FINLAND'S INTEGRATED NATIONAL ENERGY AND CLIMATE PLAN

Draft update

June 2023

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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

The government of Prime Minister Petteri Orpo was appointed on June 20, 2023. The government programme contains multiple entries about clean energy Finland. These policies and goals will be fully taken into account in Finland's final National Energy and Climate Plan update in 2024. Accordingly, Finland's new policy measures will also be outlined in more detail. This draft National Energy and Climate Plan update presents the energy and climate policy vision of the new government programme, and also policies and measures adopted by the previous government.

Finland's energy and climate policies have been centred on achieving carbon neutrality by 2035 while ensuring energy security, reducing energy import dependency, promoting a sustainable economy and protecting biodiversity. Finland plans to achieve carbon neutrality by maintaining a high share of nuclear energy, increasing electricity generation and heat production from renewables, improving energy efficiency, and electrifying most energy demand across the economy. Achieving carbon neutrality requires policy measures in all areas of energy and climate policy.

A major focus area is the development, commercialisation and cost reduction of new and emerging energy technologies to drive energy transition in hard-to-abate sectors and end-uses, especially industry and heavy transport. Bioenergy plays a key role in Finland's climate and energy policy. Forestry biomass is a significant source of electricity and heat, and biofuels support energy transition in the transport sector. Finland's plan to achieve carbon neutrality also relies on increasing carbon removals from LULUCF to offset remaining emissions.

Finland has made notable progress in reducing GHG emissions and moving towards carbon neutrality. It has one of the lowest carbon intensities of electricity generation among the EU member countries. It deployed the first new nuclear reactor in Europe in over 15 years, which started full operation in April 2023, and has seen strong growth in onshore wind generation.

Regarding energy security, Finland has brought its reliance on energy imports from Russia to practically zero. In 2021, before Russia's invasion of Ukraine, imports from Russia accounted for 81% of Finland's crude oil net imports, 75% of its natural gas net imports and 19% of its electricity net imports (in 2020). Overall, one-third of Finland's energy supply came from Russia. Following Russia's invasion of Ukraine, the government focused strongly on reducing reliance on Russian energy imports by increasing imports from other countries and reducing energy demand through improved energy efficiency and increased use of renewable energy. Since summer 2022, energy imports from Russia have been terminated, except for small volumes of nuclear fuel to the Loviisa NPP.

Key documents for this NECP update

This NECP update is largely based on the 2022 National Climate and Energy Strategy (*Ilmasto- ja energiastrategia*), the 2022 Medium-term Climate Change Policy Plan (*Keskipitkän aikavälin ilmastopolitiikan suunnitelma*), and the 2022 Climate Plan for the Land Use Sector (*Maankäyttösektorin ilmastosuunnitelma*).

The 2022 National Climate and Energy Strategy[1]is the main basis for this draft updated NECP. It outlines measures by which Finland will meet its EU climate commitments for 2030 and achieve the targets set in the 2022 Climate Change Act, namely reducing greenhouse gas emissions (excluding land use, land-use change and forestry) by 60% by 2030, 80% by 2040 and 90-95% by 2050 and for becoming carbon neutral by 2035.

The strategy focuses on the green transition and the phasing-out of Russian fossil energy, which has become increasingly topical since spring 2022. With regard to heat production, the strategy emphasises non-combustion-based heating. The electrification of the energy system and the use of system integration are essential, especially for hard-to-abate sectors. The strategy includes a national hydrogen strategy to promote the hydrogen economy and electrofuels and to set quantitative targets for hydrogen electrolysis capacity.

Key steering instruments of the strategy are the Emissions Trading System and a predictable long-term climate and energy policy. The measures outlined in the strategy will improve business opportunities for long-term investments in advanced clean technologies.

The 2022 Medium-term Climate Change Policy Plan[2] defines the measures needed to achieve Finland's emissions reduction target according to EU´s Effort Sharing Regulation. Transport is the most important sector to achieve this target. The Medium-term plan is also important for reducing emissions by 60% by 2030, a target in Finland´s 2022 Climate Change Act.

Finland´s target for emissions reduction in the effort sharing sector by 2030 is 50% compared to 2005, according to the updated effort sharing regulation. The measures included in the baseline projection are not sufficient for reaching the target. According to the policy projection in the Medium-term Climate Change Policy Plan, additional measures amounting to 5.6 Mt will be required to achieve Finland´s 2030 target. The National Climate and Energy Strategy and the Medium-term Climate Change Policy Plan assume the use of the so-called ETS flexibility to meet the target in the effort sharing sector.

[1] http://urn.fi/URN:ISBN:978-952-327-843-1
[2] http://urn.fi/URN:ISBN:978-952-361-417-8

The third key document of this draft updated NECP is Finland's first Climate Plan for the Land Use Sector[3]. The plan promotes the reduction of emissions from land use, forestry and agriculture, strengthening of removals by carbon sinks and adaptation to climate change, in accordance with the Sustainable Development Goals. The annual net impact that the additional measures in the land use sector aim for is at least three million tonnes carbon dioxide equivalent by 2035. The plan contributes to meeting Finland's target of carbon neutrality by 2035 and the climate objectives of the EU. It also sets down the measures targeted to land use changes, carbon dioxide emissions and sinks from agricultural lands and forests, long-lived wood products, and several cross-cutting measures. Links to the Medium-term Climate Change Policy Plan and the Climate and Energy Strategy were taken into account in the plan preparation process.

By the time of submitting this draft revised NECP, in late June 2023, Finland's new government has just taken office. For the 2023-2027 government term, the Government programme (dated 16 June) includes the following vision on clean energy:

> *"Finland will become a leader in clean energy while maximising its climate handprint. Finland will create clean economic growth at home and replace pollution-generating solutions around the world through technology exports. Finland will increase its share of investments, jobs and value added related to the clean economy. Finland will use its natural resources sustainably to improve its self-sufficiency.*
>
> *The Government is committed to meeting emission reduction targets and moving towards carbon neutrality followed by carbon negativity. At the same time, the Government will ensure that its decisions or policy measures do not increase everyday costs for citizens or weaken the competitiveness of business and industry.*
>
> *The Government will promote effective energy policy in a way that is predictable and takes a long-term view. Finland will strengthen its competitiveness and attractiveness as an investment target for renewable industries by doubling its production of clean electricity. The Government will ensure that electricity and products derived from it remain affordable and reliable with respect to security of supply. Smooth, predictable and legally certain permitting processes will be a competitive advantage for Finland.*
>
> *The Government aims to achieve its targets for annual net emissions by 2030. The Government pledges to draw up a programme by the end of 2024 that will reverse the emissions debt accumulated since the start of the decade.*
>
> *The Government will advance Finland's position as a frontrunner by developing a new energy and climate strategy aimed at carbon negativity with a key focus on promoting the clean transition and investments in industry. The Government will achieve climate impacts through effective emissions reduction measures, increased carbon sinks and*

[3] http://urn.fi/URN:ISBN:978-952-366-592-7

Finnish clean economy solutions. The new energy and climate strategy and technological developments will help generate investments that Finland can use to pay off its emissions debt in the 2030s.

Finland is committed to the objectives of the Climate Change Act. Achieving the emissions targets will require active measures. The Government will focus its climate action on generating cost-effectiveness, technology neutrality and sustainable business while recognising the importance of a long-term approach across parliamentary terms for attracting investments. To support the achievement of the targets, the Government will adopt a sensible and effective climate policy at the national and EU levels and with respect to international agreements.

Finland will create good conditions for sustainable investments in renewable and fossil free energy production, energy storage and new energy solutions, such as hydrogen. Finland will become a key player in the hydrogen economy and an attractive location for hydrogen refining projects.

In the use of public funds, emphasis will be placed on achieving a competitive advantage through RDI funding, smooth permitting processes and energy transfer infrastructure. The Government will invest in research, development and innovations that increase energy and resource efficiency and reduce the need for energy.

Clean and diverse nature will become even more important as a competitive advantage and source of quality of life in Finland. Finland will halt biodiversity loss as part of a sustainable economic policy. Finland will improve its self-sufficiency and the state of nature, increase value added and advance the sustainable use of natural resources by promoting circular economy solutions."

On the basis of this vision, the government will develop strategies, plans, policies and measures. It would be premature to comment on their possible contents at this stage, but they will be reflected in more detail in the final updated NECP, to be submitted to the European Commission by 30 June 2024.

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.

The draft plan also recognises the overall development in the climate and energy sector after the submitting of the first NECP in 2019, and the ensuing need for more ambitious climate action and faster clean energy transition. The draft plan takes into account raising the ambition of the EU's climate and energy policy and accelerating the transition to clean energy through the EU's Fit for 55 package and the REPowerEU plan.

Country specific recommendations issued in the context of the European Semester

The Council of the European Union adopts recommendations for Member States aimed at guiding national decision-making to ensure this supports growth and employment. The recommendations are endorsed by the European Council. In the context of the European Semester, Finland reseived in 2022 three country specific recommendations, one of which is specifically related to the energy issues, decarbonisation and security of supply. European council recommends that Finland take action in 2022 and 2023 to "*Reduce overall reliance on and diversify imports of fossil fuels by accelerating the deployment of renewables, including by further streamlining permitting procedures, and boost investment in the decarbonisation of industry and electrification transport. Develop energy infrastructure to increase security of supply.*"

Finland has taken due steps to implement the recommendations. Concrete implementation steps for all the recommendations are described in Finland's National Reform Programme 2023[4].

Concerning the third recommendation, many separate actions are described. For example:

- *"In 2022 Finnish wind power production increased by 41% compared to the previous year. Moreover, 2022 was also a record year in terms of capacity, with 2.4 GW of new wind power capacity introduced to almost double total wind power capacity (Country specific recommendation 3.3)."*
- *"Finland has been actively involved in the creation of the regional gas market with the Baltic States (Country specific recommendation 3.5). As a concrete outcome of the opening up of the market that commenced at the beginning of 2020, Finland, Estonia and Latvia formed a common market area with uniform entry and exit tariffs. This market area forms the first European gas market covering multiple countries. Lithuania is also planning to join the market."*
- *"Finland has increased its efforts to speed up permit-granting procedures and other administrative procedures (Country specific recommendation 3.2). An Act on the temporary prioritisation of certain green transition projects in the permit procedures of the Regional State Administrative Agencies in 2023–2026 and in administrative courts in 2023–2028 was drafted in 2022 and entered into force on 1 January 2023. The aim is to strengthen Finland's self-sufficiency and phasing out of fossil energy and to accelerate investments that genuinely boost the green transition."*

The matters of the country specific recommendations on energy issues, decarbonisation and security of supply are in accordance with the core principles of Finland's climate and energy policy and these issues are taken care of even without a separate recommendation.

In a broader context, the country specific recommendations are issued to support and ensure a healthy development of economic growth and employment. There is no conflict between these goals and the

[4] Finland's National Reform Programme 2023. Publications of the Ministry of Finance 2023:31. April 23th 2023. http://urn.fi/URN:ISBN:978-952-367-238-3

goals of climate and energy policy in Finland, but also climate and energy policy strongly supports economic growth and employment.

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 draft National Energy and Climate Plan. Some of the targets have already been reported in the 2019 NECP. The targets are assessed in 2023-2024 and may be revised for the final update of NECP. Tables 2 and 3 give an overview of existing 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

Parliamentary elections were held in Finland on 2 April 2023 and the new government of Prime Minister Petteri Orpo took office on 20 June 2023. Given the timeline set for submission of the draft update 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.

Finland's national energy system has been described in Chapter 2 of Finland's Eighth National Communication under the United Nations Framework Convention on Climate Change[5].

This draft NECP update is mainly based on the 2022 National Climate and Energy Strategy (VNS 6/2022 vp[1]) and the 2022 Medium-term Climate Change Policy Plan Towards a carbon-neutral society in 2035 (VNS 4/2022 vp[2]) submitted to the Parliament of Finland.

The Fit for 55 package's impact on Finland's climate and energy policy

The preparation of the National Climate and Energy Strategy and the Medium-term Climate Change Policy Plan has taken into account the legislative proposals issued by the European Commission in summer 2021 on tightening the 2030 targets (the Fit for 55 package). Thus, these are also included in this draft NECP update.

The Fit for 55 package is expected to contribute to Finland's fulfilment of the emissions reduction targets for 2030, 2040 and 2050 included in the 2022 Climate Change Act. The proposals in the package are assessed to entail greenhouse gas reductions. At the same time, some of the proposals may have significant financial consequences for the state, businesses and households. The impact assessments of the National Climate and Energy Strategy took into account the emissions reduction

[5] https://unfccc.int/sites/default/files/resource/fi_nc8_final.pdf

target for the effort-sharing sector for 2030 in accordance with the European Commission's Fit for 55 package.

REPowerEU

In addition to the Fit for 55 package, on 18 May 2022 the European Commission presented the 'RE-PowerEU' plan as a response to the rising energy prices and challenges with the security of energy supply following the Russian invasion of Ukraine. In the plan, the Commission presents a number of measures aimed at freeing the EU from Russian fossil fuels by accelerating the green transition and creating a more robust energy system.

The measures are divided into five central themes: 1) energy savings 2) diversification of energy imports 3) acceleration of Europe's transition to clean energy 4) intelligent investments and 5) expansion of preparedness.

Before the Russian invasion of Ukraine, Russia was a major source of energy imports to Finland. However, the oil and coal imports in particular were based on a competitive price and a short transport distance rather than any specific dependence on Russian energy. Crude oil imported from Russia was processed in Finland to meet the domestic demand for petroleum products, but also largely for exports of petroleum products to the global market.

Following the Russian invasion of Ukraine, Russia unilaterally stopped supplying Finland with most wood products, including wood chips in March 2022, and electricity and natural gas in May 2022.

Finland deployed a floating storage regasification unit (FSRU) to meet gas needs. Wind power capacity was increased by 75% in 2022 and the Olkiluoto 3 NPP was taken into commercial use in spring 2023. Energy companies found alternative sources for oil and coal to replace Russian imports. Since summer 2022, only small amounts of LNG have been imported from Russia.

The 2022 Climate Change Act

Finland's new Climate Change Act came into force in July 2022. The Climate Change Act lays the foundation for national work on climate change in Finland. The reformed Act sets emission reductions targets for 2030, 2040 and 2050 as well as a carbon neutrality target for 2035. The Act lays down provisions on the climate change policy plans. The scope of the Act was expanded to also cover emissions from the land use sector, i.e. land use, forestry and agriculture. Eor the first time, the Act also also includes the objective to strengthen carbon sinks.

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

Target	Target year	Year of comparison
Reduce greenhouse gas emissions in the effort sharing sector by 50%	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: targets are assessed in 2023-2024 and reported in the final update of NECP	2030	

** Target reported in the NECP in 2019. Targets are reassessed in 2023-2024 and may be revised for the final update of NECP.*

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 are listed in the reporting that Finland has submitted to the European Commission in compliance with Article 18 of Regulation (EU) No 2018/1999. In addition, the same matters are reported in Finland's Eighth National Communication under the United Nations Framework Convention on Climate Change[5]. Tables 2 and 3 give an overview of the most important policy measures.

Table 2 Overview of existing energy and climate policy measures related to decarbonisation, renewable energy and energy efficiency.

Energy supply	Industry	Transport	Residential and services	Waste	Agriculture and LULUCF
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 and Ecodesign	Quota obligation for the use of biofuels in the transport sector, enhanced measures	Consumer energy advice and Energy Efficiency agreements for service sector	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	CAP Strategic Plan 2023-2027
Promoting forest chips and other wood based fuels	Implementation and improved enforcement of F-gas regulations	CO_2 emission performance standards for new vehicles	Information dissemination and campaigns on energy efficiency		Activities on organic soils
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 regulations (including nearly zero-energy regulation)		Quota obligation for the use of bioliquids in machinery
Promoting solar power	Implementation of Revision of the F-gas Regulation 517/2014/EU	Support for charging stations and biogas and hydrogen filling stations in road traffic	Energy certificates for buildings		Promoting the production and use of biogas
Promoting new energy technology projects	Quota obligation for the use of bioliquids in machinery	Purchase subsidies for electric vehicles	Quota obligation for the use of bioliquids in space heating		New owner policy of Metsähallitus (Climate actions in state owned forests)
Phasing out coal in energy production			Minimum standards for improving the energy performance of buildings undergoing renovation or alteration.		Actions to prevent deforestation
					Promotion of forest fertilisation on mineral soils

Table 3 Overview of existing policy measures related to energy security, internal energy market and research, innovation and competitiveness.

Energy security	Internal energy market	Research, innovation and competitiveness
State-owned emergency stockpiles for imported fuels and peat (domestic)	Development plans of electricity distribution systems	Subsidies for green R&D and innovation
Private-owned mandatory reserve supplies	Advancing energy communities	
Temporary obligation for industry to increase mandatory gas reserve supplies		

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.

The Commission's climate package in summer 2021 contains a proposal for repealing the directive on alternative fuels infrastructure and a proposal for a new regulation on the topic. The proposal contains binding national minimum requirements for the charging and refuelling infrastructure for road transport vehicles, vessels and aircraft. The proposal concerns public infrastructure, i.e. charging and refuelling stations that are freely accessible by all. The proposal also contains provisions on the required content of the Member States' mandatory national plans for alternative fuel infrastructure and the reporting on the progress of the plans and the development of the infrastructure.
The European member states, the parliament and the commission reached a preliminary agreement on the regulation in March 2023.

The AFI Regulation also has significance across borders because measures are required to enable vehicles using alternative fuels, such as electricity or hydrogen, 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, renewable energy and hydrogen and climate and air. The cooperation also covers eco-design and energy labelling.

The Nordic Council of Ministers follows a vision towards 2030 for Nordic cooperation, which includes a focus on the green transition of the Nordic region to support the Nordic countries' ambitious

climate goals. This vision will be translated into multi-year cooperation programmes, which must ensure even closer cooperation on both climate and energy sector in the coming years. It is the vision of the Nordic Council of Ministers that the Nordic region should be the world's most sustainable and integrated region before 2030.

Nordic electricity market cooperation

Norway, Sweden, Finland and Denmark have long shared a single wholesale 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 socioeconomically efficient use of production and transmission resources, and it 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) under the Nordic Council of Ministers 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:

- Functioning 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
- Furthering retail market harmonisation
- Taking the initiative to involving the Baltic States in electricity market development, when appropriate
- Collaborating with market stakeholders
- Following trends and identifying research, development and innovation (RDI) needs within the Nordic electricity market

In addition to the official cooperation among the ministries, also the Nordic Transmission System Operators, regulators, producers and other market stakeholders engage in close cooperation across 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 the new European legislation, the Nordic energy ministers have decided to introduce an annual Nordic

Electricity Market Forum[6]. The first such Forum was held in Stockholm in autumn 2018. The intention is to advance communication and collaboration among electricity market stakeholders, in addition to establishing common visions and road maps for the development of the Nordic electricity market, see Section 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 joint Nordic solutions can bring significant positive effects.

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 renewable energy and hydrogen

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 CO_2 emissions.

The Working Group for Renewable Energy and hydrogen (NAFH) consists of experts from the ministries and energy authorities in the Nordic countries and autonomous areas. It supports the Nordic countries' policy and development work in the renewable energy sector through information exchange and collaboration. In addition, NAFH disseminates information about relevant projects commissioned by it in tackling different issues on renewable energy in the Nordics.

The overall objective of the NAFH is to promote the use and production of renewable energy and hydrogen in the Nordic region and to support the work of the Nordic countries in the area. The aim is to have a smooth integration of renewable energy into the energy system and create good conditions for technology development, innovation, production, infrastructure, transport and use within the area. The working group will also work to complement the national and international work on the development of the entire value chain for hydrogen-based fuels.

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.

[6] Nordic Electricity Market Forum https://nordicelforum.org/

Effective regulations and efficient market surveillance are essential 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.

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 on research strategies, results and key technical issues on the political agenda.

Nordic climate cooperation

The Nordic climate co-operation aims to help to reduce 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 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 and the Arctic Council.

Regional Gas market cooperation

Until 2020, Finland was exempt from EU rules on unbundling and third-party access in the gas sector (Directive 2009/73/EC) due to the isolated nature of the Finnish gas market. As a result, the gas market was essentially closed to competition and fully controlled by the state-owned company, Gasum, which acted as the TSO and was the only importer and wholesale supplier.

However, in January 2020 upon the commissioning of the Balticconnector pipeline that links Estonia and Finland, the Finnish gas sector became subject to EU legislation on gas market competition, and the exemptions to the Gas Directive were abolished from the Natural Gas Market Act. Price regulation of piped gas was dropped and market places for gas and internal market rules were introduced. The bidirectional Balticconnector pipeline is jointly owned by the Finnish TSO, Gasgrid Finland, and the Estonian TSO, Elering.

In January 2020, Finland also joined a common regional gas market area with Estonia and Latvia (FinEstLat gas market area). The merger of FinEstLat means the linking of the Finnish, Estonian and Latvian markets, removing the internal tariffs in the region and setting the entry tariffs in the region at the same level. The results of the operation of FinEstLat single entry tariff zone have been very positive.

By connecting the Finnish gas grid to the Estonian gas grid, the Balticconnector pipeline has allowed Finland to import gas from the Klaipeda LNG terminal in Lithuania and make use of the Inčukalns gas storage facility in Latvia. Following the commissioning of the Gas Interconnection Poland-Lithuania (GIPL) pipeline in May 2022, Finland also gained access to the broader EU gas market. A key addition to the cross-border gas infrastructure system is the floating LNG terminal in Inkoo, which was taken into commercial use in January 2023. The terminal is connected to the gas transmission system and has the capacity to supply several times the combined annual natural gas consumption of Finland and Estonia.

In general, Regional Gas Market cooperation and its tool, Regional Gas Market Coordination Group (RGMCG), have been successful in helping to integrate the gas markets in Finland, Estonia, Latvia and Lithuania as well as the region to reduce its dependency on Russian gas.

Baltic energy market interconnection plan (BEMIP)

Finland actively participates in the Baltic energy market interconnection plan High-level group and specific working groups. BEMIP aims to build an open and integrated regional electricity and gas market for the EU countries in the Baltic Sea region. From Finland's perspective, a major recent achievement under the BEMIP umbrella was the creation of the regional gas market encompassing Finland, Estonia and Latvia (FinEstLat) in 2020. In general, BEMIP has been successful in helping the region to reduce its dependency on Russian gas. Current work focuses on promoting offshore wind development in the Baltic Sea, for example.

Hydrogen cooperation

The state-owned gas TSO Gasgrid Finland is working alongside Sweden's Nordion Energi to develop the Nordic Hydrogen Route, a cross-border project aimed at building a pipeline network and an open hydrogen market in the Bothnian Bay region by 2030.

The aim of the Nordic Hydrogen Route is to drive decarbonisation, support regional green industrialisation, economic development, and European energy independence. The companies seek to develop a network of 1,000 km of new pipelines that would effectively transport energy from producers to end-users to ensure they have access to an open, reliable, and safe hydrogen market. The pipelines would serve 65 TWh of identified potential hydrogen demand in the Bothnian Bay region by 2050. The core route will be along the coastline, with a branch to Kiruna, Sweden.

The Nordic Hydrogen Route investment is estimated at EUR 3.5 billion, offering a hydrogen transportation cost of EUR 0.1-0.2 per kg. It would enable ten-fold investments of around EUR 37 billion in wind power and electrolysis. The pipeline could facilitate emissions savings of up to 20 Mt CO_2 eq. per year by 2050.

1.2.4 Administrative structure of implementing national energy and climate policies

The Government and Parliament make all major decisions concerning Finland's energy and climate policy.

The Climate Change Act (423/2022) 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 Climate Plan for the Land Use Sector and for the national adaptation plan for climate change and the Ministry of the Environment is responsible for the Medium-term Climate Change Policy Plan as well as for compiling the annual climate change report.

The Government establishes a ministerial working group for coordinating climate and energy policy. The ministerial working group has representatives from each party forming the Government.

The operation of the Ministerial Working Group concerning Climate and Energy Policy issues is based on the Government resolution concerning the organisation of official climate policy measures in the Government[7]. 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

[7] https://www.edilex.fi/valtioneuvoston_viikko/2003_05liite.html

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 Climate and Energy 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 emissions, waste management sector, building stock, 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
- 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 Finland's reporting in compliance with reporting on national systems for policies and measures and projections pursuant to Article 36 of the Commission Implementing Regulation (EU) 2020/1208[8].

Figure 1 presents a diagram of the administrative framework of drafting energy and climate policy (situation in spring 2023).

[8] https://reportnet.europa.eu/public/dataflow/900

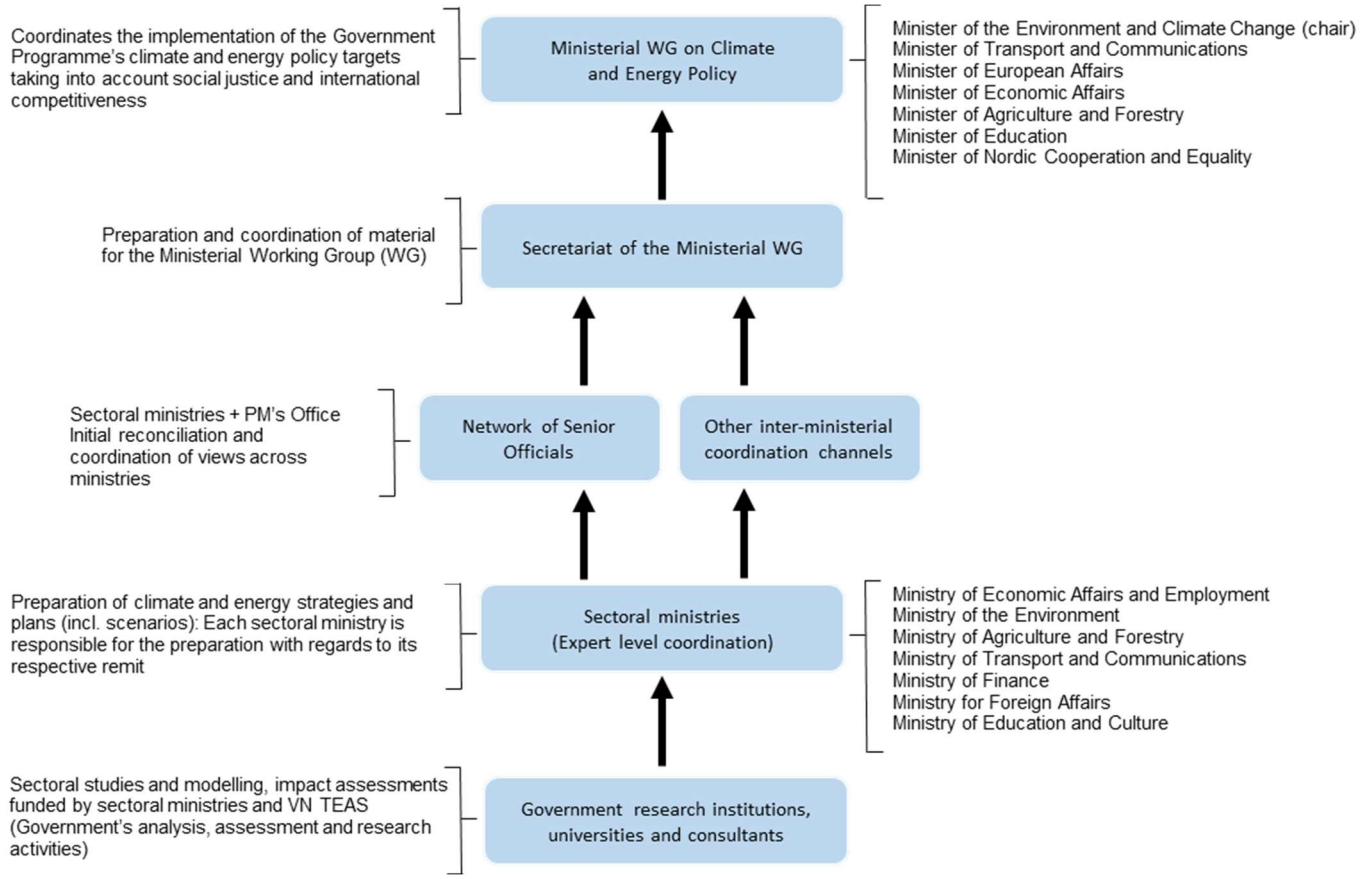

Figure 1. Administrative framework of drafting energy and climate policy.

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

1.3.1 Involvement of the national parliament

The three Government reports forming the basis of this NECP (National Climate and Energy Strategy, the Medium-term Climate Change Policy Plan and the Climate Plan for the Land Use Sector) were submitted to the Parliament in 2022 after the Government had adopted them. The Parliament debated the reports and issued related non-binding resolutions on the two last ones. The Parliament did not have time to give resolutions regarding the National Climate and Energy Strategy.

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 Section 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 draft updated National Energy and Climate Plan have already been in public consultation as part of the preparations of the National Climate and Energy Strategy, the Medium-term Climate Change Policy Plan and the Climate Plan for the Land Use Sector. In the consultations and events organised for stakeholders, all relevant parties have been consulted, including authorities, organisations, labour market parties and individual citizens.

In addition to the abovementioned strategies and plans, several other climate and energy related documents were used in preparing Finland's draft NECP update. The consultation processes of Finland's national roadmap to fossil-free transport and the EU Common Agriculture Policy (CAP) Strategic Plan are presented in this chapter as well.

In spring 2024, we are also planning to organise a proper consultation on our updated NECP before submitting it to the Commission. The consultation will most likely involvea wide range of stakeholders and citizens as well as Finland's neighbouring countries.

Carbon Neutral Finland 2035 - National Climate and Energy Strategy

As part of the preparation of the National Climate and Energy Strategy, several several studies and events were organised, including the following:

- 18 November 2019: the Ministry of Finance appointed a working group on energy taxation reform.
- 31 March 2020: the Ministry of Economic Affairs and Employment appointed a broad-based working group on peat.
- 9 June 2020: Webinar of the results on sectors low-carbon roadmaps.
- 25 September 2020: Kick-off seminar for the preparation of the climate and energy strategy.
- 16 February 2021: HIISI Stakeholder event on climate and energy projections with existing measures.
- 11 June 2021: HIISI Stakeholder event on preliminary assumptions and results of the WAM (with additional measures) projection from the perspectives of the energy and national economy and in different emission sectors.
- 30 June 2021: Publication event of the final report of the working group on sector integration.

After the strategy launch, the following events were organised to support the strategy commitments:

- 9 September 2022: Seminar on technological carbon sinks and CCUS
- 10 February 2023: Coordination meeting on sector-specific low-carbon roadmaps
- 29 March 2023: Publication event of the report of technological carbon sinks

The preparation of the National Climate and Energy Strategy started officially with the kick-off seminar, organised as a webinar and aimed for stakeholders and experts. Although, the work relating to the preparation of National Climate and Energy Plan began Before the kick-off seminar, several background work streams had already been initiated. In autumn 2019, four energy-intensive industries and nine other sectors began to work on low-carbon roadmaps to significantly reduce greenhouse gas

emissions by 2035. The sectors presented their results at the Ministry of Economic Affairs and Employment webinar on 9 June 2020 and a summary report of these roadmaps was published on 22 October 2020[9]. The working groups on energy taxation reform, peat and sector integration were ongoing and provided data to support the strategy's background work.

