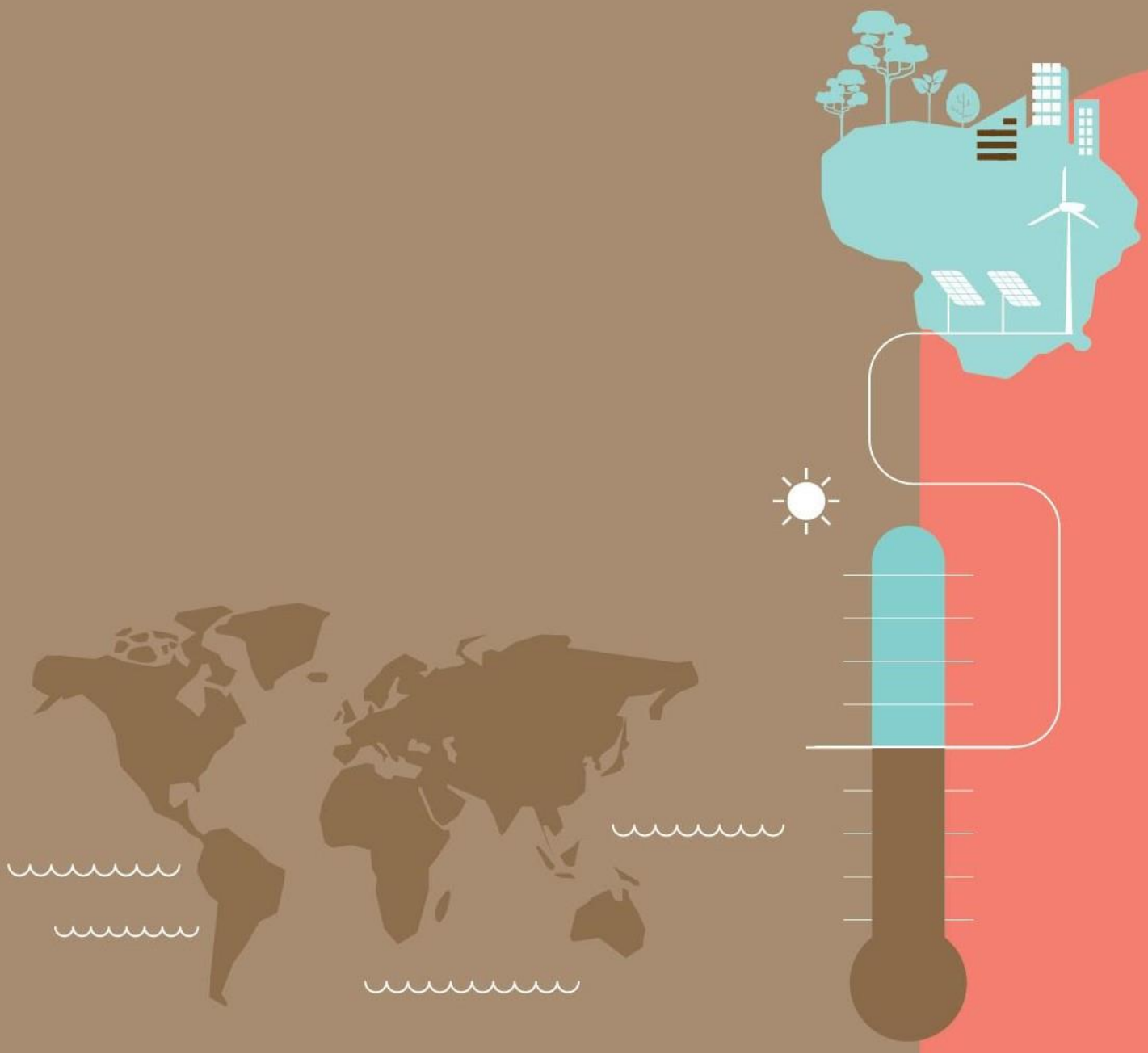
NATIONAL ENERGY AND CLIMATE ACTION PLAN OF THE REPUBLIC OF LITHUANIA FOR 2021-2030



ABBREVIATIONS

BEMIP	Baltic Energy Market Interconnection Plan
BENTE	Baltic Energy Technology Scenario Study
BRELL	Belarus, Russia, Estonia, Latvia and Lithuania
CBSS	Bio-generation development cluster
CEF	Connecting Europe Facility
CEN	Continental European Networks
CO_2	Carbon dioxide
DH	District heating
DSO	Distribution system operator
ELLI	Enhancement of Latvia-Lithuania interconnection
ENTSO-E	European Network of Transmission System Operators (electricity)
EPM	Existing policies and measures
ETS	Emissions Trading System
EU	European Union
FSIS	Family Support Information System
GDP	Gross Domestic Product
GHG	Greenhouse gases
GIPL	Gas Interconnection Poland-Lithuania
GIS	Geographical information system
GWP	Global warming potential
HFCs	Hydrofluorocarbons
HHI	Herfindal - Hirschman index
HVDC	High-voltage direct current
ICE	Internal combustion engine
Ignalina NPP	Ignalina Nuclear Power Plant
Inčukalns PDS	Inčukalns Underground Gas Storage
IPCC	Intergovernmental Panel on Climate Change
IPS/UPS	Electricity transmission network operating in part of CIS countries and Baltic countries
IS	Information systems
IT	Information technologies
KCP	Kaunas Cogeneration Plant
ktoe	Thousand tonnes of oil equivalent
LitPol Link	Lithuania-Poland electricity interconnection
LNG	Liquefied natural gas
LOLE	Loss of Load Expectation
LULUCF	Land use, land use change and forestry
MWh	Megawatt hour
N/A	Not applicable

