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Finland's Integrated Energy and Climate Plan



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<p>Abstract</p> <p>Finland's Integrated Energy and Climate Plan contains Finland's national targets and the related policy measures to achieve the EU's 2030 energy and climate targets. The Energy and Climate Plan addresses all five dimensions of the EU Energy Union: decarbonisation, energy efficiency, energy security, internal energy markets and research, innovation and competitiveness.</p> <p>The EU has set Finland a 2030 national target for reducing greenhouse gas emissions in the non-emissions trading sector by 39 % compared to 2005. At the same time, emissions from the land-use sector should be kept lower than the computational reduction in emissions from sinks. Finland also aims to increase the share of renewable energy to at least 51 % of the final energy use and to 30 % of the final energy use in road transport. With regard to energy efficiency, the target is that the final energy consumption does not exceed 290 TWh.</p> <p>The Finnish Energy and Climate Plan outlines the impact of existing policy measures on the projected evolution of greenhouse gas emissions, renewable energy and energy efficiency up to 2040. In addition, the plan describes the effects of the planned policy measures on the energy system, greenhouse gas emissions and sinks, economic development, the environment and public health. The Plan also assesses the impact of planned and existing policy measures on investment.</p> <p>Contact persons: Riku Huttunen (029 504 7277), Markku Kinnunen (029 506 4792), Bettina Lemström (029 506 4116), Petteri Kuuva (029 506 4819)</p>			
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Tiivistelmä	<p>Suomen yhdenmety energia- ja ilmastosuunnitelma sisältää Suomen kansalliset tavoitteet ja niihin liittyvät politiikkatoimet EU:n 2030 energia- ja ilmastotavoitteiden saavuttamiseksi. Energia- ja ilmastosuunnitelmassa käsitellään kaikkia viittä EU:n energiaunionin ulottuvuutta: vähähiilisyttä, energiatehokkuutta, energiaturvallisuutta, energian sisämarkkinoita sekä tutkimusta, innovaatiota ja kilpailukykyä.</p> <p>EU on asettanut Suomelle vuotta 2030 koskien kansalliseksi tavoitteeksi vähentää päästökaupan ulkopuolisia kasvihuonekaasupäästöjä 39 % vuoden 2005 tasoon verrattuna. Samaan aikaan maankäyttösektorin päästöt tulee pitää laskennallisten nielujen aikaansaamia poistumia pienempinä. Suomen tavoitteena on nostaa uusiutuvan energian osuus vähintään 51 %:iin kokonaisloppuenergian käytöstä ja 30 %:iin tieliikenteen loppuenergian käytöstä. Energiatehokkuuden osalta tavoitteena on, että loppuenergian kulutus ei ylitä 290 TWh:n tasoa.</p> <p>Suomen energia- ja ilmastosuunnitelmassa esitetään päätettyjen politiikkatoimien vaikutus kasvihuonekaasupäästöjen, uusiutuvan energian ja energiatehokkuuden arvioituun kehityskulkuun vuoteen 2040 asti. Lisäksi suunnitelmassa kuvataan suunniteltujen politiikkatoimien vaikutuksia mm. energiajärjestelmään, kasvihuonekaasupäästöihin ja nielujen aikaansaamiin poistumiin, talouden kehitykseen, ympäristöön ja kansalaisten terveyteen. Suunnitelmassa arvioidaan myös suunniteltujen ja olemassa olevien politiikkatoimien vaikutusta tuleviin investointitarpeisiin.</p> <p>Hankkeen yhdyshenkilöt: Riku Huttunen (029 504 7277), Markku Kinnunen (029 506 4792), Bettina Lemström (029 506 4116), Petteri Kuuva (029 506 4819)</p>		
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Referat	<p>I Finlands integrerade energi- och klimatplan beskrivs de nationella målsättningarna, styrmedlen och åtgärderna som Finland beslutat sig för i syfte att bidra till uppnåendet av EU:s energi- och klimatmål för år 2030. Energi- och klimatplanen behandlar energiunionens alla fem dimensioner: energitrygghet, den inre marknaden för energi, energieffektivitet, minskade växthusgasutsläpp, samt forskning, innovation och konkurrenskraft.</p> <p>EU ålägger Finland att minska utsläppen av växthusgaser i den icke-handlande sektorn med minst 39 % jämfört med utsläppen år 2005. Därtill ska växthusgasutsläppen i sektorn för markanvändning vara mindre än det kalkylmässiga upptaget i sänkor. Finland har som målsättning att öka andelen förnybar energi till minst 51 % av den slutliga energianvändningen och till minst 30 % i vägtrafiken. Inom energieffektivitet är målsättningen att den slutliga energianvändningen inte överstiger 290 TWh.</p> <p>I Finlands energi- och klimatplan beskrivs effekterna av befintliga styrmedel och åtgärder på den vägledande utvecklingsbanan för växthusgasutsläpp, förnybara energi och energieffektivitet fram till 2040. Därtill beskrivs effekterna av planerade styrmedel och åtgärder på bland annat energisystemet, på utsläpp och upptag av växthusgaser, ekonomisk utveckling, miljö och hälsa. I planen ges också en översikt över effekten av befintliga och planerade åtgärder på framtida investeringsbehov.</p> <p>Kontaktpersoner: Riku Huttunen (029 504 7277), Markku Kinnunen (029 506 4792), Bettina Lemström (029 506 4116), Petteri Kuuva (029 506 4819)</p>		
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SECTION A: NATIONAL PLAN

1 OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 Executive summary

1.1.1 Political, economic, environmental, and social context of the plan

After submitting the draft National Energy and Climate Plan (NECP) in 2018, parliamentary elections were held in Finland in spring 2019 and the new government of Prime Minister Antti Rinne took office on 6 June 2019. After that, the new government of Prime Minister Sanna Marin has taken office on 10 December 2019 but the Government Program did not change.

The Programme of Prime Minister Sanna Marin's Government¹ contains several strategic themes² one of which is "Carbon neutral Finland that protects biodiversity". In addition, objectives and measures addressing climate change are included under several other strategic themes.

This strategic theme on carbon neutrality includes the following objectives:

1. Finland will achieve carbon neutrality by 2035
2. Finland aims to be the world's first fossil-free welfare society

1 Inclusive and competent Finland – a socially, economically and ecologically sustainable society, <http://urn.fi/URN:ISBN:978-952-287-811-3>

2 Strategic themes, <https://valtioneuvosto.fi/en/rinne/government-programme>

3. Finland will strengthen carbon sinks and stocks in the short and long term.

Related to these objectives the Government Programme states:

The Government will work to ensure that Finland is carbon neutral by 2035 and carbon negative soon after that. We will do this by accelerating emissions reduction measures and strengthening carbon sinks.

The Government is committed to reforming the climate policies of the European Union and Finland so that we can do our part to limit the global mean temperature increase to 1.5 degrees Celsius. Finland aims to develop the EU's long-term climate measures so that the EU can achieve carbon neutrality before 2050. This means tightening the emissions reduction obligation for 2030 to at least 55 % below the 1990 emissions level.

We will continue our Nordic climate and energy cooperation in order to achieve carbon neutrality and will work to strengthen the position of the Nordic countries as leaders in international climate policy.

In addition, the Government Programme states:

Electricity and heat production in Finland must be made nearly emissions-free by the end of the 2030s while also taking into account the perspectives of security of supply.

Under the Government Programme, the existing Climate Change Act (*Ilmastolaki 609/2015*³) will be amended so as to enable achievement of carbon neutrality by 2035. The emissions reduction target for 2050 will be updated.

Finland has already adopted legislation to phase out the use of coal in energy production by 2029. The Government Programme also foresees i.a. a stepwise phase-out of the use of oil for heating by the beginning of the 2030s and a halving of the use of peat in energy production by 2030.

³ Unofficial translation of the Climate Change Act 609/2015 available at <https://www.finlex.fi/en/laki/kaannokset/2015/en20150609.pdf>

Some of the policy measures related to the energy and climate objectives in the Programme of Sanna Marin's Government are, to an extent, already described in the Government Programme, whereas several others remain yet to be prepared and decided. Policy measures will be implemented during the current government term 2019–2023. Work on this has already started but it has not been possible to define all of the policies and measures in line with the objectives set out in the Government Programme for the timetable of the final NECP. Therefore, this NECP is mostly based on and describes the existing, previously decided, targets and policy measures⁴. In accordance with the Governance Regulation, a draft update of the NECP will be submitted to the Commission in 2023. This update will be based on the new Medium-term Climate Policy Plan (*Keskipitkän aikavälin ilmastopolitiikan suunnitelma*), the revised Climate and Energy Strategy (*Ilmasto- ja energiastrategia*) and the Climate Programme for the land use sector, to be developed by 2021, to fully reflect the climate and energy objectives and targets in the Government Programme.

Regarding the main basis for this NECP, the National Energy and Climate Strategy from 2016 outlines concrete actions and objectives that will enable Finland to achieve the national energy and climate targets and targets adopted by the EU for 2030, and to systematically set the course for reaching the 2050 targets. The starting point of the energy and climate strategy is to look at the energy and climate policy in different sectors comprehensively from the perspectives of emissions reduction, energy policy, growth and employment. The energy and climate policies should have a long time span and be in line with the Roadmap contained in the Report of the Parliamentary Committee on Energy and Climate Issues⁵. Finland's special features, including the cold climate, long transport distances, extensive energy-intensive industry and domestic raw material resources, especially forest biomass, have been taken into account when formulating the National Energy and Climate Strategy.

4 These existing policies and measures are described in the Government reports on the National Energy and Climate Strategy for 2030 (VNS 7/2016 vp) and the Medium-term Climate Change Policy Plan for 2030 (VNS 7/2017 vp). The measures in the transport sector have been specified in the final report of the working group on transport networks.

5 Ministry of Employment and the Economy (2014) Energy and Climate Roadmap 2050. Report of the Parliamentary Committee on Energy and Climate Issues on 16 October 2014. Publications of the Ministry of Employment and the Economy. Energy and the climate 50/2014.
<https://tem.fi/documents/1410877/2769658/Energy+and+Climate+Roadmap+2050/9fd1b4ca-346d-4d05-914a-2e20e5d33074/Energy+and+Climate+Roadmap+2050.pdf>

The National Energy and Climate Strategy outlines the actions that will enable Finland to reach the targets specified in the Government Programme and adopted in the EU for 2030, and to systematically set the course for achieving an 80–95 % reduction in greenhouse gas emissions by 2050. With minor exceptions, Finland will phase out the use of coal for energy production. The Strategy contains objectives for the share of transport biofuels to be increased to 30 % and an obligation to blend light fuel oil used in machinery and heating with 10 % of bioliquids. The minimum aim is to have 250,000 electric and 50,000 gas-powered vehicles/cars on the roads. The Strategy aims for development of the electricity market at the regional and the European level to improve the flexibility to match electricity demand and supply as well as system-level energy efficiency in general. Cost-effective new production of renewable energy is planned on the basis of technology-neutral tendering in 2018–2020.

Under the National Energy and Climate Strategy, the share of renewable energy in end consumption is estimated to increase to approx. 50% and self-sufficiency in energy to 55 %. The domestic use of imported oil will be at least halved, as planned.

The other key document forming the basis for this NECP, the Medium-term Climate Change Policy Plan from 2017, defines the measures to ensure that Finland's emissions reduction target for the effort sharing sector in the EU will be achieved. The greatest non-ETS sector reductions in emissions will be achieved in the transport sector.

The Finnish target for emissions reduction in the effort sharing sector by 2030 is 39% compared to 2005. The actions now included in the baseline scenario are insufficient to achieve this. The current National Energy and Climate Strategy and Medium-term Climate Change Policy Plan are built on the assumption that Finland will take advantage of the 2 % one-off possibility to cancel ETS allowances towards the target in the effort sharing sector. Finland will inform about using the one-off flexibility in due course.

The National Energy and Climate Strategy (2016) and the Medium-term Climate Change Policy Plan (2017) are based on common projections and an impact assessment was carried out on both.

1.1.2 Strategy relating to the five dimensions of the Energy Union

This integrated National Energy and Climate Plan discusses all of the five dimensions of the Energy Union on the basis of the related government reports: (i) decarbonisation, including efforts to reduce greenhouse gas emissions, the sinks and efforts to increase renewable energy, (ii) energy efficiency, (iii) energy security, (iv) the internal energy market and (v) research, innovation and competitiveness.

1.1.3 Overview table with key objectives, policies and measures of the plan

Table 1 presents a summary of the main targets of the National Energy and Climate Plan, based on the targets set in 2016, and 2017 reports referred to in Chapter 1.1.1. Table 2 gives an overview of existing as well as planned energy and climate policy measures.

1.2 Overview of the current policy situation

1.2.1 National and Union energy system and policy context of the national plan

Finland's national energy system has been described in Chapter 2 of Finland's Seventh National Communication under the United Nations Framework Convention on Climate Change⁶.

After submitting the draft National Energy and Climate Plan in December 2018, parliamentary elections were held in Finland in spring 2019 and the new government of Prime Minister Antti Rinne took office on 6 June 2019. After that, the new government of Prime Minister Sanna Marin has taken office on 10 December 2019 but the Government Program did not change. One of the strategic themes in the Programme of Prime Minister Sanna Marin's Government is "Carbon neutral Finland that protects biodiversity". In addition, objectives and measures addressing climate change are included under several other strategic themes.

⁶ http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/952371_finland-nc7-1-fi_nc7_final.pdf

This strategic theme on carbon neutrality includes the following objectives:

1. Finland will achieve carbon neutrality by 2035
2. Finland aims to be the world's first fossil-free welfare society
3. Finland will strengthen carbon sinks and stocks in the short and long term.

In addition, the Government Programme states i.a. that electricity and heat production in Finland must be made nearly emissions-free by the end of the 2030s while also taking into account the perspectives of security of supply.

The policy measures related to energy and climate objectives of the Government Programme will be prepared, decided and implemented during the current government term 2019–2023. Given the timeline set for submission of the final NECP, it has not been possible to define the policies and measures in line with the new objectives set in the Government Programme. Therefore, the following reflects the existing, previously decided, targets and policy measures.

This NECP is based on the Government reports on the National Energy and Climate Strategy for 2030 (VNS 7/2016 vp) and the Medium-term Climate Change Policy Plan for 2030 (VNS 7/2017 vp) submitted to the Parliament of Finland.

Table 1. Summary of the main targets of the National Energy and Climate Plan.

Target	Targeted year	Year of comparison
Reduce greenhouse gas emissions in the effort sharing sector by 39 %	2030	2005
Total emissions in the LULUCF sector not to exceed the calculated sinks	Period 2021–2025 Period 2026–2030	accounted according to LULUCF regulation
Renewable energy share of final energy consumption at least 51 %	2030	
Renewable energy share of final energy consumption 30 % in road transport	2030	
Energy efficiency target: final energy consumption not more than 290 TWh (corresponds to approximately 405 TWh of primary energy consumption)	2030	

1.2.2 Current energy and climate policies and measures relating to the five dimensions of the Energy Union

The existing energy and climate policy measures and their effects have been listed in the reporting that Finland has submitted to the European Commission in compliance with Articles 13 and 14 of the Monitoring Mechanism Regulation (EU) No 525/2013⁷ and with Article 10 of LULUCF decision (EU) No 529/2013⁸. In addition, the same matters have been reported in Finland's Seventh National Communication under the United Nations Framework Convention on Climate Change¹². Table 2 gives an overview of the most important policy measures.

7 http://cdr.eionet.europa.eu/fi/eu/mmr/art04-13-14_lcds_pams_projections/pams/envwmaa2q/ and REPORTING ON POLICIES AND MEASURES UNDER ARTICLE 13 AND ON PROJECTIONS UNDER ARTICLE 14 OF REGULATION (EU) No 525/2013 http://cdr.eionet.europa.eu/fi/eu/mmr/art04-13-14_lcds_pams_projections/pams/envwmaa2q/PAMs_Finland_Report_for_PAMs_and_Projections_2017.pdf

8 https://mmm.fi/documents/1410837/4045459/update-18-1-2017-on-lulucf-actions_finland_final.pdf/dcad8afd-817f-4524-b75a-81393ab4f939/update-18-1-2017-on-lulucf-actions_finland_final.pdf.pdf

Table 2. Overview of the existing energy and climate policy measures. Measures marked with * are additional measures included in the With Additional Measures projections but not in the With Existing Measures projections.

Energy supply	Industry	Transport	Residential and services	Waste	Agriculture
Energy and carbon dioxide taxes	Energy and carbon dioxide taxes	Energy and carbon dioxide taxes	Energy and carbon dioxide taxes	Waste tax	Energy and carbon dioxide taxes
Energy Efficiency Agreements	Energy Audit Programme	Quota obligation for the use of biofuels in the transport sector, enhanced measures*	Consumer energy advice	Regulation on packaging, waste management	Energy Efficiency Agreement for Agriculture and other energy efficiency initiatives
Promoting wind power	Energy Efficiency Agreements	Promoting biogas in road transport	Ecodesign and energy labelling	Landfill regulation limiting deposit of organic waste	Rural Development Programme for Mainland Finland
Promoting forest chips and other wood based fuels	Implementation and improved enforcement of F-gas regulations	Improving the energy-efficiency of vehicles, enhanced measures*	Information dissemination and campaigns on energy efficiency		Climate Programme for Finnish Agriculture
Promoting biogas in electricity and heat production	Public procurement criteria, information measures, etc concerning F-gases *	Improving the energy-efficiency of the transport system, enhanced measures *	Building regulation		Activities on organic soils *
Promoting solar power	Quota obligation for the use of bioliquids in machinery *		Energy certificates for buildings		Quota obligation for the use of bioliquids in machinery *
A premium system for renewable electricity*			Quota obligation for the use of bioliquids in space heating *		Promoting the production and use of biogas *
Phasing out coal in energy production *					

Finland has, in 2019, passed legislation (*Laki hiilen energiakäytön kieltämisestä* (416/2019)) to phase out the use of coal in energy production by 2029. The current Government Programme also foresees i.a. a stepwise phase-out of the use of oil for heating by the beginning of the 2030s and a halving of the use of peat in energy production by 2030.

1.2.3 Key issues of cross-border relevance

Directive on the deployment of alternative fuels infrastructure

Directive 2014/94/EU of the European Parliament and of the Council on the deployment of alternative fuels infrastructure (the AFI Directive) entered into force in October 2014. The aim of this Directive was to minimise the oil dependence of transport and reduce the environmental effects of transport throughout the EU. Under the Directive, all Member States had to draft a national policy framework for the development of an alternative transport fuel market and deployment of the related infrastructure by November 2016. The national policy frameworks had to contain targets for alternative transport fuels and their distribution infrastructure for 2020 and 2030 as well as the measures necessary to ensure that these targets are reached.

The AFI Directive also has significance across borders because measures are required to enable vehicles using alternative fuels such as electricity, natural gas or biogas to move across the Union.

Nordic cooperation

Finland is a member of the Nordic Council of Ministers and, under this organisation, there are specific working groups concerning electricity markets, energy efficiency, renewable energy and climate and air. There is also cooperation in the field of eco-design and energy labelling.

Nordic electricity market cooperation

Norway, Sweden, Finland and Denmark have long shared a single electricity market and serve as a prime example of how to harmonise and deregulate electricity markets across national borders. The design of the common Nordic electricity market aims at promoting competition on equal terms and at the socioeconomic

efficient use of production and transmission resources, and is also key to integrating large shares of renewable energy into the system. The market price is set on the common power exchange, where supply meets demand on the day-ahead and the intraday markets.

The Electricity Market Group (EMG) is a working group under the Nordic Council of Ministers and commissions analyses and provides advice on electricity market issues to the Nordic energy ministers. The group consists of experts from the ministries and energy authorities in the four Nordic countries participating in the common Nordic electricity market. The Baltic states are regularly invited to the meetings.

Nordic electricity market cooperation seeks to advance a harmonised and integrated Nordic electricity market, where demand and production structures, flexibility measures and other relevant issues complement each other within the Nordic market area as a whole, in addition to promoting synchronised rules for all market participants, both companies and consumers. The focus is on:

- Function of the regional electrical system with particular emphasis on the integration of renewable power generation, security of supply, demand flexibility and smart networks
- Network investment and network planning
- Representing Nordic interests in an EU context
- A more harmonised retail market
- Taking the initiative to involving the Baltic states in electricity market development, when appropriate
- Establishing relevant collaboration with market stakeholders
- Following trends and possible research, development and innovation (RDI) needs within the Nordic electricity market

In addition to the official cooperation among the ministries, Nordic Transmission System Operators, regulators, producers and other market stakeholders also engage in close cooperation across country borders, including the Baltic states. As the electricity system is changing with influxes of large shares of renewables, the subsequent needs for system solutions on both the supply and demand side and new European legislation, the Nordic energy ministers have decided to

introduce an annual Nordic Electricity Market Forum⁹. The first such Forum was held in Stockholm in autumn 2018, and the second in Oslo in November 2019. The intention is to advance communication and collaboration between different electricity market stakeholders, in addition to establishing common visions and road maps for the future development of the Nordic electricity market, see Chapter 3.4.3.

The activities of the Electricity Market Group contribute to benefiting the Nordics through initiating Nordic collaboration on initiatives that would otherwise be undertaken at a national level, but where significant positive effects are achieved through joint Nordic solutions.

As such, Nordic electricity market cooperation is further transforming the market into an efficient and well-functioning one, with high levels of security of supply, an equal competitive playing field, environmental friendliness, transparency and incentives for price elasticity, in accordance with the decisions of the Nordic Council of Ministers.

Nordic cooperation on energy efficiency

Nordic cooperation on energy efficiency is conducted in the Networking Group on Energy Efficiency (NGEE). The group consists of experts from the ministries and energy authorities in the Nordic countries.

The main objectives of cooperation in this area are to promote Nordic cooperation on energy efficiency initiatives and to implement EU/EEA directives and programmes.

Cooperation is conducted in a network, where specific topics are discussed on an ad hoc basis within the group especially in relation to the 'Clean energy for all' package. In addition to this, the group is facilitating analysis and seminars on specific issues.

⁹ Nordic Electricity Market Forum <https://nordicelforum.org/>

Nordic cooperation on renewable energy

The Nordic countries make considerable efforts to develop and increase the use of renewable energy, with the aim to diversify the energy system, to be less dependent on imports of energy sources such as fossil fuels and to reduce CO₂ emissions. The Working Group for Renewable Energy (AGFE) – consisting of experts from the ministries and energy authorities in the five Nordic countries – supports the Nordic countries' policy and development work in the renewable energy sector by exchanging information and enhancing the collaboration between Nordic countries. In addition, AGFE disseminates information about relevant projects commissioned by it in tackling different issues on renewable energy in the Nordics. Most recently, AGFE has looked at the emerging trend of distributed electricity production and self-consumption.

AGFE aims to strengthen Nordic added value through projects that would usually occur nationally, but where positive effects are created through a Nordic joint effort. The group works to develop and manifest Nordic collaboration, and thereby increase Nordic competencies and competitiveness. AGFE also strives to develop Nordic perspectives on emerging policies and regulations within the EU. Some of AGFE's recent activities are listed below:

- In 2018, AGFE initiated a study on Distributed energy production and self-consumption in the Nordics. The aim of the study is to review the current situation and future prospect of decentralised energy production and the transition where consumers such as households are becoming also producers. The regulations and policies in the Nordic countries concerning distributed electricity production and self-consumption will be discussed, and barriers to a sound development will be identified. This study will provide useful information for policymakers and other stakeholders and will contribute to meeting upcoming requirements under the revised EU directive on renewable energy (RED II).
- AGFE works for enhanced Nordic cooperation on implementing the current EU renewable energy directive (RED I) to 2020 as well as preparing for the revised directive (RED II) that will take effect from 2020–2021.

- As a set of new forest biomass sustainability criteria were proposed in RED II, AGFE in 2017 commissioned a study on the emerging Bioenergy Sustainability Policy and its possible impacts entitled; "A Nordic analysis of the proposed EU policy for bioenergy sustainability". This work contributed to the process of revising the Directive and increasing the knowledge of its impact on the bioenergy sector in the Nordic region.
- In 2016, AGFE commissioned a study; "New Gameplan – RES Support in the Nordics" with the aim to investigate the impact of the revised State Aid Guidelines on current Nordic support schemes designed to promote renewable energy. The study contributed to the discussions regarding the design of Nordic support schemes.

Nordic cooperation on eco-design and energy labelling

Nordic cooperation on market surveillance and policy work on eco-design and energy labelling is conducted in the Nordsyn working group. It involves cooperation among Nordic market surveillance authorities (MSAs) and policy agencies.

Eco-design and energy labelling can save 10 % of energy use in the EU in 2020 which is a great contribution to the EU 2020 and 2030 goals. Effective regulations and efficient market surveillance are essential if this is to be realised and Nordsyn aims to improve the efficiency of Nordic market surveillance and policy input. Nordic authorities, producers and consumers benefit from Nordsyn, while green growth and energy efficiency are supported. The results and structure of Nordsyn can be used to improve market surveillance also in EU countries.

Some of Nordsyn's projects and results are described below.

Nordsyn sub projects:

In 2018, Nordsyn focused on

1. the strategic Nordic product heat pumps with two studies on how the products work in reality in Nordic climate;
2. an information campaign for the new product database and up revised energy labelling;
3. a Nordcrawl2 project in which the previous developed Nordcrawl web crawling tool is applied to give valuable input to market surveillance and policy work.

Earlier projects: Barriers for market surveillance cooperation (2012 and 2013–2015), Working methods (2013–2015), Information material (2013), Strategic Nordic products – Heat pumps (2014), Challenges for market surveillance – difficult products (2015–2017), Effects of market surveillance (2013–2014), Cooperation with customs (2013–2014), How small countries work with eco-design and energy labelling (2013–2014), Energy labelling online information film (2016), Heat pump list prospects (2016), Strategic Nordic products - Windows (2017–2018), Heat pump reality studies phase 1 and 2 (2017–2018), Recycler interview study (2017–2018).

Results from Nordsyn:

The most appreciated result of Nordsyn is that the Nordic countries now regularly share questions, commission answers, discussions, test results and plans through email and Skype. Even though the core of Nordsyn is continuous contact and exchange of market surveillance results, Nordsyn has also been given the possibility to perform a number of projects that improve Nordic market surveillance and knowledge of legislation among producers, retailers and consumers. The Nordsyn steering group communicates in monthly Skype meetings, emails and yearly face-to-face meetings/workshops.

Effects project: this study showed a prevented energy loss worth EUR 28 million for a market surveillance cost of around EUR 2 million in the Nordic countries, and an overall rate of 6.3 % non-compliance. These results show that the market surveillance is cost efficient, especially when countries cooperate.

Strategic Nordic products Heat pumps project: the project resulted in an overview of legislation, national work and recommendations. Some of these recommendations are further studied in the 2017 and 2018 heat pump projects.

Challenges project: the project contains a number of product studies on how to perform market surveillance on complex products (ventilation units, transformers, professional refrigeration, etc).

Nordic energy research cooperation

Nordic Energy Research (NER) is a platform for cooperative energy research and analysis in the Nordic region under the auspices of the Nordic Council of Ministers. It funds research of joint Nordic interest that supports these ambitions by expanding knowledge of sustainable energy and contributing to the development of new, competitive energy solutions.

The NER governance structure is closely connected to both the national political systems of the five Nordic countries as well as the intergovernmental Nordic system. Its board and other committees and project steering groups consist not only of representatives from national funding agencies, but also from national energy authorities, ministries and the Nordic Council of Ministers' secretariat. This creates constant interaction between research strategies, results and key technical issues on the political agenda.

According to its strategy for the period 2018–2021, NER's vision is to create the knowledge basis for the Nordic countries to become global leaders in smart energy. The mission is progressed through Nordic collaboration.

NER manages a number of projects and facilitates in various fields, ranging from compilation of results from ongoing studies, to technical research. To take a case in point, in 2015 NER selected three ambitious projects to serve as "Flagships" for Nordic research cooperation in energy for the coming 4-year period. These Flagships cover such diverse areas as flexible electricity market design to allow for more wind and solar energy; modelling how to achieve an energy-efficient and low carbon transport system; and enabling negative CO₂ emissions through new combustion-related technologies.

With regard to the regional aspects linked to the national energy and climate plans, two projects are of particular significance:

- Nordic Energy Technology Perspectives (NETP) is a Nordic edition of the International Energy Agency's (IEA) global Energy Technology Perspectives. The report has been published twice (2013 and 2016) and offers a detailed scenario-based regional analysis of how the Nordic countries can achieve a near carbon-neutral energy system.
- After completing two editions of Nordic Energy Technology Perspectives (NETP), a tracking report has been made to illustrate how the Nordics progress towards a carbon neutral society. The result is Tracking Nordic Clean Energy Progress 2019¹⁰; a brief, illustrative report that tracks the Nordic progress towards a carbon neutral society by highlighting the larger trends and by diving into cases where Nordic solutions could have a global impact. This study found that for the period 2013 to 2016, the Nordic countries are on track to meet the carbon neutral pathway, but it's likely that additional measures will be necessary to continue this trend.
- The Nordic Electric Vehicle Outlook 2018 (NEVO 2018) has been developed in cooperation between the International Energy Agency (IEA) and Nordic Energy Research. It aims to identify and discuss recent developments of electric mobility in the five Nordic countries: Denmark, Finland, Iceland, Norway and Sweden. The report assesses the current status of the electric vehicle market, the deployment of charging infrastructure and the integration with the electricity grid at the country level. It analyses the role of European, national and local policy frameworks in supporting these developments. The analysis also provides insights on consumer behaviour and includes an outlook on the progress of electric mobility in the Nordic region up to 2030.

¹⁰ <https://www.nordicenergy.org/project/tncp/>

Nordic climate cooperation

The Nordic climate co-operation aims to help to reducing greenhouse gas emissions in the Nordic area and elsewhere as well as seeks to find synergies between initiatives related to climate and air. Strategic focus areas in the field of climate are Nordic support to an ambitious implementation of the Paris agreement and global climate work in general, climate financing and governance, adaptation to climate change as well as demonstrations of Nordic solutions to mitigate climate change. A major area of emphasis of the work is to provide information basis to help the Nordic countries in their efforts to reach climate neutrality. This work is based on the Prime Ministers' Declaration on Climate Neutrality from January 2019.

The Nordic Working Group for Climate and Air has the mandate to implement the Programme for Nordic Co-operation on the Environment and Climate 2019–2024. The working group is fulfilling its mandate via project activity that consists of project activity that reflects the priorities of the co-operation programme. Projects are initiated via open calls and public invitations to tender. The working group co-operates with other working groups within the Nordic Council of Ministers as well as other international bodies, i.e. the UNFCCC, the Arctic Council.

1.2.4 Administrative structure of implementing national energy and climate policies

The Climate Change Act (609/2015) lays down the general framework for the planning of climate change policy in Finland and the monitoring of its implementation. It aims to enhance and coordinate the activities of state authorities in planning measures aimed at mitigation of climate change and adaptation to it, and at the monitoring of the implementation of these measures. Furthermore, the Act aims to strengthen the opportunities of Parliament and the public to participate in and affect the planning of climate change policy in Finland.

Regarding the coordination and compilation of climate change policy plans, the Ministry of Economic Affairs and Employment is responsible for the long-term plan for climate change policy. The Ministry of Agriculture and Forestry is responsible for the national adaptation plan for climate change and the Ministry of the Environment is responsible for the medium-term plan for climate change policy as well as for compiling the annual climate change report.

The Government of Prime Minister Sanna Marin established a ministerial working group for coordinating climate and energy policy under the leadership of the Minister of the Environment and Climate Change Krista Mikkonen. The ministerial working group has representatives from each party forming the Government.

The operation of the Ministerial Working Group on Climate and Energy Policy issues is based on the Government resolution concerning the organisation of official climate policy measures in the Government¹¹. The resolution includes policy outlines for arranging the tasks and cooperation of the ministries in the preparation and implementation of domestic climate policy. A working group consisting of representatives of different ministries functions as a network for public officials and helps in the coordination and preparation of the tasks.

The Ministry of Economic Affairs and Employment is responsible for the general coordination of the work on the Energy and Climate Strategy. The Ministry convenes a network of senior officials from the Ministry of the Environment, the Ministry of Transport and Communications, the Ministry of Agriculture and Forestry, the Ministry of Finance, the Ministry for Foreign Affairs and the Prime Minister's Office for consulting on the preparation of energy policy. Each sectoral ministry is responsible for the preparation and implementation of the policy measures related to their field as follows:

- Ministry of Economic Affairs and Employment: use of energy by industry, services and households; industrial processes; production and consumption of energy; renewable energy; (including the share of biocomponents in transport fuels); supply of electricity and district heating
- Ministry of the Environment: F-gas emission projections, waste management sector, building volume, energy consumption of buildings and their sources of heating, energy consumption of machinery and their emissions
- Ministry of Transport and Communications: energy consumption and emissions of road, waterborne, air and rail traffic

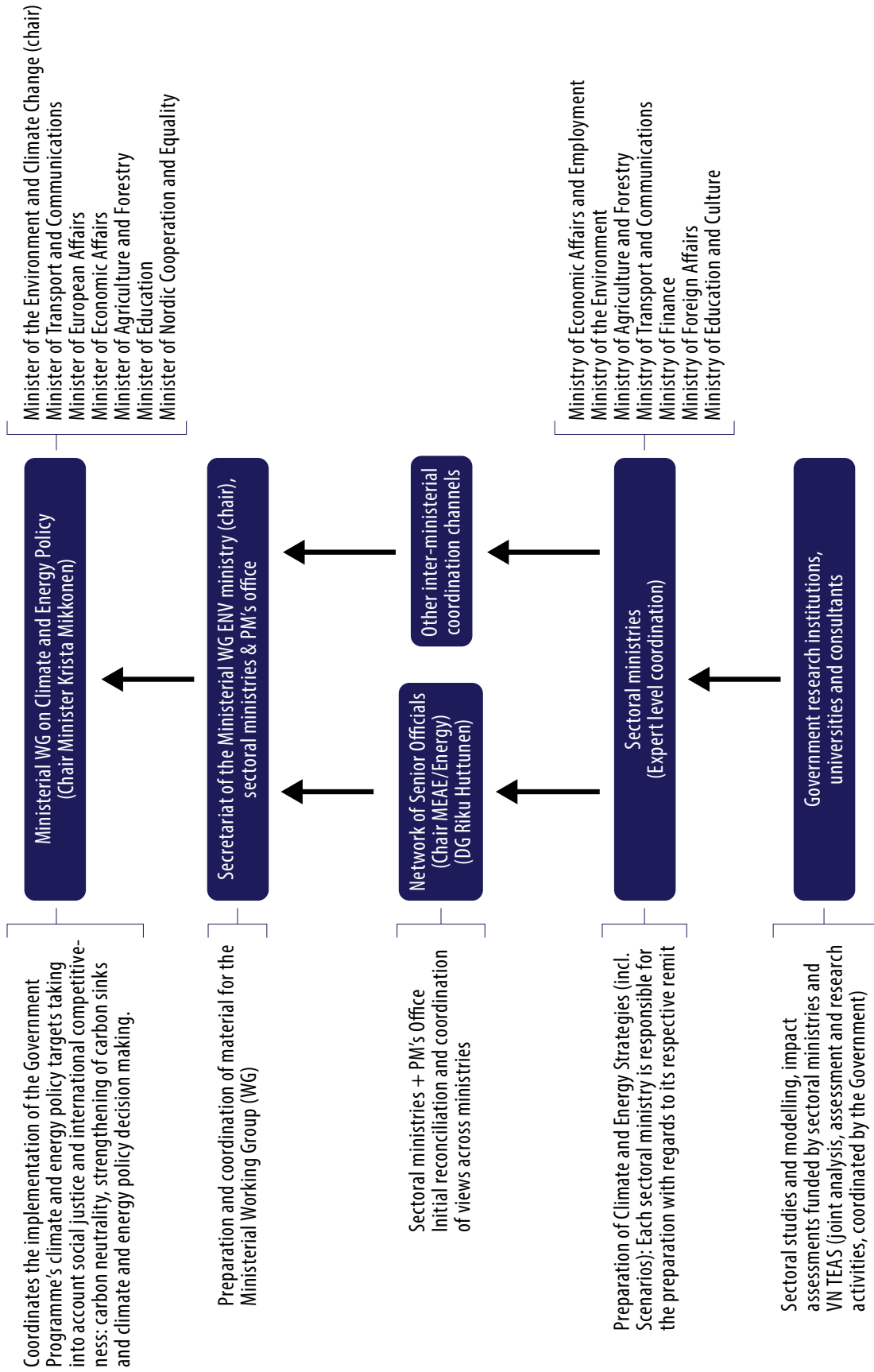
11 https://www.edilex.fi/valtioneuvoston_viikko/2003_05liite.html

- Ministry of Agriculture and Forestry: non-energy-related emissions in agriculture; use of energy in agriculture; biomass amounts; forestry; the land use, land-use change and forestry sector (LULUCF sector)
- Ministry of Finance: energy taxes, short-term economic development.

