy consumption 2000-2017

Final energy consumption in the Netherlands decreased slightly between 2000 and 2017, 2,181 petajoules to 2,108 petajoules (see Figure 4.12), although there was an increase in final consumption between 2000 and 2010 and there has been a downward trend since 2010. The decrease is mainly the result of reduced consumption by households. Final consumption decreased by 11% from 2000 onwards. This is partly due to improved insulation in homes and efficiency improvements of the heat supply, both through renovations and through new construction. This contrasts with the fact that electricity consumption rose during this period due to an increase in the use of electrical devices.

Between 2000 and 2017, total final consumption in industry decreased by 7%. In transport and mobility, between 2005 and 2010, consumption was on the rise, but by 2017, consumption ended up 2% below the level of 2005, due to more fuel-efficient cars, moderate economic growth and a shift in motorists refuelling across the border mainly between 2012 and 2014. In agriculture, including in greenhouse horticulture, final energy consumption fell by 10%. Energy consumption for heat fell due to a reduction of the acreage occupied by greenhouses and improvements in efficiency, whereas electricity consumption doubled due, for example, to lighting intensification.

Figure 4.12 Situation and forecast for final energy consumption per sector (excluding non-energy consumption) (Sources: Eurostat (situation) and PBL, 2019a (Forecasts with adopted policies))



4.3.2 Forecasts for energy consumption

Use of fossil energy carriers is gradually decreasing

Primary energy consumption is expected to decrease with the "adopted policies" policy variant to 2,601 petajoules in 2020 and to 2,374 petajoules in 2030. This is still above target consumption of 1,950 petajoules by 2030. Consumption of natural gas will decrease (see Figure 4.15) due to the continued reduction of the use of natural gas in the (primarily decentralised) generation of electricity through cogeneration and reduced demand for natural gas to heat buildings. Although the opening of three new coal-fired power plants and low coal prices have led to an increase in coal consumption in recent years, the closure of five coal-fired power plants that has taken place in recent years will result in coal consumption being lower than in 2017 by 2020. For the time being, crude oil will maintain its dominant position as a fuel in transport and as a raw material in the chemical industry. Consumption of crude oil will remain roughly the same, at the level of 2005.
It is expected that, in the years to come, crude oil will overtake natural gas as the principal energy carrier in the energy mix. Without new investments, the closure of the nuclear power plant in Borssele in 2033 will bring an end to the contribution of nuclear energy to the energy mix. The contribution of renewable sources is expected to increase significantly in the years to come, primarily due to the growth of renewable electricity production (see Section 4.2.2).

Final energy consumption continues to decline

After 2015, final energy consumption increased once more, probably due to the improving economy. This recent increase in consumption is not expected to continue; the projection foresees a downward trend. Final energy consumption is expected to fall in the policy variant of "adopted policies" to 2,080 petajoules in 2020 and 1,997 petajoules in 2030. This is still above target consumption of 1,837 petajoules by 2030. This further decline is chiefly caused by a continued decrease in the consumption of heat in the built-up environment due to demolitions, new construction projects and further energy savings. Final energy consumption in the other sectors will remain relatively constant in the period up to 2020. In many cases, this development is the result of increasing levels of activity that are compensated by increased energy efficiency. Uncertainty about the scope of economic activities is one of the key uncertainties, which could result in projected energy consumption turning out higher or lower.

Expected final consumption in the built-up environment is decreasing primarily due to the increase in insulation measures, efficiency measures and the number of heat pumps. In industry, consumption of heat and electricity is expected to remain the same, although non-energy consumption will increase slightly. The use of CHP in industry is decreasing due to adverse market conditions (see also Section 4.3.3). Several sub-sectors in industry show a difference in growth or a decrease: the metallurgical industry assumes growth, despite the uncertainty surrounding aluminium production. The food and beverage industry assumes its growth of recent years will continue, albeit at a more moderate pace. The production volume in the paper industry will shrink. The production of glass will decrease due to the closure of a glass factory in 2017. Production of the building materials industry is expected to increase in the future as a result of organic growth. It is assumed that the production of cobbles will come to an end in 2019, given that marlstone extraction operations in Limburg are to be terminated at that time. Traffic volume will increase due to economic growth, which compensates for increasing efficiency. Energy consumption for passenger transport will decrease due to increasing efficiency, but it will increase in cargo transport by road and in shipping. In agriculture, final energy consumption will decrease due to savings and sustainability improvements in energy consumption.

Anticipated energy savings well above EED target

Article 7 of the European Energy Efficiency Directive (EED) requires the Netherlands to achieve cumulative energy savings of 482 petajoules between 2014 and 2020. Only energy savings attributable to Dutch policy will count towards the target. According to RVO's monitoring data, the Netherlands will save 516 petajoules with the measures taken between 2014 up to and including 2017. This is more than is necessary to meet the obligation of 482 petajoules. The savings will be further increased by savings measures between 2018 and 2020, but this is no longer relevant for achieving the goal.

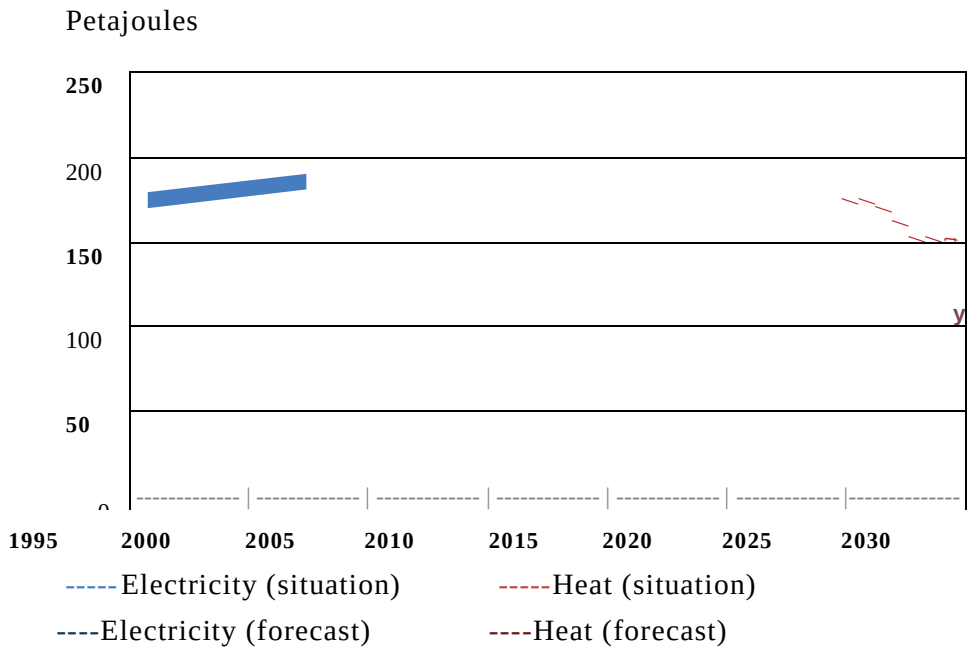
For the 2020-2030 period, Article 7 of the EED sets a preliminary target of 925 petajoules in final terms. For the Netherlands, the total EED savings based on both adopted and proposed policies are expected to be between 556 and 691 petajoules. Savings achieved exclusively with adopted policies are not known. For a more detailed explanation, see the Notification under Article 7 (Appendix III)

4.3.3 Developments and potential for combined heat and power and district heating and district cooling[118][118]

CHP generation has decreased

Following a strong rise in combined heat and power (CHP) systems in agriculture and horticulture between 2007 and 2010, virtually no new CHP systems have been introduced since then. In recent years, the number of systems remained reasonably stable, although there was a decrease in the production of electricity and heat (water/steam), due to the unfavourable price ratio between natural gas and electricity at the time. On the basis of the figures for 2017, the percentage of CHP in respect of total electricity production is roughly 38%. The heat and electricity supplied is generated from natural gas to an amount of approximately 64% and the remainder is mainly generated from fuel waste, process gas and, for a small part, from coal. The efficiency gain based on total fuel consumption in 2016 compared to separate generation can roughly be estimated at 20%.

Figure 4.13 Development of heat and electricity generation by CHP in the 2000-2030 period (Sources: CBS (situation) and PBL, 2019a (Adopted policies forecast))



CHP will continue to decrease in years to come

With the adopted policies variant the use of CHP is expected to see a further decline in the years to come (see Figure 4.13). The expectation is that the use of central CHPs (for district heating) will mainly decrease. The decentralised CHPs in industry and greenhouse horticulture remain profitable with the expected gas and electricity prices until 2030.

Small percentage of district heating in the Netherlands

Due to the extensive gas infrastructure in the Netherlands, natural gas is the most common form of heating for buildings. In 2017, a total 20 petajoules of heat was supplied via 17 major networks and a further 2.2 petajoules through smaller networks (ECN and Statistics Netherlands, 2017). In total, some 400,000 homes are connected to a heat grid, which corresponds to 5.5% of the number of homes in the Netherlands. The number of connections has grown since 2010 (4.6%), chiefly due to the completion of a number of major new construction projects.

[118] In accordance with Article 14(1) of Directive 2012/27/EU.

Based on the expectation of operators of the major heat grids, growth is expected from 20 petajoules to 22.6 petajoules in 2020 and 24 petajoules by 2030. Smaller projects will experience similar growth, amounting to a total of 27 petajoules by 2023. Further growth towards 40 petajoules is foreseen in the Climate Agreement, but will depend on the policies adopted. Various industrial complexes also make use of a heat grid. It concerns steam production, usually from a CHP. In total, this amounted to 35 petajoules in 2017 (ECN and Statistics Netherlands, 2019). This is more than all district heating combined (22 PJ). There is very little information available about these networks and their development. It is expected that some growth will still take place due to various initiatives for industrial heat exchange.

4.3.4 The development of energy performance standards in the built-up environment

Historic development of energy performance standards in the built-up environment

In December 1995, the energy performance standard for new buildings was introduced in the Netherlands and requirements were included in building regulations for the minimum energy performance of new buildings, the so-called Energy Performance Coefficient (EPC).

The EPC reveals building-specific energy consumption. This consumption relates to heating, hot water supply, ventilation, lighting and cooling of a building, based on a standard resident/user. It does not include energy consumption, for example, for cooking, washing and watching television. In addition, the EPC assumes a standardised outdoor climate and standardised use of the building. The level of the EPC requirements for non-residential buildings depends on the building's function. For example, a distinction is made between buildings with an educational function and buildings with an office function.
Between 1995 and 2015 inclusive, the EPC standards were made more stringent on several occasions, to encourage energy savings and to ensure that the measures were technically and financially feasible for all buildings. As a result, and in accordance with the European Energy Performance of Buildings Directive (EPBD), the aim is to achieve cost-effective and cost-optimal policies within the built-up environment.

Cost-optimal energy performance standards for the built-up environment

Under the EPBD II (2010/31/EU), Member States must report on the cost-optimal level of the minimum energy performance requirements every five years. In March 2018, the Netherlands submitted the accountability report to the Commission for the 2013-2018 period (Arcadis, 2018). This study included calculations designed to determine the cost-optimal level for the energy performance of buildings. However, it is often difficult to accurately establish the cost-optimal level; a cost-optimal range is produced. Current energy performance requirements for new buildings, according to the financial calculation, fall within this cost-optimal range.

According to the macro-economic calculation, the results for all building and element studies in general are comparable to the financial calculation, which means there are no other insights in relation to the cost-optimal level. Nevertheless, there are still marked differences. This is partly the result of the reduction of CO_2 emissions that are included in the macro-economic calculation. In addition, the macro-economic calculation uses a lower discount rate compared with the financial calculation. The Netherlands chose to use the financial calculation as a basis to determine the cost-optimal level.

In accordance with European Regulation (244/2012) the requirements must be tightened if the cost-optimal level of the situations subject to building regulation requirements that were studied deviates more than 15% from the established requirements. At present, this study does not currently point to such a situation, with the exception of land-based holiday homes. This means the energy performance requirement for this type of residence should be stricter. The potentially stricter requirements will be included in the cost-optimal level study for new nearly zero-energy buildings (NZEBs).

Expected developments surrounding energy performance in the built-up environment

As of 1 July 2020, all permit applications for all new buildings, both residential and non-residential, must satisfy the requirements for nearly zero-energy buildings (NZEBs). NZEBs are a result of the Energy Agreement for Sustainable Growth and the EPBD. Energy performance for nearly zero-energy buildings is determined based on three requirements:
1. The energy requirement in kWh per m² area of use per year;
2. Primary fossil energy consumption in kWh per m² area of use per year;
3. The share of renewable energy as a percentage.

In June 2019, the new methodology to determine the energy performance of buildings, the NTA 8800, was published. On the basis of this methodology, the energy performance can be determined for both the existing construction (during

renovation) and for a new construction. In May 2019, the cost optimisation study was completed, which assesses whether the NZEB requirements are at a cost-optimal and cost-effective level. The House of Representatives is to decide on the final NZEB requirements during the course of 2019. They are expected to be published in the Bulletin of Acts and Decrees after the summer of 2019. Subsequently, the laws and regulations will be amended, to allow the new methodology and NZEB requirements for new buildings to come into force as of 1 July 2020. See also Chapter 3 for more information.

4.4 Energy security dimension

As discussed in Section 4.2, the energy mix is expected to change in the coming decade. The consumption of natural gas and coal will decrease, while the use of renewable sources will increase. The national and international transport of electricity will rise as a result of the increase in renewable electricity generation and the (partially resulting) price developments. This will necessitate modifications to the electricity and gas network (see Section 4.5). This section discusses the trends and projections based on the KEV per energy carrier.

4.4.1 Natural gas security of supply

The Netherlands has substantial stocks of natural gas that have been extracted on a large scale since the 1970s, both in order to meet the domestic gas demand and as an export commodity. Most natural gas in the Netherlands is located in the Groningen gas field. For years, joint annual gas production from the Groningen gas field and the small fields fluctuated around 80 billion cubic metres, but this figure began to drop from 2015, both due to the restrictions on extraction operations from the Groningen gas field and the declining supply from the small fields. In the gas year 2018/2019, the extraction level from the Groningen field was 17.5 bcm. Following the recommendation of the State Supervision of Mines (SODM), at the start of 2018, the government decided to fully phase out gas extraction from the Groningen gas field by 2030[119]. From mid-2022, gas extraction in Groningen can be zero in an average year, assuming that the underground gas storage Norg can be structurally filled with pseudo-Groningen gas[120]. This does not mean that the field can be closed immediately in 2023. It cannot be ruled out that gas extraction will remain necessary even after 2022, for example, to provide for high gas demand on a cold winter's day.

Domestic consumption of natural gas amounted to almost 50 bcm a year until it peaked in 2010, after which consumption began to decrease.
Current consumption is around 35 to 40 bcm per year. Due to the decision to fully phase out gas extraction from the Groningen gas field, the Netherlands will have to become a net gas importer. The point at which this will happen depends on the measures the government puts in place in order to phase out gas extraction and reduce domestic demand. This will also take into account the security of supply of surrounding countries, within the context of the European Regulation on the security of gas supply in the EU. This is necessary because Belgium, Germany and France depend on gas from the Groningen gas field for a portion of their gas supply. The gas extracted from this field is known as low-calorific gas, whereas the gas that is extracted elsewhere in the world, including from the Dutch small fields, is known as high-calorific gas. As such, customers in Belgium, Germany and France, similar to customers in the Netherlands, are physically dependent on gas from the Groningen gas field, or more precisely, dependent on low-calorific gas that is supplied from (1) the Groningen gas field and (2) the GTS conversion plants where high-calorific gas is converted into low-calorific gas through the addition of nitrogen. Belgium, Germany and France will have to reduce their dependence on low-calorific gas from the Netherlands to zero between now and 2030 by transitioning to high-calorific gas or other forms of energy.

In order to phase out extraction in the short term, exports abroad will be reduced in accordance with the relevant agreements, additional nitrogen will be purchased and an additional nitrogen plant will be constructed that, according to the schedule, will be commissioned by the end of the first quarter of 2022 (GTS, 2018). A nitrogen plant allows high-calorific natural gas to be converted into low-calorific natural gas. In the longer term, the domestic demand for low-calorific and other natural gas by homes and companies will be reduced. As of 1 July 2018, there is no longer a requirement for newly built housing to have a gas connection. In this case, an "all-electric" solution is an alternative for these newly built housing areas, in addition to geothermal energy or other types of renewable energy. For existing buildings, heat grids fed from renewable sources are also an option.

[119] Letter to Parliament on Gas Extraction in Groningen, 29 March 2018, Parliamentary document 33 529, no. 457
[120] Letter to Parliament on the Gas extraction level in Groningen in 2019-2020, 10 September 2019, Parliamentary document 33 529 no. 678

In recent years, imports have rapidly increased as a result of declining gas extraction in the Netherlands. While (net) imports in 2005 accounted for almost 23 bcm, this has now increased to close to 54 bcm in 2017 (Eurostat, 2018) Natural gas is mainly and increasingly imported from Norway and Russia. Imports from Russia more than doubled to 9.4 bcm between 2010 and 2017. At the same time, imports of Norwegian natural gas have also doubled to 26 bcm. Imports from Germany have increased tenfold to 8.2 bcm, imports from Denmark and the United Kingdom fell sharply between 2010 and 2016 due to declining production in those countries, but rose again in 2017. Natural gas is also imported in the form of liquid natural gas (LNG). LNG is supplied by tanker, in contrast to gaseous natural gas, which is transported via pipelines. In 2012, the Netherlands only imported around one bcm of LNG (calculated in gaseous form), whereas this amount had already more than doubled to 2.1 bcm in 2017. Despite increasing imports, the security of supply of natural gas for the Netherlands seems to have been secured for the years to come, through our own - albeit decreasing - production (Groningen field, small fields) and an effective gas market on which a large number of suppliers operate. In addition, the demand for gas will decrease due to the use of low-calorific gas being phased out and the transition to sustainable alternatives.

4.4.2 Security of supply of coal

In the Netherlands, coal is used to generate electricity and produce steel. The Netherlands has large coal reserves, consisting of almost 1,300 megatons of mineable reserves, while only 12 megatons is used for domestic consumption (TU Delft, 2018). Since the 1970s, coal mining has been discontinued in the Netherlands and as a result the supply of coal depends entirely on imports. Coal imports amounted to 108 megatons in 2017, making the Netherlands one of the top ten coal importers worldwide. A large portion of the coal is subsequently exported to other European countries. There are relatively few concerns with regard to the security of supply of coal. It is widely available on several continents (Statistics Netherlands et al., 2018). Imported coal primarily comes from Colombia (25%), the US (19%), Germany (17%), South Africa (13%) and Russia (12%) (Statistics Netherlands, 2019c). During this decade, domestic consumption of coal is likely to decrease as a result of the coal-fired power plants being closed under the Energy Agreement. As indicated in previous chapters, in the Coalition Agreement the government decided to halt the use of coal-fired power plants to generate electricity by 2030[121], the first of which will closed by the end of 2019 (This will further reduce dependence on coal imports).

4.4.3 Security of supply of crude oil

Crude oil is the Netherlands' most important import product, good for circa 6% of the total import value (Statistics Netherlands, 2019c) A large percentage of the crude oil is directly exported to other European countries (approximately 40%), with the rest being processed in the refining sector and most of it subsequently exported as oil products. Crude oil is primarily imported from Russia, Norway, the United Kingdom, Nigeria and Saudi Arabia. Imports from Saudi Arabia have fallen significantly since 2000, while imports from Russia have increased. Due to the major uncertainties on the future production and prices of crude oil per country and possible trade with the Netherlands, no forecasts are available on the future origin of oil.

The Netherlands has a relatively large and efficient refining capacity, more than enough to be able to satisfy domestic demand. Future developments are uncertain. The demand for oil products is expected to decrease in OECD countries, but will rise in non-OECD countries, (IEA 2018). This shift in demand will lead to a large number of investments being made in the refining sector in Asia, particularly in China and India. In addition, there will be major investments in refineries in the Middle East, due primarily to the strategy of countries in this region, which focuses more on the supply of oil products and less on the supply of crude oil. Due to the new refining capacity, global competition for available raw materials and markets in this sector will increase further. In Europe the consumption of oil products has stagnated in recent years (Eurostat, 2017). There is a relatively high demand for diesel compared with that for petrol, which has resulted in the import of diesel and the export of petrol. However, it is uncertain how the market for these petrol exports, particularly North America and the west coast of Africa, will develop in the future.

Based on global and European trends, it is expected that the throughput of oil in the Dutch refining sector will decrease. The projection assumes that the conversion of crude oil into petroleum products will shrink by around 12% between 2018

[121] 121Letter to Parliament - Elaboration of the agreement on coal-fired plants in the Coalition Agreement, 13 December 2017, Parliamentary document 30 196, no. 567.

and 2030. Although this results in a decrease in the energy consumption of the Dutch refining sector, the product portfolio of petroleum products is also changing, which in turn leads to increased energy consumption per unit of fuel produced. The most important explanation for this is that fuel oil for shipping bunkers must meet stricter sulphur requirements from 2020 onwards due to IMO requirements, so a larger proportion of this fuel must be desulphurised.