NCCP	National climate action plan
NEIS	National Energy Independence Strategy
NordBalt	Submarine power cable between Lithuania and Sweden
NOx	Nitrogen oxides
PPM	Planned policies and measures
PSPP	Pumped storage power plant
RDI	Research, development and innovation
RES	Renewable energy sources
RES-E	RES-Electricity
RES-T	RES transport
RGMCG	Regional Gas Market Coordination Group
RL	Republic of Lithuania
SOx	Sulphur oxides
t CO_2 e	Tonne of carbon dioxide equivalent
TS	Transformer substation
TSO	Transmission system operator
TWh	Terawatt hour
UNFCCC	United Nations Framework Convention on Climate Change
UNFCCC	United Nations Framework Convention on Climate Change
VCP	Vilnius cogeneration plant

CONTENTS

KEY:

SECTION A: NATIONAL PLAN

A SKIRSNIS: NACIONALINIS PLANAS

1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 Summary

Political context

Lithuania has drawn up a National Energy and Climate Action Plan for the period 2021–2030 (hereinafter referred to as the 'National Plan') in accordance with the requirements set out in the Governance of the Energy Union Regulation[1]. The national plan has been prepared on the basis of and integrates the provisions, objectives, targets and measures implemented and planned in Lithuanian national legislation, international commitments, strategies and other planning documents.

The main strategic documents integrated into the National Plan are the National Energy Independence Strategy (NEIS) adopted in June 2018[2] and the National Strategy for the Climate Change Management Policy[3] adopted in 2012 and updated in 2019 as well as the National Air Pollution Reduction Plan adopted in April 2019[4]. Some of the strategies are still being developed and some are in the early stages of development, therefore their intended content has been mirrored, where possible, with planned (unapproved) policies and measures (see Figure 1.1.1).

The 2021-2030 National Progress Plan (NPP) (hereinafter 'NAP) has been developed in parallel to the preparation of the National Plan. The aim of the NPP is to identify the main developments in the country over the next decade that will ensure social, economic, environmental and security progress. Changes are planned taking into account the concept of the General Plan of the Republic of Lithuania and the fundamental values enshrined therein as well as the trends in the country's spatial development, the national progress vision and areas of development envisaged in the progress strategy 'Lithuania 2030', the National Security Strategy, the United Nations 2030 Agenda for Sustainable Development and other international agreements and commitments and the European Union ('EU') legislation, including an assessment of the current situation, recommendations from international organisations (the EU, the Organisation for Economic Co-operation and Development and the International Monetary Fund), also emerging challenges and opportunities for national progress. National development programmes will be prepared to implement the changes foreseen in the NPP. In order to ensure coherence between the two strategic planning documents, the target values of the NPP assessment indicators are directly correlated with the objectives set out in the National Plan. The objectives and/or targets set out in the NAP relevant to the national plan are as follows:

- To ensure good environmental quality and the sustainability of the use of natural resources, mitigate Lithuania's impact on climate change and increase its climate resilience;
- To improve the competitiveness of the energy sector;
- To integrate the Lithuanian natural gas market into the single EU gas market;
- To connect the Lithuanian power system with the continental European power system for synchronous operation;
- To ensure the adequacy of the Lithuanian electricity market and power system and increase the share of local electricity generation;

[1] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of Energy Union and Climate Action.

[2] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.429490/asr

[3] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.437284

[4] https://www.e-tar.lt/portal/lt/legalAct/410fbe3067f511e9917e8e4938a80ccb

- To reduce the energy poverty of the population;
- To increase the consumption of renewable and alternative fuels in the transport sector and promote sustainable intermodal mobility;
- To increase the share of renewable energy sources in domestic energy production and gross final energy consumption and introduce pollution reduction measures in the energy sector;
- To improve the energy efficiency and use of energy from renewable sources in residential and public buildings;
- To safely decommission the Ignalina Nuclear Power Plant and dispose of the resulting radioactive waste.

For each economic sector contributing to anthropogenic impacts on climate change, the NPP sets out specific greenhouse gas ('GHG') reduction targets for 2025 and 2030.