The preparation and implementation of energy and climate policy in central government is described in more detail as part of the reporting in compliance with Article 13(1) of the Monitoring Mechanism Regulation (MMR)¹³.

Figure 1 presents a diagram of the administrative framework of drafting energy and climate policy (situation in 2019).

Figure 1. Administrative framework of drafting energy and climate policy.



1.3 Consultations and involvement of national and Union entities and their outcome

1.3.1 Involvement of the national parliament

The Government reports forming the basis of this National Energy and Climate Strategy for 2030 (VNS 7/2016 vp) and the Medium-term Climate Change Policy Plan for 2030 (VNS 7/2017 vp) have been submitted to Parliament. Parliament has discussed both reports and issued related non-binding resolutions concerning them.

1.3.2 Involvement of local and regional authorities

The Association of Finnish Local and Regional Authorities has represented local and regional authorities in the consultations. The consultations are discussed in more detail in Chapter 1.3.3.

1.3.3 Consultations of stakeholders, including the social partners, and engagement of civil society and the general public

The targets and policy measures of this National Energy and Climate Plan have already been in public consultation when preparing the National Energy and Climate Strategy and the Medium-term Climate Change Policy Plan. In the consultations and events organised for stakeholders, all relevant parties have been consulted, including other authorities, organisations representing different stakeholders, non-governmental organisations, labour market parties and individual citizens. The consultations and events are listed below.

Energy and climate strategy

The following expert seminars on different topics were organised in connection with the preparation of the Energy and Climate Strategy:

- 25 November 2015: Seminar launching the strategy work.
- 27 January 2016: Expert event on the electricity market.
- 2 February 2016: Seminar on the alternatives in the implementation of the EU's policy outlines for 2030 and

their effects on the Finnish electricity and heating markets and on the realisation of the objectives of the Government Programme.

- 17 February 2016: Seminar on the reform of the subsidy policy for bioenergy.
- 23 March 2016: Seminar on the supply of forest biomass and its use in the forest industry, as raw material of advanced biofuels and as fuel in energy production.
- 4 May 2016: Workshop on energy efficiency.
- 15 June 2016: Publication of the With Existing Measures (WEM) projection.
- 9 September 2016: Seminar on the increase in decentralised energy production and changing operating models in the energy markets.
- 7 October 2016: Nordic viewpoints - the role of bioenergy as part of the EU's Energy Union, a seminar.

Citizen survey

The WEM projection for the Energy and Climate Strategy was published on 15 June 2016. On the same day, a website energiajailmasto.fi, a joint platform coordinated by the Ministry of Economic Affairs and Employment containing the survey, was opened. The website contributed to enabling citizens to participate in the preparation of the strategy.

On the website, citizens could learn about the possible new policy measures listed by government officials and take a stand on them. They could also propose measures of their own. The online debate for citizens was open for two months (15 June-16 August 2016). The website was viewed almost 3,500 times and a total of 466 comments and proposals were received.

Visitors to the website could also evaluate the different proposals by awarding them pluses and minuses. The three most popular proposals were:

- Current tax-exemption from electricity tax granted to small-scale production of electricity for own use will continue.
(+179)

- Geothermal energy will be promoted. Investments in new energy technologies may compete for aid granted to demonstration projects (+165)
- Promotion of decentralised energy production (electricity, heat, transport, storage) through sustainable and cost-effective measures. (+155).

The proposals that citizens most opposed are below. Generally, significantly fewer opposing votes were given than votes in favour. On the other hand, it is worth noting that the proposals which received the highest number of minuses also received a relatively high level of support.

- The use of coal will be banned. (-78, +64)
- The creation of the prerequisites for the joint Nordic retail market will be continued and equal treatment of electricity vendors in the retail market will be promoted by switching to a single invoice model for all vendors of electricity. (-76, +81)
- Finland will prepare to utilise its wind power potential extensively. (-70, +106)

The background report on the Energy and Climate Strategy¹² lists the policy measure proposals included in the online survey and the opinions expressed in the survey.

Panel discussion on strategy priorities at SuomiAreena in Pori

The WEM projection published in June was also used as the basis of the panel discussion of the Ministry of Economic Affairs and Employment held at SuomiAreena organised by the television channel MTV and the City of Pori on 14 July 2016.

12 https://tem.fi/documents/1410877/3570111/Energia-+ja+ilmastostrategian+TAUSTARAPOR_TTI_1.2.+2017.pdf/d745fe78-02ad-49ab-8fb7-7251107981f7/Energia-+ja+ilmastostrategian+TAUSTARAPO_RTTL_1.2.+2017.pdf.pdf

In the panel discussion, Minister of Economic Affairs Olli Rehn debated on the production and consumption of energy, self-sufficiency, decarbonisation, nuclear power and renewable energy with five energy sector experts.

The large audience present at the discussion had the opportunity to vote for the winner in each of the five discussions. The audience following the discussion online on MTV's Katsomo and on SuomiAreenaTV could participate in the voting by sending a text message or through a smartphone application. It was also possible to watch a recording of the panel discussion on MTV Katsomo.

Medium-term Climate Change Policy Plan 2030

When the Medium-term Climate Change Policy Plan was under preparation, several consultations and workshops were organised for stakeholders. In the workshops, measures proposed by stakeholders were explored, existing best practices were sought and the acceptability of the planned measures was examined. Two open seminars were organised for stakeholders, one at the beginning of the planning in February 2016 and the other in November 2016, when the decisions concerning the range of measures had mostly been made. In addition, smaller events were organised towards the end of the summer and at the beginning of autumn 2016 for stakeholders in transport and agriculture, and for actors in municipalities and regions. Internal workshops were also organised in administration to obtain comments from experts on the plans made in different sectors. In February 2017, an open workshop on the gender effects of the climate change plan was organised and experts in the sectors involved in the plan and experts in gender equality work were invited to participate. In addition, during summer 2016, it was possible for all citizens to comment on the measures planned by government officials on the above mentioned energiajailmasto.fi website.

It was possible to comment on the entire climate plan during the circulation for comments in May 2017. A total of 84 comments were made during circulation, most of which were comments on the measures in the transport sector. The comments drew attention to other measures concerning different sectors and municipal and regional climate measures. All comments are public and available to read on the lausuntopalvelu.fi website. A public summary drawn up of the comments is also

available on the climate plan website¹³. The comments were taken into account when the plan was finalised.

Other energy and climate-related events

After the drafting of the Energy and Climate Strategy and the Medium-term Climate Change Policy Plan, expert and consultation events related to the implementation of the strategy and the plan were also organised. In addition, those involved in the drafting have participated in events organised by other parties and have utilised the knowledge gained in the drafting of the Integrated National Energy and Climate Plan. These events include:

- “Kuinka suuret ovat metsien ja puunkäytön ilmastovaikutukset”, an event organised by the Natural Resources Institute Finland on the climate effects of forests and the use of wood, 7 March 2018.
- Consultation of stakeholders related to banning the use of coal, 26 March 2018.
- Consultation of stakeholders related to the generation of electricity from forest chips, 28 March 2018.
- Public debate organised by Minister of Environment, Energy and Housing Kimmo Tiilikainen. The debate also included energy issues, 23 April 2018.
- Talanoa dialogue series 2018: Päästöjään reilusti vähentävä Suomi (‘Finland reduces its emissions significantly’),
- Finnish society in 2050. Talanoa dialogue, 25 April 2018.
 - Coordination of Finland’s climate choices. Talanoa dialogue, 15 June 2018.
 - Tuumasta toimeen (‘Getting down to work’). Talanoa dialogue, 7 November 2018.
 - Summary of the dialogue series and a dialogue with a large number of representatives from stakeholders, 26 November 2018.

13 <http://www.ym.fi/download/noname/%7BC4791B40-5F32-47C8-8F09-188F3D41576F%7D/129157>

- Conference on the electricity market in Norway, 22 November 2017.
- Participation in the Nordic-Baltic Energy Conference 2018 organised by the Nordic Council of Ministers in Tallinn, 27–28 September 2018.
- How to halve citizens' carbon footprint by 2030 - a workshop for stakeholders in the Ministry of the Environment, 28 September 2018.

Statements by the public on the NECP

In the first week of December 2019, an almost-ready version of the NECP was submitted to Lausuntopalvelu.fi service where any registered user could give a public statement on the plan. This also included specifically sending a request for a statement to dozens of different associations and other public organizations. Fourteen statements were received from different advocacy groups (for wind power and bioenergy, for example) labour unions, an employers' organization (Federation of Finnish Technology Industries) and one corporation (Outokumpu Oyj, a major steel producer).

The statements were mainly positive and reflected satisfaction with how the NECP has been prepared. Some suggestions for improvements or changes were received as well. The most common are presented on the list below which also includes (as a sub-bullet) how the suggestion has been taken into account in preparing the NECP.

- Updated figures on Finland's carbon sinks to be added to the report
 - Will be incorporated into the final report submitted to the Commission
- Competitiveness of industry shall be nurtured
 - Does not directly concern the contents of the NECP but the overall political atmosphere seems to in favour of this
- The compensation for indirect costs related to the ETS and reductions in the electricity tax granted to industry should not be regarded as subsidies that are environmentally

harmful as they advance electrification in industry which, in turn, reduces use of fossil fuels

- The definition is based on some international studies and what is requested in the Governance regulation
- Renovations that improve energy efficiency of buildings should be subsidised significantly more
 - The NECP is based on already-completed previous energy and climate strategies and does not offer measure beyond those but this shall be considered going forward when the strategies are updated
- Sector coupling should be taken into account developing the internal energy market
 - There are not yet concrete political measures aimed at sector coupling and thus not in NECP either but it is a topic that will probably be on the table going forward and already discussed in the Nordic cooperation, for example

In addition, quite many comments were made on relatively low shares of heat pump energy and some other energy sources (especially wind power) or the numbers of gas and electrical vehicles presented in the future projections in the NECP compared to recent studies or estimated of the advocacy group in question. This can be considered a valid point but as previously mentioned, the NECP can contain only scenarios based on the current policies, measures and previous energy and climate strategies. It is however well possible that some projections (like the utilisation of heat pumps) will change to a great extent preparing new strategies.

1.3.4 Consultations of other Member States

Finland's draft Integrated National Energy and Climate Plan was sent on 9 November 2018 for consultation to Estonia, Sweden, Denmark and Norway. With Estonia, a Skype meeting concerning the NECP was organised on 30 November 2018. Estonia sent written comments for Finland's draft NECP. Sweden informed that they do not have any comments on the document and no response was received from Denmark and Norway.

In the Skype meeting and in their written comments, Estonia explained that the policies and measures planned in Finland may have several interactions with the developments in Estonia and raised the following two concerns:

1. According to the information provided by Eesti Energia AS, many oil shale generation capacities will be shut down in Estonia in the coming years and this will significantly decrease the dispatchable generation sources in Estonia. The regional electricity market will remain in deficit while the role of intermittent renewable electricity generation will increase in Estonia. This is why there are growing concerns in Estonia about how well the country can ensure generation adequacy in the power system.

Estonia also finds it essential to develop the electricity market services on a regional scale. Increasing the level of flexibility is vital also for Estonia and the other Baltic states.

In this situation, Estonia would like to emphasise the need for closer regional cooperation in order to identify common solutions for the generation adequacy and the electricity market integration issues that Estonia might face in the coming decades.

For these concerns, Finland will conduct a risk assessment study in the future. Under Finland's Energy and Climate Strategy for 2030, a target will be defined for the security of supply in electricity associated with the adequacy of electric power. This will happen as soon as ENTSO-E publishes its method to define a sufficient adequacy level. As a part of the risk assessment study, Finland will also evaluate regional electricity generation adequacy and this includes Estonia as well.

In addition, the regional adequacy of electricity has been discussed in Nordic fora. Finland considers it important that

the adequacy also of Estonia and the other Baltic states is included in the discussions.

2. Decarbonisation of the transport sector plays a significant role in achieving the long-term climate and energy targets. Finland plans to increase the number of electric and gas vehicles, whereas the focus in Estonia is more on vehicles using bio-methane. Estonia considers it important to ensure a more harmonised development of the charging and refuelling infrastructure to enable the usage of electric and gas vehicles on both sides of the Gulf of Finland.

Statements by the neighbouring countries on the final NECP

Finland's final NECP was sent for consultation to Sweden, Denmark, Estonia, Lithuania and Norway. The only comment was received from Denmark, which stated that due to the lack of time Denmark is unable to give comments on the Finnish plan. Regardless of the lack of comments from the neighbouring countries, the national NECPs will give a solid base for future communication and cooperation in energy and climate policy issues between Finland and Nordic and Baltic states.

1.3.5 Iterative process with the Commission

The Commission published its assessment of Member States' draft plans to implement the EU's Energy Union objectives on 18 June 2019. Since then, the Commission and Finland have had a number of bilateral meetings.

On 11 September 2019, a bilateral meeting on energy efficiency in the NECP took place in Brussels. This meeting was held with Ms. Claudia Canevari, acting Head of Unit for Energy Efficiency, DG ENER C3. In addition, other experts from the Commission attended the meeting. The discussions were about Finland's national energy efficiency target for 2030 and its impact on Governance Article 6 (ex Article 6 EE), which a Member State may take into account when setting its national target. Finland also informed the Commission about the possible new actions that will be presented in the National Energy Efficiency Task Force (the report was published on 6 October 2019) and their impact on strengthening Finland's national target and increasing Finland's contribution to the EU common goal.

On 7 October 2019, a bilateral meeting on the EPBD and issues related to the future implementation of the amendment of the EPBD took place in Helsinki. Policy Officer Mr. Dimitrios Athanasioun from the Commission was present. The discussions were about the implementation of the Energy Performance of Buildings Directive and issues related to its future implementation.

Mr. Ville Niemi from the Commission, DG Energy visited Finland on 6 September to attend the meeting of several ministries responsible for drafting the NECP. Around 15 officials were present in the meeting. In this meeting, we described the current state of preparation of the Finnish NECP and discussed the recommendations that Finland had received from the Commission in June and the best ways forward in finalising Finland's NECP.

In addition to these bilateral meetings, Finland attended the following meetings to contribute to NECP preparation:

- Meetings of the Commission's Technical Working Group on NECPs on 3 July and 17 September 2019 in Brussels.
- Workshop on renewables and energy efficiency on 11 September 2019 in Brussels.
- A joint meeting with members of the Technical Working Group on NECPs, the SET Plan Steering Group, and the Innovation Fund Expert Group on 16th September in Brussel.
- A Nordic-Baltic Energy Conference 2019: Good governance, policy design and solutions towards 2030. This Conference was organised in Estonia in 23–24 October 2019 and a whole session of the conference was dedicated to questions on updating the NECPs of the Nordic countries and Baltic states, and the need for regional coordination. Finland attended this Conference and presented its NECP preparation process. The European Commission was also present at the Conference.

1.4 Regional cooperation in preparing the plan

1.4.1 Elements subject to joint or coordinated planning with other Member States

In 2015, the Nordic Council of Ministers for Business, Energy & Regional Policy (the Nordic Council of Ministers for Sustainable Growth as from the beginning of 2018) decided to carry out a strategic study on Nordic energy cooperation and the possibilities to develop it over the following 5 to 10 years. The study was headed by Jorma Ollila and the final report was published in 2017. In accordance with the report's proposal concerning the operational implementation of Nordic energy cooperation, a meeting of public officials coordinating the preparation of the national plans was organised at the initiative of Sweden on 8 May 2018 in order to exchange information and to share best practices. Since then, this ad-hoc group has discussed and shared best practises related to the preparation of the NECPs. A seminar on the modelling of estimated developments related to Energy and Climate Strategies was organised in Oslo on 10 and 11 October 2018.

A meeting of Nordic senior officials was organised in Stockholm on 10 October 2018 and the national plans were also discussed in the meeting. The NECPs were on the agenda of the high-level meeting of the Nordic Council of Ministers and of the Nordic Energy Seminar - The energy system of the future, both on 1 October 2019.

1.4.2 Explanation of how regional cooperation is considered in the plan

Regional cooperation is important in the Nordic and Baltic context. The well-functioning Nordic-Baltic electricity market is expected to continue and even expand in the future. The future common gas market between Finland and the Baltic states will increase regional cooperation in that field.

The regional aspect has been taken into consideration in the modelling of the electricity market and other energy related assessments.

Chapter 1.2.3 provides more information on the regional cooperation.

2 NATIONAL OBJECTIVES AND TARGETS

2.1 Dimension decarbonisation

2.1.1 GHG emissions and removals

i. The elements set out in point (a)(1) of Article 4

ii. Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. Where applicable for the contribution to the overall Union commitment of reducing the GHG emissions, other objectives and targets, including sector targets and adaptation goals, if available

According to the Effort Sharing Regulation (ESR), Finland should, by 2030, reduce its greenhouse gas emissions in the effort sharing sector by 39% compared to 2005 levels. This corresponds to a permitted amount of a 20.6 Mt CO₂ equivalent in 2030. However, if flexibility measures are used, the emissions may be higher. The binding target imposed by the EU will be achieved following a linear trajectory established for cutting emissions over the period 2021–2030. The need to reduce emissions will increase towards the end of the period. The starting point of the emissions reduction trajectory is determined on the basis of the average emissions between 2016 and 2018, and calculation of the trajectory will begin from June 2019. Final certainty about the starting point will be obtained in 2020. Based on the current estimation, the starting point is at the level of about 30.2 Mt CO₂ equivalent. The annual emissions allocations in tonnes will be determined in a delegated act issued later.

Finland will take advantage of the 2% one-off possibility to cancel ETS allowances towards the target in the effort sharing sector. The maximum annual flexibility set for Finland is 0.7 Mt CO₂ equivalent. The LULUCF flexibility mechanism included in the Commission's proposal has not been taken into account because of the uncertainty related to it. Finland will include the reporting information on utilising LULUCF flexibility as soon as it becomes available. Finland may use the other flexibility mechanisms such as transfers between years and emissions trading between the Member States if necessary.

Under the regulation concerning the land use, land-use change and forestry (LULUCF) sector, a Member State must ensure that the accounted total emissions in the sector will not exceed the accounted sinks over the periods 2021–2025 and 2026–2030. The accounting is applied to the following land-use categories: deforestation, afforestation, managed forest land, managed cropland and grasslands. By 15 March 2027 and by 15 March 2032, Finland will submit the LULUCF compliance report including the balance of total accounted emissions and removals for the period from 2021 to 2025 and from 2026 to 2030 and, where applicable, details on the intention to use or on the use of the flexibilities and related amounts. The Commission will make an assessment of the inclusion of wetlands in the LULUCF sector for the period 2026–2030. Over the period 2021–2030, Finland will be able to use the country-specific flexibility of 10 Mt CO₂ to reach the target.

For the managed forest land category, Member States shall calculate a Forest Reference Level (FRL), against which the net removals or accounted emissions from managed forest land are accounted. The FRL consists of a projection of the managed forest land sink assuming that the forest management practices of the reference period (2000–2009) are continued during the compliance period (2021–2025). Based on the feedback from the LULUCF Expert Group and the recommendations of the Commission (Commission Staff Working Document SWD(2019) 213 final), Finland recalculated its FRL and revised its National Forestry Accounting Plan (NFAP) submission, paying particular attention to the consistency of the model estimate with the data in the GHG inventory. The proposed FRL for managed forest land for the period 2021–2025, as detailed in the revised NFAP submission, is -21.16 Mt CO₂ equivalent, excluding harvested wood products (HWP) and 27.64 Mt CO₂ equivalent including HWP.

The Natural Resources Institute Finland (Luke) has updated the long-term scenarios and greenhouse gas projections for the LULUCF sector based on new data on forest growth and revised growth model assumptions. According to the revised WEM estimate, the LULUCF net sink would be -20.1 Mt CO₂ equivalent in 2025. Retaining the LULUCF net sink on this level could enable reaching carbon neutrality by 2035.

Other national objectives and goals aimed at reducing greenhouse gas emissions include the objectives outlined in the National Energy and Climate Strategy to ban the use of coal in energy production by 2030 and to halve the domestic consumption of mineral oil (petrol, diesel oil, light and heavy fuel oils and aviation fuels) compared to 2005 levels by 2030. On 1 April 2019, an Act banning the use of coal for energy generation in 2029 was passed. The ban will apply as of 1 May 2029 and incentives for energy utilities to implement the change already by 2025 are being prepared. Halving the use of oil, in turn, will support the reduction of emissions in the effort sharing sector.

The objectives and measures for promoting the use of transport biofuels and other renewable energy sources in transport have been included in the National Energy and Climate Strategy, the Medium-term Climate Change Policy Plan and in Finland's plan compliant with the Directive on the deployment of alternative fuels infrastructure (2014/94/EU). The aim is to increase the share of transport biofuels in all transport fuels consumed in Finland to 30 % by 2030. Another objective is to bring the number of electricity-powered cars in Finland to at least 250,000 and the number of gas-powered cars to 50,000 by 2030.

Figure 2 shows Finland's greenhouse gas emissions in 2000–2017 and the projected development in the With Additional Measures (WAM) projection until 2040. The WAM projection includes a set of cost-efficient additional energy and climate policy measures that are included in the Energy and Climate Strategy and in the Medium-term Climate Change Policy Plan in order to reach the targets specified in the 2015 Government Programme and adopted in the EU for 2030. The WAM projection includes new measures in addition to the existing measures implemented by 1 January 2018. Measures implemented after the 1 January 2018 are WAM measures.

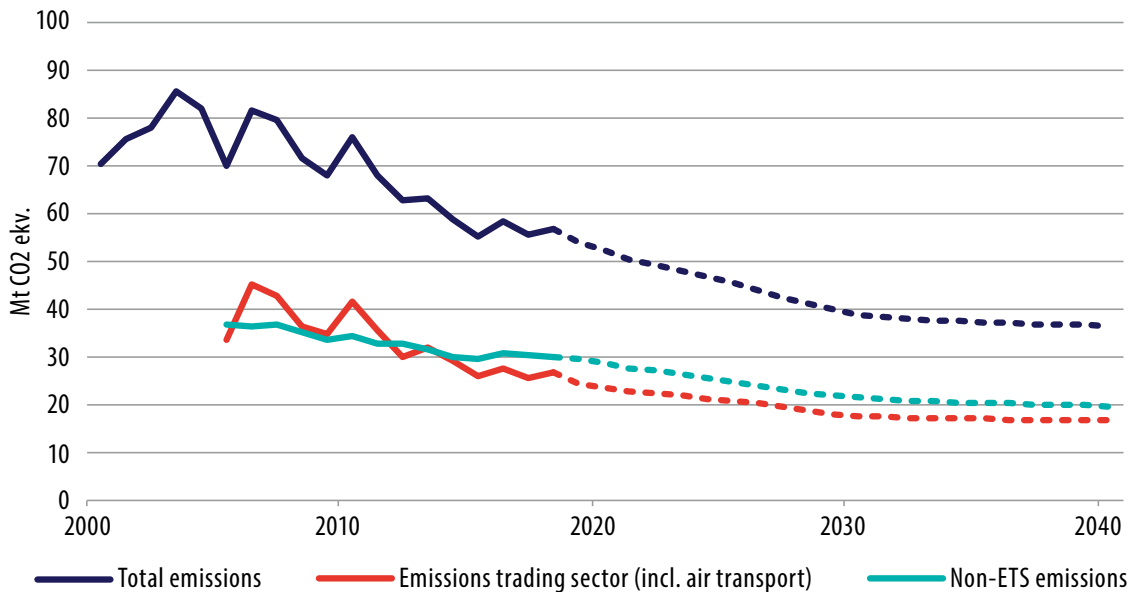


Figure 2. Actual greenhouse gas emissions 2000–2018 and the projected development in the WAM projection until 2040.

Adaptation to climate change

A key tool in preparing for climate change in Finland is the National Climate Change Adaptation Plan¹⁴. The government resolution on a National Climate Change Adaptation Plan 2022 was adopted in 2014. The objective of this plan is for Finnish society to have the capacity to adapt to climate change and manage the associated risks. The measures introduced by the plan help to mitigate the adverse consequences of climate change, including those impacting human safety and living conditions, the natural environment, livelihoods and functions vital to society. Climate change adaptation policy is implemented cost-effectively by mainstreaming adaptation into normal planning and decision-making processes in different sectors. The objective of the Plan is to provide actors with access to the requisite methods for assessing and managing climate risks and that society's ability to adapt is improved, innovative solutions promoted and awareness of climate change adaptation disseminated by means of research and development, communications and training. The National Climate Change Adaptation Plan 2022

14 https://mmm.fi/documents/1410837/5120838/MMM-_193086-v1-Finland_s_National_climate_Change_Adaptation_Plan_2022.pdf/582041ee-3518-4a63-bf60-7133aed95a9c/MMM-_193086-v1-Finland_s_National_climate_Change_Adaptation_Plan_2022.pdf

is part of the climate change policy planning system complying with the Climate Change Act.

Adaptation to climate change has been taken into consideration in the energy modelling efforts related to policy preparation. Due to climate change, rainfall and average outdoor temperature are expected to increase. Higher precipitation will lead to increased potential of hydropower production. The projections assume a hydropower production increase of 5 % in 40 years due to higher precipitation. One drawback of higher rainfall in the summer is that it can hamper peat extraction.

It is estimated that increasing windiness will also increase Finland's wind power potential. There is little information about how climate change will affect solar energy, although some estimates suggest that solar energy may be reduced as a consequence of greater cloudiness.

In relation to bioenergy production, it is essential to examine the changes and risks in the availability of bioenergy. In Finland, biomass supply is estimated to increase due to a longer growing season and improved potential productivity, hence increasing e.g. the potential for forest biomass both for industry and energy production. On the other hand, climate change is expected to increase the prevalence of heavy rain and shorter periods of snow and frost, which affect forest management. As a whole, varying weather conditions pose challenges to forest harvesting. Variable weather conditions may also affect the availability and transport of energy wood. Similarly, weather conditions might affect, for example, the quality of forest chips used in energy production, i.e. the moisture content of forest chips. From the point of view of preparedness, the adequacy and availability of solid wood fuels is particularly important in winter, when the demand for heating is greatest.

Average temperatures will increase in the future as winters become milder and summers become hotter. It is estimated that the amount of energy needed for heating in winter will decrease more than the increase in energy needed for cooling in summer. Consequences of increasing temperature on the heating need in buildings have been estimated by the Finnish Meteorological Institute and Finnish

Environment Institute¹⁵ and are included in the projections. In total for the whole building stock, the net heating energy need is projected to decrease by 0.3–0.4 % a year, being 3.7 % less in 2030 and 6.7 % less in 2040 compared to 2020.

Chapter 3.3 on energy security describes one measure to adapt to climate change, namely making the electricity distribution network more resilient against extreme weather conditions.

2.1.2 Renewable energy

i. The elements set out in point (a)(2) of Article 4

The national renewable energy target set for 2030 in the National Energy and Climate Strategy (2016) is 50% of the gross final energy consumption. However, according to the Commission recommendation, this is slightly below the share of 51 % that results from the formula in Annex II of the Governance Regulation. Based on the Commission's feedback, Finland has assessed the recommendation and the market development in the energy sector. Due to recent good development in the field of renewable energy and especially in wind power, the slightly higher target could be achieved. Therefore, Finland sets a 51 % share for Finland's national contribution to the Union's binding target of 32 % of renewable energy in compliance with the Renewable Energy Directive.

Table 3 shows the indicative minimum levels for intermediate years concerning the renewable energy target until 2030. The indicative development meets the minimum requirement for the national development of renewable energy described in point (a)(2) of Article 4 of the Regulation on the Governance of the Energy Union.

¹⁵ Rakennusten energiankulutuksen perusskenaario Suomessa 2015–2050. Suomen ympäristökeskuksen raportteja 35/2016. Finnish Environmental Institute, 2016. <http://hdl.handle.net/10138/166673>

Table 3. The renewable energy targets and minimum levels for the intermediate years [share of gross final consumption of energy].

	2020	2022	2025	2027	2030
Finland's EU obligation	38 %				
Finland's RES target for 2030 and the minimum level for the intermediate years		41 %	44 %	47 %	51 %

ii. Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2030 in the electricity, heating and cooling, and transport sector

Figure 3 and Table 4 show the estimated development in the WAM projection of the overall renewable energy share (RES overall) as well as sector-specific shares of final energy consumption for the electricity (RES-E), heating and cooling (RES-H&C) and transport sectors (RES-T). For the calculation of the numerator of the indicator RES-T, renewable electricity supplied to road vehicles is considered to be four times its energy content and 1.5 times when supplied to rail transport. When calculating the numerator of RES-T, the amount of biofuels for transport produced from feedstock listed in Annex IX of the Renewable Energy Directive is considered to be twice its energy content. In the WAM projection, the total share of liquid biofuels in road transport increases from 18 % in 2021 to 30 % in 2030 in accordance with the quota obligation set in national legislation¹⁶, where double counting ends after 2020. In 2020, the total share of liquid biofuels is assumed to be 13.5 %. In the WAM projection, the amount of biofuels produced from feedstock listed in Annex IX is assumed to increase linearly from 6.5 % of all liquid road transport fuel in 2020 to 10 % in 2030. As stipulated in the Renewable Energy Directive for indicator RES-T, the average share of electricity from renewable sources of the two years prior to the year in question is used in the calculation of the share of renewable electricity in the electricity supplied to road and rail vehicles.

16 Laki biopolttoaineiden käytön edistämisestä liikenteessä annetun lain muuttamisesta (419/2019) <https://www.finlex.fi/fi/laki/alkup/2019/20190419> <https://www.finlex.fi/fi/laki/alkup/2019/20190419>

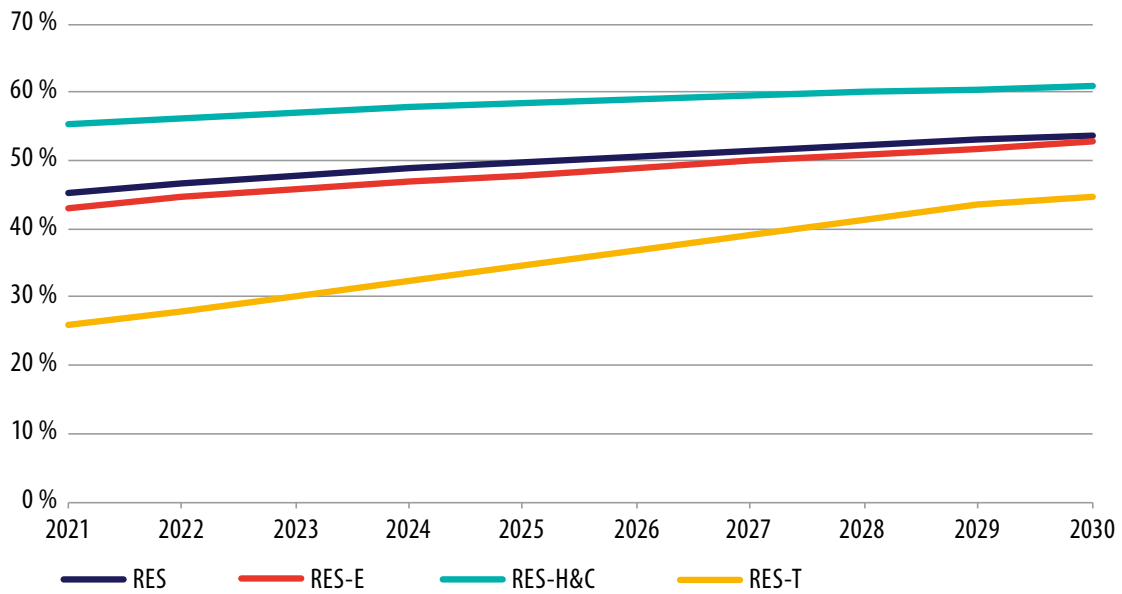


Figure 3. Estimated trajectories for the overall and sectoral shares of renewable energy in gross final energy consumption from 2021 to 2030 in the WAM projection.

Table 4. Overall and sectoral shares of renewable energy in gross final energy consumption in the WAM projection.

	2020	2022	2025	2027	2030
RES overall	44 %	47 %	50 %	52 %	54 %
RES-E	41 %	45 %	48 %	50 %	53 %
RES-H&C	54 %	56 %	58 %	60 %	61 %
RES-T	21 %	28 %	34 %	39 %	45 %

iii. Estimated trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectorial trajectories for renewable energy from 2021 to 2030, including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW

iv. Estimated trajectories on bioenergy demand, disaggregated between heat, electricity and transport, and on biomass supply by feedstocks and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink

Table 5 describes the production and use of renewable energy, grouped by technology and by sector. The figures in the table represent the estimated amounts of gross final energy consumption in the WAM projection, not that of total primary energy or fuel amounts. The estimates for the transport sector correspond to the actual energy content of the energy source without any coefficients. Table 5 also shows the estimated development of bioenergy in the heating, electricity and transport sectors.

The electricity and heating markets are competed industries and the central government does not therefore have a plan on how the installed capacity of each technology will develop in the future. However, assuming 3,200 peak load hours, the wind power volume in the WAM projection in 2030 would equal an installed capacity of 5,500 MW. This is 2.7 times the installed capacity at the end of 2018. Equally, assuming 900 peak load hours for solar power, the WAM projection generation volume in 2030 would equal an installed capacity of 1,200 MW, which is tenfold the installed capacity at the end of 2018. The installed hydropower capacity is currently 3,200 MW and no significant change is expected in the coming years.

Table 5. Renewable energy per sector and technology in the WAM projection [TWh of gross final consumption].

	2020	2022	2025	2027	2030
RES					
Hydropower	14	14	15	15	15
Wind power	8	11	13	15	18
Solar energy	0.2	0.3	0.5	0.7	1.1
Bioenergy	106	113	119	122	124
Heat pumps	6	7	7	7	7
Total	135	145	154	159	165
RES-E					
Hydropower	14	14	15	15	15
Wind power	8	11	13	15	18
Solar energy	0.2	0.3	0.4	0.7	1.1
Biomass	14	14	15	16	16
Total	36	40	43	46	50
RES-H&C					
Solar energy	0.0	0.0	0.0	0.0	0.0
Biomass	87	90	94	95	97
Heat pumps	6	7	7	7	7
Total	93	97	101	102	104
RES-T (excl. coefficients)					
Liquid biofuels	6	9	10	10	10
Biogas	0.0	0.0	0.1	0.1	0.2
Renewable electricity	0.3	0.4	0.5	0.6	0.8
Total	6	9	10	11	11

In Finland, bioenergy has a key role in the production of renewable energy. Bioenergy production is largely integrated into forestry and forest industries. In recent years, energy derived from wood fuels has accounted for around one fourth of Finland's total energy consumption. A major share of wood fuels is derived from wastes and residues of the forest industry, including black liquor originating in the pulp-making process and bark, sawdust and other industrial wood residues. Also forest chips – or in other words logging residues or other low value biomass from silvicultural and harvesting operations – are used for energy production. Table 6 shows the amounts of biomass by type used as primary energy in the WAM projection.

As a result of the positive trend in the forest industries, more wastes and residues (black liquor, sawdust, bark, etc.) are available for energy production. In recent

years, the growth in the consumption of wood fuels in Finland has been based especially on an increase in burning forest industry by-products and wood residues.

Wood-based fuels are predicted to be black liquor and other concentrated liquors, sawdust, bark and other industrial wood by-products created in connection with the forest industries and wood processing. Based on this, the share of wood-based fuels based on imports in all wood-based fuels in Finland is predicted to remain small, only a few per cent.

The energy and climate projections estimate that, at the level in 2030, the amount of forest chips in heat and electricity production will rise to about 24 TWh, which corresponds to about 12 million cubic metres per year, about 1.5 times the current level. We can assume that most of the forest chips will consist of small-diameter stems gathered in connection with the management of young forests. The remainder is expected to consist of logging residues from regeneration felling and, to a minor extent, of stumps.

Table 6. Biomass by type in the WAM projection [TWh of primary energy consumption].

	2020	2025	2030
Black liquor and other concentrated liquors	44	47	49
Industrial wood residue and forest chips	41	48	50
Small-scale combustion of wood, pellets, etc.	19	19	20
Waste (biodegradable fraction)	4	4	4
Total	109	118	123

As most of the forest-based energy is based on industrial wood wastes and residues as well as harvesting and forest management residues, its impact on the LULUCF sector sink is small. LULUCF accounting in the period of 2021–2030 is based on IPCC guidelines, respectively assuming instant oxidation of forest management residues.

v. Where applicable, other national trajectories and objectives, including those that are long term or sectorial (e.g. share of renewable energy in district heating, renewable energy use in buildings, renewable energy produced by cities, energy communities and self-consumers, energy recovered from the sludge acquired through the treatment of wastewater)

Article 24 in the Renewable Energy Directive encourages Member States to increase the share of renewable energy and waste heat and cold in district heating and cooling. Figure 4 shows the historical as well as expected future development of district heat from renewable energy sources and waste heat. Today, fossil fuels are used to produce slightly more than half of the district heating.