There were various other projects ongoing to support the preparation of the climate and energy strategy, including the project "Carbon neutral Finland 2035 - measures and impacts of the climate and energy policies (HIISI)"[10] and the HIISI follow-up project[11]. The objective of the HIISI project was to produce estimates on how Finland could sustainably achieve the national and European Union climate and energy targets in 2030, 2035, 2040 and 2050. Two stakeholder events were organised in connection with the HIISI project on 16 February 2021 and 11 June 2021 (listed above). The HIISI follow-up project focused on the Government's new climate and energy policy measures (announced in autumn 2021), which could not be taken into account on the original HIISI project. Both projects produced assessments on measures and impacts on Finland's greenhouse gas emissions and removals, costs and the economy and the environment, but the HIISI follow-up project only presented the base assumptions and results of calculations that did differ from the premises drawn up in the HIISI project.

In relation with the National Climate and Energy Strategy, the work of the Medium-term Climate Change Policy Plan (KAISU) and the Climate Plan for the Land Use Sector (MISU) began. The preparation of these plans included several stakeholder and citizen participation hearings and consultations, which are described below in this section.

Public Consultation of the National Climate and Energy Strategy

The draft version of the national climate and energy strategy was circulated for comments through public consultation. Consultation was carried out online at Lausuntopalvelu.fi service from 14 April to 18 May 2022. During this period, 149 comments were received. The consultation aimed to engage stakeholders to the strategy process and hear their opinion on every section of the strategy. The commentators represented ministries and other state authorities, municipalities, companies, trade or interest organisations, private citizens and other bodies.

In the statements, the submitted open comments concerned particularly the reduction of greenhouse gas emissions, increasing sinks, the promotion of renewable energy and energy efficiency. In the area of greenhouse gas emissions and increasing sinks, the commentators submitted statements on the land use and effort sharing sector in particular and emphasised the sector-specific low-carbon roadmaps with mainly positive feedback. Many comments mainly supported the emissions trading system, but the use of the LULUCF flexibility mechanism did raise comments both in favor and against it. Those in favor of the flexibility mechanism referred to cost-effectiveness and the mechanism's capacity to

[9] http://urn.fi/URN:ISBN:978-952-327-796-0
[10] https://urn.fi/URN:ISBN:978-952-383-257-2
[11] https://publications.vtt.fi/pdf/technology/2022/T402.pdf

allow reaching the emissions reduction targets set for the effort sharing system. Negative comments concerned areas such as the unfairness of the use of flexibility, or the uncertain nature of the use of the flexibility mechanism. The targets for sinks in the land use sector and the targets for reducing emissions from agriculture were also highlighted in the comments, particularly their uncertainty, for example related to the volume of the sinks.

Concerning the promotion of renewable energy, the comments were given on how the energy system should be based on non-combustion energy and that technology neutrality and the magnitude of emission reductions should be a priority. The Government Decree on General Terms of Granting Energy was primarily supported. However, it was pointed out, that attention should be paid on what kind of projects are supported and the potential impact of the aid distorting competition in relation to the allocation of the aid. The statements also emphasised wind power, related harm and the balanced geographical distribution of wind power.

Regarding the promotion of energy efficiency, the need for overall reduction of energy consumption and energy saving was emphasised, which should also be emphasised in the strategy. In addition, the means for reducing transport sector emissions, improving energy efficiency and electrifying transport should be taken into account in the strategy. According to the statements, renewable energy sources, electricity, energy efficiency measures and energy savings were considered to strengthen the security of supply and it was stated that climate targets should not be jeopardised due to security of supply issues. Furthermore, it was commented that there is no reason to increase dependence on a specific energy source with regard to delivery reliability and security of supply.

Regarding hydrogen and electrofuels, the need of promoting the hydrogen economy actively through political measures was highlighted. Some comments stated that the targets set for hydrogen are too low and that there would be potential for more substantial targets at the national level. Statements against nuclear energy point out that nuclear waste poses unresolved environmental risks, while those in favor of nuclear energy emphasise positive views regarding zero-emissions nuclear energy. The reform of the Nuclear Energy Act is supported and a separate decree is proposed to enable SMR plants.

The impacts of the strategy policies were broadly commented on. Regarding to the achievement of the climate targets, it was stated that uncertainty concerning the carbon neutrality and carbon negativity targets should be taken into account and, if necessary, the need for additional measures should be assessed. The cost-effectiveness of emissions reduction measures was requested to be specified and the importance of a just transition was highlighted. Additionally, opinions varied on the impacts on the energy system.

The comments given during the consultation were thoroughly analysed and taken into account when finalising the strategy. The Government adopted the National Climate and Energy Strategy on 30 June 2022. The Strategy outlines measures by which Finland will meet its EU climate commitments for 2030 and will become carbon neutral by 2035.

Medium-term Climate Change Policy Plan

A wide range of citizens and stakeholder groups was heard during the preparation of the Medium-term Climate Change Policy Plan in 2020 and 2021. Participation opportunities like these were mostly arranged during the early phases of the preparation, so the discussions did not revolve around the final entries in the plan, but were on a more general scale. There was considerable interest in climate matters, which was demonstrated, for example, by the high respondent rate of the citizen survey. The plan was based on the principle that carbon neutrality should be achieved as cost-efficiently and fairly as possible. The wide-ranging engagement of citizens produced valuable information on the impact of various climate actions.

Online survey

The Ministry of the Environment set up an online survey to collect citizens' opinions on how emissions could be mitigated effectively and fairly. The survey ran from 19 January to 19 February 2021 and proved to be very popular with 18,000 responses. The themes in the survey were transport, food and housing, which are the primary sources of emissions from consumption. The survey contained multiple choice questions and free text fields for the respondents to assess the acceptability of different measures and their impact on the respondent's life.

Citizens' panel

The Ministry of the Environment commissioned the University of Turku to arrange a Citizens' Panel on climate action. The Panel sessions were held in April 2021. The Panel contemplated the fairness and impact of the climate action in the Climate Policy Plan and issued a statement. The Panel had 33 members selected by random sampling. The Panel's input consisted of a list prepared by the Ministry of the Environment on 14 measures on transport, housing and food that might be included in the plan. The discussions in the Panel's small groups adhered to the rules of deliberative discussion, which seek to increase common understanding.

In the general points of the statement the Panel pointed out that, even if people are prepared to take action to slow down climate change, they are worried about the economic impacts that climate actions may have on them. The Panel considered it important to take individual and regional differences into account in the actions included in the Climate Policy Plan.

Consultation with special groups

To support the preparation of the Climate Policy Plan, young people were asked which kind of measures would help mitigate consumers' emissions that originate from housing, mobility and food consumption. To achieve this, the Government cooperated with the first-year students of the European Studies Programme of Tampereen lyseon lukio high school. The students designed surveys to collect opinions on these themes on a larger scale. The surveys reached a total of 2,000 young people as well as older age groups in Tampere and its surrounding municipalities. The suggestions created

by the young people contained several concrete measures and information on the acceptability of measures in general, which supported the preparation of the Climate Policy Plan.

Sámi consultation

Pursuant to section 9 of the Act on the Sámi Parliament, the Ministry of the Environment reserved an opportunity for hearings and negotiations with the Sámi Parliament on the preliminary measures in the Climate Policy Plan. The Sámi Parliament considered the Plan important and the transition to low-carbon community structure and transport system essential. The Sámi Parliament stated that a fair transition towards carbon neutrality should take place without the climate measures endangering Sámi livelihoods and culture.

Stakeholder consultation

In January 2021, the Ministry of the Environment held an open webinar on the launch of the preparation of the Climate Policy Plan. The webinar described the progress of the preparation and opportunities for participating in it.

The Ministry of the Environment also held a workshop in April 2021 for stakeholders to express their views on the planned measures in the Climate Policy Plan. The workshop consisted of a presentation on the preliminary emissions reduction measures in transport, agriculture and energy use in buildings. The participants were divided into small groups and invited to state their views on the preliminary measures and on how to reduce emissions and promote social fairness.

Written statement consultation procedure

The Ministry of the Environment requested statements on the draft Climate Policy Plan via the *lausuntopalvelu.fi* web service from 8 December 2021 to 14 January 2022. Two hundred and ten statements were received, comprehensively representing the sectors affected by climate policy. Sixty-seven of the statements came from private individuals.

Most statements on the impact of the Climate Policy Plan's additional measures or action plan supported more ambitious climate measures. In particular, more ambition was desired for the reduction of emissions from transport and agriculture, building-specific heating, carbon footprint of consumption and public procurement. The stakeholders seeking more ambition were mostly associations, communities and private individuals. Many free-text responses expressed support for the targets and measures of the Climate Policy Plan, but they also presented many additional suggestions and clarifications. Some of the targets and measures were criticised as insufficient and a few respondents proposed downscaling or a review of some measures.

Climate Plan for the Land Use Sector

Interaction with various stakeholders and actors played a key role in the preparation of the Climate Plan for the Land Use Sector. The feedback received from the interactive events was utilised in the specification of the measures, in prioritisation, definition of information requirements, and impact assessment.

The feasibility and acceptability of measures in the plan were discussed in interactive events. In autumn 2021, the interactive events were targeted at regional actors, and a broad range of potential measures were discussed in the events. In the events arranged in early 2022, the discussion was based on measures that had been tentatively prioritised, and the aim was to gain feedback on how interesting the measures were, about the effectiveness of the planned policy instruments, and any bottlenecks involved. Young people and landowners were the specific target group of the interactive events in the autumn and spring. During autumn 2021 and spring 2022, a total of 12 interaction events were organised. The summaries of each discussion, as well as the summaries of the discussions in autumn 2021 and spring 2022, are available in Finnish on the website of the Ministry of Agriculture and Forestry[12].

The purpose of the interactive events was to form an understanding of the feasibility of the measures, the practical viewpoints for their implementation and the acceptability of the measures for the actors concerned, and landowners. The aim was not to find a shared view, but to introduce various viewpoints to the preparation process. The interest and acceptability of various climate action measures have also been analysed in studies. At the events, the aim was to identify potential new climate measures and to collect information and viewpoints from the regional starting points of climate action.

After the draft Climate Plan for the Land Use Sector was finalised, it was circulated for comments between 14 April–18 May 2022 in the Lausuntopalvelu.fi online service. A total of 108 comments were provided by key ministries, trade and professional organisations, interest groups, research institutions, government agencies and institutions, companies, environmental organisations and a few private individuals.

EU Common Agriculture Policy (CAP) Strategic Plan

The national CAP Strategic Plan for years 2023-2027 was prepared from 2018 to 2022. A main objective in the preparation process was to broadly involve various stakeholder groups. In September 2018, the Ministry of Agriculture and Forestry set four sub-working groups for the national CAP preparation process. In addition to working group meetings, 29 workshops and 11 discussion events were organised for stakeholders between 2018 and 2020[13]. The workshops and discussion events

[12] https://mmm.fi/maankayttosektorin-ilmastosuunnitelma/maankayttosektorin-ilmastosuunnitelman-laatiminen (in Finnish)
[13] CAP consultations between 2018-2020 (in Finnish).

provided material for the preparation of new policy measures, including evaluations on the previous CAP.

The Ministry of Agriculture and Forestry organised a citizen survey on the CAP reform in the Ota kantaa web service from 12 February 2019 to 31 March 2019. Almost 2500 responses were received. The survey involved also those stakeholders not attending the workshops and discussion events and offered them an opportunity to express their opinions on the future needs and objectives of agricultural policy. The survey results were used to prepare the CAP Strategic Plan. They were also published on the webpage of the Ministry of Agriculture and Forestry[14].

The new CAP Strategic Plan was submitted to Lausuntopalvelu.fi service for comments from 2 July to 10 September 2021. The ministry also sent targeted requests for a statement to relevant associations and other public organisations. A total of 367 statements were received. Specifications and clarifications were made to the CAP Strategic Plan based on the received comments.

Roadmap to fossil-free transport

The objectives and measures for reducing greenhouse gas emissions from transport until 2030 have been included in the government resolution on reducing greenhouse gas emissions from domestic transport (roadmap to fossil-free transport). The Government adopted the resolution in May 2021. The roadmap's objectives and measures were included in the 2022 Medium-term Climate Change Policy Plan .

The draft resolution was circulated for comments from 15 January to 19 February 2021, and 349 comments were received. Of these, 176 were comments by private individuals and 173 by organisations. Comments were primarily collected online at lausuntopalvelu.fi. As a rule, the roadmap's objective of halving emissions from domestic transport by 2030 and achieving carbon neutrality in transport by 2045 was considered important. A key concern expressed in many comments was the increase in traffic and transport costs due to emissions reduction measures and the effects of the cost increases on households, businesses, workplaces, the national economy and competitiveness.

1.3.4 Consultations of other Member States

Finland's draft updated National Energy and Climate Plan was not sent for consultation to neighbouring countries. The reason for this was lack of time in preparing the plan and the preliminary nature of the plan. Finland's updated plan will be more comprehensive in summer 2024. At that time, the entries of the new government's Government Programme will been fully taken into account in the updated plan. In 2024, Finland plans to send the updated National Energy and Climate Plan for consultation to neighbouring countries before delivering it to the Commission.

[14] The results of the Ota kantaa –survey on 12.2-31.3.2019 on the reform of the EU agricultural policy (in Finnish)

1.3.5 Iterative process with the Commission

The Commission has offered member states a possibility for a bilateral meeting concerning the preparation of NECP. Finland has not seen a need for this kind of meeting when preparing the draft updated NECP.

Ms. Sanna Ek-Husson from the Commission, DG Energy visited Finland on 3 May to attend the meeting of several ministries responsible for drafting the NECP. Around 10 officials were present in the meeting. In this meeting, we described the current state of preparation of the Finnish NECP and discussed the guidance given by the Commission for updating the NECPs and how this guidance could best be taken into account in the preparation of the Finnish updated NECP.

In addition, the dialogue with the EU Commission has taken place through working groups under the Energy Union Committee and the Ad-hoc Working Group of Climate Change Committee. Finland has attended several meetings in 2022 and 2023.

1.4 Regional cooperation in preparing 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 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.

Section 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

Effort sharing sector

According to the Effort Sharing Regulation (ESR), Finland should, by 2030, reduce its greenhouse gas emissions in the effort sharing sector by 50% compared to 2005 levels. This corresponds to a amount of 17.2 Mt CO_2 equivalent in 2030. However, if flexibility measures are used, the emissions may be higher.

The annual emissions allocations for the years 2021–2022 remain the same as in the previously valid effort-sharing regulation executive decision (2020/2126). In 2021, the emissions from the Finnish effort-sharing sector were 27.5 Mt CO2-eq., or about 1.4 Mt CO2-eq below the allocation. The annual emissions allocations for the years 2023–2030 will be recalculated based on the regulations defined in the decree.

The final emissions data used in the review of the achievement of the target obligation will not be recorded until 2027.

Finland will use 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 CO_2 equivalent. It does not seem likely that the LULUCF flexibility mechanism included in the Effort Sharing regulation could be utilized by Finland. Finland may use the other flexibility mechanisms such as transfers between years and between the Member States, if necessary.

LULUCF

Under the regulation concerning the land use, land-use change and forestry (LULUCF) sector (EU 2018/841), a Member State must ensure that the accounted total emissions in the sector will not exceed the accounted sinks over the period 2021–2025. The accounting is applied to the following land-use categories: deforestation, afforestation, managed forestland, managed cropland and grasslands. By 15 March 2027, Finland will submit the LULUCF compliance report, including the balance of total accounted emissions and removals for the 2021-2025 period and, where applicable, details on

the use of or intention to the flexibilities and related amounts. Over the period 2021–2035, Finland may use the country-specific flexibility of 5 Mt CO_2 to reach the target.

During the period 2021-2025, 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. 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 CO_2 equivalent, excluding harvested wood products (HWP) and -27.64 Mt CO_2 equivalent including HWP. Finland will make at least one technical correction to the FRL due to the methodological changes in the drained organic forestland GHG balance estimation.

The revised LULUCF regulation (EU 2023/839) sets a net sink target for Finland, which is -17.8 Mt in year 2030, or equal to an increase in the sink of 2.9 Mt compared to the average level in 2016-2018. It is not yet possible to estimate the sink budget formed as cumulative sum of the removals for the years 2026-2029, since it would require the data from the year 2023.

Other objectives and targets

The objectives and measures for promoting the use of transport biofuels and other renewable energy sources in transport have been included in the Roadmap to fossil-free transport, the National Climate and Energy 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). Under the previous government, the target was to increase the share of transport biofuels in road transport fuels consumed in Finland to 34% by 2030. Another objective was to bring the number of electricity-powered cars in Finland to at least 750,000 and the number of gas-powered cars to 130,000 by 2030.

For the target for agriculture, see Section 5.5.

Carbon capture and storage

Carbon capture and storage (CCS) is an option for reducing CO_2 emissions. It can involve capturing CO_2 from fossil fuels or bioenergy (BECCS) or directly from the atmosphere (DACCS). In Finland, no geological storage sites have been identified. The closest available potential storage sites are in the North Sea, and a possible ship transport of CO_2 has been planned in the few CCS projects. The most recent project was Neste company’s plan to make blue hydrogen and ship the captured CO_2 to the North Sea for storage. Neste, however, cancelled this blue hydrogen project following Russia’s attack on Ukraine and the subsequent termination of Russian natural gas imports to Finland.

There are no active CCS projects in Finland, nor any large fossil CO_2 point sources with the potential to emit for decades and thus to suit for capture. The largest fossil point source in Finland is the Raahe

steel plant, but SSAB, the owner. has firm plans to convert the plant to green steel production. Another CCS option could be the capture and storage of biogenic CO_2 (BECCS). It has been studied, but not realised in Finland, as it does not currently offer economic benefits for the emitter or for the state.

Other technical storage possibilities for CO_2 have been studied and investigated, and although the sector is attracting wide attention, no concrete projects have been implemented so far. The utilisation of captured CO_2 is a focus area, and several projects that combine CO_2 mainly from biological origin with clean hydrogen to make synthetic methane for the transport sector are becoming operational from 2024. There are also projects, supported by the State, to produce synthetic methanol and ammonia.

Projected development of emissions

Figure 2 shows Finland's greenhouse gas emissions in 2000–2022 and the projected development in the With Existing Measures (WEM) projection until 2030. The WEM projection includes all measures decided by the 2019-2023 government. The measures are in line with the latest Climate and Energy Strategy and the Medium-term Climate Change Policy Plan. Finland held parliamentary elections in April 2023 and no policies of the new government are yet included in the projections. The projections will be updated for the final NECP update in 2024.

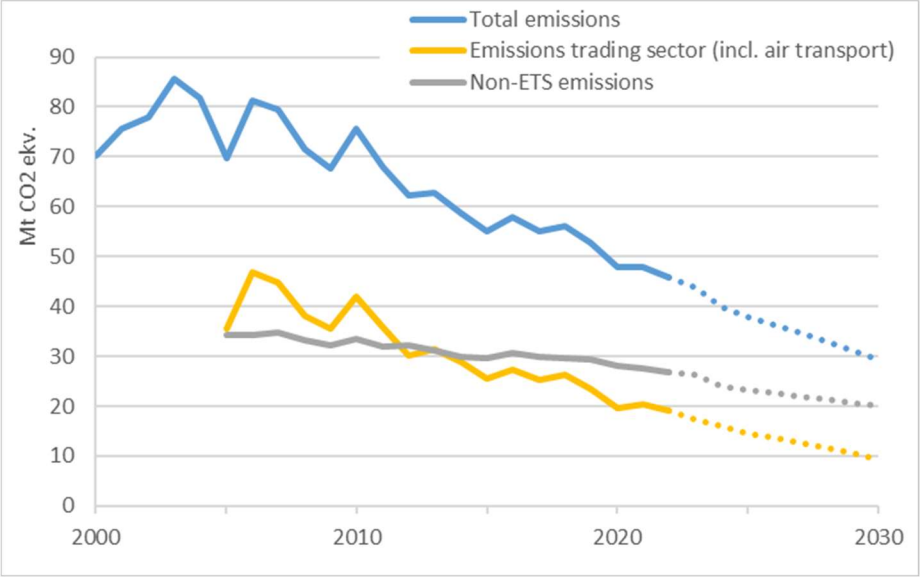

Figure 2. Actual greenhouse gas emissions 2000–2022 and the projected development in the WEM projection until 2030.

Adaptation to climate change

A key tool in defining adaptation measures for climate change in Finland is the National Climate Change Adaptation Plan[15]. The government resolution on a National Climate Change Adaptation Plan 2030 was adopted in 2022. It defines the adaptation measures through 2030 by integrating them into each sector's planning, decision making and activities. A mid-term evaluation supporting the development of the plan was published in 2019.

The objective of the National Climate Change Adaptation Plan is for the Finnish society to have the capacity to adapt to climate change and manage the associated risks. The need for adaptation is assessed for different sectors and regions. One of the objectives is to develop a follow-up system to assess the progress with the measures and their impact. The 2022 National Climate Change Adaptation Plan is part of the climate change policy planning system complying with the Climate Change Act. It also contributes to implementing the EU Adaptation Strategy in the national context.

Adaptation to climate change has also been considered in the energy modelling efforts related to policy preparation. Climate change is expected to increase rainfall and average outdoor temperatures. Higher precipitation will lead to somewhat increased potential for hydropower production. Heavy precipitation events could become more frequent in the summer, resulting in more flooding. The projections assume a hydropower production increase of 3% in 20 years due to higher precipitation. On the other hand, long periods of very low precipitation are likely, causing hydrological drought that reduce hydropower production. This matters in Finland because hydropower plays a central role as a regulating power source, and more widely, because Scandinavian precipitation largely determines the electricity price on the Nordic power exchange.

It is estimated that increasing windiness will also increase Finland's wind power potential. The frequency of strong winds is projected to increase, especially in coastal regions. Severe winter and summer storms can negatively impact the energy system, damaging electricity lines, poles and transformers, causing power outages. Weather risks to wind turbines e.g. due to icing, seem manageable.

There is little information about how climate change will affect solar energy, although some estimates suggest that greater cloudiness may reduce solar energy availability. Winters could become cloudier, further reducing the already small solar energy potential in the winter.

In relation to bioenergy production, it is essential to examine the changes and risks to its availability. In Finland, the energy use of forest biomass is significantly linked to the procurement of wood for the forest industry. Thus, the availability of industrial raw wood and energy biomass is affected by the same factors; 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

[15] Valtioneuvoston selonteko kansallisesta ilmastonmuutokseen sopeutumissuunnitelmasta - Maa- ja metsätalousministeriö (mmm.fi)

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. their moisture content. 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 rise in the future as winters become milder and summers become hotter. On average, it is estimated that heating energy needs will decrease more than cooling energy needs will increase. Consequences of rising temperatures on space heating needs have been estimated by the VTT Technical Research Centre of Finland[16] 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% per year, declining by 3.6% from 2020 to 2030 and by 6.7% to 2040.

Section 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

Finland has currently set a target of 51% for the share of renewable energy (gross final consumption) in compliance with the Renewable Energy Directive.

Finland notes the agreement reached on the proposed revision of the Renewable Energy Directive between the European Parliament and the Council of the European Union. As soon as the revision of the Renewable Energy Directive has entered into force, all national efforts needed will be carefully assessed, including national target for the share of renewable energy. Finland is looking forward to reporting the outcomes of the assessment in the update of the NECP by 30th June 2024.

Table 4 shows the indicative minimum levels for intermediate years concerning the current renewable energy target until 2030.

Table 4 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%

[16] Energiajärjestelmän ja kasvihuonekaasujen kehitykset: Hiilineutraali Suomi 2035 – ilmasto- ja energiapolitiikan toimet ja vaikutukset, https://julkaisut.valtioneuvosto.fi/handle/10024/163645

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

In Figure 3 and Table 5 show the estimated development in the WEM projection in the 2020s of the overall renewable energy share (RES overall) as well as the 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 as well as the denominator 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. Likewise, 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 original NECP submitted in 2019, the multiplication factors were applied only to the numerators. 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.

In 2022, the previous government increased the 2030 target for the quota obligation of liquid and gaseous biofuels in road transport to 34%. [17] However, the target was reduced to 12% and 13.5% for the years 2022 and 2023 following the energy crisis and the need to limit the costs of transportation fuels. The 10% sub-target can be filled with biogas produced from Annex IX feedstock and with renewable fuels of non-biological origin (RNFBO). The minimum share of advanced biofuels must be 3.5% in 2030. It is also proposed that in 2030, sustainable aviation fuels should cover 6% of the RES-T target. This aviation fuel requirement is, however, not yet included in the WEM projection and in the trajectories in Figure 3. The current government, in office since 20 June 2023, may revise these national targets and quotas.

The final decision on maintaining the energy-based target in transport has not been made. However, new sub-targets for renewable fuels of non-biological origin (RNFBO) must be set. Also, a credit mechanism for economic operators that supply renewable electricity to electric vehicles through public recharging will be included in the national quota/distribution obligation.

Long-term trajectories (i.e. until 2040) for the expansion for renewable energy with existing policy measures is presented in Figure 10 on page 118.

[17] Laki uusiutuvien polttoaineiden käytön edistämisestä liikenteessä annetun lain muuttamisesta (1134/2022)

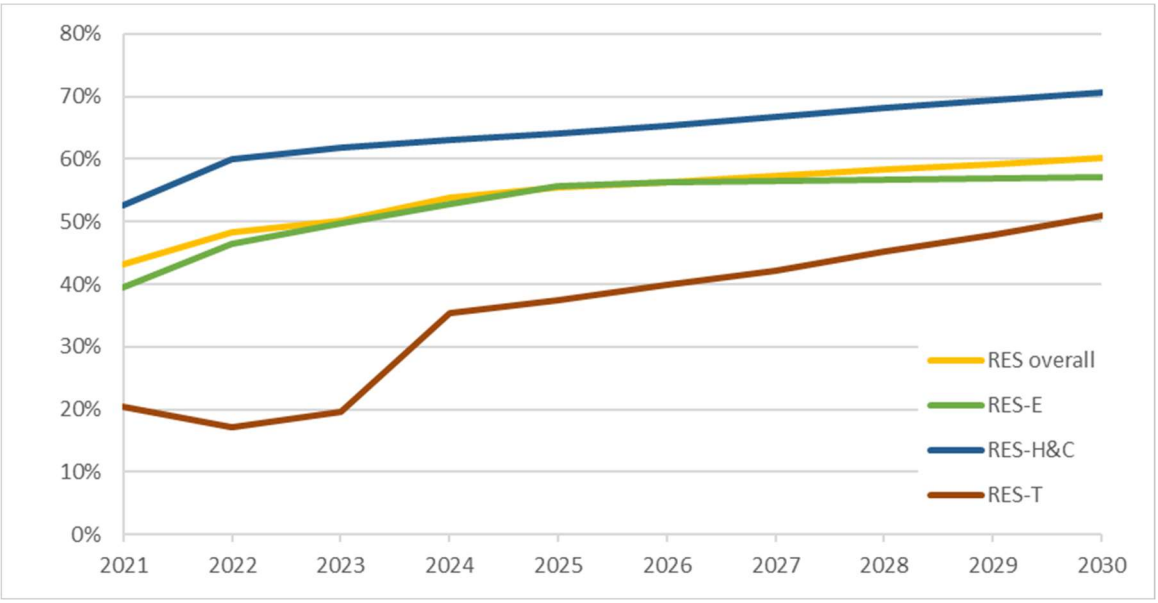

Figure 3. Estimated trajectories for the overall and sectoral shares of renewable energy in gross final energy consumption from 2021 to 2030 in the WEM projection.

Table 5 Overall and sectoral shares of renewable energy in gross final energy consumption in the WEM projection.

	2020	2022	2025	2027	2030
RES overall	44%	48%	55%	57%	60%
RES-E	40%	46%	56%	57%	57%
RES-H&C	58%	60%	64%	67%	71%
RES-T	14%	17%	37%	42%	51%

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

Table 6 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 WEM 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 6 also shows the estimated development of bioenergy in the heating, electricity and transport sectors.

The electricity and heating markets are competitive industries and the central government does not therefore have a plan on how the installed capacity of each technology will develop. However, assuming 3,200 peak load hours, the wind power volume in the WEM projection in 2030 would equal an installed capacity of 7,200 MW. This is 1.3 times the installed capacity at the end of 2022. Equally, assuming 900 peak load hours for solar power, the WEM projection generation volume in 2030 would

equal an installed capacity of 2,800 MW, which is more than fourfold the installed capacity at the end of 2022. The installed hydropower capacity is currently 3,200 MW and no significant change is expected in the coming years.

Table 6 Renewable energy per sector and technology in the WEM projection [TWh of gross final consumption].

	2022	2025	2027	2030
RES Overall				
Hydropower	13	15	15	15
Wind power	12	20	22	23
Solar energy	0.4	0.6	1.3	2.5
Bioenergy	107	118	119	120
Heat pumps	8	10	11	13
Total	**140**	**164**	**168**	**173**
RES-E				
Hydropower	13	15	15	15
Wind power	12	20	22	23
Solar energy	0.4	0.6	1.3	2.4
Bioenergy	13	15	14	14
Total	**38**	**50**	**52**	**55**
RES-H&C				
Solar energy	0.0	0.0	0.0	0.0
Bioenergy	89	92	93	93
Heat pumps	8	10	11	13
Total	**97**	**102**	**104**	**106**
RES-T (excl. coefficients)				
Liquid biofuels	5	12	11	11
Biogas	0.2	0.4	0.6	0.9
Renewable electricity	0.5	1	1.6	2.6
Total	**6**	**13**	**13**	**15**

Finland has set, according to TEN-E Regulation, non-binding targets for offshore wind in the context of BEMIP Offshore Wind Working Group. The non-binding targets are 1 GW for 2030, 5 GW for 2040 and 12 GW for 2050.

In October 2019, the Ministry of Economic Affairs and Employment appointed a working group to prepare a national biogas programme for the medium term. The working group was tasked with describing the current state of biogas production, the most significant factors slowing down or preventing large-scale production and use of biogas, and measures for resolving these issues and for implementing the measures included in the Government Programme regarding biogas. The report including policy measure suggestions was published in January 2020. Several new measures were introduced, including the inclusion of biogas in the distribution obligation, setting up schemes for nutrient recycling, additional investment aid for farm-scale projects and promoting biogas-fuelled vehicles. Most of the measures had already been implemented by the end of 2022. However, there are some major barriers for wider uptake of biogas production because of the uncertainty of the sector as well as restrictions in State aid regulation.