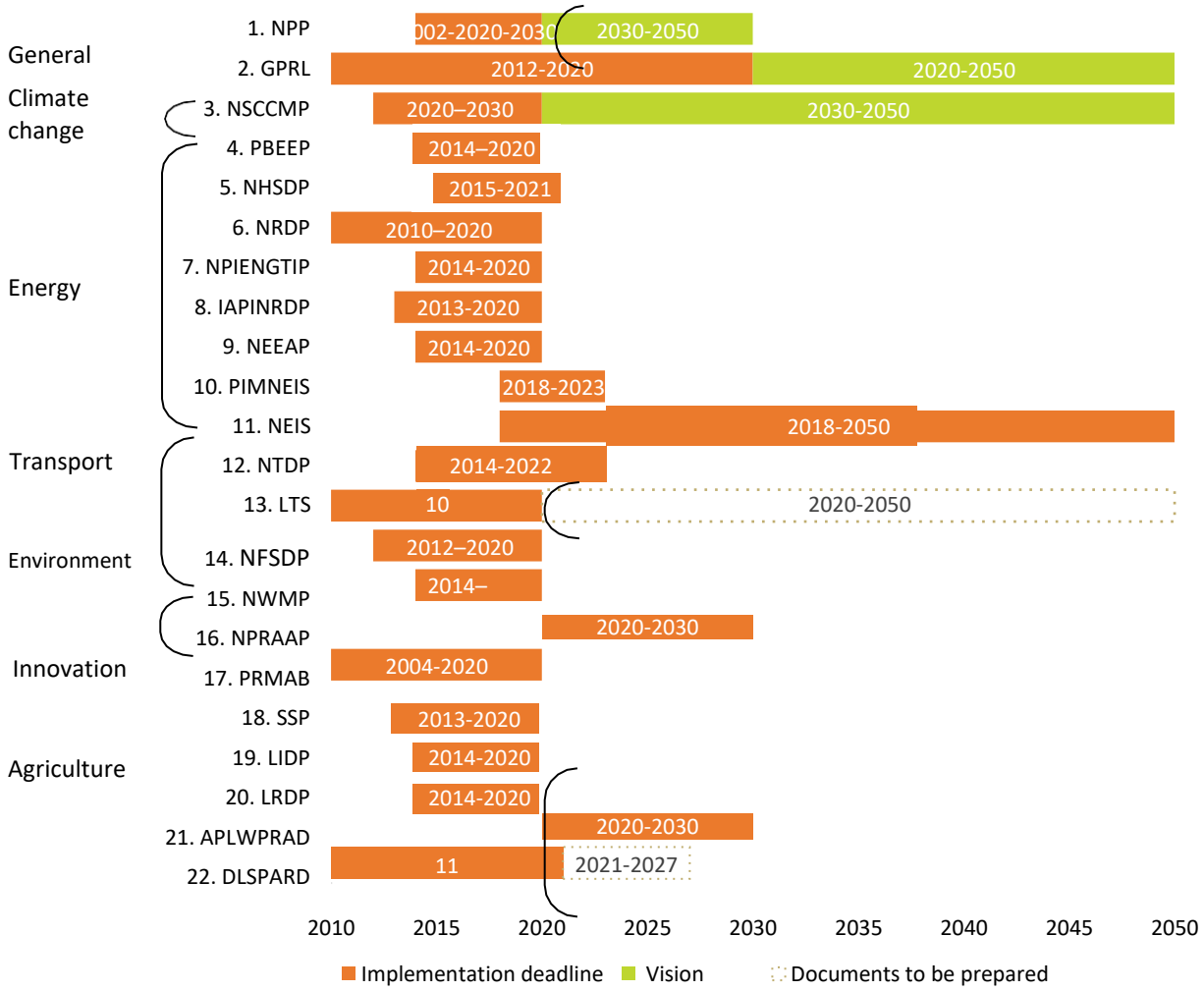


Fig. 1.1.1 Lithuanian strategic planning documents

Abbreviations:

1. NPP – National Progress Plan;
2. GPTRL – General Plan of the Territory of the Republic of Lithuania;

3. NSCCMP - National Strategy for the Climate Change Management Policy
4. PBEEP - Public Buildings Energy Efficiency Programme 2014–2020;
5. NHSDP - National Heat Sector Development Programme;
6. NRDP - National Renewables Development Programme;
7. NPIENGTIP - National Plan for the Implementation of Electricity and Natural Gas Transmission Infrastructure Projects;
8. IAPINRDP - Interinstitutional Action Plan for the implementation of the National Renewables Development Programme;
9. NEEAP - National Energy Efficiency Action Plan;
10. PIMNEIS - Plan of implementing measures for the National Energy Independence Strategy;
11. NEIS - National Energy Independence Strategy;
12. NTDP- National Transport Development Programme;
13. LTS - Lithuanian Transport Strategy;
14. NFSDP - National Forestry Sector Development Programme;
15. NWMP - 2014–2020 National Waste Management Plan;
16. NPRAAP -2020–2030 National Plan for Reducing Ambient Air Pollution;
17. PRMAB - Programme for the renovation/modernisation of multi-apartment buildings;
18. SSP - Smart Specialisation Programme;
19. LIDP - Lithuanian Innovation Development Programme;
20. LRDP - Lithuanian Rural Development Programme;
21. APLWPRAD - Action Plan of the Lithuanian White Paper on Rural and Agricultural Development;
22. DLSPARD - Draft Lithuanian Strategic Plan for Agricultural and Rural Development.

The general main planning document of the territory of the Republic of Latvia is also being prepared, which provides for the long-term development prospects of the territory of the country. It will become one of the country's key development instruments, with solutions up to 2030 and a proposed vision up to 2050. The projected spatial development orientations focus heavily on climate change mitigation and adaptation[5].