Article 24.10 states that Member States shall not be required to apply paragraphs 2 to 9 of Article 24 if its share of efficient district heating and cooling systems constitutes over 90% of total sales of its district heating and cooling. According to current calculations, the share of efficient district heating systems of total sales will exceed the threshold of 90% in Finland, which means that Finland will be obliged to implement only paragraph 1 of Article 24. However, Finland considers the aim of increasing the share of renewable and waste heat in district heating important and measures are addressed towards this end. Also the district heating companies are actively seeking new opportunities to cut down on their use of fossil fuels.

A quota obligation has been introduced for light fuel oil used for heating. The obligation for bio liquids will be a 10% share in 2028. With the exception of light fuel oil used for heating, no other sector-specific targets have been set for heating and cooling produced using renewable energy.

The Government Programme sets the target of phasing out fossil fuel oil in heating by the beginning of the 2030s. Oil heating will no longer be used in properties owned by central and local governments after 2024. There are plans to adopt a separate action plan to encourage properties using oil heating to switch to other forms of heating during the 2020s.

On 1 April 2019, an Act banning the use of coal in energy production as from 1 May 2029 was passed. The ban will reduce the use of coal by an estimated 3 TWh compared to market-based development without the ban. Phasing out coal will have a notable impact on the district heating sector, because in Finland coal is used mainly in combined heat and power (CHP) plants. A special incentive package to support replacement investments is under preparation for those district heating companies in towns and cities that phase out the use of coal as early as 2025.

The Government Programme indicates that heat pumps generating heat for district heating networks will be transferred to the lower category of electricity tax, which

is mainly applied to energy intensive industries. This change should have a positive effect on the utilisation of waste heat.

Together with already existing measures and the new abovementioned plans, Finland will increase the share of renewable energy and waste heat in the heating and cooling sector in line with Article 23 in REDII.

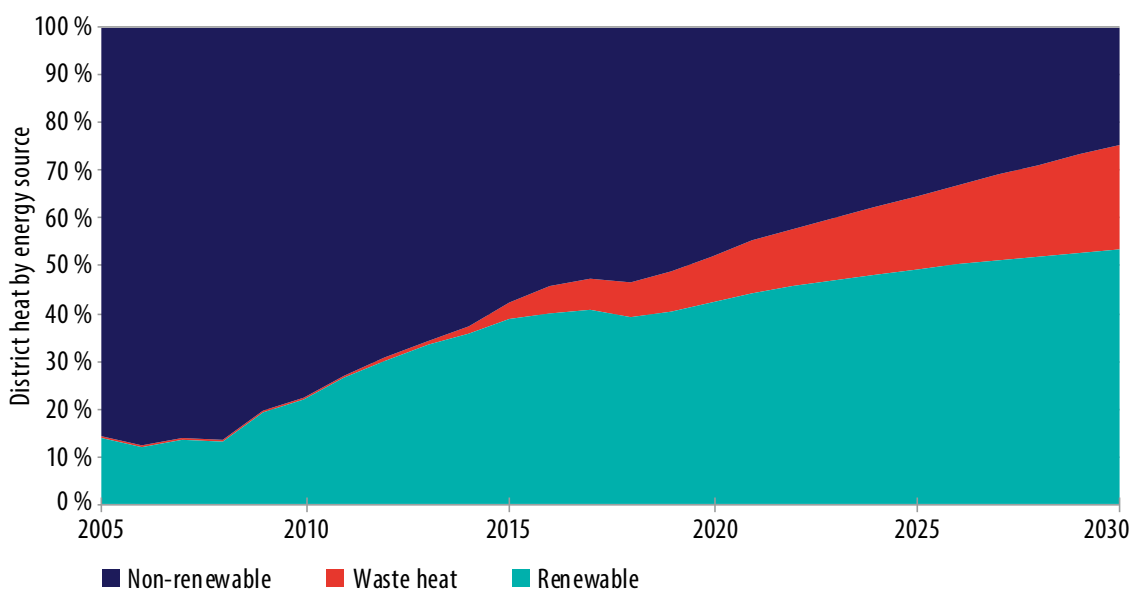


Figure 4. District heat by energy type (renewable energy, waste heat and non-renewable energy) in the WAM projection.

Chapter 3.1.2 discusses energy communities in more detail.

2.2 Dimension energy efficiency

i. The elements set out in point (b) of Article 4

ii. The indicative milestones for 2030, 2040 and 2050, the domestically established measurable progress indicators and their contributions to the Union's energy efficiency targets as included in the roadmaps set out in the long-term renovation strategies for the national stock of

residential and non-residential buildings, both public and private, in accordance with Article 2a of Directive 2010/31/EU

iii. Where applicable, other national objectives, including long-term targets or strategies and sectoral targets, and national objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling

Finland's indicative national energy efficiency target for 2020, in accordance with the Energy Efficiency Directive, is the absolute level of final consumption of energy at 310 TWh. The corresponding level of primary energy consumption has been estimated at 417 TWh. In 2017, Finland had achieved a level of 294 TWh for final energy consumption, corresponding to 371 TWh of primary energy consumption. The possibility to achieve the national energy target 2020 seems realistic but depends, however, significantly on the weather conditions. The heating demand can vary substantially - more than 5% in final energy consumption - between years due to significant differences in heating degree days between cold and mild winters. The competitiveness of Finnish energy intensive industry on the global market also greatly influences final energy consumption. When industry is running flat out, its final energy consumption accounts for almost 50% of the energy demand in Finland.

The 2030 energy efficiency target in final energy consumption is 290 TWh. The corresponding primary energy consumption is about 405 TWh. Figure 5 shows the WAM projection of primary and final energy consumption over the period 2018–2030.

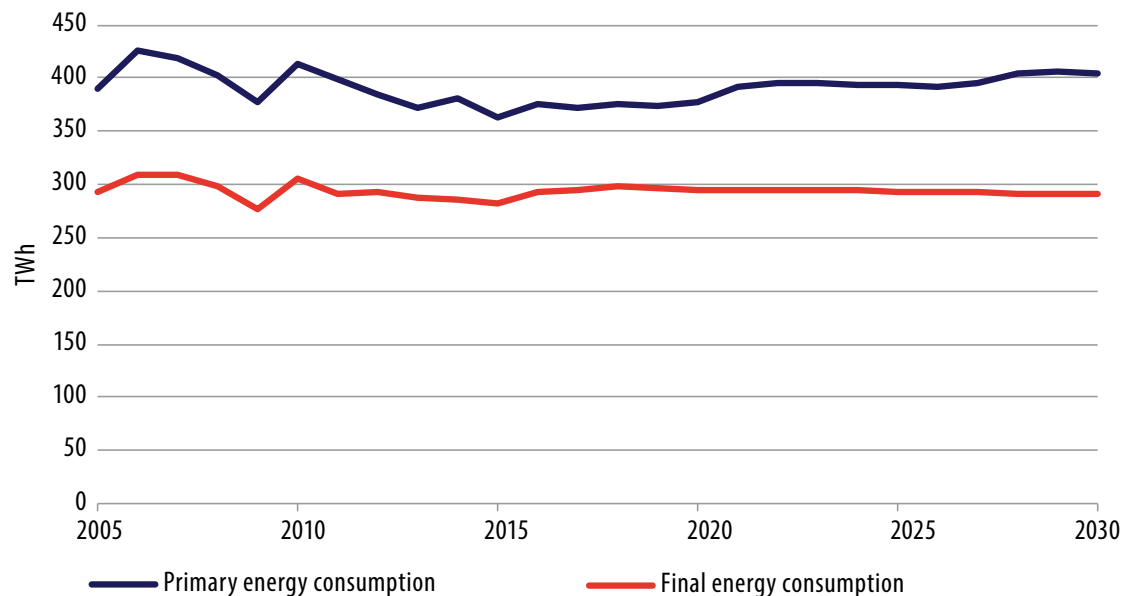


Figure 5. Historical figures and indicative development of primary and final energy consumption of 2018–2030 in the WAM projection. Data source for 2005–2017 figures: Eurostat.

As a result of Finland’s long-time efforts to improve energy efficiency in all sectors, **final energy consumption** is estimated to decrease slightly during the 2020s, although the Gross Domestic Product (GDP) is estimated to increase. Building stock volumes continue to increase and industrial production is expected to grow particularly in the pulp and paper sector. At the same time, industry is developing its processes towards carbon neutrality, which often means electrification of the energy use and potentially increased energy use. This transition is also driven by the Government Programme that sets the national target of carbon neutrality by 2035. It should be noted that industrial energy use is difficult to forecast and includes substantial uncertainties.

Primary energy consumption is estimated to greatly increase comparatively from 2020 until 2030. The main reason is the start-up of two nuclear power plant units, whose output will largely replace imported electricity. The two units are estimated to increase primary energy consumption by 26 TWh and 19 TWh, respectively, compared to the level with an equivalent amount of imported electricity. The effect of increased nuclear power on primary energy consumption can be seen clearly in Figure 5. There can also be some increase in primary energy when coal-based

cogeneration of heat and power in big cities is converted to biomass boilers, replaced by heat pumps and other means of heat production before 2030.

Level of energy savings requirement – EED Article 7

Finland's national cumulative energy saving obligation in accordance with Article 7 of the Energy Efficiency Directive for the period 2014–2020 is 49 TWh_{cum}. The estimated cumulative energy saving effects of the measures implemented in the period 2014–2020, presented in the 2018 annual report of the Energy Efficiency Directive, are 92.7 TWh_{cum} at the end of 2020. Finland notified the Commission in December 2018 of already achieving Finland's national cumulative energy saving target for the period 2014–2020.

The annual final energy consumption as defined in the EED Article 2(3) and averaged over the years 2016–2018 (the data of for 2018 is preliminary) is 238 TWh. Finland's cumulative energy savings target, based on this average, for the period 2021–2030 is 105 TWh_{cum}. The formulation "supplied to" in the definition of the EED Article 2(3), has been taken into account by deducting auto-production of electricity, steam and heat from Eurostat FEC2020–2030 data.

Table 7 lists energy efficiency methods for the 2020s which are estimated to result in total cumulative savings of 153 TWh_{cum}.

Table 7. Main measures for the energy savings objectives of EED Article 7 and their estimated cumulative savings 2021–2030.

Energy Efficiency Measure	Cumulative savings TWh _{cum} 2021–2030
Energy Efficiency Agreements	82.43
Heat pumps for detached and terraced houses	20.40
Transport fuel taxation/car traffic	15.35
Energy Audit Programme – SMEs and municipalities	11.43
Energy efficiency measures in the agriculture sector	11.40
Energy efficiency agreements / customer advice services	10.97
Mass and measure modifications in truck transport	1.08
Total	153.1

Finland opts to use alternative measures in the EED Article 7 implementation in the upcoming obligation period 2021–2030, further information is provided in Annex 1 to this NECP.

Renovation of public buildings owned and occupied by central government – EED Art 5

The energy saving target for the central government for the period 2014–2020 is 8,225 MWh. According to the 2018 annual report in compliance with the Energy Efficiency Directive, the energy savings in force in 2017, achieved with the measures implemented between 2014 and 2017, totalled 13,240 MWh. The long-term energy savings in force in 2020, achieved with the measures implemented between 2014 and 2017, will total 11,369 MWh.

In compliance with Article 5 of the EED, Finland will continue the alternative approach for the period 2021–2030. The amount of annual energy savings that would have been achieved by the default 3 % renovation rate was 1,285 MWh in 2014 and will be 1,070 MWh in 2020. Respectively the annual 3 % renovation rate would deliver 1,038 MWh (1,070 x 0.97) energy savings in 2021 and 789 MWh in 2030. These values are used as the first and the last year targets for the alternative approach during the period 2021–2030.

The equivalent energy savings to be reached by 2020 were notified to be 8,225 MWh. By 2030, the amount of equivalent energy savings to be reached is 17,312 MWh. The methodology and parameters for calculating the energy savings

delivered by the default 3 % renovation rate has not been changed. Therefore, Finland can confirm that the condition “at least equivalent” is fully taken into account also for the new period. A detailed description of the methodology and parameters used is presented in the EU PILOT (EUP(2017)9259).

Energy efficiency in energy production

Finland efficiently utilises the Cogeneration Heat and Power (CHP) and district heating potential. A significant part of the heated building stock in towns, cities and densely populated municipalities is connected to a district heating network. Finnish district heating statistics show that district heating is used to heat around 90 % of all Finnish residential apartment buildings, 30 % of industrial buildings and more than 60 % of other buildings. In single-family houses, district heating accounts for about 10 %. District heating in residential, commercial and public buildings has a total market share of 46 % (2017). Almost 70 % (68 % in 2017) of district heat production is based on CHP. Similarly, CHP electricity accounts for about a third of Finland's electricity production. Since district heating suppliers are dominant in their operating areas with regard to the choice of heating source, the competition authority monitors them and can, if necessary, intervene in any abusive use of a dominant position, for example in the case of retail prices for district heating.

Energy efficiency agreements also cover energy production and energy services that serve the achievement of the indicative national energy efficiency target. The National Energy Efficiency Action Plan 2017 (NEEAP-4¹⁷) estimated that the energy saving effects of the measures implemented within the scope of agreement activities in the energy sector will total almost 1.7 TWh in 2020.

Energy efficiency in the transport sector

Finland has set separate sector-specific targets only in the field of transport. The objectives and measures for improving the energy efficiency of transport have been included in the National Energy and Climate Strategy and the Medium-term Climate Change Policy Plan. These measures are related to improving the energy efficiency

17 https://ec.europa.eu/energy/sites/ener/files/documents/fi_neeap_2017_en.pdf

of vehicles on the one hand, and to improving the energy efficiency of the entire transport system on the other. Improving the energy efficiency of vehicles reduces vehicle-specific consumption and greenhouse gas emissions, while improving the energy efficiency of the transport system reduces total mileage and, consequently, fuel consumption and greenhouse gas emissions across the transport sector.

Long-term renovation strategy

Finland is in the course of establishing a long-term renovation strategy with an overview of the building stock in 2020 and indicative targets for the years 2030, 2040 and 2050. The strategy will be published in March 2020 by the Ministry of the Environment. Below is a description of the preliminary targets and other information regarding Finland's long-term renovation strategy.

The Finnish building stock will be expressed through e.g. building type, building year, location, main heating source and energy efficiency level. In addition, public buildings will be dealt with separately from the rest of the building stock. The building stock will be divided into (1) buildings that are already highly energy efficient, (2) buildings that require renovation and (3) worst-performing buildings. Policies and actions will be planned according to the targets. The indicators will cover at least energy use of the building stock, energy efficiency levels of the buildings, GHG emissions from building use, GHG emissions from renovations, energy poverty, the number and size of apartments, living conditions, smart energy systems and societal impacts.

The Finnish long-term renovation strategy aims at decarbonising the current building stock by 2050. This draft description of the strategy includes the 2020 building stock description as well as initial targets for the years 2030, 2040 and 2050 for the heating consumption in buildings and for the related greenhouse gas emissions. The targets take into consideration the existing policy measures as well as additional policy measures required to decarbonise the Finnish building stock (phase-out of oil heating and energy renovation subsidies). The full version of the strategy will also include e.g. the tracking of energy efficiency levels of the Finnish building stock (the full version will be submitted in accordance with the EPBD in March 2020). Additional indicators will include e.g. energy poverty, solar panel installations and apartment sizes. The building types included in the strategy

are detached buildings, terraced houses, residential apartment blocks and service buildings.

The heating energy use of the Finnish building stock in 2020 is estimated to be about 65 TWh. Besides the heating of buildings, saunas, a Finnish speciality, consume notable amounts of energy - about 2.6 TWh in 2020. Another Finnish characteristic is the popularity and rapid increase in heat pumps in buildings: about 5.8 TWh of the building heating in 2020 is estimated to come from the energy that is harvested by heat pumps.

The initial target levels for heating energy use of buildings (excluding saunas) are 54 TWh in 2030, 45 TWh in 2040 and 37 TWh in 2050, including the energy harvested by heat pumps. This corresponds to an energy saving of 16 % in 2030, 30 % in 2040 and 42 % in 2050, when compared to the baseline year 2020.

Energy savings from heating energy in buildings comprises two main factors: energy efficiency improvements and maintenance, and removals from the building stock and efficiency of space utilisation. Figure 6 shows the total heating energy savings compared to the baseline year 2020, allocated to the different sources of energy savings.

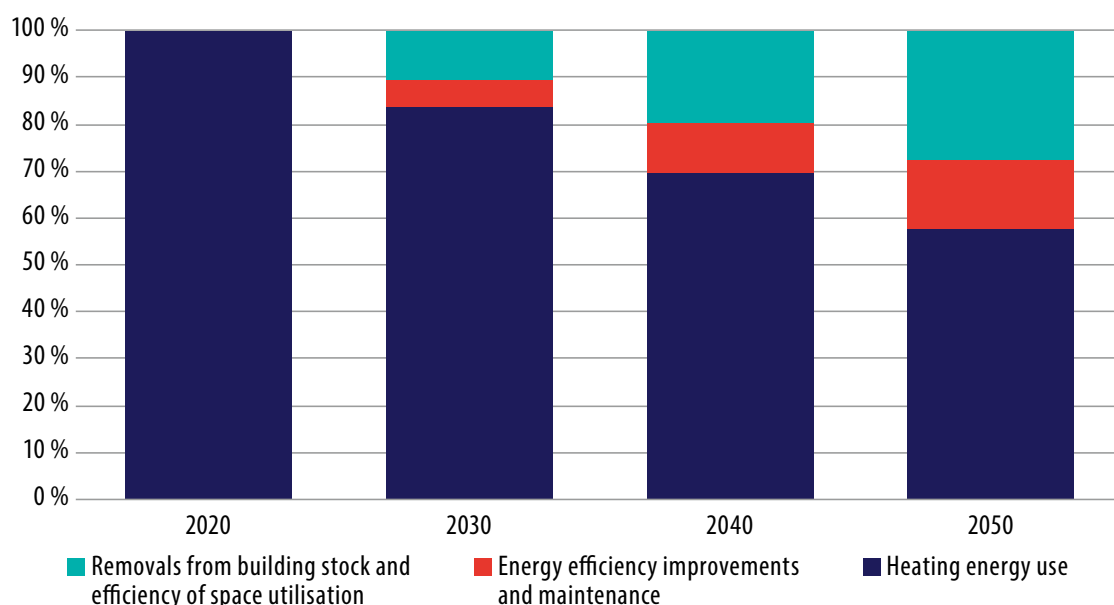


Figure 6. The total heating energy use and saving in the 2020 building stock when compared to the energy use in the base year 2020 (heating energy use of 2020=100 %).

The greenhouse gas emissions of the 2020 building stock are 7.7 Mt CO₂ equivalent. The corresponding emissions are 2.9 Mt CO₂ equivalent for 2030, 1.6 Mt CO₂ equivalent for 2040 and 0.7 Mt CO₂ equivalent for 2050. This leads to total emissions reductions of 62 % in 2030, 80 % in 2040 and 91 % in 2050, when compared to the baseline year 2020.

The factors behind the emissions reductions in building energy use are Energy efficiency improvements and maintenance, which include the energy efficiency improvements in renovations as well as improved building maintenance and automation practices; decarbonisation of heating at the building level, which includes changes in heating sources (removals of oil-fired heating boilers and installations of heat pumps); removals from building stock and efficiency of space utilisation; and finally decarbonisation of centralised energy production (district heating and electricity).

The impacts of decarbonisation policies vary in terms of energy sources. The main decrease in heating sources relates to fossil fuel use (consists almost entirely of heating oil), and the main increase is related to the heat pump use in heating. Figure 7 shows the impacts of the decarbonisation policies on the use of different heating energy sources.

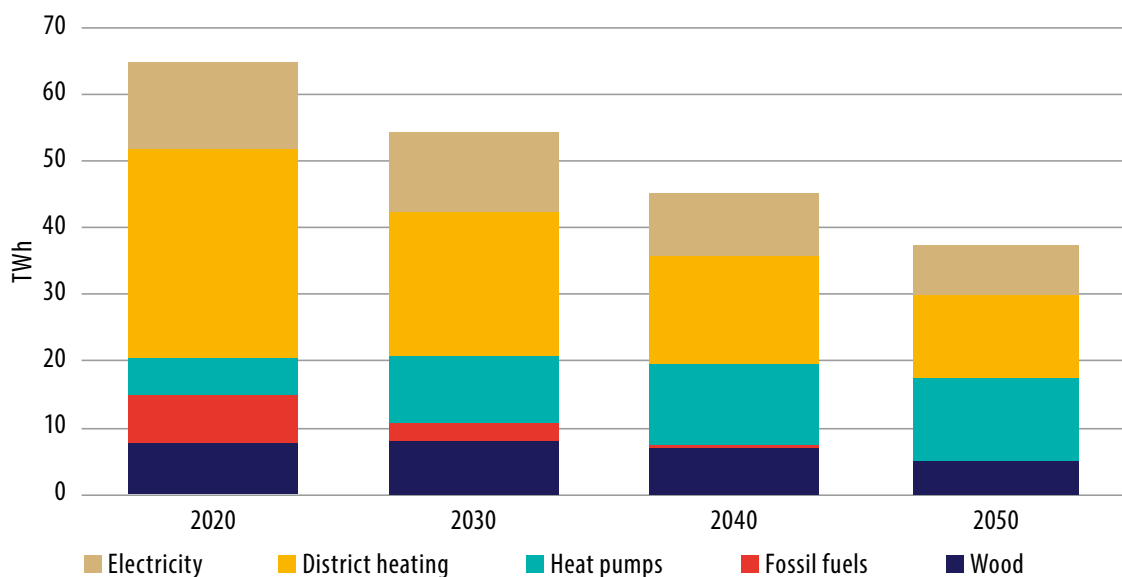


Figure 7. Heating energy sources of the remaining 2020 building stock in 2020–2050.

Main results of the recent Energy Efficiency Working Group

In November 2018, the Ministry of Economic Affairs and Employment appointed an Energy Efficiency Working Group to review the potential for improving energy efficiency during the period of 2021–2030. The working group proposed measures enabling Finland to achieve the energy savings objectives defined in Article 3 and Article 7 over the 2021–2030 period. The working group was assisted by expert working groups on industry, consumers, services and transport, consisting of the best national energy efficiency experts in each sector. The expert working groups compiled the existing and new energy efficiency measures in their respective sectors and assessed the potential for improving the efficiency of the existing ones. An impact assessment was carried out on selected measures to determine energy saving impacts and their feasibility. Table 8 shows the estimated annual savings (in 2030).

Table 8. Energy efficiency actions and their contributions towards the national energy efficiency target 2030¹⁸

Energy Efficiency Measures	Savings 2030GWh/y
Energy Efficiency Agreements	25,770
Energy Efficiency Agreements / Customer Advice Services	83
Energy Efficiency Agreements Increasing the coverage	1,095
Energy Efficiency Agreements: Improved reporting	1,078
Energy Audit Programme	1,420
Energy Audit Programme: Increasing volumes	1,817
Waste heat project	1,600
Energy efficiency measures in agriculture sector	3,889
Energy efficiency measures in agriculture sector: farming land arrangement	278
Energy efficiency investments of farms	99
EU binding CO ₂ thresholds: Cars	8,671
EU binding CO ₂ thresholds: Light-duty vehicles	285
EU binding CO ₂ thresholds: Heavy-duty vehicles	604
Campaign of wrecking old cars (2015 and 2018)	35
State aid for full electrical vehicles (until 2021)	0.1
Fuel tax for cars	1,236
Mass and measure modifications in truck transport	20
Implementation of eco-design directive	7,075
Heat pumps for detached and terraced houses	11,956
Building code, energy efficiency in new buildings	9,337
Building code, energy efficiency in renovation	3,810
Total	80,159

Finland continues the effective implementation of the Voluntary Energy Efficiency Agreement Scheme and other energy efficiency actions described above after 2020 and will continue many other energy efficiency policy measures based on policy decisions made before the period 2021–2030.

Link between energy consumption and gross domestic product

The EU Energy efficiency target for 2030 is indicated in terms of final energy or primary energy consumption. When considering early actions, anticipated GDP growth, its structure – based heavily on energy intensive industries – and the

18 Report of the energy efficiency working group, 2019. Työ- ja elinkeinoministeriön julkaisu 2019:53. <https://tem.fi/julkaisu?pubid=URN:ISBN:978-952-327-456-3>

changes in energy supply, it is very ambitious for Finland to contribute to the declining projection of the energy use 2021–2030.

Finland started active energy efficiency policies and measures already after the 1973 oil crisis. The Government launched the first comprehensive Energy Efficiency Action Plan in 1993 and established the sustainable development company Motiva Ltd to implement many of the plan's activities, including the Energy Audit Programme. This long history of energy efficiency policies and measures in Finland means that there are no silver bullets or low-hanging fruit to improve energy efficiency.

Economic growth in the 2020s will come partly from relatively energy intensive sectors: the forest industry (pulp production based solely on virgin fibre, new products and biorefineries) and data centres. Also in the forest industry, increasing demand for further processed bio- and other products typically increases the energy intensity of the products.

Without these foreseen changes, final energy consumption would decrease steadily with increasing energy efficiency. However, the changes described above will mean the increase in final energy use roughly offsets the energy efficiency gains achieved at the same time. Progress will become even more evident in future as illustrated in Figure 8, which shows that rising GDP does not increase final energy consumption in the same proportion. On the contrary, improved energy technology and energy efficiency actions taken have already helped and will in future help to disconnect growth of the national economy from the amount of energy consumption.

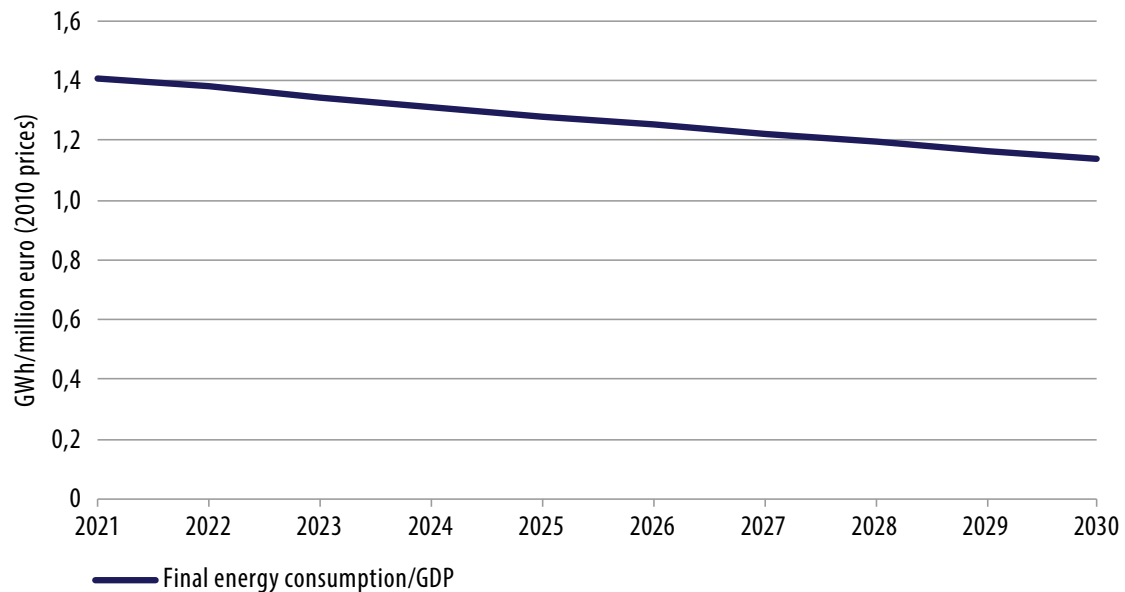


Figure 8. Final energy consumption per GDP for the WAM projection.

2.3 Dimension energy Security

i. The elements set out in point (c) of Article 4

ii. National objectives with regard to increasing: the diversification of energy sources and supply from third countries; for the purpose of increasing the resilience of regional and national energy systems

The Government Decision on the Targets of Security of Supply (1048/2018) outlines the targets for the security of energy supply. The security of energy supply must be based on diverse energy sources and fuels, sufficient and decentralised energy production and reliable transmission and supply systems. The security of energy supply is based on well-functioning energy markets, a clear long-term energy policy that encourages investments, and energy efficiency.¹⁹

¹⁹ Government decision on the objectives of security of supply, Chapter 3.1. <https://www.finlex.fi/fi/laki/alkup/2013/20130857>

Under the Government decision, for Finland to be prepared for disruptions in the availability of energy and to meet the commitments under international agreements, requires the National Emergency Supply Agency to hold imported fuels in state-owned reserves to last for an average of five months at normal consumption rates. The implementation of this obligation is constantly monitored and, as necessary, the quantities, qualities and locations of export fuels are changed to align to the situation prevailing at any given time.

The Government decision on the targets of security of supply also states that the use of peat in combined power and heat generation must be secured. To ensure availability should weather risks be realised, the target is to have peat reserve stocks covering six months' use at the beginning of the peat production season.

International cooperation is constantly developing and intensifying. In the past few years, there has been significant development in cooperation with the EU, the IEA, the Nordic countries and NATO. Of the Nordic countries, Finland has agreements concerning security of supply with Sweden and Norway. Also, the relationships with the security of supply authorities of Estonia have intensified. The National Emergency Supply Agency has together with the Ministry for Foreign Affairs invested in the personnel resources of international cooperation in the field of security of supply.

According to the recent market report by the Finnish Energy Authority²⁰, the total installed generation capacity in Finland at the end of 2018 was about 17,600 MW. However, no more than 12,000 MW of the installed capacity (including peak load reserves) is estimated to be available during peak demand. This is due to the unavailability of thermal power plants and the unpredictable nature of wind power. Consumption peaks occur during the winter months and are highly affected by outdoor temperature and length of cold spell.

Table 9 below shows the highest hourly electricity demands in 2011–2018 and the actual electricity generation during peak consumption and the highest annual

20 Energy Authority, National Report 2018 to the Agency for the Cooperation of Energy Regulators and to the European Commission - Finland. 11.7.2019.

<https://energiavirasto.fi/documents/11120570/13026619/Raportti-National-report-2019-Finland/5f0408b2-5903-11cf-29a3-3a6d0ed0d2a5/Raportti-National-report-2019-Finland.pdf>

generation for 2011–2018. The table shows that the record peak consumption of 15,105 MW was in 2016. During last winter (2018–2019), the highest hourly load was 14,062 MWh/h. The consumption peak is closely related to the weather conditions.

Table 9. The peak hourly electricity consumption in Finland 2011–2018. Source: Finnish Energy Authority²¹, Fingrid²²

	2011	2012	2013	2014	2015	2016	2017	2018
Peak demand (MWh/h)	14,804	14,304	14,034	14,228	13,494	15,105	14,273	14,062
Generation during peak demand (MWh/h)	12,063	11,916	11,843	11,632	10,992	10,874	9,963	10,602
Highest annual generation (MWh/h)	12,261	11,981	11,843	11,722	11,164	11,456	11,042	11,382

iii. Where applicable, national objectives with regard to reducing energy import dependency from third countries, for the purpose of increasing the resilience of regional and national energy systems

The National Energy and Climate Strategy sets a national target of 55 % for energy self-sufficiency. The target has been set according to the national rules for calculation and does not include electricity produced with nuclear power in Finland. National targets related to energy self-sufficiency also include the decision to ban the use of coal for use in energy production by 2030 and to halve domestic use of mineral oil (petrol, diesel oil, light and heavy fuel oil, aviation fuels) compared to 2005 levels by 2030.

In addition, the opening of the gas market from the beginning of 2020, the construction of the Balticconnector gas pipeline and the related objective of creating a regional gas market comprising Finland and the Baltic states will reduce the dependency on natural gas imported from Russia.

21 Finnish Energy Authority. Kertomus sähkön toimitusvarmuudesta vuosina 2017–2018 sekä tehotaseennuste talvikaudelle 2018–2019. 29.11.2018 <https://energiavirasto.fi/documents/11120570/12722768/Raportti-s%C3%A4hk%C3%B6n-toimitusvarmuus-2018.pdf/74c52466-b53b-6927-202b-9362ff30c660/Raportti-s%C3%A4hk%C3%B6n-toimitusvarmuus-2018.pdf.pdf>

22 Fingrid, Sähköjärjestelmän toiminta talvella 2017 – 2018. 19.3.2018 <https://www.fingrid.fi/globalassets/dokumentit/fi/tiedotteet/ajankohtaista/sahkojarjestelman-toiminta-talvella-2017---2018.pdf>

iv. National objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and energy storage.

The National Energy and Climate Strategy and the Medium-term Climate Change Policy Plan have set the objective to increase the share of biofuels to 30% of fuels used in road transport and to replace 10% of light fuel oil use with bioliquids. The majority of biofuels and bioliquids are estimated to be domestic and their raw materials are estimated to include biodegradable waste, side streams of the forest and other industries, and logging residues. The act concerning the quota obligation for biofuel use in transport and in heating was passed in spring 2019 and entered into force on 1 April 2019.

As for the transport sector, the objective is also to increase the number of electric cars to at least 250,000 and the number of gas-powered cars to at least 50,000 by 2030. The majority of the gas used in transport is domestic biogas. Domestic energy sources account for a large share also in Finland's electricity production.

The objectives of the National Energy and Climate Strategy to increase the number of renewable sources of energy described in Chapter 2.1.2 also promote the diversification of energy sources. Finland has not set specific objectives for the diversification of deliveries from third countries. National objectives are mainly related to reducing the dependency on imports from third countries (see the next section). Regarding imported fuels, the oil and coal markets are global, so it is possible to switch supply sources even within a short period of time. To prepare for possible supply disruptions, compulsory stockpiles related to the security of supply of oil products and coal are held. As regards natural gas, the already completed LNG terminals, those under construction and the Balticconnector gas pipeline enable a decentralised supply of gas.

Decentralised electricity and heat production based on renewable energy will be promoted. An effort will be made to increase decentralised small-scale production, mainly on market terms and through economic incentives through the electricity markets and taxation. The interest of citizens, companies and the public sector in utilising renewable sources in the energy solutions of individual buildings will be encouraged through guidance with information and local reference sites.

Finland has been at the forefront of promoting real-time price signals for consumers. As required by legislation, smart electricity meters were effectively installed at all customers already in 2013. All customers have the possibility of choosing an electricity contract with dynamic pricing. At the end of 2018, approximately 9% of retail customers had a dynamic electricity price contract²³.

Consumer protection and competitiveness in the retail sector are reflected in measures aimed at curbing hefty single price increases, such as the legislation that lays down restrictions on the annual price increases of electricity transmission charges. Also, other means are currently under consideration by the Ministry of Economic Affairs and Employment.

The role of flexibility and demand response was further emphasised in the National Energy and Climate Strategy. Based on the strategy, the Ministry of Economic Affairs and Employment tasked a large working group (Smart Grid Working Group) to find ways to promote further customers' participation in the electricity markets and resource adequacy in 2016. The working group completed its work in October 2018 and gave concrete proposals on how to improve the situation²⁴. The Ministry of Economic Affairs and Employment is currently implementing these proposals in parallel with the Clean Energy Package implementation.

2.4 Dimension internal energy market

2.4.1 Electricity interconnectivity

i. The level of electricity interconnectivity that the Member State aims for in 2030 in consideration of the electricity interconnection target for 2030 of at least 15 %, with a strategy with the level from 2021 onwards defined in close cooperation with affected Member States, taking into

23 <https://energiavirasto.fi/documents/11120570/13026619/Raportti-National-report-2019-Finland/5f0408b2-5903-11cf-29a3-3a6d0ed0d2a5/Raportti-National-report-2019-Finland.pdf>

24 Flexible and customer-centred electricity system; Final report of the Smart Grid Working Group 2018 http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161147/TEM_39_2018.pdf?sequence=1&isAllowed=y

account the 2020 interconnection target of 10 % and the following indicators of the urgency of action:

(1) Price differential in the wholesale market exceeding an indicative threshold of EUR 2 /MWh between Member States, regions or bidding zones;

(2) Nominal transmission capacity of interconnectors below 30 % of peak load;

(3) Nominal transmission capacity of interconnectors below 30 % of installed renewable generation.

Each new interconnector shall be subject to a socioeconomic and environmental cost-benefit analysis and implemented only if the potential benefits outweigh the costs

The level of interconnection of electric networks is defined as the ratio of commercial transmission capacity to the neighbouring EU countries, excluding connections to third countries, divided by the installed power plant capacity. Finland's electricity interconnection target for 2030 is to keep the level of interconnectivity above 15 %.

According to data for 2017, the installed power plant capacity in Finland is about 17,100 MW and commercial transmission connections, excluding connections to Russia, total 3,700 MW. The level of interconnection is thereby 22 % (3,700 MW divided by 17,100 MW). When the nuclear power plant unit OL3 in Olkiluoto is completed in 2020, the generation capacity will be 18,700 MW and, correspondingly, the commercial transmission connections, excluding connections to Russia, will decrease due to technical characteristics of the power system to total 3,400 MW. In 2020, the level of interconnectivity will thus fall to 18 %. The peak load in Finland has varied between 13,400–15,100 MW in the period 2010–2018.²⁵ The

²⁵ <https://www.fingrid.fi/globalassets/dokumentit/fi/tiedotteet/ajankohtaista/sahkojarjestelman-toiminta-talvella-2017---2018.pdf>

current total transmission capacity to neighbouring EU countries is thus 25–28 % of the historical peak load.