Finland has not set targets for hydrogen production, but the 2022 Climate and Energy Strategy has a non-binding target for 200 MW of electrolyser capacity by 2025.

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

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 typically accounted for one fourth to one third 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 chemical 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 7 shows the volumes of biomass by type used as primary energy in the WEM projection.

Generally, an increased wood use in the forest industries results in more wastes and residues (black liquor, sawdust, bark, etc.) being available for energy production. In recent years, the consumption of wood fuels in Finland has been relatively steady as also newer renewable energy technologies are becoming more common.

Wood-based fuels will consist of black liquor and other concentrated liquors, sawdust, bark and other industrial wood by-products from forest industries and wood processing. Based on this, the share of imported wood-based fuels in all wood-based fuels in Finland is projected to remain small, only a few per cent.

In the energy and climate projections for 2030, the volume of forest chips in heat and electricity production will rise to about 26 TWh, or about 13 million cubic metres per year, about 1.2 times the current level. Most of the forest chips will be 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 7 Biomass by type in the WEM projection [TWh of primary energy consumption].

	2020	**2025**	**2030**
Black liquor and other concentrated liquors	44	46	48
Industrial wood residue and forest chips	39	49	51
Small-scale combustion of wood, pellets, etc.	15	15	13
Waste (biodegradable fraction)	4	5	4
Total	**102**	**115**	**117**

As most of the wood-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 relatively small. LULUCF accounting in the 2021–2030 period 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, renewable energy communities and renewable 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 projected development of district heat from renewable energy sources and waste heat. In 2021, renewable fuels produced 47% and waste heat 14% of district heating. Finland has not made a final decision on whether renewable electricity used for district heating will be counted for in the average annual increase.

Article 24.10 states that a Member State shall not be required to apply paragraphs 2 to 9 of Article 24 if efficient district heating and cooling systems account for more than 90% of total istrict heating and cooling sales. According to current calculations, this will be the case in Finland, and therefore Finland will be obliged to implement only paragraph 1 of Article 24. However, Finland still has to assess carefully whether the Energy Efficiency Directive recast will have an impact on this. Finland considers the aim of increasing the share of renewable and waste heat in district heating important and addresses measures to this end. Also, the district heating companies are actively seeking opportunities to reduce their use of fossil fuels.

A renewable quota obligation has been introduced for light fuel oil used for space heating. The obligation for bioliquids will be a 10% share in 2028. No other sector-specific targets exist for heating and cooling from renewable energy.

The 2019-2023 Government Programme set a target of phasing out fossil fuel oil in space heating by the beginning of the 2030s. Financial support is available for switching away from oil to clean energy in heating in the 2020s.

Since December 2021, based on the amended and Use and Building Act (132/1999), at least 38% of the commercial energy used in buildings must be from renewable sources. This minimum requirement for renewable energy applies to new buildings and existing buildings that are subject to a major renovation. The share of renewable energy is calculated from the calculated delivered energy of the building.

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

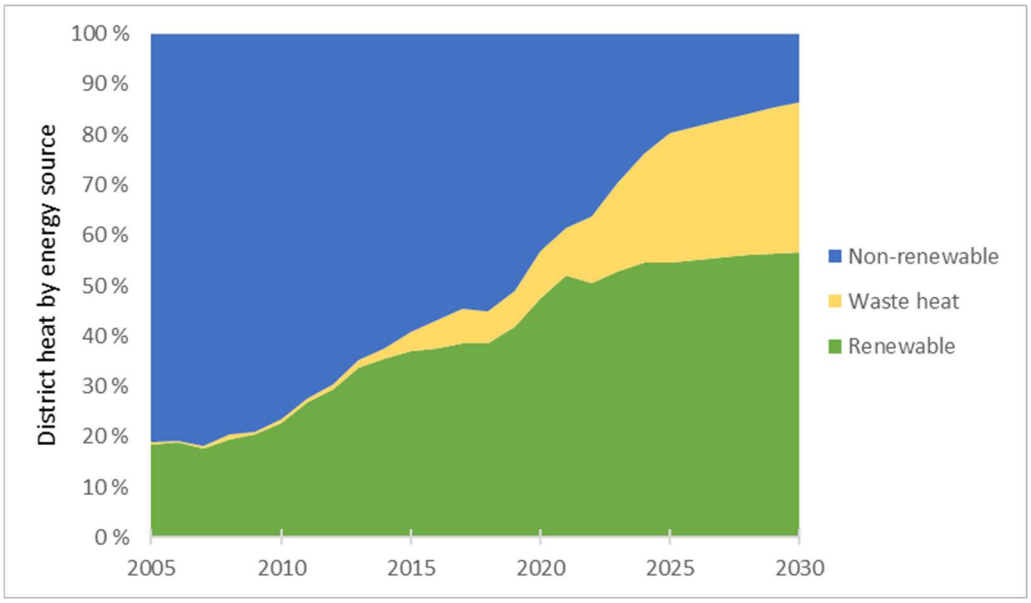

Figure 4. District heat by energy type (renewable energy, waste heat and non-renewable energy) in the WEM projection.

Section 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

1) The indicative national energy efficiency contribution in Article 3 of Directive 2012/27/EU

Finland notes the agreement reached on the proposed recast of the Energy Efficiency Directive between the European Parliament and the Council of the European Union. As soon as the recast of the Energy Efficiency Directive has entered into force, all national efforts needed will be carefully assessed, including the re-numbered Article 4 and the achievement of EU-level binding target for final energy consumption. Finland is looking forward to reporting the outcomes of the assessment in the update of the NECP by 30 June 2024.

2) The cumulative energy saving obligation in Article 7 of Directive 2012/27/EU

Finland notes the agreement reached on the proposed recast of the Energy Efficiency Directive between the European Parliament and the Council of the European Union. As soon as the the recast of the Energy Efficiency Directive has entered into force, all national efforts needed will be carefully assessed, including the increased cumulative target of the re-numbered Article 8. Finland is looking

forward to reporting the level of target and relevant policy measures in the update of the NECP by 30 June 2024.

3) Target on reducing total final energy consumption of public bodies

Finland notes the agreement reached on the proposed recast of the Energy Efficiency Directive between the European Parliament and the Council of the European Union. As soon as the recast of the Energy Efficiency Directive has entered into force, all national efforts needed will be carefully assessed, including the binding reduction target on public bodies´ total final energy consumption of new Article 5. Finland is looking forward to reporting the level of reduction and relevant measures in the update of the NECP by 30 June 2024.

4) Requirement to ensure the exemplary role of public bodies´ buildings

Finland notes the agreement reached on the proposed recast of the Energy Efficiency Directive between the European Parliament and the Council of the European Union. As soon as the recast of the Energy Efficiency Directive has entered into force, all national efforts needed will be carefully assessed, including the 3% renovation target or alternative approach of re-numbered Article 6. Finland is looking forward to reporting the relevant data concerning the chosen mechanism, to ensure the exemplary role, in the update of the NECP by 30th June 2024.

The NECP will be updated with the information of Annex I in the final NECP update in 2024.

Energy Efficiency Working Group 2023

In May 2023, the Ministry of Economic Affairs and Employment appointed an Energy Efficiency Working Group 2023, consisting of representatives from several ministries, to prepare the national implementation of the Energy Efficiency Directive recast. The group will also prepare the necessary legislation.

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

Energy efficiency in the transport sector

The objectives and measures for improving the energy efficiency of transport have been included in the Roadmap to fossil-free transport, the Medium-term Climate Change Policy Plan and National Climate and Energy Strategy. These measures concern improving the energy efficiency of both vehicles and the entire transport system. 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

The Finnish long-term renovation strategy aims at decarbonising the current building stock by 2050. 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 fossil fuels in district heating production as well as renovation subsidies). The strategy also includes the tracking of energy efficiency levels of the Finnish building stock now and in the future. The building types included in the strategy are detached buildings, terraced houses, residential apartment blocks and service buildings.

The long-term renovation strategy puts the heating energy use of the Finnish building stock in 2020 at about 71 TWh, of which purchased energy 65 TWh. In recent years, heat pumps have become more common in both existing and new buildings: in 2020, they provided about 6.4 TWh of space heating. In 2021, the Finnish building stock used about 80 TWh for heating (2021 was colder than 2020), of which heat pumps provided 8.1 TWh.

The initial target levels for heating energy use of buildings are 56 TWh in 2030, 45 TWh in 2040 and 36 TWh in 2050, including the energy harvested by heat pumps. This corresponds to an energy saving of 22% in 2030, 36% in 2040 and 49% in 2050 from the baseline year 2020. Energy savings from heating energy in buildings come from three main sources: climate change, energy efficiency improvements and maintenance, and removals from the building stock and efficiency of space utilisation. Figure 5 shows the total heating energy savings compared to the baseline year 2020, allocated to these three sources of energy savings.

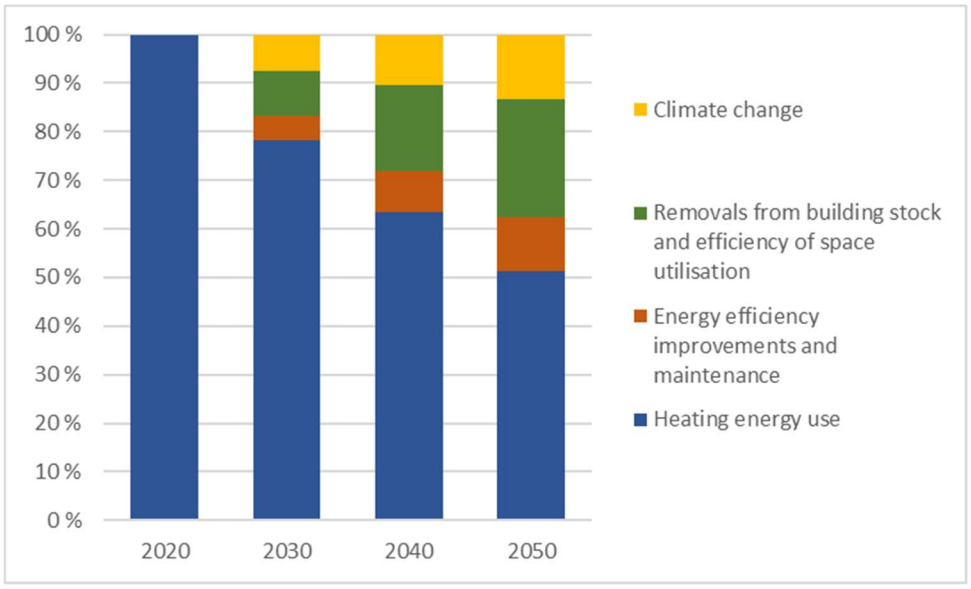

Figure 5. The total heating energy use and saving in the 2020 building stock when compared to the energy use in the base year 2020 (heating energy use of 2020=100%).

In the long-term strategy, the greenhouse gas emissions of the building stock in 2020 are 7.8 Mt CO_2 equivalent. The corresponding emissions are 2.9 Mt CO_2 equivalent for 2030, 1.5 Mt CO_2 equivalent for 2040 and 0.7 Mt CO_2 equivalent for 2050. This equals total emissions reductions from the baseline year 2020 of 63% in 2030, 81% in 2040 and 92% in 2050.

Four factors explain the emissions reductions in building energy use: 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 on energy use vary by energy source. The largest decrease is in fossil fuel use (almost entirely heating oil), and the largest increase is in heat pump use. Figure 6 shows the impacts of the decarbonisation policies on the use of different heating energy sources.

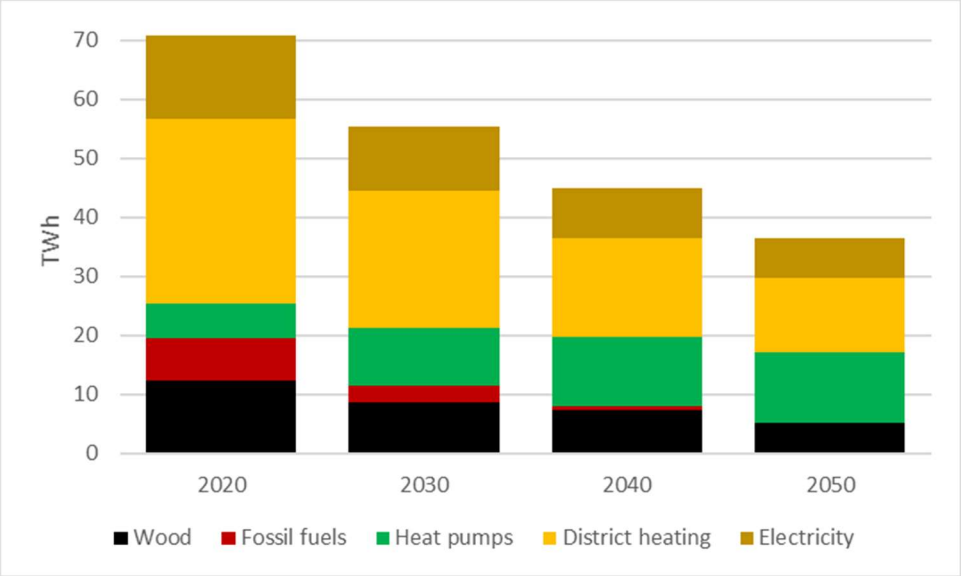

Figure 6. Heating energy sources of the remaining 2020 building stock in 2020-2050 (TWh).

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) states that 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. The Decision is being revised to take into the crises of recent years and new threats. The new Decision is planned to enter into force in spring 2024.

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 (privately and) 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 imported 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 (wet weather reduces the amount of peat harvested), 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. Recently, there has been significant development in cooperation with the EU, the IEA, the Nordic countries and NATO. In the Nordic countries, Finland has security of supply agreements with Sweden and Norway. Also, the relationships with the security of supply authorities of Estonia have been strengthened. Together with the Ministry for Foreign Affairs, the National Emergency Supply Agency has invested in the personnel resources for international cooperation in the field of security of supply.

According to the Finnish Energy Authority[18], total installed power generation capacity in Finland was about 20,000 MW at the end of 2022. However, the entire capacity is not available during the peak load periods. The Energy Authority estimated in autumn 2022 that 11,300 MW of Finnish electricity generation capacity (only market based capacity) was available for the consumption peaks in winter 2022–2023. 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 they are highly affected by outdoor temperatures and the length of cold spells.

Table 8 below shows the highest hourly electricity demand per year for 2015-2023, the actual electricity generation during the peak demand hour and the highest hourly generation per year for 2015-2023. The record peak consumption of 15,105 MW was in January 2016. During last winter (2022-2023), the highest hourly load was 12,192 MWh/h. The demand peak is closely related to the weather conditions. Last winter, electricity customers' measures to save energy significantly reduced electricity demand, especially during the peak hours.

Table 8 The peak hourly electricity consumption in Finland 2015-2023

Winter season	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**
Peak demand (MWh/h)	15,105	14,237	14,062	14,542	12,388	14,267	14,175	12,192
Generation during peak demand (MWh/h)	10,874	9,963	10,602	10,978	9,849	11,191	10,169	11,240
Highest annual generation (MWh/h)	11,456	11,042	11,382	11,195	10,264	11,409	11,704	13,122

Source: Fingrid.[19]

After May 2022, Finland has not imported electricity from Russia.

The floating LNG terminal (FSRU) in Inkoo started its commercial operations in January 2023. The objective of the terminal is to open a new supply route for natural gas from the international LNG

[18] Energy Authority, preliminary information, Latest published report: National Report 2021 to the Agency for the Co-operation of Energy Regulators and to the European Commission - Finland. 11.7.2022. https://energiavirasto.fi/en/-/national-report-on-electricity-and-natural-gas-markets-in-2021

[19] Fingrid Sähköjärjestelmän toiminta talvella 2022–2023, https://www.fingrid.fi/globalassets/dokumentit/fi/kanta-verkko/sahkonsiirto/sahkojarjestelman-toiminta-talvella-2022-2023.pdf

market. The LNG terminal will help Finland permanently phase out its dependency on Russian gas. The vessel has an annual regasification capacity of 40 TWh, which far exceeds Finland's annual need for natural gas. The LNG terminal also enables gas deliveries to the Baltic States and even to Poland through the Balticconnector pipeline.

In October 2022, a small-scale LNG terminal in Hamina was connected to the Finnish gas system and started its commercial operations. The injection capacity of the Hamina LNG terminal is 6 GWh/d.

Gas consumption in Finland has plummeted as a market-based response to high gas prices since 2021. In 2022, the annual gas consumption was roughly half the level of consumption in 2021. In 2023, gas consumption appears to be even lower than in 2022, thanks to fuel switching and energy saving. Daily gas consumption data is available on the website of Gasgrid Finland, the gas TSO[20].

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

National targets to reduce greenhouse gas emissions by replacing fossil fuels are closely related to energy self-sufficiency targets. The policy also includes the decision to ban the use of coal for use in energy production by May 2029.

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 were at the time aimed to reduce the dependency on natural gas imported from Russia.

In addition to the EU's common objectives, Finland has so far not set a separate official national target to phase out Russian gas. As a result of several factual events and decisions, Finland is decoupled from the use of Russian pipeline gas since May 2022, while small volumes of LNG of Russian origin may have been imported since then.

The pipeline gas imports from Russia were completely stopped in May 2022 by the Russian exporter Gazprom. Gazprom cut off the gas flow to Finland due to Gasum's decision not to pay pipeline gas supplies in roubles. Later also the physical connection of the Finnish and Russian gas systems has been separated by the Finnish gas TSO Gasgrid Finland.

On 7 May 2022, the Cabinet Committee on Economic Policy decided on measures to lease a large-scale floating LNG terminal in cooperation with Estonia. The rental of a floating LNG terminal aimed at enabling Finland to detach from the dependence of Russian pipeline gas. The final political decisions and the commercial agreements were completed in spring and summer 2022. The floating LNG terminal in Inkoo started its commercial operations in January 2023.

[20] https://gasgrid.fi/en/gas-market/market-information/

In October 2022, a small-scale LNG terminal in Hamina was connected to the Finnish gas system and started its commercial operations. The injection capacity of the Hamina LNG terminal is 6 GWh/d.

In January 2023, Gasgrid Finland also expanded the capacity of the Finnish gas system in Inkoo, enabling the supply of gas corresponding to Finland's peak consumption from the western direction.

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.

As of June 2023, the national legislation sets a quota obligation to increase the share of biofuels to 34% 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.

As for the transport sector, the objective is also to increase the number of electric cars to at least 880,000, the number of electric lorries and busses to at least 7,000 and the number of gas-powered lorries and busses to at least 6,100 by 2030. Most of the gas used in transport is domestic biogas (approximately 56% in 2021). Domestic energy sources account for a large share also in Finland's electricity production.

Finland has not set specific objectives for the diversification of deliveries from third countries. National objectives mainly concern 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 completed LNG terminals in Inkoo and Hamina as well as two off-grid LNG terminals in Pori and Tornio, and the Balticconnector gas pipeline enable a decentralised supply of gas. In addition, since May 2022 Finland does not import electricity from Russia.

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 electricity 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. According to the preliminary information from the Energy Authority, approximately 13.7% of retail

customers had a dynamic electricity price contract at the end of 2022. The latest official information, from 2021, shows a 9% share.[21]

Consumer protection and competitiveness in the retail sector are reflected in measures aimed at curbing hefty single price increases, such as the legislation restricting annual increases of electricity transmission charges. During the energy crisis, Finland carried out several measures to alleviate the very high electricity prices for the consumers.

The role of flexibility and demand response was further emphasised in the National Climate and Energy 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 customer 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 situation[22]. The Ministry of Economic Affairs and Employment is currently implementing these proposals in parallel with the Clean Energy Package implementation.

Pursuant to Regulation (EU) No 2022/1032 of the European Parliament and of the Council, Finland is obliged to ensure that national market actors have arrangements with underground gas storage operators or other market actors located in Member States with underground gas storages to ensure an annual gas storage volume of at least 15% of Finland's average annual gas consumption over the previous five years by 1 November. From 20 February 2023, the Act on Obligation Storage of Import Fuels is supplemented with a fixed-term obligation on market participants under the Regulation (EU) No 2022/1032 to ensure gas storage arrangements. The additional storage obligation will apply from 2023 to 2025.

In accordance with the Council Regulation No 2022/1854 on an emergency intervention to address high energy prices, the member states had to determine the peak electricity consumption hours in the winter season and implement measures to reduce electricity consumption during these hours by at least 5% (Article 4). In Finland, the peak consumption times were determined to be between 8-10 am and 5-8 pm on weekdays, and the main measure was an energy saving campaign and counselling. Electricity consumption during peak hours decreased by 8.3% compared to a situation where electricity saving measures would not have been implemented. Compared to the average of of the reference period (Article 3), monthly gross electricity consumption declined as follows:

- November 2022: 731,812 MWh (a decline of 9.95%)
- December 2022: 638,071 MWh (8.00%)
- January 2023: 992,478 MWh (11.86%)

[21] https://energiavirasto.fi/en/-/national-report-on-electricity-and-natural-gas-markets-in-2021
[22] 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

- February 2023: 1,052,214 MWh (13.80%)
- March 2023: 588,405 MWh (7.46%)

Nordic cooperation in the field of energy security

Nordic cooperation on energy security is extensive. In 2023, the Nordic Council of Ministers (the official body for inter-governmental co-operation in the Nordic region) launched the report "The Nordic Energy Trilemma – Security of Supply, Prices and Just Transition[23]", which reviews factors that drove the most severe energy crisis in recent memory, with an emphasis on electricity markets, the preparedness of the Nordic countries, and how they responded. The report identifies risks to the Nordic energy transition and assesses current measures to mitigate them. Where no such measures exist, it proposes actions to address the gaps. The recommendations herein define national, Nordic, and international actions to increase energy security and emergency preparedness, such that our societies are ready for the energy crises of the future.

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 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.

[23] https://www.nordicenergy.org/publications/the-nordic-energy-trilemma-security-of-supply-prices-and-just-transition/

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 electricity interconnectivity 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 target for 2030 is to keep the level of interconnectivity above 15%.

According to data for 2022, the installed power plant capacity in Finland is about 18,000 MW and commercial transmission connections, excluding connections to Russia, total 3,700 MW. The level of interconnection is thereby 20.6% (3,700 MW divided by 18,000 MW). Adding the nuclear power plant unit OL3 in Olkiluoto, in full commercial use since spring 2023, increased the generation capacity to 19,600 MW and, correspondingly, the commercial transmission connections were decreased due to technical characteristics of the power system to total 3,400 MW. In spring 2023, the level of interconnectivity thus stands at 17.3%. The peak load in Finland has varied between 12,400–15,100 MW in the period 2016–2021.[24] The current total transmission capacity to neighbouring EU countries is thus 23–27% of the historical peak load. Of note, electricity trade between Finland and Russia is suspended since May 2022.

Fingrid Oyj (the Finnish transmission system operator) and Svenska Kraftnät (the Swedish transmission system operator) are constructing a 400 kV alternating current connection of 800 MW between northern Finland and northern Sweden by 2025. The project is called Aurora Line. The project has received EUR 127 million in EU PCI funding. The project has shown strong socioeconomic benefits in both countries, especially in Finland[25]. With the Aurora Line, commercial transmission connections to neighbouring EU countries in 2025 would be 4,200 MW and the installed power plant capacity around 21,000 MW. This equals an interconnectivity level of 20%. The predicted peak load in 2025 is around 15,700 MW[26]. Thus, the transmission capacity is predicted to be approximately 27% of the peak load in 2025.

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

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[24] https://www.fingrid.fi/globalassets/dokumentit/fi/tiedotteet/ajankohtaista/sahkojarjestelman-toiminta-talvella-2017---2018.pdf

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

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

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

The electricity price difference between Finland and the Nordic electricity market has fluctuated in recent years. The price differences had declined to very low levels in 2018-19, but have increased somewhat since then, reflecting the developments in broader European electricity markets. Table 9 shows the price differences between Finland, its neighbouring bidding zones and the Nordic System Price.

Table 9 Yearly average price difference between Finland (FI), Sweden (bidding areas SE1 and SE3), Estonia (EE) and Nordic System Price in EUR/MWh in 2015–2022.

	Price difference in EUR/MWh			
Year	**SE1-FI**	**SE3-FI**	**EE-FI**	**SYS-FI**
2022	-94.98	-24.83	38.78	-18.18
2021	-29.85	-6.34	14.39	-10.03
2020	-13.63	-6.83	5.67	-17.09
2019	-6.1	-5.68	1.82	-5.1
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

Source: Calculated from the market data by Nordpool.

The total installed renewable generation capacity at the end of 2021 equalled 9,500 MW in Finland, so the share of nominal transmission capacity to the neighbouring EU countries was 39% 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 Aurora Line interconnector between Finland and Sweden is expected to be 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)

Electricity

Fingrid, the electricity TSO, lists the key transmission infrastructure projects in its current ten-year network development plan for 2022-2031[27] . Overall, it foresees a significant need for transmission grid expansion and has plans to add 3,200 km of 400 kV lines and 2,000 km of 110 kV lines by 2031. The current transmission grid length is around 15,000 km.

By 2031, Fingrid plans to invest around EUR 3 billion in transmission system expansion and maintenance. These plans are closely aligned with Finland's energy and climate goals. Fingrid lists three main challenges for the grid: decreasing generation from co-generation plants in southern Finland; integrating higher shares of generation from nuclear, wind and solar PV; and meeting increased electricity demand resulting from electrification. It therefore plans to build additional transmission lines between the south of Finland (demand centres) and the north and west (the main sites for wind generation and interconnections with Sweden). Beyond 2031, it also has plans to expand interconnections between Finland and Estonia.

Gas

As outlined in the NCES and the Roadmap to Fossil-Free Transport, the government is pursuing policies aimed at reducing natural gas consumption in industry, decarbonising gas supply, enhancing regional gas market co-operation, supporting increased gas consumption in transportation, and diversifying gas supply sources.

The government has sought to increase gas supply from alternative sources and intends to maintain a more diversified range of supply sources in the future. Major infrastructure projects to assist in these efforts include the Balticconnector pipeline connecting Finland with Estonia, in use since 2020, and the floating LNG terminal in Inkoo, in commercial use since January 2023. The terminal is connected to the gas transportation system and has the capacity to supply up to four times Finland's annual natural gas consumption. Other infrastructure projects include the three small LNG terminals which were taken into use between 2016 and 2022 (see point 4.5.2).

[27] https://www.fingrid.fi/globalassets/dokumentit/en/customers/grid-connection/fingrid-main-grid-development-plan-2022-2031.pdf

In January 2023, Gasgrid Finland also expanded the capacity of the Finnish gas system in Inkoo, enabling the supply of gas corresponding to Finland's peak consumption from the western direction.

Specifically for hydrogen, the government objective is to make Finland the leader in the European hydrogen value chain by 2030, building on the secure supply of abundant, inexpensive clean electricity and other competitive advantages. This involves a large-scale construction of hydrogen production and transportation capacity and adopting legislation on the hydrogen market. More details are outlined in the February 2023 Government Resolution on Hydrogen.

Gasgrid Finland is working to accelerate the development of hydrogen infrastructure in Finland. Gasgrid is also working alongside Sweden's Nordion Energi to develop the Nordic Hydrogen Route, a cross-border project aimed at building a pipeline network and an open hydrogen market in the Bothnian Bay region by 2030.

The aim of the Nordic Hydrogen Route is to drive decarbonisation, support regional green industrialisation, economic development, and European energy independence. The companies seek to develop a network of 1 000 km of new pipelines that would effectively transport energy from producers to consumers to ensure they have access to an open, reliable, and safe hydrogen market. The pipelines would serve 65 TWh of identified potential hydrogen demand in the Bothnian Bay region by 2050. The core route will be along the coastline, with a branch to Kiruna, Sweden.

The Nordic Hydrogen Route investment is estimated at EUR 3.5 billion, offering a hydrogen transportation cost of EUR 0.1-0.2 per kg. It would enable ten-fold investments of around EUR 37 billion in wind power and electrolysis. The pipeline could facilitate emissions savings of up to 20 Mt CO_2 equivalent per year by 2050.

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 Climate and Energy 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 to ensure competitive electricity prices and security of supply and to give 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, which tends to increase electricity exports to Central Europe and subsequently raise the Nordic system price. The effect of price fluctuation in the Central European market is also more strongly transmitted to the Finnish electricity market. Wholesale price increases across borders in autumn 2022 proved this point well.

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 around 2,300 MW in 2021, so the connection is very robust. Price levels in the Estonian and Finnish wholesale markets have often greatly converged in recent years (see Section 2.4.1). The Baltic States already represent an integral part of the Nordic electricity market.

The Nordic electricity market has become further integrated with the Central European market, thanks to the recent commissioning of the Nordlink (NO2-DE) and North Sea Link (NO2-UK) connections. 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 closer 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

Until 2020, Finland was exempt from EU rules on unbundling and third-party access in the gas sector (Directive 2009/73/EC) due to the isolated nature of the Finnish gas market. As a result, the gas market was essentially closed to competition and fully controlled by the state-owned company, Gasum, which acted as the TSO and was the only importer and wholesale supplier.

However, in January 2020 upon the commissioning of the Balticconnector pipeline that links Estonia and Finland, the Finnish gas sector became subject to EU legislation on gas market competition, and the exemptions to the Gas Directive were abolished from the Natural Gas Market Act. Price regulation of piped gas was dropped and gas market-places and internal market rules were introduced.

In line with the Gas Directive, the Natural Gas Market Act legislated the separation of gas transmission and sales activities, resulting in the creation of the new TSO, Gasgrid Finland, which was unbundled from Gasum. Gasgrid Finland remains fully state-owned. The Natural Gas Market Act also legislated open access to the natural gas transmission and distribution networks, as well as to Finland's LNG terminals.

In January 2020, Finland also joined a common regional gas market area with Estonia and Latvia (FinEstLat gas market area). The merger of FinEstLat means the linking of the Finnish, Estonian and Latvian markets, removing the internal tariffs in the region and setting the entry tariffs in the region at the same level. The results of the operation of FinEstLat single entry tariff zone have been very positive. The final objective is to create a regional gas market comprising Finland and the three Baltic States, including 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 has defined a national target for the reliability standard as 2.1 hours of loss of load expectation in accordance with Article 25 of Regulation 943/2019[28]. If the markets will not fulfil this target, Energy Authority is tasked to procure strategic reserve capacity for this purpose.

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

Finland does not have quantitative objectives to protect 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 (588/2013) and the Natural Gas Market Act (587/2017) currently in force[29]. On 1 February 2019, an amendment came into force regarding a centralised information exchange database called Datahub to provide each party in the electricity retail market with all relevant information on electricity trading. Today, the Datahub stores information on around 3.8 million electricity points of use. Approximately 80 distribution system operators (DSOs) responsible for electricity transmission and 80 electricity suppliers have switched to the Datahub. The system provides secure, fair and up-to-date access to data for all authorised parties. The Datahub enables a more efficient and consistent transfer of data,

[28]Government decision on reliability standard 17.3.2022 https://valtioneuvosto.fi/delegate/file/103732
[29] http://www.finlex.fi/fi/laki/ajantasa/2013/20130588 ; http://www.finlex.fi/fi/laki/ajantasa/2017/20170587

which is essential for developing the electricity retail market. It is also vital to developing other opportunities, such as services for enabling significantly better demand flexibility even at an individual consumer level. Datahub is administered by Fingrid Datahub Oy, which is a subsidiary of Fingrid, the TSO.