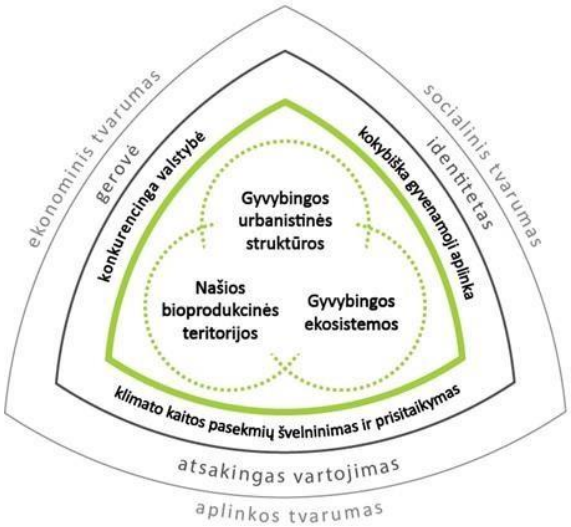


Fig. 1.1.2. Concept of the General Spatial Plan of the Lithuanian Territory

KEY:

Ekonominis tvarumas – economic sustainability *Gerovė – well-being* *Konkurencinga valstybė – national competitiveness* *Socialinis tvarumas – social sustainability* *Identitetas – identity* *Kokybiška gyvenamoji aplinka – High-quality living environment* *Atsakingas vartojimas – Responsible consumption*	*Klimato kaitos pasekmių švelninimas ir prisitaikymas – Climate change mitigation and adaptation* *Gyvybingos urbanistinės struktūros – Viable urban structures* *Našios bioprodukcinės teritorijos – Efficient bioproduction areas* *Gyvybingos ekosistemos – Viable ecosystems* *Aplinkos tvarumas –Environmental sustainability*

[5] http://www.bendrasisplanas.lt/

Energy context

The NEIS has identified four priority areas: reducing the impact on climate change and ambient air pollution, reliability, competitiveness and involvement of the country's businesses in the efforts towards energy progress. Those four areas correlate directly with the main dimensions of the National Plan identified in the Governance of the Energy Union Regulation: decarbonisation, energy efficiency, energy security, internal energy market and research, innovation and competitiveness.

In line with the NEIS, Lithuania has set ambitious targets to make a significant contribution to the Energy Union and the implementation of the policy objectives of the EU energy and climate framework. Lithuania, together with Latvia and Estonia, will synchronise through Poland with a reliable and unified power system of continental Europe by 2025. By 2030, a 45% share of renewable energy in final energy consumption is expected to be achieved (one of the biggest ambitions for the development of RES in the EU), of which 45% in electricity and 90% in district heating will come from RES. Also, at least 30% of consumers will generate electricity for their own use. The share of domestic electricity production in Lithuania will increase from 35% to 70%, while the share of RES in transport will increase to 15% and Lithuania will become the leader in energy innovation in the region.

The NEIS vision for 2050 is advanced energy, generating added-value for the State and the consumer, using low-GHG technologies and clean energy sources, resistant to cyber threats and climate change, and providing energy reliably at competitive prices. In pursuit of the goals set by the United Nations 2030 Agenda for Sustainable Development, the Paris Agreement, the EU's 2030 climate and energy framework, Lithuania's energy sector by 2050 will produce 80% of its energy from clean sources (low GHG and ambient air emissions), supply consumers with energy safely and competitively and contribute to the development of the country's modern economy, its competitiveness and efforts to attract investment. The sources of energy production will consist of renewable energy sources and technologies that ensure the production of energy without polluting the environment. Consumers will be enabled to produce their own energy to meet their needs.

Environmental context

In the last few decades, Lithuania has achieved remarkable progress in the area of environmental protection. Compared with 1990 figures, Lithuania has cut its GHG emissions more than by half, or 57%, which is the largest reduction in the EU-28, while[6] in terms of per capita GHG emissions in 2017 Lithuania had the ninth lowest result in the European Union[7]. It should be noted that these results have been achieved despite the country's economic growth and that the positive downward trends are expected to continue. This creates good conditions for achieving a zero-GHG emission economy in the future.

Lithuania is also among the leading European countries in terms of its share of GHG removals in its forests, behind only Sweden and Denmark in the Union[8]. In 2017, removals in forests accounted for 7.8 million tonnes of CO_2 eq, which is 1/3 of the country's total GHG emissions.

Despite these strengths, Lithuania lags behind the EU countries in the area of tax policy. According to the EC, Lithuania's environmental taxes as a percentage of GDP are considerably lower (1.9% of GDP) than the EU average (2.4% of GDP in 2017). The largest part of the Lithuanian transport fleet consists of almost

[6] https://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics#Trends_in_greenhouse_gas_emissions

[7] https://ec.europa.eu/eurostat/databrowser/view/t2020_rd300/default/bar?lang=en

[8] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20180321-1

1.5 million passenger cars, 69% of which are diesel cars, with an average age of 15 years and average CO_2 emissions of 160-170 g/km. Transport charges are the lowest in the EU and do not take into account the environmental performance of vehicles. Motor vehicles are not taxed in Lithuania on the basis of CO_2 emissions. Incentives for choosing lower CO_2 emission cars are very limited and only started in 2019 in the form of compensations for the purchase of low-emission cars. Lithuanian excise duties on petrol, diesel and other motor fuels are among the lowest in the EU. As the common indirect energy tax rate is amongst the lowest in the EU, [9] the EC recommends introducing new environmentally oriented taxes and increasing existing ones.[10]

Social context

The social context of the National Plan can be described as an indicator of energy poverty. In Lithuania, it reached 28% in 2018, which means that 28% of Lithuanian people believe that their homes are underheated, and despite this figure being highly subjective, Lithuania is one of the EU countries most affected by energy poverty. Accordingly, existing and planned measures relating to energy efficiency, financial support for vulnerable consumers, adequate energy pricing and consumer education and information will be used to address this problem.