In order to reduce the risks of disruptions in the supply of crude oil, the Netherlands has a mixed system for holding strategic oil stocks. Both industry and the government (through the Netherlands Petroleum Stockpiling Agency, COVA) are required to hold emergency stocks of oil under the Petroleum Products (Stockpiling) Act (Wet voorraadvorming aardolieproducten) 2012. Any company that supplies the Dutch market with more than 100 kilotons of eligible petroleum products per calendar year is required to hold 5% in excess amounts as a mandatory stock. This equates to approximately a total of 13.5 days of net imports. The COVA is responsible for supplementing this up to the total mandatory stock of 90 days of net imports.

4.4.4 Security of supply of electricity

Domestic generation capacity in the Netherlands has increased from almost 21 MWe in 2000 to over 34 MWe in 2017 (Statistics Netherlands, 2019d). Due to the increased generation capacity, the export of electricity has also risen from 4 billion kWh in 2000 to almost 19 billion kWh in 2018. During this period, imports fluctuated between around 15 billion kWh (in 2009 and 2010) and over 30 billion kWh between 2012 and 2015 and almost 27 billion kWh in 2018 (Statistics Netherlands, 2019e). The KEV expects imports and exports will increase in the period leading up to 2030, due to the strong growth in generation capacity based on wind energy and solar power. The import balance is expected to increase up to and including 2020, but a further increase in renewable energy generation will increasingly reduce the need for net imports. From 2023 onwards, the Netherlands is expected to become a net exporter of electricity. Fluctuations in electricity generated from solar and wind energy can be absorbed due to the increase in connection with foreign countries.

The electricity security of supply standard, the Loss Of Load Expectation (LOLE), is an expectation value of up to four hours per year when insufficient generation capacity is available to meet demand. The security of supply of electricity is considered with and without the import and export of electricity. Up to 2024, domestic generation capacity will be sufficient to satisfy the standard (TenneT, 2018). LOLE will rise slightly to 2.5 hours a year (see Table 4.5) in the coming years, but will remain within the norm. This is due to decreasing capacity surplus as a result of thermal energy being phased out while the demand for electricity is increasing. The substantial increase in solar and wind energy makes a limited contribution to security of supply - for as long as storage is insufficient - due to its intermittent nature. Under normal circumstances, around 2025, situations of temporary import dependence could occur. This does not necessarily constitute a problem to supply security, since connections with other countries provide sufficient capacity to absorb such dependence (see also section 4.5). In the past, the Netherlands has also had periods of import dependence (such as between 2005 and 2007). What's more, the Netherlands has a substantial amount of relatively modern conserved gas capacity, which with favourable market conditions could qualify for deconservation in a relatively limited period of time.

Table 4.5 Main results of monitoring, situation 2014-2017 and forecast for 2018-2025 with non-availability of production resources according to data provided by producers (base variant) (Source: TenneT, 2018)

	Elec-	Non-	operational capacity				LOLE NB	Firm
	tricity demand	operational capacity	Total	Solar PV/ wind/hydro	Thermal (excl. waste)	Other (e.g. waste)	based on challenges	capacity deficit
Year	TWh	GW	GW	GW	GW	GW	h	GW
2014	114.0	2.7	28.7	3.5	24.2	1.1	0.00	-3.9
2015	114.7	4.4	28.8	4.0	23.8	1.1	0.00	-3.9
2016	115.9	4.1	28.4	4.9	22.3	1.1	0.02	-1.8
2017	116.3	3.6	30.0	6.4	22.4	1.2	0.01	-1.9
2018	115.8	2.9	29.5	7.1	21.2	1.2	0.01	-2.0
2019	114.8	3.1	30.5	8.6	20.7	1.2	0.01	-2.1
2022	114.2	2.1	35.1	14.4	19.4	1.2	0.07	-1.6
2025	113.8	2.5	39.8	20.7	17.8	1.2	2.50	-0.2

4.5 Internal energy market dimension

4.5.1 Electricity interconnection

Current interconnection[122]

An important aspect of the integrated electricity market is the development of network connections between countries, so-called interconnectors. The Netherlands currently has connections with Germany, Belgium, the United Kingdom and Norway, with a total import/export capacity of 7 gigawatts (see Table 4.6).

Table 4.6 The Netherlands' interconnection capacity in megawatts (Source: PBL, 2019a)

Capacity in megawatts Connection	2019	2020	2025	2030
NL-DE	3950	4250	5000	5000
NL-BE (BE-NL)	1400 (2400)	1400 (2400)	3400	3400
NL-DK	0	700	700	700
NL-UK	1000	1000	1000	1000
NL-NO	700	700	700	700
Total	**7050**	**8050**	**10800**	**10800**

The electricity markets of Belgium, France and the Netherlands have been integrated since 2008. More recently, the markets of Germany (since 2010) and the United Kingdom (2014) have also been coupled to the Dutch market. Connections with this regional market have also been made with the Scandinavian and Central European markets (TenneT, 2018). This has manifested in a highly integrated (Northwestern) European electricity market in which the Netherlands plays a pivotal role. This integration contributes to competition on the energy market, boosts the security of supply and facilitates the integration of renewable electricity. A high degree of connectivity allows national electricity surpluses or deficits to be absorbed more easily. Figure 4.14 shows the transmission network.

Figure 4.14 Transmission network and interconnectors (Source: TenneT)

[122] With reference to overviews of existing transmission infrastructure by Transmission System Operators.

Expected interconnectivity extensions[123]

Extending electricity network connections with Germany and Belgium

The Netherlands currently has direct connections with Germany, Belgium, the United Kingdom and Norway. Extensions mean that these connections will increase from seven to nine gigawatts in 2021. There are no concrete expansion plans for the connections with Norway and the United Kingdom. The Cobra cable is currently being laid between the Netherlands and Denmark, which is a connection of 700 megawatts expected to be fully operational in 2020. The 1,500 megawatt Doetinchem-Wesel connection between the Netherlands and Germany was commissioned at the end of September 2018. Capacity between Belgium and the Netherlands will increase from 2 to 3.4 gigawatts before 2025 through the completion of the Rilland transformer station, the installation of an additional phase shifter in Maaseik in Belgium and internal reinforcements in the Belgian grid in view of the closure of the Doel nuclear power plant.

Following the decision of the European Council of 23 October 2014 to increase European interconnection to 10% in 2020 and to 15% by 2030, the European Commission created an expert group that published a report on 15 November 2017 on the expected European interconnection capacity required for 2030. This report cites two new ways to measure interconnection, with the Netherlands comfortably exceeding its targets with both alternative measuring methods (EC, 2017a). Table 4.7 shows the percentages of interconnection based on the definition used by the European Commission (EC, 2017b). The Netherlands also exceeds its targets with ease based on this definition.

	2019	2020	2025	2030
Total interconnection capacity (MW)	7,050	8,050	10,800	10,800
Electricity generation capacity (excluding conserved units) (MWe)	34,887	37,602	52,646	59,018
Interconnection (%)	20.2%	21.4%	20.5%	18.3%

Table 4.7 Interconnections, capacity of electricity generation and interconnectivity (Sources for capacity of electricity generation: PBL, 2019a (Adopted policies forecast))

Interconnection developments in the gas network

There are currently no plans to radically expand the gas network. However, in time, sections of the low-calorific gas network could be made suitable for transporting high-calorific gas, as a result of the low-calorific gas phase-out and the possible increase in the consumption of high-calorific natural gas. Furthermore, the intended transition from low-calorific gas to high-calorific gas by industrial large-scale consumers may necessitate the creation of new connections to the high-calorific gas network.

The current Network Development Plan of the operator of the national gas transport grid GTS, the Network Development Plan (NOP) 2017, provides for maintenance and limited expansion of the gas network during the period up to 2025 (GTS, 2017a). This expansion relates to connections to other countries as a result of the projected increase in imports. Incremental Capacity Tests (ICT) are a new element of the NOP 2017. These allow market parties to inform GTS once every two years if they require an expansion of the interconnection points capacity of the European gas network. The first ICT ran from 6 April to 1 June 2017, but did not result in any expansion (GTS, 2017b).

Plans to expand connections to the gas network in the long term are currently being discussed, since natural gas extraction from the Groningen field is being completely phased out. There are a number of options available to absorb demand for natural gas, which have various consequences for the gas network and connections to the network. The main options are: importing high-calorific natural gas from Norway and Russia, gas extraction from other (small) Dutch fields and switching to other types of gas, such as biogas and hydrogen, and/or electrification.

[123] With reference to national network development plans and regional investment plans of TSOs.

4.5.2 Energy transmission infrastructure

Characteristics of existing transmission **infrastructure**[124]

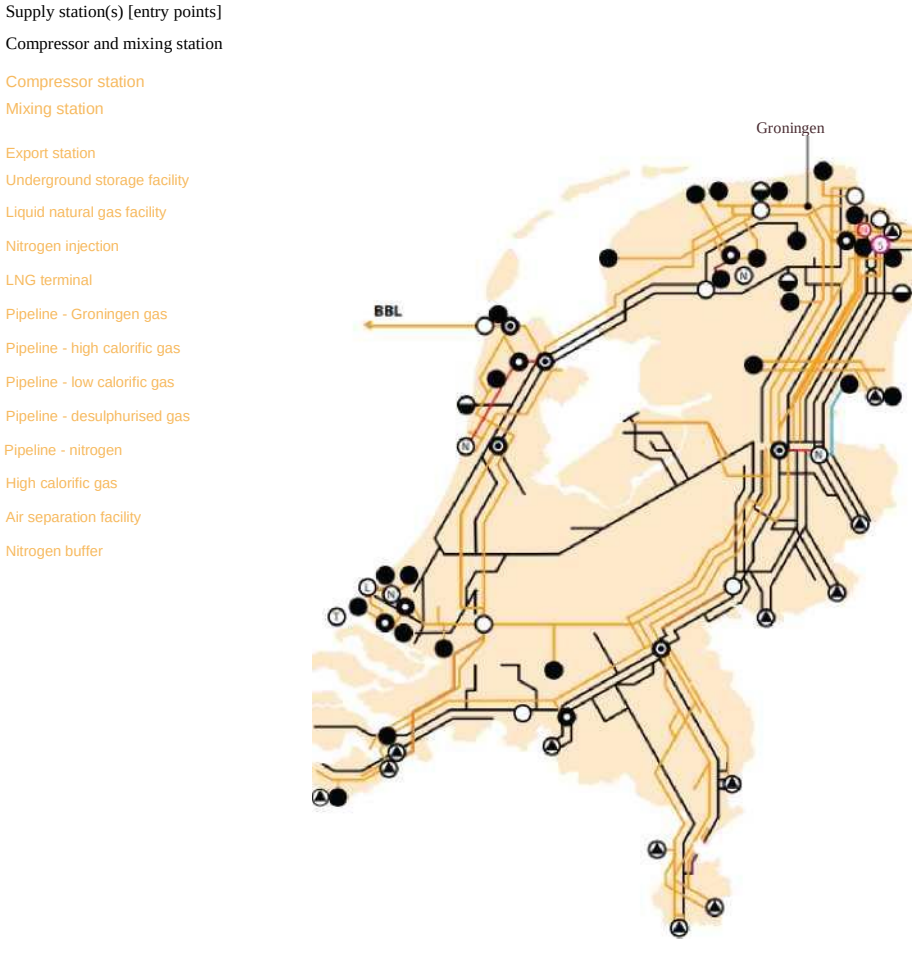
Size and voltage of the electricity network

The high-voltage grid connects the ultra-high-voltage grid with the distribution networks. Power plants, energy-intensive industry, larger wind farms (35 to 500 megavolt-ampere), etc. are all connected to the high-voltage grid. The high-voltage network mainly consists of networks with a voltage of 50 kilovolts, 110 kilovolts or 150 kilovolts; networks of the latter two voltages have been managed by TenneT since 1 January 2018. The high-voltage network consists of approximately 5,020 kilometres of overhead lines and approximately 3,850 kilometres of underground cables. The ultra-high-voltage grid transports power over greater distances within the Netherlands. The large electric power plants from 500 megavolt-ampere are connected to it. This network also has connections with Belgium, Germany, and also via direct current connections with Great Britain and Norway. TenneT is this grid's network operator; it has a voltage of 220 kilovolts or 380 kilovolts. The ultra-high-voltage grid consists of circa 2,840 kilometres of overhead lines and approximately 40 kilometres of underground cables.

Natural gas transmission network

The transport networks operated by Gasunie Transport Services (GTS) consist of pipes and stations. The transmission networks are divided into a high-pressure grid (HTL) and an intermediate-pressure grid (RTL) based on pressure class. The HTL is subdivided into a Groningen gas (G-gas) transport network and a high-calorific gas transport network based on the type of gas flowing through the network (see Figure 4.15).

Figure 4.15 Transmission network for high-calorific gas (yellow) and Groningen gas (black) (Source: ECN, 2016).



[124] With reference to overviews of existing transmission infrastructure by TSOs.

The two HTL networks are connected via blending stations where different combinations of high-calorific gas and nitrogen are added to the G-gas network. The HTL networks contain a large number of compressor stations as well as pipelines. These stations can be used to increase the pressure of the gas to facilitate further transport. Gas is fed into the network at entry points. These can be supply points for gas originating from domestic production, border points where gas enters from other networks (or via an LNG terminal) or points connected to gas storage facilities.
Gas can be supplied via the connections with Germany and Belgium and in the form of LNG on the Maasvlakte (the GATE LNG terminal). The possibility of enabling limited supply from the United Kingdom via the Bacton Balgzand Line (BBL) is currently being explored.

After transport, gas is removed from the HTL at exit points or at metering and pressure-regulating facilities. Exit points are the transfer points for domestic customers (the gas distribution stations), border points where gas is transferred to other networks and points that are connected to gas storage facilities. The RTL begins at a metering and pressure-regulating facility from which HTL gas is distributed and in turn, the networks of the regional grid operators are largely supplied by exits on the RTL. The RTL is basically only used to transport G-gas.

Expected expansion of transmission infrastructure[125]

Developments in the electricity transmission network

The Netherlands has one of the most reliable national electricity grids in the world, with 99.99% reliability (Netbeheer Nederland, 2017). The capacity of the high-voltage grid will be expanded in the next few years in order to provide the electricity market with an effective and reliable supply of energy. Expansions involving the 380 kV network, which are ongoing or planned, include the Randstad 380 kV Noordring connection, the Noord-West connection, the Zuid-West connection and the Doetinchem-Wesel connection (completed at the end of 2018).

Developments in the natural gas transmission network

GTS regularly compiles a Network Development Plan (NOP), the most recent is the NOP 2017 (see above). This NOP uses three scenarios to demonstrate that the gas transmission system in the Netherlands is robust enough to respond to the expected changes in the supply and demand of gas over the next ten years and that any necessary investments are limited. However, there will be a greater need to convert high-calorific gas into gas that is suitable for the low-calorific consumer market, due to the decision to reduce gas extraction from the Groningen field as quickly as possible and to eventually halt it. This is why at the end of March 2018, the government decided to proceed with the construction of an additional nitrogen plant to allow the decrease in production from the Groningen field to be compensated by the conversion of high-calorific gas to low-calorific gas. The plan is for the plant to be commissioned in the first quarter of 2022 (Gasunie, 2018).

4.5.3 Electricity and gas markets and prices

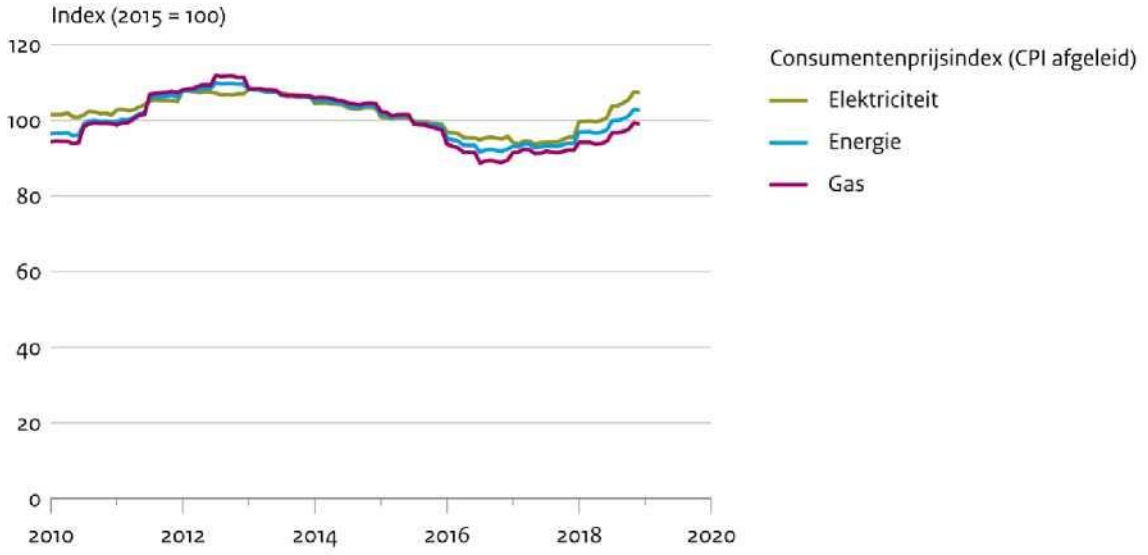
Trends of energy markets and prices

Energy prices for end consumers

The Consumer Price Index (CPI) for energy reflects price developments for natural gas and electricity consumption by households (see Figure 4.16). Since 2000, household energy bills have increased by an average of 4.5% per year, while inflation has been at an average of 1.8% per annum. The relatively large increase in energy prices for households is partly due to the steady increase in fuel prices on the global market. The CPI for energy fell sharply during the crisis as of the end of 2008, but returned to maximum levels early 2013. Since then it has fallen dramatically once more. The consumer price has since risen slightly due to the increase of the energy raw material in 2016 and this trend continued in 2017 (Statistics Netherlands, 2018a).

[125] With reference to national network development plans and regional investment plans of TSOs.

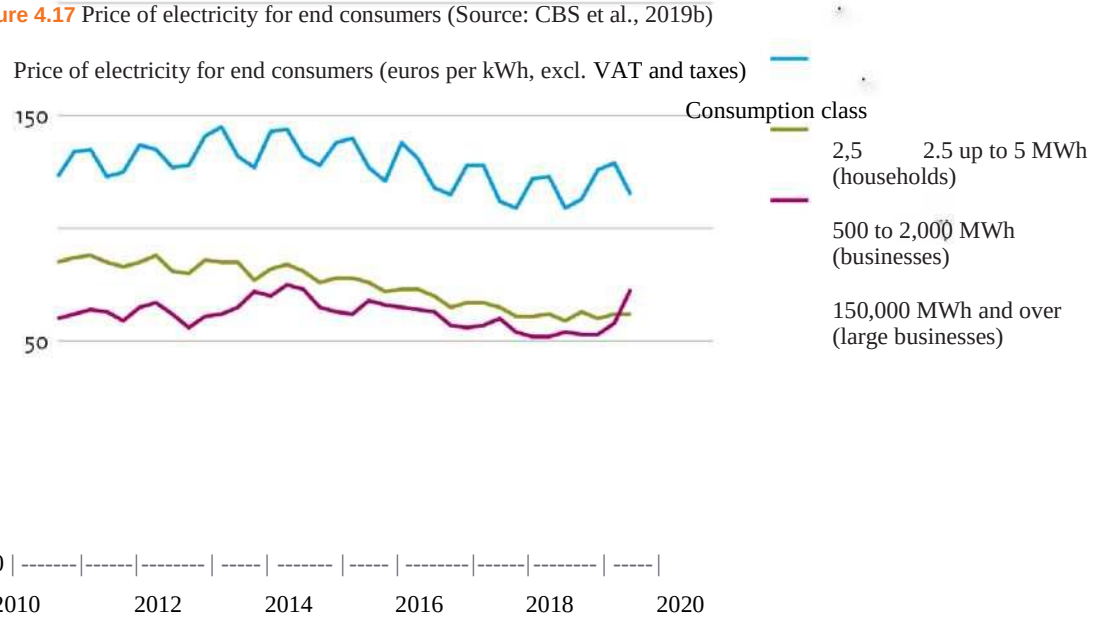
Figure 4.16 Consumer price index (CPI) for energy, electricity and gas (Source: CBS et al., 2019b)



Price of electricity for end consumers

The price of electricity depends, for example, on fuel prices of oil, coal and natural gas (see Figure 4.17). Another key component involves the costs of the transmission networks.