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

In Finland, energy poverty is treated as part of social policy, because of our northern location it is important to safeguard the basic needs of households, such as energy and adequate indoor temperature. Finland has a comprehensive social assistance system, the aim of which is to guarantee a minimum income for all. Although there is no aid specifically targeted at energy poverty, aid to housing costs or basic needs can be considered to mitigate energy poverty. Energy poverty and its risk can be reduced by providing energy advice to households and by means of various financing solutions for energy investments.

According to section 19 of the Constitution, anyone who is unable to secure a decent life has the right to the necessary means of subsistence and care. The Act guarantees everyone the right to secure basic income during periods of unemployment, illness, incapacity for work and old age, and on the basis of the birth and loss of a child's guardian.

The Act on Social Assistance (1412/1997) lays down the grounds for social assistance, which ensures the supply of electricity to vulnerable and energy-poor customers. Expenditure on household electricity and energy purchases related to housing is covered by social assistance. According to section 7a of the Act, in addition to the expenditure covered by the basic component of social assistance, the necessary amount of other basic expenditure is taken into account, for example, the costs arising from space heating and household electricity.

Low-income households may receive housing allowance either as general housing allowance [Act on General Housing Allowance (938/2014)] or as housing allowance for pensioners [Act on Housing Allowance for Pensioners (571/2007)]. Housing allowance may be granted for the housing costs of rental housing, right-of-occupancy housing, owner-occupied dwelling or part-occupied dwelling. Acceptable housing costs have been defined for different types of housing. For example, in rental dwellings, these include rental and separately paid water and heating costs. However, the housing allowance does not cover other electricity consumption.

Subsidies aimed at improving energy efficiency include energy subsidies granted by the Finnish Housing Finance and Development Agency (ARA) for renovation projects in residential buildings, in connection with measures aimed at improving energy efficiency and smart and flexible energy consumption [Government Decree on energy subsidies for residential buildings in 2023 (1095/2022)].

Finland notes the agreement reached on the proposed recast of the Energy Efficiency Directive between the European Parliament and the Council of the European Union. As soon as the recast of the

Energy Efficiency Directive has entered into force, all national efforts needed will be carefully assessed, including re-numbered Article 24. Finland is looking forward to reporting the outcomes of the assessment in the update of the NECP by 30 June 2024.

As stated in the previous NECP from 2019, individual studies on energy poverty in Finland were carried out in 2013, 2015 and 2018. According to these studies, energy poverty is still rare in Finland, as social security mitigates its effects. Also, a new study was launched in 2023 and is yet to be completed.

Finland recognises that according to SCF regulation Member State should submit to the Commission a Social Climate Plan by 30 June 2025 and the requirement to ensure consistency between the Plan and the updated National Energy and Climate Plan to be submitted by 30 June 2024.

Between October 2022 and the first quarter of 2023, when the energy crisis impacted the energy prices and the electricity prices were exceptionally high in Finland, the central government introduced several subsidies for the winter to provide support for households and companies.

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

In 2021, Finland set a goal to increase total spending on R&D (public and private) to 4% of GDP by 2030 (versus 3% of GDP in 2021). Finland is also committed to supporting a target for EU-wide spending on R&D to reach 3% of EU-wide GDP by 2030 (versus 2.2% in 2018). The R&D Funding Act, which entered into force at the start of 2023, set increasing levels of annual government R&D funding to ensure that government R&D funding reaches 1.2% of GDP by 2030. This is intended to drive increased private sector R&D funding to reach the 4% goal. The R&D Funding Act does not require specific allocations to energy R&D, but the government is committed to reaching carbon neutrality by 2035 and sees a major role for R&D in driving the clean energy transition. To complement the R&D Funding Act, a parliamentary working group on R&D and innovation is drafting a long-term plan to set the main guidelines for allocating public R&D funding, but it will not decide on allocations across themes or sectors. A more detailed plan will be prepared as part of the government programme in 2023.

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 efforts to deal with this transformation and to develop 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 programmes 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.

Finland is also active in the SET Plan and is chairing the Bureau, which is composed of active Member States and Association Countries. In the Implementation Working Groups (IWG), Finland is co-chairing 3 of them and also participating many others. The revamping of the SET Plan during 2022-2023 gives an extra push for the Green Deal and transformation of the energy system. A better alignment and integration of clean energy technology promotion and funding on Member State and EU-level is needed.

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 of this Section 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 Union's climate-neutrality objective set out in Article 2(1) of Regulation (EU) 2021/1119

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

Under the Effort Sharing Regulation, Finland must reduce the sector's emissions by 50% from 2005 to 2030, while the 2022 Climate Change Act sets an objective of making Finland carbon-neutral by 2035. The current measures are not sufficient to attain these objectives. The 2022 Medium-term Climate Change Policy Plan investigates the actions needed to close the gap and how the emissions of the effort sharing sector can be reduced to meet the 2030 target and reach carbon-neutrality by 2035. A more detailed description of the measures defined in the 2022 Medium-term Climate Change Policy Plan is provided below.

Transport

In the effort sharing sector, transport offers the greatest potential for reducing emissions. The goal is to reduce transport emissions by at least half by 2030 compared to 2005 levels. Measures will be focused on road transport where with existing measures (WEM), emissions could be reduced by approximately 49.3%, or 3.68 Mt CO_2 equivalent by 2030. The emissions reduction measures fall in three categories:

1) *Replacing fossil fuels with alternative transport fuels*

The main measure in this category is the biofuel distribution obligation (see Section 3.1.2). The current legally binding target is for biofuels to account for 34% of all fuels consumed in road transport in 2030. This would help avoid around 3 million tonnes of CO_2 emissions in 2030. The current government, in office since 20 June 2023, may revise this target for renewable fuels in road transport. Other measures included in this category are the promotion of the infrastructure for electricity and biogas used in transport. VTT Technical Research Centre of Finland (2020)

estimates that in 2030, public charging infrastructure subsidies could reduce emissions by approximately 0.01–0.02 Mt CO_2 equivalent and recharging grants for housing companies and workplaces by approximately 0.02–0.1 Mt CO_2 equivalent.

2) *Renewal of the car fleet*

The main measure in this category are the binding CO_2 threshold values applicable to automotive manufacturers at the EU level. According to an estimate by VTT Technical Research Centre of Finland (2021), the updated regulation on CO_2 emission performance standards for cars and vans will reduce greenhouse gas emissions from transport by approximately 0.21 Mt CO_2 equivalent in 2030. In that same year, the existing regulation on CO_2 emission performance standards for heavy-duty vehicles will reduce emissions by approximately 0.091 Mt CO_2 equivalent. Finland has not yet assessed the emissions reduction impact of the proposed new regulation on CO_2 emission performance standards for heavy-duty vehicles.

In 2018, Finland introduced a purchase subsidy for battery electric vehicles and a conversion subsidy for converting an old car into an ethanol- or gas-powered car. This subsidy expired at the end of 2022. A subsidy for purchasing gas-powered trucks was introduced in December 2020, and one for purchasing electric trucks and electric and gas-powered vans from the beginning of 2022. According to an estimate by VTT Technical Research Centre of Finland (2021), the subsidy for purchasing electric cars will reduce greenhouse gas emissions from transport by approximately 0.019 Mt CO_2 equivalent in 2030. Purchase subsidies for electric and gas-powered trucks and vans would reduce emissions by around 0.009 Mt CO_2 equivalent in 2030.

Finland also supports the electrification of transport through tax changes. The taxable value of zero- and low-emission company cars has been temporarily reduced and the charging benefit of electric vehicles at workplaces has been temporarily exempted from tax. The car tax on battery electric vehicles was abolished as of 1 January 2022. The Ministry of Finance estimates that the removal of the car tax on battery electric vehicles will reduce emissions by around 0.01 Mt CO_2 equivalent in 2030.

3) *Improving the energy efficiency of the transport system*

Measures included in this category 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). Other measures to improve the energy efficiency of the transport system include the investment programme for walking and cycling, discretionary government grants for public transport, making use of vehicles with greater sizes and weights in goods transport by road, and comprehensive EU-level emissions trading in road transport.

There is no separate assessment of the emissions reduction impacts of the MAL agreements. According to an estimate by the Finnish Transport and Communications Agency (2020), an investment programme for walking and cycling could reduce emissions by around 0.004 Mt/year and public transport subsidies by around 0.008 Mt/year. Further, HCT transport could reduce emissions by 0.06 Mt CO_2 equivalent in 2030. According to an estimate by VTT Technical Research

Centre of Finland, emissions trading in road transport could reduce emissions by up to 0.189 Mt CO_2 equivalent by 2030.

Building-specific heating

Emissions from building-specific heating have been declining in recent years, but annual variation occurs due to, for example, heating needs. The reason for the declining trend in emissions from separate heating is the decrease in oil heating and improvements in the energy efficiency of buildings. The majority of emissions from separate heating are caused by oil heating. In 2021, emissions from separate heating amounted to 2.2 Mt CO_2 equivalent. In 2021, residential buildings accounted for 41% of emissions from building-specific heating, commercial and service buildings for 40% and agriculture for 19%. Emissions from building-specific heating have decreased by 55% from the 2005 level.

In the oil sector, the Government has concluded a heating fuel distribution energy efficiency agreement HÖYLÄ IV, the purpose of which is to improve the energy efficiency of oil-heated buildings and promote renewable forms of energy in oil heating. The agreement covers the period 2017–2025.

Emissions are expected to decrease further as a result of the renewal of the building stock, renovation building and changes in heating systems. The obligation to distribute biofuel oil and replacing fossil oil heating with other forms of heating will have a significant impact on reducing emissions.

Greenhouse gas emissions from oil heating of residential buildings amounted to 0.8 Mt CO_2 equivalent in 2019. Around 80–90% of this comes from detached and semi-detached houses. Oil heating accounts for about 40% of all emissions from detached and semi-detached houses. According to the Finland in 2019 survey, 133,000 single-family houses used oil boilers in 2019, on average around 2,220 litres of oil per year per house.

According to the Finnish Gas Association, in 2019 Finland had around 4,800 natural gas-fired residential buildings, of which around 4,000 were detached houses and around 750 terraced houses and blocks of flats. The total number of natural gas stoves in the household and service sectors is around 25,400. Around 13,000 households are heated with natural gas, a small fraction of Finland's 2.8 million household-dwelling units. In the service sector, around 1,200 buildings are heated with natural gas.

The phasing out of oil in residential properties will be promoted with the aid introduced. Subsidies for detached houses may be granted for costs arising from the removal and modification of the oil heating system of detached houses in year-round residential use to other heating systems. In summer 2022, the subsidy system for detached houses was extended to also apply to phasing out natural gas heating.

The subsidy for phasing out oil heating has significantly activated the replacement of heating systems. By June 2023, a total of 28,357 owners of detached houses had applied for aid for switching away from oil heating, of which more than 24,101 had received a favourable decision. A total of 951 owners of detached houses had applied for grants for phasing out gas heating, of which 889 had received a

favourable decision. So far, when those who have received a favourable decision implement a heating method change, the estimated impact on annual emissions is approximately 0.14 Mt CO_2 equivalent.

An alternative form of support for owners of detached houses to renew their heating system is the income tax credit for household expenses, including labour costs on phasing out oil heating. In 2022–2023, the credit was up to EUR 3,500 per person per year, or EUR 7,000 per household with two adults.

Efforts will also be made to reduce emissions from residential buildings by means of energy subsidies for projects that improve energy efficiency. The estimated impact on annual emissions is approximately 0.16 Mt CO_2 equivalent. The impacts will affect emissions from all residential buildings and not just oil-heated properties. Therefore, some of the emissions reduction impacts will be directed at the emissions trading sector.

The phasing out of oil heating in municipality-owned buildings and the transition to other forms of heating have been accelerated with grants since October 2020. Around 9,300 oil-heated buildings are owned by municipalities and municipal enterprises in Finland, of which around 4,300 are in use and around 5,000 are empty. Even empty buildings often have to be heated. The grant accounts for 30% of the costs approved and incurred in the grant decision. The grant will be increased by 5 percentage points, if the municipality has acceded to a voluntary energy efficiency agreement.

By 2030, the combined impact of the measures in building-specific sector will be approximately 0.7 Mt CO_2 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 biofuel in heating, machinery and stationary engines entered into force on 1 April 2019 (laki biopolttoöljyn käytön edistämisestä 418/2019). The act sets an obligation to supply light fuel oil with bioliquids so that the share of biofuels will increase from 3% in 2021 towards 10% in 2028.

The Ministry of the Environment and the Association of Finnish Technical Traders have a Green Deal for years 2019–2025 on non-road mobile machinery to increase the share of low-emission machinery. Through voluntary commitments made under this agreement, those operating in the sector will aim to increase the supply of fully electric and other low-emission non-road mobile machinery and encourage its wider use. The Ministry of the Environment, Senate Properties, and the Cities of Espoo, Helsinki, Turku, and Vantaa have a voluntary Green Deal for years 2020–2030 to reduce emissions at construction sites. As part of the implementation of the voluntary Green Deals, Motiva created in 2021 a training package for non-road mobile machinery with funding and coordination from the Ministry of the Environment. The training package is freely available for operators in the non-road mobile machinery sector and it has been further developed and updated in 2022–2023.

The conversion of tractors to use biogas is supported as an environmental investment through agricultural investment subsidies. Subsidies are available for modifications to enable biogas use and for the equipment involved, but not for purchasing the tractor itself. Modifications of diesel engines and

accessory purchases to convert tractors and other agricultural machinery to use biogas are eligible for a subsidy as environmental improvement measures. The subsidy covers 35% of eligible costs, including costs of the purchase and installation of new equipment.

There are also continuous efforts to improve the knowledge base of emissions calculations from non-road mobile machinery.

Industrial fuel use

Industry sector in Finland is highly energy-intensive. Industry sector energy demand has fluctuated in line with economic activity. Between 2011 and 2021, there was a progressive decrease in the shares of electricity (27% to 26%), oil (24% to 22%), district heat (13% to 10%), coal (3.8% to 2.1%) and peat (2.3% to 1.0%) in industry sector. At the same time, the share of bioenergy and waste increased (24% to 33%). Finland is notable for the relatively low use of natural gas, just 5.6% of industry total final consumption in 2021.

The largest industrial energy-consuming sector in 2021 was pulp and paper, accounting for 48% of industry total final consumption. The other main sectors in terms of energy demand were chemical and petrochemical (15%), iron and steel (7%), agriculture/forestry (6%), construction (6%), wood (4%), and food and tobacco (3%).

In supporting the goal to achieve carbon neutrality by 2035, in 2019 the government announced its intention to prepare sectoral low-carbon road maps for key industrial energy sectors in co-operation with companies and organisations in each sector. By 2021, 13 industrial sectors had prepared their road map, supported by the Ministry of Economic Affairs and Employment [30]. These road maps provide the government with estimates of anticipated sectoral development, include GHG emissions and energy consumption, and indicate the investment needs of various sectors. The main conclusions from these road maps include a recognised need for investments in research and new technologies, including energy and materials efficiency; alternative energy sources (biofuels, hydrogen and electrification); the increased exploitation of waste heat; and the implementation of CCUS.

Finland supports financially the industry sector in decarbonisation. A special Energy Aid grant for new technologies and large-scale demonstration projects is available for investments over EUR 5 million taking forward future energy technologies. Finland also introduced a support scheme in 2022 that provides payments to offset increased electricity costs resulting from ETS allowance prices. The payments can cover 25% of ETS-related electricity costs up to a maximum of EUR 150 million per year. Any company receiving the payments must use at least half of the subsidy for activities to reduce emissions, improve energy efficiency and increase the use of renewables. Industries across most sectors are eligible for the support, but they must demonstrate that they have performed an energy audit or that they are exempt from conducting one and that at least 30% of their energy consumption is

[30] https://www.climate2035.fi/, http://urn.fi/URN:ISBN:978-952-327-796-0

electricity produced from carbon-free sources. The investments must be completed by the end of 2028.

The measures for reducing emissions from industrial oil use are the obligation to supply light fuel oil with 10% bioliquids content, 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 and improving energy efficiency.

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 life-cycle carbon dioxide emissions. A strategic stockpile fee is collected on both fossil and bio-based transport fuels in connection with the excise duty. The current energy tax structure for energy used in transportation is illustrated in Figure 7. The energy content tax for gasoline is approximately EUR 60.5 per MWh (the benchmark rate) and the carbon dioxide tax for life-cycle emissions is EUR 77 per tCO_2[31]. For gas oil, the energy content tax is reduced by EUR 25.95 per MWh compared to the benchmark rate. Tax rates for gaseous fuels used in transportation are also lower than the benchmark rates for transport use as gaseous fuels are taxed with benchmark rates of heating use. Also, the energy tax rate of electricity used in road transportation is lower. For passenger cars, lower taxation of diesel, gaseous fuels and electricity is corrected with a vehicle tax on propulsion force so that lower taxation effectively applies mostly to commercial vehicles.

[31] This equals approximately a tax rate of EUR 93 per tCO_2 applied to emissions of fuel combusted.

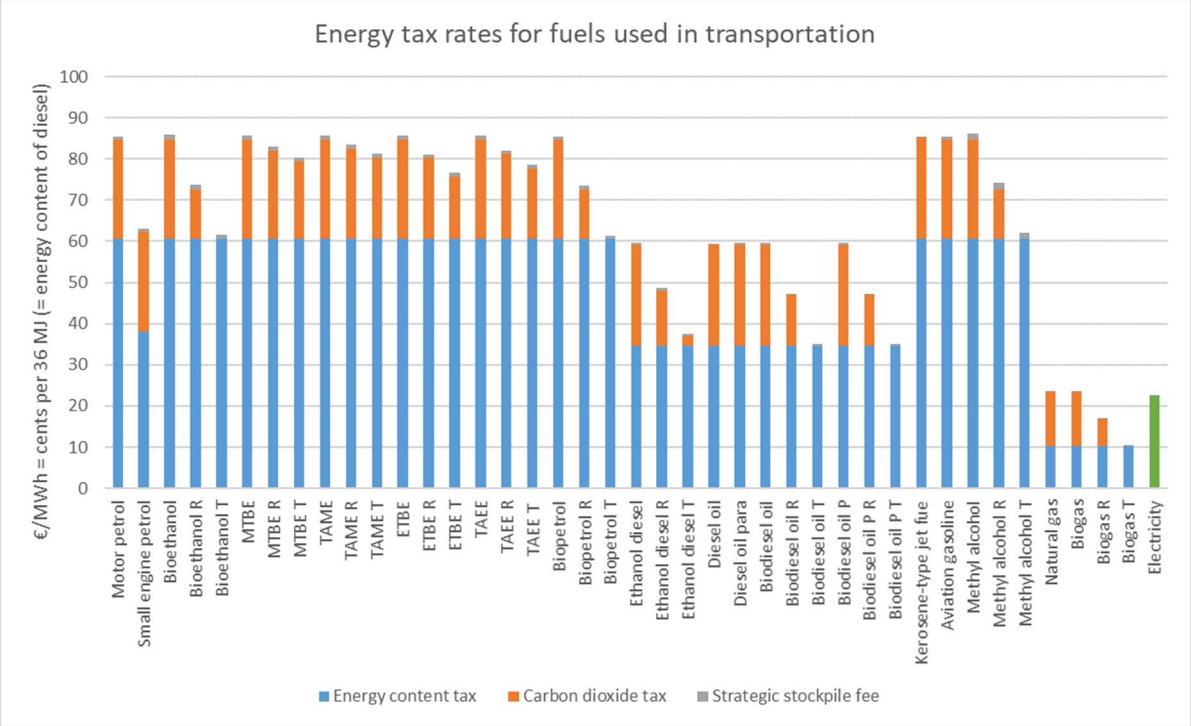

Figure 7. Current energy tax structure and rates for energy used in transportation.

The energy tax structure for fuel used for heating and mobile machinery and electricity is illustrated in Figure 8. The energy content tax for separate heating and mobile machinery is EUR 10.33 per MWh and the carbon dioxide tax is EUR 53 per tCO_2. Energy content tax rates for fuels used in combined heat and power production are reduced by EUR 7.63 per MWh (see Figure 8). The energy content tax for oil products used in the professional agriculture (excluding transport use) is rebated. The tax rebate for fuels used by energy intensive businesses in manufacturing, mining and greenhouse cultivation will be phased out by the end of 2024. The energy tax of electricity for manufacturing, mining, certain data centres and certain heat pumps and agriculture is at the EU minimum level, EUR 0.5 per MWh (class II). For households, services etc. the energy tax of electricity is EUR 22.4 per MWh. Small-scale production of electricity for own use is exempt.

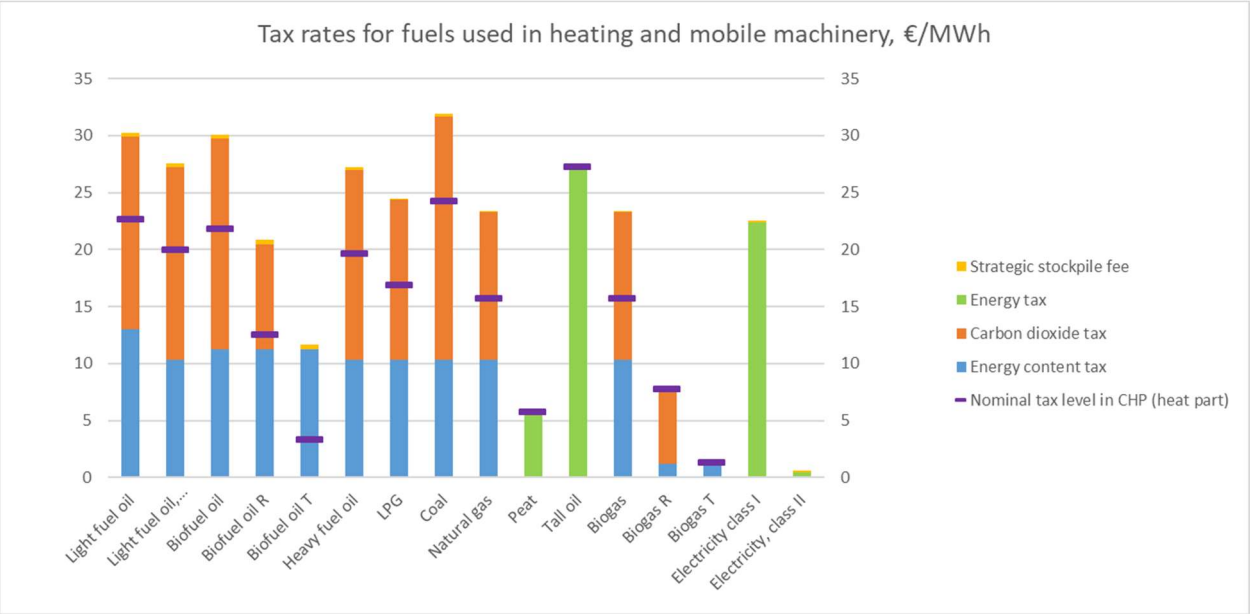

Figure 8. Tax rates for fuels used in heating and mobile machinery [EUR/MWh].

Waste management

Emissions from waste management originate from landfilling, composting, digestion and the treatment of wastewater. Especially emissions from landfilling have decreased since 2005. On the other hand, carbon dioxide emissions from waste incineration are growing, because of increased incineration capacity. Alternative policy measures such as a Green Deal to reduce emissions from waste incineration have been assessed. So far, national measures to reduce emissions from waste incineration have not been implemented. Instead, it seems likely that the sector will be included in the EU´s emissions trading scheme in the coming years.

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. From the peak year 2008, emissions have by now decreased around 40%. 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 and cooling substances 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 CO_2 equivalent.

Agriculture

Agricultural greenhouse gas emissions come from dispersed biological emission sources, which makes reducing them more complicated than in many other sectors. It is worth noting, though, that

agricultural land is not just a source of greenhouse gas emissions, but it may also sequester atmospheric carbon into soil. Favorable cultivation practices, such as plant cover in winter, perennial grassland and reduced soil tilling, make this possible.

The current measures in the agricultural sector are mainly related to the implementation of the EU's Common Agricultural Policy (CAP). The new CAP period from 2023 to 2027 began in January 2023. The main tasks of Finland's CAP Strategic Plan include safeguarding active food production, climate and environmental sustainability in agriculture and strengthening the vitality of the renewing rural areas. However, in its CAP strategic plan, each EU country is obliged to display a higher ambition on environment and climate action compared to the previous programming period and is required to update the plan when climate and environmental legislation is modified. The aim is that 40% of the total EU funding for CAP measures will be allocated to climate measures at the EU level. The Member States are obliged to allocate 35% of the rural development funds to environmental and climate measures at the national level. In addition to this, at least 25% of the budget for direct payments is allocated to eco-schemes, providing stronger incentives for climate- and environment-friendly farming practices and approaches.

Hence, compared to the previous programming period, the Finnish CAP Strategic Plan has increased the environmental and climate ambition. Finland's CAP Strategic Plan includes measures that, in addition to impacts on water bodies, also contribute to increasing and preserving carbon in soil. The emission reduction impact will affect both the land use sector and the agricultural sector. These measures include turning cleared areas permanently into grassland, catch crops, soil improvers and renovation plants, subsidies for grasslands and fallows (including grasses on peat fields), investments on controlled subsurface drainage and their management, establishing and managing wetlands (including climate wetlands). An investment subsidy is also available for more efficient storage, treatment and use of manure and for investments in energy efficiency and sustainable energy, such as biogas plants. The advisory services in the programme offer advice on energy efficiency and issues related to the mitigation of and adaptation to climate change. Since it is neither possible nor appropriate to implement all climate change mitigation or adaptation measures in agriculture through the EU's Common Agriculture Policy, national measures are also required. These measures are identified in the Medium-term Climate Change Policy Plan and in the Climate Plan for the Land Use Sector[32]. The emissions reduction measures proposed in the Medium-term Climate Change Policy Plan related to land use change include restricting clearing of fields, restricting the transfer of previous peat production areas to agricultural use, afforestation of wasteland and conversion of agricultural land into climate wetlands. Measures related to arable land use include cultivation of wet peatlands (paludiculture), adding carbon to fields by cultivating grass instead of annual crops and introducing precision farming methods. In addition, efforts are made to reduce methane emissions from dairy cows through feeding methods.

[32] https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/164301/MMM_2022_15.pdf?sequence=1&isAllowed=y (in Finnish)

The Medium-term Climate Change Policy Plan has also highlighted a number of measures that are likely to reduce greenhouse gas emissions from agriculture in the future but for which the emission impact cannot be calculated at the moment. Such measures include improving the real estate composition of fields, changes in the age structure of cattle, increasing use of gender-selected semen, improving carbon sequestration with various soil improvers, increasing compliance with nutrition recommendations, reducing food waste, developing public procurements, promoting carbon markets, and deepening cooperation between stakeholders in the food system.

The Climate Plan for the Land Use Sector complements the climate measures targeted at agricultural peatlands. Alternative measures include raising the groundwater level on peaty arable land to prevent peat decomposition, the promotion of perennial grasslands without tilling and converting agricultural land into managed wetlands (when the area would no longer be used for agricultural production). These measures targeted at agricultural soils also reduce CO_2 emissions in the land use, land-use change and forestry (LULUCF) sector.

Finland does not have a separate strategy for reducing methane emissions, but addresses them as part of the sectoral strategies. Agriculture is the biggest source of methane emissions in Finland (in 2020, approximately 49% of CH_4 emissions in Finland originated from agriculture, including enteric fermentation and manure management)[33].

In the agriculture sector, methane emissions mostly depend on the number of domestic animals. The expected reduction in the number of bovine animals also reduces the methane emissions from their digestion. In addition, the reduction in the number of bovine animals and pigs will reduce the emissions from manure processing.

Enteric methane emissions from ruminants can be reduced by changing feeding practices for dairy cows. Using rapeseed cake in the feeding of dairy cows can reduce methane emissions by approximately 10% per litre of milk if the cows are fed predominantly with roughage, i.e. grass. However, as more than 40% of the feed of dairy cows is concentrated feed, rapeseed cake would mostly replace the currently widely used rapeseed meal, and the actual reduction in methane emissions would probably be 3–5% per cow.

Of the feed additives that reduce enteric methane production, research has advanced furthest with regard to 3-NOP (3-nitrooxypropanol), which has been approved in the EU as a feed additive for dairy cows and cows for reproduction. In the best-case scenario, this additive may reduce methane emissions from dairy cows by up to 25%, but at the same time, it means permanent cost to farmers.

The Ministry of Agriculture and Forestry is funding studies and projects to develop feeding solutions applicable for Finnish grass roughage based feeding that reduce greenhouse gas emissions from bovines enteric digestion. The projects aim to find solutions for reducing greenhouse gas emissions related to cattle feeding in Finnish feeding systems and, in particular, enteric methane emissions pro-

[33] Finland Methane Action Plan: file:///C:/Users/03077699/Downloads/Finland%20Methane%20Action%20Plan_0.pdf

duced in rumen fermentation. The projects also aim to enhance knowledge about the means for reducing emissions that are already available or will be introduced within the next 5 to 10 years, as well as incentives and steering instruments through which the introduction and use of such means can be promoted. The projects started in autumn 2022.

The Government has strongly highlighted the role of manure management and nutrient recycling as part of the overall sustainability of agricultural production. Various incentive schemes are available for research, experiments, advice and investments in streamlining manure management and nutrient recycling. The purpose is to create the conditions for a well-functioning market of organic fertilisers and thereby ensure efficient recycling and use of nutrients. An experimental nutrient recirculation programme has run since 2016. The support scheme for biogas investments and new manure processing techniques was launched in December 2020. Another subsidy scheme for the production of biogas based on nutrient cycles is also being prepared.

Ammonia is to some extent involved in greenhouse gas emissions because part of the ammonium nitrogen landing on the ground is transformed into nitrous oxide. International treaties and EU legislation oblige Finland to reduce its ammonia emissions into the air. Approximately 90% of Finland's ammonia emissions originate from agricultural sources. The most effective measures for reducing ammonia emissions from agriculture involve manure, its storage, and its application. Ammonia emissions can also be reduced by measures involving the feeding of domestic animals, but these measures are more difficult to regulate, and impact is more difficult to assess, than measures related to the management of manure.

In addition to the measures referred to above, many other factors may help reduce greenhouse gas emissions from agriculture by 2035. However, the magnitude remains difficult to estimate. For example, gender-selected semen is a relatively new technology. The goal is to reduce the number of male dairy calves and increase the share of faster-growing dairy– beef crossbreed calves among dairy cattle. More research is needed on the use and effects of gender-selected semen, but the method is already rapidly gaining popularity.