The social context of the national plan has been further assessed in terms of the impact on macroeconomic indicators such as GDP and jobs, which is described in detail in Section 5.2. The macro-economic assessment showed that the planned package of policies and measures presented in the National Plan would have a positive impact on the country's GDP, contribute to job growth and raise household incomes in all income groups.

Main targets set in the national plan

The National Plan sets national and EU-level targets for Lithuania in order to contribute to the agreed general EU energy and climate change targets for 2030.

Table 1.1.1. National and EU targets for 2030

Target	EU		Lithuania		Implementation
	2020	2030	2020	2030	2017
GHG reduction targets under the Doha amendment to the Kyoto protocol and Paris Agreement, compared to 1990 level	-20%	At least -40%	EU-level target		- 22% (EU)
GHG reduction targets in the EU Emissions Trading System sectors compared to 2005 level	-21%	-43%	EU-level target		- 29% (EU)
GHG reduction targets outside the EU Emissions Trading System compared to 2005 level	-10%	-30%	+15%	-9%	+0.1% (LT)

[9] https://ec.europa.eu/info/sites/info/files/file_import/2019-european-semester-country-report-lithuania_lt.pdf

[10] https://ec.europa.eu/info/sites/info/files/file_import/2019-european-semester-country-specific-recommendation-commission- recommendation-lithuania_lt.pdf

Target	EU		Lithuania		Implementation
	2020	2030	2020	2030	2017
Share of renewables in gross final energy consumption	20%	32%	23% (under Directive 2009/28/EC) 30% (under NEIS)	45%	24.2% (LT)
Use of renewables in transport	10%	14%	10%	15%	4.3% (LT)
Level of electricity interconnection	10%	15%	EU-level target		23.0% (LT)
Energy efficiency targets - Primary energy consumption in 2003 - Final energy consumption in 2030 - Final energy savings (EED, Art. 7)	20% 1474 Mtoe N/A	32.5% 1273 Mtoe 956 Mtoe	PEC - 6 Mtoe FEC - 4.3 Mtoe 11.67 TWh	PEC - 5.4 Mtoe; FEC - 4.5 Mtoe 27 TWh	PEC - 6.5 Mtoe FEC - 5.5 Mtoe 7.5 TWh (LT)

1.2 Overview of the current policy situation

Energy policy area

Regarding policies and measures Lithuania will follow the objectives of the EU's energy policy which are as follows:

- Implementation of the targets of the EU's climate change and energy policy. The balanced development of EU's renewable energy sources and energy efficiency improvement is encouraged. Obligations related to the development of local and renewable energy sources and energy efficiency improvement after 2020 will be based on the burden sharing principle, which ensures the respective contribution of each EU Member State in the pursuance of the objectives relating to renewable energy sources and energy efficiency improvement on the EU level by 2030.

- Completion of the EU internal energy market. After having been isolated from the EU's internal energy market and networks for a long time, Lithuania supports the EU's infrastructural, regulatory, and financial measures aimed at further integration into the EU's internal energy market, while taking advantage of the benefits it offers in respect to increased energy security, competitiveness, and sustainable development. A fully integrated and effectively functioning internal energy market of the EU is a priority objective of Lithuania.

- Assurance of energy security in the Baltic region. The aim is to implement, as quickly and fully as possible, the provisions of the European Energy Security Strategy and to ensure that the results of the implementation of the measures of this Strategy are regularly reviewed at the EU level.

- Adequate EU long-term financing programming policy. The aim will be to ensure the continuity of the financial instruments of the EU for energy infrastructure and decommissioning of the Ignalina NPP and adequate funding in order to alleviate the financial burden on Lithuanian consumers

- Strengthening of the EU's external energy policy. Strengthening the EU's external energy policy, coordinated action by EU Member States and solidarity in the event of crises also contribute to Lithuania's security and, therefore, efforts will be continued to intensify the EU dialogue with key energy suppliers, notably the US, Canada, Norway and Australia.

Over the last ten years, the Lithuanian energy sector has undergone radical restructuring in order to reduce and ultimately fully eliminate its energy dependence on Russia, which has resulted in unreasonably high resource prices and the use of energy as a political lever. The implementation of the National Energy Independence Strategy (NEIS), structural reforms and strategic projects in the energy sector have increased the diversity of energy supply routes and sources and reduced the cost of energy resources to consumers.

Taking into account these results and the new 2030 EU energy and climate targets as well as new trends in the energy sector, in June 2018 the Seimas approved an updated NEIS, which includes the main national energy policy objectives, directions and their implementation targets for 2030 and a vision for 2050.

Under the renewed NEIS, the continuity of existing policies and orientations in the field of RES and energy efficiency will be maintained, Lithuania's attractiveness for investment will be improved, new technologies that are non-GHG and climate resilient to zero emissions will be implemented, innovation in the energy sector will be promoted and progress in the field of energy will be ensured. From a country importing energy technologies, Lithuania needs to become a country creating and exporting energy technologies.