Fingrid Oyj (Finnish transmission system operator) and Svenska Kraftnät (Swedish transmission system operator) have signed a letter of intent concerning the construction of an alternating current connection of 800 MW between northern Finland and northern Sweden by 2025. The transmission line project is included in the EU's Project of Common Interest list approved in spring 2018. The project has shown strong socioeconomic benefits in both countries, especially in Finland²⁶. Commercial transmission connections to neighbouring EU countries would then be 4,200 MW and the installed power plant capacity somewhere in the order of 21,000 MW. This equals an interconnectivity level of 20%. The predicted peak load in 2025 is in the order of 15,700 MW²⁷. Thus, the transmission capacity is predicted to be approximately 27 % in 2025, excluding the effect of connections to Russia.

The Finnish Government is fully committed to delivery of the project between Finland and Sweden. Swift delivery of the project is a key target in the development of the regional electricity markets. The importance of the project has also been acknowledged in the National Energy and Climate Strategy for 2030.

The EU's aim is to bring the level of interconnection in the Member States to at least 10 % by 2020 and at least 15 % by 2030. Finland's interconnection capacity exceeds these targets.

The price difference in electricity between Finland and the Nordic electricity market has fallen in recent years. Whereas in 2015 the average difference between Finland and the Nordic System Price in the day-ahead market was as high as EUR 8.68/MWh, it was just EUR 2.81/MWh in 2018. The price difference between Finland and Estonia has decreased fairly steadily in 2012–2018 and was just EUR 0.27/MWh in 2018. Table 10 shows the price differences between Finland, its neighbouring bidding zones and the Nordic System Price.

26 For more information, see ENTSO-E ten years network development plan 2018, <https://tyndp.entsoe.eu/tyndp2018/projects/projects/111#cba-results>

27 <https://tem.fi/documents/1410877/2132100/S%C3%A4hk%C3%B6ntuotannon+skenaariolaskelmat+vuoteen+2050+%E2%80%93selvitys+22.2.2019/8d83651e-9f66-07e5-4755-a2cb70585262/S%C3%A4hk%C3%B6ntuotannon+skenaariolaskelmat+vuoteen+2050+%E2%80%93selvitys+22.2.2019.pdf>

Table 10. Yearly average price difference between Finland (FI), Sweden (bidding areas SE1 and SE3), Estonia (EE) and Nordic System Price in EUR/MWh in 2012–2018. Source: Calculated from the market data by Nordpool.

Price difference in EUR/MWh				
Year	SE1-FI	SE3-FI	EE-FI	SYS-FI
2018	-2.57	-2.26	0.27	-2.81
2017	-2.35	-1.95	0.01	-3.78
2016	-3.5	-3.21	0.61	-5.54
2015	-8.5	-7.66	1.42	-8.68
2014	-4.6	-4.4	1.59	-6.41
2013	-1.97	-1.71	1.98	-3.06
2012	-4.92	-4.32	2.56	-5.44

The total installed renewable generation capacity equals approximately 7,900 MW in Finland, so the share of nominal transmission capacity to the neighbouring EU countries is 47 % of the installed renewable generation.

Altogether, the additional indicators accompanying the interconnection target show that Finland is already very close to or above the targeted levels and above the target levels after 2025 when the new interconnector between Finland and Sweden and Olkiluoto 3 nuclear power plant have been commissioned.

2.4.2 Energy transmission infrastructure

i. Key electricity and gas transmission infrastructure projects, and, where relevant, modernisation projects, that are necessary for the achievement of objectives and targets under the five dimensions of the Energy Union Strategy

ii. Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)

In addition to the 800 MW interconnection between Finland and Sweden described in Chapter 2.4.1 above, the most important projects concerning the domestic electricity transmission infrastructure are listed in Table 11.

The Ministry of Economic Affairs and Employment grants permits to grid owners to build cross-border electricity interconnectors based on the network operators' applications. The Finnish Government has long been of the view that there should be no increase in dependency on third countries for electricity imports. Thus, in the foreseeable future there will be no increases in capacity to third countries.

Table 11. The most important electricity infrastructure projects²⁸

Transmission line/corridor	Project status	Project description
Hikiä-Orimattila	Under construction Expected in operation 2019	New 400 kV AC single circuit overhead line of 70 km between substations Hikiä and Orimattila.
North-South reinforcements P1 stage 2	Planned/Under consideration Seeking permission Expected in operation 2022	New 400 kV AC single circuit overhead line of 300 km between Pyhänselkä and Petäjavesi. The line will be series compensated. Built to increase the north-south transmission capacity thus enabling the integration of new renewable, new connection to Sweden and conventional generation and RES in northern Finland and to compensate the dismantling of obsolete existing 220 kV lines.
Keminmaa-Pyhänselkä	Planned/Under consideration Seeking permission Expected in operation 2024	This transmission line is part of the third 400 kV AC connection between Finland and Sweden. The project will deliver an 800 MW increase in transmission capacity.

In October 2016, Finnish Baltic Connector Oy and Estonian Elering AS made a decision to invest in the construction of the Balticconnector gas pipeline connection between Finland and Estonia. The Balticconnector gas pipeline will enter commercial service on 1 January 2020. The new gas pipeline connection is needed to open up Finland's gas market and to create an interconnected gas market of Finland and the Baltic states.

²⁸ Nordic Grid Development Plan 2017, page 9
<https://energinet.dk/-/media/10ACA6E691D94E0ABC600C0B07216E7E.pdf>

2.4.3 Market integration

- i. National objectives related to other aspects of the internal energy market such as increasing system flexibility, in particular related to the promotion of competitively determined electricity prices in line with relevant sectoral laws, market integration and coupling, aimed at increasing the tradable capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, and real-time price signals, including a timeframe for when the objectives shall be met**
- ii. Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets including a timeframe for when the objectives are to be met**
- iii. Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters**

Electricity

Well-functioning regional and European electricity markets and sufficiently strong cross-border connections are the most efficient and cost-effective way of guaranteeing competitive electricity prices and security of supply. The objective in accordance with the National Energy and Climate Strategy is therefore to develop Finland's electricity market as part of the regional electricity markets of the Nordic countries and the Baltic states, and more widely as part of the internal electricity market in Europe. A European-wide electricity market with a common set of rules is the best way of reaching competitive electricity prices, security of supply and given incentives for flexibility in the electricity system.

The Nordic electricity markets are characterised by the substantial share of hydro capacity accompanied by CHP and other thermal units, and a growing share of wind power generation. The electricity generation portfolios of the Nordic countries complement each other. The dynamics of the electricity market are affected by the new transmission capacity from Norway to Central Europe and the UK. SKM

Predictor has estimated that the new connections will increase electricity exports to Central Europe and subsequently raise the Nordic system price by EUR 3.5 /MWh in the mid-2020s²⁹. The effect of price fluctuation in the Central European market will also be more strongly transmitted to the Finnish electricity market.

Regarding the wholesale market, the electricity market is already coupled to the Baltic market. The transmission capacity between Finland and Estonia (EstLink 1 & 2) is currently 1,000 MW. The installed net capacity of the Estonian electricity system was less than 3,000 MW in 2018³⁰, so the connection can be deemed very strong. Price levels in the Estonian and Finnish wholesale markets have greatly converged in recent years (see Chapter 2.4.1). The Baltic states already represent an integral part of the Nordic electricity market.

The Nordic electricity market will be further integrated with the Central European market in coming years when the new Nordlink (NO2-DE) and North Sea Link (NO2-UK) connections are finalised in early 2020s. Higher connection capacity with Central Europe and the increasing share of intermittent renewable energy, particularly wind energy, requires strengthening the interconnector capacity also within the Nordic market area. The increased level of market integration with Central Europe is estimated to contribute to higher price volatility during the winter months in Finland, given the high prices of fuels and emissions allowances.

Gas

Construction of the Balticconnector gas pipeline between Finland and Estonia will enable the opening and renewal of the gas market. When this investment is completed, the derogation from the Internal Market in Article 49(1) of the Natural Gas Directive will be dropped and the gas market will be fully open to competition from the beginning of 2020. Under the new Natural Gas Market Act (maakaasumarkkinalaki 587/2017)³¹, price regulation of piped gas will be dropped,

29 Sähköntuotannon skenaariolaskelmat vuoteen 2050. SKM Market Predictor AS, 2018. <https://tem.fi/documents/1410877/2132100/S%C3%A4hk%C3%B6ntuotannon+skenaariolaskelmat+vuoteen+2050+%E2%80%93selvitys+22.2.2019/8d83651e-9f66-07e5-4755-a2cb7058-5262/S%C3%A4hk%C3%B6ntuotannon+skenaariolaskelmat+vuoteen+2050+%E2%80%93selvitys+22.2.2019.pdf>

30 https://elering.ee/sites/default/files/public/Infokeskus/elering_vka_2018_web_trc_ENG_v4.pdf

31 <http://www.finlex.fi/fi/laki/ajantasa/2017/20170587>

and gas marketplaces and internal market rules will be introduced. On 1 January 2020, Finland will join a common regional gas market area with Estonia and Latvia (FINESTLAT-gas market area). Finland also aims at joining a regional entry-exit system with Estonia and Latvia from 1 January 2022. The final objective is to create a regional gas market comprising Finland and the three Baltic states including also Lithuania. The creation of the regional gas market is being prepared between the ministries, the national regulatory authorities and gas network operators in Finland, Estonia, Latvia and Lithuania.

iv. National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of the energy system with regard to renewable energy production, including a timeframe for when the objectives are to be met

Finland will define the national target for the security of supply related to the adequacy of electric power when the methodology concerning the definition has been approved in the EU. At the moment, the target related to the adequacy of electric power has been defined indirectly through the size of power reserve described in Chapter 2.3.

v. Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail energy sector

Finland does not have quantitative objectives for the protection of energy consumers and to improve the competitiveness of the energy retail market.

The requirements related to consumer protection have been included in the Electricity Market Act (sähkömarkkinalaki 588/2013) and the new Natural Gas Market Act (587/2017) currently in force³². On 1 February 2019, an amendment came into force regarding a centralised information exchange database called Datahub, which will provide each party in the electricity market with all relevant information on electricity trading. Datahub will enable even more efficient and consistent transfer of data, which will be essential in the future electricity

32 <http://www.finlex.fi/fi/laki/ajantasa/2013/20130588>; <http://www.finlex.fi/fi/laki/ajantasa/2017/20170587>

retail market. This kind of common platform is also vital to developing other opportunities, such as services for enabling significantly better demand flexibility even at an individual consumer level. The project has already started and is expected to be completed in 2022.

2.4.4 Energy poverty

i. Where applicable, national objectives with regard to energy poverty including a timeframe for when the objectives are to be met

One possible definition of energy poverty is that it means difficulty in maintaining or satisfying basic needs due to high energy costs. There is not a significant number of households in Finland that would suffer from energy poverty. This is why Finland does not have national objectives related to energy poverty as mentioned in Article 3.3 (d) of the Governance Regulation. In Finland, energy poverty is in current practice discussed as part of general social policy, which secures the right of all citizens to basic necessities such as energy.

In relation to point 3.3 (d) of the Governance Regulation, Finland has made three studies concerning energy poverty, in 2013, 2015 and 2018.

The first study, *Selvitys energiaköyhyydestä - Kotitalouksien energiakustannukset*³³, examines the importance of energy poverty in Finland. The report defines the concept of energy poverty and identifies to what extent and what kind of households can be affected by energy poverty. In addition, the report assesses how to respond to the challenges posed by energy poverty and how to respond to them most appropriately. According to the study, energy poverty affects a small proportion of households in Finland as part of poverty otherwise. The group at risk of energy poverty is primarily low-income households living in large non-energy-efficient dwellings outside urban areas. The report contains suggestions and recommendations for action to prevent and resolve the energy poverty problem.

33 *Selvitys energiaköyhyydestä - kotitalouksien energiakustannukset* (Energy Poverty Survey). Ympäristöministeriön raportteja 21, 2013. https://julkaisut.valtioneuvosto.fi/bitstream/handle/10138/41424/YMra21_2013_Selvitys_energiakoyhydesta_FINAL.pdf?sequence=2&isAllowed=y

The study in 2015, *Pienituloisen omistusasujan energiaköyhyys*³⁴, is a follow-up to the Energy Poverty Survey in 2013. This study, which combines energy poverty with questions on improving energy efficiency in housing, examines the relationship between changes in housing improvements and the way in which the heating system is changed to the risk of energy poverty. In this study, energy poverty means difficulty in maintaining or satisfying basic needs due to energy costs. The review of the survey is limited to owner-occupied dwellings. According to the survey, there are 60,000 to 100,000 households in Finland living in owner-occupied housing included in groups at risk of suffering from energy poverty (but not suffering from energy poverty at the moment). In Finland, however, energy poverty is still rare, as social security mitigates its effects. The risk of energy poverty can be reduced and energy poverty can best be prevented by developing new types of financing. Particularly interesting are the financial instruments in which investment costs are paid by generating energy cost savings and state-guaranteed loans.

The latest study, *ASSIST - Support Network for Household Energy Saving*, in 2018 has been conducted by VaasaETT as a part of the ASSIST 2GETHER –project.³⁵

According to the ASSIST-report, at present, there is already a very comprehensive social support system designed to guarantee a minimum income for all in Finland. Although there are no subsidies specifically targeted at energy poverty, subsidies that reduce housing expenditure or are targeted at meeting basic needs such as energy costs can be considered an aid to mitigate energy poverty. These subsidies include, for example, housing allowance and social support. In addition to these direct subsidies, tax credit for household expenses is also an aid to reduce energy poverty.

In Finland, the consumer is protected by the obligation imposed on energy companies to limit disconnection of the electricity supply, especially in winter. Due to unpaid bills, electricity distribution can usually be disconnected five weeks after the customer has been reminded. During the winter months (October to April), the

34 *Pienituloisen omistusasujan energiaköyhyys* (Energy poverty of a resident's owner with low-income). *Energiaköyhyyden jatkoselvitys liittyen asuntojen lämmitysremontteihin ja energiakuluihin*. Ympäristöministeriön raportteja 6, 2015.

http://julkaisut.valtioneuvosto.fi/bitstream/handle/10138/153653/YMra_6_2015.pdf?sequence=1&isAllowed=y

35 <https://www.assist2gether.eu/>

electricity supply will not be disconnected for non-payment until four months have elapsed since the due date of the payment where the home is a permanent one in which heating is dependent on electricity.

Information management aimed at improving households' energy efficiency is provided by many organisations in Finland. Energy advice to consumers is under the responsibility of the Ministry of Economic Affairs and Employment and under the auspices of the Energy Agency. The sustainable development company Motiva Ltd promotes and supports the work of regional energy advisers.

2.5 Dimension research, innovation and competitiveness

i. National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union including, where appropriate, a timeframe for when the objectives are to be met

ii. Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives including long-term targets (2050) for the deployment of low-carbon technologies, including for decarbonising energy- and carbon-intensive industrial sectors and, where applicable, for related carbon transport and storage infrastructure

iii. Where applicable, National objectives with regard to competitiveness

Finland makes major investments in developing new technologies and commercialising innovations. In recent years, Finland has invested in research and innovations much above EU and OECD averages measured in % of GDP. The Finnish Research and Innovation Council has set a target for Finland to be the most attractive and most competent environment for innovations and experiments by 2030. Finland has invested heavily in particular to speed up the introduction of clean and smart energy systems and associated products and services, and also more extensively to speed up resource-wise solutions that are based on user

needs and required by communities. For example, the innovation funding agency Business Finland invested approximately EUR 150 million in energy-related projects.

In October 2016, Finland joined the Mission Innovation project launched in connection with the Paris climate summit, in which 20 countries with a leading role in energy use and energy technologies undertook to double their R&D investments in clean energy over five years. The Mission Innovation cooperation will be used to promote the networking of Finnish cleantech companies and research institutes in the field and to create partnerships. For this purpose, the aim is to strengthen a clean energy ecosystem as part of the growth programme (a cooperation network for actors) based on strong public-private partnership. The current National Energy and Climate Strategy states that Finland will continue to make major investments in developing new technologies and commercialising innovations. Full use will be made of international Mission Innovation cooperation. Since the strategy was launched in 2016, several actions have been taken to fulfil the goals of the strategy.

The energy sector is undergoing a massive transformation which involves a huge number of new business opportunities for companies. Constant renewal is expected in the energy sector, which is reflected especially in many system level developments. The transforming energy system will create new business opportunities while changing existing ones. New, more comprehensive service concepts will be created. R&D&I funding is being allocated to the efforts to deal with this transformation and to the development of related new business models. For experimentation and development purposes, cooperation networks (ecosystems) are to be established where the parties produce added value in the form of products, services and information in close interaction, both for each other and for customers outside the ecosystem. Exact programs and R&D&I funding cannot be given for 2030 and beyond. Government planning consists of one year of budget planning and 4 years of action and economy planning.

3 POLICIES AND MEASURES

3.1 Dimension decarbonisation

3.1.1 GHG emissions and removals

i. Policies and measures to achieve the target set under Regulation (EU) 2018/842 as referred in point 2.1.1 and policies and measures to comply with Regulation (EU) 2018/841, covering all key emitting sectors and sectors for the enhancement of removals, with an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement

ii. Where relevant, regional cooperation in this area

iii. Without prejudice to the applicability of state aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

The 2017 Medium-term Climate Change Policy Plan defines policy measures enabling Finland to achieve the emissions reduction obligation in the Effort Sharing Regulation (39% reduction in emissions compared to 2005). The 2030 target level for Finland is going to be around 20.6 Mt CO₂ equivalent. According to the WEM projection, existing policies and measures will lead to an emissions level of approximately 26.4 CO₂ equivalent in 2030, leaving a gap of about 6 Mt CO₂

equivalent between the WEM projection and the target in 2030³⁶. If full advantage is taken of one-off flexibility, the gap will be about 5 Mt CO₂ equivalent. With the measures of the Medium-term Climate Change Policy Plan, this gap can be covered (see Figure 9). A more detailed description of the measures defined in the Medium-term Climate Change Policy Plan is provided below.

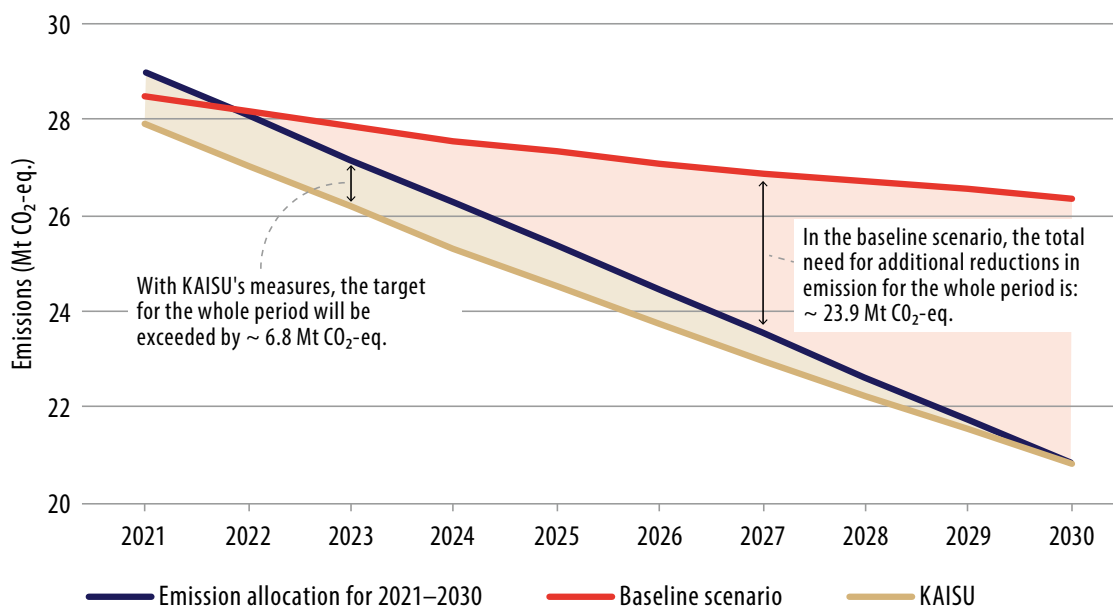


Figure 9. The emission allocation for the period 2021–2030, an estimate of emissions according to the WEM projection (baseline scenario) and with the measures of the Medium-term Climate Change Policy Plan (KAISU). One-off flexibility is not included in the figure.

Transport and spatial planning in urban areas

In the effort sharing sector, the greatest potential for reducing emissions is in the area of transport. The goal is to reduce transport emissions by at least half by 2030 compared to 2005 levels. Measures will be focused on road transport, which presents the greatest potential for emission savings. Additional measures in the transport sector are estimated to result in a reduction of approximately 3.1 Mt CO₂ equivalent by 2030. The emission reduction measures can be grouped into three sets:

³⁶ The climate and energy objectives of the Programme of Prime Minister Sanna Marin's Government in office since December 2019 are not yet implemented into national plans, or policies and measures.

1. Replacing fossil fuels with renewable and low-emission fuels and power sources.

The emissions reduction in this set is estimated at about 1.6 Mt CO₂ equivalent.

The main measure is a quota obligation of biofuels, see Chapter 3.1.2. Other measures included in this set are the promotion of the transport infrastructure and the infrastructure for biogas use in transport. An appropriation of EUR 3 million per year is reserved in the Government budget for 2018–2021 to promote the infrastructure for electric vehicles and use of biogas in transportation, and in addition an appropriation of EUR 1.5 million is reserved to promote the infrastructure for electric vehicles in residence houses.

According to the existing Governmental Programme, the promotion of alternative fuels in transport will be promoted by continuing and raising the subsidy for building charging infrastructure and including sustainably produced biogas in the scope of distribution obligation. An obligation will be set for petrol station chains to provide a certain number of charging points for electric cars. In addition, the purchase subsidy for electric cars will be assessed and a national obligation will be set in accordance with the Energy Performance of Buildings Directive to build a charging infrastructure for electric cars whenever a large-scale renovation is completed in a housing company or on business premises.

In addition, the aim is to intensify cooperation between the Nordic countries to reduce transport emissions, for example, by developing a shared set of target indicators relating to different emissions reduction measures in transport in the Nordic countries.

2. Improving the energy efficiency of vehicles and other means of transport.

The emission reduction in this set is estimated at about 1.1 Mt CO₂ equivalent.

The main measure in this category is the binding CO₂ threshold values applicable to automotive manufacturers at the EU level. The main measures at the national level are support for buying fully electric cars (EUR 2,000) and support for gas or ethanol conversions of old cars (EUR 1,000 for gas and EUR 200 for ethanol conversions). An appropriation of EUR 6 million per year is reserved in the Government budget for 2018–2021 for this purpose.

In 2018, there was an eight-month scrapping premium campaign, too. In this campaign the buyer of a new car who scraps an old car was offered support from central government to the amount of EUR 1,000–2,000, depending on the power source of the new car.

The introduction of a low-emission fleet in the public sector will be accelerated in line with EU requirements. Finally, a voluntary Green deal is being developed for car dealers directing them to present low-emission vehicle alternatives to customers.

3. Improving the energy efficiency of the transport system.

The estimated reduction in emissions in this set is approximately 0.4 Mt CO₂ equivalent, including the impact that the development of land use will have on emissions.

Measures included in this set are participation in the coordination of transport and land use in urban regions, and in work concerning transport systems through, for example, agreements on land use, housing and transport (MAL). The aim is to ensure that projects promoting walking, cycling and public transport are prioritised in urban transport planning and project funding. In 2018–2021, an appropriation of

EUR 5.5 million per year has been reserved in the central government budget for the promotion of digitalisation and public transport services in large urban regions and for increasing contractual rail transport services as part of the change in people's mobility habits. In addition to these, jobs and services in growing urban regions are steered towards regional centres, sub-centres and public transport nodes with a high service level, and infill construction and the creation of locations that are beneficial for the community structure and the use of such locations for new construction will be promoted in urban regions.

According to the existing Governmental Programme, a programme for the promotion of walking and cycling will be implemented. In 2020–2022, EUR 41 million will be reserved for the planning work and project promotion related to walking and cycling. In connection with the network development projects, an amount of EUR 10 million of the total funding will be allocated to meet the infrastructure needs of walking and cycling. A climate-based overall increase of EUR 20 million a year will be provided for public transport subsidies and purchases. Legislation will be introduced enabling the introduction of traffic congestion charging in city regions, with the aim of managing traffic.

The amount of rail investment will be increased from the current level. Besides direct financing from the budget, separate funding will be provided for different projects (for example, the main railway line and its extensions, the railway line west from Helsinki (including the Espoo urban railway), the railway line east from Helsinki). However, progress in large-scale rail projects calls for agreement between the central government, municipalities and other possible beneficiaries regarding project implementation and financing.

Finally, a reform of taxes and payments in sustainable transport will be initiated to reduce emissions. Taxation of fossil fuels will be increased by EUR 250 million over the electoral term in line with the forecast rise in consumer prices. Changes in income taxation and benefits will be made in order to take into consideration the impact on low-income individuals.

Beside these measures, the Government Programme lines, that a roadmap for fossil-free transport will be drafted in this Governmental period. The roadmap will present the measures to halve GHG emissions from national transport by 2030 and to net-zero transport emissions by 2045. The roadmap identifies both the most important measures to remove GHG in the mid- and long term as well as the costs and assessments of impacts. As part of the work, the introduction of traffic congestion charging and the development of an emissions trading system for transport will be assessed. The roadmap will be finished at autumn 2020.

Building-specific heating

Greenhouse gas emissions from building-specific heating are included in the effort sharing sector. The majority of emissions are caused by oil heating. Emissions from oil heating can be reduced by improving the energy performance of oil-heated buildings, increasing the use of biofuel oil or changing the heating method. As a measure to reduce the emissions from building-specific heating, an act for an obligation to supply light fuel oil used in heating with 10% of bioliquid was passed and entered into force on 1 April 2019. As an example to other actors, central government will phase out oil heating in its premises by 2024 and encourages all public actors to do the same. In addition, the energy efficiency of the existing building stock will be improved and the use of renewable energy will be promoted. Alongside these measures, clean combustion of pellets and chopped wood will be promoted to reduce soot and particle emissions. By 2030, the combined impact of these measures will be approximately 0.2 Mt CO₂ equivalent.

Machinery

Emissions from machinery can be reduced by increasing the energy efficiency of machinery or by switching to alternative fuels or power sources. An act to promote

the use of biofuel in heating, machinery and stationary engines entered into force on 1 April 2019 (laki biopolttoöljyn käytän edistämisestä 418/2019). The act sets an obligation to supply light fuel oil with bio-liquid so that the share of biofuel will increase from 3 % in 2021 towards 10 % in 2028. In addition, the use of biogas in machinery will be promoted, contributions will be made at the EU level to the development of CO₂ regulation applied to machinery, energy-efficient and low-emission machinery will be promoted through public procurements, and guidance through information will be used to promote energy-efficient use of machinery.

Alongside these measures, the knowledge base related to the reduction in CO₂ emissions from machinery will be strengthened and the taxation of heating fuels has been increased; light fuel oil for heating is also used in machinery. In October 2019, a voluntary Green deal on machinery was agreed upon between the Ministry of the Environment and the Association of Finnish Technical Traders. The deal promotes a reduction in emissions from machinery. The emission reduction achieved using these measures by 2030 is estimated at approximately 0.5 Mt CO₂ equivalent.

Industrial oil use

The measures for reducing emissions from industrial oil use are the obligation to supply light fuel oil with 10 % bio liquid, promoting the replacement of fuel oil-fired boilers by boilers fired with solid fuel, enhancing energy audit activities and increasing the taxation of heating fuels.

Energy taxes

Energy taxation is aimed at mitigating climate change. In the past few years, the emphasis on the taxation of liquid fuels has shifted towards carbon dioxide tax. The heat values and carbon dioxide emissions of bio-based fuels are lower than those of fossil fuels and a tax consisting of an energy content tax and a carbon dioxide tax helps to ensure that taxation on biofuels is lower than that on fossil fuels.

The excise duty on fuels, or the fuel tax, consists of an energy content tax and a carbon dioxide tax. The energy content tax is based on the heat value of the fuel and the carbon dioxide tax on its specific carbon dioxide emission when burnt. A

strategic stockpile fee is collected on both fossil and bio-based transport fuels in connection with the excise duty.

Energy taxation is described in more detail in the IEA's In-depth-review of Finland's energy policy³⁷.

Waste management

Emissions from waste management originate from landfilling, composting, digestion and the treatment of wastewater. In addition, waste incineration causes carbon dioxide emissions which have increased due to extended incineration capacity. Alternative policy measures to reduce emissions from waste incineration will be assessed. Furthermore, the implementation of the Government Decree on Landfills will be monitored and followed up.

F-gases

Fluorinated greenhouse gases, or F-gases, are emitted by various appliances that use these industrial gases that are highly harmful to the climate. Existing measures will reduce F-gas emissions efficiently but with a delay. As additional measures to speed up emissions reductions, appliances containing F-gases will be avoided in public-sector procurements, the introduction of alternative technologies will be promoted and the recovery of F-gases will be enhanced by means of training and disseminating information. In addition, alternative technologies suited to local conditions will be explored and demonstrated. By 2030, the combined impact of these measures will be approximately 0.3 Mt CO₂ equivalent.

Agriculture

The current measures in the agricultural sector are mainly related to the implementation of the EU's Common Agricultural Policy (CAP). The Rural Development Programme for Mainland Finland 2014–2020 contains several measures related to the mitigation of and adaptation to climate change: incorporation of slurry into the soil, recycling of nutrients and organic matter,

37 <https://webstore.iea.org/energy-policies-of-iea-countries-finland-2018-review>

environment management of grasslands, catch crops, plant cover in arable land in winter and the use of organic cover for horticulture plants and seed potatoes. An investment subsidy is available for controlled subsurface drainage, for more efficient storage, treatment and use of manure and for investments in energy efficiency and sustainable energy, such as biogas plants. As part of the advisory services in the programme, it is possible to receive advice on energy efficiency and issues related to the mitigation of and adaptation to climate change. National funding was provided between 2016 and 2018 for the three-year project “Making use of agricultural nutrients”, which disseminates information on the funding possibilities related to the recycling of nutrients, promotes new experiments, disseminates research information and identifies and removes bottlenecks in the recycling of nutrients.

The additional measures in the agricultural sector mentioned in the Medium-term Climate Change Plan mainly apply to the mitigation of emissions from organic soils. These measures include growing crops in organic soils for several years with zero tillage, raising the water table through controlled subsurface drainage, the afforestation of organic soils and the promotion of biogas production. Also, the sequestration and storage of carbon in the soil and the implementation of the “4 per 1000” initiative will be promoted through research projects and experiments. By 2030, the reduction in greenhouse gas emissions in the agricultural sector through the above measures will be of the order of 0.5 Mt CO₂ equivalent. Moreover, the promotion of biogas production would reduce the emissions from other industries in the effort sharing sector by a total of some 0.31 Mt CO₂ equivalent by 2030. Measures to reduce greenhouse gas emissions in agriculture would also have an effect on the land use sector, in which the abovementioned measures could reduce emissions by approximately 1.15 Mt CO₂ equivalent by 2030.

Land use, land-use change and forestry (LULUCF) sector

Direct aid, fully funded by the EU under the Common Agricultural Policy or CAP, is now associated with agri-environmental requirements, and 30% of direct payments have been linked to greening payments. Farmers must comply with three greening measures on their eligible hectares. Greening payment measures that affect the soil include the requirements of perennial grassland, diversification of cultivation and partly also ecological focus areas. Other measures that fall within the scope of CAP cross-compliance conditions and impact the soil include the prohibition of burning

stubble and the requirement of plant cover in fallow land. A number of research projects related to the carbon sinks and stocks of agricultural land and the impact of these measures are currently under way. The impacts of the greening payments, cross-compliance conditions and environment payments of the EU's Common Agricultural Policy on soil carbon stocks in Finland will be examined.

The Rural Development Programme for Mainland Finland includes also measures, which affect the soil. These measures are mentioned in the paragraph above (Agriculture).

The size of the managed forests sink depends mainly on the forest growth and harvesting rates, resulting from the global demand for e.g. housing and packaging. The objectives of forest use have been reconciled in the National Forest Strategy 2025. Active forest management and use will maintain the forests' health and ability to grow, which is a basic requisite for their capacity to bind carbon. The National Energy and Climate Strategy emphasised the importance of enhancing the implementation of the National Forest Strategy, especially maintaining good forest health and strengthening the growth and carbon capture capacity of the forests in the long term. The projects implementing the National Forest Strategy has been evaluated and updated during 2018.

A significant source of emissions in the land use sector is the clearance of forest for other land use purposes mainly as a result of civil engineering, construction and clearing land for cultivation. Finland is the most forested country in the EU and estimates indicate that the potential for reforestation is limited.

A climate programme for the land use sector will be drawn according to the Government Programme. The Finnish Government is already preparing a wide range of additional measures in the land sector to reduce emissions and to enhance removal by sinks. This involves developing guidance instruments and incentives for maintaining and strengthening carbon sinks and storage of forests and soil, safeguarding the management, growth capacity and health of forests, preventing land use change and maintaining and managing growth conditions in agricultural soils. The measures include, for example, promoting continuous plant cover and cultivation techniques to sequester carbon or reduce emissions, implementing a pilot for carbon sequestration and storage markets, promoting the use of diverse forestry and forest management methods, and mitigating deforestation to

settlements and to cultivation through various means. Due to the early stage of the plan, the impact of such additional measures on the forest land sink cannot yet be estimated. Finland will supplement information on measures and their expected impacts in the future reporting as the information becomes available.

Public financing for private forest owners, around EUR 50–60 million annually, is based on the Act on the Financing of Sustainable Forestry (34/2015), which states the general objectives of forestry financing: increase the growth of forests, maintain road networks for forestry purposes, secure forest biodiversity and promote the adaptation of forests to climate change. Nature management in commercial forests is promoted through environmental support and forest nature management projects. Private forest owners themselves invested EUR 223 million in 2015 for forest management and improvement work.

The impact of the measures on compliance with the LULUCF Regulation needs to be assessed by land use category. The net emission/sink of afforestation and deforestation are calculated in absolute values. The net emission/sink of cropland, grassland, and wetland are compared with the average emission/sink of the period 2005–2009. For the managed forest land category, Member States calculate a Forest Reference Level (FRL), against which the net removals or accounted emissions from managed forest land are accounted. The FRL consists of a projection of the managed forest land sink assuming that the forest management practices of the reference period (2000–2009) are continued during the compliance period (2021–2025). The proposed FRL for managed forest land for the period 2021–2025, as detailed in the revised NFAP submission, is -21.16 Mt CO₂ equivalent without harvested wood products (HWP) and -27.64 Mt CO₂ equivalent with HWP. Due to a cap on accounted net emissions, Finland can benefit only up to 25 Mt CO₂ equivalent during 2021–2030 if the net removals exceed the FRL. If the net removals are lower than the FRL, Finland can use forest flexibility up to 44 Mt CO₂ equivalent during 2021–2030, but cannot compensate the emissions from other land use categories. On top of forest flexibility, Finland is permitted to use an additional 10 Mt CO₂ equivalent country-specific flexibility. The most recent long-term scenarios suggest that it could be possible for Finland to comply with the no debit requirement of the LULUCF regulation, but there are several uncertainties regarding the estimates (see also section 4.2.1).

3.1.2 Renewable energy

i. Policies and measures to achieve the national contribution to the binding 2030 Union target for renewable energy and trajectories as referred to in point (a)(2) Article 4, and, where applicable or available, the elements referred to in point 2.1.2, including sector- and technology-specific measures

Production aid for electricity from renewable energy sources

The sliding feed-in tariff system for the production of electricity from renewable energy sources came into force in Finland on 25 March 2011. The aid scheme concerns government support for electricity production based on wind power, biogas and small-scale CHP (wood fuels). The aid scheme has been phased out: It was closed for new power plants from 1 November 2017 for wind power and for biogas and small-scale CHP plants from 1 January 2019. However, the plants under the scheme will receive the aid up to 12 years from the start of production.

In May 2018, Parliament approved the Act on the Amendment of the Act on Production Aid for Electricity from Renewable Energy Sources (laki uusiutuville energialähteillä tuotetun sähkön tuotantotuesta annetun lain muuttamisesta 441/2018), which lays down provisions on the new premium system. The premium system is based on a competitive tendering process and investments in different renewable energy sources compete with each other so as to take into account the cost-effectiveness target. An auction was held in 2018 and decisions were made in March 2019. The aid was granted for seven projects within total of 1.36 TWh/a worth of annual electricity production. All of the projects concerned wind power. The power plants are expected to start production from 2021 onwards.

Under the Energy and Climate Strategy, no new operating aid schemes will be introduced or auctions held.