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

Forests are Finland's largest carbon sink. Forest stand biomass growth binds more carbon than is released into the atmosphere as a consequence of felling and natural drain. The size of the net sink of forests varies from year to year particularly due to felling, whereas factors that influence felling volumes include the market situation of forest industry products, and demand for wood. The highest emissions come from the soil of drained peatlands in forests and on cropland. In addition, smaller emissions are generated by treated wetlands, including peat production areas or unsuccessfully drained forest areas or drained forest areas without drainage repair, that have transformed into wetlands again. Forest fires, prescribed burning and restoration burning, and nitrogen fertilisation of forests generate minimal emissions.

The 2022 Climate Plan for the Land Use Sector specifies how climate emissions from the land use, land-use change and forestry sector can be reduced, and carbon sinks and reservoirs strengthened. The annual net impact aimed for by the additional measures in the land use sector is at least three

million tonnes of carbon dioxide equivalent by 2035 (Mt CO_2-eq.). The net sink is expected to increase by a total of 5.3 Mt CO_2-eq. by 2035 compared to the 2020 level, exceeding the minimum target set for the Plan.

The Climate Plan for the Land Use Sector brings together ongoing measures such as the updated ownership policies of the State Forests (Metsähallitus), the ash fertilisation of peatland forests (part of the Fixed-term Act on the Financing of Sustainable Forestry since 2020), and the Act on Fixed Term Support for Afforestation. It also outlines additional measures in four categories: resource-efficient land use and land-use change; climate-resilient use of peatlands; other measures to promote carbon sequestration and carbon storage; and crosscutting measures. In addition to the ongoing measures presented above, the new measures focus on, e.g. actions in the peatland fields and forests, development of carbon markets, the swift and timely forest regeneration, increasing the amount of dead wood for climate and biodiversity perspectives, promoting training and expertise and communication. The most effective measures have been identified in halting deforestation and promoting actions in the peatlands. Preliminary climate impacts of the measures presented in the Climate Plan for the Land Use Sector are presented in Table 10. The system of monitoring needs to be developed to ensure that the effects of the measures are shown in the greenhouse gas inventory. The Catch the Carbon programme has been advancing climate measures in the LULUCF sector since its launch in 2020.

Table 10 Preliminary climate impacts in 2030 and 2035 of the measures presented in the Land Use Sector Climate Plan (million tonnes of carbon dioxide equivalent). Source: Natural Resources Institute Finland 2022.

Measure	Area	Climate impact in 2030	Climate impact in 2035
New ownership policy decisions concerning Metsähallitus		0.4 million tonnes CO_2 eq.	0.7–0.9 million tonnes CO_2 eq.
Preventing the conversion of forests into fields	about 1,700–1,900 ha per year		0.5 million tonnes CO_2 eq.
Act on fixed-term support for afforestation	3,000 ha per year, of which 40% in peat production areas	0.09 million tonnes CO_2 eq.	0.11 million tonnes CO_2 eq.
Afforestation of low-yield arable land	9,000 ha in 2024–2028	0.09 million tonnes CO_2 eq.	0.10 million tonnes CO_2 eq.
Raising the groundwater level in peaty agricultural lands (grasslands) -30 cm	2030: 20,000 ha 2035: 32,500 ha	0.135 million tonnes CO_2 eq.	0.219 million tonnes CO_2 eq.

Measure	Area	Climate impact in 2030	Climate impact in 2035
Paludiculture, groundwater level -30 cm	2030: 5,000 ha 2035: 10,000 ha	0.047 million tonnes CO_2 eq.	0.094 million tonnes CO_2 eq.
Paludiculture, groundwater level -5 – -10 cm	2030: 2,500 ha 2035: 5,000 ha	0.047 million tonnes CO_2 eq.	0.094 million tonnes CO_2 eq.
Managed wetlands (no longer in agricultural use)	2030: 4,000 ha 2035: 7,500 ha	0.072 million tonnes CO_2 eq.	0.136 million tonnes CO_2 eq.
Perinnial grasslands without tilling	2030: 40,000 ha 2035: 40,000 ha	0.081 million tonnes CO_2 eq.	0.081 million tonnes CO_2 eq.
Rewetting of low-yield, thick peaty arable land into wetlands	2030: 10,000 ha 2035: 10,000 ha	0.181 million tonnes CO_2 eq.	0.181 million tonnes CO_2 eq.
Comprehensive planning of peatland forest management (avoidance of remedial ditching)	-	-	-
Comprehensive planning of peatland forest management (continuous cover forestry)	6,000 ha per year	0.21 million tonnes CO_2 eq.	0.21 million tonnes CO_2 eq.
Ash fertilisation of peatland forests	26,000 ha per year	0.18 million tonnes CO_2 eq.	0.40 million tonnes CO_2 eq.
Promotion of forest fertilisation on mineral soils	25,000 ha per year	0.46 million tonnes CO_2 eq.	0.28 million tonnes CO_2 eq.
Increasing carbon stocks of decaying wood in commercially utilised forests by leaving trees for biodiversity and climate reasons	-	-	-
Total		**1.99 million tonnes CO_2 eq.**	**3.11–3.31 million tonnes CO_2 eq.**

The overall LULUCF sector has been a net sink in Finland because its emissions are smaller than the removals. This net sink from the LULUCF sector can vary a lot from one year to the next. However, according to Statistics Finland's preliminary data, the LULUCF sector was for the first time a net

source of emissions in 2021. As a result, in July 2022 as the Government approved the Climate Plan for the Land Use Sector, they decided on the following additional actions:

- Start legislative work to prepare for a land use change fee.
- Set as one of the objectives of the National Forestry Strategy 2035 the maintenance and increase of the carbon sink as well as the promotion of the achievement of the carbon sink and emission targets of the Climate Change Act and the EU's LULUCF targets.
- The METKA scheme supports climate-friendly forest management.
- Carry out a climate assessment study of the Forest Act and identify measures in the Forest Act that could promote sink growth in the short and long term.
- Analyse the reasons why the land use sector has become a net source of emissions and what it means in terms of meeting the 2021–2025 EU LULUCF target.

The CAP Strategic Plan for the years 2023–2027 includes also measures on 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 National Forest Strategy was revised in 2022 (National Forest Strategy 2035) and its implementation began at the beginning of 2023. The National Forest Strategy 2035 is a coordinating strategy for the whole sector that brings together humans, the environment and the economy. The strategy takes into account the principle of comprehensive sustainable development and the important role of forests in climate change mitigation and adaptation. The objectives of forest use have been reconciled in the National Forest Strategy 2035. 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 Climate and Energy 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.

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 agricultural use. Finland is the most forested country in the EU, and estimates indicate that the potential for reforestation is limited. EU Deforestation Regulation entered into force in June 2023. It will help decrease deforestation caused by agriculture, especially as it hinders the clearing of forest for grazing. Public financing for private forest owners, around EUR 45–60 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 174 million in 2021 for forest management and improvement work.

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 wind power plants from 1 November 2017 and for new 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 uusiutuvilla energialähteillä tuotetun sähkön tuotantotuesta annetun lain muuttamisesta 441/2018), which lays down provisions on the premium system. The premium system was based on a competitive tendering process where renewable energy technologies competed with each other on the basis of cost-effectiveness. The only 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.

The 2022 Climate and Energy Strategy did not introduce any new operating aid schemes or auctions.

Aid for the use of forest chips

Finland promotes the use of forest chips in combined heat and power generation (CHP) 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 EU ETS emissions allowance and has thus been in decline since the beginning of 2018. When the price of the allowance is above EUR 23.7/CO_2 tonne, no aid is paid, which has recently been the case. The aid scheme was closed for new power plants in March 2021. 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 for the non-ETS sector, including plants producing renewable fuels for transport (advanced biofuels, biogas, RFNBOs), and non-ETS electricity and heat production of companies and municipalities and other communities. 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 a given

technology will be phased out as the technology develops, the costs decrease and competitiveness improves. The typical annual budget has been EUR 30–40 million for small-scale projects, and there is typically a separate funding for large-scale demonstration projects (~EUR 50 million). However, decisions concerning the state budget are made annually. Additional funding has been awarded to projects replacing coal use.

Finland also allocated EUR 480 million of European Union's Recovery and Resilience Funds to renewable energy, energy infrastructure and electrification projects (see point 5.3).

Promotion of the use of renewable fuels

The Act on Promoting the Use of Renewable Fuels in Transport (laki uusiutuvien polttoaineiden käytön edistämisestä liikenteessä 446/2007) has been in force since 2008. Under the Act, the share of the energy content of renewable fuels in the total energy content of the petrol, diesel oil, natural gas and renewable fuels delivered by distributors for consumption (i.e. quota obligation) will steadily increase to 34% by 2030 (no double counting). The biofuels and biogas included in the quota obligation must meet EU sustainability criteria. In addition, RFNBOs have to comply with the rules laid down in the renewable energy directive and the delegated act concerning the additionality principle for hydrogen. The Government Programme of 16 June 2023, however, sets a lower target for renewable fuels in transport.

In addition to the overall target, there is a minimum quota for advanced biofuels, biogas and RFNBOs. The level is currently at 2% (2021–2023), 4% in 2025 and will increase to 10% by 2030. Biofuels and biogas produced from the feedstock in Annex IX A has to be at least 1% in 2025 and 3.5% by 2030.

Currently the legislation only covers road transportation and there is no credit system for charging. The revised renewable energy directive will be transposed into national legislation in 2024.

Furthermore, there is a separate quota obligation for light fuel oil used in heating and machinery. The share of bioliquids must be at least 10% by 2028.

Transport

The measures in transport have been listed above (Promotion of the use of biofuels) and in Section 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 agreements on statistical transfers with Belgium concerning the years 2020 and 2021.

Finland and Luxembourg have also agreed on a EUR 40 million aid scheme for solar energy projects in Finland through the new Renewable Energy Financial Mechanism. Otherwise Finland has not planned new agreements on joint projects or statistical transfers.

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) 2018/2001

Finland has not planned any new aid schemes for electricity from renewable energy sources nor any revisions to the old ones.

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.

In line with Article 16 of REDII, the Finland has designated a contact point to guide through and facilitate the administrative permit application and granting process. The contact point is established by designing the contact point authority (Centre for Economic Development, Transport and the Environment of South Ostrobothnia) and launching a digital contact point. The digital contact point enables contact between applicants, competent authorities and the contact point authority and submitting of a permit application.

Swift and well-functioning permit-granting processes are of key importance in accelerating the clean energy transition. Finland has worked hard and successfully over many years to speed up and streamline permit-granting processes for renewable energy production facilities, with especially positive results in permitting wind power. It is also of great importance that permit-granting processes guarantee that environmental impacts have been taken into account thoroughly, which is essential for local acceptance of renewable energy production.

The 2022 Climate and Energy Strategy sets an objective for the permitting authorities to limit the duration of the licencing process for priority investments to 12 months. Finland has accelerated licencing procedures for green transition investments by allocating more resources to permitting authorities. Green transition investments may apply for priority in some permit granting processes in several authorities during years 2023–2026 and courts during years 2023–2028. Grants to municipalities and regional councils to speed up permit and planning procedures for green transition investments and wind power construction have been awarded by Ministry of Environment.

Mapping of the areas necessary for meeting national contributions towards the EU's 2030 renewable energy target will be conducted as part of transposition of RED III. Possibilities for acceleration areas according to RED III will be assessed and national legislation will be revised to match the updated requirements of the directive, for example regarding the timelines for permit-granting processes.

Finland has a functioning certification scheme for installers of renewable energy production devices. The scheme will be revised and the required measures will be implemented especially to broaden the scope of the certification scheme to designers and to set up a framework to ensure a sufficient number of trained and qualified installers according to RED III.

The uptake of power purchase agreements has increased in Finland especially concerning new wind power projects. However, for several reasons, project developers have recently been more reluctant to agree on long-term power purchase agreements. During the implementation of REDIII, 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) 2018/2001 to promote and facilitate the development of renewable self-consumption and renewable energy communities

As described in Section 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 an energy community within one property, typically an apartment block, an energy community crossing property limits and a virtual energy community.

In essence, all these concepts are now enabled in Finland. In April 2023, the Working Group on Energy Communities finalised its report. The task of the Working Group was to examine and assess the benefits of distributed energy communities and to propose concrete measures by which distributed energy communities can promote active participation in the electricity market. The Working Group recommends to facilitate the distribution of energy by decentralised energy communities and active customers throughout Finland. Decentralised energy communities can serve consumers' opportunities to participate actively in the electricity market better through the netting of electricity within the balance period. At the same time, the applicability of tax legislation to decentralised energy communities must be examined. The Working Group also considers that information on energy communities, such as information on different types of communities, the establishment of an energy community and

operating practices, should be improved. 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

District heating is the most common heating form in Finland. District heat is produced in combined heat and power production or solely as heat. 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 development of entirely new areas. The share of renewable fuels and waste heat has risen in district heating significantly during the last decade. In 2021, the share of renewables in district heating reached almost 47% and the share of waste heat 14%.

District cooling production in 2022 was 335 GWh (mainly heat pump and free cooling). The same heat pumps often produce both heat and cooling energy (cooling water is cooled and heating water is warmed up in the same process). District cooling also utilises ambient energy from the sea, lakes and rivers as well as outdoor air, when possible.

Finland sees carbon-neutral heating, including district heating and cooling, as a key component for reducing GHG emissions. Looking ahead, geothermal heat and other non-combustion solutions, such as heat pumps and hybrid solutions, are preferred over solid biomass, as the availability of sustainably produced biomass is limited. The government plans to promote new non-combustion district heating production and storage, as well as continue to support the growing use of waste heat from industrial facilities. Finland is a pioneer in the utilisation of thermal storage, and several new projects recently started operations or have been planned.

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 residues from 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 production 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 the future, either.

The cascading principle of biomass use aims at ensuring that biomass is used according to its highest economic and environmental added value. Finland does not intend to set out new support schemes for the usage of forest biomass for energy. If seen necessary, further measures to ensure the application of the biomass cascading principle need to be decided upon.

The sustainability of biomass production is regulated in REDII. Finland implemented the sustainability criteria for forest biomass in June 2021. 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 and forest regeneration of harvested areas 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 and protection of forests, 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. The 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 waste and residue streams streams of agriculture for CHP generation and for transport fuel, and there is also potential for solar electricity investments. 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.

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 Section 3.1.2 above. In addition, in 2019, Finland banned the use of coal for power and heat by law from May 2029 on. No new power plants burning hard or brown coal will be built, nor will any replacement investments for coal use be made. Once the existing plants using pulverised fuel combustion have been decommissioned, coal will only be used as a backup fuel in exceptional situations.

The ban will reduce the use of coal by an estimated 3 TWh compared to market-based development without the ban. Early phase-out by 2025 is eligible for special incentives to support replacement investments.

The measures in transport have been listed in the Section 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 Section 3.1.2. The feed-in tariff scheme concerning wind power, biogas and small-scale CHP has been phased out and closed to new power plants. 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 to continue aid for the use of forest chips after 2021 have been made. In the premium system, there was only one auction round and according to the current plan, there will be no new ones. All power plants within the above-mentioned 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 Climate and Energy Strategy, the focus is more on new energy technology projects.

Energy tax expenditure by type of tax is reported in Table 11. The benchmark rates depend each time on the tax expenditure concerned and are not fully comparable with each other. The figures are based on actual data or estimates for 2021 and 2022.

Table 11 Energy tax expenditure 2021-2022 [mill. euro].

	Benchmark rate	2021	2022
Lower tax rate for diesel compared to the benchmark rate of transport use	Energy content tax of transport use (per €/MJ same as gasoline)	707	695
Tax reduction on paraffinic diesel (ended in the beginning of 2023)	Energy content tax of regular diesel (per €/MJ same as diesel)	72	30
Lower tax rate for gas used in transport compared to the benchmark rate of transport use	Energy content tax (per €/MJ same as gasoline) and CO2 tax of transport use	15	15
Lower tax rate for electricity used in transport compared to the benchmark rate of transport use	Energy content tax of transport use (per €/MJ same as gasoline)	9	14
Tax reduction on fuel used for diesel engines in rail transport	Energy content tax of transport use (per €/MJ same as gasoline)	14	14
Tax exemption for electricity used in rail transport	Electricity class I	16	16
Lower tax rate for gasoil used in mobile machinery compared to the benchmark rate in transport	Energy content tax (per €/MJ same as gasoline) and co2 tax of transport use	478	472
Energy tax exception for CHP production	Energy content tax of heating fuels in non-CHP use	136	106
Tax exemption on peat up to 10,000 MWh/year (before 2022 5,000 MWh/year)	Energy content tax (per €/MJ) and co2 tax (€/tCO2) as for other fossil fuels	18	27
Lower excise tax on peat compared to the benchmark rate of heating use	Energy content tax (per €/MJ) and co2 tax (€/tCO2) as for other fossil fuels	137	98
Tax reduction for biogas used in heating	Energy content tax of heating fuels	5	5
Tax exemption for wood based fuels	Energy content tax (per €/MJ) of fossil fuels (other than peat)	480	0
Tax exemption for waste incineration	Energy content tax of heating fuels	29	29
Reduced electricity tax for industry, greenhouse cultivation and data centers	Electricity class I	811	759
Energy tax refund for energy intensive industry	The amount of refund	209	66
Energy tax refund for professional farmers and professional greenhouse growers	The amount of refund	35	78

There is no established definition for a fossil fuel subsidy in the energy tax categorisation. The tax rates for renewable fuels are the same or lower than for fossil fuels for the same use. Thus, there are no clear subsidies for fossil fuels in the tax system.

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

The Ministry of Transport and Communications launched in May 2021 a Roadmap for fossil-free transport to reduce greenhouse gas emissions from transport (the Government resolution on the reduction of greenhouse gas emissions in domestic transport). The Roadmap formed the basis for planning and sizing the emissions reduction measures for transport in the 2022 Medium-term Climate Change Policy Plan.

In May 2022, the Ministry of Transport and Communications appointed a working group to prepare a distribution infrastructure programme and study the use of electricity, renewable methane and hydrogen as power sources in road transport to replace fossil fuels. The Programme to improve the distribution infrastructure for new fuels in road transport in Finland by 2035 was completed in March 2023. The programme sets targets related to both vehicles and the distribution infrastructure in order to promote the use of these power sources. The programme also defines the necessary measures for achieving the targets. Reviews related to other modes of transport will be carried out later.

The distribution infrastructure programme aims to ensure that the requirements of the AFIR Regulation are met in road transport in Finland. To this end, the programme includes national objectives and measures that exceed the Regulation's requirements. The aim has been to ensure the development of distribution infrastructure throughout Finland in the manner required by the energy transition.

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 energyefficient 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 renewable 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

Finland notes the agreement reached on the proposed recast of the Energy Efficiency Directive between the European Parliament and the Council of the European Union. As soon as the recast of the Energy Efficiency Directive has entered into force, national efforts will be carefully assessed to define and specify the policies and measures needed for the period 2021–2030. This work will be carried out by the Energy Efficiency Working Group 2023, appointed by the Ministry of Economic Affairs and Employment in May 2023. The group consists of representatives from different ministries with the support of large group of sectoral experts. While assessing the need for new measures, the systematic work and effort to promote energy efficiency continues in Finland.

Finland is looking forward to reporting the outcomes of the assessment in the update of the NECP by 30 June 2024. The current policies and measures are listed below.

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 agreement period is 2017–2025, and the agreements are in an important role in meeting Finland's cumulative energy saving targets set for the period 2021–2030 in Article 7 of the Energy Efficiency Directive (EED). Finland is planning to continue the Voluntary Energy Efficiency Agreements also beyond 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 take action to reach the target.

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

The agreement scheme also supports meeting the obligations set out in other EED articles and also implementing the Energy Performance of Buildings Directive (EPBD). The Voluntary Energy Efficiency Agreements cover industries (industry, energy and private-sector services), the property sector, the municipal sector, and the oil sector (distribution of liquid heating fuels).

The municipalities and companies signing 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 fuel taxes and value added tax.

Road transport

The measures in transport have been listed in Section 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 voluntary audits involving support and into compulsory energy audits carried out in large companies every four years. Energy aid for energy audit activities is granted to voluntary audits.

Energy performance of buildings

Finland has adopted an energy subsidy scheme designed especially for housing companies to support energy efficiency improvements 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.

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 to both 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 was 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 energy efficiency improvements are technically, functionally and financially feasible.

Under Decree 4/2013 of the Ministry of the Environment, the requirements set for the energy efficiency of renovation projects can be met in three alternative ways. A party engaging in a building project subject to a permit must select one of the 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. The Decree also sets out requirements for the technical systems.

According to the Cost-optimal reports of Finland submitted to the Commission in 2023, the minimum requirements for new buildings and for existing buildings are on a cost-optimal level. 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 for new buildings, which

set out the minimum level of building requirements. See NEEAP IV[34], Section 3.6.1 and RA-no-YM measures.

Long-term renovation strategy

The Finnish National Long-Term Renovation Strategy 2020-2050 (EC, 2020) was published in 2020. It aims to reduce the energy consumption and emissions of the building stock by 90% by 2050 in relation to 2020 levels. It contains three pillars:

1) building loss and space utilisation efficiency;
2) maintenance and renovations; and
3) decarbonising heating.

The first pillar aims to accompany the ongoing long-term domestic migration concentrating the Finnish population in large urban areas: energy efficiency is easier to attain in the denser urban areas, combined with the demolition of older buildings in rural zones. Policies support this strategy through demolition subsidies and spatial planning. As part of the second pillar, property owners are encouraged to prepare a property-specific strategy or a strategy for the entire building stock on repair actions for the next 15–20 years, involving a gradual improvement of buildings towards the nearly zero-energy level, or preparation for demolition. With respect to heating, the third pillar of the strategy includes a target to phase out fossil oil by 2030. Fossil oil will be phased out in state-owned buildings by 2024, and a subsidy for phasing out oil heating from family houses has been in place since 2020.

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 encompass improving the overall efficiency of primary energy use and the overall efficiency of energy production within the scope of Voluntary Energy Efficiency Agreement activities.

District heating and cooling

Energy efficiency measures in the field of district heating and cooling concern 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.

[34] https://www.motiva.fi/files/12745/Suomen_neljas_kansallinen_energiatehokkuuden_toimintasuunnitelma_NEEAP-4.pdf

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 (energiatehokkuuslaki 1429/2014) lays down provisions on the energy efficiency requirements concerning central government authorities with regard to public procurements.

Annual training events focusing on the energy efficiency requirement of public procuremet is organised by Motiva Ltd. 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 Section 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 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

In October 2021, Motiva launched a three-year project to create an information service hub on sustainable financing and increasing competence and knowledge related to financing. The project is carried out in cooperation with the Ministry of the Environment, the Energy Authority and the Federation of Finnish Local and Regional Authorities, the Federation of Finnish Commerce, the Confederation of Finnish Industries, RAKLI and the Federation of Finnish Enterprises.

The project compiles an information service on sustainable financing where both companies and municipalities can easily find relevant information of financing and support, especially in connection

with improving energy efficiency and renovation of buildings. The information service has been developed in cooperation with stakeholders so that it meets the needs of users and supports their work in the implementation of energy efficiency and renovation projects, for example. The implementation of the information service is one of the measures of Finland's long-term renovation strategy 2020–2050 in the roadmap 2021-2030 published in spring 2021.

One of the project results are the roundtables for sustainable financing since 2022, which bring together actors from several fields to discuss, share information and experiences and develop sustainable financing. Examples and experiences are used to help disseminate information on good practices, methods and financing opportunities beyond sectoral boundaries.

Sustainable Energy Investment Forums (SEIF) have been organised in Finland in 2020 and in 2021, with support of EC. The forums (roundtables) provided indepth information on financing energy efficiency in Finland.

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. Continuously adjusting energy consumption according to the supply situation is becoming increasingly feasible. Hybrid systems that combine various 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 the “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. Considering overall cost-efficiency 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

The strategic governmental programme was initiated in 2019 in a close collaboration with government ministries as well as over 200 stakeholders in tens of workshops and meetings. The Programme was published in 2021 as the governmental resolution. It outlines several key measures to promote the transition towards the circular economy.

The circular economy programme sets ambitious targets for the use of natural resources: In 2035, our total domestic consumption of primary raw materials should not exceed the 2015 level. Resource productivity and circular material use rate should be doubled by the mid-2030s. The programme also emphasises the key role of regions and municipalities in accelerating the circular economy. The key actions are the Circular Economy Green Deal with stakeholders, the Circular Design –education programme for companies and the Circular Economy Finland competence center.

Key ministries (Environment and Economic Affairs), together with the research institutes and stakeholders, are preparing scenarios on the opportunities offered by a circular economy to promote environmental objectives and economic interests. These scenarios are combined with calculations of domestic material streams (RMC). Combining these scenarios and calculations will help local governments, companies and other operators to identify the most impactful actions and draft the Circular Economy Strategic Green Deal. The content should be published by 24.11.2023. Already over 80 regions, cities, associations and companies have made the preliminary agreement and are participating in the scenario work together with research institutes.

The Circular Economy Finland (KiSu) competence center gathers a network of experts in the circular economy, which includes e.g. companies, research and training organisations, municipalities, regions and various networks and interest organisations. The aim is to connect actors in the competence network who can, on the one hand, utilise information, know-how or solutions related to the circular economy, or offer and develop them. The actions are highlighting concrete piloted and profitable circular economy measures and finding ways to scale them and sharing best practices and criteria compiled based on workshops.

In addition, the Circular Design education programme has been implemented with 50 companies. This is the first national training programme deep-diving into circular design principles and focusing on generating concrete product/service concepts to secure companies' competitive advantage in the biggest market transition of our time. In addition, this programme will prepare companies for the forthcoming Ecodesign Directive requiring product durability, reliability, reusability, upgradability, repairability, ease of maintenance/refurbishment/recycling and energy and resource efficiency, just to mention but a few. The 1-year programme is government-funded.

As a key measure, Finland is implementing 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. Also waste and chemical strategies have implemented circular economy actions.

The World Circular Economy Forum (WCEF) is a landmark event that brings together business leaders, policymakers and experts to present the world's best circular economy solutions. WCEF is a global initiative of Finland and the Finnish Innovation Fund Sitra, their funding may close soon in upcoming years. They are working with partners to lead the way in the transition to a fair and competitive carbon-neutral circular economy.

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 security of supply agreements 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. As for ensuring generation adequacy in the light of the renewable energy contribution, including demand response and storage, the Finnish strategic reserve system played earlier a significant role. National legislation concerning the strategic reserve[35] was renewed in 2022 based on the regulation 943/2019. The approach the Commission has taken for strategic reserves does not allow Member States to be prepared for exceptional situations, such as cold winter days or cut off of electricity supply from third countries. For the period November 2022 – October 2023, Energy Authority did not receive any offers that fulfilled the tendering criteria. For the period 2023–2024, Energy Authority deemed that no reserve capacity is needed. This is mostly due to Olkiluoto 3 NPP started its operation during spring 2023 and the approach which prevents Finland to dimension the reserves based on e.g. cold winter day.

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

The strategic reserve system is open to participation from demand response facilities and storage. The power reserve system (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 Government has defined the target for the security of electricity supply associated with the adequacy of electric power according to the EU's Electricity Regulation. Demand response and storage are further promoted by applying the proposals by the Smart Grid Working Group as discussed in Section 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.

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 (and by 2036 for electricity distribution companies with low degree of cabling). By the end of 2023, 75% 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 built to withstand storms and snow and thus to avoid disruptions to 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 risk assessments of the security of electricity supply, risk-preparedness plans in case the risks are realised, the management of electricity crisis situations, ex-post evaluation of the crisis situations and various types of monitoring.

The Regulation obliges the competent authority in each Member Stateto publish a preparedness plan based on national electricity crisis scenarios. The preparedness plan shall include all planned or introduced measures to prevent, prepare for or mitigate an electricity crisis situation. The preparedness plan shall also include regional and bilateral measures to ensure that electricity crises with cross-border effects are appropriately prevented and managed. Finland has prepared and published 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 the KYBER-ENE project[36], carried out jointly with energy sector companies and VTT Technical Research Centre of Finland Ltd.

Gas

In 2019, 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 supply disruptions (emergency plan). The Gas pool, a part of Finland's security of supply organisation, was also 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 Commission informs the Gas Coordination Group (GCG) of notifications concerning the prevention plans and emergency plans and publishes them on the Commission's website. The plans were published[37] and the Commission was informed on 30 October 2019. The plans were prepared in close cooperation with the Baltic States.

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 (even Russia’s termination of gas exports to Finland in May 2022 did not disrupt gas supply to consumers). 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.

Balticconnector, the gas pipeline connecting the gas networks of Finland and Estonia, was commissioned on 1 January 2020.

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[36] https://www.huoltovarmuuskeskus.fi/energia-ala-kehitti-yhteiset-toimintatavat-kyberuhkia-vastaan/

[37] https://www.huoltovarmuuskeskus.fi/files/dd39b2c2275f8ace9da8b573345fd85dbc7f693e/finland-gas-preventive-action-plan-and-emergency-plan.pdf

There are three LNG import terminals in Finland: Pori, Tornio and Hamina. Of these, Hamina is connected to the natural gas network, the others are off-grid terminals. In January 2023, the FSRU in Inkoo was commissioned (see section 4.5.2).

Most of the natural gas consumption can be replaced quickly 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 option in disruptions to gas availability may also be to adapt gas-using production or to interrupt it. In Finland, a large share of natural gas is used in CHP, and if their gas supply is disrupted, they can switch to other fuels or their production can be replaced with production at other plants.

Users of natural gas, except for consumer customers and essential social and health care, are primarily responsible for their own preparedness plans. They are also responsible for the operability of their possible reserve fuel systems, the buffer stocks of reserve fuel and the organisation of the required transports.

To prepare for any disruptions to energy imports and to meet its commitments under international obligations, Finland maintains 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 stocks by companies (industrial stocks) and state-owned stocks (public stocks).

ii. Regional cooperation in this area

Regional cooperation in the field of energy security is carried out in the Electricity Market Group 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 on 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 gas supply.

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

Solidarity arrangements under the Solidarity mechanism among Member States as per the EU Gas SoS Regulation and the new Council Regulation (EU) 2022/2576 between Finland and Estonia were signed on 25 April 2022.