RES

The development of RES is carried out in accordance with EU and national strategy instruments and legislation. The main orientations and measures for the development of RES are laid down in the updated NEIS and the Law of the Republic of Lithuania on Energy from Renewable Sources, separately for each sector.

In 2018, the share of RES in total final energy consumption was 24.21%, taking into account the statistical transfer of energy to Luxembourg. These results were mainly due to the share of RES in the heat sector, which amounted to 46.50%. The share of RES in electricity production was 18.41% and in transport 4.33%.

Lithuania reached and exceeded the 2020 EU target of 23% as early as 2014, when RES accounted for 23.66% of gross final consumption of energy. Therefore, in October 2017 Lithuania transferred part of the generated surplus to Luxembourg and became the first EU Member State to sign a cooperation agreement on the transfer of statistical quotas for renewable energy sources.

Lithuania plans to attain the target of 45% RES in final energy consumption by 2030. This will be achieved through the organisation of neutral auctions for the allocation of promotion quotas and the widespread deployment of small-scale renewable energy installations owned by private energy consumers and communities. Investment in smart energy systems, including transmission, distribution and storage infrastructure, and in increasing the required balancing capacity are envisaged to successfully integrate larger volumes of renewable energy and a large number of electricity generating customers.

Energy efficiency

One of Lithuania's most important energy priorities is to increase energy efficiency throughout the energy chain, from energy production to energy consumption by final consumers. Energy efficiency improves the financial situation of the country's residents, increases the competitiveness of business, reduces emissions of GHG and ambient air pollutants, and improves ambient air quality. Efforts will be made to make energy efficiency an integral part of everyday activities for businesses and final consumers alike. The target is that

by 2030 Lithuania's energy intensity indicators reach the European Union average and are reduced 1.5 times compared to 2017. In order to achieve this target, it is planned to continue the renovation of inefficient residential and public buildings, to increase consumer education and to improve the energy performance of businesses.

On the other hand, it is important to note the improvement in Lithuania's energy productivity indicator (overall energy efficiency indicator), which shows the country's energy efficiency and allows decoupling of energy consumption and the country's economic growth. In 2017, Lithuania had the best performance among the Baltic States, reaching EUR 4.8/kgoe (EU average energy productivity stood at EUR 8.3/kgoe).

Transport

In the transport sector, fuel and energy consumption increased by 42.4% between 2010 and 2018, while diesel consumption increased by 11% between 2010 and 2018, accounting for 74% of fuel consumption in the transport sector. Road transport accounts for 90% of total fuel consumption in the transport sector. Diesel vehicles dominate public transport fleets and freight transport.

The share of renewable energy sources (RES) in transport fell from 4.6% in 2015 to 3.7% in 2017 due to an increase in energy consumption in transport. The main part of the RES consists of biofuels and only a small part is electricity consumption in railways and trolleybuses.

In order to increase the share of RES and alternative fuels in transport and the efficiency of the transport sector, incentives and obligations will be introduced, which will be laid down in the Law on Alternative Fuels and subordinate legislation. The plan is to reorient public transport fleets and encourage public entities to choose clean vehicles. The aim will be to develop the market for advanced biofuel, to electrify the railways and to prepare infrastructure for the electrification of light vehicles. The concept of biomethane gas use in the transport sector and its implementing measures are being developed. Additional efforts will be made to reduce the consumption of polluting fossil fuels through fiscal measures.

Competitiveness of the energy sector

One of the most important challenges facing the energy sector is to increase the competitiveness of the country's economy and ensure the supply of energy and energy resources at competitive market prices, which would be one of the lowest in the region. In Lithuania, energy and energy resources account for a significant share of industrial costs and household budgets, while in industry the cost of energy in terms of product costs remains high and is 20% higher than the EU average[11]. Lower costs of energy resources and a positive import-export balance of energy resources and technologies would increase the competitiveness of the country's economy. Lithuania needs to reduce energy costs and increase the competitiveness of Lithuanian business, implement more efficient and modern technologies for energy production, supply and consumption, ensure optimal pricing of energy resources, promote liquidity in the energy trade market, improve conditions for energy supply and consumption as well as its reliability and availability. The functioning and long-term development of the energy sector must be based on the principles of sustainable development, while the objectives of the climate change policy must be achieved through the most effective means selected on the basis of cost-benefit analysis.

Climate change management policy area

[11] https://www.ena.lt/energijos-vartojimo-efektyvumas/

The Lithuanian climate change management policy is formulated and implemented in accordance with international agreements: the United Nations Framework Convention on Climate Change ("UNFCCC"), adopted in New York in 1992, which is implemented through country-specific commitments and GHG emission reduction mechanisms; the 1997 Kyoto Protocol establishing two commitment periods: the first commitment period of 2008-2012 and the second period of 2013-2020; the 2015 Paris Agreement[12]; the European Union legislation for the implementation of its climate change and energy targets for 2020 and 2030 ;and the EU's long-term climate change strategy papers defining the EU's vision for a climate-neutral economy by 2050[13].