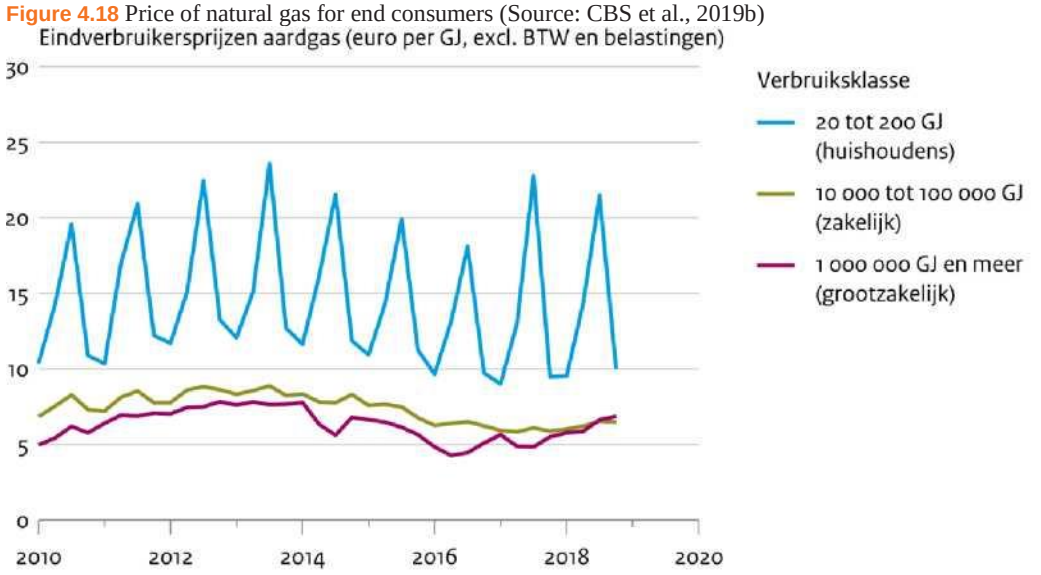
Figure 4.17 Price of electricity for end consumers (Source: CBS et al., 2019b)



Price of natural gas for end consumers

Figure 4.18 shows the development of the price of natural gas for end consumers as of 2007. In general, the price of natural gas follows the price of crude oil (see Section 4.1.3). Significant world events also have an effect on the price of natural gas. The strong fluctuations of the price for households that take place within a year are the result of the high demand for natural gas during the winter period.

Figure 4.18 Price of natural gas for end consumers (Source: CBS et al., 2019b)



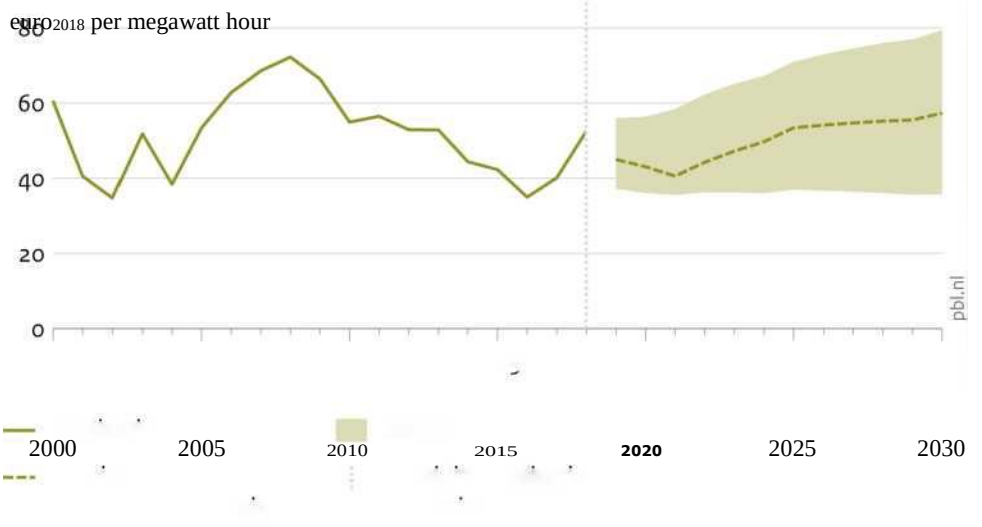
Key: **verbruiksklasse = consumption class**
huishoudens = households
zakelijk = business
grootzakelijk = large business

Forecast for electricity market developments

The Dutch electricity market is highly integrated with the Northwestern European market. This means developments in our neighbouring countries are crucial to production in the Netherlands, to imports and exports and, to the price of electricity. These developments could involve the development of generation capacity, including the share of renewable energy, and that of the electricity demand in neighbouring countries.

Figure 4.19 shows the expected wholesale price in the Netherlands. Major factors that influence the development of wholesale prices up to now include lower fuel prices, overcapacity of supply and the increase in renewable energy generation in the Netherlands and Germany. The increase in the forecast can be explained by the influence of rising fuel prices and the decrease in overcapacity.

Figure 4.19 Development of the average wholesale price of electricity (Source: PBL, 2019a)



The wholesale price in the Netherlands is significantly affected by developments in other countries in the Northwestern European market. The network companies of most countries expect a slight increase of the demand for electricity in the long term, due to electrification of the heat demand and transport. The effect is expected to be greater than the reduction in the demand for electricity from energy savings. Every two years, the European network of high-voltage grid operators, ENTSO-E, compiles a pan-European network development plan, referred to as the Ten-Year Network Development Plan (TYNDP). For the short term (until 2025) there is one scenario, "Best Estimate". For the longer term, 2030 and 2040, there are several scenarios, all of which are in line with the EU's climate targets for 2030. The development of demand, generation capacity and network connections between countries is based on the Sustainable Transition scenario from the TYNP2018 (ENTSO-E, 2018). In this scenario, the necessary CO_2 reduction in the European electricity sector is achieved by replacing lignite and coal-fired generation with natural gas.
Both wind energy and solar power capacity in Europe is increasing significantly, from about 106 gigawatts of wind power in 2019 to more than 173 gigawatts by 2030. Solar power capacity will increase from 71 gigawatts in 2019 to 131 gigawatts by 2030. The capacity of lignite and coal-fired power plants in Europe will decrease from 64 gigawatts in 2019 to below 19 gigawatts by 2030. The capacity of gas-fired power plants is expected to increase by 25 gigawatts from 2019 to 100 gigawatts in 2030 (see Figure 4.20).

Figure 4.20 Electricity generation capacity development in Germany, France, Belgium, the United Kingdom, Norway and Denmark (source: PBL, 2019a)

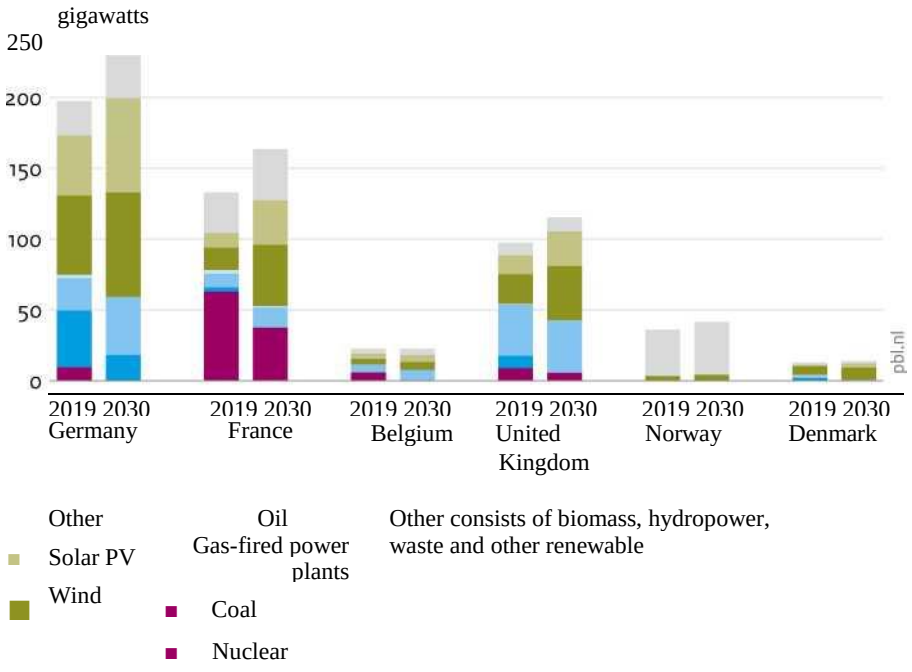
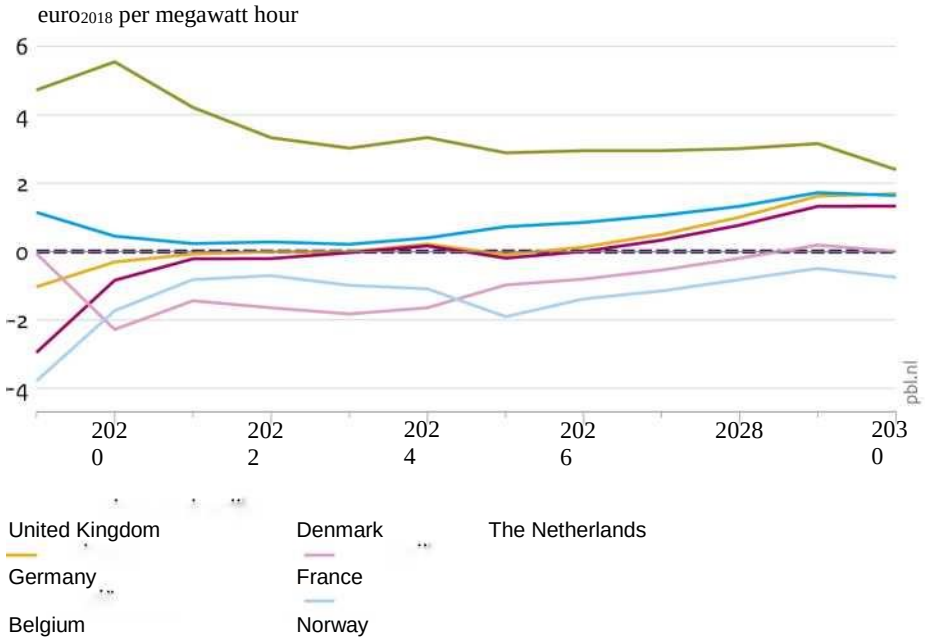


Figure 4.21Development of the wholesale price of electricity in Northwestern Europe (Source: PBL, 2019a)



The price difference between the Netherlands and Germany is expected to decrease, resulting in the prices being very similar after 2021 (see Figure 4.21). An important reason for this is the increase in interconnections and market integration. Moreover, the two countries increasingly resemble one another in terms of the composition of their generation capability, given that the share of renewable energy is growing in the Netherlands and nuclear power and coal-fired capacity are being phased out in Germany. By 2030, prices in the Netherlands will be slightly lower than in Germany, though the difference will be negligible. In the next few years, the price of electricity in the United Kingdom will be relatively high because the old coal-fired power plants have been decommissioned. Afterwards the price difference will decrease due to the increase in the capacity of gas-fired power plants and renewable energy sources. The capacity of the network connections between the United Kingdom and the rest of Europe will also be expanded significantly as of 2020. However, any future expectations involving the United Kingdom will be subject to change, given that they depend on the outcome of the Brexit negotiations.

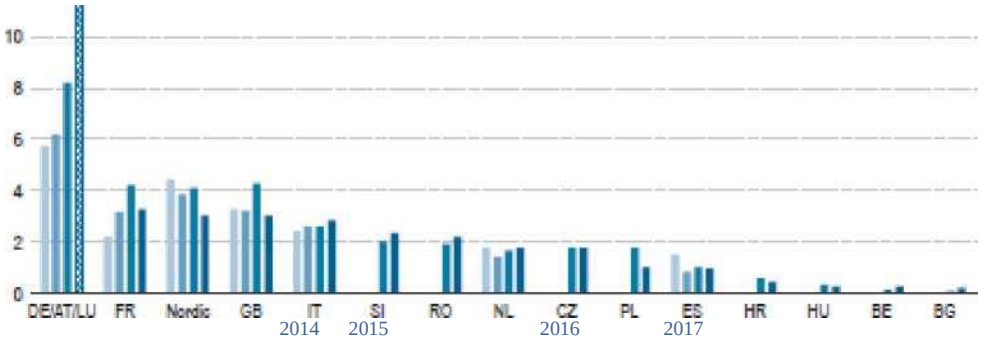
4.5.4 Electricity and gas market operations

Based on quantitative data, this section provides a better understanding of the functioning of energy markets in the Netherlands. The annual reports produced by the Agency for the Cooperation of Energy Regulators (ACER/CEER) have been used to achieve the results of the monitoring of the internal electricity and gas market. ACER/ CEER, in cooperation with national regulators, compiles reports on wholesale markets, retail markets and consumer protection in Europe[126]. These reports focus, among other things, on developments in supply and demand, prices and the liquidity of energy markets. For the sake of brevity, an explanation is provided of the liquidity of wholesale gas and electricity markets and some indicators of "market health" for wholesale gas. For detailed information on the availability of cross-border capacity and the efficient use thereof, refer to the actual reports.

The liquidity of the wholesale electricity market
Liquidity can be measured in different ways. The churn factor is the volume traded through stock exchanges and mediators in relation to physical consumption. The higher this factor, the greater the liquidity. In the Netherlands, the churn factor increased by 10% between 2016 and 2017 (see Figure 4.22). High liquidity contributes to a competitive market.

[126] See https://www.ceer.eu/web/portal/national-reporting-2018

Figure 4.22 Churn factors in key European forward markets 2014-2017 (source: ACER/CEER, 2018a)



The liquidity of the wholesale natural gas market

Being an established hub, the Dutch gas market is one of the highest category hubs, with broad liquidity, large forward markets, which contribute to the possibilities of covering supply risks and serving as a reference price for other hubs in the European Union and for the indexation of long-term contracts (see Figure 4.23)

Figure 4.23 Ranking of hubs in the EU based on monitoring data from 2017 (Source: ACER/CEER, 2018b)

Established hubs
• Broad liquidity
• Sizeable forward markets which contribute to supply hedging
• Price reference for other EU hubs and for long-term contracts indexation

Advanced hubs
• High liquidity
• More reliant comparatively on spot products
• Progress on supply hedging role but relatively lower liquidity levels of longer-term products

Emerging hubs
• Improving liquidity from a lower base taking advantage of enhanced interconnectivity and regulatory interventions
• High reliance on long-term contracts and bilateral deals

Liquid-incipient hubs
• Embryonic liquidity at a low level and mainly focused on spot
• Core reliance on long-term contracts and bilateral deals
• Diverse group with some jurisdictions having
- organised markets in early stage
- to develop entry-exit systems

The Dutch market for Title Transfer Facilities (TTF) for "day-ahead (DA) gas" is the largest in the EU. During the 2016-2017 period, the number of transactions decreased by 15% and average price volatility decreased from about 40% to over 30%. Via TTF, gas already located in the Dutch network can be transferred without leaving the network, thereby promoting market liquidity. See figures 4.24 and 4.25.

Figure 4.24 The average price volatility of the day-ahead gas market in selected EU hubs in 2016 and 2017 as a % (Source: ACER/CEER, 2018b)

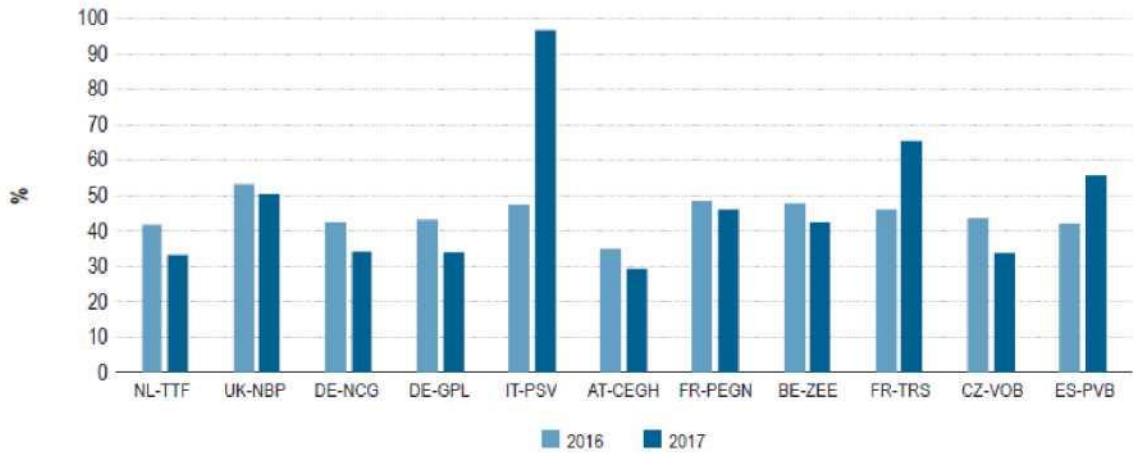
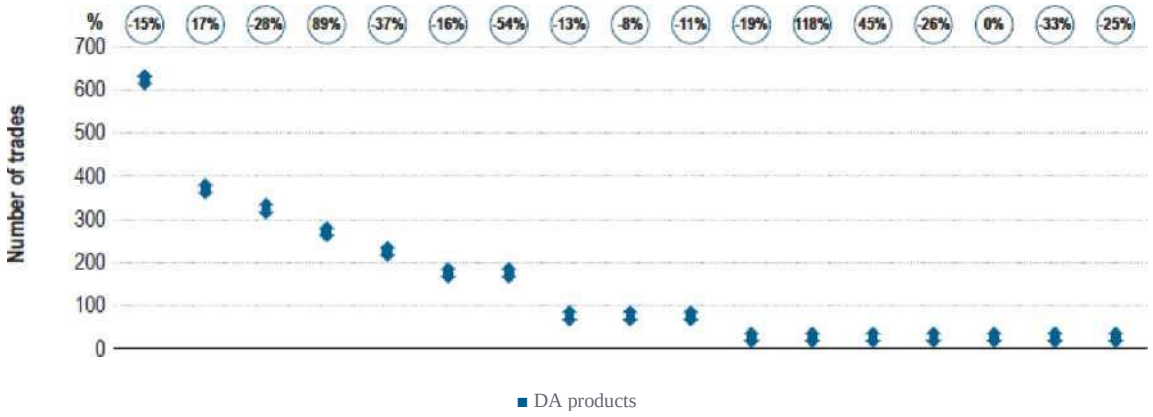


Figure 4.25 Number of implemented "trades" daily average of day-ahead products in 2017 and percentage change compared with 2016 (Source: ACER/CEER, 2018b)



The previously cited report on the wholesale market for gas also includes indicators for "market health". For the purpose of illustration we specify how the Netherlands scores for these indicators (Herfindahl-Hirschmann Index (HHI) and residual supply (RSI). The higher the HHI, the greater the market share of the largest suppliers. The RSI indicates the percentage of the supply within one country for which there are alternatives to the largest provider. The higher the RSI, the "more competitive" the market. The Netherlands scores in the green healthy zone (see Figure 4.26).

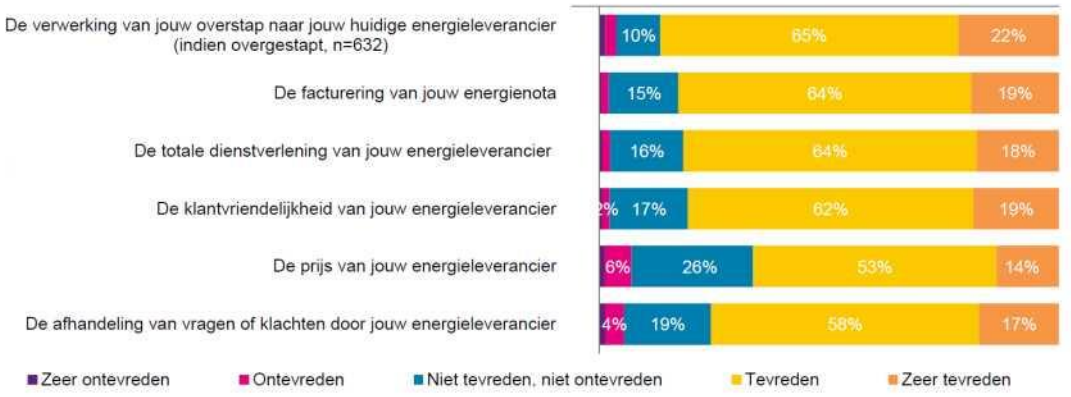
Figure 4.26 Overview of indicators for ‘market health’ in each EU Member State in 2017 (Source: ACER/CEER, 2018b)

[Figure not reproduced: see original document]

Consumer satisfaction with energy suppliers

The Energy Monitor of the Consumer and Market Authority (ACM) focuses on consumer satisfaction with their energy supplier. Satisfaction in 2019 is comparable to previous years. Satisfaction with the process of switching to another supplier is high, with 87% satisfied to very satisfied (see Figure 4.27).

Figure 4.27 Consumer satisfaction with energy suppliers (source: ACM, 2019)



4.5.5 Energy poverty

Internationally, there is no clear-cut definition of the concept of energy poverty. Moreover, the Netherlands does not have a specific policy on energy poverty (see Chapter 2), which means no specific data is collected for this topic. The European Energy Poverty Observatory (EPOV) collects and bundles knowledge related to energy poverty across the EU. Data originate, among others, from Eurostat's annual EU SILC survey. The EPOV uses four primary indicators of energy poverty:

1. The percentage of households that indicate they cannot afford to adequately heat their home, based on the question: *"Can your household afford to keep its home adequately warm?"*
2. The percentage of households that indicate payment arrears of their energy bill, based on the question: *"In the last twelve months, has the household been in arrears, i.e. has been unable to pay on time due to financial difficulties for utility bills (heating, electricity, gas, water, etc.) for the main dwelling?"*
3. The indicator for *Hidden Energy Poverty,* based on the percentage of households with absolute energy expenditure lower than half the national median.
4. The "double median energy ratio", which is equal to the percentage of households that spends a greater share of income on energy than twice the national median share.

Based on the EPOV indicators, we can see that energy poverty in the Netherlands is less common than in the rest of the European Union. The first indicator reveals how citizens judge the extent to which they are financially able to adequately heat their home. Figure 4.28 shows that households in the Netherlands are far less likely to experience financial problems in this area than people elsewhere in Europe. We observe the highest scores in specific countries in Central, Eastern and Southern Europe. Only 2.6 percent of Dutch respondents said in 2016 that they had difficulty paying to heat their home.