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 Climate and Energy 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 (588/2013) requires the transmission system operator Fingrid to improve its grid according to the reasonable needs of its users. It also requires Fingrid to develop the transmission grid in a way that Finland remains as one bidding zone. Based on this requirement, Fingrid is also developing interconnectors to neighbouring countries with one new interconnector to Sweden under construction and two interconnectors being planned (one to Sweden and one to Estonia).

ii. Regional cooperation in this area

The Nordic transmission system operators work in close cooperation to develop the electricity infrastructure. They publish a common Nordic Grid Development Plan every two years. The latest joint plan was launched in November 2021. Also, the ministries in the Nordic countries cooperate in the electricity market field through the Electricity Market Group of the Nordic Council of Ministers, and the national regulatory authorities cooperate through NordREG[38]. Cooperation between the Nordic countries in the electricity market has been intensified by establishing a cooperation forum, the Nordic Electricity Market Forum[6] 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 finances its infrastructure investments out of its profits and through national and international money and capital markets. The company's long-term credit rating

[38] NordREG, http://www.nordicenergyregulators.org/

is AA- (by both Fitch Ratings and S&P Global Ratings). The cross-border Aurora Line, a joint project of Fingrid and Svenska kraftnät to be commissioned in 2025, received EUR 127 million of CEF funding in 2022.

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 (588/2013) requires the transmission system operator Fingrid to improve its grid according to the reasonable needs of its users. The investments made in the projects described in Section 2.4.2 are based on this obligation.

The Natural Gas Market Act (maakaasumarkkinalaki 587/2017) obliges 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 ensure the security of supply of natural gas.

Until 2022, Finland sourced the vast majority of its natural gas from Russia by pipeline. However, following Russia’s invasion of Ukraine, Russia terminated pipeline gas deliveries to Finland in May 2022. The loss of Russian gas prompted major gas consumers to use alternative fuels (primarily coal, biomass and propane) and implement efficiency measures. As a result, natural gas consumption declined by over 50% in Finland in 2022. The government succeeded in securing a long-term gas supply to substitute Russian gas with increased LNG imports through a floating storage regasification unit (FSRU). The FSRU was installed at the Port of Inkoo in December 2022 and began commercial operations in January 2023.

ii. Regional cooperation in this area

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

Regional cooperation in the gas market has been described above in Section 1.2.3.

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 financed the 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 co-operation 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 market[39]. 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*.

At 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

This work was further strengthened by the Nordic Prime Ministers´ Declaration on Nordic Carbon Neutrality[40], 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 roadmap[41]. 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 working together, the participants can contribute to setting the scene and making the Nordic countries achieve the 2030 electricity market vision.

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[39] 2030 Vision for the Nordic Electricity Market
https://nordicelforum.org/wordpress/wp-content/uploads/2019/06/Vision-for-the-nordic-electricity-market-EN_2.pdf

[40] https://www.ym.fi/download/noname/%7B5CF4258D-8264-4F5C-8527-081CCBBF2AE2%7D/143425

[41] 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

Gas

Until 2020, Finland was exempt from the EU rules on unbundling and third-party access in the gas sector (Directive 2009/73/EC) due to the isolated nature of the Finnish gas market. As a result, the gas market was essentially free from competition and fully controlled by the state-owned company, Gasum, which acted as the TSO and was the only importer and wholesale supplier.

However, in January 2020 upon the commissioning of the Balticconnector pipeline that links Estonia and Finland, the Finnish gas sector became subject to EU legislation on gas market competition, and the exemptions to the Gas Directive were abolished from the Natural Gas Market Act. Price regulation of piped gas was abolished and gas market-places and internal market rules were introduced.

In line with the Gas Directive, the Natural Gas Market Act legislated the separation of gas transmission and sales activities, resulting in the creation of the new TSO, Gasgrid Finland, which was unbundled from Gasum. Gasgrid Finland remains fully state-owned. The Natural Gas Market Act also legislated open access to the natural gas transmission and distribution networks, as well as to Finland's LNG terminals.

In January 2020, Finland also joined a common regional gas market area with Estonia and Latvia (FinEstLat gas market area). The merger of FinEstLat means the linking of the Finnish, Estonian and Latvian markets, removing the internal tariffs in the region and setting the entry tariffs in the region at the same level. The results of the operation of FinEstLat single entry tariff zone have been very positive.

By connecting the Finnish gas grid to the Estonian gas grid, the Balticconnector pipeline has allowed Finland to import gas from the Klaipeda LNG terminal in Lithuania and make use of the Inčukalns gas storage facility in Latvia. Following the commissioning of the Gas Interconnection Poland-Lithuania (GIPL) pipeline in May 2022, Finland also gained access to the broader EU gas market.

The floating LNG terminal (FSRU) in Inkoo started its commercial operations in January 2023. The objective of the terminal is to open a new supply route for natural gas from the international LNG market. The vessel has an annual regasification capacity of around 40 TWh, which far exceeds Finland's annual need for natural gas. The LNG terminal also enables gas deliveries to the Baltic States and even to Poland through the Balticconnector pipeline.

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, 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 market[42]. On 9 March 2018, five Nordic transmission system operators concluded a cooperation agreement on the development of a new Nordic balance service model[43].

See also sub-point v below.

Smart meters

Nearly 100% of electricity consumers in Finland have had a smart meter with hourly measurement resolution since 2013. Most of the current smart meters will come to the end of their lifetime in 2025-30. Finland is transitioning the retail market to 15 minutes balance settlement by the summer of 2023. By this time, all large consumers (over 3*200A fuse) will have a second-generation smart meter with a 15-minute resolution and all consumers whose smart meter can be remotely updated will have it adjusted to the 15-minute resolution. All customers will receive smart meters with a 15-minute resolution by 2028.

All customers may choose an electricity contract with dynamic pricing based on the day-ahead market prices. Almost all retail suppliers offer dynamic contracts. At the end of 2022, approximately 14% of retail consumers had a dynamic electricity price contract. Many service providers, including aggregators, offer small consumers the option to participate in the balancing markets.

The Datahub, the centralised information exchange system for the retail electricity market, went live in February 2022. In accordance with the Electricity Market Act, it will store information related to electricity accounting points, such as customer and consumption data. The system is intended to speed up information exchange between parties, with the data being available to everyone entitled to it at the same time in an impartial and up-to-date manner.

In addition to electricity companies' customer service portals, the information stored in the Datahub will be available for viewing through Datahub's own customer service portal after the system's introduction in 2023. The service will display the user's personal data and customer information for their accounting point. Logging into the service uses the Suomi.fi strong authentication. Through the service, electricity consumers can also authorise a third party to act on their behalf in the Datahub. The launch of the customer service portal will be announced separately.

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

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

Demand side response

DSR is well developed in Finland. The government estimates that around 1 000 MW of DSR participated in the day-ahead market in September 2022. The government expected the level to increase going into the winter of 2022/23. Based on Fingrid's estimations, up to 200 MW of DSR is in the intraday markets, up to 530 MW of DSR up-regulation and 100 MW of DSR downregulation in the balancing markets, 410 MW of DSR up-regulation in FCR-D, 10 MW of DSR in FCR-N, and 80 MW of DSR in the fast frequency reserve markets.

In 2018, the Smart Grid Working Group proposed a programme to increase DSR capacity and the opportunities for consumers to provide DSR to participate. The working group's key proposals were to:

1) clarify the roles of actors in the market-based implementation of DSR (e.g. principles for the storage of electricity, discontinuation of the load control implemented by distribution networks);
2) improve the operating prerequisites for energy communities and aggregation models;
3) define the functionalities of next-generation smart meters;
4) enable flexibility in the operation of grid companies; and
5) enable joint invoicing for all suppliers.

Energy storage

Finland deploys limited energy storage. In 2022, the largest energy storage projects were all battery projects and included 30 MW/30 MWh in Lappeenranta, 6 MW/6.6 MWh in Ii, 4 MW/1.5 MWh in Lempäälä, 2 MW/2.1 MWh in Espoo, 2 MW/1 MWh in Järvenpää and 1.2 MW/0.6 MWh in Helsinki. Also, several battery-storage projects and a pumped hydroelectric energy storage are under development in Pyhäsalmi, with up to 150 MW of capacity, depending on the final concept. More recently, in spring 2023, plans for up to 4 GW of pumped hydro projects were presented by Kemijoki Oy which owns several hydropower plants in the Kemijoki river in Lapland.

The Energy Authority has taken the approach that DSOs should not own or operate storage facilities. The Electricity Market Act requires DSOs to consider demand response, electricity storage and other alternatives to grid expansion in their development plans. Some DSOs have procured services from electricity storage facilities.

There are no specific targets for energy storage capacity, but the government aims to increase the deployment of energy storage. Some partial investment subsidies are available through the Energy Aid programme, but generally new projects are based on market revenues. The taxation of electricity storage was reformed at the beginning of 2019 to eliminate double taxation (for storing and discharge). The regulation concerning the definition of equipment used in independent electricity generation was specified on 14 September 2020. The National Battery Strategy 2025, published in January 2021, presents a road map for Finland to become a major player in the international battery industry.

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

Specifically for hydrogen, the government objective is to make Finland the leader in the European hydrogen value chain by 2030, building on the secure supply of abundant, inexpensive clean electricity and other competitive advantages. This involves a large-scale construction of hydrogen production and transportation capacity and adopting legislation on the hydrogen market. More details are outlined in the February 2023 Government Resolution on Hydrogen.

The eventual implementation of the EU's Gas Package (entering the trilogue phase in June 2023) will prompt the drafting of a Hydrogen Market Act. Work on this Act will commence as soon as the EU level negotiations are finalised.

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)[44]. On 1 February 2019, an amendment came into force regarding a centralised information exchange database (the Datahub), which will provide each party in the electricity market with all relevant information on electricity trading. The 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 Datahub is in use since 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 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.

Starting in late 2021, global energy prices began to rapidly increase, especially in Europe. Price spikes and high volatility persisted until early 2023, driven by the Russian invasion of Ukraine. In February 2022, Finland announced a range of measures to reduce the impact of higher energy prices, particularly for household electricity and heating and for transportation and agricultural companies. The government estimated these measures to decrease tax revenues by EUR 450 million in 2022, with no increase in government spending.

In early 2022, the Electricity Market Act was amended to reduce retail electricity prices by limiting the allowed profits for distribution system operators (DSOs) and the allowed increase in distribution

[44] https://www.finlex.fi/fi/laki/ajantasa/2013/20130588

network tariffs. The rate of return for DSOs was reduced from 5.73% to 4%, the lowest level ever. The limit for the maximum annual tariff increases was reduced from 15% to 8%. These changes are expected to reduce DSO charges to consumers by EUR 350 million.

The 2023 budget also includes several measures to limit the impact of high electricity and heating costs, especially for low-income families with children. Increased electricity prices can now be taken into consideration when granting social assistance. A fixed-term four-month income tax credit for electricity costs (it was estimated to reduce tax revenue by EUR 265 million) was introduced. The government also prepared a separate financial support scheme for electricity available to households unable to make full use of the fixed-term income tax credit. This scheme is estimated to increase spending by EUR 85 million. In addition, the government lowered the value-added tax (VAT) on electricity from 24% to 10% from December 2022 to April 2023 (this is estimated to decrease tax revenue by EUR 290 million). The government also increased funding for housing allowances to help cover higher heating costs and to support the renovation of single-family houses. The government estimates this will cost around EUR 6.3 million in 2023. On top of these measures, a compensation scheme was introduced in early 2023. This scheme compensates household consumers with high electricity price directly on their bills. The compensation applies to consumption in the winter months retrospectively and thus it did not affect the consumption. Estimated budget expenditure is EUR 400 million.

The government prepared a windfall profit tax on electricity producers to offset the cost of aid to consumers, while ensuring that clean energy investments continue. According to the legislation, the tax would be 30% of the company's net profits exceeding a 10% return on capital in 2023. The law entered into force at the beginning of 2023 and the tax will be paid in early 2024. The government amended the Electricity Market Act to increase consumer awareness of electricity supply contracts that use spot pricing. Consumers will now be required to expressly consent to spot pricing. When offering an electricity supply contract that uses spot pricing, the supplier must provide information on the opportunities, costs and risks of the contract.

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 proposals [45] were to:

[45] http://urn.fi/URN:ISBN:978-952-327-346-7

- Clarify 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)
- Improve the operating prerequisites for different energy communities and aggregation models
- Define the functionalities of next-generation smart meters
- Enable flexibility in the operation of grid companies
- Enable joint invoicing for all suppliers

The Ministry of Economic Affairs and Employment is 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 the Finnish electricity market legislation.

All customers may choose an electricity contract with dynamic pricing based on the day-ahead market prices. Almost all retail suppliers provide the option of dynamic contracts to their customers. At the end of 2022, approximately 14% of retail consumers had a dynamic electricity price contract. Many service providers, including aggregators, who offer small consumers the option to participate in the balancing markets.

3.4.4 Energy poverty

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

See above Section 2.4.4.i.

Currently the energy market situation has calmed down, and the electricity prices have declined. To assess whether permanent impacts of energy poverty occur in Finland that social policies or economic policies cannot mitigate, a thorough study about energy poverty is planned to be launched in autumn 2023. The results of this study will be reported in the update of the NECP by 30th June 2024.

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 renewable energy or energy efficiency.

The National Roadmap for Research, Development and Innovation (adopted in 2020 and updated in 2021) is the main document guiding overall technology innovation policy. It details the measures to boost funding to reach the 4% goal. The road map notes that encouraging increased innovation (especially in the private sector) requires a credible long-term commitment to public funding. It also notes that the unpredictability of public funding is a weakness of Finland's innovation system. The road map introduces a new partnership model to facilitate better co-ordination between the public and private sectors through the development of innovation ecosystems and new operating models for testing, piloting and scaling innovations. The partnership model will also better group national programme financing with EU and other international funding, and ensure that the funding targets key growth areas and ecosystems and is awarded on a competitive basis.

In 2021, Finland set a goal to increase total spending on R&D (public and private) to 4% of GDP by 2030 (versus 3% of GDP in 2021). Finland is also committed to supporting a target for EU-wide spending on R&D to reach 3% of EU-wide GDP by 2030 (versus 2.2% in 2018). The R&D Funding Act, which entered into force at the start of 2023, set increasing levels of annual government R&D funding to ensure that government R&D funding reaches 1.2% of GDP by 2030. This is intended to drive increased private sector R&D funding to reach the 4% goal.

The purpose of energy aid is particularly to promote the introduction and placing on the market of new energy technologies. Energy aid's role in the innovation chain is particularly important for technologies at an advanced state of development technologies seeking first commercial targets. It can help support the competitiveness and job creation of companies operating in Finland. 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 2020, total government energy research and development (R&D) spending was EUR 177 million. 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 Energy Aid programme has a total budget of EUR 200 million for 2022–26. Business Finland awards the smaller grants, while the funding decisions for large projects are taken by the Ministry of Economic Affairs and Employment.

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.

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.

Business Finland launched a Smart Energy programme 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.

EU and international collaboration

Finland’s public and private R&D and innovation entities are highly active in international co-operation on energy topics. This includes co-operation through EU initiatives and international organisations, including the IEA technology collaboration programmes, Mission Innovation and the Clean Energy Ministerial. The National Climate and Enery Strategy notes that the government’s focus areas for international R&D advocacy and co-operation include energy system integration, hydrogen and circular economy.

Finland has been actively involved in the operation of the EU SET-Plan. Finland is chairing the Bureau, which is helping the Commission in running and functioning 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 and is also co-chairing the Implementation Working Group on Nuclear Energy.

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.

Finland participates in the IEA technology collaboration programmes, which are multilateral mechanisms that support global collaboration to advance co-operation on research and the use of specific energy technologies). As of October 2022, 10 Finnish entities (the Ministry of Economic Affairs and Employment, Business Finland, VTT, Finnish Energy Industries, the Finnish Heat Pump Association, Tampere University of Technology, Aalto University, Åbo Akademi Process, Kemijoki Oy, and Lappeenranta University of Technology) were participating in 22 TCPs (equality in energy transitions, energy technology systems analysis, buildings and communities, district heating and cooling, energy storage, heat pumping technologies, user-centred energy systems, smart grids, high-temperature superconductivity, industrial technologies and systems, advanced fuel cells, advanced motor fuels, advanced materials for transportation, clean and efficient combustion, hybrid and electric vehicles, fluidised bed conversion, GHG programme, bioenergy, hydrogen, hydropower, PV power systems, wind energy). The Finnish government sponsors participation in two TCPs (industrial technologies and systems and advanced fuel cells).

Finland is part of the Clean Energy Ministerial (CEM), a high-level global forum that promotes policies and programmes to advance the deployment of clean energy technologies. Finland participates in numerous CEM initiatives (EVs, biofuture platform, long-term scenarios for the energy transition, international smart grid action network, regional and global energy interconnection, equality in energy transitions, 21st century power partnership, and hydrogen) and campaigns (global commercial vehicle drive to zero, EV30@30, power system flexibility and biofuture).

Finland also particpaites in the Mission Innovation initiative. When joining in 2016, Finland committed to doubling public innovation funding for clean energy by 2020 and was quite well on track to reach the doubling target of EUR 109.4 million in 2021 (the statistics are dragging behind). Finland participated in seven of the eight innovation challenges of the first phase of Mission Innovation, which ended in 2020 (smart grids, off-grid access/energy storage, CCUS, sustainable biofuels, converting sunlight, clean energy materials, and affordable heating and cooling). Mission Innovation 2.0

was launched in 2021. Finland is participating in the areas of clean hydrogen, net zero industries and the innovation platform.

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.

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

The projections presented in this chapter are based on data produced for the National Climate and Energy Strategy, the Medium-term Climate Change Policy Plan and the Climate Plan for the Land Use Sector. All three Government Reports were submitted to the Parliament in 2022. For the reports, comprehensive modelling and assessments were conducted by experts from various research fields in an extensive project "Carbon neutral Finland 2035 – measures and impacts of the climate and energy policies" (HIISI project[10]) financed by the Government's analysis, assessment and research activities. The analysis and results of the HIISI project have been complemented by other studies and updated with recent information and data.

The Covid-19 pandemic and its assumed effects on the economy were considered in the modelling. In contrast, the energy crisis following Russia's unprovoked and unjustified invasion of Ukraine is not included in the projections, as most of the modelling work was conducted before February 2022. For the LULUCF sector, the most recent results from the national forest inventory on a decline in tree growth were not yet available for the projection work.

A full update of the WEM projection is in the making in 2023-2024. All modelling assumptions reported in this Section will be updated and reported along with the updated projections in the final update of the NECP to be submitted in June 2024.

i. Macroeconomic forecasts (GDP and population growth)

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 "What kind of expertise will Finland need in 2040?" report of Pellervo Economic Research PTT and Merit Economics, which has been complemented and updated in the HIISI project with industry-specific low-carbon strategies and recent energy and climate policies and measures. The macro-economic projections are described in the report "Macroeconomic scenarios: Carbon neutral Finland 2035 – measures and impacts of climate and energy policies"[46]. Table 12 shows the assumptions for GDP and the average annual increase in national economic output during the period 2020–2040.

The population growth in the projections is based on the population forecast drawn up by Statistics Finland in 2019. Table 13 shows the population development. The population increases only slightly

[46] https://urn.fi/URN:ISBN:978-952-383-295-4

from the current 5.53 to 5.57 million in 2030. In 2031, the population starts to decrease. The population's age structure will change significantly over the next couple of decades as the share of older age groups increases.

Assumptions for GDP and population development will be updated in the final NECP update in 2024.

Table 12 GDP and the average annual increase in national economic output in the projections.

	2020	**2030**	**2040**
GDP, million EUR in 2016 prices	223,640	256,440	294,530
		2020–2030	**2030–2040**
Annual growth		1.4%	1.4%

Table 13 Population [mill. inhabitants].

2020	**2025**	**2030**	**2035**	**2040**
5.53	5.56	5.57	5.56	5.53

ii. Sectoral changes expected to impact the energy system and GHG emissions

The energy sector is strongly affected by policy measures to reduce the emissions, enhance energy efficiency and increase the share of renewable energy sources. Both the supply and demand sides have faced significant changes in the last decade, partly from policy measures; partly from developments in the energy and fuel markets and energy technology. The transition is only half completed, and the emissions will decline further in the energy sector.

District heating, power generation, and industrial energy use are strongly affected by the EU ETS allowance rice, which makes the use of fossil fuel increasingly uncompetitive and together with energy taxation, efficiently cuts emissions in these sectors. This trend will lead to increased electricity demand replacing some fossil fuel consumption, which is also reflected in the low-carbon roadmaps prepared by all major industries and sectors[30]. In power generation, the emphasis is shifting from fossil fuels (especially coal and natural gas) and peat to renewables. In district heating and industry, fossil fuels are increasingly being replaced with renewables and waste heat recovery. Electrification is a major trend in the industrial sector and in heating and cooling, bringing more electric boilers, heat pumps and electricity based industrial processes. In specific industrial sectors, electrolysis-based hydrogen production is also expected to take off, although the exact timing is difficult to predict. Carbon Capture in its various forms (such as CCS, CCSU, BECCS) can reduce emissions even further.

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

The projections were modelled by external experts in 2021–2022 before the EC recommended parameters were published in May 2022. Assumed fossil fuel prices in the world market correspond to

the recommended harmonised values provided by the Commission for the 2021 greenhouse gas emission projections. The impact of the energy crisis is not reflected in the prices.

The carbon price is an output of the modelling, not input. It is not possible to reproduce exactly the EC recommended parameters. Table 14 shows the fossil fuel and EU ETS prices of the WEM projection.

Assumptions for fossil fuel prices and EU ETS carbon price will be updated along with the updated projections in the final NECP update in 2024.

Table 14 Price of EU ETS emission allowances and fossil fuels [euros in 2016 prices].

	2020	2025	2030	2035	2040
EU ETS, EUR/t CO_2	27	50	60	70	80
Crude oil, EUR/GJ	7	12	14	15	16
Coal, EUR/GJ	2	3	3	3	3
Natural gas, EUR/GJ	4	6	6	7	8

iv. Technology cost developments

Assumptions for technology cost development will be included in the final NECP update in 2024.

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

The historical trend and the development in the WEM projection of GHG emissions in the EU ETS and effort sharing sectors are shown in Figure 2 on page 33. Net removals of the LULUCF sector and GHG emissions in transport and other energy use are shown in Figure 9 on page 111.

The WEM projection will be updated for the final NECP update to be submitted in 2024.

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

Figure 9 shows the historical development of greenhouse gas emissions and removals by sector up to 2022 (for LULUCF to 2020) and the estimated development based on current national and EU policies and measures until 2040.

All sectoral projections will be updated for the final NECP update to be submitted in 2024.

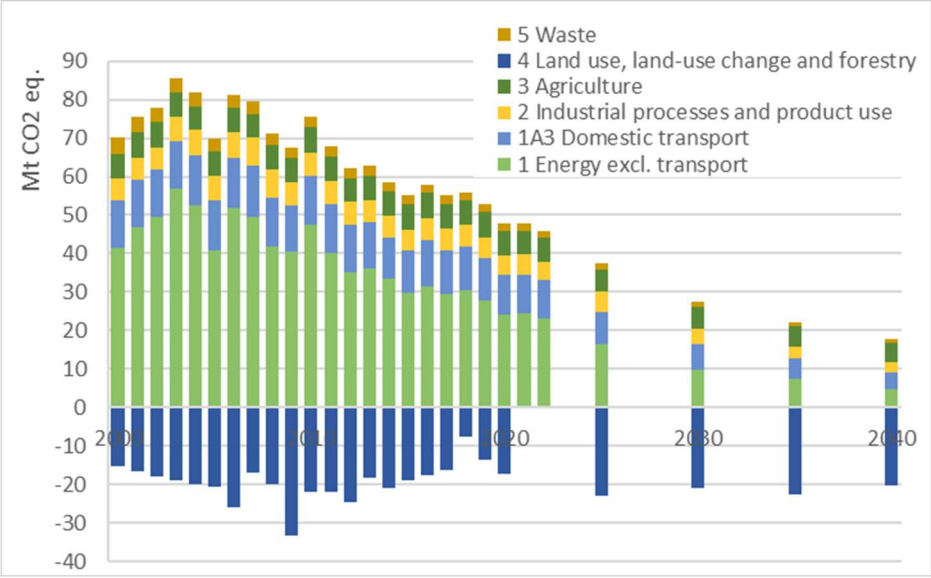

Figure 9. The historical development of greenhouse gas emissions and removals in 2000-2022 (LULUCF 2000-2020) and the estimated development until 2040 based on current national and EU policies and measures.

Transport

Greenhouse gas emissions from domestic transport (without domestic air traffic) totalled 9.8 Mt CO_2 equivalent in 2022. 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 have mainly been decreasing since 2008. From 2005 to 2022, greenhouse gas emissions from transport dropped by some 2.7 million tonnes in total, or by 22%.

The WEM projection for transport is based on the traffic performance projected until 2030 by the Finnish Transport and Communications Agency Traficom. According to the projection, car traffic performance will increase by approximately 33% in 2021–2060 and heavy-duty vehicles' performance will increase by 6.5-7.4% in 2021–2060. Other key assumption in the WEM projection are the replacement rate of cars and technologies and the average CO_2 emissions of new vehicles which are projected by VTT Technical Research Centre of Finland Ltd. In the WEM projection, the annual replacement rate of cars is estimated at approximately 5%. In 2030, the specific emissions of new cars would be close to the limit that the EU has established for car manufacturers, and in 2035, sales of combustion engine cars will stop completely. 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 road transport. In the WEM projection, the actual share of biofuels was 18% in 2021 and estimated at 34% in 2030. The estimate is based on the Act on Promoting the Use of Renewable Fuels in Transport (laki uusiutuvien polttoaineiden käytön edistämisestä liikenteessä 446/2007), which stipulates that biofuels and other renewable fuels must account for a share of 34% of all road transport fuels sold from 2030.

Agricultural sector

The emissions reported by Finland in the agricultural sector in 2021 totalled about 6.3 Mt CO_2 equivalent. Agricultural sector is the second most significant source of greenhouse gas emissions in Finland accounting for approximately 13% of Finland's total emissions and some 23% of emissions from the effort sharing sector. Emissions from the agricultural sector remained pretty much at the same level between 2005 and 2021. Agriculture projections were updated in 2022. In the WEM projection, the total emissions from the agricultural sector are expected to decrease. Emissions from the agricultural sector will decrease by around 0.9 million tonnes of CO_2 eq. by 2030, 1.1 million tonnes of CO_2 eq. by 2035 and 1.3 million tonnes of CO_2 eq. by 2040 (compared to the 2020 level).

The decline in livestock numbers and increase in use of feed additives will reduce methane emissions from cattle's digestion. In addition, the decrease in cattle and pig numbers will reduce emissions from manure processing and manure application. However, there is uncertainty about the future price and scale of adoption of feed additives and thus the emissions reduction from cattle.

Measures identified to reduce N_2O emissions from organic soils will also affect the CO_2 emissions from the LULUCF sector. The increasing grass area in crop rotations and continuous use of catch crops will increase the emissions of plant residues but reduce nitrogen mineralisation emissions from mineral soils, leaving the net effect in the agricultural sector small per hectare but positive for the climate. Energy-related emissions related to agriculture are reported in the energy sector.

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 2021, the emissions from building-specific heating amounted to 2.2 Mt CO_2 equivalent in the effort sharing sector, which is about 8% 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 come from the heating of residential buildings followed by the heating of commercial and public buildings. In the WEM projection, the emissions from building-specific heating of residential and commercial buildings decrease from the recent 1.5 to 2 million tonnes CO_2 eq. to 0.6 million tonnes CO_2 eq. in 2030.

Waste management

Greenhouse gas emissions from waste management totalled 1.8 Mt CO_2 equivalent in 2021, 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: CO_2, 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 45% from 2005 to 2021. 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 CO_2 emissions from biological treatment. However, CO_2 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 facilities that burn municipal waste are mainly calculated for the effort sharing sector, while emissions from co-incineration plants belong to the EU ETS. The waste incineration emissions of the effort sharing sector have increased significantly since 2005. The increase in emissions is due to the increase in energy utilization of municipal waste. About 62% of the municipal waste generated in 2021 was used as energy, while in 2008 only about 17% of the municipal waste was incinerated. In 2008 emissions from municipal waste incineration was lower than 0.1 Mt CO2 eq. and in 2021 accordingly 0.7 Mt CO_2 eq. Emissions from waste incineration are still expected to increase slightly in the next few years, but level off after that.

F-gases

In 2021, fluorinated greenhouse gas emissions totalled 0.9 Mt CO_2 equivalent, which currently equals approximately 3% of emissions in the effort sharing sector. Emissions peaked in 2008 at approximately 1.4 Mt CO_2 equivalent. Since the peak year of 2008, emissions have decreased by slightly more than 40%. 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 CO_2 equivalent by 2030 and further to 0.24 Mt CO_2 equivalent by 2040.

Machinery

Various types of machinery currently account for a total of 9% of emissions in the effort sharing sector. In 2021, total emissions from machinery were 2.5 Mt CO_2 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, CO_2 is the most significant greenhouse gas, but machinery also emits small quantities of methane and nitrous oxide.

Industry

Energy-related emissions from industry totalled 9.8 Mt CO_2 equivalent, of which 2.6 Mt CO_2 equivalent originated from non-ETS activities in 2021. Energy-related emissions are mainly CO_2 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 but the energy-based and process emissions will slightly decrease, amounting to approximately 8 Mt

CO_2 equivalent in 2030. This is because industry is becoming more energy efficient and produces fewer emissions, which will offset the increase in emissions due to growth in industrial activities.

Energy industry

Greenhouse gas emissions from the energy industry were 13.4 Mt CO_2 equivalent (proxy) in 2022. Although the emissions somewhat vary 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 thermal power generation 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, hydro levels (i.e. long-term average plus impact of climate change) and wind conditions.

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 significant increase in the use of renewable energy sources, mainly wind power, biomass in CHP plants, waste heat recovery in district heating and solar power. All these changes reduce GHG emissions and strengthen the energy supply self-sufficiency together with the recently commissioned new Olkiluoto 3 nuclear power unit (1,600 MW_e).

Small power plants and boilers are not included in the EU ETS. The total emissions of these plants, excluding waste incineration plants, amounted to 0.7–0.8 Mt CO_2 equivalent in 2021. 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* amounts to 0.7 Mt CO_2 equivalent (2022, proxy). 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 roughly stay at the current level or slightly decrease.

LULUCF sector

In 2020, the LULUCF sector as a whole acted as a CO_2 sink for -17.3 Mt CO_2 equivalent according to the 2022 GHG inventory submission. This sum of removals and emissions, i.e. carbon stock changes and greenhouse gas emissions, in 2020 was 29% larger than it was in 1990. For forest land, the largest sink was tree biomass, with -27.8 million tonnes CO_2 of net removals in 2020. Mineral soils on forest land were a sink of -5.2 million tonnes of CO_2, whereas organic forest soils were a

source of 3.8 million tonnes of CO_2. Other emission sources in the forest land category are methane and nitrogen oxide emission from drained organic forest lands (2.6 Mt CO_2 equivalent), nitrogen fertilisation (0.04 Mt CO_2 equivalent) and biomass burning in forest fires and in controlled burning (0.004 Mt CO_2 equivalent in 2020). Although the LULUCF sector has been a significant net carbon sink, it also produces significant emissions. The largest emissions come from drained organic soils of forests and croplands. Other emission sources in the LULUCF sector include grasslands, peat production areas, forest fires and nitrogen fertilisation of forests.