In order to ensure the implementation of the international agreements on climate change[14] and the targets set in EU legislation for Lithuania, the Seimas of the Republic of Lithuania approved the National Strategy for the Climate Change Management Policy in 2012, which sets short-term objectives and targets for climate change mitigation and adaptation until 2020 and long-term indicative targets and objectives until 2050. Taking into account the results of the implementation of the National Strategy for the Climate Change Management Policy and Lithuania's new EU energy and climate change targets for 2030, and in implementing the long-term objectives of the Paris Agreement and the EU vision of climate neutrality for 2050, the Strategy is being renewed and will enter into force from 2021.

Table 1.2.1. Lithuania's legally binding short-term climate change mitigation targets compared to 1990 and other targets set in the NSCCMP.

Short-term targets		
Description	Target for 2020	2017
GHG emission reduction in the EU ETS sectors	8.5 Mt CO_2 eq	6.3 Mt CO_2 eq
GHG emission reduction in sectors outside EU ETS	15.2 Mt CO_2 eq	14,9 Mt CO_2 eq
Share of renewable energy in gross final energy consumption	23%	24.2%
Reduction of energy consumption	Savings of 11.67 TWh	7.5 TWh (2017)
Financial support	no less than 0.38% of the country's GDP is allocated for the implementation of updated short-term climate change mitigation targets	N/A

To implement this Strategy, in 2013 the Government approved the Interinstitutional Action Plan on the

[12] The 22 December 2016 Law No XIII-184 of the Republic of Lithuania on the Ratification of the Paris Agreement adopted based on the United Nations Framework Convention on Climate Change

[13] 28 November 2018 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank A Clean Planet for all. A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy, COM(2018) 773 final

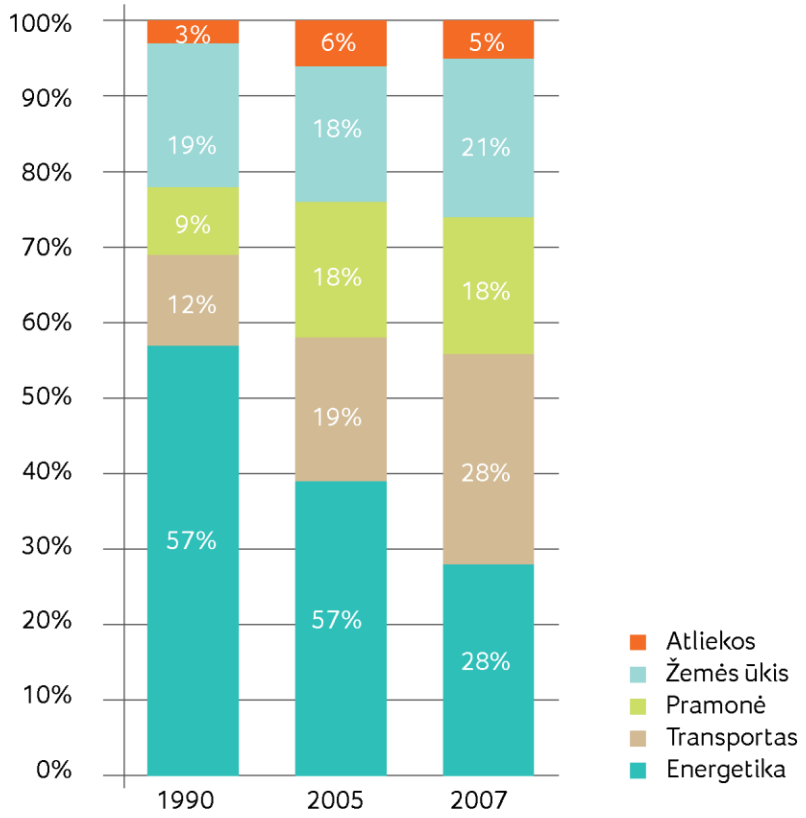
[14] The Doha Amendment to the UNFCCC Kyoto Protocol for the 2013-2020 period

implementation of the targets and objectives for 2013-2020 of the National Strategy for the Climate Change Management Policy, which defines measures for the reduction of GHG emissions and adaptation to climate change in all the sectors of the Lithuanian economy, including: industry, energy, agriculture, residential development, transport, health, waste management, etc.

The measures for the implementation of the objectives and targets of the National Strategy for the Climate Change Management Policy 2021-2030 are included in the Integrated National Action Plan for Energy and Climate Action.

For the implementation of the objectives and targets of the above Strategy, based on the interinstitutional operational plan and other cross-sectoral and sectoral development programs, EUR 2 billion will be invested from the EU structural and investment funds for 2014-2020 and the State budget, under the Climate Change Programme, in the implementation of measures related to climate change mitigation and around EUR 0.9 billion will be invested in the adaptation to climate change in all sectors of the Lithuanian economy in the period of 2014-2020. Sustainable growth of the Lithuanian economy has been ensured due to the growth of national GDP and reduction of GHG emissions (total GHG emissions from all sectors of economy decreased by 9.8% and the country's GDP increased by 36% between 2005 and 2017), as well as the fulfilment of Lithuania's GHG reduction targets established by international agreements and EU legislation.

Since 1990, the structure of GHG emissions has changed as a result of the transformation of the country's economic activity (contraction of the industrial sector and development of the services sector, changes in the energy resources used, etc.) and the measures taken to reduce GHG emissions.