Aid for the use of forest chips

Finland promotes the use of forest chips in combined heat and power generation (CPH) with operating aid for electricity from forest chips. The aid is granted to compensate for the higher production costs of electricity from forest chips compared to fossil fuels. The maximum aid for electricity produced from forest

chips has been EUR 18/ MWh. However, the aid depends on the price of the emissions allowance and has thus been in decline since the beginning of 2018. When the price of the EU ETS is above EUR 23.7/CO₂ tonne, no aid is paid, which has recently been the case. At the beginning of 2019, 53 power plants were within the scope of the aid. New power plants can be approved to the scheme until 1 February 2021 and the aid is paid for up to 12 years from the start of production.

Energy Aid Scheme

Renewable energy is also promoted through the Energy Aid Scheme (investment subsidy). Aid is primarily targeted at the commercialisation of new technologies and to the non-ETS sector, including plants producing advanced biofuels for transport, and non-ETS electricity and heat production of companies. Aid is paid up to 30% for mature technologies and up to 40% for new technology projects. However, aid levels are typically much lower, especially for mature technologies. The objective is that aid for different technologies will be phased out as a technology develops, the costs are reduced and competitiveness improves. The typical annual budget has been EUR 30–40 million and this trend is expected to continue in future. However, decisions concerning the state budget are made annually. Since the start of 2019, there has been a separate budget (2019: +EUR 40 million) allocated for large demonstration projects. A similar additional budget has been proposed for 2020. In addition, an aid scheme totalling EUR 90 million has been planned for the early phase out of coal use in energy production. If approved, the aid scheme will be in force 2021–2023.

Promotion of the use of biofuels

The Act on Promoting the Use of Biofuels in Transport (laki biopolttoaineiden käytön edistämisestä liikenteessä 446/2007) has been in force since 2008. Under the Act, the share of the energy content of biofuels in the total energy content of the petrol, diesel oil and biofuels delivered by distributors for consumption (i.e. quota obligation) will steadily increase to 20% by 2020, taking into consideration the double counting rule. The biofuels included in the quota obligation must meet EU sustainability criteria.

By 2030, the share of biofuels in road transport will be increased from a physical share of about 13.5% of energy content by 2020, as required under current

legislation on the biofuels quota obligation, to 30%. An act for increasing the quota obligation came into force on 1 April 2019.

Furthermore, the quota obligation has been extended to apply to light fuel oil used in heating and machinery so that the share of bioliquids must be at least 10% by 2028.

Energy taxation

Renewable energy is also promoted through taxation. While, renewable fuels are not taxed on heat production, fossil fuels are taxed according to their energy content as well as CO₂ content. Energy taxation provides an incentive for the use of bioenergy in CHP production and building-specific heat production.

In 2015, a legislative change reducing the taxation of small-scale electricity production entered into force. Electricity production plants with a nominal output below 100 kVA and plants larger than that but with an annual production of at most 800,000 kWh were exempted from the obligation to pay electricity tax. These producers may themselves use at the site tax-free the electricity they have generated. If the electricity produced is distributed through the electricity network, the system operator distributing the electricity for consumption will collect the electricity tax on it.

Transport

The measures in transport have been listed above (Promotion of the use of biofuels) and in Chapter 3.1.1 under the heading 1) "Replacing fossil fuels with renewable and low-emission fuels and power sources".

Energy advisory services

The funding allocated to energy advisory services is directed to regional activities (promoting energy efficiency and the use of renewable energy in counties) and communication about demand-side response to consumers. The target groups in the counties are companies, local authorities and citizens. The advisory services implemented in the counties include the promotion of energy efficiency agreements and energy audits, the promotion of municipal renewable energy

audits in municipalities and companies, energy advisory services for consumers and also support for the strategic promotion of work related to energy and climate issues

ii. Where relevant, specific measures for regional cooperation, as well as, as an option, the estimated excess production of energy from renewable sources which could be transferred to other Member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

Finland has not concluded any agreements on statistical transfers, joint projects or joint aid schemes with other countries for the coming years.

iii. Specific measures on financial support, where applicable including Union support and the use of Union funds, for the promotion of the production and use of energy from renewable sources in electricity, heating and cooling, and transport

See Section 3.1.2.i.

iv. Where applicable, the assessment of the support for electricity from renewable sources that Member States are to carry out pursuant to Article 6(4) of Directive (EU) 2018/...

Finland has not planned new aid schemes for electricity from renewable energy sources nor are there any plans to revise the old aid schemes. Decisions concerning the operating aid for forest chips (explained in Chapter 3.1.2) will be made in 2020.

v. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of power purchase agreements.

Under Article 16 of REDII, the Member States shall set up or designate one or more contact points to guide through and facilitate the administrative permit application and granting process. In addition, the directive requires streamlining administrative procedures. Finland has not yet implemented the abovementioned Article into national law.

The abovementioned directive includes provisions concerning information and training as well as facilitating the uptake of power purchase agreements. There is already a number of measures implemented after RED I that are still in place. These measures are to be revised and if needed, new measures will be implemented. The uptake of power purchase agreements has increased recently especially concerning new wind power projects. However, during the implementation of RED II, it will be assessed whether there is a need for additional measures.

Summary of the policies and measures under the enabling framework Member States have to put in place pursuant to Article 21(6) and Article 22(5) of Directive (EU) 2018/... to promote and facilitate the development of renewable self-consumption and renewable energy communities

As described in Chapter 3.1.2. the key concepts to promote energy communities have been identified in the work of the Smart Grid Working Group in 2018 set up by the Ministry of Economic Affairs and Employment. Key concepts include energy community within one property, typically an apartment block, energy community crossing property limits and virtual energy community.

The Government has commissioned a study on the unjustified barriers concerning self-consumption and renewable energy communities. The study is expected to be completed by the end of 2019. If unjustified barriers are found, an assessment will be made as to whether they can be removed.

In addition, there is a Rural Development Programme in force described in Section 3.1.2.i.

vi. Assessment of the necessity to build new infrastructure for district heating and cooling produced from renewable sources

A decision to invest in the construction of new district heating or district cooling infrastructure is typically based on demand. In Finland, district heating networks have been built at almost all sites where it is economically viable to do so. Even very small networks have been built to connect, for example, public buildings in small built-up areas. New investments are mainly related to the establishment of entirely new areas. The fuel or energy source used to produce the energy for the district heating or district cooling does not play a key role.

vii. Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation taking into account:

- **biomass availability, including sustainable biomass: both domestic potential and imports from third countries**
- **other biomass uses by other sectors (agriculture and forest-based sectors); as well as measures for the sustainability of biomass production and use**

The use of wood-based fuels in Finland is mainly based on industrial side streams and such energy fractions created in connection with forest management work and felling for which there is no demand in the forest industry processes. The aim is to direct these biomass fractions to power and heat generation and to the manufacture of transport biofuels. In Finland, the use of wood-based fuels as a whole is promoted by the emissions trading system, the operating aid for electricity from forest chips, the taxation of fossil fuels and peat, and the aid schemes encouraging forest management, such as the sustainable forestry aid scheme designed for private forest owners. About one tenth of the raw materials used in the forest industry is imported, so the corresponding proportion of the generation of renewable energy based on industrial side streams is based on imported wood. Imports are not expected to account for a significant share of the total amounts of wood-based fuels in future, either.

The sustainability of the production of biomasses is regulated in REDII. Member States must bring into force the laws, regulations and administrative provisions by 30 June 2021 derived from the directive and Finland has started the implementation process. Finland has legislation and monitoring systems in place to minimise the risk of unsustainable forest biomass production. The most important law ensuring the sustainability of forest management in Finland is the Forest Act. The requirements concerning legality of harvesting operations (i) and forest regeneration of harvested areas (ii) are included in the Forest Act. Other relevant acts are the Forest Damages Prevention Act, The Timber Measurement Act and The Act on the Placing on the Market of Timber and Timber Products, which implements EU Timber Regulation No 995/2010 in Finland. Concerning the objectives to minimise negative impacts on biodiversity and soil (iv) and protection of forests (iii), also environmental legislation has a key role. Roughly 2.7 million

hectares of forests are protected or under restricted use, which is 12% of the total forest area in Finland. The sustainability of forest management is assessed and monitored on the basis of Pan-European Criteria and Indicators for Sustainable Forest Management. The National Forest Inventory (NFI), the monitoring system for forests and forest resources, produces diverse information on Finnish forests. NFI results are widely used in assessing the sustainability of forest management.

In agriculture, the potential in energy production lies especially in utilising biomass-based side streams of agriculture for CHP generation, as transport fuel and in solar electricity. The majority of the biogas potential is associated with farming. There has been wide interest in increasing biogas production on farms or from agricultural biomasses for some time. While farms have plenty of biomasses suitable for biogas production, these biomasses have so far only been utilised to a minor extent. The reason for this is that yield/cost analyses have been unable to identify adequate numbers of cost-effective applications. In addition, profitable concepts for costly plants have been hard to find. Achieving profitability is particularly difficult if costs are incurred for the raw material. Typically, biogas production on farms has advantages that are not directly associated with energy economy, including more efficient nutrient recycling, cutting greenhouse gas emissions, improved hygiene and reduced odour nuisances. Circular economy-related benefits are often in a key role.

The Government during 2015–2019 funded more than 70 research and development projects during the last four years to promote biomass nutrient recycling enhancing actions of SMEs and research institutes as well as communicate and inform about the benefits of nutrient recycling and importance of bio-waste separation and food waste reduction. The Government of Prime Minister Sanna Marin has decided to prepare a national biogas programme to improve Finland's vitality and to achieve Finland's climate targets.

3.1.3 Other elements of the dimension

i. Where applicable, national policies and measures affecting the EU ETS sector and assessment of the complementarity and impacts on the EU ETS

ii. Policies and measures to achieve other national targets, where applicable

iii. Policies and measures to achieve low-emission mobility (including electrification of transport)

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

Activities related to technology-neutral support for electricity production and energy taxation are described in Chapter 3.1.2 above. In addition, the Energy and Climate Strategy for 2030 (2016) already outlined that Finland will phase out the use of coal for energy by 2030. No new power plants burning hard or brown coal will be built, nor will any replacement investments based on coal be made. Once the existing plants based on pulverised fuel combustion have been decommissioned, coal will only be used as a backup fuel in exceptional situations.

On 1 April 2019, the Government passed an act banning the use of coal in energy production as of 1 May 2029. The ban will reduce the use of coal by an estimated 3 TWh compared to market-based development without the ban. A special incentive package to support replacement investments is under preparation for those district heating companies in towns and cities that undertake to give up the use of coal by as early as 2025.

The measures in transport have been listed in the Chapter 3.1.1 under the headings 2) "Improving the energy efficiency of vehicles and other means of transport" and 3) "Improving the energy efficiency of the transport system".

The main aid schemes concerning renewable energy in Finland have been the operating aid scheme and energy aid scheme. The operating aid scheme consists of a feed-in tariff for renewable electricity, aid for the use of forest chips and premium system, which have been explained in more detail in Chapter 3.1.2. The feed-in tariff scheme concerning wind power, biogas and small-scale CHP has been phased out and no new power plants are accepted to the scheme. Aid for the use of forest chips has not been paid since December 2018 due to the current level of EU ETS prices. No decisions on continuation of aid for the use of forest chips after 2021 have been made. In the premium system, there has only been one auction round and

according to the current plan, there will be no new auction rounds. All power plants within the abovementioned schemes may receive aid for up to 12 years.

There are no plans to phase out the energy aid scheme. However, according to the national Energy- and Climate Strategy as well as the Government Programme, the focus is more on new energy technology projects. Therefore, while the budget for the scheme is estimated to stay at the same level or even increase, the aid for mature technologies will be reduced.

Energy subsidies that are considered environmentally harmful are reported in Table 12. The assessment of environmentally harmful subsidies is based on the evaluation tool developed by the OECD and previous Finnish studies on the subject. The vast majority of environmentally harmful energy subsidies are tax expenditure items targeted at lowering the cost of energy consumption in industry, transport and agriculture sectors. The benchmarks depend each time on the tax expenditure concerned and are not fully comparable with each other. The two largest environmentally harmful subsidies are the reduced electricity tax rate for industry, data centres and greenhouses, which is usually considered together with the energy tax refunds for energy-intensive enterprises, and the reduced energy tax rate for gas fuel used in transport mobile machinery. The figures are based on actual data or estimates for 2018, up-to-date budget data or estimates for 2019 and budget proposal data estimates for 2020.

Most of the environmentally harmful energy tax expenditure items remain almost constant over the period because there are no tax rule changes affecting them. An exception to this general trend is the amount of energy tax refunds for agriculture, which shrinks from 2018 to 2020, because the tax refund increases decided for 2018–2019 do not continue to 2020. The compensation subsidy for the indirect costs of emission trading is expected to grow somewhat markedly with the rising market price of emission allowances.

Table 12. Environmentally harmful energy subsidies 2018–2020 [mill. euro].

	2018	Budget 2019	Budget proposal 2020
Energy tax refunds for energy-intensive enterprises	222	225	235
Reduced electricity tax rate for industry, data centres and greenhouses	625	630	633
Reduced energy tax rate for peat	180	194	196
Compensation subsidy for indirect costs of emission trading	27	30	78
Reduced energy tax rate for diesel used in transport	422	419	389
Reduced energy tax rate for gas oil used in transport mobile machinery	464	456	451
Energy tax refunds for agriculture	62	55	35

There is no established view in Finland on which energy subsidies are considered fossil fuel subsidies. One of the reasons for this is that many of the environmentally harmful energy subsidies mentioned in Table 12 do not make any distinction per se whether the energy consumption is based on fossil energy sources or renewable sources. Many of the environmentally harmful energy subsidies in Table 12 nevertheless fall partially - or in the case of reduced energy tax rate for peat where the aforementioned distinction is made, wholly - upon the consumption of energy that was produced by burning fossil fuels.

In connection with the budget negotiations of the 2020 budget, the Government announced that it intends to launch preparatory work aimed making cuts to environmentally harmful subsidies and redirect the funds released to more productive and sustainable uses. Decisions based on this preparatory work are scheduled for autumn 2020. Initially, tax expenditures will be reduced by phasing out the tax reduction for paraffinic diesel.

3.2 Dimension energy efficiency

Planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2, including planned measures

and instruments (also of financial nature) to promote the energy performance of buildings, in particular as regards the following:

i. Energy efficiency obligation schemes and alternative policy measures under Articles 7a and 7b of Directive 2012/27/EU and to be prepared in accordance with Annex II

ii. Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, including policies, measures and actions to stimulate cost-effective deep renovation and policies and actions to target the worst performing segments of the national building stock, in accordance with Article 2a of Directive 2010/31/EU

iii. Description of policy and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models

iv. Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote energy audits and energy management systems, consumer information and training measures, and other measures to promote energy efficiency)

v. Where applicable, a description of policies and measures to promote the role of local energy communities in contributing to the implementation of policies and measures in points i, ii, iii and iv

vi. Description of measures to utilise energy efficiency potentials of gas and electricity infrastructure

vii. Regional cooperation in this area, where applicable

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

The policies and measures for the period 2021–2030 required in the updated Energy Efficiency Directive have been outlined by the extensive energy efficiency working group appointed by the Ministry of Economic Affairs and Employment. The working group started its work in November 2018.

For the implementation of Article 7 of the Energy Efficiency Directive over the period of 2014–2020, Finland has chosen the alternative policy measures described in Section 3.3.2 of the National Energy Efficiency Action Plan (NEEAP) IV²³. Finland will continue with alternative policy measures also over the period of 2021–2030. Planned measures for the implementation of Article 7 are defined in Chapter 2.2.

Voluntary Energy Efficiency Agreements

Energy savings and energy efficiency have been improved through Voluntary Energy Efficiency Agreements drawn up between the Government and industrial/municipal associations already since the 1990s. The current period of the agreement for 2017–2025 plays an important role in the achievement of Finland's cumulative energy saving targets set for the periods 2014–2020 and 2021–2030 in Article 7 of the Energy Efficiency Directive. Finland will continue the Voluntary Energy Efficiency Agreement also after the current period (2017–2025).

The agreements are intended to guide companies and municipalities towards continuous improvement in energy efficiency. The participants set a quantitative target to improve their energy efficiency and they implement actions in order to reach their targets.

The Government grants energy subsidies to support the implementation of new energy-efficient technologies and, case-dependently, the conventional energy efficiency investments and energy audits of the participant municipalities and small companies.

The agreement scheme also supports the implementation of the obligations set out in other articles of the directive and also supports the implementation of the Energy Performance of Buildings Directive (EPBD). Voluntary Energy Efficiency

Agreements cover Industries (Industry, Energy sector and Private Service sector), Property Sector, Municipal Sector, and Oil Sector (Distribution of liquid heating fuels).

The municipalities and companies signing up for the agreement undertake to

- Promote energy efficiency in a goal-oriented and systematic manner, for example, through the deployment of an energy management system,
- Explore the possibilities to save energy by carrying out energy audits,
- Explore the financing solutions (e.g. PPP, EPC and ESCO) and use them as necessary when financing is an obstacle to investing in energy efficiency,
- Train their personnel and inform the personnel about promoting energy efficiency, and
- Monitor their energy consumption and report their consumption and energy savings on an annual basis.

Transport fuel taxation

Energy savings are created as a result of Finland's higher transport fuel taxation (including excise duty, carbon dioxide-based taxes, strategic stockpile fee and value added tax) compared with the EU's minimum requirements for the level of fuels taxes and value added tax.

Road transport

The measures in transport have been listed in Chapter 3.1.1 under the headings 2) "Improving the energy efficiency of vehicles and other means of transport" and 3) "Improving the energy efficiency of the transport system".

Energy audits

Along with the Energy Efficiency Act (energiatehokkuuslaki 1429/2014), which entered into force at the beginning of 2015, energy audits have been divided into a voluntary side involving support and into compulsory four-yearly energy audits

carried out in large companies. Energy aid for energy audit activities is granted to voluntary audits. These include four audit models for service properties, three audit models for industry, two audit models for the energy sector, a municipal renewable energy audit, energy planning for farms, and an energy audit model for transport chains that, with minor adjustments, can be used also as an energy audit model for transport companies (NEEAP IV²³, KETO-3-TEM).

Energy performance of buildings

Finland will adopt an energy subsidy scheme designed especially for housing companies with the goal of supporting improvements in energy efficiency and measures aiming toward smart, flexible energy consumption. The principle of the subsidy scheme is that the assistance will be paid in proportion to the energy efficiency benefits achieved. The projects must be cost-effective and appropriately designed.

Finland will phase out the use of fossil fuel oil in heating by the start of the 2030s. Oil heating will no longer be used in properties owned by central and local governments after 2024. Finland will adopt a separate action plan to encourage properties using oil heating to switch to other forms of heating during the 2020s.

The Land Use and Building Act (132/1999) was amended in 2017 in order to transpose the nearly zero-energy (NZEB) provisions of the Energy Performance of Buildings Directive. The amendment came into force on 1 January 2017.

Minimum requirements for all new buildings are issued in the National Building Code of Finland. The requirements are set out in the Decree of the Ministry of the Environment on the Energy Performance of New Buildings (1010/2017). The requirements came into force on 1 January 2018. The same requirements apply both to private and public buildings. These regulations set the level for NZEB in Finland. The same requirements apply to the renovation of an existing building to a nearly zero-energy building.

Under the Decree, the overall energy consumption (E-value) of a building must not exceed the given limits. The E-value includes energy consumption of the heating, ventilation, domestic hot water, cooling, as well as system auxiliary units, consumer equipment and lighting. The Decree also sets out requirements for heat losses,

summertime temperatures, specific fan power of ventilation and AC as well as for energy consumption metering.

The minimum requirements for existing buildings are set out in the Decree of the Ministry of the Environment on Improving the Energy Efficiency of Buildings in Conjunction with Repair and Modification Work (4/2013). The requirements came into force on 1 June 2013. The Decree has been supplemented with the Decree of the Ministry of the Environment on Amending the Decree of the Ministry of the Environment on Improving the Energy Performance of Buildings Undergoing Renovation or Alteration (2/2017). The requirements must always be fulfilled in the case of repairs and modifications where the improvement of energy efficiency is technically, functionally and financially feasible.

Under Decree 4/2013 of the Ministry of the Environment, compliance with the requirements set for the energy efficiency of renovation projects can be done in three alternative ways. A party engaging in a building project subject to a permit must select one of following alternatives: 1) energy efficiency requirements for each building element, 2) E-value requirements of a building or 3) Energy consumption requirements for a building. In addition to the three previous alternatives, the Decree sets out requirements for the technical systems.

According to the Cost-optimal reports of Finland submitted to the Commission in 2018, the minimum requirements for new buildings and for existing buildings are on a cost-optimal level. The next review will take place in 2022–2023. As regards buildings, the most important current energy efficiency measures are promoting the installation/use of heat pumps in terraced and single-family houses (RA-04-TEM), the energy efficiency agreement on the distribution of heating fuel oil, and the energy efficiency regulations on new buildings, which set out the minimum level of building requirements. See NEEAP IV²³, Section 3.6.1 and RA-no-YM measures.

Promotion of energy efficiency at system level

Energy efficiency has been taken into consideration in the planning of networks and in tariffs and regulations (Electricity Market Act 588/2013).

Maintaining the prerequisites for combined power and heat generation

Efficient cogeneration works in an open energy market and competes with other generation methods. The energy efficiency measures in efficient cogeneration are related to improving the overall efficiency of primary energy use and the overall efficiency of energy production within the scope of energy efficiency agreement activities.

District heating and cooling

Energy efficiency measures in the field of district heating and cooling are related to improving the efficiency of primary energy use, more efficient utilisation of waste heat and the overall efficiency of energy production within the scope of Voluntary Energy Efficiency Agreement activities.

Communication and training to promote energy efficiency

The communication, advisory and training activities related to energy efficiency cover all sectors from consumers to industry. The nationally coordinated Energy advice for consumers and the guidance implemented by energy companies cover all aspects of consumer communications and guidance related to the promotion of energy efficiency and use of renewable energy. Guidance for transport, renovation and partly also for farms is included in the nationally coordinated Energy advice for consumers service.

Energy efficiency in awarding public contracts

In compliance with the Directive, the Energy Efficiency Act (energiatsehokkuuslaki 1429/2014) lays down provisions on the energy efficiency requirements concerning central government authorities with regard to public procurements. Guidelines on the energy efficiency of public procurements, updated by the Ministry of Economic Affairs and Employment in January 2016, have been drawn up for central government authorities and other public administration.

In addition, Motiva Ltd continues to organise annual training events focusing on the energy efficiency requirements of public procurements. The energy efficiency of procurements is also promoted by the Competence Centre for Sustainable and Innovative Public Procurement, established in 2017. The aim of the Competence

Centre is to increase procurements that promote the sustainable development goals from both the social and the environmental perspective.

Energy Aid Scheme

Energy aid (explained in more detail in Chapter 3.1.2.) may be granted also to investments for companies that have signed energy efficiency agreements. For new energy technology projects, aid may be granted also for companies outside the energy efficiency agreements. In addition, energy aid is granted for voluntary energy audits. The total budget for energy efficiency investments has traditionally been EUR 10–20 million of the total Energy Aid Scheme budget.

In addition, energy aid will be used to promote non-ETS investments related to decentralised energy production and renewable fuels in transport.

Regional cooperation

Regional cooperation is carried out with Sweden, Denmark, Norway and Iceland in the networking group on energy efficiency. The group has also worked in cooperation with the Baltic states.

Funding

A comprehensive report on financial solutions related to energy efficiency was compiled in 2017 and 2018. The report sought to identify financial instruments that could be used to improve energy efficiency in Finland. Obtaining financing for good projects is generally not a problem in Finland although the prerequisites for granting financing are today examined more closely. It is essential to provide information on energy efficiency and its benefits so that the macroeconomic aspects can be considered when investments are made. Information must also be available at the right time. The work will be continued in 2019 and beyond with the aim of bringing together actors both from the financial sector and from organisations that implement energy efficiency measures to identify concrete procedures to promote the implementation of energy efficiency measures.

Energy efficiency first principle

Improved energy efficiency throughout the whole energy system, from production and transmission to distribution and end-use, makes a major contribution to the national goals of a competitive low-carbon economy and the security of energy supply.

The future energy system will be flexible and intelligent. In addition to directing energy production, energy consumption may also be managed and coordinated as indicated by the current production situation. Hybrid systems that combine different forms of production will become more widespread. Flexibility of demand will change the role of the consumer. An active consumer will simultaneously consume, produce, save and store energy. Digitalisation and the Industrial Internet will help to improve the efficiency of energy use everywhere. Energy efficiency is a cost-effective way of reducing greenhouse gas emissions and the mentality of the circular economy will further increase the efficient use of resources.

Finland aims to benefit from the “smart and efficient integrated energy system” approach to implement the idea of “energy efficiency first” principle: Combined generation of heat and power, and related district heating and cooling with smart demand response mechanisms improve energy efficiency, help to increase the share of renewables and link heating with electricity to provide flexibility.

Finland has for decades used the potential for aligning energy efficiency and renewable energy policies, linking heating with electricity for flexibility and integrating more renewables in both heating and electricity, and utilising waste heat and waste cold. Bearing in mind the benefits from greater sector coupling through electrification as the energy system decarbonises, the heating/cooling sector is critical and the use of more renewable sources will be encouraged. Taking overall cost-efficiency into account at the whole energy system level from supply to end use of energy will help to facilitate the “energy efficiency first” -principle also in practice.

Energy communities

See Section 3.1.2.i.

Circular economy

In 2016, the Finnish Innovation Fund Sitra published for a first time the Finnish roadmap to a circular economy³⁸ and updated it in 2019. The aim of the Finnish Government and the roadmap is to make Finland a global leader in the circular economy by 2025. The roadmap describes the concrete actions that can accelerate the transition to a competitive circular economy in Finland. The roadmap highlights best practices and pilots that can be easily replicated. It was constructed in close cooperation with government ministries, as well as almost 50 other representatives from the public, private and third sectors.

Finland has recognised that shifting towards the circular economy has many synergies with greenhouse gas emission reduction measures and the potential to make a significant contribution to reaching Finland's energy and climate goals. There is an ongoing research project by the Finnish Environment Institute to better understand the potential quantifiable greenhouse gas emission effects of the circular economy and the most cost-efficient policy measures moving towards the circular economy.

Motiva Ltd, a state owned company which promotes the efficient and sustainable use of energy and materials, has developed external material efficiency audits to provide support to businesses to help them identify and make resource efficiency improvements. Material efficiency is a subsidised programme in which authorised auditors perform the auditing using the audit model. The Government is offering economic incentives for these audits. Motiva Ltd has also developed a Finnish Industrial Symbiosis System (FISS), which is a systematic way to help companies and other organisations to create partnerships and new business opportunities through more efficient use of raw materials, technology, services and energy. Around 650 companies from different sectors and around 5,000 resources are currently involved across Finland.

The Government Programme aims to strengthen the role of Finland as a forerunner of the circular economy. The Programme outlines several key measures to promote the transition towards the circular economy. These measures include

³⁸ Leading the cycle - Finnish roadmap to a circular economy 2016–2025
<https://media.sitra.fi/2017/02/28142644/Selvityksia121.pdf>

the implementation of the strategic circular economy programme and associated indicators. To prepare and implement the programme, EUR 7.2 million have been allocated for 2020–2023. Also, additional funding of EUR 48 million has been granted for 2020–2021 to support innovation and ecosystems in the circular economy.

As a key measure, Finland will also implement the Plastics Roadmap to improve the efficiency of plastics recovery, recycling and product design, creating conditions for investments and innovations in the circular economy and reducing the dependency on fossil raw ingredients by increasing bio-based and biodegradable solutions.

3.3 Dimension energy security

i. Policies and measures related to the elements set out in point 2.3

Point 2.3 not only describes the national objectives with regard to energy security but also includes some of the measures applied to energy security. In energy security, it is not always easy to separate the objectives from the respective measures.

The measures mentioned and described in point 2.3 include:

- The National Emergency Supply Agency holds imported fuels in state-owned reserves to last for an average of five months' normal consumption.
- Of the Nordic countries, Finland has agreements concerning security of supply with Sweden and Norway.

In addition to the measures described in point 2.3, some further measures are listed below.

Electricity

Finnish generation adequacy is affected by the development of regional electricity markets. According to the SKM Market Predictor's report²⁹, the Nordic power

balance will strengthen in the 2020s due to increases in the generation of wind power and nuclear energy. Overall, the supply of electricity is predicted to increase by 70 TWh, while the demand for electricity is estimated to grow by only 45 TWh in the Nordics by 2030. Thus, electricity exports from the Nordics will increase by 2030, particularly to the UK and Germany.

As for ensuring generation adequacy in the light of the renewable energy contribution, including demand response and storage, the Finnish strategic reserve system plays a significant role. The strategic reserve system is open to participation from demand response facilities as well. The power reserve system³⁹ (strategic reserve) ensures security of the electricity supply in Finland in situations in which the market-driven production of electricity does not cover consumption. The system has been in use since the beginning of 2007. Both power plants and facilities capable of demand-side flexibility can participate in the power reserve. The Energy Authority defines the size of the power reserve required in Finland, organises the competitive tendering process for plants to be included in the reserve, confirms the terms of the reserve and monitors the operation of the system and compliance with the law. The total power reserve capacity over the period 1 July 2017 – 30 June 2020 is 729 MW. Thus, the national target for the security of supply related to the adequacy of electric power has been defined indirectly through the size of the power reserve. The National Energy and Climate Strategy outlines that the Government will define the target for the security of electricity supply associated with the adequacy of electric power according to the EU's Electricity Regulation. The target will be defined once the Commission has approved the methodology compliant with the Regulation.

Demand response and storage are further promoted by applying the proposals by the Smart Grid Working Group as discussed in Chapter 3.4.3. These initiatives include the definition of the improved functionalities of next-generation smart meters and the discontinuation of the flexibility implemented by distribution network operators to encourage market-based initiatives. Overall, the proposals by the Smart Grid Working Group highlight the significance of market-based solutions for demand response and storage.

³⁹ The act on the power reserve ensuring balance between generation and consumption of electricity (117/2011). <http://finlex.fi/fi/laki/ajantasa/2011/20110117>

Finland has imposed binding reliability standards on distribution system operators to ensure resilience in electricity distribution networks, especially in severe weather conditions. The Electricity Market Act (588/2013) sets out limits for power outages following extreme weather conditions. Under the Electricity Market Act, distribution networks must be designed and built in a way that the longest permitted interruptions in electricity supply are a maximum of 6 hours in urban areas and a maximum of 36 hours in rural areas. The electricity distribution companies are free to choose the measures they employ to meet these obligations. One possible measure is to replace overhead power lines with underground power cables. These requirements are to be met stepwise by 2028. By the end of 2019, 50% of the distribution network must be within the time limits provided by the Electricity Market Act. Already now a significant decrease in outage durations and the number of customers affected by outages has been observed.

Electricity transmission power lines are already built so that storms or snow do not disrupt power transmission.

Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC is also an integral part of the energy security dimension. The Regulation sets out the rules governing cooperation between Member States to prevent, prepare for and manage electricity crisis situations. Cooperation is carried out in the spirit of solidarity and transparency, taking fully into account the requirements of the competitive market for electricity. The Regulation includes provisions related to the assessment of risks in the security of electricity supply, drawing up risk-preparedness plans in case the risks are realised, the management of electricity crisis situations, ex-post evaluation of the crisis situations and different types of monitoring.

Under the Regulation, the competent authority in each Member State, including Finland, should publish a preparedness plan based on national electricity crisis scenarios. The preparedness plan should include all planned or introduced measures to prevent, prepare for or mitigate an electricity crisis situation. The preparedness plan should also include regional and bilateral measures to ensure that electricity crises with cross-border effects are appropriately prevented and managed.

Finland will prepare and publish its own preparedness plan according to the timetable defined in the Regulation.

The National Emergency Supply Agency has been actively promoting cybersecurity in the energy sector by carrying out sector-specific cybersecurity exercises, programmes and sharing best practices. One example is KYBER-ENE project⁴⁰ which was carried out together with energy sector companies and VTT Technical Research Centre of Finland Ltd.

Gas

In 2017, the National Emergency Supply Agency as the competent authority prepared plans for the prevention of risks in the security of supply of natural gas (prevention plan) and for actions to be taken in the event of disruptions in supply (emergency plan). The natural gas section of the Oil pool, a part of Finland's security of supply organisation, has also been engaged in the work. The plans are based on the repealed regulation of the European Parliament and of the Council concerning measures to safeguard security of gas supply (994/2010). Concerning the implementation of the risk preparedness regulation and the preventive action and emergency plans for gas, Finland is part of the risk group which includes also Estonia, Latvia and Lithuania. The preventive action and emergency plans have been actively prepared by the group.

The prevention plans and emergency plans complying with the Regulation of the European Parliament and of the Council EU No 2017/1938 concerning measures to safeguard security of gas supply and repealing Regulation (EU) No 994/2010 (Security of Gas Supply Regulation) must be published and the Commission must be informed of them at the latest on 1 March 2019. The Commission informs the Gas Coordination Group (GCG) of notifications concerning the plans and publishes them on the Commission's website. The plans were published⁴¹ and the Commission was informed on 30 October 2019. Plans were made in close cooperation with the Baltic states.

40 <https://www.huoltovarmuuskeskus.fi/energia-ala-kehitti-yhteiset-toimintatavat-kyberuhkia-vastaan/>

41 <https://cdn.huoltovarmuuskeskus.fi/app/uploads/2019/10/31111328/Finland-gas-preventive-action-plan-and-emergency-plan.pdf>

The security of natural gas supply in Finland has been good and there have been no significant disruptions in the supply over the past twenty years. In the event of a disruption in Finland's largest single gas infrastructure, the remaining infrastructure will be able to satisfy the total demand for gas for 24 hours during peak consumption.

In Finland, the most challenging situation in terms of the supply norm set in the Regulation would be a situation in which the procurement of gas from Russia to Finland is completely interrupted for a longer period of time. During long-term disruption in the gas supply, biogas or LNG injected into the network would be supplied to protected gas customers, i.e. households that have joined the distribution network.

Balticconnector, the gas pipeline connecting the gas networks of Finland and Estonia, will come on stream on 1 January 2020.

Finland has implemented projects to build import terminals for liquefied natural gas: the first terminal was completed in Pori in autumn 2016 and the second one was completed in Tornio in 2019. There are no plans to connect these terminals to the gas transmission network. The LNG terminal to be constructed in Hamina will be connected to the local supply network and is estimated to be in use in 2020.

Most of the natural gas consumption can quickly be replaced by alternative forms of energy or by switching to an alternative fuel. Fuels that can replace natural gas primarily include light and heavy fuel oil and, for gas-specific use, liquefied petroleum gas, LNG and biogas that is injected into the natural gas network. One alternative in disruptions in the availability of natural gas may also be to adapt production or to interrupt it.

Users of natural gas, except for consumer customers, are primarily responsible for their own preparedness plans and the operability of the reserve fuel systems possibly related to them, the buffer stocks of reserve fuel and the organisation of the required transports.

To prepare for any disruptions in the availability of imported energy and to meet its commitments under international obligations, Finland keeps reserves of imported fuel covering an average of five months' normal consumption. This amount does

not include natural gas consumption by industry. As regards natural gas, the reserves comprise compulsory stockpiles by companies and state-owned reserves.

ii. Regional cooperation in this area

Regional cooperation in the field of energy security is carried out in the Electricity Market Group operating under the Nordic Council of Ministers. Among other things, the working group monitors the estimations ENTSO-E and the Nordic transmission system operators make of the adequacy of electric power.

Cooperation related to the security of gas supply is carried out between the authorities in Finland and the Baltic states. The authorities have drawn up contingency plans for the gas supply.

General cooperation related to the security of energy supply is carried out between the Nordic emergency supply organisations (NordBER, Nordisk Beredskapsforum).

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

The emergency stockpiling of imported fuels is financed through a strategic stockpile fee. No specific requirements regarding the security of supply are related to biofuels. However, a strategic stockpile fee is also levied on biofuels.

3.4 Dimension internal energy market

3.4.1 Electricity infrastructure

i. Policies and measures to achieve the targeted level of interconnectivity as set out in point (d) of Article 4

The National Energy and Climate Strategy outlines that well-functioning regional and European electricity markets and sufficiently strong cross-border connections are the most efficient and cost-effective ways of guaranteeing competitive electricity prices and security of supply. The Electricity Market Act (Sähkömarkkinalaki 588/2013) requires the transmission system operator Fingrid

to improve its grid according to the reasonable needs of its users and also requires Fingrid to develop the transmission grid in a way that Finland remains as one bidding zone.

ii. Regional cooperation in this area

Nordic transmission system operators work in close cooperation to develop the electricity infrastructure. They publish a common Nordic Grid Development Plan every other year. The latest joint plan was launched in August 2019⁴². Also, the ministries in the Nordic countries cooperate in the electricity market field through the Electricity Market Group operating under the Nordic Council of Ministers and the national regulatory authorities through NordREG⁴³. Cooperation between the Nordic countries in the electricity market has been intensified by establishing a cooperation forum, Nordic Electricity Market Forum¹¹ for the ministries, regulatory authorities, transmission system operators and market participants.