The LULUCF sector has been a net sink in Finland during the years 1990–2020, though the net sink has varied greatly annually mainly as a result of the volume of commercial fellings. However, according to the 2023 GHG inventory submission, the LULUCF sector was in 2021 a net source of emissions for the first time. The sector as a whole acted as a CO_2 source of 0.5 million tonnes of CO_2 equivalent. The main reason for the sector turning from a net sink to a net source in 2021 is that the carbon sink of forests decreased considerably due to increased felling removals, decreased growth of growing stock and changes in applied methodology. A new method was adopted for calculating the CO_2 emissions from drained forest peatlands. The projections for the LULUCF sector presented in this draft NECP update were estimated in early 2022, which means the old method for estimating the CO_2 emissions from drained forest peatlands was used, and that the projections are now inconsistent with the most recent inventory results (2023 GHGI). New projections, which take into account the new method, will be prepared in 2023–2024 and reported in the final NECP update in June 2024.

The LULUCF sector as a whole is projected to be a net sink in the WEM projection. In 2035, the net sink is estimated to be -22.7 million tonnes of carbon dioxide equivalent. This value is from the old projection where the observed change in forest growth was not accounted for and thus this projection overestimates the forest carbon sink.. In the old projection net sink is projected to increase by a total of 5.3 million tonnes of carbon dioxide equivalent by 2035 compared to the 2020 level, exceeding the minimum target set out in the Climate Plan for the Land Use Sector.

In the WEM projection for the agricultural sector, measures targeted at organic soils are also expected to decrease emissions in the LULUCF sector by around one million tonnes of CO_2 eq. by 2030, 1.3 million tonnes of CO_2 eq. by 2035, and around 1.6 million tonnes of CO_2 eq. by 2040 (compared to the 2020 level). This is due to a reduction in land clearing and conversion of land from cropland and grassland to afforested land and wetlands. In addition, grassland cultivation with increased water levels and paludiculture are expected to decrease emissions from organic soils.

To some extent, the projections for the agricultural sector and the LULUCF sector include different measures for cropland and grassland, different implementation areas, and different assumptions about the cultivation history, i.e. different parameters. The LULUCF projection also includes a few measures targeted at organic soils that are not included in the WEM projection for agriculture. The LULUCF sector projection therefore produces slightly higher emissions reductions for cropland and grassland than using the measures and parameters of the agriculture WEM projection.

In the WEM projection, the harvesting increases by up to 80 million cubic metres (including the use of wood for bioenergy) in 2026 to 2035, the estimated carbon sink of forests (including trees and soil) will be approximately at the level of -22.6 Mt of CO_2 eq. per annum by 2035. The decreasing trend

in emissions from wetlands is due to the decreasing energy use of peat, resulting in a smaller area being needed for peat extraction.

Agricultural land, or arable land and grassland, are a net source of greenhouse gas emissions in Finland, sized at approximately6.1–9.5Mt CO_2 equivalent per year in the reporting period 1990–2021. Of these, emissions from arable land account for approximately 90%. The development of the surface area of grasslands and the emissions from these grasslands is expected to remain more or less stable until 2040. The trend in emissions from grasslands has been declining since 1990.

The Harvested Wood Products (HWP) pool was a net sink of 1.3 million tonnes of CO_2 in 2020. HWP has been a net sink over the period 1990–2020, except in 2009. The annual fluctuations in the time series are generally due to changes in the economic situation and the demand for wood products.

The total CO_2 emissions from Wetlands were 2.1 Mt of CO_2 for 2021. The emissions have increased by 56% compared to the year 1990, when they were 1.3 Mt CO_2, and 5% compared to 2020, when they were 2.0 Mt CO_2. The most significant source of emissions is the peat extraction areas.

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, also hydropower, wind power, air- and ground-source heat pumps and solar power are used. Renewable energy is one of the most significant means for reaching Finland's energy and climate targets. 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 43.1% in 2021 (taking into account statistical transfers to other countries). The EU 2020 target for the share of renewable energy in Finland in 2020 was 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.

Table 15 shows the share of renewable energy in the gross final consumption of energy in 2010, 2015, 2020 and 2021. The shares have been calculated using coefficients and normalisations compliant with the ILUC and RED II Directives.

Table 15 Overall and sector-specific share of renewable energy in the gross final consumption of energy. Source: Eurostat ShaRES.

	2010	2015	2020	2021
RES	32.2%	39.2%	43.9%*	43.1%*
RES-E	27.2%	32.2%	39.6%	39.5%
RES-H&C	44.0%	52.6%	57.6%	52.6%
RES-T (with coefficients)	4.4%	24.6%	14.3%	20.5%

*Statistical transfers to other countries have been deducted

Table 16 shows the amounts of energy from renewable sources as final consumption in 2010, 2015, 2020 and 2021. The figures for hydropower and wind power have been normalised using the utilisation periods of maximum load over 15 and 5 years, respectively. The figures in the transport sector correspond to actual figures without coefficients. Only the compliant bioenergy is included in the figures.

Table 16 Amount of renewable energy as final consumption by energy source in different sectors [TWh]. Compliant fuels only. Source: Eurostat ShaRES.

	2010	2015	2020	2021
RES Overall				
Hydropower	13.5	13.9	14.5	14.8
Wind power	0.3	2.0	6.9	8.4
Solar power	0.0	0.0	0.2	0.3
Bioenergy	85.7	94.6	99.5	100.9
Heat pump energy	2.7	4.7	6.1	6.7
Total	**102.2**	**115.3**	**127.2**	**131.1**
RES-E				
Hydropower	13.5	13.9	14.5	14.8
Wind power	0.3	2.0	6.9	8.4
Solar power	0.0	0.0	0.2	0.3
Bioenergy	11.0	11.4	11.6	11.9
RES-H&C				
Solar power	0.0	0.0	0.0	0.0
Bioenergy	73.0	77.4	83.3	81.3*
Heat pump energy	2.7	4.7	6.1	6.7
RES-T (actual contribution without coefficients)				
Liquid biofuels	1.7	5.7	4.4	7.6
Biogas	0.0	0.0	0.1	0.1
Renewable electricity	0.2	0.2	0.3	0.4

**Preliminary estimation of compliant bioenergy*

Figure 10 shows the historical development of renewable energy between 2000 and 2022 and the projected development based on existing policies to 2030 and an outlook to 2040. The corresponding shares of renewable energy in gross final energy consumption are presented in Figure 3 on page 37.

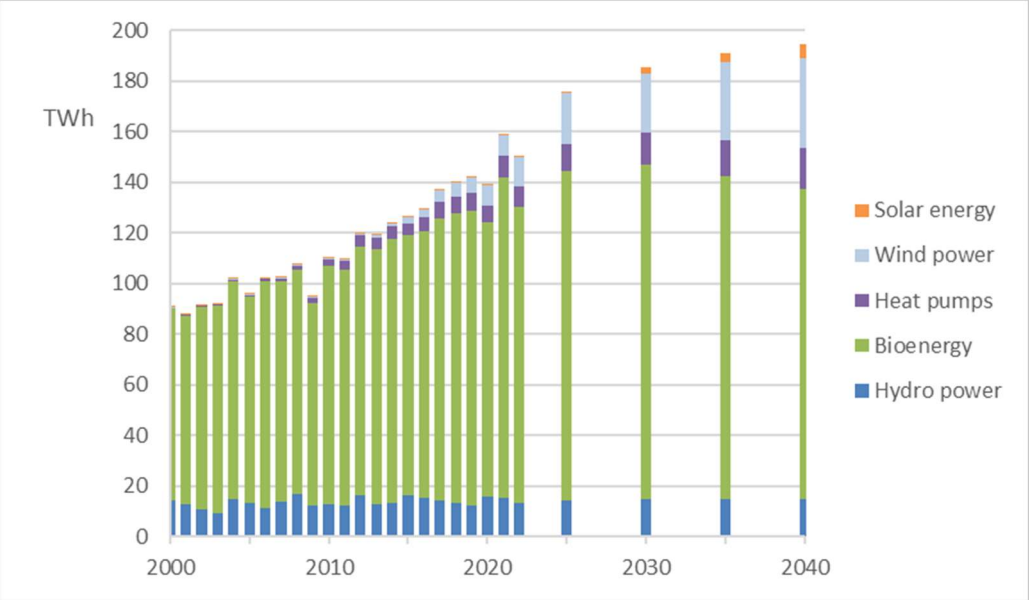

Figure 10. Historical development of renewable energy between 2000 and 2022 and the projected development based on current policies until 2030 and an outlook until 2040.

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

Final energy consumption as defined in the Energy efficiency directive, FEC (Europe 2020-2030), has varied between 272 and 309 TWh in the 2000s. Corresponding primary energy consumption, PEC (Europe 2020-2030), is 348 to 427 TWh. The trend of both is moderately downward.
In the WEM projection, the primary energy consumption in 2030 is 362 TWh and the final consumption of energy 270 TWh. A sector-specific examination of the WEM projection shows that the final energy consumption in 2030 would be about 132 TWh for industry, 47 TWh for the residential sector, 33 TWh for the service sector, 38 TWh for transport, 10 TWh for international aviation and 9 TWh

for other sectors together. Final energy consumption figures exclude distribution losses, power plants' own use and ambient heat from heat pumps, but includes international aviation. There is no estimation of primary energy consumption by sector. Figure 11 shows historical development 2010–2021 and projections to 2040 for primary energy consumption in total and final energy consumption for each sector.

The WEM projection will be updated for the final NECP update to be submitted in 2024

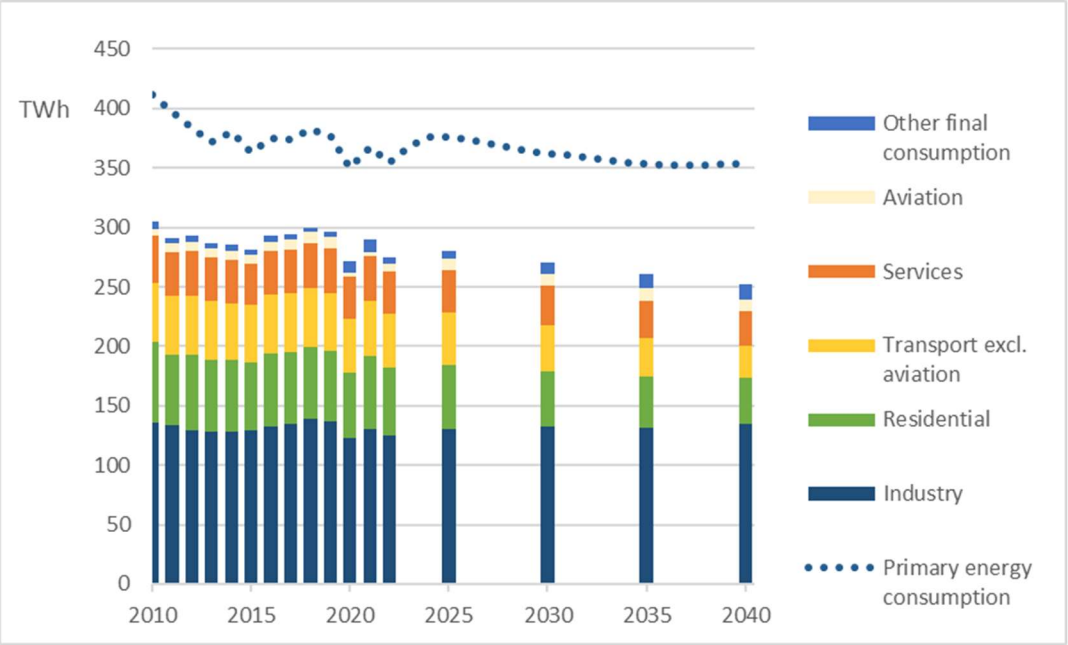

Figure 11. Historical development of primary energy in total and final energy consumption by sector between 2010 and 2022 and the projected development based on current policies until 2030 and an outlook until 2040.

The EU energy efficiency target for 2030 is indicated in terms of final energy and primary energy consumption. When considering early actions, anticipated GDP growth, its structure − based heavily on energy intensive industries − and the changes in energy supply, it is very challenging for Finland to contribute in quantity 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), data centres and hydrogen production. Without these, both primary and final energy consumption would decrease more rapidly along with increasing energy efficiency. The increase in economic activity partly offsets the energy efficiency gains achieved at the same time. Thus, a more describing indicator for energy

efficiency is the energy intensity with regard to GDP. Figure 12 shows the relative primary and final energy consumption per GDP in 2010-2021 and the estimated development of the indicators in the WEM projection. Improved energy technology and energy efficiency actions have disconnected economic growth from the energy consumption volume.

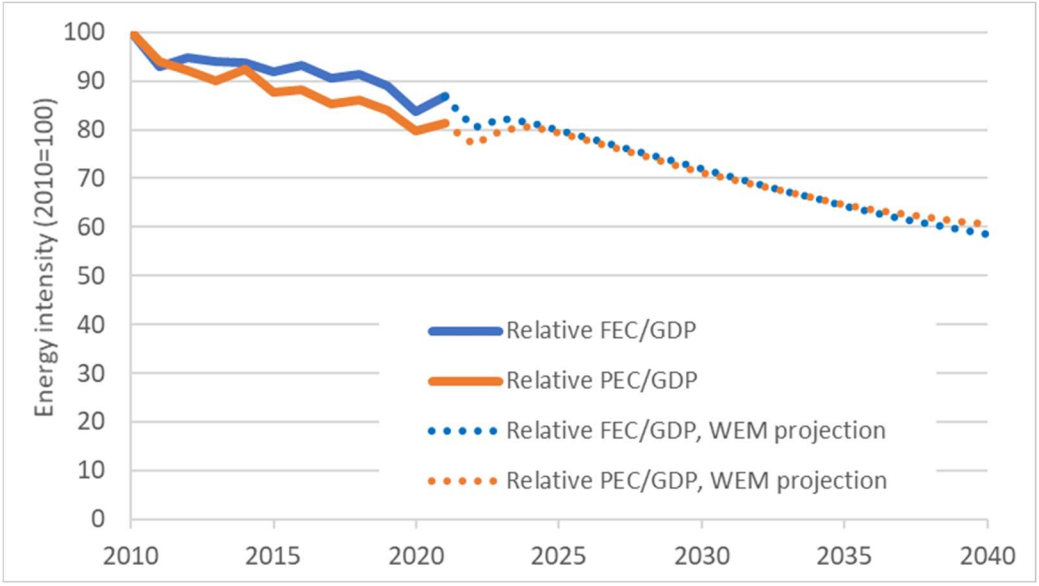

Figure 12. Relative energy intensity (primary and final energy consumption per GDP, 2010 = 100) for the WEM projection.

Finland has been utilising high-efficiency combined heat and power (CHP) production for decades. Today, efficient cogeneration and efficient district heating and cooling operate in open energy markets and compete more and more with other generation, heating or cooling methods, such as small-scale heat pumps. Nevertheless, and thanks to the fact that also the district heating sector is heavily investing in new production methods, such as large-scale heat pumps, district heating and cooling are feasible options especially in towns, cities and densely populated municipalities. In these areas, a significant part of the heated building stock has been connected to district heating. Statistics indicate that district heating accounts for almost 90% of the heat use in apartment blocks, 34% in all residential buildings, 43% in industrial buildings and more than 60% in commercial and public buildings (service sector). The share in single-family houses is about 7%. District heating has a total market share of 45% in residential and commercial and public (service sector) buildings.

In 2021, sales of district heating were 35.3 TWh. With temperature correction, the consumption equals 35.7 TWh. In the same year, the generation was 39 TWh. The consumption of district heating is projected to be 33 TWh in 2025 and 31 TWh in 2030. The share of cogeneration is expected to fall but at the same time, the share of renewables and waste heat recovery (currently about 60% of the total generation) will increase. This is also reflected in a study[47] published in 2020, in which the technical potential of waste heat not yet utilised in Finland was estimated at 35 TWh compared to the

[47] https://tem.fi/documents/1410877/2897650/EEDselvitys+l%C3%A4mmityksest%C3%A4_loppuraportti+2020.pdf

currently utilised 5 TWh. Although not all of the potential is feasible, it is clear that there are still many waste heat streams that are not yet harnessed especially in industry. Also ambient heat will be extracted more and more.

In 2022, eleven companies sold district cooling whose sales amounted to over 300 GWh. In 2030, sales of district cooling are projected to be 490 GWh. Almost one-quarter of the current generation comes in the form of free cooling (e.g. cool enough lake water) which does not require additional heat pumps.

NZEB definition in new buildings

- Decree of the Ministry of the Environment on the energy performance of new buildings (1010/2017)[48]
- Decree of the Ministry of the Environment on the Indoor Climate and Ventilation of New Buildings (1009/2017)[49]
- Decree of the Ministry of the Environment on water and sewerage systems of buildings[50]

NZEB definition in renovated buildings

The cost-effective deep renovation of buildings, including staged deep renovation requirement level in connection with repairs is in accordance with the following regulations:

- Ministry of the Environment decree on improving the energy performance of buildings undergoing renovation or alteration (4/2013)[51]
- 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)[52]

The EPBD is being recast and after its entry into force, these decrees will be reviewed.

[48] https://www.finlex.fi/fi/laki/alkup/2017/20171010
[49] https://www.finlex.fi/fi/laki/alkup/2017/20171009
[50] https://www.finlex.fi/fi/laki/alkup/2017/20171047
[51] https://www.finlex.fi/fi/viranomaiset/normi/700001/40799
[52] https://www.finlex.fi/fi/viranomaiset/normi/700001/43242

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

In 2022, the total energy supply was 360 TWh (proxy). Finland's domestic energy sources are wood-based fuels, hydropower, wind power, solar energy, waste and peat. The energy import dependency, calculated as the proportion of imported net energy in the gross available energy, was 38% in 2021. Since summer 2022, Finland does not import energy from Russia except for uranium and small amounts of LNG. Figure 13 shows the current distribution of the energy sources in the total energy supply.

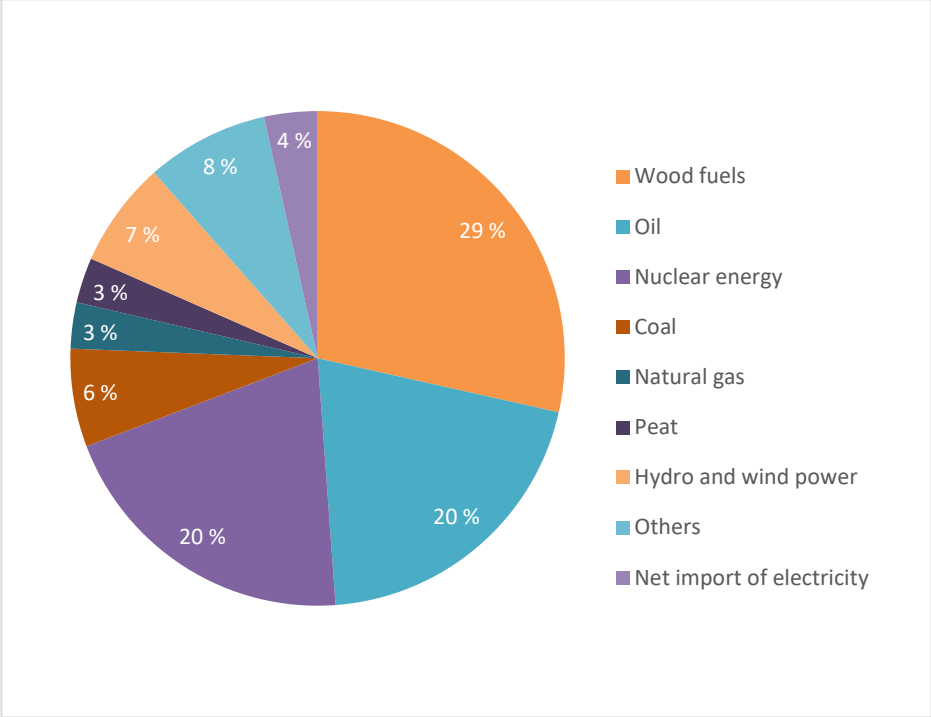

Figure 13. The distribution of different energy sources in the total energy supply in 2022 (proxy). Source: Statistics Finland.

Domestic electricity generation was 69 TWh (proxy) in 2022. This consisted of nuclear power (35%), combined heat and power production (23%), both in connection with district heat production and by industry for its own use, hydropower (19%), wind power (17%) and conventional condensing power (5%). Total electricity consumption was 82 TWh (proxy).

The power system is interconnected with the power systems of Russia, Sweden, Norway and Estonia but no electricity is imported from Russia since May 2022. Net imports from the Nordic and Baltic countries (and Russia in the past) vary considerably from year to year, mainly due to variations in hydropower production in the Nordic countries. Between 1990 and 2022, 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, while about 2,000 MW of thermal power 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, the import dependence will decrease thanks to the commissioning of the Olkiluoto 3 nuclear power unit (1,600 MW) in April 2023. Finland will, however, remain dependent on electricity imports during winter peak hours[53].

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 43% in 2021. 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, and the 2020 target was exceeded by a wide margin.

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 helped reduce energy intensity (Figure 12). Figure 14 shows the historical development of energy supply by source from 2000 to 2022.

As Finland does not produce any fossil fuels, all supplies of crude oil, natural gas and coal are imported. Oil and coal can be easily procured from various sources on the global market. Also, the gas infrastructure has been improved to diversify supply channels, especially after the floating LNG terminal in Inkoo came online in January 2023. Finland does not import Russian energy (except for uranium and small amounts of LNG to smaller terminals) and is not significantly dependent on any one country in terms of energy security.

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[53] 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

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

As described in Section 4.2, the most significant future changes in the WEM projection in electricity and heat production are the recently commissioned nuclear power plant unit (Olkiluoto 3) and the increase in renewable energy supply, mainly wind power and biomass. District heat production from heat-only plants (both boilers and newer technologies such as heat pumps) is expected to slightly grow at the expense of combined heat and power production, which is struggling with feasibility under low average electricity prices, despite the period of higher prices from 2022 to early 2023. Figure 14 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 roughly 60% today and is expected to approach 80% toward the end of the 2020s, mainly due to increased use of domestic renewable energy and new nuclear power that reduce the need to import fossil fuels and electricity.

The WEM projection will be updated for the final NECP update to be submitted in 2024

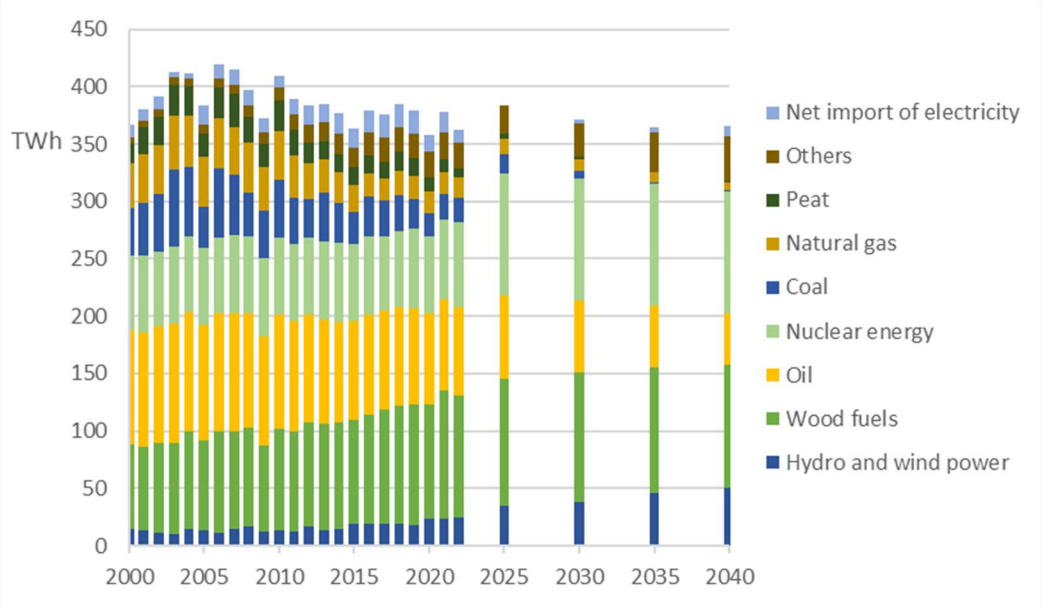

Figure 14. Historical development (2000 – 2022) and WEM projection of the primary energy supply until 2040.

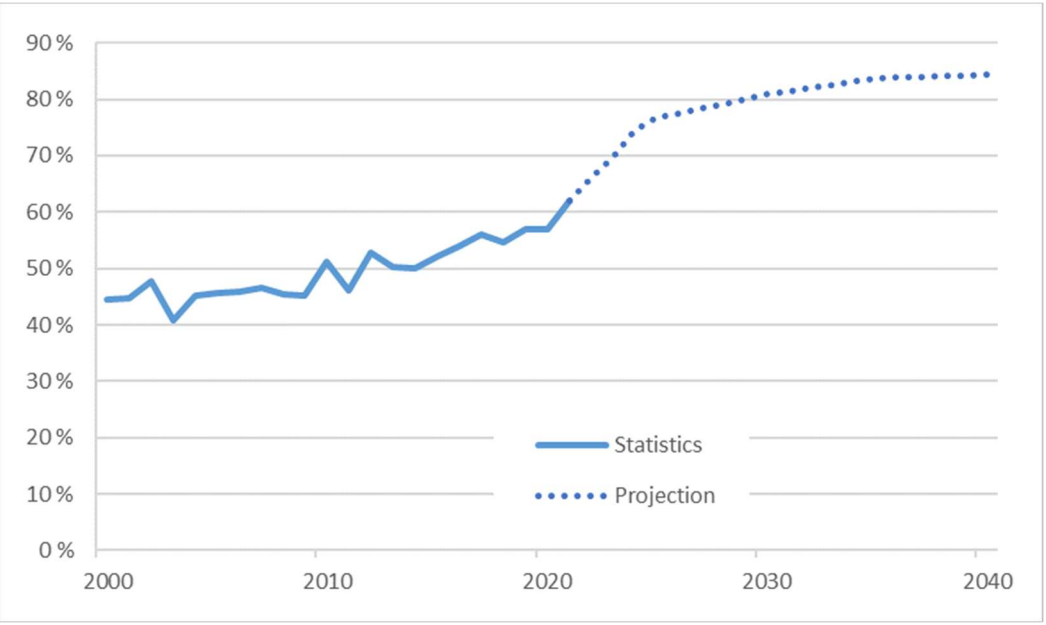

Figure 15. Historical self-sufficiency in energy supply 2000 - 2021 and the projected development in the WEM projection until 2040.

Table 17 shows the projected development of peak load demand for electricity and available generation and interconnector capacity in peak load situations in 2023, 2030 and 2040. However, the figures contain significant uncertainties, as the industrial demand is extremely difficult to predict (it depends on when hydrogen production takes off, for example). In any case, a strong increase is expected in the renewable capacity (especially wind and solar) whereas the number of conventional CHP plants will likely decrease. However, the generation capacity estimates in the table below do not include intermittent renewable capacity, since that production is uncertain during peak hours. Finland will continue to import the required deficit during such hours from the neighbouring countries through the common Nord Pool electricity market.

Table 17 Projection of demand, generation capacity and interconnector capacity in peak load situations [MW].[54] [55]

	2023	2030	2040
Peak demand	14,400	17,000	18,000
Generation capacity *	12,900	15,300	15,300
Deficit	1,500	1,700	2,700

[54] https://www.fingrid.fi/en/news/news/2022/fingrid-has-updated-its-estimate-of-the-adequacy-of-electricity-in-the-coming-winter-electricity-consumption-has-decreased--energy-saving-measures-must-continue/

[55] https://energiavirasto.fi/documents/11120570/158131816/AFRYn+selvitys+s%C3%A4hk%C3%B6j%C3%A4rjestelm%C3%A4n+resurssien+riitt%C3%A4vyydest%C3%A4+vuoteen+2033.pdf/33b8021d-5b91-5c5b-1ec0-29c00ab04911/AFRYn+selvitys+s%C3%A4hk%C3%B6j%C3%A4rjestelm%C3%A4n+resurssien+riitt%C3%A4vyydest%C3%A4+vuoteen+2033.pdf?t=1682512099666

Interconnector capacity	3,400	4,350	4,350

including strategic reserves, excluding wind powerand solar PV capacity.

4.5 Dimension internal energy market

4.5.1 Electricity interconnectivity

i. Current interconnection level and main interconnectors

Section 2.4.1 describes the current interconnection levels and its development in the near future. Table 18 lists the main interconnectors.

Table 18 List of main interconnectors.

To country	Type	Export	Import	Name of interconnector
Sweden SE1	AC	1,100 MW	1,500 MW	
Sweden SE3	HVDC	1200 MW	1,200 MW	FennoSkan 1 & 2
Estonia EE	HVDC	1,000 MW	1,000 MW	EstLink 1 & 2
Norway	AC	100 MW	120 MW	
Russia (connections not in use since May 2022)	AC	350 MW	1,400 MW	
Total (without RU)		**3,400 MW**	**3,820 MW**	

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

Table 19 shows planned interconnector investments.

Table 19 Planned interconnector investments.

To country	Type	Export	Import	Information
Sweden SE1	AC	+900 MW	+800 MW	Completion in 2025

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 20 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 20 Current size of the main grid operated by Fingrid (2021).

Component	Length/number
400 kV transmission lines	5,500 km
220 kV transmission lines	1,400 km
110 kV transmission lines	9,200 km
Total transmission lines	**16,100 km**
substations	121

Gas

Gasgrid Finland is Finland's natural gas TSO. It operates a 1,150 km high-pressure transmission pipeline network, confined to the south of the country. Finland´s natural gas transmission system also encompasses two cross-border interconnections, four compressor stations, three small-scale LNG terminals and, since January 2023, a floating storage regasification unit (FSRU) in the southern port of Inkoo. However, the physical connection between Finnish and Russian gas systems was disconnected in 2022.

The gas system mainly supplies industrial users and natural gas co-generation plants which receive gas directly from the transmission network. In addition to natural gas, small quantities of biogas are

injected into the gas transmission network from four biogas plants (Espoo, Kouvola, Lahti and Riihimäki).

Until Russia suspended gas imports to Finland in May 2022, natural gas was supplied to Finland mostly from Russia through a 1,310 km pipeline that enters Finland at the Imatra interconnection point. The Imatra interconnection had a total capacity of 22 mcm/d, far in excess of Finland's average daily gas consumption of 7.1 mcm in 2021, and also comfortably above the 2021 daily peak consumption of 18 mcm.

The bidirectional Balticconnector pipeline was commissioned in early 2020. The 77 km offshore pipeline runs between Inkoo in southern Finland and Paldiski in northwest Estonia; it is jointly owned by the Finnish TSO, Gasgrid Finland, and the Estonian TSO, Elering. The nominal transmission capacity between Estonia and Finland is around 8 mcm/d. However, the available capacity from south to north is currently 5.5 mcm/d due to constraints in the Baltic States' gas systems.