The Netherlands also scores exceptionally low with regard to the second indicator, the percentage of households with payment arrears of their energy bill (2%). The percentage of households with payment arrears in the Netherlands in 2016 was even the lowest of all EU countries (Figure 4.29). Central, Eastern and Southern European countries also demonstrated the highest percentages for this indicator too.

The Netherlands' score for the indicator for Hidden Energy Poverty (energy expenditure lower than half the national median) (circa 3.5%) is also the lowest of all countries in the EU (Figure 4.30). Finally, with 6.5 percent, the Netherlands also has the lowest score for the share of households with an energy ratio above the double median, the fourth indicator.

Figure 4.28 Share of households in Europe that indicate they could not afford to adequately heat their home in 2016 (source: PBL, 2018b)

Figure 4.29 Share of households in Europe with payment arrears in 2016 (source PBL, 2018b)

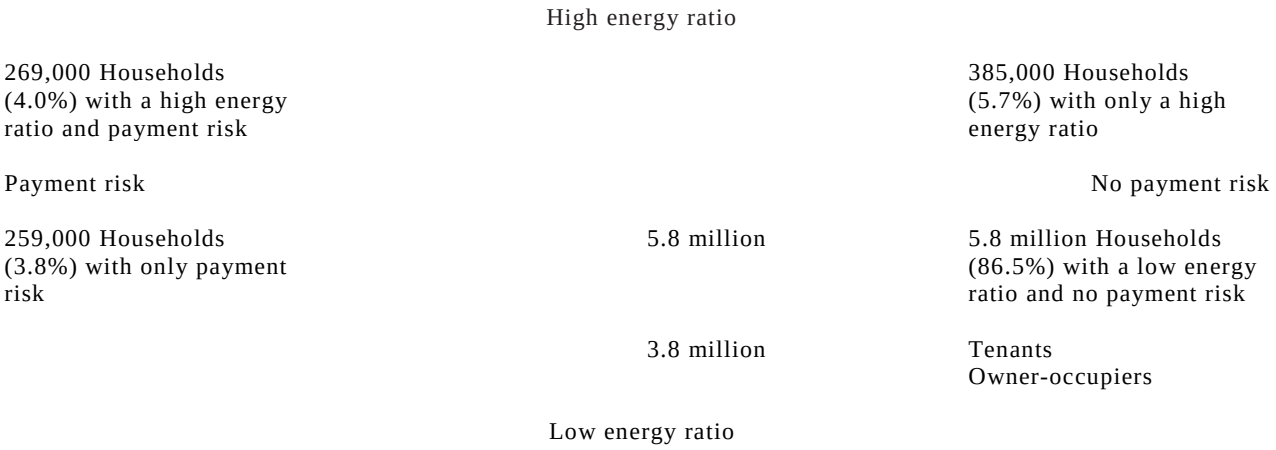
Figure 4.30 Share of households in Europe with "Hidden Energy Poverty" in 2016 (source PBL, 2018b)

In 2018, the PBL also conducted a study on the affordability of the household energy bill in the Netherlands. It opted for a broader interpretation of the concept of energy poverty. Among other things, extremely energy-efficient behaviour for financial reasons, as well as disconnection due to lack of payment falls under energy poverty (PBL, 2018b). The report looked at the share of disposable income a household spends on energy (the energy ratio) and the extent to which a household has money left over for basic living expenses after housing and energy costs (the payment risk). PBL is introducing a methodology for determining the average energy bill per income group, in which the Netherlands is divided into five income groups. If disposable income minus the actual net cost of energy and housing is less than the minimum standard amount for (other) basic costs, the household will not be left with enough at the end of the month to cover basic living costs. This can lead to payment arrears and debts for energy, rent or mortgage, but also for care or other domains.

One problem with the energy ratio as an indicator is that there is no clear limit as to when the energy burden is too high. At the household level, the energy ratio merely provides an indication of energy costs as part of a household's total budget. The payment risk indicator does give an idea of whether a household has a financial problem. The disadvantage of the payment risk indicator is that it is not clear whether an affordability issue stems from the level of the energy bill. Households with a high energy ratio do not always present a payment risk, and conversely, a payment risk does not automatically mean a high energy ratio.

As shown in Figure 4.31, in the Netherlands there was a total of 528,000 households with a payment risk in 2014-2015. About half of these households (269,000) also have a high energy ratio. The remaining (259,000) households do not have a high energy ratio, but often relatively high living costs (low incomes). This may indicate a form of hidden energy poverty, but can also be due to an outdoor lifestyle or an energy-efficient newly-built house, which means that energy consumption is relatively low.

Figure 4.31 Households according to energy ratio and payment risk in 2014 (source: PBL, 2018b)



The remaining 6.2 million households posed no payment risk in 2014-2015, but some had relatively high energy costs given their income. It concerns 385,000 households with a high energy ratio who, after living and energy costs, had an average of over €400 per month of disposable income available, on top of the minimum required budget.
The 528,000 households with a payment risk have an affordability issue related to living and energy costs. Some of them, 259,000 households, do not have a high energy ratio. These households have insufficient budget for the minimum cost of living due to low income and/or high housing costs. It often concerns younger, small households who have recently moved or live in a highly urban environment. Tenants are also over-represented in this group. In general, it concerns households in newly-built homes with higher living costs and lower energy costs as well as households in smaller homes with relatively high living costs and poor energy labels.
The remaining 269,000 households with a payment risk are very similar in composition to other households with a payment risk, but are more likely to live in an older home with a poor energy label. Moreover, they have little to no financial scope to cope with changes in spending.

4.6 Research, innovation and competitiveness dimension

4.6.1 Trends in the low-carbon technology sector

Trends in the low-carbon technology sector in the Netherlands

This section provides an overview of the economic significance of the Dutch energy sector in recent years with a focus on the developments in the transition to the development and application of low-carbon technologies for energy savings and renewable energy. In this section a differentiation is made between energy operations and activities related to energy investments.127 Energy operations are usually capital-intensive. In contrast investment-related activities are often labour-intensive and as a result, are important for employment potential in the energy supply.

International position

At the international level, similar definitions and data of low-carbon technologies and the corresponding "sector" are still being worked on. Many definitions and data are still incomparable and it is therefore difficult to provide official, comparable data related to the overall position of the low-carbon technology sector in different countries. However, an "unofficial" study is published every three years by a commercial consultancy group, the Clean Tech Group, from the USA. This Global Clean Tech Innovation index compares about 40 countries, including the G20, in terms of their clean tech sector developments. In the most recent report (2017), the Netherlands is ranked 15th (see text box below).

> The Netherlands scores above the global average in both inputs to and outputs of cleantech innovation, achieving 15th position in the overall Index. Scoring 5th in general innovation drivers, the Netherlands succeeds in producing a high-quality innovation ecosystem, and promotes a strong national entrepreneurial culture. Above average access to private finance for start-ups together with a good score for public R&D expenditure in the cleantech sector provides the country with significant cleantech-specific drivers. This manifests in the country's good score for emerging cleantech, scoring 11th place for evidence of early-stage venture capital investment. This culminates in the Netherlands' relative success in commercialised cleantech, particularly in its strength in cleantech trade, scoring 3rd and 6th place in cleantech commodity imports and exports respectively. A weakness, however, is its low renewable energy consumption relative to total primary consumption. See: https://www.cleantech.com/

This report is now several years old (there might be an update in 2020) and since then a number of aspects have experienced considerable development: according to expectations, investments in low-carbon technologies and the generation and consumption of renewable energy are increasing considerably in the Netherlands (see below). Better and internationally comparable data is also being worked on, including by the statistics agencies. Future reports under the Governance Regulation are expected to contribute further to a more uniform and comparable picture of the sector.

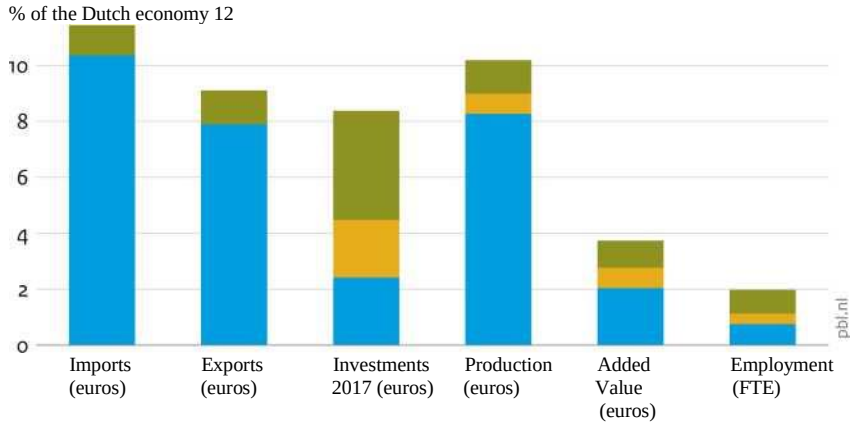
However, the available data used in this chapter still relate mainly to energy-related activities. They try and provide a picture of the total energy-related sector and to subsequently indicate developments in renewable energy shares or energy-related low carbon technology in that total. Later reports also include other climate-relevant activities that are not energy related, where possible.

127 Energy operations consist of activities related to the extraction, production, conversion, trade, storage, transport and supply of energy (including refineries, oil and gas extraction, fuel stations and renewable energy generation). Investments are made by operational sectors to ensure that these activities are consistent or keep up with the demand from end consumers. End consumers of energy also make investments, for example in new energy-efficient industrial boilers or insulation. In turn, these investments by operational sectors and end consumers lead to economic activities in other sectors, such as for construction and utilities companies, technology manufacturers, R&D, the government, consultancy and other services, and are referred to as "activities from investments". For more information on the demarcation and definitions of energy-related activities and the distinction between conventional and sustainable, we refer the reader to the background reports (Statistics Netherlands, 2015; Van Dril et al. 2016).

Economic key indicators of the sector

An initial overview of the economic impact of energy within the Dutch economy has been outlined in Figure 4.32 using a number of key indicators. The economic indicators in this chapter are largely derived from the national accounts of Statistics Netherlands. The National accounts provide a coherent and consistent overview of the entire Dutch economy, including energy-related activities[128].

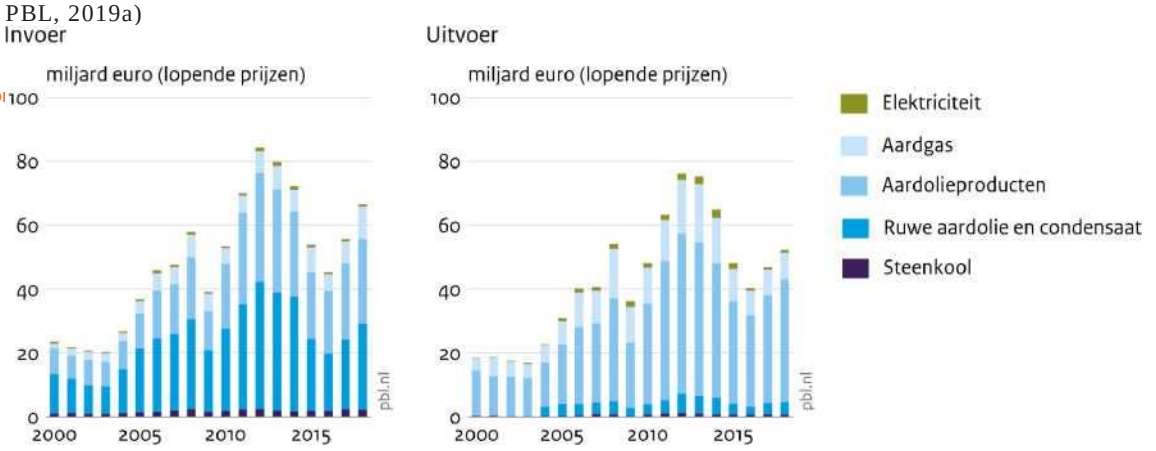
Figure 4.32 Share of energy activities in relation to the entire Dutch economy for various economic indicators in 2018. (Source: PBL, 2019a).



The total contribution of energy to gross domestic product was 3.7 percent in 2018. The energy domain is capital intensive; the share of investments (8.4 percent) is four times higher than the share of employment (2.0 percent). The figure also shows that the energy import and export value represents a relatively high proportion; this is linked to the direct import and export of fossil energy carriers and to the trade in processed energy products. The Netherlands has extracted a high quantity of natural gas, and exported a portion of it, over a long period. Exports have declined due to the reduction of gas extraction and is now shifting to imports. Furthermore, the Netherlands imports a lot of crude oil that is processed by the refining sector into all kinds of petroleum products, which are then largely exported.

[128] In 2018, the national accounts were overhauled, which means that new sources, methods and concepts have been implemented. This has had a particular impact on the figures for investments in renewable energy. The changes are explained in a background report (CBS, 2019f).

Figure 4.33 Imports and exports of energy products between 2015 and 2018, at current prices. (Source: PBL, 2019a)



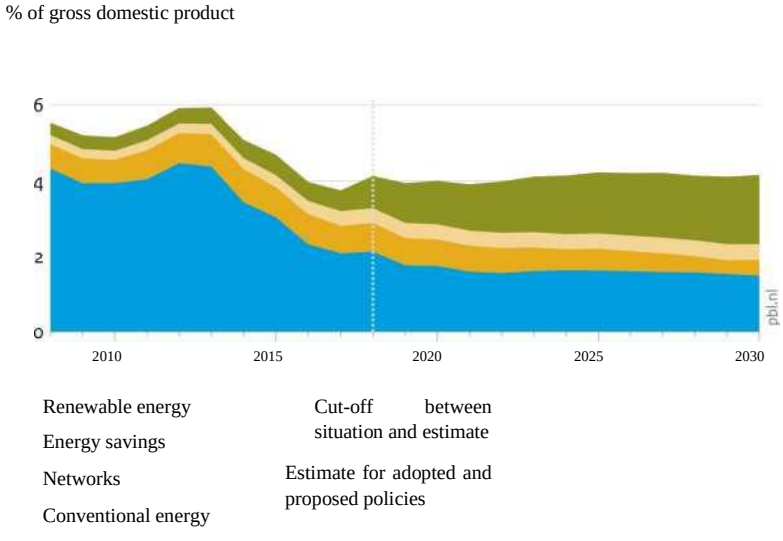
Over the past four years, a variation has been observed in the total import value of 45 billion to 66 billion and the export value of 40 billion to 52 billion (see Figure 4.33). This variation is explained by fluctuations both in price and in volume. Especially between 2014 and 2015, the oil price fell sharply, which can be seen in the import and export value of energy products. Since 2016, energy prices have risen once more. The value of natural gas exports peaked in 2013, partly due to the high gas extraction level in Groningen. In the following years, exports of natural gas decreased, partly due to reduced gas extraction level in Groningen and a fall in the price of gas.

The following sections describe further turnover, investments and employment in the energy sector, separately addressing the relevant shares of renewable energy and energy-saving technology for the low-carbon position. It addresses both the figures achieved and expected developments. These expectations are based on the KEV, assuming adopted and proposed policies known on 1 May 2019. Some policies announced later under the Climate Agreement have not yet been incorporated. Moreover, expectations are mainly provided as information about trends. Chapter 5 discusses the necessary investments for energy transition activities.

Production and added value

The contribution of energy-related activities for conventional and renewable energy is outlined in figure 4.34.

Figure 4.34 Contribution of energy-related activities to the Dutch economy, expressed as a percentage of total GDP. (Source: PBL, 2019a)



The peak in 2012 and 2013 was mainly related to a relatively high amount of natural gas extraction, investments in new coal-fired power plants and high energy prices, affording conventional energy sectors a temporary increase in added value. After this peak, there have been no more major investments in conventional power plants and natural gas extraction has declined. This can also be observed in the sharp decrease in the added value of conventional sectors in recent years. In the projections, it is still falling slightly, but stabilises in 2022 (around 1.6 percent). Renewable energy added value demonstrates an upward trend from 2008 onwards, from 0.3 percent in 2010 to 0.8 percent in 2018. This upward trend is also evident in the projections, with renewable energy's contribution to total gross domestic product around 1.8 percent by 2030.

The added value of renewable energy activities shows an upward trend over time; it rose to more than 2.3 billion euros in 2018. While most conventional sectors are seeing added value dwindle, the total added value of renewable energy is expected to reach around 10 billion euros by 2030.

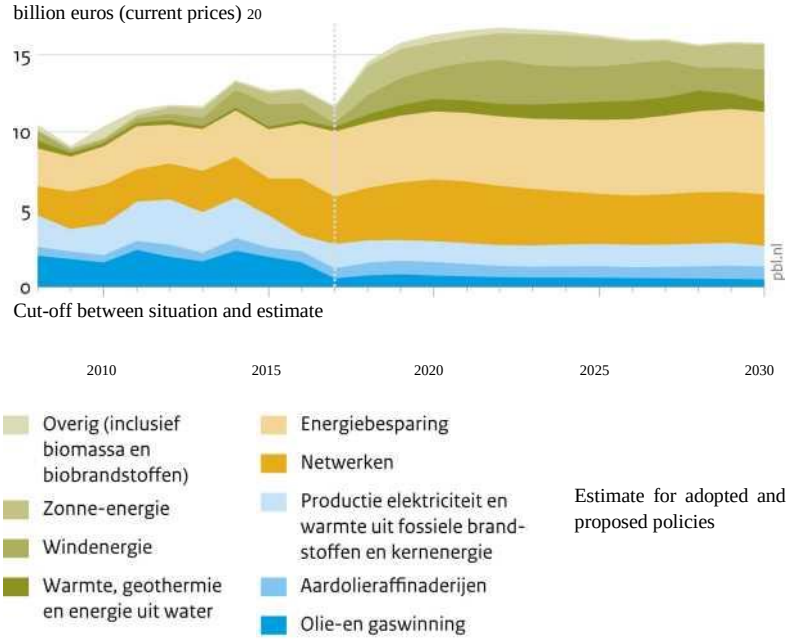
The added value of renewable energy comprises several components, such as the revenues of electricity generation with installations that generate renewable energy, but also, for example, companies that produce and install wind turbines and solar panels and or their components. In the KEV, the PBL expects more than a quarter of the projected added value of renewable energy to be related to the investment activities of companies benefiting from investments by 2030.

One of the sources contributing to this growth in added value of renewable energy activities is energy generated from biomass. The production value of this sector has grown from around 1.9 billion euros in 2016 to almost 2.7 billion euros in 2017, with added value rising from almost 1 billion euros to 1.2 billion euros. An important factor in this increase is the growth in biofuel production for transport. Growth in biofuel demand is expected to increase until 2020 and stabilise thereafter (PBL, 2019a).
Solar power generation is expected to increase by 200 percent between 2020 and 2030. The solar panels are installed on the roofs of houses and other buildings or in solar fields, where, depending on the type of connection, another electricity price applies. The growth in the number of solar panels also translates into an increase in the added value of this technology. In addition, other forms of renewable energy, such as the production of heat using geothermal energy, also contribute to the expected increase in added value. The increase in this case, as with solar PV, is mainly in profit income and not in employment income and employment.

Investments

Total investment in energy gradually increased up to and including 2014, but decreased slightly between 2015 and 2017 (see Figure 4.35). The decrease in this period is the result of opposing trends in the underlying sectors. Investments in conventional sectors have fallen sharply since 2014, while investments in renewable energy and energy savings have increased. Investments in networks also increased slightly during this period. Investments in conventional energy are expected to stabilise after 2017, but investments in renewable energy, energy savings and networks are expected to continue to rise. As a result, total investments will increase to an average of 16 billion euros by 2030.

Figure 4.35 Development of investments in energy installations and energy savings, in current prices. The development of inflation within the projections is included in the appendix containing the tables. (Source: PBL, 2019a)



In the conventional sectors, considerable investments were made in three new coal-fired power stations in the electricity sector and additional drilling for oil and gas extraction until 2014. After 2014, investments in these two conventional sectors fell from 4.9 billion in 2014 to 2.1 billion in 2017. On the other hand, investments of oil refineries remained stable during this period (between 600 million and 800 million euros). Investments in the conventional energy supply are expected to remain at about the same level as in 2017. This is related, among other things, to developments in the capacity of gas-fired power plants and cogeneration (CHP) installations. This does not involve investments in new power plants, but maintenance investments in existing power plants.

Total investments in renewable energy increased between 2008 and 2016, but fell in 2017, bringing them to circa 2014 levels. The main causes of the increase between 2010 and 2016 are investments in wind energy and solar power. Investments in solar power grew from 500 million euros in 2014 to almost 1 billion in 2017. Investments in wind energy also show very strong growth over a longer period of time, but are volatile year-on-year. This is due to the construction of large offshore wind farms. Offshore wind farms such as Luchterduinen and Gemini resulted in significant investment spikes, but after these farms were commissioned, investments decreased in 2017. After 2017, they increased again due to the construction of new wind farms (RVO.nl, 2019a). Investments in other renewable energy sources, such as geothermal energy, biomass and biofuels have increased since 2014, but are relatively modest compared with investments in wind energy and solar power. In the forecasts the greatest share of investments in renewable energy is determined by investments in solar power and wind energy. The huge increase in the established capacity of solar power and wind energy results in investments that account for approximately 70 to 80% of total investments in renewable energy between 2020 and 2030.