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

The transmission system operator Fingrid has announced it will apply for CEF funding for the new cross-border connection between Finland and Sweden on the Project of Common Interest list. Fingrid and Svenska Kraftnät will finance the rest of the investment. The Finnish Government fully supports this project.

3.4.2 Energy transmission infrastructure

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

The Electricity Market Act (Sähkömarkkinalaki 588/2013) requires the transmission system operator Fingrid to improve its grid according to the reasonable needs of its

42 Nordic Grid Development Plan 2019, <https://www.fingrid.fi/en/pages/news/news/2019/nordic-grid-development-plan-2019/>

43 NordREG, <http://www.nordicenergyregulators.org/>

users. The investments made in the projects described in Chapter 2.4.2 are based on this obligation.

The Natural Gas Market Act (maakaasumarkkinalaki 587/2017) imposes an obligation on natural gas system operators to develop the network. The system operator must maintain, use and develop its natural gas network and connections to other networks in accordance with customers' reasonable needs and for its part secure the supply of natural gas to customers. The transmission system operator must also build sufficient cross-border transmission capacity for the integration of the European transmission system if building it is required from the financial point of view to satisfy reasonable and technically feasible demand for natural gas and to pay attention to the security of supply of natural gas.

The Finnish Government has established a separate company, Baltic Connector Oy, to head the construction of the Balticconnector gas pipe connection between Finland and Estonia. The unbundled Gas Transmission System Operator (Gasgrid Finland), which will start operations on 1 January 2020, will operate the Balticconnector pipeline as part of the Finnish transmission system.

ii. Regional cooperation in this area

Regional cooperation in the electricity market has been described above in Chapter 3.4.1.

In 2015, the ministries, the national regulatory authorities and the gas transmission system operators in Finland and the three Baltic states established a regional group for the coordination of the regional gas market and will work in close cooperation within this coordination group to create a regional gas market from the beginning of 2020.

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

The Balticconnector gas pipeline project on the Project of Common Interest list received EUR 187.5 million through the EU's CEF funding instrument. Finnish Baltic Connector Oy and Estonian Elering As will finance remaining costs of the project.

3.4.3 Market integration

i. Policies and measures related to the elements set out in point 2.4.3

The regional electricity market formed by the Nordic and the Baltic states is promoted through cooperation of the ministries, regulatory authorities, transmission system operators and market participants.

Nordic cooperation has been further strengthened by the Nordic Council of Ministers' decision to establish a Nordic Electricity Market Forum. The first Nordic Electricity Market Forum was held in Stockholm in November 2018 and resulted in a new and ambitious vision for the Nordic electricity market⁴⁴. The vision states that

In 2030, the Nordics should have the world's most competitive, innovative and consumer-oriented electricity market, that contributes to reaching the Nordic climate goals.

In the first forum, the participants agreed that there are grounds for annual Nordic Electricity Market Forums as a venue for:

- Communication, collaboration and creating synergies among the different types of electricity market stakeholders (e.g., producers, consumers, TSOs, regulators, etc.)
- Interactions between electricity market policymakers and non-policy stakeholders
- Input on joint Nordic standpoints on electricity market issues, e.g. in relation to new EU regulations on electricity markets
- Discussions on forward-looking themes, such as visions and long-term strategies specific to the Nordic electricity market, as well as preparation of relevant action plans

⁴⁴ 2030 Vision for the Nordic Electricity Market
https://nordicforum.org/wordpress/wp-content/uploads/2019/06/Vision-for-the-nordic-electricity-market-EN_2.pdf

This work was further strengthened by the Nordic Prime Ministers Declaration on Nordic Carbon Neutrality⁴⁵, adopted in January 2019. The vision was also further discussed and endorsed by the Nordic Energy Ministerial meeting in June 2019.

The 2019 Nordic Electricity Market Forum continued to address the vision and the action points formulated in the roadmap⁴⁶. Different stakeholders presented news and priorities for the electricity market – giving an overview of status quo in the Nordic region. The forum is also a place for discussion – and together participants can contribute to setting the scene and making the Nordic countries achieve the 2030 electricity market vision.

Construction of the Balticconnector gas pipeline between Finland and Estonia will enable the opening and renewal of the gas market. When this investment is completed, the derogation from the Internal Market in Article 49(1) of the Natural Gas Directive will be dropped and the gas market will be fully open for competition from the beginning of 2020. In the new Natural Gas Market Act (maakaasumarkkinalaki 587/2017)⁴⁷, price regulation of piped gas will be dropped and gas marketplaces and internal market rules will be introduced. On 1 January 2020, Finland will join a common regional gas market area with Estonia and Latvia (FINESTLAT-gas market area). Finland also aims at joining a regional entry-exit system with Estonia and Latvia from 1 January 2022. The final objective is to create a regional gas market comprising Finland and the three Baltic states including Lithuania. The creation of the regional gas market is being prepared between the ministries, the national regulatory authorities and the gas network operators in Finland, Estonia, Latvia and Lithuania.

ii. Measures to increase the flexibility of the energy system with regard to renewable energy production such as smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, real-time price signals,

45 <https://www.ym.fi/download/noname/%7B5CF4258D-8264-4F5C-8527-081CCBBF2AE2%7D/143425>

46 ROADMAP FOR REACHING THE NORDIC ELECTRICITY MARKET VISION
<https://nordicelforum.org/wordpress/wp-content/uploads/2019/06/Handlingsplan-for-at-opn%C3%A5-2030-visionen-FINAL.pdf>

47 <http://www.finlex.fi/fi/laki/ajantasa/2017/20170587>

including the roll-out of intraday market coupling and cross-border balancing markets

Increasing the level of flexibility is part of the regional cooperation described above. As regards the electricity markets, the countries already have a single day-ahead market and an intraday market⁴⁸. On 9 March 2018, five Nordic transmission system operators concluded a cooperation agreement on the development of a new Nordic balance service model⁴⁹.

See also sub-point v below.

iii. Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

iv. Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

The requirements related to consumer protection have been included in the Electricity Market Act (sähkömarkkinalaki 588/2013) currently in force³⁷. On 1 February 2019, an amendment came into force regarding a centralised information exchange database called Datahub, which will provide each party in the electricity market with all relevant information on electricity trading. Datahub will enable even more efficient and consistent transfer of data, which will be essential in the future electricity retail market. This kind of common platform is also vital to developing other opportunities, such as services for enabling significantly better demand flexibility even at an individual consumer level. The project has already started and is expected to be completed in 2022.

To improve the competitiveness of the retail market, the Energy Authority publishes on its website an independent electricity price service, www.sahkonhinta.fi, in

48 www.fingrid.fi/en/pages/news/news/2018/nord-pool-restructures-for-the-future/

49 www.fingrid.fi/sivut/ajankohtaista/tiedotteet/2018/pohjoismaisen-tasehallintasopimus-julki-ja-tasehallintarakenne-ehdotus-toimitettu-energiavirastolle/#

which electricity consumers can compare the electricity offers of different suppliers. The service is free of charge and available to all electricity users and suppliers.

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

In terms of the adequacy of electric power, it is also important that the prerequisites for combined power and heat generation remain part of an energy-efficient and low-emission energy system with a high degree of security of supply.

In October 2018, the Smart Grid Working Group set up by the Ministry of Economic Affairs and Employment proposed an extensive operational programme to increase the demand-side response of electricity and the opportunities for customers to participate. The working group's key proposals⁵⁰ were:

- Clarifying the roles of actors in the market-based implementation of demand-side response (e.g. principles for the storage of electricity, discontinuation of the flexibility implemented by distribution networks)
- Improving the operating prerequisites for different energy communities and aggregation models
- Defining the functionalities of next-generation smart meters
- Enabling flexibility in the operation of grid companies
- Enabling joint invoicing for all suppliers

The Ministry of Economic Affairs and Employment is currently implementing these proposals in parallel with the Clean Energy Package implementation. Implementation is well under way in Finland. Many elements of the flexibility requirements, such as fully deregulated retail markets, balancing responsibility, customers' ability to choose dynamic tariffs, 100% roll-out of smart meters, etc., already exist in Finnish electricity market legislation.

The objective set in the Government's Energy and Climate Strategy is to create a regional gas market for Finland and the Baltic states. The ministries, the national

⁵⁰ <http://urn.fi/URN:ISBN:978-952-327-346-7>

regulatory authorities and the gas transmission system operators in Finland and the Baltic states work in close cooperation within the group for the coordination of the gas market to create a regional gas market from the beginning of 2020. Finland's aim is to join the regional gas market step by step. In the first stage, the aim is to join the regional agreement between the transmission system operators on the removal of capacity payments at interconnection points, harmonisation of feed-in charges and the compensation mechanism for transmission charges. In the second stage, the aim is to form a regional balance area.

3.4.4 Energy poverty

i. Where applicable, policies and measures to achieve the objectives set out in point 2.4.4

Finland does not have national indicative objectives to reduce energy poverty as indicated already in Chapter 2.4.4. Prevention of energy poverty is part of general social policy. Chapter 2.4.4 discusses non-energy specific measures to mitigate energy poverty.

The Ministry of the Environment has conducted two studies on energy poverty in Finland^{28, 29}. Problems relating to energy poverty are mainly targeted in Finland through social aid schemes to guarantee sufficient indoor temperatures and a supply of electricity for households. In addition, the Social Insurance Institution of Finland (Kela) provides security deposits to energy companies. If an energy company requires a deposit from its customer, the customer may apply for the security deposit from Kela in connection with social support. This "electricity security deposit" relieves the energy poverty concerns of people in the most vulnerable situations.

Energy advisory services and support for energy efficiency improvements are used to reduce household energy costs. Changes in consumption habits may reduce energy costs by 5–35 %. Motiva Ltd, a sustainable development company owned by the State of Finland, provides energy advice for consumers related to living, building and renovation, heating options and mobility.

National electricity and gas market regulations include detailed restrictions applying to the rights of energy companies to disconnect supplies in case of unpaid

bills. For example, under the Electricity Market Act (588/2013), the electricity supply to an electrically-heated building cannot be disconnected between the beginning of October and end of April until four months have passed since the date of non-payment.

3.5 Dimension research, innovation and competitiveness

i. Policies and measures related to the elements set out in point 2.5

ii. Where applicable, cooperation with other Member States in this area, including, where appropriate, information on how the SET-Plan objectives and policies are being translated to a national context

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

Finland supports research, innovation and competitiveness in energy technology with a number of measures, of which energy aid is crucial. Based on project assessments, the Ministry of Economic Affairs and Employment and Business Finland may grant energy aid to companies, municipalities and other organisations for investment and research projects that promote the use of renewable energy or energy efficiency.

The purpose of energy aid is particularly to promote the introduction and placing on the market of new energy technologies. Energy aid plays an important role in the innovation chain when the development of the technologies is already advanced and the first commercial targets are sought. The competitiveness of companies operating in Finland and the creation of new jobs can thus be supported in this way. Energy aid can be granted to companies, municipalities and other communities. The aid is not granted, for example, to housing companies, residential properties or farms.

The primary purpose of the aid is to enhance the profitability of early-stage investment and minimise the risks associated with the introduction of new technology.

In 2018, the grant authority for energy aid was EUR 55 million in the central government budget. The budget authority for energy aid is established annually in the central government budget. In recent years, aid has also been granted for certain specific purposes through separate budget reserves. The Government allocated a total of EUR 100 million for investments in renewable energy and new technologies for the period 2016–2018.

At the beginning of this decade, the Finnish Funding Agency for Innovation Tekes invested heavily in SHOK programmes (Strategic Centres for Science, Technology and Innovation). Of the energy and environmental sector programmes, SGEM (Smart Grid and Energy Markets) has produced significant competence that can be utilised in the development of intelligent electricity networks and smart control. The FLEXe programme (Flexible Energy Systems) initiated an examination of the requirements for a flexible energy system. Companies have taken the lead in utilising the programme's research findings. The project, completed in 2016, investigated the building of an intelligent and flexible energy system in the Åland Islands.

Business Finland's Smart Energy programme was launched in 2018. It develops test platforms and innovation ecosystems that boost the competitiveness of Finnish companies and exports of Finnish expertise in the growing international markets and also attracts investments to Finland. The ecosystems will open up opportunities also for SMEs to enter energy markets, in which large investments are necessary.

The development of new business and new solutions requires opportunities for experimentation. Test platforms provide an opportunity to conduct experiments and pilots, and to implement research and development projects in the programme focus areas. These include smart networks, renewable energy, energy efficiency, sustainable and smart energy solutions and systems, their related products and services, and resources-wise solutions based on user needs. Instead of developing an individual technology, the intention is to develop ecosystems and integrate technology into a smart system. The aim is to create in Finland several test platforms that are internationally attractive and will also bring investments to Finland.

The importance of Mission Innovation cooperation is growing. Finland was accepted to the Mission Innovation initiative in October 2016. When joining,

Finland committed to doubling public innovation funding for clean energy by 2020. The baseline was the average of the funding granted by TEKES to projects on renewable energy sources, storage of energy, energy systems and energy networks between 2013 and 2015, plus the average of the energy aid allocated to new energy technologies in the same theme areas over the same time period by the Ministry of Economic Affairs and Employment. Calculated in this way, the baseline of public funding for RD&I in clean energy settled at EUR 54.7 million, which would be EUR 109.4 million when doubled in accordance with the objective. Doubling also takes into account the demonstration aid for new technologies allocated to the key projects in the field of energy. This was EUR 20 million in 2016 and EUR 40 million in 2017 and 2018. Finland is quite well on track with the Mission Innovation cooperation doubling target towards EUR 109.4 million in 2021, since the contribution in 2018 was EUR 92.9 million and the increase from the baseline was almost 70%.

Finland also participates in Clean Energy Ministerial (CEM) cooperation, the first meeting of which was held in Washington in 2010. The participating countries account for about 80% of global energy use. A central part of CEM's operation consists of initiatives covering the following themes: bioenergy, CCS, energy and women, Clean Energy Solutions Centre, electric vehicles, energy efficiency, smart electricity network, solar and wind energy, solar energy and LED, hydropower and sustainable development. Finland participates in the Electric Vehicles and Smart Grids initiatives. Finland has also joined the 21st Century Power Partnership initiative, the Women in Energy (C3E) initiative and the until 30 campaign related to it, and the campaign promoting the more flexible use of power plants and electric transport between cities (Pilot City Programme).

Finland – China (Business Finland – MoST) joint call related clean energy collaboration was opened at the end of 2018. The Joint Call in Smart Energy theme with Germany was launched and 10 joint projects were funded.

Finland has also been actively involved in the operation of the SET-Plan. The SET-Plan combines the promotion and better coordination of energy technology in the EU and the EEA countries. A total of 14 implementation plans were prepared in the SET-Plan between 2016 and 2018. Finland has participated actively in the preparation and introduction of these implementation plans. Finland has chaired and co-chaired the preparation of two implementation plans (Action 6 and Action

8) and continues to chair the related Implementation Working Groups. A good example of the flexibility of the SET-Plan is the eBattery plan. Finland participates in the implementation of the plan and has also strengthened its own activities, for example, through Business Finland's "Batteries from Finland" 2018–2020 activation programme. Finland has launched an ecosystem type of consortium named BatCircle, involving more than 30 companies, universities and research institutes. Finland is also active in Set-Plan key action no 7. "Batteries for e-Mobility and Stationary Storage", where Finland is leading the working group related to battery recycling. This is a good example of how SET-Plan objectives and policies are translated into national use.

Business Finland, the Finnish funding organisation for innovation, is actively advancing ecosystems promoting low-carbon business like funding so-called Growth Engines. The name Growth Engine describes cooperation networks – ecosystems – aimed at new business activities amounting to more than EUR 1 billion. Growth Engines are implemented through an enterprise-driven partnership model between companies, research organisations and public actors, which strive to find solutions to global market disruption and create new growth sectors in Finland.

Growth Engine funding enables collaboration between companies of different sizes, research organisations and public actors to achieve a common concrete business goal, launching a new operator, a platform company to achieve a business goal and the construction of the platform company's business.

The Government has allocated EUR 60 million of capital funding for Growth Engines in 2018 (EUR 30 million) and 2019 (EUR 30 million). In addition, Business Finland channels its normal funding (about EUR 200 million 2018–19) and services to projects that meet the ambitious and funding criteria of companies, research organisations and communities operating in Growth Engines, aiming at achieving a Growth Engine's business objective.

Growth Engines currently operate in the fields of carbon compensation, smart port and marine services, artificial intelligence and new solutions for a societal scale model of renewable energy production.

SECTION B: ANALYTICAL BASIS

4 CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

- i. Macroeconomic forecasts (GDP and population growth)**
- ii. Sectoral changes expected to impact the energy system and GHG emissions**
- iii. Global energy trends, international fossil fuel prices, EU ETS carbon price**
- iv. Technology cost developments**

Economic growth and the change in the structure of the economy play a key role in the estimation of energy consumption and emissions. The economic outlook provided by the Ministry of Finance forms the basis for the estimate regarding the development of the Finnish economy in the near future, whereas longer-term development assumptions are based on the *Uutta, vanhaa ja sinivalkoista – Suomi*

2040 report of VTT Technical Research Centre of Finland Ltd ⁵¹ and the modelling related to the report. Table 13 shows the GDP and the average annual increase in national economic output during the period 2016–2040. In the case of the forest industry, the growth assumptions are based on the expertise of Pöyry Management Consulting and published in the report Suomen metsäteollisuus 2015–2035⁵².

Table 13. GDP and the average annual increase in national economic output in the projections.

	2016	2020	2030	2040
GDP, million EUR in 2016 prices	216,111	231,000	285,000	354,000
		2016–2020	2020–2030	2030–2040
Annual growth		1.6%	2.1%	2.2%

The Finnish economy underwent a structural change in the 2010s, where the role of services has increased and traditional industries have been forced to adapt to changes in global demand and competition. The Government is carrying out major reforms in order to cut public sector expenditures and to bring the Finnish economy onto a path of sustainable growth and higher employment. The impact of the reforms is included in the economic growth assumptions of the WEM and WAM projections.

With these fairly high economic growth assumptions, industrial activity, and hence also energy demand, increases steadily during the projected period. If the assumed economic growth level, however, is not reached, greenhouse gas emissions can be expected to be lower than the projections indicate.

The population growth in the projections is based on the population forecast drawn up by Statistics Finland. Table 14 shows population development.

51 <https://www.vtt.fi/inf/pdf/technology/2018/T327.pdf>

52 Suomen metsäteollisuus 2015 – 2035. Loppuraportti X304203, 19.1.2016, Pöyry Management Consulting, <https://tem.fi/taustaselvitykset>

Table 14. Population [mill. inhabitants].

2016	2020	2025	2030	2035	2040
5.50	5.60	5.69	5.77	5.83	5.86

Assumed fossil fuel prices in the world market and the assumed prices of emissions allowances in the EU's emissions trading system correspond to the values recommended or suggested by the Commission for greenhouse gas emission projections. Table 15 shows the default values.

Table 15. The prices of the EU ETS emission allowances and fossil fuels [euros in 2016 prices].

	2020	2025	2030	2035	2040
EU ETS, EUR/t CO ₂	15.5	23.3	34.7	43.5	51.7
Crude oil, EUR/GJ	13.86	15.73	17.33	18.08	19.14
Coal, EUR/GJ	2.64	3.16	3.79	4.01	4.18
Natural gas, EUR/GJ	8.91	9.64	10.49	11.20	11.58

Table 16 shows the assumptions for technology cost development that are used in the electricity market modelling work. The figures represent levelised cost of energy (LCOE) in 2016 prices for given technologies.

Table 16. Technology cost development [euros in 2016 prices].

Levelized Cost of Energy (LCOE)	2020	2025	2030	2035	2040
Combined Cycle Gas Turbine (new)	65.5	64.0	68.3	71.4	73.8
Hard Coal (new)	78.8	82.6	87.2	92.2	94.3
Bio-CHP	47.2	50.1	53.1	55.1	57.0
Wind Power - onshore	33.7	33.1	32.1	30.9	30.0
Wind Power - offshore	66.9	60.6	53.9	48.1	42.9
Solar Power - large scale	70.0	64.3	59.2	54.6	50.5
Solar Power - small scale	81.9	76.8	71.8	66.8	61.8

4.2 Dimension Decarbonisation

4.2.1 GHG emissions and removals

i. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

ii. Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

Transport

Greenhouse gas emissions from domestic transport totalled 11.3 Mt CO₂ equivalent in 2017. Transport emissions account for approximately a fifth of Finland's total greenhouse gas emissions and some 40 % of emissions in the effort sharing sector. Greenhouse gas emissions from domestic transport increased from the economic depression in the early 1990s until 2007. Since 2008, they have mainly been decreasing. From 2005 to 2017, greenhouse gas emissions from transport dropped by some 1.3 million tonnes in total, or by 10 %.

The WEM projection for transport is based on the traffic performance projected until 2030 by the Ministry of Transport and Communications and VTT Technical Research Centre of Finland Ltd. According to the projection, road transport performance will increase by approximately 0.9 % a year in 2016–2020 and by approximately 0.8 % a year in 2021–2030. This rate would result in a total increase of 12 % in road transport performance by 2030. Another key assumption in the WEM projection is the replacement rate of cars and the average CO₂ emissions of new vehicles. In the WEM projection, the annual replacement rate of cars is estimated at approximately 5 %. In 2020, the specific emissions of new cars would be close to the limit of 95 g/km that the EU has established for car manufacturers, but they would no longer decrease after 2020 without new (EU-level) measures. The third factor having a substantial impact on transport greenhouse gas emissions in the WEM projection is the share of biofuels in the total consumption of fuel in transport. In the WEM projection, the actual share of biofuels is estimated at 13.5 % in 2020 and beyond. The estimate is based on the Act on Promoting the use of Biofuels in Transport (laki biopolttoaineiden käytön edistämisestä liikenteessä 446/2007), which stipulates that biofuels must account for a calculated share of 20 % of all transport fuels sold from 2020. The quota obligation allows 'double counting', in

which certain biofuels that do not compete with food production count double for compliance with the target. The WEM projection is based on the assumption that starting from 2020 the share of non-double counted biofuels will be 7% and the share of double counted biofuels 6.5%. Thus, the calculated share of biofuels would be 20% while their actual share would be 13.5% in 2020–2030.

Agricultural sector

The emissions reported by Finland in the agricultural sector in 2017 totalled about 6.5 Mt CO₂ equivalent. The agricultural sector accounts for approximately 12% of Finland's total emissions and some 22% of emissions from the effort sharing sector. Emissions from the agricultural sector remained at the same level between 2005 and 2017. According to the WEM projection, total emissions from agriculture are estimated to slightly increase from 2005 to 2020, but in 2030 they will be below the 2005 level.

Building-specific heating

Emissions from heating buildings are divided between the EU ETS sector and the effort sharing sector. In the effort sharing sector, the main source of emissions was building-specific oil heating. Emissions from certain small heating plants are also included in statistics concerning the effort sharing sector. In 2017, the emissions from building-specific heating amounted to 2.6 Mt CO₂ equivalent in the effort sharing sector, which is about 9% of the sector's total emissions. The majority of these emissions were generated by oil heating. Emissions from building-specific heating have declined in recent years, but there has been some fluctuation because of year-to-year temperature variations. The majority of emissions from building-specific heating are produced in the heating of residential buildings followed by the heating of commercial and public buildings.

Waste management

Greenhouse gas emissions from waste management totalled 1.9 Mt CO₂ equivalent in 2017, or 6% of Finnish emissions in the effort sharing sector. The most significant greenhouse gas produced in waste management is the methane emitted from landfills. Waste management emissions in the effort sharing sector also include the greenhouse gases produced in the biological treatment of waste and in

the disposal and treatment of waste water: CO₂, methane and nitrous oxide. These emission sources are of limited importance and their emission volumes are stable. Greenhouse gas emissions from waste management have reduced by approximately a third from 2005 to 2017. The greatest reductions have been achieved in methane emissions from landfills following a decrease in the landfilling of organic waste. The increased use of digestion in the biological treatment of waste has slightly reduced CO₂ emissions from biological treatment. However, CO₂ is still being emitted from the digestion residue that will be composted and the remaining compost windrows. According to the WEM projection, emissions from the waste management sector will decrease by around 60% by 2030 compared to 2005 levels.

Emissions from waste used as energy are included in the energy sector. They are covered by the EU ETS when waste is being burned together with other fuels as 'co-incineration' for example in power plants at industrial facilities. In 2030, total emissions from waste incineration will amount to approximately 0.8 Mt CO₂ equivalent, of which some 0.6 Mt CO₂ equivalent will be emissions from waste incineration plants included in the effort sharing sector.

F-gases

In 2017, F-gas emissions totalled 1.3 Mt CO₂ equivalent, which currently equals approximately 2% of all greenhouse gas emissions and approximately 4% of emissions in the effort sharing sector. Emissions peaked in 2014 at approximately 1.46 Mt CO₂ equivalent. Fluorinated greenhouse gases (F-gases) are used as refrigerants and extinguishing agents and in plastic foaming, for example.

Measures under the original F-gas Regulation, applied between 2007 and 2014, and the new F-gas Regulation and the Mobile Air Conditioning Directive (MAC Directive) are estimated to reduce F-gas emissions to 0.59 Mt CO₂ equivalent by 2030 and further to 0.24 Mt CO₂ equivalent by 2040.

Machinery

Various types of machinery currently account for a total of 8% of emissions in the effort sharing sector. In 2017, total emissions from machinery were 2.4 Mt CO₂ equivalent per year.

Machinery is used in industry and construction, trade, services, the public sector, households, agriculture and forestry. Machinery is usually equipped with combustion engines. Quantitatively, the most common fuel is gasoil but petrol is also used. Among machinery emissions, CO₂ is the most significant greenhouse gas, but machinery also emits small quantities of methane and nitrous oxide.

Industry

Energy-related emissions from industry total 10.3 Mt CO₂ equivalent, of which 0.9 Mt CO₂ equivalent originated from non-ETS activities in 2016. Energy-related emissions are mainly CO₂ emissions and originate from all branches of industry. These days, the EU ETS also covers more than 90% of industrial process emissions. According to the WEM projection, industrial activities continue to grow. As a result, the energy-based and process emissions will also increase slightly, amounting to approximately 11 Mt CO₂ equivalent in 2030. Industry is becoming more energy efficient and produces fewer emissions, which will offset the increase in emissions due to growth in industrial activities. Thus, in the WEM projection, energy-related emissions from industry will remain at their current level throughout the 2020s.

Energy industry

Greenhouse gas emissions from the energy industry were 18.7 Mt CO₂ equivalent in 2016. Although the emissions vary considerably from year to year, the trend is a steady decline. District heating emissions vary according to heating demand (cold or warm winters), whereas emissions from condensing power vary depending on the hydro situation in the Nordic-Baltic electricity market. The projections assume future years to be standard years with respect to heating demand and hydro levels (i.e. long-term average plus impact of climate change).

Emissions from the energy industry mainly fall within the scope of the EU emissions trading system (EU ETS). In addition to the EU ETS, the energy industry is strongly affected by other policy measures to reduce emissions, to enhance energy efficiency and to increase the share of renewable energy sources.

In the WEM projection, the most significant future changes in electricity and heat production are the start-up in 2020 of a 1600 MW nuclear power plant unit currently under construction, one additional nuclear power plant unit in the late 2020s

and the increase in the use of renewable energy sources, mainly wind power and biomass in CHP plants. All these changes reduce emissions.

Small power plants and boilers are not included in the EU ETS. The total emissions of these plants, excluding waste incineration plants, amount to 0.2–0.3 Mt CO₂ equivalent. In the WEM projection, the emissions from these plants are expected to slightly decrease in the future.

Other fuel consumption

Emissions from the greenhouse gas inventory category *1.A.5 Other non-specified emissions of fuels* amount to 1.1 Mt CO₂ equivalent. The unknown consumption of light and heavy fuel oil, LPG and natural gas account for the largest share of consumption in this subcategory. In practice, the amounts consumed are determined as the difference between total sales and known consumption. The subcategory also includes the fuels consumed by the Finnish Defence Forces, statistical adjustments and smaller emission sources, such as helicopters. According to the greenhouse gas inventory report, uncertainty regarding emissions in this subcategory may be up to ±10–50%, depending on the fuel, which is substantially higher than in other energy subcategories. In the WEM projection, emissions from this subcategory are expected to increase marginally to approximately 1.2 Mt CO₂ equivalent by 2030 due to growing economic activity.

LULUCF sector

The annual net sink of the LULUCF sector reported by Finland to the United Nations Framework Convention on Climate Change between 1990 and 2017 varied between -14 and -33.7 Mt CO₂ equivalent. In 2017, the LULUCF sector was a sink of -20.4 Mt CO₂ equivalent. As a whole, the LULUCF sector is expected to remain as a sink during the obligation period 2021–2030.

Agricultural land, or arable land and grassland, are a net source of greenhouse gas emissions in Finland, sized at approximately 5.4–7.7 Mt CO₂ equivalent per year in the reporting period 1990–2017. Of these, emissions from arable land account for approximately 90%. After 2020, emissions from agricultural lands are expected to increase. The development of the surface area of grasslands and the emissions from

these grasslands is expected to remain stable until 2030. The trend in emissions from grasslands has been declining since 1990.

The reported sink of managed forest land varied between -18.4 and -47.4 Mt CO₂ equivalent between 1990 and 2016. The size of the sinks varies from year to year, mainly as a result of the volume of commercial fellings. In 2017, managed forest lands were a sink sized at -27.0 Mt CO₂ equivalents. According to the estimation of the Natural Resources Institute Finland, forests will continue to act as a sink in Finland also in future.

With the exception of 2009, wood products in Finland were mainly a sink over the period 1990–2017. In 2017, wood products were a reported net sink sized at -4.0 Mt CO₂ equivalent. Wood products are estimated to remain sinks during the period 2021–2030.

About 72 % of the land area of Finland is forests. The change of forests to other land use purposes is estimated to continue for such reasons as the structural change in agriculture and urbanisation. Emissions from deforestation over the second period of the Kyoto Protocol have been approximately 3.3–3.9 Mt CO₂ equivalent. Emissions from deforestation during the period 2021–2030 are expected to decline slightly. The most significant factor reducing the emissions from deforestation is the reduction of emissions from the clearing of fields when the oldest cleared sites become managed agricultural lands. During the second period of the Kyoto Protocol, afforestation has in Finland been both a small sink (about -0.2 – -0.4 Mt CO₂ equivalent) and a small emission in 2015 (0.3 Mt CO₂ equivalent). According to the estimation of the Natural Resources Institute Finland, afforestation will be a sink until 2030, but the sink gained from afforestation is estimated to continue to decline mainly because of emissions caused by the afforestation of wetlands and agricultural lands.

The decision to include wetlands in the calculations in accordance with the LULUCF Regulation for the period 2026–2030 will be made later. Annual emissions from reported wetlands were approximately 1.3–2.4 Mt CO₂ equivalent during the period 1990–2017. The land area of the areas used in peat production and consequently also emissions from managed wetlands are expected to decline until 2030. However, the current estimations are very uncertain and do not include, for example, emissions or removals caused by the restoration of mires.

Natural Resources Institute Finland (Luke) is updating long term scenarios and greenhouse gas projections respectively for the LULUCF sector based on new data. The results will be available in early 2020. The estimated size of the forest sink depends on the chosen methodology and assumptions. There are two ways for estimating the net carbon sink of forests, namely through gains and losses or through stock change. The proposed FRL and the GHGI are currently based on the gains and losses approach, while the long-term scenarios are based on the stock change approach. The different methods yield different results, and it is not possible to state with certainty, which one produces more reliable future projections.

Figure 10 shows the historical development of greenhouse gas emissions and removals and the estimated development based on current national and EU policies and measures until 2040.

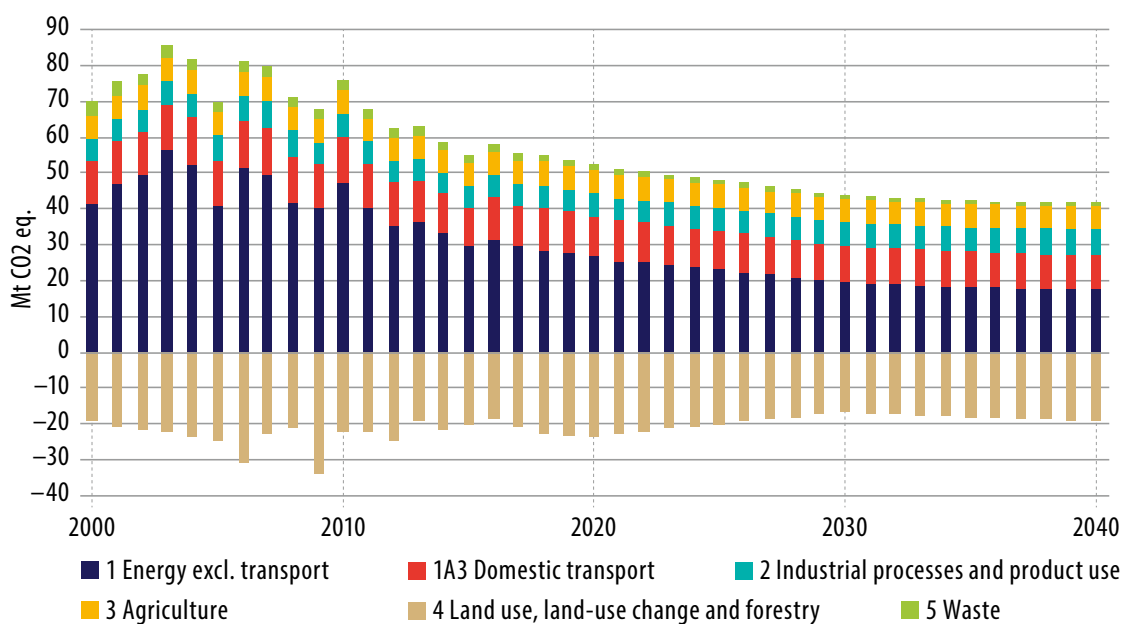


Figure 10. The historical development of greenhouse gas emissions and removals and the estimated development until 2040 based on current national and EU policies and measures.

4.2.2 Renewable energy

i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

ii. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

Finland is one of the world's leading users of renewable energy sources. The most important renewable energy sources are bioenergy wood and wood-based fuels in particular. In addition to that, also hydropower, wind power, air- and ground-source heat pumps and solar power are used. Renewable energy is one of the most significant means by which Finland's energy and climate targets can be reached. The current high level of wood utilisation in forest industry forms a backbone in meeting renewable energy targets.

The share of renewable energy in the gross final consumption of energy was 41 % in 2017. The EU target for the share of renewable energy in Finland in 2020 is 38 % of gross final energy consumption and this was reached for the first time in 2014. The share of renewable energy in Finland's gross final consumption is the second highest in the EU countries.

Table 17 shows the share of renewable energy in the gross final consumption of energy in 2005, 2010, 2015 and 2017. The shares have been calculated using coefficients and normalisations compliant with the ILUC Directive.

Table 17. Overall and sector-specific share of renewable energy in the gross final consumption of energy. Source: Eurostat ShaRES.

	2005	2010	2015	2017
RES	28.8 %	32.4 %	39.3 %	41.0 %
RES-E	26.9 %	27.7 %	32.5 %	35.2 %
RES-H&C	39.1 %	44.2 %	52.6 %	54.8 %
RES-T (with coefficients)	0.9 %	4.4 %	24.8 %	18.8 %

Table 18 shows the amounts of energy from renewable sources in 2005, 2010, 2015 and 2017. The amounts of hydropower and wind power have been normalised using the utilisation periods of maximum load over 15 and 5 years, respectively. The energy quantities in the transport sector correspond to actual quantities without coefficients.

Table 18. Amount of renewable energy as final consumption by energy source in different sectors [TWh]. Source: Eurostat ShaRES.

	2005	2010	2015	2017
RES Overall				
Hydropower	13.9	13.9	14.1	14.5
Wind power	0.2	0.3	2.0	4.5
Solar energy	0.0	0.0	0.0	0.1
Bioenergy	72.6	86.3	94.6	101.5
Heat pump energy	0.6	2.7	4.7	5.1
Total	87.2	103.3	115.6	125.7
RES-E				
Hydropower	13.9	13.9	14.1	14.5
Wind power	0.2	0.3	2.0	4.5
Solar energy	0.0	0.0	0.0	0.0
Biomass	9.5	11.0	11.4	11.9
RES-H&C				
Solar energy	0.0	0.0	0.0	0.0
Biomass	63.1	73.7	77.4	85.1
Heat pump energy	0.6	2.7	4.7	5.1
RES-T (actual contribution without coefficients)				
Liquid biofuels	0.0	1.7	5.7	4.5
Biogas	0.0	0.0	0.0	0.0
Renewable electricity	0.2	0.2	0.2	0.3

Figure 11 shows the historical development of renewable energy between 2000 and 2017 and the projected development based on existing policies until 2030 and an outlook until 2040.