By connecting the Finnish gas grid to the Estonian gas grid, the Balticconnector pipeline has allowed Finland to import gas from the Klaipeda LNG terminal in Lithuania and make use of the Inčukalns gas storage facility in Latvia. Following the commissioning of the Gas Interconnection Poland-Lithuania (GIPL) pipeline in May 2022, Finland also gained access to the broader EU gas market.

The LNG terminal capacity is very recent. The capacity is as follows:

- The Pori terminal (in use since 2016; off-grid): 30,000 m^3
- The Manga terminal in Tornio (in use since 2019; off-grid): 50,000 m^3
- The Hamina terminal (in use since October 2022): 30,000 m^3
- The Floating Storage Regasification Unit (FSRU) in Inkoo (in use since January 2023): 151,000 m^3

The FSRU alone has a regasification capacity of around 5 bcm/year, or almost four times Finland's annual gas consumption.

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

Electricity

Fingrid's Development Plan 2022-2031 includes around EUR 3 billion of investments aligned with Finland's energy and climate goals. The plan indicates that the main upcoming challenges are the decreasing generation from co-generation plants in southern Finland; integrating higher shares of generation from nuclear, wind and solar PV; and meeting increased electricity demand resulting from electrification. The plan notes that additional transmission lines are needed between the south of Finland (demand centres) and the north and west (the main sites for wind generation and interconnections with Sweden). The Development Plan 2022-2031 suggests investments for 3,700 km of new transmission lines (2,300 km of 400 kV and 1,400 km of 110 kV), 41 new substations and the modernisation of 21 existing substations.

Gas and hydrogen

Following the commissioning of the Inkoo floating LNG terminal and the expansion of the capacity of the transmission network in Inkoo, Finland no longer has any need to expand the transmission infrastructure for natural gas.

Regarding hydrogen, Gasgrid Finland is working to accelerate the development of hydrogen infrastructure in Finland. Gasgrid is also working alongside Sweden's Nordion Energi to develop the Nordic Hydrogen Route, a cross-border project aimed at building a pipeline network and an open hydrogen market in the Bothnian Bay region by 2030.

The aim of the Nordic Hydrogen Route is to drive decarbonisation and support regional green industrialization, economic development and European energy independence. The companies seek to develop a network of 1,000 km of new pipelines that would effectively transport energy from producers to consumers to ensure they have access to an open, reliable, and safe hydrogen market. The pipelines would serve 65 TWh of identified potential hydrogen demand in the Bothnian Bay region by 2050. The core route will be along the coastline, with a branch to Kiruna.

The Nordic Hydrogen Route investment is estimated at EUR 3.5 billion, offering a hydrogen transportation cost of EUR 0.1–0.2 per kg. It would enable ten-fold investments of around EUR 37 billion in wind power and electrolys capacity. The pipeline could facilitate emissions savings of up to 20 Mt CO_2 eq. per year by 2050.

Gasgrid Finland has also launched a hydrogen transmission demonstration project to supply the Ovako steel mill in Imatra with by-product hydrogen produced by Kemira, the chemicals company, at its Joutseno plant. The project, which is at design phase in June 2023, encompasses constructing a 23 km hydrogen pipeline, the country's first one extending beyond an industrial site. The demonstration project will enable the implementation of Finland's first full hydrogen value chain from electricity through chemical industry by-product hydrogen to green steel industry end products and, consequently, will promote the development of Finland's energy and raw materials system. The project has received EUR 9.5 million in RRF energy investment support under the EU's NextGenerationEU funding instrument for project design and potential construction.

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 are currently two power exchanges active in the Nordic market: Nord Pool AS and EPEX SPOT. In 2021, 72% of the electricity supply in Finland was traded through the Nord Pool day-ahead market. Day-ahead wholesale prices have experienced notable volatility in recent years, dropping to a historic low in 2020 (annual average price 28.02 EUR/MWh) as pandemic

restrictions reduced demand, and surging to all-time high in 2022 (154.04 EUR/MWh), as a result of the energy crisis. A fine demonstration of volatility, the average spot price for May 2023 (26.61 EUR/MWh) was 90% lower than the average for August 2022 (261.49 EUR/MWh). Figure 16 shows the montly average day-ahead price for Finland from January 2010 to May 2023.

Finland has been heavily dependent on integrated European electricity markets to fill the significant deficit in generation capacity compared to peak load. In recent years, Finland has imported over 20% of its annual electricity supply and around 30% of power demand during winter peaks. This import dependency, however, is declining rapidly with the commissioning in 2023 of the 1.6 GW Olkiluoto NPP and several GWs of wind power capacity. In light of the significant volume of planned generating capacity additions, the government foresees Finland to become self-sufficient in electricity supply, at least at the annual level, in the course of this decade.

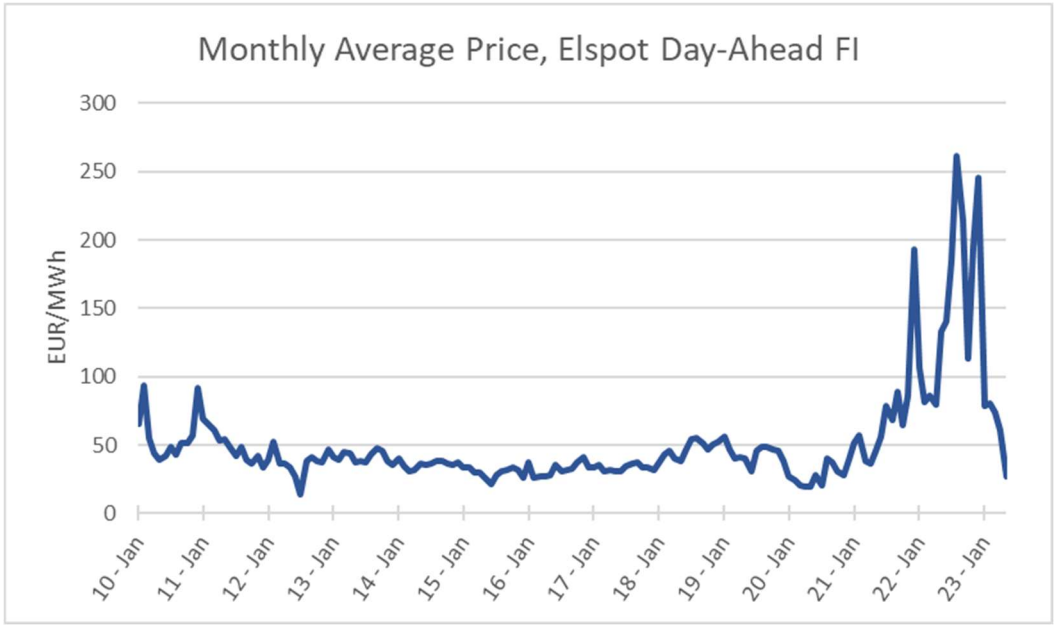

Figure 16. Monthly average prices in price area Finland from January 2010 to May 2023. Source: Nord Pool

Gas

Until 2020, Finland was exempt from EU rules on unbundling and third-party access in the gas sector (Directive 2009/73/EC) due to the isolated nature of the Finnish gas market. As a result, the gas market was essentially closed to competition and fully controlled by the state-owned company, Gasum, which acted as the TSO and was the only importer and wholesale supplier.

However, upon the commissioning of the Balticconnector pipeline in January 2020, the Finnish gas sector became subject to EU legislation on gas market competition, and the exemptions to the Gas Directive were abolished from the Natural Gas Market Act.

In line with the Gas Directive, the Natural Gas Market Act legislated the separation of gas transmission and sales activities, resulting in the creation of the new TSO, Gasgrid Finland, which was

unbundled from Gasum. Gasgrid Finland remains fully state-owned. The Natural Gas Market Act also legislated open access to the natural gas transmission and distribution networks, as well as to Finland's LNG terminals.

Gas wholesale and retail markets

Finland has been actively involved in creating a regional gas market with the Baltic countries. The common natural gas market, known as the FinEstLat market, came into operation in 2020, becoming Europe's first multi-country gas market connecting more than two countries.

In 2021, there were 39 registered wholesale gas suppliers in Finland. However, the Finnish wholesale market remains concentrated, with the state-owned Gasum holding a market share of around 60%. Since the beginning of 2020, gas trading services have been provided by the GET Baltic exchange. GET Baltic administers an electronic trading system for spot and forward natural gas products with physical delivery across Finland, Estonia, Latvia and Lithuania. GET Baltic daily market wholesale gas price is shown in Figure 17.

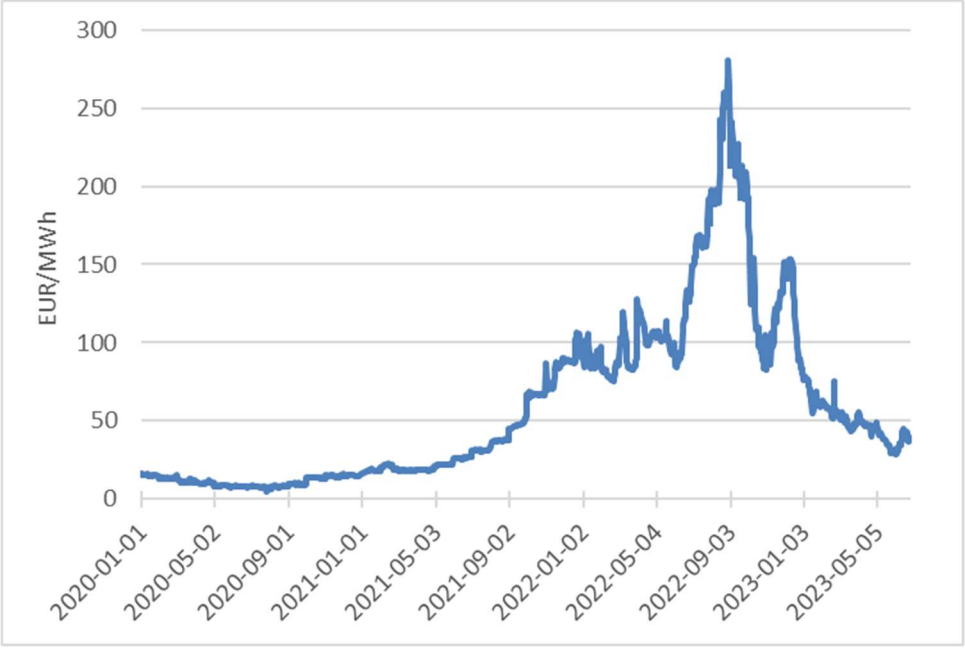

Figure 17. GET Baltic daily market wholesale gas price, January 2020 – June 2023.
Source: https://www.getbaltic.com/en/market-data/.

The Finnish retail gas market is very small, with around 25,000 retail consumers in total. Retail consumers mainly consist of households which use gas for cooking purposes only. In 2021, there were 15 registered gas retailers in Finland.

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

Electricity

Currently the market is under great uncertainty. The prices for the coming years depend heavily, on the one hand, on the speed of increase in new generation capacity, especially wind power, and on the other hand, on the speed of increase in new demand, especially electrolysis capacity. In addition, if the new demand and generation capacities are not flexible, it will have a significant negative effect on prices. Depending on these factors, prices are estimated to stay relatively modest up to 2030, after which there can be more fluctuations.

Gas

A roadmap establishing a process for regional gas market integration of FinEstLat gas market area with Lithuania was agreed in 2020 by the energy ministries, national regulatory authorities (NRAs) and gas transmission system operators from Estonia, Finland, Latvia and Lithuania. The initial plan was for the FinBalt single entry tariff system to enter into force in October 2023, but this has been postponed at least until October 2024, because of the circumstances resulting from Russia's aggression against Ukraine.

The eventual implementation of the EU's Gas Package (entering the trilogue phase in June 2023) will imply some changes to the Natural Gas Market Act. More importantly, it will prompt the drafting of a Hydrogen Market Act. Work on these legislative projects will commence as soon as the EU level negotiations are finalised. The Government Bill for new gas market legislation is expected to be given to the Parliament in 2025.

The National Climate and Energy Strategy of 2022 focuses on the green transition and the phasing-out of Russian fossil energy, which has become increasingly topical since spring 2022. The strategy includes a national hydrogen strategy to promote the hydrogen economy and electrofuels and to set quantitative targets for hydrogen electrolysis capacity. Finland has not set targets for hydrogen production. The target for electrolyser capacity in the Strategy is 200 MW in 2025.

Furthermore, the government objective is to make Finland the leader in the European hydrogen value chain by 2030, building on the secure supply of abundant, inexpensive clean electricity and other competitive advantages. This involves a large-scale construction of hydrogen production and transportation capacity and adopting legislation on the hydrogen market. More details are outlined in the February 2023 Government Resolution on Hydrogen.

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

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 as a share 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-smart solutions that are based on user needs and required by communities. For example, the innovation funding agency Business Finland has invested hundreds of millions in energy-related projects.

The competitiveness of low-carbon technologies compared with the alternatives has improved considerably over the past few years. The competitiveness of intermittent renewable forms of energy (solar and wind power) has improved. 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.

From 2010 to 2019, the number of new patents in energy-related technologies in Finland varied from a maximum of 159 in 2018 to a minimum of 37 in 2000. In 2019, most patents were issued for energy efficiency (45%) followed by renewables (18%), waste (14%), other power and storage (10%), fossil fuels (7%), and hydrogen and fuel cells (5%). In 2019, 8% of patents in Finland were dedicated to energy-related technologies, compared to 10% in the European Union. In 2019, the number of patents for environment-related technologies per EUR billion GDP in Finland was 0.82, ranking fifth among the member countries of the International Energy Agency (IEA), and notably higher than the IEA average of 0.53.

In addition to national funding, energy technology innovation in Finland is supported by EU funding, including through the EU Framework Programme for Research and Innovation, the European Union’s main mechanism for directing innovation funding to member states. Horizon 2020, the framework programme from 2014 to 2020, provided EUR 80 billion for R&D through a competitive process open to all EU public and private entities and designed to increase public-private partnerships and

international co-operation. Horizon 2020 provided a total of EUR 1.52 billion of funding to Finland, with around EUR 400 million going to energy and climate projects, including EUR 126 million for secure, clean and efficient energy; EUR 112 million for climate action, environment, resource efficiency and raw materials; EUR 77 million for smart, green, integrated transport; EUR 75 million for advanced manufacturing and processing; and EUR 8 million for nuclear energy.

Horizon Europe, launched in February 2021, is the EU Framework Programme for Research and Innovation for 2021-27. It aims to provide EUR 95.5 billion in innovation funding and will continue to support energy-related technology innovation and sets goals to increase international R&D co-operation. Business Finland hosts the national liaison office for Horizon Europe in Finland, which offers free services to support Finnish R&D actors in applying for Horizon Europe funding. The EU Innovation Fund commercial demonstration of innovative low-carbon technologies is funded by ETS revenues. The Finnish company Neste received EUR 88 million from the EU Innovation Fund for a project to produce and use low-carbon hydrogen at one of its refineries.

In 2022, Finland introduced the Energy Investment Aid scheme to award funding from the EU Recovery and Resilience Facility (RRF), using a method similar to the Energy Aid programme (see 3.1.2). The scheme will provide around EUR 490 million in funding for energy investments, including energy infrastructure, the deployment of new energy technology, hydrogen, CCU and electrification of industries. Funding is granted in 2021-2023 and the funded projects must be finished by 2026. This has accelerated clean energy technology implementation. Regarding the electricity price and its components, except for customers with very small consumption, the consumer price of electricity is in Finland below the EU average when all three price components are taken into account (see Figure 18). For all customer groups in Finland, the electrical energy and its supply costs are for all customer groups lower in Finland than in the EU on average, whereas network costs and/or taxes and levies are often higher. The relatively cheap electricity improves Finland's competitiveness. The energy crisis rose the electricity prices very high in whole Europe during the autumn and winter 2022–2023. The spring has brought the prices down and in Finland and Northern Sweden the wholesale day-ahead prices have been the lowest ones in Europe. In 2022, Finnish households paid an average of 29 eurocents per kWh for electricity (band DB, yearly consumption 1,000–2,500 kWh). Households with a consumption of 15,000 kWh or more (band DE, typical size for electrical heating) paid 15 cent/kWh. Industrial customers paid on average 13–14 cnt/kWh (band ID, IF). Corresponding EU average prices were 29 cnt/kWh (band DB), 24 cent/kWh (band DE) and 21–22 cent/kWh (band ID, IF).

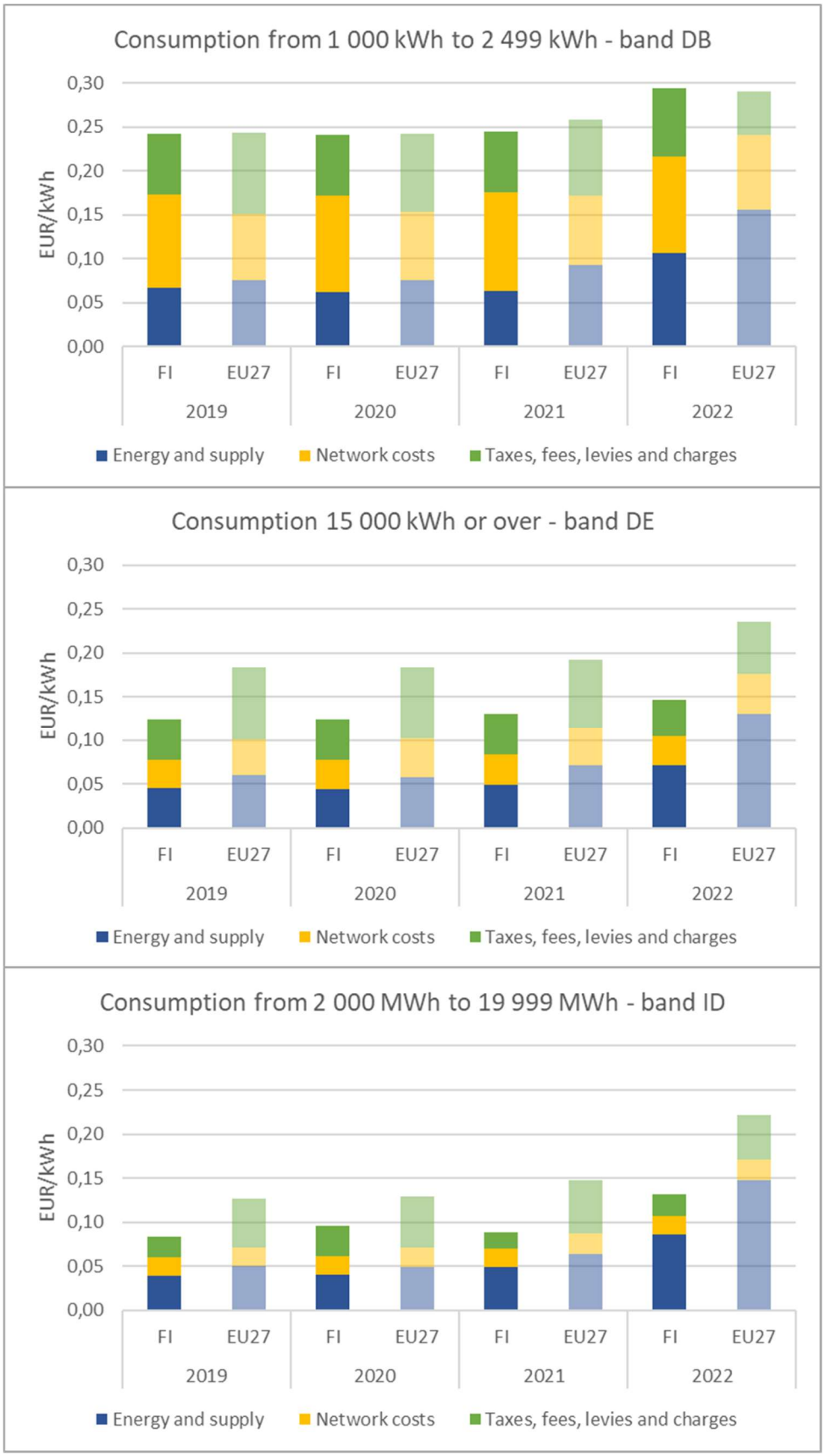

Figure 18. Electricity price by price component in Finland and the EU for three different customer groups. Source: Eurostat

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.

Agriculture

In December 2021, Prime Minister Sanna Marin's government set an ambitious emissions reduction target of 29% for Finnish agriculture (including agricultural emissions in the effort sharing sector and land use, land-use change and forestry sector) by 2035. This means emissions from agriculture should decrease by 4.6 Mt CO_2 equivalent by 2035 (measured with GWP AR4). This national target is in line with EU's climate neutrality objective.

The potential measures to achieve the 29% emission reduction target are specified in the Carbon Euro Programme56. Most of these measures are also mentioned in the WEM projection, but the scale and parameters vary. Controlled subsurface drainage, the promotion of paludiculture, the reduction and replacement of one-year cereal cultivation with grassland, the removal of poorly productive arable land from agricultural production and the afforestation of low-yield arable land are considered the most effective means to reduce emissions from agriculture in organic soils. For mineral soils, carbon sequestration and afforestation have been identified as potential measures for emissions reduction in Finland's conditions.

The above-mentioned measures reduce emissions in the agricultural sector, as well as in the land use, land-use change, and forestry sector. Other measures that could help to achieve the 29% emissions reduction target in agriculture are more precise nitrogen fertilisation, the use of additives in feeds for bovines, as well as a decrease in the number of bovines and utilising renewable energy in agriculture.

Achieving the challenging 29% emissions reduction target is unlikely to be possible with public guidance and incentives alone. Hence, private emissions compensation payments, food industry climate and responsibility programmes, and farm-level solutions and goals, including yield targets, will be needed.

[56] https://mmm.fi/documents/1410837/1516663/HERO_selvitys_2022.pdf/fd751aad-a2f2-a31a-396a-872d034f823b/HERO_selvitys_2022.pdf?t=1650519685134 (in Finnish)

Transport

The new baseline projection (WEM) for greenhouse gas emissions from transport was completed in August 2022. Greenhouse gas emissions will increase in the projection in 2022–2023 due to a temporary lowering of the obligation to distribute renewable fuels, but will decrease from 2023 onwards due to increases in the obligation. Changes in the obligation to distribute renewable fuels will have the most significant impact on reducing greenhouse gas emissions in the 2020s, and the impact will decrease from the 2030s onwards as the number of battery electric vehicles increases, i.e. as the absolute consumption of fuels decreases. In particular, the stricter CO_2 performance standards for passenger cars and vans under the EU directive will significantly reduce the WEM emission trajectory. Greenhouse gas emissions from domestic transport will decrease by 49.4% compared to the 2005 greenhouse gas emissions, which means that they will be very close to the 50% target for reducing greenhouse gas emissions.

The new WAM (with additional measures) projection for transport was also completed in August 2022. According to this projection, emissions from domestic transport will decrease by around 53% by 2030 and by around 98.4% by 2045 compared to 2005.

Energy security

As for the rest of the dimensions, Finland's National Emergency Supply Agency is planning on increasing the number of wood fuel terminals all around the country. This would ensure better availability of biomass than at the moment thus contributing to the energy security.

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.

As almost all of the planned measures are currently expressed only as goals, the actual concrete policy measures are not yet known. Therefore, it is not possible to carry out a credible assessment of their interactions for this version of the NECP update. Better impact assessments will only become available closer to implementation of the policy measures, typically in connection with preparing new legislation. This part of the NECP will be updated for the final version to reflect the most recent situation.

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.

Finland currently has only preliminary goals for transport and agriculture in the category of planned policies and measures. The transport sector aims at complete decarbonisation whereas the emissions from agriculture would be reduced by 29%, but there are not yet decisions on their implementation. At this point, indicative estimates are available of additional emissions reductions compared to the WEM projection, but further impact assessments will be available only closer to implementation, such as in connection with preparing new legislation. The general principle of planning and preparing new policies and measures is that emissions reductions should be implemented in a way that is socially and regionally fair and consults with many sectors of society.

5.3 Overview of investment needs

i. Existing investment flows and forward investment assumptions with regards to the planned policies and measures

RRF funding for energy projects

A total of EUR 483.2 million has been reserved for energy investment aid under Finland's Recovery and Resilience Plan. Funding is available for the following types of projects:

- Investments in energy infrastructure (P1C1I1): EUR 154.35 million
- Investments in new energy technology (P1C1I2): EUR 154.35 million
- Low-carbon hydrogen and carbon capture and utilisation (P1C2I1): EUR 127 million
- Direct electrification and decarbonisation of industrial processes (P1C2I2): EUR 47.5 million

The Ministry of Economic Affairs and Employment made the first aid decisions under Finland's Recovery and Resilience Plan in October 2022. At that time, aid was granted to six projects for EUR 99,827,863. In December, the Ministry granted investment aid to 16 projects for a total of EUR 119,196,068, while 14 projects received funding for EUR 108,730,715 in February 2023.

As of June 2023, about EUR 93 million of the budget remains to be allocated to the electrification of industry and investments in energy infrastructure. The application round for these funds closed in late May 2023 and the aid will be granted in autumn 2023.

In addition, Business Finland has granted aid to two low-carbon hydrogen projects, in total around EUR 61.3 million.

Planned investments in clean energy transition

The table below contains figures on planned clean energy investments up to 2030 by sector. The figures are based on announcements by individual business enterprises. They are indicative and mostly include projects at planning and preliminary study stages. Their total volume, EUR 127 billion, is substantial (Finland's 2022 GDP was around EUR 265 billion) and even if only a fraction of them were to be built, they would still significantly help decarbonise Finland´s economy.

Table 21 Volume of planned clean energy investments up to 2030 by sector.

Energy technology sector	EUR, million
Onshore wind power generation	54,000
Offshore wind power generation	43,000
Clean hydrogen production	11,000
Low-carbon steel production	6,100
Battery minerals, chemicals and materials production	4,900
Electricity transmission grid expansion and reinforcement	3,000
Energy storage (pumped hydro generation)	2,500
Nuclear power generation (Loviisa NPP lifetime extension to 2050)	1,000
Solar power generation	900
Biogas production	370
Bioenergy CHP production (biomass-fired CHP plant in Helsinki)	250
Heat pumps	200
Fuel switch to non-fossil sources (in industry and power plants)	120
Waste heat recovery	80
Total	**127,420**

Source: Confederation of Finnish Industries, Fingrid, Finnish Wind Power Association.

Investment needs for public recharging points for electric vehicles

The investment costs of the distribution infrastructure for alternative fuels in Finland were assessed as part of evaluating the Commission's proposal for a regulation on the deployment of alternative fuels infrastructure. The minimum requirements under the regulation would result in significant additional investment needs, especially for heavy-duty vehicles. The estimated costs of achieving the objectives set in the regulation would be approximately EUR 65 million for the part of electric charging pools for heavy-duty vehicles in 2030, whereas the costs for hydrogen refuelling stations would total around EUR 14 to 42 million. While the construction of charging infrastructure for light vehicles

would also result in additional investment needs, it is likely that the targets for 2025 will at least be achieved, as the pace of constructing public high-power charging stations is accelerating. This development is also promoted by the current subsidies. The costs for 2030 will largely depend on whether the increasing recharging point and pool criteria are taken into account in current investments.

Other transport investments

No estimates have so far been produced on the private investments needed to renew the vehicle fleet. However, the minimum goal set in the roadmap to fossil-free transport is 700,000 battery electric vehicles in Finland in 2030, which would mainly enter the Finnish fleet as new vehicles. The average prices of battery electric vehicles were around EUR 50,000 in April 2022, which would mean that the investment needs shouldered by private consumers, companies and other actors would, as a rough estimate, be as high as EUR 35 billion. The investment needs in new driving powers for the heavy-duty vehicle fleet will also be in the range of billions of euros.

To reach the objective of halving transport emissions, substantial investments will also be necessary in sustainable mobility infrastructure. In 2018, the ILMO45 report estimated that the investment costs of sustainable mobility could cumulatively amount to around EUR 17 billion in total by 2045. Measures for developing a sustainable transport system for the years to come were identified in the National Transport System Plan, on the basis of which an investment programme was drawn up for the transport network. The measures will be promoted as permitted by the estimated annual central government appropriations.

Investment subsidies under the CAP Strategic Plan 2023–27

Finland's CAP Strategic Plan for 2023–27 includes the majority of investment subsidies for agriculture and rural enterprises as well as other measures promoting renewable energy, resource efficiency, environmental protection, climate change mitigation and adaptation, and air quality in farms and rural areas. Climate issues are one of the cross-cutting themes of the entire plan. Farms can receive investment subsidies for investments that promote renewable energy and energy efficiency and the state of the environment. The CAP plan also offers investment subsidies to rural enterprises producing renewable energy.

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)

No gaps have been identified.

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

ii. Impacts on energy prices, utilities and energy market integration

iii. Where relevant, impacts on regional cooperation

As almost all of the planned measures are currently expressed only as goals, the actual concrete policy measures are not yet known. Therefore, it is not possible to carry out a credible assessment of their interactions for this version of the NECP update. Better impact assessments will only become available closer to the implementation of the policy measures, typically in connection with preparing new legislation. This part of the NECP will be updated for the final version to reflect the most recent situation.

5.5 The contribution of planned policies and measures to the achievement of the Union's climate-neutrality objective set out in Article 2(1) of Regulation (EU) 2021/1119

Agriculture

In December 2021, Prime Minister Sanna Marin's government set an ambitious emissions reduction target of 29% for Finnish agriculture (including agricultural emissions in the effort sharing sector and land use, land-use change and forestry sector) by 2035. This national target is in line with EU's climate neutrality objective. According to the emissions reduction target of 29%, emissions from agriculture should decrease by 4.6 Mt CO_2 equivalent by 2035 (measured with GWP AR4). The potential measures to achieve the 29% emissions reduction target are specified in the Carbon Euro Programme[56]

Transport

According to the Climate Act, Finland will be carbon neutral by 2035. The targets for reducing emissions from transport must be in line with this goal. By 2030, Finland will reduce emissions from domestic transport by at least 50% compared to the 2005 level. The aim is to achieve an entirely fossil-free transport sector by 2045.

In the WAM projection for transport, replacing fossil fuels with renewable fuels and electricity will have the greatest impact on reducing greenhouse gas emissions in the long term. Full implementation of WAM measures in transport can almost entirely achieve fossil-free road transport if electric fuels

and hydrogen become more common as an energy source for transport. At the same time, however, transport energy consumption must also be reduced.

Energy sector

As for improving the supply of renewable fuels, the National Emergency Supply Agency is planning a measure of increasing the number of wood fuel terminals in Finland, which is expected to make wood fuels somewhat more storable on average. This would increase their availability to energy utilities also in case of temporary supply disruptions and thus decrease the use of peat and other fossil fuels as secondary fuels.