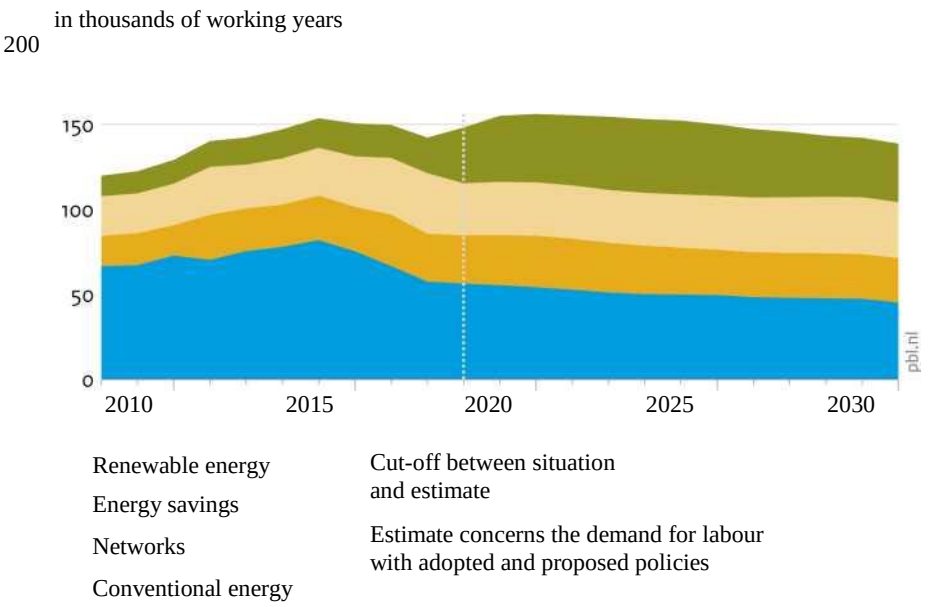
Investments in energy savings increased from 2.5 billion euros in 2010 to 4.2 billion euros in 2017. The estimates also include an increase in investments in energy savings, but future growth does slow down in the estimates. PBL expects these investments to be around 5 billion euros by 2030. One of the reasons for the increase in investments is the configuration of the information obligation for companies under the Environmental Management Act. The expectation is that the amendment to the regulation will mean companies are more likely to invest in energy-saving measures.

Investments in the necessary infrastructure for transporting and distributing gas and electricity increased from 2.6 billion in 2014 to 3 billion euros in 2017. According to the PBL, these will continue to grow, especially in electricity infrastructure. This may involve connecting wind farms in the North Sea to the coastal electricity grid, as well as strengthening existing grids, for example by constructing a wind farm or a solar field.

Employment

Total employment in the energy sector increased to about 154,000 working years in 2014. After this, employment fell to 148,000 working years in 2018. PBL expects the total number of projected working years to vary between 155,000 and 139,000 working years up to 2030 (Figure 4.36). However, this is expected to shift from labour in conventional sectors to renewable energy and energy savings. In 2008, 56% of employment was related to conventional sectors and 29% to renewable energy and energy savings. In 2018, it amounted to 38 percent for conventional energy and 43 percent for renewable energy and energy savings. By 2030, 33% of employment in the energy sector is expected to be related to conventional sectors and 48% to renewable energy and energy savings. The share of employment in networks remains relatively stable.

Figure 4.36 Development of energy-related gross employment (2008-2018) and demand for labour. Forecasts for adopted and proposed policies. (Source: PBL, 2019a)



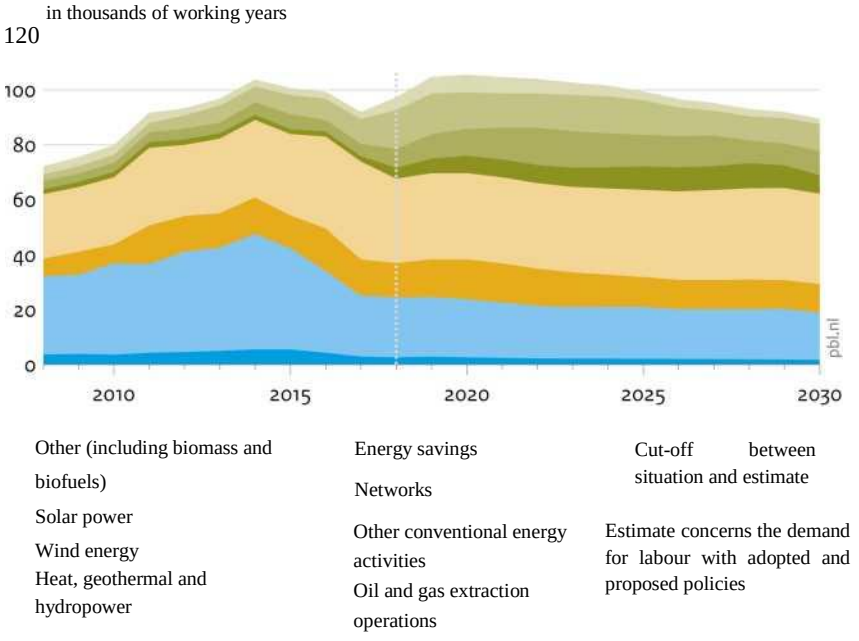
Employment in the low carbon sector resulting from investments

In total about a third of energy-related employment involves energy operations and two thirds are related to investments. Developments in investments can be translated into economic activities resulting from them, i.e. the expected direct demand for labour from investments. Whether this demand for work is also converted into employment depends on labour productivity and whether companies can find suitable workers.

The direct demand for labour in the Netherlands differs from one technology to another. A large share of the energy technology used is imported, so this does not result in a demand for labour in the Netherlands to produce this technology. However, Dutch companies do usually install the technology. This is incorporated in the situations and estimates of investment activities (from Dril, 2019) (see Figure 4.37).

In particular, the activities related to energy savings and solar power result in a relatively high demand for labour in the Netherlands. These are activities such as insulating homes and installing solar panels. This is labour-intensive work. For solar power, employment increased by almost 60% between 2014 and 2017 and by around 25% for energy savings. Increased investments in other technologies, such as wind energy, also generate additional demand for labour. However, work activities involving these technologies are characterised by a higher import share and, due to the higher costs per working year, result in an equally high investment but in fewer full-time jobs. Therefore, the increase in investments in wind energy in recent years has not translated directly into an increase in employment in the wind energy sector. This has currently returned to the level of 2014.

Figure 4.37 Gross employment in activities resulting from investments between 2008-2018 and expected demand for labour between 2019 and 2030 (PBL projections to 2030 for adopted and proposed policies; source: PBL, 2019a)



In 2017, investments in electric transport generated more than 4,200 working years in the Netherlands. This involved a variety of activities, such as the installation of charging stations, but also the development and production of batteries, software, propulsion technology and vehicles. Since 2008, Dutch employment in electric transport has experienced continuous growth. In 2017, for example, 800 additional working years were created compared with 2016. Growth in electric transport up to 2020 is expected to be significant, but after 2020 PBL expects it to decline because policy after 2020 is as yet unclear (PBL, 2019a). As of 2025, sales of electric cars are expected to increase once more. As a result, the expected demand for labour will reach a similar level in 2030 as in 2017.

The total expected demand for labour in the Netherlands due to investments in conventional sectors, renewable sectors, networks and energy savings shows a decrease until 2030. This brings the total expected demand for labour from investments to about the same level as employment resulting from investments in 2017. It is uncertain whether there will be a sufficient supply of labour and a suitable workforce in the future to meet this demand (PBL, 2019a).

4.6.2 Trends in spending, research and innovation related to low-carbon technologies

Every year, the Netherlands Enterprise Agency (RVO) publishes the "Publicly Funded Energy Research" monitor on behalf of the Ministry of Economic Affairs and Climate Policy (RVO, 2019b). This report is used for reporting to the IEA. The results are also used in the NEV. It provides an insight into Dutch government expenditure related to energy research conducted by knowledge institutes, universities and businesses, and the underlying energy themes on which it is focused. Public investments in energy research via fiscal instruments (the WBSO), public funds (the Innovation Fund for SMEs+) and direct payments by the Ministry of Education, Culture and Science to universities are beyond the scope of this monitor.

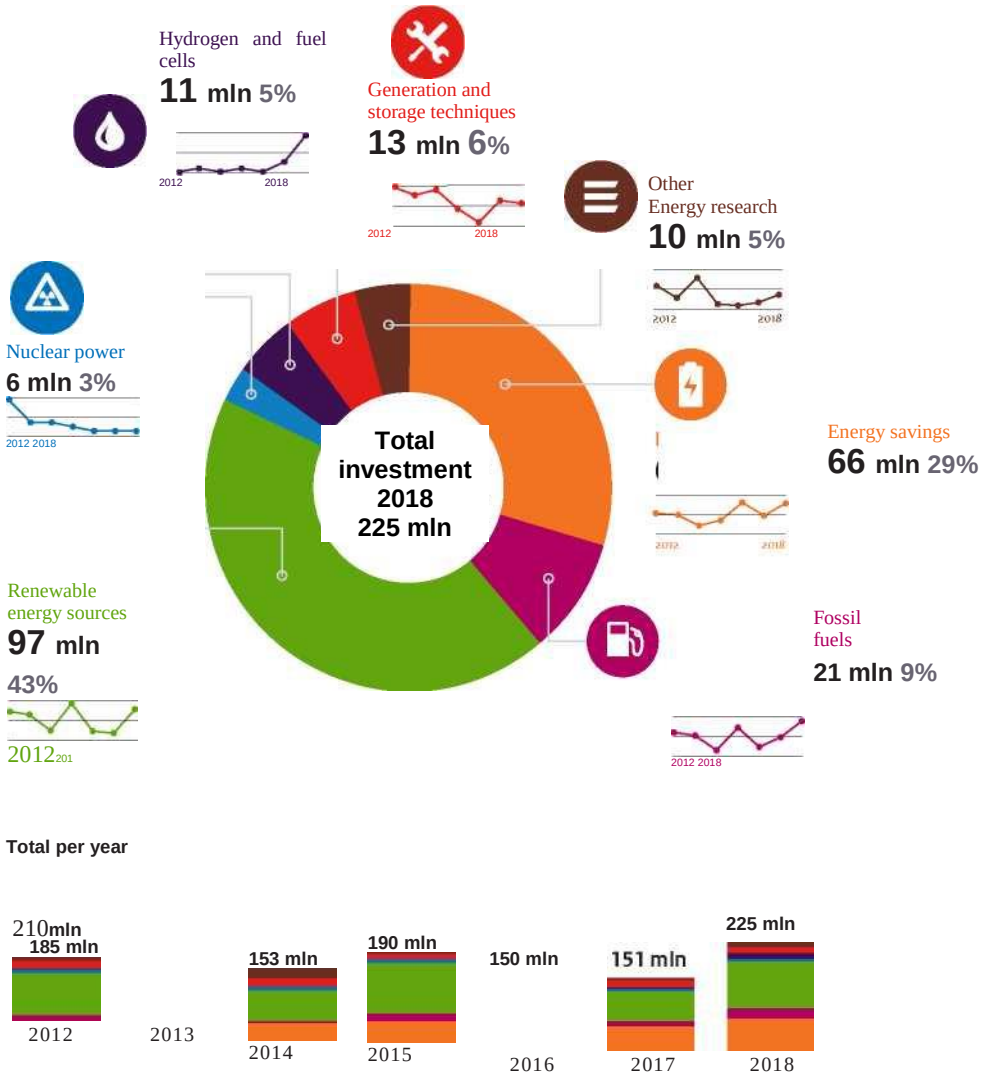
In 2018, the central government invested 225 million euros of public funds in energy research and development (RVO.nl, 2019c), a sharp increase compared with previous years (see Figure 7). This is the result of additional resources in 2018 for energy innovation and development, made available by the government in the climate envelope, for measures contributing to the ambition to reduce CO_2 emissions in the Netherlands by 49% by 2030. The measures financed from the climate envelope crop up in many different sectors.

Figure 4.38 also shows the distribution of public investments by category. In 2018, more than 43% (97 million euros) of funds were spent on renewable energy innovation projects and some 66 million euros on research, and the development of

energy-saving measures. These are the two largest categories that also focus on energy technology categories that are subject to a large-scale roll-out. Energy research on hydrogen and fuel cells has been expanding for several years. Investments in fossil fuel research (conventional energy) are limited and focus on carbon capture and storage (CCS).

The figure does not show companies' (possibly private) expenditure within energy innovation projects.
In the Top Sector Energy approach, the amount has fluctuated around 100-150 million euros per year since the Top Sector Policy was introduced in 2012, around 40% of total investments. Total public and private investments in the Top Sector Energy amount to circa 2 billion euros (RVO.nl, 2019c) from 2012 onwards. This does not include all investments in energy innovation, because companies also invest in energy innovation, but do not always make this information publicly available.

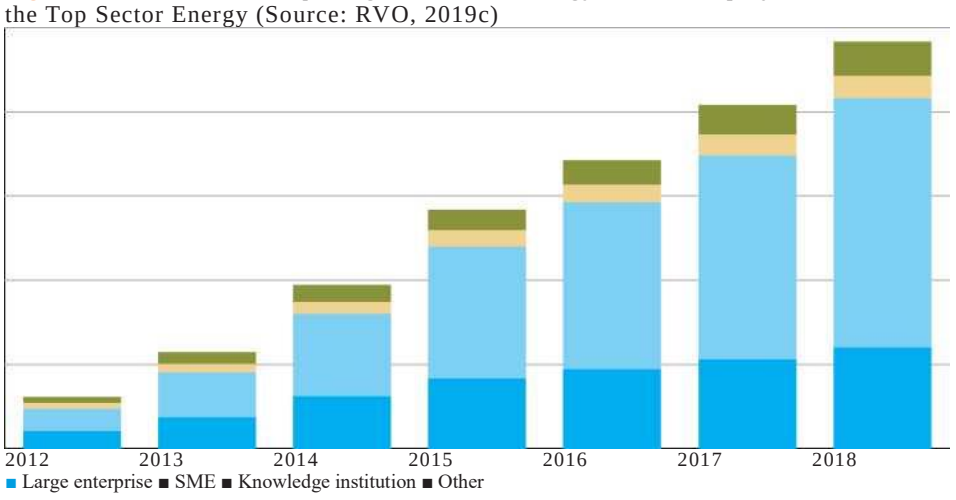
Figure 4.38 Public investments in energy research based on a committed subsidy, in current prices. Source: RVO.nl (2019b).



Number of companies

One of the objectives of the top sectors policy is to help companies, including SMEs, improve the way they collaborate with knowledge institutions. RVO monitors the number and type of organisations involved in energy innovation projects. Figure 4.39 shows how the energy innovation network of the Top Sector Energy grew between 2012 and 2018. It distinguishes between participation by the different types of organisations.

Figure 4.39 Number of unique organisations in energy innovation projects related to the Top Sector Energy (Source: RVO, 2019c)

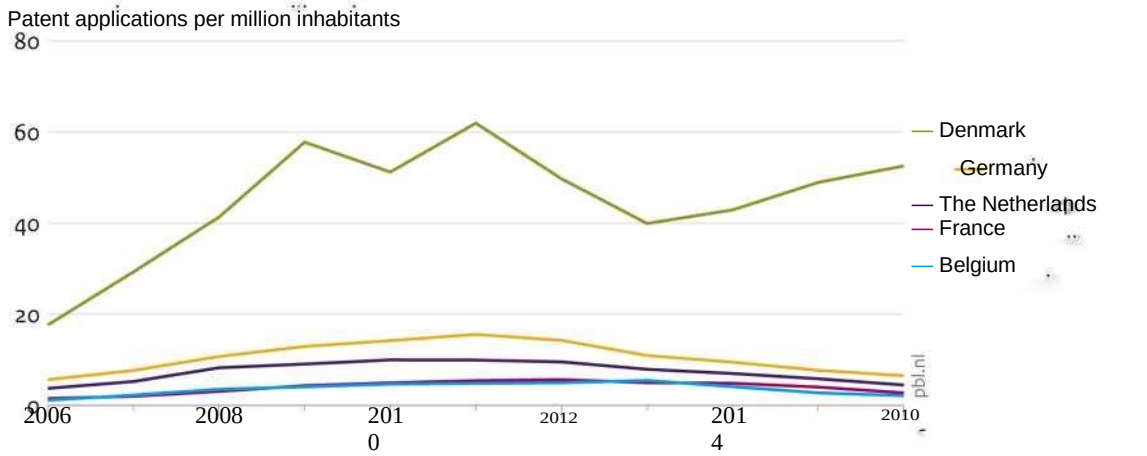


In total, more than 2,400 individual organisations participate in over 2,600 projects (RVO, 2019c). On average, three participants work together on a project. The number of SMEs participating in the projects has increased considerably since 2012. This applies to both absolute and relative numbers and in relation to other types of organisation. SMEs now account for more than 60% of participants. The number of organisations in the "Other" category is still increasing too. These include public organisations such as water boards.

Patent applications for renewable energy

Figures related to the number of patent applications provide an indication of the results of efforts in the field of innovation. Figure 4.40 shows the number of international patent applications submitted from the Netherlands and a number of other European countries to the European Patent Office (EPO) or the World Intellectual Property Organization (WIPO). As of 2011, there has been a downward trend in the number of patent applications in the field of renewable energy. This applies to most other countries shown in the figure. This may be a sign that the relevant technologies have matured and are now primarily involved in a scaling up phase.

Figure 4.40 Number of international patent applications related to renewable energy per million inhabitants (Source: PBL, 2019a)



The EU SET programme also examines trends in patents. It does so in a similar way on behalf of the various participating EU countries. Figure 4.41 shows the distribution of patents for the Netherlands per energy theme. This shows that the Netherlands is relatively well represented in patents concerning the themes of smart solutions for consumers, CCUS and energy efficiency in buildings.

Figure 4.41 Development of the number of patents in energy technologies from Dutch applicants (Source: Pasimeni et al., 2018)

Number of researchers

As previously explained in this section, energy-related employment is increasing as a result of investments in renewable energy. In relation to the NEV 2017, Statistics Netherlands estimated the distribution of employment created by investments in renewable energy and energy savings between 2008 and 2016, both according to product profile (energy technology) and process profile (type of work). According to this study, the number of working years for researchers resulting from investments in renewable energy and energy savings since 2010 amounts to over 3,200 (Statistics Netherlands, 2018)[129]. No data is available for the total number of energy-related working years of researchers in the Netherlands as a whole.

4.6.3 Structure of current energy prices and subsidies for fossil and other energy

This section examines the different elements that currently determine energy prices for Dutch companies. Energy prices comprise three main components:

- Energy and energy supply costs. Global market prices are discussed in Section 4.1. Prices for end consumers (consumers and businesses) are discussed in Section 4.5.3;
- Grid (operation) and transport costs (detailed below);
- Taxes and levies (detailed below).

The distribution of these three components partly depends on energy consumption, applicable tariff categories and the type of energy concerned. As a result there are considerable differences in distribution: a rough indication for consumers is 15-24% grid operation, 30-40% taxes/surcharges and 44-51% supply costs.130

[129] Source: https://www.cbs.nl/nl-nl/achtergrond/2018/50/de-impact-van-de-energietransitie-op-de-werkgelegenheid

130 Rough estimate based on various sources consulted in September 2018: Netbeheer Nederland, Energiemarktinformatie.nl and Essent.

Taxes and levies

The Netherlands applies a differentiated system of taxes and levies that have an effect on energy consumption. In principle, energy tax must be paid for electricity or gas supplied via the distribution network or a direct line, purchased on the exchange or obtained through other means. Consumers are also required to pay VAT on the applicable amount (currently 21%).

The level of the energy tax also depends on the quantities of natural gas and electricity. Tariffs also differ according to the type of tax and per year. The tariffs are available in the Dutch Tax and Customs Administration tables.[131] No energy tax needs to be paid for the consumption of:

- Electricity, self-generated using renewable energy sources;
- Electricity, self-generated using an emergency unit in the event of failure of supply from the distribution network;
- Self-extracted landfill gas, sewage treatment gas or biogas;
- Electricity, self-generated using a CHP unit.

A reduced energy tax rate applies for natural gas used for heating in the horticulture sector. Natural gas used as input for generating electricity is exempt from energy tax under certain conditions, in accordance with the Energy Tax Directive. With regard to non-profit institutions and religious buildings, the energy tax applies a partial refund scheme. Pursuant to the Convention of Mannheim, coastal and inland waterways are exempt from excise duty, while a reduced tariff applies to other applications, such as for machinery in construction and agriculture. Under the Chicago Convention, international aviation is exempt from excise duty with regard to the use of kerosene.

There is also a reduced energy tax rate for locally generated renewable electricity. If a cooperative or owners' association generates renewable electricity and supplies it to its members, the members would be entitled to the lower rate under certain conditions. One of the conditions is that the cooperative or owners' association must be recognised by the Dutch Tax and Customs Administration. In some cases, an energy tax refund may be obtained, including for block heating and for participation in a multi-year agreement (under certain conditions, such as sufficient progress).

There are no subsidies in the Netherlands aimed exclusively at promoting the consumption of energy from fossil sources. However, these exceptions to the energy tax and lower rates lead to missed tax revenues that are characterised as a subsidy in accordance with the Definition of the WTO. This subsidy may lead more generally to higher consumption of both fossil and renewable energy. A list of related government measures will soon be submitted to the IEA for the in-depth review organised by the latter of energy policy in the Netherlands.