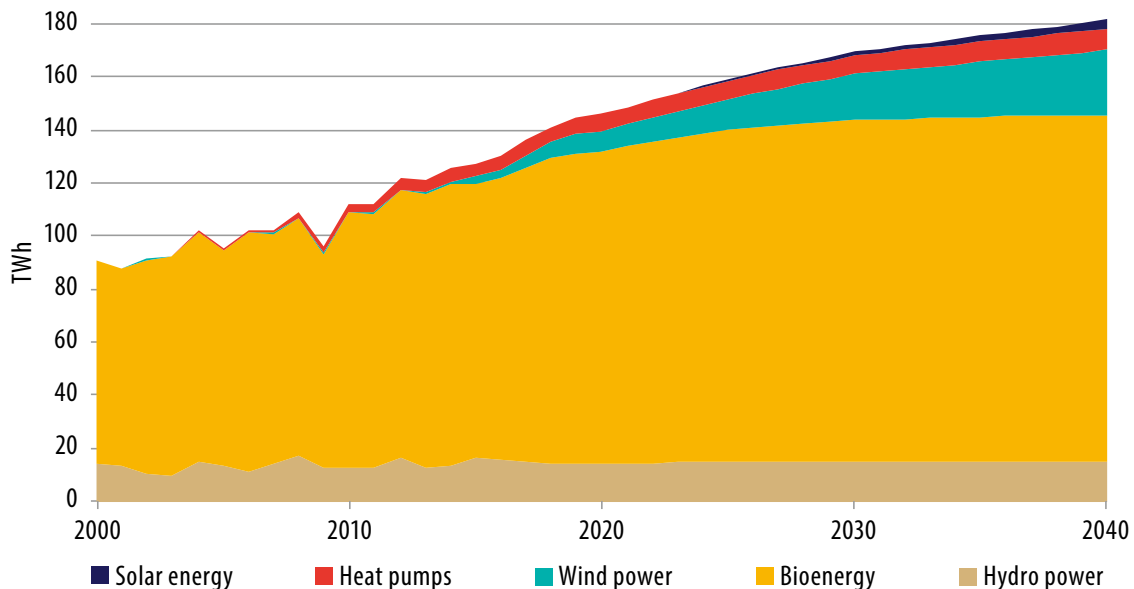


Figure 11. Historical development of renewable energy between 2000 and 2017 and the projected development based on current policies until 2030 and an outlook until 2040.

4.3 Dimension energy efficiency

i. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

iii. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)

iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with to Article 5 of Directive 2010/31/EU

In the WEM projection, the primary energy consumption in 2030 is 411 TWh and the final consumption of energy 297 TWh. A sector-specific examination of the WEM projection shows that the final energy consumption in 2030 would be about 147 TWh for industry, 59 TWh for households, 37 TWh for the service sector, 45 TWh for transport and 8 TWh for other sectors together. Final energy consumption figures exclude distribution losses and power plants' own use. There is no estimation of primary energy consumption by sector. Figure 12 shows historical development 2005–2017 and projections until 2040 for total primary energy consumption and final energy consumption for each sector.

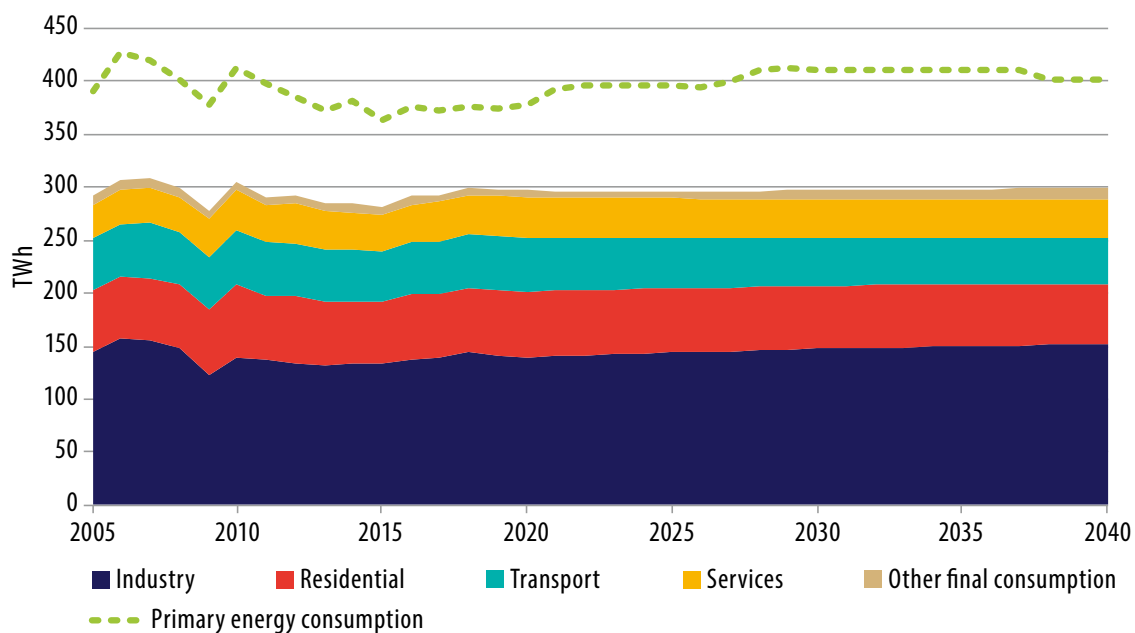


Figure 12. Historical development of primary energy and final energy consumption by sector between 2005 and 2017 and the projected development based on current policies until 2030 and an outlook until 2040.

Finland's cumulative energy savings target, based on this average, for the period 2021–2030 is 105 TWh_{cum}. The wording "supplied to" in the definition of EED Article 2(3), has been taken into account by deducting house or auxiliary loads of electricity, steam and heat from Eurostat FEC2020–2030 data. Finland intends

to keep implementing the ongoing national energy efficiency measures. These include energy efficiency agreements, energy advice for consumers, promotion of deployment of heat pumps in detached and terraced houses, energy audit activities (in addition to the compulsory audit in the EED) and promotion of investments in heating plants. They are all together estimated to result in total cumulative savings of 153 TWh_{cum} as explained in Table 7 in Chapter 2.2.

Efficient cogeneration and efficient district heating and cooling operate in open energy markets and compete with other generation, heating or cooling methods. District heating and cooling are built especially in towns, cities and densely inhabited municipalities. In these areas, a significant part of the heated building stock has been connected to district heating. Statistics indicate that 90 % of apartment blocks, 30 % of industrial buildings and more than 60 % of other buildings use district heating. The share in single-family houses is about 10 %. District heating has a total market share of 38 %. In 2017, sales of district heating were 33.2 TWh. With temperature correction, consumption equals 35.7 TWh. The consumption of district heating is projected to be 34 TWh in 2025 and just over 33 TWh in 2030.

In 2017, district cooling was sold by nine companies and the sales of district cooling amounted to 220 GWh. In 2030, sales of district cooling are projected to be 490 GWh.⁵³

4.4 Dimension energy security

i. Current energy mix, domestic energy resources, import dependency, including relevant risks

Finland is dependent on imported fuels. Accordingly, the cornerstones of Finnish energy policy are a diversified and reliable supply of energy and improved self-sufficiency. Energy-intensive basic industries, the cold climate and long distances

⁵³ Report by Finnish Energy in 2015:

https://energia.fi/ajankohtaista_ja_materiaalipankki/materiaalipankki/rakennusten_jaahdytysmarkkinat_-_tutkimushanke.html#material-view

underline the significance of energy for the wellbeing of Finland's inhabitants and competitiveness.

Until the 1960s, Finland's energy policy relied on the electricity produced by hydropower stations and the extensive use of wood. Due to limited hydro resources, the use of coal and oil started to increase rapidly and the need to find new energy sources became clear. A gas pipeline from Russia to eastern Finland was completed in 1973 and later extended to the capital area and to some other cities. The first nuclear power plant unit was taken into use in 1977, followed by three other units in 1979 to 1982. A fifth unit is currently under construction and is expected to be completed in 2020 and sixth towards the end of 2020s. The 1970s also brought peat into the Finnish energy mix.

In 2018, the total energy supply was 384 TWh. Finland's domestic energy sources are wood-based fuels, hydropower, wind power, waste and peat. Its energy dependence, calculated as the proportion of imported net energy in the total primary energy supply (TPES), was 44 % in 2017. Figure 13 shows the current distribution of the different energy sources in the total energy supply.

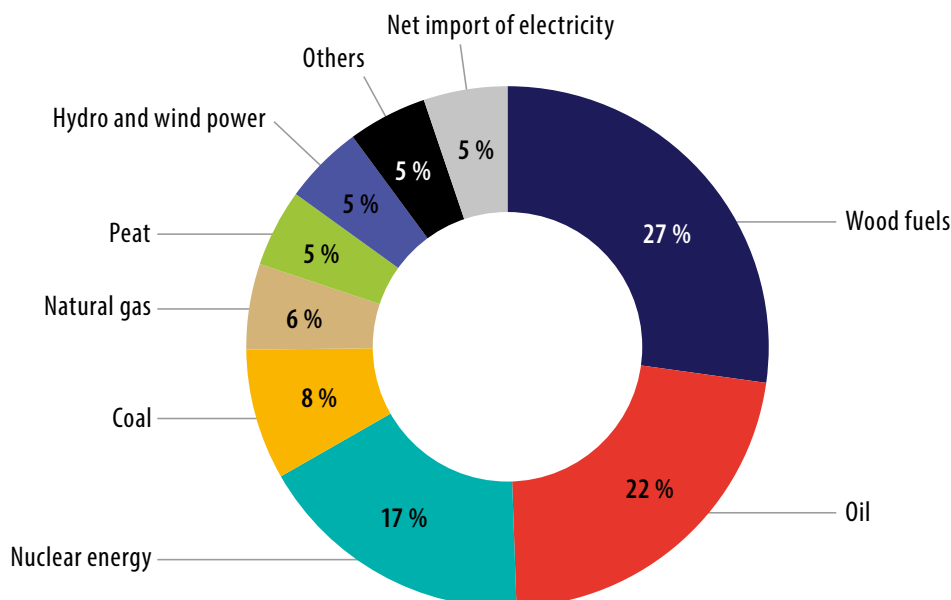


Figure 13. The distribution of different energy sources in the total energy supply in 2018.

Source: Statistics Finland.

Domestic electricity generation was 67.5 TWh in 2018. This consisted of combined heat and power production (32 %), both in connection with district heat production and by industry for its own use, nuclear power (32 %), hydro power (19 %), conventional condensing power (7 %) and wind power (9 %). Total electricity consumption was 87.4 TWh.

The power system is interconnected with the power systems of Russia, Sweden, Norway and Estonia. Net imports from the Nordic countries, Baltic states and Russia vary considerably from year to year, mainly due to variations in hydropower production in the Nordic countries. Between 1990 and 2018, maximum net imports were 20.4 TWh (2017) while minimum net imports were 3.7 TWh (1996).

The share of net imports of electricity has grown in recent years and about 2,000 MW of generation capacity has been shut down since 2010. The high share of net imports is not a problem in itself. Well-functioning regional and European electricity markets and sufficiently strong cross-border connections are the most efficient and cost-effective way of guaranteeing competitive electricity prices and security of supply. However, generation adequacy during winter peak hours is a concern before the commercial operation of Olkiluoto 3 nuclear power unit starts in 2020. Two simultaneous large failures over 1,200 MW (e.g. the largest generation unit and significant interconnector) on an especially cold winter day would create a situation where curtailment of demand could be needed⁵⁴.

In Finland, renewables accounted consistently for around 30 % of gross final energy consumption for the period 2000 to 2007, but the figure has increased in recent years, reaching 41 % in 2017. In 2010, an extensive package of specific targets concerning different renewable energy sources was launched in order to reach the EU 2020 renewable energy target set for Finland, i.e. 38 % of its gross final energy consumption. The package promotes the use of forest chips and other wood-based energy in particular, alongside wind power, the use of transport biofuels and increased utilisation of heat pumps. Since 2010, measures have been strengthened and adjusted when needed. Wood energy and wood pellets are exported and

54 Suomen sähkötehon riittävyys ja kapasiteettirakenteen kehitys vuoteen 2030, Pöyry Management Consulting Oy, 23.1.2015. https://tem.fi/documents/1410877/2717655/Suomen_sahkotehon_riittavyys_ja_kapasiteettirakenteen_kehitys_vuoteen_2030_2015.pdf/56b3f402-31fa-48a7-a6ef-d750e4665f78/Suomen_sahkotehon_riittavyys_ja_kapasiteettirakenteen_kehitys_vuoteen_2030_2015.pdf.pdf

imported to some extent, the net amount depending on the year is typically between -1 and +1 TWh.

Combined heat and power production (CHP) provides opportunities for the cost-effective use of renewables both by industrial producers and at district heating plants. The amount of energy Finland saves annually through CHP approximately corresponds to one-tenth of all primary energy used in the country. CHP accounts for more than one third of all electricity production compared with the EU average of 12 %. Installed wind power capacity has been steadily increasing in Finland since 1990 as a result of the Government's support measures. The capacity was only about 1 MW in 1992, whereas it had climbed to 82 MW in 2005 and reached 630 MW at the end of 2015. By the beginning of 2019, the installed wind power capacity had increased to 2,041 MW.

For several decades the use of primary energy, as well as electricity increased and reached their peak values in 2006 to 2007. Demand rose faster than GDP until 1994. Thereafter, both the energy intensity and the electricity intensity of the economy have decreased. The decrease reflects the structural change in the economy from basic industry towards services and less energy-intensive industry. Furthermore, increased energy efficiency has contributed to the positive development of energy intensity. Figure 14 shows the historical development of the different energy sources in the period 2000 to 2018.

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

As described in Chapter 4.2, the most significant future changes in the WEM projection in electricity and heat production are the two nuclear power plant units currently under construction and in the planning phase, respectively, and the increase of renewable energy sources, mainly wind power and biomass. District heat production from heat-only plants is expected to slightly increase its share at the expense of combined heat and power production, which is struggling with the feasibility due to low electricity prices. Figure 12 outlines the primary energy supply by energy source in the WEM projection until 2040.

Figure 15 shows the projected development of self-sufficiency in total energy supply. Self-sufficiency is 55 % today and is expected to exceed 70 % by the end of

the 2020s. The positive development is mainly due to increased use of domestic renewable energy and new nuclear power that reduce the need for imported fossil fuels and electricity imports.

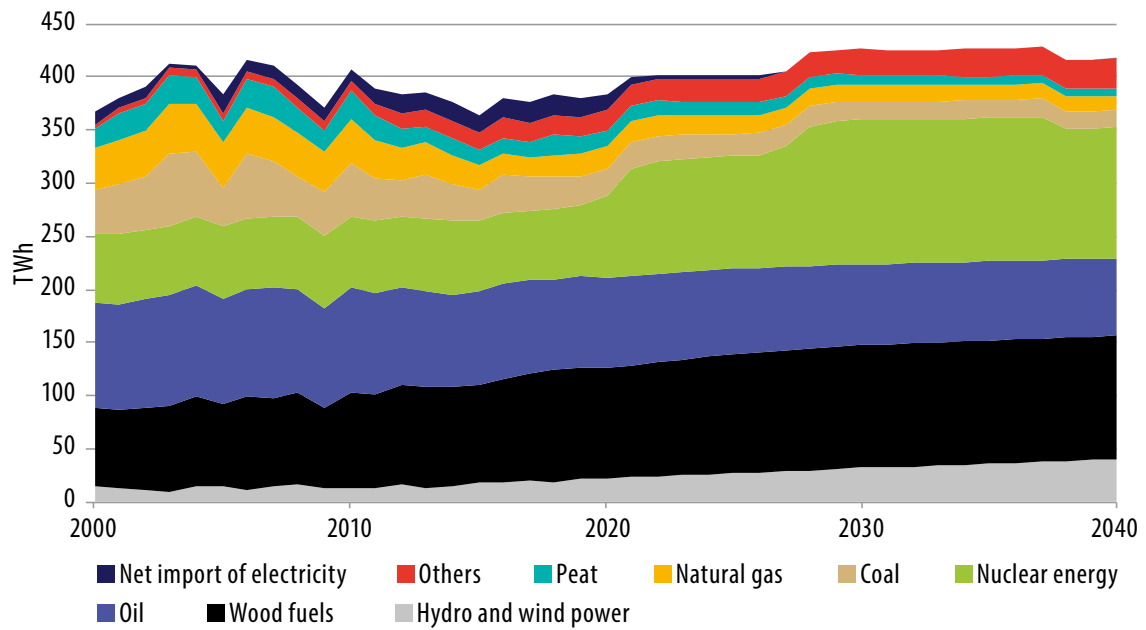


Figure 14. Historical development (2000 – 2018) and WEM projection of the primary energy supply until 2040.

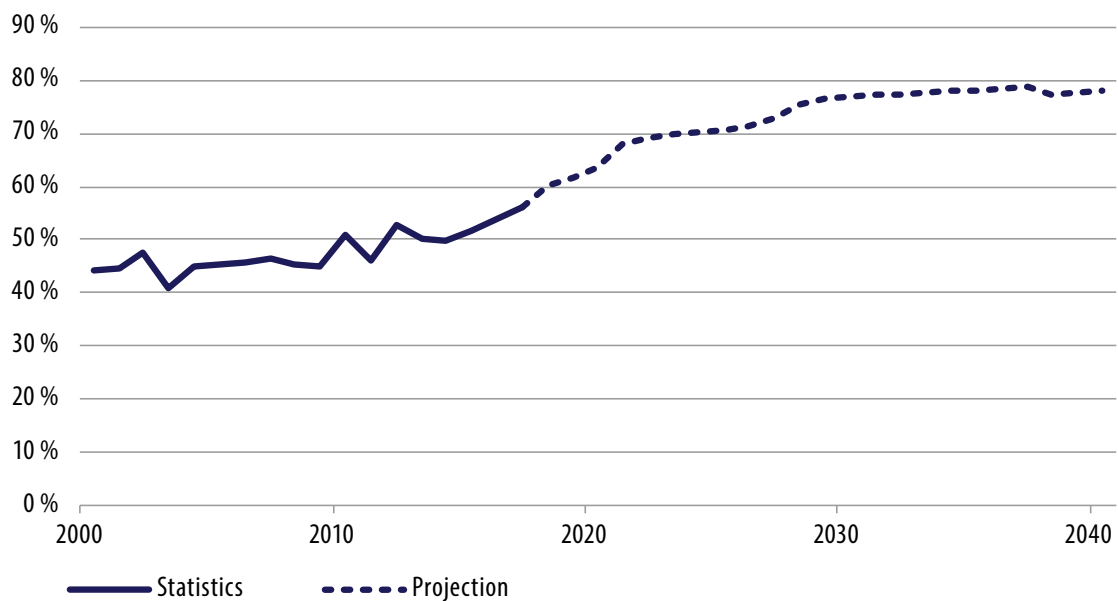


Figure 15. Historical self-sufficiency in energy supply 2000 - 2017 and the projected development in the WEM projection until 2040.

SKM Market Predictor estimates in its study²⁹ that the projected electricity demand at peak load increases from 15,300 MW in 2020 to 16,200 MW in 2030. After the start of Olkiluoto 3 nuclear power plant unit, the margin between electricity supply and demand in terms of capacity decreases to about 1,620 MW in 2020. In the mid-2020s, generation adequacy may decline temporarily when some conventional condensing and CHP plants are likely to shut-down. The investment of Fennovoima Hanhikivi nuclear power plant is expected to increase generation adequacy again in the late 2020s despite constantly growing electricity consumption and peak demand. The operation permits of Loviisa 1 and 2 nuclear power units are in force until 2027 and 2030 respectively. Unless the operation permits of Loviisa nuclear power units are extended, the generation adequacy margin will again clearly decrease. In the projections, these two units are decommissioned in the late 2030s. Table 19 shows the projected development of peak load demand and available generation and interconnector capacity in peak load situations for the years 2020, 2030 and 2040.

Table 19. Projection of demand, generation capacity and interconnector capacity in peak load situations [MW].⁶⁴

	2020	2030	2040
Peak demand	15,300	16,200	17,000
Generation capacity *	13,680	13,920	12,960
Deficit	1,620	2,280	4,040
Interconnector capacity	4,850	6,050	6,050

* including strategic reserves in 2020, wind power equalling 6% of installed capacity, PV capacity not included.

4.5 Dimension internal energy market

4.5.1 Electricity interconnectivity

i. Current interconnection level and main interconnectors

Chapter 2.4.1 describes current status of the interconnection level and its development in the near future. Table 20 lists the main interconnectors.

Table 20. List of main interconnectors.

To country	Type	Export	Import	Name of interconnector
Sweden SE1	AC	1100 MW	1500 MW	
Sweden SE3	HVDC	1200 MW	1200 MW	FennoSkan 1 & 2
Estonia EE	HVDC	1000 MW	1000 MW	EstLink 1 & 2
Norway	AC	100 MW	120 MW	
Russia	AC	350 MW	1400 MW	
Total		3750 MW	5220 MW	

ii. Projections of interconnector expansion requirements (including for the year 2030)

Table 21 shows planned interconnector investments and decommissionings.

Table 21. Planned interconnector investments and decommissionings.

To country	Type	Export	Import	Information
Sweden SE1	AC	+900 MW	+800 MW	Completion 2025
Sweden SE3	HVDC	+800 MW	+800 MW	FennoSkan 1 replacement late 2020's
Sweden SE3	HVDC	-400 MW	-400 MW	FennoSkan 1 decommissioning
Total		+1300 MW	+1200 MW	Net increase of capacity

4.5.2 Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas

Electricity

The Finnish electricity system is part of the Nordic synchronous power system along with the Swedish, Norwegian and Eastern Denmark systems. Finland is also connected to the Russian and Estonian power systems by direct current connections. The Nordic synchronous system is connected to the Central European power system and the Baltic power systems through direct current connections.

The main grid is the primary electricity transmission network and includes the 400, 220 and 110 kV lines that are most important for power transmission, and substations. Table 22 shows the size of the main grid operated by Fingrid. Local transmission to small users takes place in distribution grids.

The main grid serves electricity producers and consumers by enabling a functional electricity market throughout the country as well as cross-border trade. The majority of electricity consumed in Finland is transmitted via the main grid. Fingrid is responsible for main grid operation, planning and supervision.

Table 22. Current size of the main grid operated by Fingrid (2017).

Component	Length/number
400 kV transmission lines	5,100 km
220 kV transmission lines	1,600 km
110 kV transmission lines	7,600 km
total transmission lines	14,300 km
submarine cables	320 km
substations	119

Gas

Finland's gas pipeline network is currently isolated from the networks of the other Member States. Two transmission pipelines connect the gas pipeline system to the Russian system. The maximum import capacity is 24.1 million cubic metres per day (in 20 degrees Celsius). Finland's gas pipeline system is located in the southeast and southern Finland and its length is 1,300 kilometres. The transmission system operator is the state-owned company Gasum Oy.

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)

Electricity

Fingrid has a EUR 1.2 billion investment programme for the years 2015–2025. In the latter half of the present decade and early 2020s, grid investments will focus mainly on renewing ageing transmission lines and substations. The most significant new cross-border interconnector will be the third AC interconnector between Finland and Sweden. This project is scheduled for completion in 2025.

Existing subsea DC cables to Sweden and Estonia will be renewed in this timeframe (2040). When these interconnectors are replaced also their capacity will be reviewed. Also the DC interconnectors to Russia will be renewed but the capacity will remain the same.

Gas

In October 2016, Finnish Baltic Connector Oy and Estonian Elering AS made a decision to invest in the construction of the Balticconnector gas pipeline

connection between Finland and Estonia. The Balticconnector gas pipeline will be enter commercial service on 1 January 2020. The capacity of the Balticconnector pipeline will be 7.2 million cubic metres per day.

In 2020, a new LNG terminal currently under construction in the town of Hamina will be connected to the gas transmission network. The storage capacity of the Hamina LNG terminal will initially be 30,000 cubic metres. The entry capacity into the transmission system as well as into the local distribution system will be 0.5 million cubic metres per day.

4.5.3 Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

Electricity

Finland forms an integrated wholesale electricity market with Denmark, Norway, Sweden, Estonia, Lithuania and Latvia. The Nordic-Baltic market has been price linked to the North Western European electricity market since 2013. There is currently one power exchange (Nord Pool AS) active in the Nordic market and another (EPEX SPOT) entering the market. In 2018, 72% of the electricity supply in Finland was traded through the Nord Pool day-ahead market. Figure 16 and Figure 17 show the historical time series of monthly and hourly average day-ahead spot prices.

Finland is heavily dependent on integrated European electricity markets as there is a significant deficit in generation capacity compared to peak load. Finland imports over 20% of its annual electricity supply and around 30% of power consumption during winter peaks.

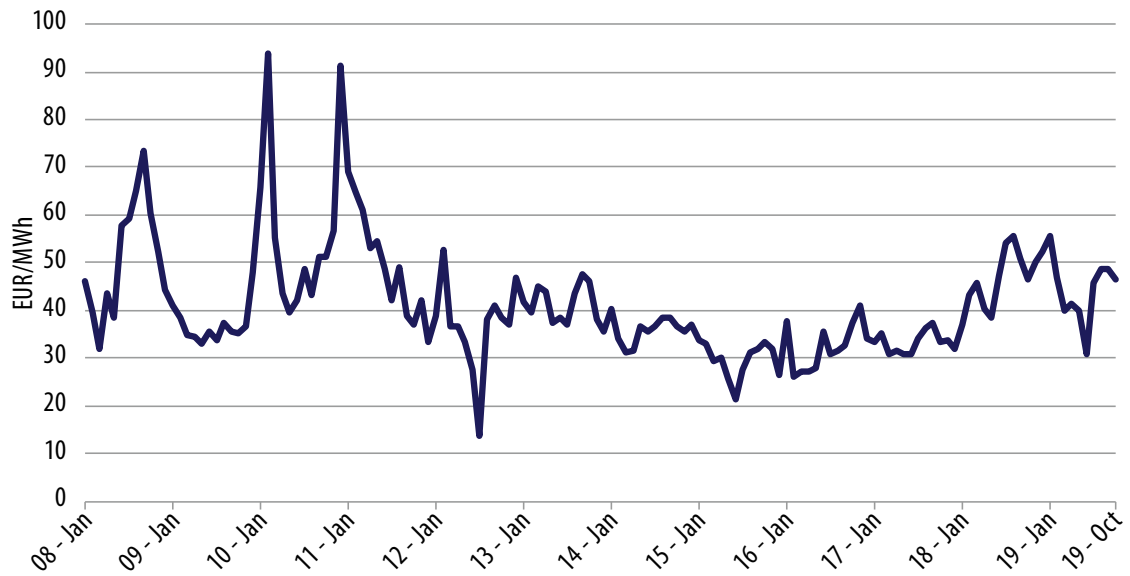


Figure 16. Monthly average prices in Finland's price area in 2008–2019.

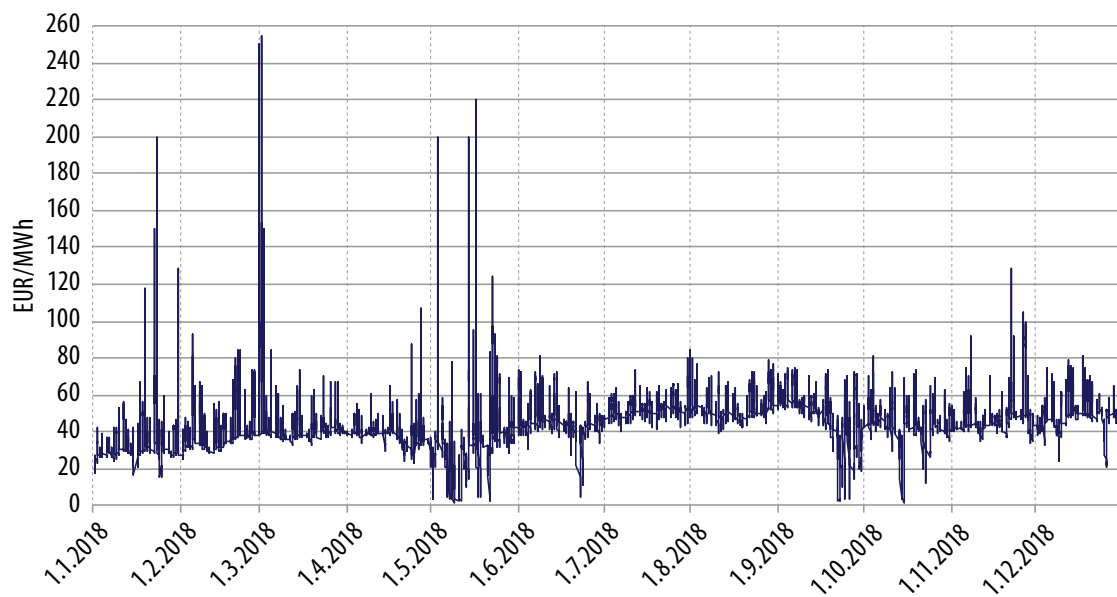


Figure 17. Hourly prices in Finland's price area in 2018.

Gas

Until 31 December 2019, Finland applies a derogation for isolated markets in accordance with Article 49(1) of Directive 2009/37/EC. As regards natural gas, there has been no third party access to a pipeline network, so buyers of natural gas have

been unable to hold a tendering process for their natural gas supply. Wholesale and retail sellers have bought their natural gas from Gasum Oy, the owner of the transmission system. Gas produced from renewable energy sources has had limited access to the pipeline network, however. In addition, buyers of natural gas can trade between themselves in the secondary market the natural gas they have bought from Gasum.

Because of the natural gas supply monopoly, both the wholesale and the retail market prices have been regulated.

Figure 18 and Figure 19 show the time series starting from 2001 of both the energy price and total price of natural gas for different type (T1 – T8) industrial size natural gas consumers. All prices exclude taxes, calculated according to gross calorific value and in EUR per MWh. The total price of natural gas includes both the price for transmission and energy.

Three examples of different type of natural gas consumers, T1, T4 and T8, are given here. The detailed information about annual consumption, peak load time and contracted capacity are as follows.

Table 23. Description of natural gas consumer types T1, T4 and T8.

Type of consumer	T1	T4	T8
Annual consumption (GWh)	50	150	1,000
Peak load time (h)	4,000	6,000	6,000
Contracted capacity (MW)	12.5	25	166.7

Complete price statistics are available on the Energy Authority's website⁵⁵.

⁵⁵ <https://www.energiavirasto.fi/maakaasun-hintatilastot>

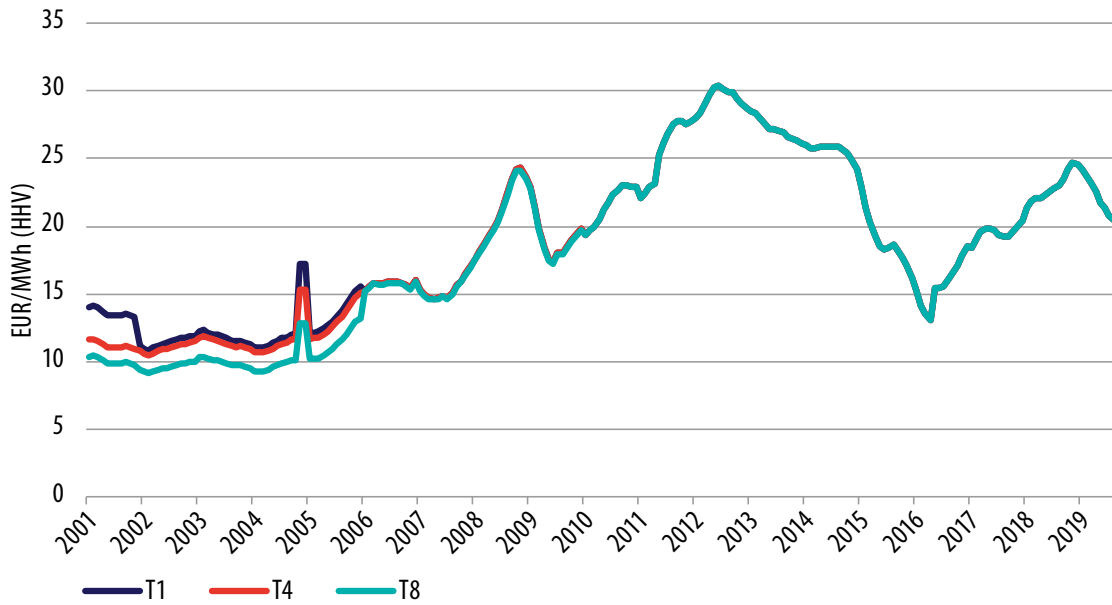


Figure 18. Price for energy for industrial size natural gas consumers.

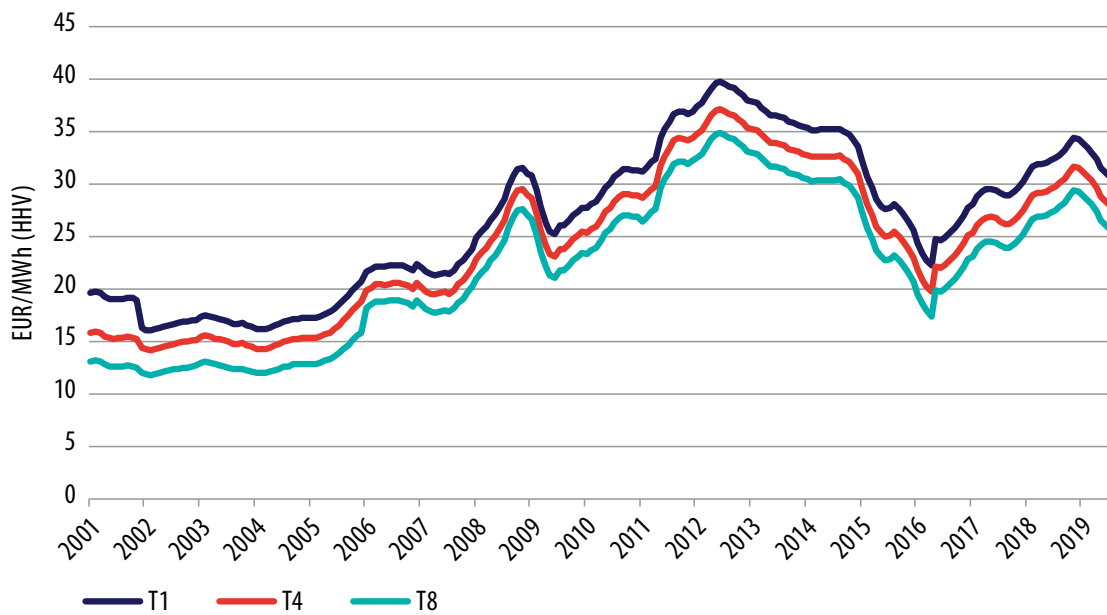


Figure 19. Total price for industrial size natural gas consumers.

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Electricity

According to SMK Market Predictor's study²⁹, the Nordic countries will increasingly integrate into the Central European electricity market, and thus the importance of the Central European region as a price-driver for the Nordic electricity market is emphasised. Although the share of wind and solar power in the European electricity balance will significantly rise over the coming decades, fuel prices and emission allowance prices will remain important price-drivers for the Central European electricity market for a long time. Another important price-driver for Central Europe is the abandonment of nuclear and coal-fired power capacity because of ageing or political decisions.

Despite the growth in wind and nuclear power, the rising central European price level keeps also the Nordic price level rising. The regional price of Finland follows the Nordic system price until the end of the 2020s, when the introduction of Hanhikivi 1 nuclear power plant and the new interconnection between Northern Sweden and Finland will lower Finland's regional price to the price level in northern Sweden. The regional price of Finland follows the regional price of northern Sweden until the exit of Loviisa 1 and 2 nuclear power plant units increases the regional price of Finland closer to the Nordic system price after the mid-2030s (Figure 20).

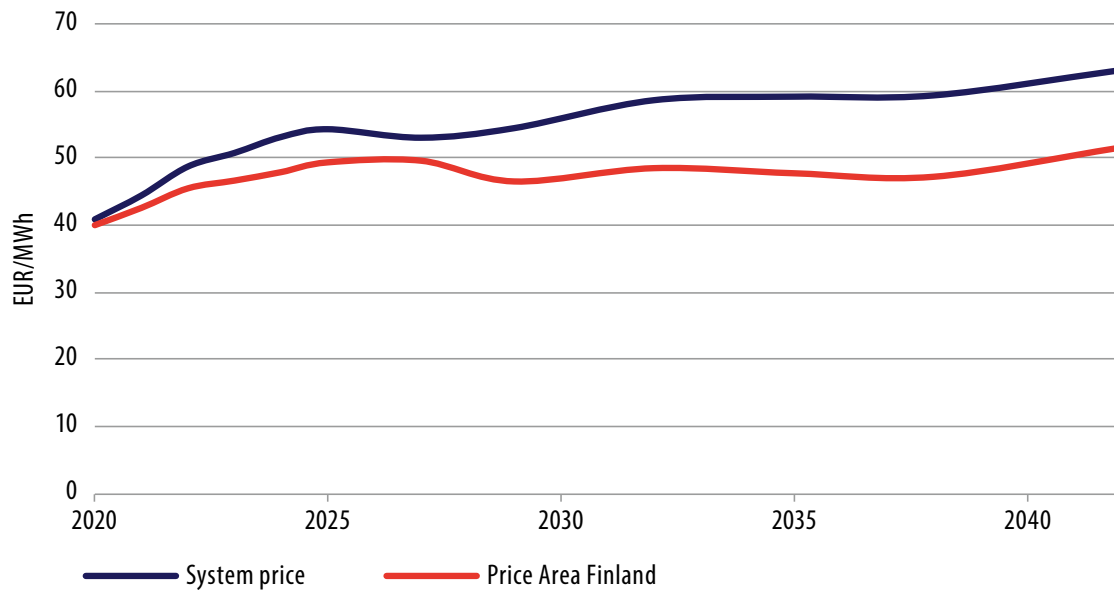


Figure 20. Projection of the electricity wholesale price in the WEM projection (EUR per MWh in 2016 prices) ²⁹.