Surcharge for Sustainable Energy

An additional levy on energy consumption was introduced through the Surcharge for Sustainable Energy Act (ODE) on 1 January 2013.
The purpose of the new levy was to cover cash expenditure related to the Sustainable Energy Production Incentive (SDE+) scheme.

However, the ODE is not an earmarked levy. Due to the budgetary rules applied in the Netherlands, which prescribe a strict separation between income and expenditure, there is only an ex-ante estimate of the level of ODE income required to cover cash expenditure for the renewable energy incentive estimated in advance. This revenue and expenditure, determined ex-ante, is not corrected during the course of the incumbent government's budget period.

The ODE is levied 50% on households and 50% on businesses. The tariffs rise annually in order to cover the estimated increasing SDE+ budgets arising from the target to achieve a 14% share of renewable energy in 2020. The tariffs are included in the Dutch Tax and Customs Administration tables (see link above). As of 1 January 2020, the distribution of the Surcharge for Sustainable Energy (ODE) will be adjusted from 50/50 to one third / two thirds, in favour of households. As a result, companies will contribute more to the subsidies for sustainability than in the past. With the design of the ODE sliding-scale, companies with relatively low consumption are relatively spared. It usually concerns SMEs with an energy

[131] See:https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen?projectid = 6750bae7-383b-4c97-bc7a-802790bd11

consumption up to the first and second brackets of the energy tax. Larger businesses will bear a greater share of the burden of energy and climate policy. This adjustment was not included in the KEV 2019.

Grid operation and transport costs

These are the fixed costs for connection to the electricity, gas or heat grid. Since 1 January 2009, transport costs for household users depend on the type of connection, also known as the capacity tariff. These tariffs vary per grid operator, per region and per connection.

5 Impact assessment of planned policies and measures

This chapter examines the effects of planned policies and measures as referred to in Chapter 3. A differentiation is made between proposed policies as taken into account in the KEV 2019 and the announced policies and actions in the Climate Agreement.

5.1 The consequences of planned policies and measures on the energy system and greenhouse gas emissions and removal

5.1.1 Effects of proposed policies according to the KEV

In the "proposed policy" variant, in addition to adopted measures the KEV takes into account proposed policies made public and officially published on 1 May 2019, which have been worked out in sufficient detail. The package of proposed policies only varies to a limited extent compared with adopted policies. The main changes in this policy variant since the NEV 2017 are:

- Nearly Zero-Energy Buildings (NZEBs): new construction requirements for buildings after 2020;
- Ecodesign wood-burning stoves, emission requirements enter into force as of 2020 instead of 2022;
- OCAP expansion: additional supply of industrial CO_2 from 0.1 to 0.2 Mton to promote crop growth in greenhouse horticulture.
- Kilometre tax for freight traffic as of 2022;
- As of 1-1-2021 a flight tax of 7 euros per departing passenger and 1.93-3.85 euros per tonne of freight for freight carriers (tariff depends on aircraft type noise emissions).

The effects of these differences on greenhouse gas emissions and energy consumption/mix are discussed below. Detailed greenhouse gas emission figures and of this policy variant (with additional measures) can be found in Appendix 6.

Greenhouse gas emissions

The differences in greenhouse gas emissions

During the period up to and including 2020, emissions with proposed policies are almost at the same level as with adopted policies. By 2020, emissions with proposed policies will amount to circa 11 ktons of CO_2 equivalents lower, mainly as a result of the closure of the Hemweg power plant at the end of 2019. Between 2020 and 2030, the KEV policy variants with adopted and proposed policies also give roughly the same picture: by 2030, the national total will be 144 Mton of CO_2 equivalents with proposed policies (excluding emissions from land use); with adopted policies this is 145 Mton of CO_2 equivalents. Half the difference is due to the electricity sector (0.4 Mton of CO_2 equivalents), the other half is due to lower emissions (approximately 0.2 Mton of CO_2 equivalents) in the built-up environment and mobility.

The 2030 emission reduction with proposed policies amounts to 35 [28-39] percent compared with 1990, 14 [10-21] percentage points lower than the 49 percent target cited in the Climate Act. The estimated absolute emissions in 2030 are 31 [22- 46] megatons of CO_2 equivalents above the target of 113 megatons of CO_2 equivalents arising from the Climate Act. This does not include policies announced in the Climate Agreement.

The maximum permitted cumulative emissions for the Netherlands for the 2021-2030 period amount to 891 megatons of CO_2 equivalents. On the basis of proposed policies, the cumulative estimated N-ETS emissions for 2021-2030 amount to 925 megatons of CO_2 equivalents, which is approximately 6 Mton lower than with adopted policies. For this period this amounts to a deficit and therefore a policy challenge of 34 megatons of CO_2 equivalents.

Renewable energy

The expected share of renewable energy hardly differs between the policy variants with adopted and proposed policies. In

2023, a share of 16.1% (14.4-17.0%) is expected in both policy variants, which means that the target of 16% in the Energy Agreement will just be achieved in 2023. The expectation for 2030 with proposed policies - without implementation of the Climate Agreement, but with an assumed continuation of the SDE+ - is 25.0 percent (20.7-26.4%). With adopted policies, the share is slightly lower than with proposed policies at 24.7%. This minor difference is partly due to greater use of renewable energy in the built-up environment. This is largely due to the application of the nearly zero-energy standard for the construction of new buildings after 2020. One of the requirements is that a building's energy demand should be satisfied as much as possible with renewable energy. The ambition of a share of 27-35% of renewable energy by 2030 will not be achieved with the adopted and proposed policy.

Energy consumption and mix

By 2030, primary energy consumption with only adopted policies will be 2,374 petajoules and with proposed policies at 2,397 [2,267-2,585] petajoules. In 2030, with adopted policies alone, final energy consumption is expected to amount to 1,997 petajoules; and 2,025 [1,908-2,166] petajoules with proposed policies. With proposed policies both final and primary energy consumption are a little higher than with adopted policies alone, without the policies in the Climate Agreement, because the proposed policies assume that Schiphol Airport will be permitted expansion (possibly limited).
The resulting growth in fuel consumption and bunkers is greater than the mitigating effect of the proposed flight tax.

The energy mix in the variant with proposed policies does not differ significantly compared with adopted policies alone. Only the consumption of oil products will be 2.7% higher by 2030 due to the reason mentioned above. Coal consumption will be slightly lower too as of 2020 due to the closure of the Hemweg power plant. By 2030, coal consumption will be the same once more, as the ban on coal combustion from 2030 has also been included in the policy variant with only adopted policies.

5.1.2 Effects of the Climate Plan

The Climate Plan outlines the main points of the climate policy to be implemented over the next ten years. The contents are largely determined by the Climate Agreement, established in June 2019 involving over a hundred social (public and private) parties. The agreement contains a package of measures, which are actively supported by as many contributing parties as possible and with which the political CO reduction target of 49% will be achieved by 2030.

However, the Climate Agreement came too late to be included in the PBL's Climate and Energy Outlook (KEV) 2019. That is why the PBL performed a separate analysis for the final Climate Agreement (PBL, 2019b). The announced policies and actions have not been analysed in full. This means that the findings are indicative and may differ as soon as they are taken into account in full in the next KEV (2020). The analysis also focuses on the expected reduction of greenhouse gases and the effects have not been analysed for all indicators needed for the NECP. The effects are determined in relation to the KEV with adopted and proposed policies

PBL concludes that the package of policy instruments in the Climate Agreement will lead to an emission reduction of 43-48% compared to 1990. The Netherlands' climate target for 2030 (-49%) is outside this bandwidth, and according to the PBL, is not expected to be achieved with the Climate Agreement. It should be noted that current insights on expected developments as described in the KEV 2019, are more unfavourable with regard to the greenhouse gas reduction projection than the NEV 2017 forecast that served as a reference to the draft Climate agreement.

In 2030, as a result of the Climate Agreement, emissions could amount to between 116 and 126 Mton of CO_2 equivalents. The emissions related to land use could decrease to 3-4 Mton by 2030 as a result of the Climate Agreement. The policy package can lead to a total emission reduction of circa 18-28 Mton compared to the KEV 2019 (including proposed policies). In addition to the above, approximately 2 Mton of emissions related to land use can also be reduced when implementing the Climate Agreement. These emissions, which do not count towards achieving the Netherlands' target of 49%, could decrease to 3-4 Mton by 2030 as a result of the Climate Agreement. Table 5.1 shows the expected effects per climate platform.

Table 5.1 Greenhouse gas emissions per sector in 2018 and 2030 with the current base path (KEV 2019) and with the expected impact of the Climate Agreement (PBL, 2019b)

Sector	2018[a] [Mton]	Estimate 2030 [Mton] Emissions KEV 2019	Reductions Climate Agreement	Residual emission Climate Agreement	Major factors related to uncertainty
Built-up environment	**24.4**	**19**	1.3-3.8	15.2 - 17.7	Achievement of cost reductions Focus on natural gas consumption in the services sector target
Mobility	**35.6**	**32.9**	1.3-3.6	29.3 - 31.7	Scope of the use of biofuels Scope and criteria of zero-emission zones Post-2025 car tax structure
Industry	**57.2**	**54.2**	14.3[b]	39.9[b]	Methodology for determining the process for the tax-free emission allocation at company level, rate of CO2 levy and SDE++ admission criteria Guaranteeing the development of the necessary infrastructure
Electricity	**45.2**	**13.7**	-0.3 - 2.5	11.2 - 14	CCUS project Tata Steel Yes or No?
Agriculture	**26.9**	**24.5**	1.7 - 4.3	20.2 - 22.8	The willingness of companies to invest
Land use[c]	**5.6**[d]	**5.6**	1.5 - 2.4	3.2 - 4.1	Support for measures (peat meadows)
Total	**189.3**	**144.3**	18 - 28	116 - 126	
Total (including land use)	**195**	**149.9**	20 - 31	119 - 130	

[a] Preliminary figures for emission registration
[b] Due to decisions to be made about the structure of the instruments, these figures constitute the basis for analysis and not the result
[c] LULUCF, Land Use, Land-Use Change and Forestry
[d] Concerns emissions in 2017. Emissions from land use are not yet known for 2018.

5.2 Effects of planned policies and measures on the economy

This section examines the effects of climate and energy policy on the macroeconomy, income and employment. The effects of (also proposed) climate and energy policies on safety, health and nature are discussed in paragraph 5.3.

Effects largely determined on the basis of the draft Climate Agreement

In 2019, the CPB analysed the Climate Agreement for effects on public finances, income distribution and burden sharing (CPB, 2019). The overall macroeconomic effects of all climate and energy policies have been examined.

Overall climate and energy policy leads to a lower GDP of around -0.5%

On the one hand the series of adopted policies and the draft Climate Agreement involve an extra burden that reduces growth, as well as higher expenditure that partially compensates for this (CPB, 2019a). As a result, GDP will be about 0.5% lower by 2030. The main additional burden concerns the ODE to finance the SDE++, the increased burden of the energy tax and the abolition of the net-metering scheme for small-scale solar PV. These taxes, together with all other additional burdens, lead to an increase in the burden of €4.6 billion, while public expenditure will be € 3.9 billion higher by 2030 than in 2018 (CPB, 2019) Due to the policy effect of consumption and production decisions made by citizens and businesses, with the aim of reducing CO_2 emissions, citizens and businesses will adapt their behaviour and production process and ultimately labour productivity will be structurally reduced. The benefits and damage avoided with less severe climate change and other environmental quality effects (such as cleaner air quality) have not been included.

Climate and energy policy leads to limited lower income

The series of climate and energy policies up to and including 2030 will lead to a (cumulative) negative income effect of, on average, -0.4% compared with 2018 and a worsening income level (CPB, 2019). Lower incomes will decline more than higher incomes by 2030. The decline for the lowest income group is -0.5%, while the highest income group will fall -0.3% as a result of overall climate and energy policy between 2018 and 2030. Climate and energy policy already adopted is almost two-thirds responsible for this scenario. The package of measures in the Climate Agreement leads to a positive effect on income of 0.3% in 2030 (compared to 2018) and is least advantageous for higher incomes. Higher incomes will generally improve by 0.2%, while lower incomes will improve by 0.7% as a result of the package of measures in the Climate Agreement. The energy tax sliding scale between electricity and gas has a worsening effect, while increasing the tax reduction in the energy tax exerts a positive effect. This burden relief outweighs the additional burden, which levels out the overall impact of the Climate Agreement. However, the low income group shows more negative and positive peaks, which partly depend on the ownership and type of car, and differences in energy consumption.

Longer-term employment effects are marginal

Overall climate and energy policy has a very limited effect on labour supply or total demand for workers (CPB, 2019). The incentive for cleaner production does not create additional demand for workers, as this happens (at least partly) at the expense of spending on other, alternative technological developments. Although there is little or no reduction in employment in the long term, there will be friction in the labour market, as employment shifts to a limited extent to companies that engage in cleaner production. Employment is shifting from coal-fired power plants, agriculture, metal, and consumer and food products to the construction of wind turbines and the services sector.

Economic effects of the CO_2 tax on industry are modest

The risk of industrial activities moving abroad is expected to be limited (CPB, 2019 and PBL, 2019c). The measures leading to additional burden for companies relate to sectors that mainly produce for the domestic market (heavy industry is not taxed very much). The part of the package that may lead to relocation concerns industry measures. However, that part has been designed in such a way that companies reduce their CO_2 emissions in the longer term and can thereby avoid the levy. Therefore it is not expected to lead to a significant additional burden on industry or the relocation of their activities.

5.3 Effects of planned policies and measures on safety, health and nature

The measures in the Climate Agreement can, by the eradication of fossil sources, generate gains for health, safety and nature. The National Institute for Public Health and the Environment (RIVM) examined the expected effects of the Climate Agreement (RIVM, 2019). This study assumes that the ambitions for reducing greenhouse gases per climate platform will be achieved. This is a rough estimate and is not based on consideration of the announced policies.

Safety

With regard to safety, it mainly concerns the elimination of carbon monoxide poisoning from the use of natural gas installations in the home. If all homes are gas-free by 2050, 10-50 deaths a year will be prevented. In addition, risk sources disappear, eliminating the chance of a disaster involving ten or more deaths caused by these sources. The end of fuel transport in particular is a major improvement.

Health

For health, the gains are mainly delivered by replacing combustion engines (petrol, diesel, gas) with electric motors. As a result, lower levels of nitrogen oxides and particulate matter enter the air. It is estimated that these emissions could fall by 10% by 2030 compared to 2016. As a result, the burden of disease from air pollution will decrease by one to several percent. A further decrease in nitrogen oxides and particulate matter from climate measures is expected by 2050, which could double the reduction in the burden of disease. Exposure to diesel smoke in the workplace can cause lung cancer and other conditions. The eradication of diesel smoke can reduce work-related disease by one to several percent. Electric cars make less noise at low speeds, reducing noise pollution within the built-up area. This could lead to a noise reduction of one decibel by 2030 and 3-4 decibels by 2050. If we succeed in achieving a reduction of 3-4 decibels, the disease burden caused by noise will decrease by 15-25%.

Nature

As far as nature is concerned, the Climate Agreement provides gains by a further reduction in nitrogen deposition. An additional reduction of circa 10% is possible by 2050. If this decrease is achieved, the natural surface area for which the nitrogen load is below the critical value will increase. This has beneficial effects on nature and biodiversity.

Air polluting emissions

In order to assess the effects on health and nature, the expected CO_2 emission reductions have been translated into emission reductions of NO_x, SO_2 and particulate matter (PM_{10}). These substances are decisive with regard to health effects. Table 5.2 shows the expected residual emissions from NO_x, SO_2 and PM_{10}. The impact of climate policy on emissions from NO_x, SO_2 and PM_{10} is relatively low. The rough estimate shows that if the Climate Agreement targets are achieved in full, emissions of NO_x will decrease by circa 45 ktons, 13% of emissions in 2016. For SO_2, the reduction amounts to 9 ktons, 30% of emissions in 2016. For PM_{10} the reduction is 3 ktons, 13% of emissions in 2016.

Table 5.2 Emissions of NO_x, SO_2 and PM_{10} per climate platform in 2016 and 2030 in ktons (source: RIVM, 2019)

Emissions in ktons	2016			Estimated residual emissions in ktons 2030		
Sector	NOx	SO_2	PM_{10}	NOx	SO_2	PM_{10}
Electricity generation	14.5	5.8	0.2	3-4	0	0
Industry	29.6	19.7	7.0	24-25	16-18	6-7
Built-up environment	12.2	0	0.3	8-9	0	0.3
Mobility	241.4	6.6	10.2	221-225	6.5-6.6	9-10
of which road traffic exhaust related	*74.2*	*0.2*	*2.0*	*54-58*	*0*	*1-2*
of which shipping	*111.0*	*6.1*	*3.3*	*111.0*	*6.1*	*3.3*
of which are mobile.	*19.3*	*0.02*	*1.2*	*19.3*	*0.02*	*1.2*
Agriculture and land use	43.7	0.2	6.4	41-42	0	6.0-6.4
of which greenhouse horticulture	*10.6*	*0.0*	*0.0*	*8-9*	*0*	*0*
of which farm animals and fertiliser	*23.8*	*0*	*5.7*	*23.8*	*0*	*5.7*
Total	**341.4**	**32.3**	**24.1**	**297-306**	**23-25**	**21-22**

5.4 Overview of the necessary investments

The figures presented in this section provide an indicative and preliminary picture of the expected and necessary investments. The historical and expected investments in this section are based on the KEV (PBL, 2019a), on adopted and proposed policy. It does not include policies announced in the Climate Agreement. As a result, the expected investments do not yet provide a complete picture of what can be expected with the implementation of the Climate Agreement.

An indication of the investments needed to achieve the national climate target of a 49% reduction is based on the analysis of the draft Climate Agreement (PBL, 2019d). There are a number of major differences between the draft Climate Agreement and the announced Climate Agreement. For example, the draft Climate Agreement assumes a bonus/malus scheme for industry, while the government decided to introduce a CO_2 tax for industry instead. The Energy tax (EB) and Surcharge for Sustainable Energy (ODE) will also be adjusted, which will, on balance, make companies pay more and citizens less. The promotion of fully electric passenger cars has also been cut back in relation to the draft Climate Agreement. The differences with regard to the CO_2 levy and the sliding-scale in the EB and ODE, were analysed separately as a government variant for the draft Climate Agreement by the PBL (2019c). The results of both studies have been incorporated in this section.

i. Existing investment flows and future planned investments related to planned policies and measures

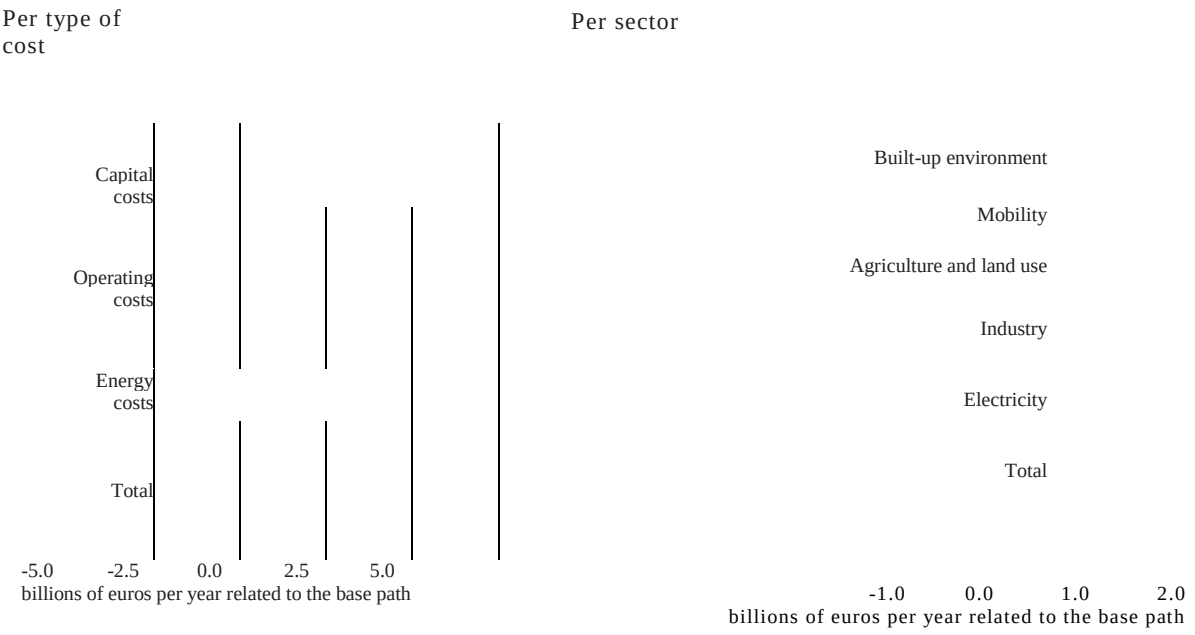
Existing investment flows and expected investments have already been discussed in section 4.6.1. No specific analysis is available for investments needed to meet the targets by 2030 and the way in which these investments could be mobilised. However, the analysis of the draft Climate Agreement by PBL (2019d) and the government variant (2019c) provide insight into the expected national costs and investments. The expected effects are expressed in a bandwidth (lower and upper limit), due to major uncertainties (at the time) about the structure of proposals and the expected reaction to them from the actors concerned. In the optimistic scenario (the upper limit), greenhouse gas emissions will be sufficiently reduced to meet the climate target of a 49% reduction by 2030 (PBL, 2019d). The corresponding investments also provide an indication of the necessary investments.