Gas

It is expected that from 2020 onwards, the gas supply conditions in Finland will comply with the conditions determined for agreements with Gazprom by the Commission's investigation concerning competition. The price of gas energy will thus be determined on the basis of the reference price of the liquid gas hubs in Central Europe.

4.6 Dimension research, innovation and competitiveness

- i. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)**
- ii. Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers**

iii. Breakdown of current price elements that make up the main three price components (energy, network, taxes/levies)

iv. Description of energy subsidies, including for fossil fuels

The competitiveness of low-carbon technologies compared with the alternatives has improved considerably over the past few years. The competitiveness of renewable forms of energy with particularly great variation (solar and wind power) has improved. According to monitoring of energy technology exports carried out in Denmark, energy technology exports accounted for just under 10 % of Finland's goods exports in 2016, which is among the highest percentages in Europe. Finland's traditional strengths include bioenergy solutions. Finland is also a significant importer of energy technology. Finland imports solar energy systems (both solar power and heat), among others.

According to the estimate made by the Ministry of Economic Affairs and Employment of Finland, Finnish energy technology exports in 2018 grew to EUR 5.1 billion euros. The estimate excludes energy technology related services. The share of energy technology accounted for 7.9 % of total exports for the year. Finland's trade balance in energy technology was clearly positive in 2016–2018. In 2018, the energy technology trade balance was around EUR 1 billion, meaning that Finland exported more energy technologies than it imported. The Finnish energy technology cluster is globally competitive. The analysis included energy technologies related to energy production, distribution, storage as well as certain materials and components.

Public research and development funding targeted at the energy sector has declined over the past few years. In 2015, EUR 177.5 million of public R&D funding was allocated to the energy sector, EUR 69.7 million in 2016, EUR 61.7 million in 2017 and the estimate for 2018 is EUR 42.4 million. In 2015, the financing provided to innovations in the energy sector by Finland was highest in the IEA countries in relation to GDP.

The consumer price of electricity for households in Finland is below the EU average, which improves Finland's competitiveness. In 2017, Finnish households paid an average of 16 eurocents per kWh for electricity (EU average 20 eurocents per kWh) The price of electricity for other than households in Finland was about 7 eurocents

per kWh (EU average euro 11 cents per kWh). Finland taxes fossil fuels fairly heavily and the difference is considerable, particularly when compared to non-EU countries. The competitiveness of an individual industry in terms of energy price also partly depends on the electricity tax reliefs and refunds granted.

5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

5.1 Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals including comparison to projections with existing policies and measures (as described in section 4)

i. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive EU 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures.

Figure 2 and Figure 10 show the development of greenhouse gas emissions and removals in the WEM and WAM projections. The WEM projection estimates that the total greenhouse gas emissions (excluding LULUCF) in 2020 and in 2030 will be 53 and 44 Mt CO₂ equivalent respectively, whereas the WAM projection assesses that they will be 52 and 39 Mt CO₂ equivalent, respectively.

Finland is in the course of reaching its EU 2020 emissions reduction goal and its corresponding emissions reduction obligation under the second commitment period of the Kyoto Protocol with existing policy measures. The effect of the additional measures is aimed at the 2020s and in full by 2030 at the latest. With the measures in the WAM projection, the renewable energy share will rise to above 50% of gross final energy consumption and the use of imported oil for domestic

needs will be halved by 2030 compared to the 2005 level. The use of coal in energy production will end by 2029.

The ban on coal in energy production will impact the energy system. Coal CHP plants will mainly be replaced by heat-only boilers using biomass. The use of forest chips is expected to increase by 2.0–2.8 TWh. Market-based development of coal use would lead to a 200 MW decrease in coal CHP generation capacity during 2025–2030. The ban on coal as a result of legislation will further decrease CHP generation capacity by 300 MW. This reduces the flexibility of the electricity system and the generation adequacy between supply and demand will be tighter. The ban on coal by 2029 will also have a marginal impact on power prices, EUR 0.1–0.3 per MWh depending on the fuel price scenarios.

Even though the electricity demand increases steadily in the WAM projection, electricity generation by district heating CHP plants is likely to decrease. In the 2020s wind and solar power are expected to be competitive and grow their share of generation. Figure 21 shows the development of the electricity supply in the WAM projection until 2030.

The dependency of electricity imports in particular at peak load situations remains a challenge in the 2020s despite investments in smart grid solutions and system flexibility. Further measures will be considered in the coming years.

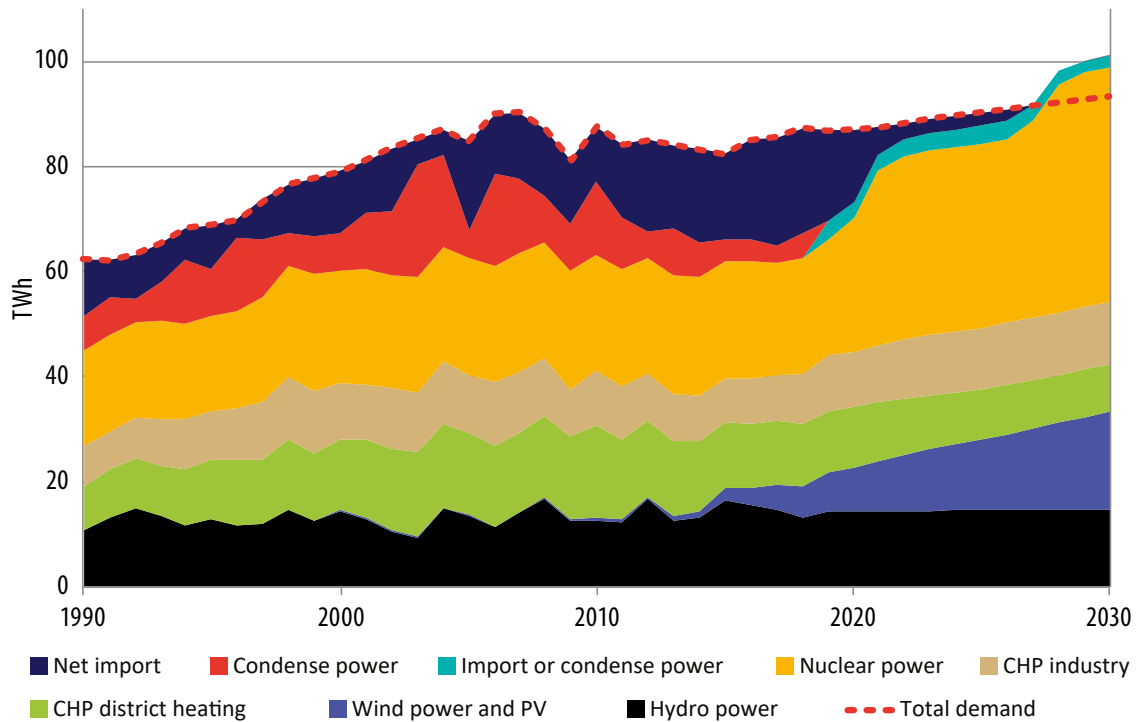


Figure 21. Development of electricity demand and supply in the WAM projection.

The planned transport sector policy to increase the number of electric vehicles to 250,000 by 2030 significantly increases the amount of electricity used by the sector (Figure 22). At the end of the 2020s, electricity demand of road transport will equal that of the railways. Thereafter road transport electricity is expected to double by 2040. Total use of electricity in the transport sector is not more than 1–2% of the total electricity demand during the assessed period. Its impact on electricity generation is small on a yearly level, but charging batteries and active use of them as two-way electricity storage can affect both the short-term electricity market and the local grid. Thus, electric vehicles can, with clear rules and developed market solutions, contribute to an overall efficient and advanced energy system.

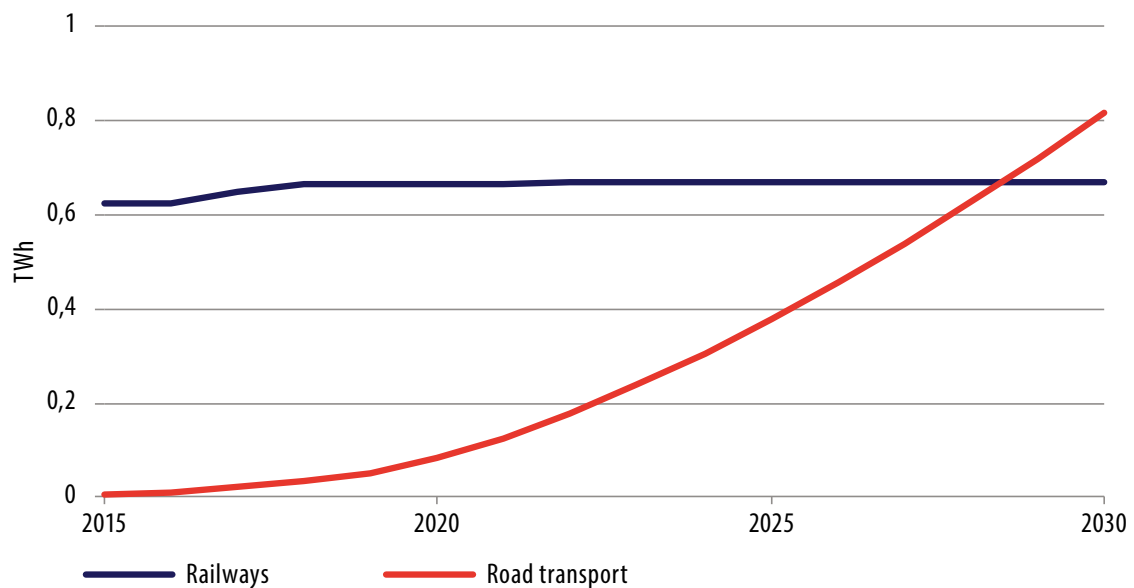


Figure 22. Development of the use of electricity in the transport sector in the WAM projection.

ii. Assessment of policy interactions (between existing policies and measures and planned policies and measures within a policy dimension and between existing policies and measures and planned policies and measures of different dimensions) at least until the last year of the period covered by the plan, in particular to establish a robust understanding of the impact of energy efficiency / energy savings policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply.

The new premium system for renewable electricity increases annual electricity generation by (only) 1.4 TWh, which can well be integrated in the existing power system. The premium system plays an important role in contributing to the market-based deployment of wind power in the future. Large-scale integration of variable renewable energy into the energy system requires greater system flexibility. There is a need for a variety of service providers and for more diversified markets, for

which a number of proposals have been presented in the report of the Smart Grid Working Group⁵⁶.

Installation of large wind farms requires the electricity grid to be strengthened at both the local and national grid level. Electricity companies must develop the network according to customers' reasonable needs. In addition, as the use of energy in society as a whole shifts increasingly to electricity, electricity demand increases and there is a continuous need to invest in network infrastructure. Therefore, in relation to the network infrastructure, there is no risk of stranded costs, rather the opposite.

The 1.4 TWh subsidised production slightly weakens the profitability of existing power plants as they cannot sell quite as much electricity as before. In addition, the spot price drops slightly, which reduces the returns of all electricity producers. This renewable energy measure is not considered to be of any importance to the energy security dimension and the direct impact on the internal market dimension is also marginal, see also Chapter 4.5.

Finland has imposed binding reliability standards on distribution system operators to ensure resilience in electricity distribution networks, especially in severe weather conditions. One possible measure for the DSOs is to replace overhead power lines with underground cables. The Finnish Energy (an association representing the energy industry, including DSOs) has estimated that this measure will release an area of 40,000 hectares for afforestation. Thus, replacing medium-voltage overhead power lines with underground cables could have a policy interaction with carbon sinks in the longer term.

The planned Datahub facilitates the development of services that are related to small-scale electricity production, the creation of energy communities, etc. This is expected to speed up the deployment of small-scale electricity production and thus supports the low-carbon dimension. An increase in small-scale electricity production that is used on site results in lesser billing for distribution companies and suppliers. Consequently, it is likely that distribution companies will change the

56 https://tem.fi/documents/1410877/2132296/%C3%84lyverkkoty%C3%B6ryhm%C3%A4n_keskeiset_ehdotukset_241018/3800ce98-68bc-da20-52e9-494722cfc2bd/%C3%84lyverkkoty%C3%B6ryhm%C3%A4n_keskeiset_ehdotukset_241018.pdf; <https://tem.fi/alyverkot>

structure of distribution tariffs over time so that they emphasise less the energy component and introduce capacity-based components.

The ban on the use of coal in energy production is good for the low carbon dimension but not necessarily favourable for the energy security dimension, at least with regard to security of electricity supply. The ban on coal in 2029 as a result of legislation will decrease CHP generation capacity by 300 MW. This will reduce the flexibility of the electricity system and the generation adequacy between supply and demand will be tighter. The policy measure will result in a slight increase in the market price of electricity, see Chapter 5.4.

Policies and measures for the dimension of decarbonisation, such as biofuels/ bioliquids quota obligations for the transport and heating sectors, requires the development of new technologies. Thus, the dimension of decarbonisation has policy interactions with the dimension of research, innovation and competitiveness.

As an additional consideration, building sector projections show that improvement in the energy efficiency of buildings reduces the use of district heating. This development is likely to occur even if the total building volume increases. As the district heating network has already been fully built, there is a risk that the number of paying customers will be insufficient to maintain the district heating infrastructure. The problem is even accelerated if district heating customers chose to disconnect and switch to decentralised heating such as e.g. heat pumps. Consequently, it is important to ensure the competitiveness of district heating and CHP.

iii. Assessment of interactions between existing policies and measures and planned policies and measures, and Union climate and energy policy measures.

All the measures implemented and planned in all the five dimensions that Finland has indicated in this report are either related to the implementation of EU legislation or contribution to achieving the EU's energy and climate targets. The policy measures will ensure that Finland takes care of its own share and contributes adequately to the EU's common energy and climate goals. The policy measures also ensure that Finland is also on the path to achieving long-term goals by 2050.

5.2 Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures.

The impact assessment of NECP is based on two separate impact assessments reports, one prepared for the Finland's National Energy and Climate Strategy⁵⁷ from 2016 and the other prepared for the Medium-term Climate Change Policy Plan (KAISU)⁵⁸ from 2017. In addition, Finland's National Energy and Climate Strategy and Medium-term Climate Change Policy Plan both include one chapter on impact assessments. In the Energy and Climate Strategy it is Chapter 4, including also impacts on the national economy (Chapter 4.5) and environmental impacts including also, for example, the quantity of air impurities (Chapter 4.6). Chapter 13 of the Medium-term Climate Change Policy Plan is about the impacts of the policy plan, including economic impacts and also the impact on the national economy (Chapter 13.2), impacts on human health and the environment (Chapter 13.3) and impacts on security (Chapter 13.4). These documents are available also in English 5 and 6.

The conclusion of the impact assessments of the National Energy and Climate Strategy is that the proposed actions and measures allow Finland to reach the targets of the EU Effort Sharing Decision and national targets to increase renewable energy, to reduce fossil fuel consumption, and to increase self-sufficiency of energy consumption. The largest share of additional emission reductions would be

57 <https://tietokayttoon.fi/julkaisu?pubid=16902> (in Finnish).

58 <https://tietokayttoon.fi/julkaisu?pubid=21004> (in Finnish).

achieved in the transport sector followed by a reduction in emissions from the oil heating of buildings, work machinery, waste management, F-gases and agriculture.

Realisation of the targets of the Energy and Climate Strategy affects economic steering and the national economy. According to the impact assessments, the gross domestic product would be 0.6 %-points lower than the baseline in 2030. Employment would grow by over 3 % by 2030 compared to 2015, but would remain 0.15 %-points lower than in the baseline.

By 2030, investments will fall by less than 1 % compared to the WEM projection. Private consumption will fall by about 0.4% compared to the WEM projection, mainly due to the rise in the average price of transport fuels and cars, which will weaken purchasing power. Rising domestic prices will weaken export competitiveness and reduce exports by more than 1 % compared to the WEM projection, but compared to 2015, growth will still be over 40 %. The measures in the WAM projection change the structure of both demand and production compared to the WEM projection. However, the changes are not very dramatic.

Forest biomass is the largest growing renewable energy source from 2015 to 2030. The impact assessment of Finland's National Energy and Climate Strategy from 2016 concludes that the existing felling potential in Finnish forests will be large enough to supply the estimated needs of both the forest and energy industries, and since a major share of wood fuels are derived from the by-products of the forest industry, Finnish forests will remain a carbon sink. Natural Resources Institute Finland (Luke) has updated scenarios for carbon sinks based on new data on forest growth.⁵⁹ The study was published in February 2019 and partly updated in autumn 2019.

According to the impact assessments of the Energy and Climate Strategy and the Medium-term Climate Change Policy Plan, they will affect climate change, nature's biodiversity and water basins, air pollution, health and living conditions. The details of the practical implementation are essential since these will influence how increased harvesting affects biodiversity and what welfare impacts different population groups will experience. According to the impact assessments, increased

⁵⁹ Development of emissions and sinks in the agricultural and LULUCF sectors until 2050 (in Finnish) http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161408/20-2019-MALULU_.pdf

wood use may potentially have negative impacts on biodiversity, but this depends, for example, on how additional felling is carried out and on what measures are taken to prevent adverse effects. The effects of an increase in biofuel production will highly depend on the raw feedstocks used for production. The impacts on biodiversity can be mitigated by introducing new incentives to uphold the biodiversity of forests. This can be done by several means, such as leaving dead trees to a greater extent in regeneration areas and avoiding fellings in valuable nature areas.

In the impact assessment of the Medium-term Climate Change Policy Plan, the assessments of the measures of the non-ETS sector under the effort sharing regulation have been updated and extended. According to the results of the energy system model TIMES, a realistic overall emission reduction potential compared to the baseline (WEM projection) totals 5.1–6.8 Mt CO₂ equivalent in 2030. The largest potentials are identified in transport, but there are also substantial uncertainties regarding these emissions reductions and associated costs. Additional emissions reductions are achievable especially through decreasing the use of mineral oil in the heating of buildings and in fuel use of work machines. An increased share of biofuels in transport, heating and machinery is the most significant individual measure. In total, the KAISU measures have only a minimal impact on the growth of gross domestic product. In combination with other policy measures, the KAISU measures affect the environment, people's health and living conditions in many ways. The level of impacts depends on many factors, making the anticipation of impacts uncertain. Careful monitoring is therefore needed to verify the reaching of targets and other impacts.

Economic impacts of policies and measures have also been reported in Chapter 5.5. of Finland's Seventh National Communication under the United Nations Framework Convention on Climate Change¹². The information in the Seventh National Communication is based on the situation at the end of 2017 and the impacts of the policy measures of Finland's National Energy and Climate Strategy. The results related to the Medium-term Climate Change Policy Plan on the macroeconomic level are very similar to those of the National Energy and Climate Strategy.

A dynamic applied general equilibrium model that describes the economy from the perspective of decisions made by households, companies and the public sector is used for the economic impact assessment.

Table 24 shows the impact of the WAM measures on the national economy in 2030 in comparison to the WEM projection.

Table 24. Impact of the WAM measures on the national economy in 2030.

	Change compared to the WEM projection [percent]	Impact on the domestic product compared to the WEM projection [percentage point]
Domestic product	-0.59	
Private consumption	-0.40	-0.23
Investments	-0.85	-0.10
Public consumption	0.00	0.00
Exports	-1.75	-0.76
Imports	-1.33	0.49

Water impacts resulting from climate change mitigation measures are closely related to the development of wood use. When forestry is intensified, the effects will be in the same direction as with the more severe climate. Both increase the load on the water. Nitrogen and phosphorus loads cause eutrophication of waterways and solids loads cause turbidity, silting and overgrowth. Increasing logging in line with the objectives of the Energy and Climate Strategy will increase the load on the water.

Most of the serious health hazards associated with air pollution are caused by small particles. The largest domestic sources of small particles are small-scale wood combustion, road traffic, including both exhaust and street dust, and machinery. Burning wood in fireplaces and stoves reduces air quality, especially in densely built areas of small houses. The small particles emissions from wood burning cause premature deaths and increase the incidence of illness just as the small particles in traffic. Small-scale wood combustion is also an important source of black carbon emissions. The relative share from wood burning is growing as the other sources such as transport are becoming less important. No significant reduction in small particulate emissions from small-scale wood burning can be foreseen without noticeable technological changes in the equipment used.

Exposure to particles from small-scale combustion will decrease slightly in the future, but there is only a minor difference between the WEM and WAM projections. In the transport sector, the shift towards increased use of electricity and gas is

reflected in improved air quality in urban areas. In the current situation, the biggest air quality-related mortality effects in Finland are caused by long-term exposure to small particles of small-scale combustion and street dust, each causing about 200 premature deaths per year.

All of the air pollutants considered will be significantly reduced from 2015 to 2030, although overall energy use will increase. Emissions reductions for combustion installations and the transport sector are largely the result of EU legislation coming into or already in force. The major impact of fuel changes is the reduction in the use of coal, which significantly reduces sulphur and nitrogen oxide emissions, and the increased use of wood in combustion plants, which, despite tightening emission limits, may slightly increase nitrous oxide emissions.

For air pollutants, the differences between the WEM and WAM projections are small. The most significant changes are the partial replacement of coal by renewable energy sources and the declining fuel consumption of road transport as a result of more efficient transport and a modal shift as well as the increasing number of electric and gas vehicles.

Under the Programme of Prime Minister Sanna Marin's Government, a fair transition is a guiding theme in the Government's climate policy. Emissions reduction measures will be carried out in a way that is fair from a social and regional perspective, and that involves all sectors of society. The Government will establish a ministerial working group on climate and energy issues, which will be in charge of preparing climate policy as a whole. Assessing climate impacts will become a part of the normal process of drafting legislation.

Work to combat climate change requires contributions from all sectors of society. The Government will establish a round table on climate policy in connection with the sustainable development committee. By bringing together a variety of operators in society, it can be ensured that climate actions are in the best interests of society and have broad approval from the public.

For example, the Government will establish a broad-based peat industry working group to explore how the use of peat can be directed away from energy use and increase its use in innovative, high added value products. The working group will present the means to ensure that the change occurs in a way that is fair at the

regional and social levels and that does not jeopardise the security of electricity and heat supply in Finland. The aim is to reduce use of peat by at least a half by 2030.

5.3 Overview of investment needs

i. Existing investment flows and forward investment assumptions with regards to the planned policies and measures

General policies on investments and RDI

Securing the necessary funding is the key to meeting energy and climate policy targets. In the context of the European Semester, the Council Recommendation on the 2019 National Reform Programme of Finland and delivering a Council opinion on the 2019 Stability Programme of Finland recommended that Finland take action in 2019 and 2020 to:

Focus investment-related economic policy on research and innovation, low carbon and energy transition and sustainable transport, taking into account regional disparities.

Under the Programme of Prime Minister Sanna Marin's Government, Finland will see significant improvements in its research and innovation environment, and a rising level of investments. The Government's goal is to raise RDI investments to 4% of GDP and to make Finland the world's best environment for innovation and experiments.

The transition to a low-carbon economy will require additional investments, particularly in bioeconomy, the circular economy, clean energy solutions, energy efficiency, emissions-free forms of energy production, energy storage solutions, carbon recovery and energy utilisation, along with research, development and innovation activities and measures to bring these solutions to market.

In industrial sectors, the Government is preparing, in cooperation with industry operators, sector-specific low-carbon roadmaps. The aim is to find technological pathways, which still need RDI investments in order to meet the ambitious

climate targets. The sector-specific low-carbon roadmaps will be included in the Government's international growth programme.

In the transport sector, the Government's goal is to reduce transport emissions by at least 50 % compared to the 2005 level by 2030. This is a step towards carbon-free transport. In order to reduce transport emissions, measures will be taken to reduce transport performances, to promote the transition towards more sustainable mobility and to phase out fossil fuels.

Investment needs for the ban on coal

The economic impact of premature investment costs in the cities of Helsinki and Vaasa are EUR 34 million. In addition to this, EUR 2–4 million needs to be invested in additional equipment in other cities with multi-fuel boilers.

Investment generated by the tender process for renewable electricity production

The Energy Authority has carried out the tendering process and the deadline for tenders was 31 December 2018. It received over 20 tenders for new wind power capacity of which seven were accepted in the rising price order. According to the SKM report, the investment cost for wind power is EUR 1.5 million/MW. Based on this the overall investment cost would be EUR 600–750 million.

Investment needs for the centralised data exchange solution

The total cost of the centralised data exchange solution, Datahub, is approximately EUR 36 million, of which the transmission system operator accounts for EUR 19.6 million and the electricity companies EUR 16.6 million. The average investment of electricity companies per customer is EUR 0.5 per year during 10 years. Investments are almost equally distributed between retailers and distribution system operators.

Investment needs for the production of biofuels

According to the research study "Biopolttoaineiden kustannustehokkaat toteutuspolut vuoteen 2030"⁶⁰, the development of the WAM projection presented in the Energy and Climate Strategy is estimated to amount to a total of 800,000 oil equivalent tonnes (toe) of biofuels in 2030. The amount of bioliquids needed to replace light fuel oil is estimated at 34,000 toe/a in heating and 69,000 toe/a in machinery, i.e. a total of 103,000 toe/a and the remaining 700,000 toe/a in domestic traffic. Biofuels production capacity in Finland is currently more than 500,000 toe, so the additional requirement by 2030 would be around 400,000 toe, if the obligations presented are to be fully met by domestic production.

Based on earlier estimates, the cost of investing 400 ktoe in production capacity would be up to EUR 1,300 million by 2030. However, there are significant uncertainties surrounding the estimated amount of biofuel needed. If, for example, energy efficiency did not improve and the number of electric vehicles would be half of the 250,000 vehicles projected for 2030, the required amount of biofuels would be raised annually by about 600 ktoe in the 2030 situation.

Investment needs for public recharging points for electric vehicles

Finland's national plan for the distribution network for alternative transport fuels⁶¹ estimates that in 2030 at least 25,000 public recharging points should be provided for a minimum of 250,000 electric vehicles. This number is based on the Alternative Fuels Infrastructure directive (2014/94/EU), which indicates that the appropriate average number of recharging points should be equivalent to at least one recharging point per 10 cars.

If we assume that the average investment cost of one fast charger is approximately EUR 40,000 and the average investment cost of one medium-speed charger is

60 Cost effective pathways of biofuels until 2030 (in Finnish but abstract in English). <http://urn.fi/URN:ISBN:978-952-287-614-0>

61 Distribution network for alternative transport fuels. Finland's national plan. Ministry of Transport and Communications, Reports 44/2017 <http://urn.fi/URN:ISBN:978-952-243-501-9>

approximately EUR 14,000⁶², the estimated investments of building the public charging infrastructure are EUR 415 million by 2030. This is based on an assumption that 10% of public recharging points are fast chargers.

There are no similar estimates of the investment needs for the natural gas infrastructure in Finland because no official targets have been set for natural-gas-supplying gas stations by 2030.

Investment needs for the main rail infrastructure network

According to the Government Programme, the Government will examine the opportunities to finance three large rail network development projects. These projects are the following:

- Main line and its extensions
- Western rail line from Helsinki (including the Espoo urban railway)
- Eastern rail line from Helsinki

The investment costs of the Main line and the Western rail line from Helsinki are estimated to be approximately EUR 8.5–8.9 billion in the 2020s. However, the negotiations are still ongoing and no actual decisions about these projects have been made.

Investment needs for the security of supply of electricity networks

The investments needs for the security of supply of electricity networks are estimated in the report of the electricity transmission pricing and security of supply⁶³.

62 The average costs are estimated based on research report of VTT Technical Research Centre of Finland: Tieliikenteen 40%:n hiilidioksidipäästöjen vähentäminen vuoteen 2030: Käyttövaihtoehtojen ja niiden kansantaloudelliset vaikutukset (in Finnish). [http://www.doria.fi/bitstream/handle/10024/162111/Tieliikenteen%2040%20hiilidioksidip%20C3%A4%20C3%A4st%20C3%B6jen%20v%20C3%A4hent%20C3%A4minen%20vuoteen%202030%20K%20C3%A4ytt%20C3%B6voimavaihtoehtojen%20ja%20niiden%20kansantaloudelliset%20vaikutukset%20\(VTT%20Oy\).pdf](http://www.doria.fi/bitstream/handle/10024/162111/Tieliikenteen%2040%20hiilidioksidip%20C3%A4%20C3%A4st%20C3%B6jen%20v%20C3%A4hent%20C3%A4minen%20vuoteen%202030%20K%20C3%A4ytt%20C3%B6voimavaihtoehtojen%20ja%20niiden%20kansantaloudelliset%20vaikutukset%20(VTT%20Oy).pdf)

63 Jarmo Partanen. Electricity transmission pricing and security of supply. Publications of the Ministry of Economic Affairs and Employment 43 – 2018. <http://urn.fi/URN:ISBN:978-952-327-356-6>

Based on the report, under the Electricity Market Act, distribution companies must develop their grids and operations so that after 2028 a single disruption may not last more than 6 hours in areas covered by local detailed plans and 36 hours in other areas.

Since the 2017 legislative amendments, the Energy Authority has been able to grant companies and extension until 2036 at the most where there are very serious grounds. Total investments by distribution companies amounted to EUR 9.5 billion in 2016–2018, of which about EUR 3 billion is related to security of supply requirements.

The investments significantly exceed the required amount of straight-line depreciations under the Energy Authority control scheme, resulting in considerable needs for equity capital or non-equity capital. The domestic content of the security of supply investments is 70–90%. The effect of significant and accelerated investments on distribution companies' revenues is estimated at +10–40% in 2018–2028, depending on regional circumstances.

Investment needs in electricity interconnector capacity

The estimated costs of the construction of an alternating current connection of 800 MW between northern Finland and northern Sweden are just under EUR 200 million. The transmission line is planned from Messaure in Sweden via Keminmaa to Pyhänselkä in Finland, spanning a distance of around 370 kilometres.⁶⁴

ii. Sector or market risk factors or barriers in the national or regional context

No significant sector or market risk factors are recognised.

iii. Analysis of additional public finance support or resources to fill identified gaps identified under point (ii)

⁶⁴ Fingrid Oyj, Press Release 16.12.2016. <https://www.fingrid.fi/>

5.4 Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

i. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

The ban on the use of coal in energy production and the new premium system for 1.4 TWh renewable electricity will have marginal impacts on the Nordic power system. By 2030, CHP generation capacity is expected to decrease by 300 MW compared to market-based development. This will decrease marginally the flexibility of the Nordic power system. The inertia of the power system will decrease marginally when conventional power plants are shut down and variable renewable energy production increases.

ii. Impacts on energy prices, utilities and energy market integration

The impact of Finnish subsidised renewable electricity generation on neighbouring countries, energy market integration and electricity prices has been examined in SKM Market Predictor's study²⁹.

On an annual basis, Finland is a net importer of electricity and is expected to remain a net importer at least until the mid-2020s, despite an increase in domestic production capacity. Consequently, subsidised renewable energy production primarily reduces the need for imports from neighbouring countries. According to SKM Market Predictor's analysis, the increase in renewable energy output of 1.4 TWh to be built as a result of a tendering process, will reduce electricity imports from Sweden by about 0.9 TWh annually, which is equivalent to about one-twentieth of Sweden's estimated total exports at the beginning of the 2020s. Similarly, imports from Russia would contract by about 0.2 TWh on an annual basis, whereas exports to Estonia would increase by about 0.2 TWh.

SKM Market Predictor estimates that the increase of 1.4 TWh in renewable electricity generation will lead to a reduction in the Nordic-Baltic system price

of about EUR 0.25 per MWh at the beginning of the 2020s. As Nordic renewable electricity production continues to grow at the same time, the price effect of Finnish subsidised production will be smaller later on. In conclusion, SKM Market Predictor notes that the impact of Finnish subsidised renewable electricity generation on neighbouring countries, electricity prices and the integration of energy markets is small.

The ban on the use of coal by 2029 will have a marginal impact on power prices, depending on the fuel price scenarios an increase of EUR 0.1–0.3 per MWh can be expected.

Finland, Sweden and Norway all have ambitious goals to reduce emissions in the transport sector. A quota obligation of biofuel in the transport sector has an important role in the beginning. This will create a joint Nordic market for biofuels in transport.

iii. Where relevant, impacts on regional cooperation

The renewable energy target in transport sector increases the activities of private companies and research institutes especially in biofuels and electric vehicles. This offers an excellent opportunity for regional cooperation in the dimension of research, innovation and competitiveness.

In the dimension of internal energy markets, the quota obligation of biofuels is expected to foster a joint Nordic biofuel market.

ANNEX 1

Level of energy savings requirement – Period 2021–2030 of the EED Article 7

The annual final energy consumption, as defined in the EED Article 2(3), and averaged over the years 2016–2018, is 238 TWh. Consumption for 2018 is preliminary. Finland’s cumulative energy savings target for the period 2021–2030 is 105 TWh_{cum} (= 238 x 0.008 x 55).

The formulation “supplied to” in the definition of EED Article 2(3), has been taken into account by deducting auto-production of electricity, steam and heat from Eurostat FEC2020–2030 data.

Energy Efficiency Measures – Period 2021–2030 of the EED Article 7

Finland opts to take alternative measures in the EED Article 7 implementation in the upcoming obligation period 2021–2030.

The seven energy efficiency measures planned for the implementation of revised EED Article 7 are listed in the table below. Most of them are also used in the ongoing EED Article 7 obligation period 2014–2020. However, some of these will be strengthened with some new amendments and features. Detailed descriptions of these measures and the method of calculating the cumulative energy savings to be achieved from each measure will be presented in the final EED notification June 2020.

Monitoring of the achievement of the energy savings target referred to in Article 7 of the Energy Efficiency Directive may take into account energy savings resulting from individual energy efficiency measures implemented in 2021–2030. In accordance with Governance Regulation Annex III requirements, an estimate of the expected cumulative energy savings impact under the Directive during the two intermediate periods and the entire period 2021–2030 are presented in Table

25. The estimated cumulative savings impact pursuant to Article 7 is shown for the periods 2021–2025, 2026–2030 and the entire period 2021–2030. Cumulative savings shown for measures 1–7 are not overlapping.

Table 25. Planned Energy Efficiency Measures under Art. 7 during the obligation period 2021–2030 and their cumulative energy saving impacts (TWh_{cum}).

Energy Efficiency Measure		Period 1 2021–2025		Period 2 2026–2030		Period 1&2 2021–2030	
		TWh _{cum}	ktoe _{cum}	TWh _{cum}	ktoe _{cum}	TWh _{cum}	ktoe _{cum}
1	Energy Efficiency Agreements	59.95	5,155	22.48	1,933	82.43	7,088
2	Heat pumps for detached and terraced houses	16.00	1,376	4.40	378	20.40	1,754
3	Transport fuel taxation/car traffic	8.55	735	6.80	585	15.35	1,320
4	Energy Audit Programme - SMEs and municipalities	8.31	715	3.12	268	11.43	983
5	Energy efficiency measures in agriculture sector	8.44	726	2.96	255	11.40	980
6	Energy Efficiency Agreements/ Customer Advice Services	5.54	476	5.43	467	10.97	943
7	Mass and measure modifications in truck transport	1.08	93	0.00	0	1.08	93
Total		107.9	9,275	45.2	3,885	153.1	13,161

As for the ongoing obligation period, Finland has planned also to calculate during spring 2020 the option to notify only taxation measures instead of the separate energy efficiency measure presented in the table.

ANNEX 2: SEPARATE DOCUMENTS SUBMITTED TO THE COMMISSION

1. List of policies and measures
2. List of parameters and variables
3. GHG emissions by IPCC sector, by gas and policy sector

Finland's Integrated Energy and Climate Plan

Finland's Integrated Energy and Climate Plan contains Finland's national targets and the related policy measures to achieve the EU's 2030 energy and climate targets. The Energy and Climate Plan addresses all five dimensions of the EU Energy Union: decarbonisation, energy efficiency, energy security, internal energy markets and research, innovation and competitiveness. Finland's Integrated Energy and Climate Plan outlines the impact of existing policy measures on the projected evolution of greenhouse gas emissions, renewable energy and energy efficiency up to 2040. In addition, the plan describes the effects of the planned policy measures on the energy system, greenhouse gas emissions and sinks, economic development, the environment and public health. The plan also assesses the impact of planned and existing policy measures on investment.

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