Capital costs, energy costs and operating costs collectively determine national costs. National costs in 2030 amount to between 1.6 billion and 1.9 billion euros (PBL, 2019d) (see Figure 5.1). The capital costs herein are annual depreciation on investments over the lifetime of the installations in which investments have been made. Cumulative investments between 2019 and 2030 inclusive amount to 56 billion to 75 billion euros. The above figures relate to the increase in national costs and investments in 2030 compared to the NEV 2017.[132] The extra investments cannot simply be compared with the expected investments based on the KEV; and national costs are not included in the KEV. The difference between the lower and upper limit is the result of uncertainty in the structure of the policy instruments proposed in the draft Climate Agreement and the reaction of actors to it. In principle, environmental uncertainties are not included in the bandwidths presented.[133] However, the uncertainty in other external developments (such as developments in energy prices) is high, which means that the overall uncertainty bandwidth related to costs is greater than the bandwidth that covers structural and behavioural uncertainty.

[132] The base path adopted by the PBL in assessing the draft Climate Agreement is based on the NEV 2017 according to the policy variant with "adopted and proposed policies with no new rounds of the SDE+ grant scheme after 2019", as described in Chapter 4 of the draft NECP.

[133] One exception is that in the lower and upper margins of EU standards for passenger cars and promoting electric vehicles, in addition to the behavioural uncertainty of consumers and car manufacturers, other assumptions have been made about the decrease in battery costs for electric cars. The built-up environment at the bottom of the bandwidth also assumes that there will be no cost reduction, and at the top of the bandwidth it is assumed that demand bundling and other policies will considerably reduce costs for sustainability.

Figure 5.1 National costs in the implementation of the draft Climate Agreement in 2030 (PBL, 2019d)



Expected effect with implementation of the draft Climate Agreement

Of which:

Bandwidth given structural and behavioural uncertainty, without environmental uncertainty

National costs are dominated by the cost of measures in the electricity sector. This mainly concerns the cost associated with the increase in renewable electricity generation and strengthening electricity grids. In the built-up environment, the bandwidth in the national cost is modest (Table 5.3). Part of the bandwidth is linked to the structure of the standard for existing non-residential buildings. If this were to primarily lead to electricity savings, the costs are relatively low, but the direct emission reduction will also be low. If this primarily resulted in savings on natural gas consumption (e.g. due to more insulation), then the costs are relatively high. Costs of expanding and increasing the sustainability of heat grids are closely linked to measures in the built-up environment. In this regard costs range between 50 and 350 million by 2030. This difference is due to differences in numbers of new connections and differences in the assumed available SDE+ budget for sustainable heat sources.

As far as mobility is concerned, the additional blending of advanced biofuels leads to additional costs, while the other measures, including boosting electric transport, will hardly lead to any additional costs or, on the contrary, to net benefits in 2030. In the case of many measures in this sector, lower energy and maintenance costs can offset the additional costs of more expensive vehicles and charging points.
In agriculture, national costs are dominated by methane reduction (housing modifications, feed measures, manure fermentation installations) and increasing the sustainability of greenhouse horticulture (in particular for CO2 supply).

In industry, the additional costs are 90 to 430 million per year. In addition to income from energy savings, this also takes into account benefits resulting from avoided purchases of emission allowances in the EU ETS (100 to 200 mln). The analysis of the government variant[134] includes the national costs associated with measures in industry between 40 and 650 million euros (additional costs compared to the reference) (PBL, 2019c). The costs depend heavily on the extent to which cheap reduction potential is unlocked, and future energy prices and CO2 emission allowances in the EU ETS. Cumulative (possibly additional) investments in industry amount to circa 5.5 to 6.5 billion euros in the 2020-2030 period.

[134] The PBL (2019c) has examined four variants of a CO2 levy. This is based on variant 1 (the "tonnage levy"), because it is in line with the intentions in the Climate Agreement.

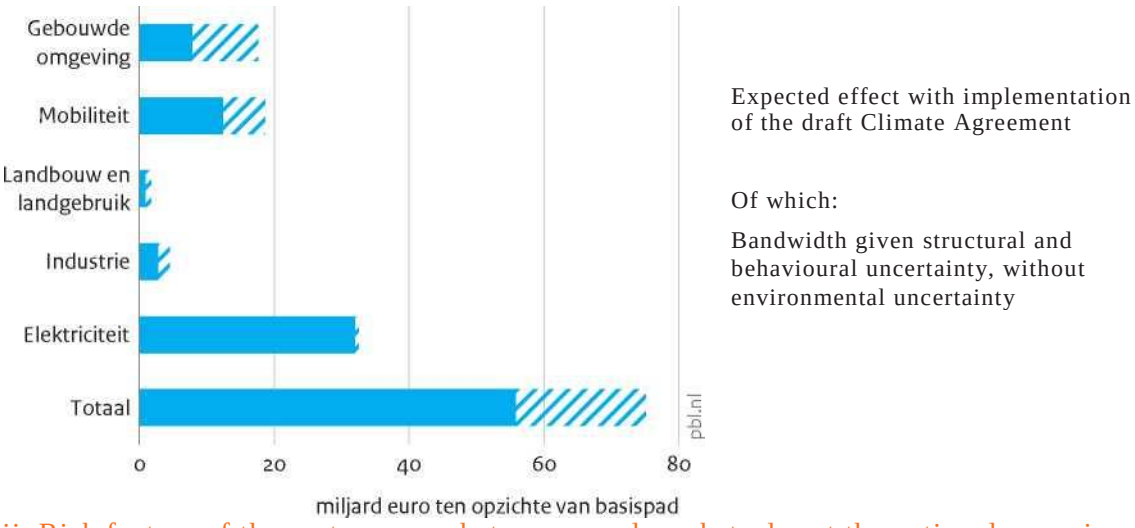
Table 5.3 National costs in 2030 and cumulative investments from 2019 to 2030 inclusive (source: PBL, 2019d)

Cluster	National costs (mln euros per year)		Investments 2019 to 2030 inclusive (bln euros)	
	Lower threshold	Upper threshold	Lower threshold	Upper threshold
Built-up environment	80	90	6.8	13.5
New constructions	10	-10	0.9	0.6
Existing non-residential buildings	0	40	2.7	3.7
Existing homes - district-oriented approach	90	110	3.2	9.1
Existing homes - voluntary district-oriented approach	-20	-60	0	0.1
Mobility	230	-440	12.4	18.7
EU - standardisation of passenger cars	50	-250	-2.8	2.2
EU - standardisation of trucks and delivery vans	-70	-110	1.9	3.0
Truck levy	20	-30	0.2	0.2
Renewable fuels	140	270	0	0
Promoting electric vehicles	140	-120	12.8	10.9
Other passenger transport measures	-40	-160	0	0
Freight transport	0	-30	0.3	2.4
Agriculture and land use	0	40	0.9	1.8
Methane reduction and other greenhouse gases (OBKG)	50	120	0.2	0.7
Land use	10	20	0.1	0.2
Greenhouse horticulture	-60	-110	0.6	0.8
Industry	90	430	2.8	4.5
Electricity generation	1,090	1,190	32.0	32.6
Other	120	570	1.0	4.1
Heat grids (outside the built-up environment)	50	350	0.3	2.4
Removal of gas connections	30	180	0.5	1.5
Green gas	40	40	0.2	0.2
Total	**1,600**	**1,900**	**56.0**	**75.0**

National costs can also be broken down into capital costs (interest and depreciation on investments), energy costs and other operating costs. It illustrates that the energy transition leads to a more capital-intensive energy system with lower costs for the purchase of energy carriers (especially coal, oil and gas). Capital costs increase by 4.0 to 4.9 billion euros per year. Energy costs decrease by 3.0 to 3.4 billion euros per year. Other operating costs increase by 0.6 billion to 1.4 billion euros per year. National costs are the balance of these large items in absolute terms, and therefore, they are relatively sensitive to other assumptions about exogenous developments that affect capital costs and energy prices.

Cumulative additional investments between 2019 and 2030 (additional compared to investments in the reference) amount to circa 56 to 75 billion euros (Figure 5.2) (PBL, 2019d). Investments in the electricity sector account for around half of this. In the electricity sector, the uncertainties caused by structural and behavioural uncertainty are minor, but those resulting from environmental factors (such as the cost development of renewable electricity generation and grid costs) are significant.

Figure 5.2 Investments in implementation of the draft Climate Agreement related to the base path, 2019-2030 (source: PBL, 2019d)



ii. Risk factors of the sector or market concerned or obstacles at the national or regional level

Diverse factors have a significant impact on emission reductions and investments that can be expected from the Climate Agreement. Therefore, the expected investments in the analysis of the draft Climate Agreement are expressed as a bandwidth: the lower and upper limits. This bandwidth is determined by uncertainties in the structure of policy instruments and the behaviour of actors. In addition, environmental factors are also uncertain.

- Structural uncertainty. The structure of the policy instrument in the draft Climate Agreement leaves scope for interpretation. In the case of the final Climate Agreement many proposals still need to be elaborated in terms of the structure of policy instruments and actions. This can lead to different outcomes. The choices that still have to be made in the detailed structure determine whether more or fewer emission reductions can be achieved.
- Behavioural uncertainty. The extent to which policy instruments will change the behaviour of actors is uncertain. Households, for example, could quickly respond to tax incentives through agreements in their district, but they may also wait for options to become cheaper. In many cases, it is not possible to identify the structural uncertainty and behavioural uncertainty separately, partly because the behavioural uncertainty is linked to a certain extent to the structure of the instruments.
- Environmental uncertainty. Exogenous developments are uncertain, such as the development of international energy markets, European emissions trading or policy in neighbouring countries. Technological developments are also uncertain. These uncertain environmental factors cause uncertainty through prices, markets and technology. The effects of many policy instruments depend heavily on how prices will develop. These uncertainties are included in the bandwidth of the KEV, but are not part of the lower and upper limits in the assessment of the draft Climate Agreement.

Further elaboration of the agreements in the Climate Agreement decreases structural uncertainty and thus indirectly reduces behavioural uncertainty. Environmental uncertainty concerns the dynamic context in which Dutch climate policy is developed. Dutch policy only has a limited impact in this regard.

iii. Analysis of additional financial government aid or public funds to remedy the shortcomings identified in point iii

The additional investments needed to achieve the climate target of a 49% reduction by 2030 is mobilised by the use of policy instruments and actions by stakeholders as agreed in the Climate Agreement (see Chapter 3). Most emission reductions and investments in the draft Climate Agreement are achieved through standardisation and subsidisation (PBL, 2019d). The ban on using coal to generate electricity is by far the most important in terms of scale. As far as mobility is concerned, the compulsory blending of biofuels and the introduction of emission-free zones together potentially provide a

relatively large contribution to sectoral emission reductions. The standardisation of non-residential buildings can make a substantial contribution in the built-up environment. In the district-oriented approach, the perseverance of municipalities to end the consumption of natural gas in designated districts is an important element in the package to ensure emission reductions and investments for housing.

Subsidies and tax benefits play a major role in achieving emission reductions in all sectors (PBL, 2019d). The SDE+(+) is important in the aforementioned integration of renewable electricity and plays a dominant role in the expected reductions and investments by industry. The SDE+(+) also contributes to reductions and investments in agriculture and the built-up environment. In addition, grants for owner-occupiers play an important role in the built-up environment in combination with prices and the above-mentioned district-oriented approach. With regard to mobility, the package of tax incentives and subsidies makes the most important contribution to the growth of electric passenger cars.
The agricultural sector is adapting existing environmental subsidies so that a reduction of greenhouse gas emissions can help elevate it.

Pricing also plays a role in reducing emissions and boosting investment, but has a predominantly supportive role. In industry, prices are an important incentive by means of a CO_2 tax, depending on the CO_2 price in the EU ETS. The shift (or additional shift) in energy taxes from electricity to natural gas and the increase in ODE tariffs makes a limited direct contribution to the expected reduction, but does support other policies. The increase in excise duty on petrol and diesel is linked to a package of subsidies and tax incentives for electric vehicles. A minimum CO_2 price will be introduced in the electricity sector, which, in addition to the ban on using coal to generate electricity, has a limited but above all supportive effect.

The Climate Agreement also includes a number of voluntary agreements, such as the proposals on "Anders Reizen" (Alternative Travel) aimed at reducing CO_2 emissions in work-related traffic, drawing up road maps for social real estate or creating a website to inform citizens about opportunities to make their homes more sustainable. In a few cases an agreement has been reached, such as that related to natural gas-free new constructions. These agreements often support other policies.

5.5 Effects of planned policies and measures on other Member States and regional cooperation

Higher electricity demand due to CO_2 industry levy

The introduction of a levy on CO_2 emissions, under the assumption that industrial production does not change as a result of the introduction of the levy, will lead to greater electricity demand from 7 to 12 TWh from industry than estimated in the assessment of the draft Climate Agreement (PBL, 2019c). In order to satisfy this extra demand, more electricity can be imported (or less exported) or more can be generated in the Netherlands. Extra imports from abroad often lead to additional emissions there. Additional production within the Netherlands will, if the established renewable capacity is the same, come from gas-fired power plants and thus lead to additional emissions. However, it is also possible that, in the case of increasing demand, additional investments will also be made in electricity generated from renewable sources.

Appendix 1 Sources

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Appendix 2 European Commission Recommendations

Recommends the Netherlands take action to:	The Netherlands' response
Recommendation 1	
Underpin the welcome level of ambition of a 27-35 % renewable energy share for 2030 as the Netherlands' contribution to the Union's 2030 target for renewable energy by detailed and quantified policies and measures that are in line with the obligations of Directive (EU) 2018/2001 of the European Parliament and Council[135] in a way that enables a timely and cost-effective achievement of this contribution. Include an indicative trajectory that reaches all the reference points pursuant to Article 4(a)(2) of Regulation (EU) 2018/1999.	The share of renewable energy established by Europe that applies to the Netherlands in 2030 amounts to a contribution of 26%. The expectation according to the KEV 2019 is 24.9% (bandwidth 20.2% - 26.7%). However, not all measures in this field are included in the KEV 2019. Based on the mid-term estimate of 24.9% in the KEV 2019, the PBL estimates that the share of renewable energy in 2030, including the measures of the Climate Agreement, will amount to 30% - 32%. The target indicated is at least 27%. This is explained in section 2.1.2.i.
Ensure that the renewable energy target for 2020 set out in Annex I of Directive 2009/28/EC of the European Parliament and of the Council[136] is fully met and maintained as a baseline from 2021 onwards, and explain how it intends to meet and maintain such baseline share. Put forward trajectories and corresponding measures in the heating and cooling sector and the transport sector to meet the indicative target included in Article 23 of Directive (EU) 2018/2001 and the transport target in Article 25 of Directive (EU) 2018/2001. Provide additional details on simplification of administrative procedures on the enabling framework for renewable self-consumption renewable energy communities, in line with Articles 21 and 22 of Directive (EU) 2018/2001.	Section 3.1.2 includes policies and measures. With regard to the indicative trajectory with reference points, section 2.1.2 i indicates that the contribution is at least 16.3% in 2022, 19.6% by 2025 and 22.5% in 2027. PBL's analysis of the measures in the draft Climate Agreement indicates an expected share of renewable energy of 11.4% by 2020 (KEV 2019), which means Europe's renewable energy target of 14% is out of reach. The government is doing everything it can to nonetheless achieve the target of 14%. This is explained in section 2.1.2.i. On the basis of the Climate Agreement, more information on heating and cooling is included in section 2.1.2. ii Additional information has been provided in 3.1.2.vi, complying with this part of the recommendation.

[135] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (*OJ L 328, 21.12.2018, p. 82).*
[136] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (*OJ L 140, 5.6.2009, p. 16)*

Recommends the Netherlands take action to:	The Netherlands' response
Recommendation 2	
Review its final energy consumption contribution in view of the need to increase the level of efforts to reach the Union's 2030 energy efficiency target, and identify additional policies and measures that could deliver further energy savings by 2030. List additional policies and measures to the ones already in place for the purposes of achieving the Netherlands' 2020 energy efficiency targets. The expected impact in terms of energy savings, their implementation period and the targeted sectors are required in the final integrated national energy and climate plan. Continue efforts regarding the energy saving obligation schemes beyond 2020, taking into account that the energy savings obligation in 2021-2030 is more ambitious than the current one.	The final consumption contribution in 2030 was increased on the basis of definition changes (cf Eurostat) from 1,864 petajoules to 1,837 petajoules. As far as primary energy use is concerned, there are no adjustments to the draft version: this remains at 1,950 petajoules in 2030 (assessed as sufficient by the EC). This is described in section 2.3.i. Section 3.2.2 outlines policies and measures. A more detailed summary is provided in the notification related to Article 7 (Appendix 3). The expected effects of Climate Agreement policies are not included (in accordance with KEV 2019), which means that achieving the Article 7 obligation cannot be substantiated numerically.
Recommendation 3	
Specify the measures supporting the energy security objectives on diversification and reduction of energy dependency, including measures ensuring flexibility and electricity generation adequacy in light of the ambitious renewables target.	Section 2.3 includes additional details and substantiation on energy security. The measures are included in Section 3.3.
Recommendation 4	
Clarify the national objectives and funding targets research, innovation and competitiveness, specifically related to the Energy Union, to be achieved between 2021 and 2030, so that they are readily measurable and fit for purpose to support the implementation of targets in the other dimensions of the integrated national energy and climate plan. Underpin such objectives with specific and adequate policies and measures, including those to be developed in cooperation with other Member States, such as the Strategic Energy Technology Plan.	Information about MMIPs has been added in Section 2.5, providing more clarity on the targets for research, innovation and competitiveness in relation to climate and energy. There are no national competitiveness targets. Policies and measures, including international cooperation, have been added in Section 3.5.

Recommends the Netherlands take action to:	The Netherlands' response
Recommendation 5	
Intensify the already excellent regional cooperation arrangements within the Pentalateral Energy Forum based on the political declaration of 4 March 2019 to extend this regional cooperation to specifically include the development and monitoring of the national energy and climate plans in particular as regards relevant issues for cross-border cooperation.	Section 1.4.i explains that the Netherlands will include this recommendation in the elaboration of the political declaration and enhanced regional cooperation in the NECPs in the Penta context during the Dutch (Penta) Presidency of the Benelux in 2020.
Recommendation 6	
Provide a general overview of the investment needs to achieve the climate and energy objectives, and a general assessment of the sources of that investment, including appropriate financing at national and regional level.	In Section 5.3 information has been added based on the analysis of the draft Climate Agreement. The figures presented in this section provide an indicative and preliminary picture of the expected and necessary investments. The historic and expected investments in this section are based on the KEV (PBL, 2019), on the basis of the adopted and proposed policies. It does not yet include policies announced in the Climate Agreement. As a result, the expected investments do not yet provide a complete picture of what can be expected with the implementation of the Climate Agreement.
Recommendation 7	
List all energy subsidies, including in particular for fossil fuels, and actions undertaken as well as plans to phase them out.	This has been done in Section 4.6.4. Section 3.1.3 has also been updated accordingly.
Recommendation 8	
Complement the analysis of the interactions with air quality and air emissions policy with more quantitative information, at least including the required information about the projected air pollutants emissions under the planned policies and measures.	The KEV 2019 does not contain projections on emissions of air pollutants (this will probably be available in early 2020). However, a RVIM study was used that examined, among other things, the health effects of the Climate Agreement. A rough estimate was also produced for this purpose regarding emissions of air pollutants. It is included in Section 5.3
Recommendation 9	
Integrate just and fair transition aspects better, notably by providing more details on social, employment and skills impacts of planned objectives, policies and measures. Include a dedicated assessment of energy poverty issues, along with related objectives or specific policies or measures as required by the Regulation (EU) 2018/1999.	The policy approach to the labour market, training and employment in relation to the transition has been included in Section 3.5. The text corresponds to that in the Climate Plan. Section 5.2 addresses the Climate Agreement's effect on income and employment (in addition to the economic impact). RVO has provided an outlook of the current situation as regards energy poverty based on available sources (including the PBL study Measuring With Two Standards). This has been incorporated in Section 4.5

Appendix 3 Notification of the measures taken by the Member States and methods for implementing Article 7 of Directive 2012/27/EU (ANNEX III)

In this notification, the Netherlands provides insight into how it will fulfil the obligations in Article 7 of Directive 2012/27/EU (hereinafter referred to as "the Directive") in accordance with Article 3(2)(h) of the European Regulation (EU) 2018/1999.

1. Mandatory energy savings

Mandatory energy savings for the period 2014 to 2020 inclusive amount to 482 petajoules, in accordance with the fourth National Energy-Efficiency Action Plan.

Mandatory energy savings for the period 2021 to 2030 inclusive is based on the following basic principles
925 PJ:

- Reference consumption is based on the average final consumption of energy between 2016 and 2018 inclusive (the three years leading up to 2019) (see Table 1);
- Annual final energy consumption in 2016 and 2017 originates from Eurostat: Table: "Final energy consumption (Europe 2020-2030)" (update 06.02.19);
- Consumption in 2018 is based on expected energy consumption according to the KEV 2019 (PBL, 2019a), as Eurostat will not publish the data for 2018 until 2020;
- Once Eurostat has also published the final consumption for 2018, reference consumption and thus the mandatory energy savings will be updated. This will be reported in the first NECP progress report (March 2023).

Table 1 Final consumption of energy from 2016 to 2018 inclusive

Year	Final energy consumption in ktoe	Final energy consumption in petajoules*	Source
2016	49,890	2,089	Eurostat
2017	50,340	2,108	Eurostat
2018	50,436	2,112	KEV2019
Average	50,222	2,103	

* the conversion factor used is 23,8845897 ktoe/petajoule

The cumulative mandatory energy savings are determined by multiplying the annual mandatory energy savings of 0.8% by the reference consumption. Therefore, the annual energy savings amount to 16.8 PJ (or 401.8 ktoe). For each year from 2021 to 2030 inclusive, the annual savings are multiplied by the relative multiplier for that year. The sum results in mandatory cumulative energy savings for the period from 2021 to 2030 inclusive (see Table 2). The energy savings in the individual years in Table 2 serve to substantiate mandatory cumulative energy savings and do not apply as separate targets.

Table 2 Cumulative energy savings from 2021 to 2030 inclusive

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Multiplier	10	9	8	7	6	5	4	3	2	1	55
Cumulative energy savings (PJ)	168	151	135	118	101	84	67	50	34	17	925
Cumulative energy savings (ktoe)	4,018	3,616	3,214	2,812	2,411	2,009	1,607	1,205	804	402	22,098

2. Policies

Introduction

The Netherlands has opted for alternative savings measures (according to "Article 7b") to comply with the mandatory energy savings according to both Article 7.1 (a) and (b). The fourth National Energy Efficiency Action Plan of the Netherlands (April 2017) defined the policies implemented by the Netherlands to meet the mandatory energy savings for the period 2014 to 2020 inclusive under Article 7.1 (a). This notification deals with the policies that the Netherlands will

implement in order to meet the mandatory energy savings for the period 2021 to 2030 under Article 7.1 (b).

National policies and elected policies

Current energy and climate policy is anchored in the 2013 Energy Agreement, the 2017 Coalition Agreement, the Climate Agreement and the Climate Act. The Climate Agreement contains many agreements on actions that will be undertaken and new policies that will be implemented to achieve the climate target of a 49% reduction in greenhouse gases by 2030 (see Chapter 3 of the final NECP). Many of these policies will contribute to achieving the mandatory energy savings under Article 7. In addition to new policies, a number of existing policies (whether or not in adapted form) will continue after 2020. An overview of these policies can be found in Appendix I.

Depending on the (expected) energy saving effects and the monitoring approach to be developed (see paragraph 3 below), the Netherlands can choose not to include the energy savings achieved in all policy measures in order to meet the mandatory energy savings.

Expected effects of policies 2014 to 2020 inclusive

According to Article 24 of the EED, in the annual report sent to the European Commission in April 2019, the savings achieved amounting to 516 PJ / 12,235 ktoe were reported cumulatively in the period 2014 to 2017 inclusive. This saving is the result of actions taken by implementing the MJA/MEE, EIA measures and the policies in the built-up environment. This has been adjusted for the overlap between these policies. The savings will increase further by actions undertaken in 2018, 2019 and 2020. This will achieve the mandatory energy savings of 482 PJ / 11,512 ktoe.

Expected effects of policies 2021 to 2030 inclusive

The expected effects of the adopted and proposed policies have been analysed in the PBL's national Climate and Energy Outlook (KEV), (see Table 3). According to the PBL, the expected cumulative energy savings of the adopted and proposed policies are insufficient to meet the mandatory energy saving of 925 PJ (PBL, 2019a). This does not yet include the effects of all the policies listed in Appendix I. This is because the policies in the Climate Agreement were not announced in time to be included in the KEV. Therefore, the expected energy savings according to Table 3 is an underestimation. The next KEV in 2020 is expected to analyse the Climate Agreement policies, provided that they have been developed in sufficient detail, including the expected effect on energy savings. If the Netherlands chooses not to include all the savings achieved with these policies in the progress report for the mandatory savings, the savings will be lower than mentioned below.

The PBL's climate agreement analysis shows that the announced policies are expected to result in an additional emission reduction of 18-28 Mton of CO_2 equivalents by 2030 compared with the expected emissions according to the KEV 2019 included proposed policies (PBL, 2019b). This achieves an emission reduction of 43 - 48% compared with 1990. The expected emission reduction is partly achieved by energy consumption savings. If the annual KEV shows that the climate target is not within reach, the government will take additional measures to bring the goal within reach. In doing so, the Netherlands expects to be able to fulfil the mandatory energy savings according to Article 7.1 (b).

Table 3 Expected cumulative energy savings 2021-2030 per sector for the target for Article 7 of the EED (in petajoules)

	Adopted and proposed policies (petajoules)
Industry	66 - 159
Agriculture and horticulture	11 - 24
Households	180 - 256
Services	207 - 256
Transport and mobility	29 - 45
Total	**556 - 691**

Source: KEV (PBL, 2019a)

Table 3 only includes a bandwidth for the expected effects, not a mid-term estimate. This is because there are still uncertainties about how Article 7, which was amended in 2018, will be implemented. We do not yet know the effect of all the changes with regard to whether or not the effects of certain policies and techniques will be included.

The expected effects are not determined per policy but per sector. It is often not possible to isolate the impact of an individual policy in relation to other policies that seek to influence the same target group. It is a complex of policies and

actions by key actors that encourages parties to take energy-saving measures. This approach prevents savings from policies being counted twice. This is explained in more detail in paragraph 3 (Calculation method).

3. Calculation method

This paragraph describes the basic principles generally used by the Netherlands when calculating both achieved (ex-post) as well as expected (ex-ante) energy savings according to Article 7 (unless indicated otherwise). Appendix II contains a brief overview of some important and generally applied principles.
A specific description of the calculation method and any deviations from the principles described here will be specified in the Method Documents. The latter will be available by 25 June 2020 at the latest, in accordance with the deadline on which the revision of the Directive should be implemented.

The exact instruments and monitoring pertaining to several new policies announced in the Climate Agreement in June 2019 still need to be elaborated. This applies, for example, to new policies such as the CO_2 levy for industry or the amendment of existing policies such as the extension of the SDE+ scheme. It is possible that the Method Documents, for which these policies are important, will be supplemented after 25 June 2020.

A system approach is becoming increasingly important for monitoring climate and energy policy. The transition to a low-carbon economy is a dynamic and complex process, in which a package of policies must contribute to development. A single policy instrument alone will not usually be sufficient; the goals of the transition can only be brought within reach through the interplay of policies and stakeholder actions. For example, some policies (such as the Green Deals) ensure the right (legal) preconditions and the combination of the energy tax and a subsidy ensures that a particular target group takes measures. Moreover, it is not possible to plan the process of the energy transition as a whole and it must be possible to adjust it based on insights and experiences. This requires monitoring changes at system level (e.g. electricity generation, heating for homes etc.). This calls for an approach in which a coherent package of policies, in addition to actions by other stakeholders, jointly monitor the relevant key factors for success (Hekkert and Ossebaard, 2010 and Smink, Hekkert and Negro, 2015)).

This means the calculation of energy savings is determined per sector/sub-sector. For this purpose, data collected by monitoring policies and/or that are available on the basis of market data (e.g. the supply of the amount of insulation materials) are used. The Method Documents will indicate, per sector/sub-sector, which data will be used and what specific and/or different principles will be applied.

Measuring methods
The Directive specifies which methods can be used in Annex V point 1.

The (ex-post) savings achieved as a result of policies are determined by technical estimates. Direct measurements on the energy consumption of individual measures are not usually available. The possible benefits of direct measurements are generally disproportionate to the higher implementation costs compared to technical estimates.

The main database for technical estimates concerns monitoring data available when implementing the policies (e.g. applications for a subsidy or tax deduction) and/or on the basis of market data (e.g. the supply of insulation materials). This provides data on the measures taken in sectors/sub-sectors in a given year, such as the number of investments in energy-efficient installations or saving measures. Subsequently, the energy savings are determined by means of assumptions about lifetime and reference (see lifetime and calculation method below).

The expected (ex-ante) savings are determined by PBL in the context of the national Climate and Energy Outlook (KEV), which uses the KEV modelling instruments[137]. Technical estimates are also applied

Savings on primary or final energy consumption
Savings on final consumption are expressed as savings in final energy consumption in final terms. Therefore, no calculation method is required for conversion from or to primary energy consumption.

[137] For an explanation of some models that PBL uses in the KEV, see: https://www.pbl.nl/onderwerpen/ energie-en-energievoorziening/modellen

Lifetime of energy savings

The period in which savings from measures can be counted is a maximum of seven years for the obligation period from 2014 up to and including 2020 and a maximum of 10 years for the period 2021 to 2030 inclusive. The lifetimes of the measures taken in the relevant sectors are diverse, but according to the CEN Workshop Agreement (CWA) 15693 (April 2007) are often well above seven years[138]. For example, the lifetime of insulation measures is generally a lot longer than 20 years, for vehicles over 10 years and for heating systems (such as HR boilers) about 15 years. Lifetimes are only shorter than ten or seven years for energy savings achieved through behavioural measures, organisational measures and consumer electronics/equipment (including lighting). If such measures are taken, the savings are only counted in accordance with this shorter lifetime. Specific assumptions about lifetimes are explained in the Method Documents.

Calculation method

In order to determine energy savings based on data about the measures taken, assumptions are required for the lifetime (see above) and the reference used. In principle, the energy saving is determined by the difference between energy consumption in the situation without policy intervention (the reference) and the situation after policy intervention.

In principle, the reference is determined by the implementation of European policies and the application of minimum European energy efficiency and/or CO_2 emission standards (see Table 4). This is usual for measures that replace a device, installation or vehicle at the end of its usual lifetime. Only if the new device, installation and/or vehicle is more efficient at the time of replacement than the European standard that applies at the time will this result in additional energy savings. This ensures the additionality of the calculated energy savings in accordance with Annex V(2)(a) of the Directive. If a device, installation and/or vehicle is replaced before the end of its usual lifetime, in principle, the situation applies as a reference is that without early replacement during the usual lifetime of the replaced device, installation and/or vehicle (see Figure 1).

Figure 1 Schematic diagram in the case of early replacement

Table 4 Relevant European CO2 and/or energy standards

Categories of savings measures	Relevant European CO2 or energy standards
Devices and small installations	The Ecodesign Regulation
Industrial installations	The energy efficiency levels of Best Available Techniques (BBT) under the Industrial Emissions Directive
Vehicles	European CO2 emission standards for vehicles
New constructions	Minimum energy performance requirements under the Energy Performance Buildings Directive (EPBD)

If no mandatory and/or specific European standard applies, the reference shall be determined by the standard in the market at that time. If there is no information (e.g. in the case of specific process installations in industry) a measure (or project) specific reference situation is used.

In the case of the expected (ex-ante) energy savings between 2021 to 2030 inclusive, the reference for adopted and proposed policies is determined by energy efficiency in the base year 2020[139]. The efficiency in the reference (e.g. energy consumption per unit of production) is compared with the energy efficiency in the policy variants of the projections in the KEV. If energy savings occur through premature replacement and/or higher efficiency compared with European standards,

[138] At the Meeting of the EED Expert Group on Lifetimes on 15 March 2019 in Brussels it was revealed that this CWA still serves as an effective data source for the lifetimes of measures.

[139] For the period 2014 to 2020 inclusive, the base year is 2013

only the part that is the result of national policy is counted.

The Method Documents, which will be available per policy or package of policies, by 25 June 2020 at the latest, describe the specific basic principles and methods used when calculating the achieved (ex-post) and expected (ex-ante) energy savings.

Avoiding double counts

Savings in a given sector are influenced in the Netherlands by horizontal policies (such as energy taxation and the EIA) on the one hand and a package of sectoral policies (see paragraph 2 on polices) on the other. Although multiple policies strive to influence the same actor or target group, policies are often complementary. Double counts are prevented by determining the total effects of the achieved (ex-post) and expected (ex-ante) savings measures per sector or sub-sector (see explanation of the system approach above).

In the event that the achieved energy savings are determined on the basis of multiple and (possibly partly) overlapping data sources, the Netherlands also ensures that double counts are prevented. For example, to determine energy savings in the period 2014 to 2020 inclusive, the total savings by the EIA and MJA/MEE will be corrected for companies that have also submitted an EIA application (due to the savings according to the EIA by MJA/MEE participants). The total savings are then also reduced by the savings made by the EIA and MJA/MEE in the built-up environment. The savings determined using the system approach for the built-up environment are thus decisive. If necessary, an approach will be described in the Method Documents.

Climate differences

The Netherlands does not apply any methods that take potential climate differences within the Netherlands into account.

4. Monitoring and controls

The Netherlands has an extensive and reliable system of monitoring, inspection and controls both at national level and at the policy level. Tasks and competences are laid down in legislation and implementing organisations have capacity and expertise. At the national level, this system consists of:

- *Ex-ante evaluation in policy preparation.* Article 3.1 of the Compatibility Act 2016 requires the expected effectiveness and efficiency of new policies
- *Periodic evaluations of policy instruments.* This normally involves examining the effect of a policy, with a focus on effectiveness (does it work?) and efficiency (is the goal achieved as cheaply as possible?). Since 2006, the Periodic Evaluation Research Scheme (RPE) has stipulated that ministers are obliged to periodically conduct policy evaluations and screening (or have them conducted).
- *Periodic policy screening.* A policy screening summarises the knowledge of the effectiveness and efficiency of a whole policy area. The screening examines the coherence between different forms of policy. Separate evaluations of policy instruments underpin this.
- *Investigations by the Court of Audit (ARK).* The Court of Audits (ARK) is a High Council of State, an independent institution and not part of the government or parliament. The ARK has legal powers and has a number of statutory tasks. For example, it monitors central government's revenue and expenditure and reports on it in an annual report to parliament on Accountability Day. In addition, the ARK conducts separate investigations, in which it can decide for itself which themes or policy components are examined. The energy transition is one of the topics being examined.
- *Annual Climate and Energy Outlook (KEV).* The KEV is an annual study of the achievements and expected progress and effects of overall energy and climate policy produced by the Netherlands Environmental Assessment Agency (PBL). The PBL is independent with regard to the investigations it conducts. The KEV provides, on the one hand, an integral overview and analysis of the announced renewable energy generation, energy consumption and savings, as well as the associated greenhouse gas emission reductions. This is based on the most recently available statistical data (CBS and other sources) and implementation data related to policy instruments (RVO and others). Therefore, there is an internal review of the quality and coherence of the data used. This annual study ensures a coherent, up-to-date, independent view of actual achievements, as well as effectiveness, added value and forecasts with the package of adopted or proposed policies. If the expected progress is insufficient to achieve the targets, this will provide important information for adjusting the policy. If the KEV shows that the mandatory energy savings will not be met, additional measures will be taken. The KEV and background reports thus form an important basis for the national system required under UN and EU rules concerning emission reports, PAMs and projections in the Netherlands and guarantees for the achievement of policy objectives. The KEV publications are publicly available.

Monitoring, inspection and controls related to implementation are also carried out at the policy level. The Netherlands has opted to implement alternative policies. These policies include taxes, tax benefits, subsidies, agreements and standards. Their enforcement varies depending on the policy. In the event that legal standards must be met (such as energy performance requirements in new housing construction), the competent authority acts as an independent and legal enforcer, which can impose administrative penalties (such as fines). In the case of taxes, the Dutch Tax and Customs Administration acts as an independent enforcer. For other policies (such as subsidies and agreements), missing out on the benefits of incentives serves as encouragement for policy implementation. In addition, the Netherlands Enterprise Agency generally acts as an implementation organisation that oversees compliance with subsidy rules and agreements (as with the multi-year energy-efficiency agreements).

The monitoring and verification system is explained per policy in the Method Documents.

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Appendix I Overview of policies that contribute to energy savings in accordance with Article 7 from 2021 to 2030 inclusive

Title of instrument	Target sector
CO2 price electricity sector	Energy
BOSA Promoting the construction and maintenance of sports accommodations (amended as of 2019 with energy measures).	Built-up environment
VAT Value Added Tax: reduced rate for insulation	Built-up environment
Digital platform	Built-up environment
Energy Performance Requirement for Offices (Label C)	Built-up environment
Climate campaign: Iedereen doet wat (Everyone does something)	Built-up environment
MMIP 3. Acceleration of energy renovation in the built-up environment	Built-up environment
MMIP 4. Renewable heat (and cooling) in the built-up environment (including greenhouse horticulture)	Built-up environment
MMIP 5. The new energy system in the built-up environment in balance	Built-up environment
NEF National Energy Savings Fund	Built-up environment
Standardisation of Non-residential Buildings and Road Maps	Built-up environment
Natural gas-free Districts and Large-Scale Testing Grounds Programme	Built-up environment
PRE Programme for small-scale energy-saving measures	Built-up environment
RVV Landlord Levy Sustainability Reduction Scheme	Built-up environment
Housing standards and target values	Built-up environment
Rental sector starter motor	Built-up environment
Heat fund and building-related financing	Built-up environment
WEW Flexible mortgage for energy saving measures	Built-up environment
District-oriented approach	Built-up environment
WWS Housing Valuation System & EPV Energy Performance Allowance	Built-up environment
NP RES National Regional Energy Strategy Programme	Built-up environment, Agriculture
Net-metering (and VAT refund for solar PV)	Built-up environment, Energy
ISDE Investment Subsidy Renewable Energy small appliances	Built-up environment, Industry
National CO2 industry levy	Industry
Regional industrial cluster and frontrunner programmes	Industry
EB/RED/ODE: (Regulatory) Energy Tax & Surcharge for Sustainable Energy	Industry, Built-up environment, Agriculture
Climate Act	Industry, Built-up environment, Agriculture, Transport
EIA Energy Investment Deduction scheme	Industry, Built-up environment, Energy, Agriculture
Green projects scheme (green investments)	Industry, Built-up environment, Agriculture
MMIP 6. Closing industrial chains	Industry, Energy, Services, Research
MMIP 7. A 100% CO2-free industrial heat system	Industry, Energy, Services, Research
Green Deals (GD)	Industry, Built-up environment, Energy, Agriculture, Transport
Environmental Management Act: Mandatory energy savings	Industry, Built-up environment, Agriculture
Environmental Management Act: Information obligation	Industry, Built-up environment, Agriculture
Stimulation of Sustainable Energy Production (SDE+)	Industry, Agriculture, Energy

Title of instrument	Target sector
MIA Vamil Environmental Investment Rebate and the Arbitrary depreciation of environmental investments	Industry, transport, Agriculture
BL/BL-plus Agriculture Guarantee & GL Agriculture Guarantee	Agriculture
CO2 sector system	Agriculture
EHG Energy Efficient and Renewable Energy Greenhouse Horticulture (& Precursors IMM Investments in Environmentally Friendly Measures & IRE Investments in Energy Savings)	Agriculture
MEI Market introduction for energy innovations	Agriculture
Kas als energiebron (Greenhouse as an energy source) Programme	Agriculture
Convenant Schone en Zuinige Agrosectoren (Clean and Energy-efficient Agrosectors Agreement) (Agroconvenant)	Agriculture, Industry
GD203 Het Nieuwe Draaien	Agriculture, Transport
Vehicle taxation: BPM, MRB and income tax addition	Transport
"Kies de beste band" (Choose the best tyre) Campaign	Transport
HNR Het Nieuwe Rijden	Transport
National Charging Infrastructure Agenda	Transport
Truck levy	Transport
MMIP 9. Innovative transmission and use of sustainable energy carriers for mobility	Transport, Built-up environment, Industry, Research
MMIP 10. Targeted transport movements for people and goods	Transport, Built-up environment, Research

A description per policy can be found in Appendix 4.

Appendix II General principles for calculating energy savings between 2021 and 2030 inclusive

	Basic principle	Explanation
Period in which the effects are counted	From 2021 to 2030 inclusive. Savings are counted cumulatively. A measure with a lifetime of >10 years, will count 10 times in 2021. A measure in 2022 nine times, etc.	
Lifetime of measures and decreasing savings of measures during the lifetime	Lifetime according to the CEN Workshop Agreement (CWA) 15693 (April 2007). If this is subject to a deviation, it is explained.	Almost all technical measures have a lifetime longer than 10 years. During the obligation period, decreasing savings during the lifetime of technical measures do not play a role (or at least, not a demonstrable one). Non-technical measures (such as behavioural change resulting from information campaigns) do have a limited lifetime.
Small-scale renewable behind the meter (e.g. PV, solar boiler)	It only counts as a saving if it leads to a better conversion return compared with the reference and/or reduced supply/sale of energy to end users	Biomass typically does not produce a better conversion yield and/or reduced supply/sale of energy. Consumption of self-generated electricity usually leads to reduced supply.
Heat pumps	As a saving, with the exception of electricity consumption.	In accordance with Eurostat "FEC2020-2030", consumption of ambient heat by heat pumps is not counted as consumption.
Building renovation	Counts as a saving insofar as this is the result of policies (e.g. minimum energy performance requirements).	
New constructions	Does not count as savings, with the exception of national standards in relation to energy performance that goes further than that in the EPBD.	For example, zero on the meter/net supply homes that, as of 2020, go further than the EPBD standard.
Additionality	Savings due to the implementation of European obligations do not count unless national policy goes further, e.g. with stricter standards or faster implementation.	Examples include Ecodesign, CO2 emission standards for vehicles and energy taxes.

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