KEY
Waste
Agriculture
Industry
Transport
Energy

Fig. 1.2.1. Lithuanian GHG emissions by sector, %

Administrative structure of implementing national energy and climate policies

Lithuania's energy policy is formulated and its implementation is coordinated by the Ministry of Energy. The development and implementation of the Lithuania's climate change mitigation and adaptation policy is coordinated by the Ministry of the Environment. In formulating the energy and climate policy, both ministries cooperate actively with the Ministries of Finance, Transport, Economy and Innovation, Education, Science and Sport, Agriculture, Health and the Interior, as well as with the relevant committees of the national parliament, municipalities, the Research Council of Lithuania, state research institutions and universities, companies, organisations and other persons. In addition, the National Climate Change Committee has been established for consultations on the development of the Lithuanian climate change policy and coordination of its implementation. The Committee includes 21 representatives of ministries, local authorities, research, industrial and non-governmental organizations, in addition to 20 observers.

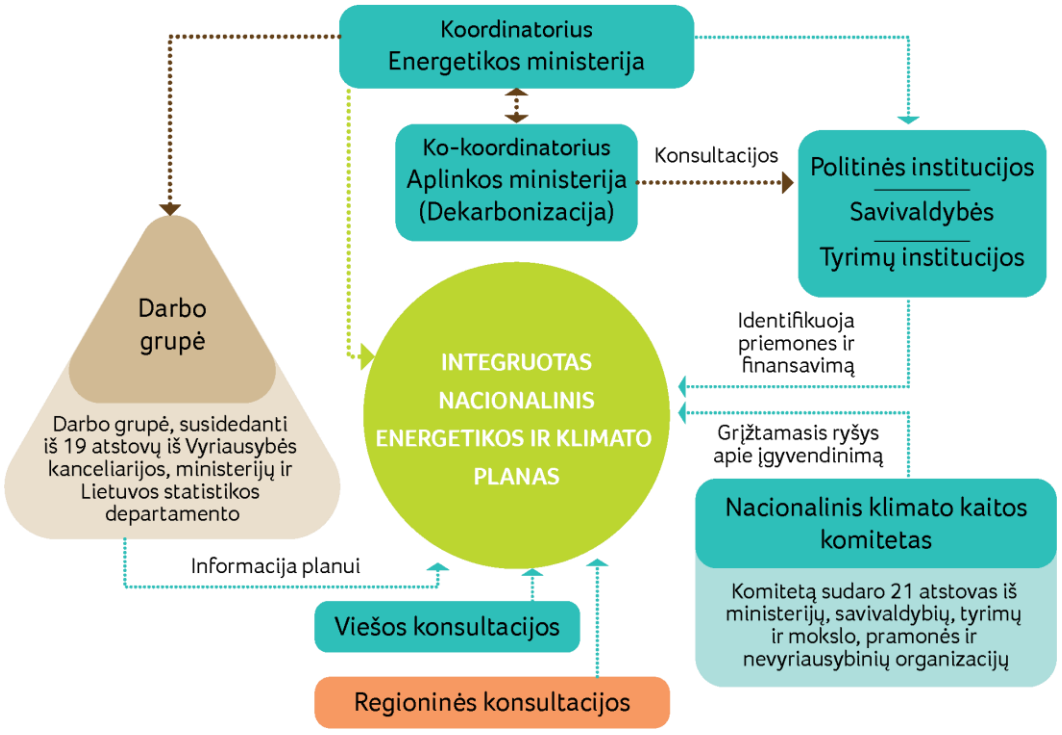
The Lithuanian Parliament (Seimas) approves framework national energy and climate strategies and the Government approves strategy implementation action plans as well as development programmes for all economy sectors. New plans are drawn up every five years or more often if there is a need at national level.

Each year, ministries and institutions in their system draw up strategic plans containing measures with

appropriations for a period of three years. Funds for the projects and measure implementation are allocated yearly from national and local budgets. EU funds, such as the EU Structural and Investment Funds and other targeted funding instruments (such as the Connecting Europe Facility), as well as funds from the National Climate Change Programme account for a significant share of energy and climate investment. It should be noted that revenues from the statistical transfer of RES to Luxembourg will also be invested in renewable energy-related research and renewable energy development in Lithuania. Investment from the Modernisation and Innovation Funds is also expected to make a significant contribution to the achievement of future energy and climate objectives.

1.3 Consultations, involvement of national and Union entities, and the outcome of consultations

The national plan has been drawn up with the involvement of the national parliament, in close consultation with the socio-economic partners, associations and the public. During the preparation of the plan, its draft was presented at various energy conferences in Lithuania and abroad, in regional councils, and discussed with EU Member States in regional and bilateral formats.



KEY

Koordinatorius	Coordinator
Energetikos ministerija	Ministry of Energy
Ko-koordinatorius	Co-coordinator
Aplinkos ministerija	Ministry of the Environment
Dekarbonizacija	Decarbonisation
Konsultacijos	Consulting
Politinės institucijos	Political bodies
Savivaldybės	Municipalities
Tyrimų institucijos	Research bodies

Darbo grupė Darbo grupė susidedanti iš 19 atstovų iš Vyriausybės kanceliarijos, ministerijų ir Lietuvos statistikos departamento Informacija planui Integruotas nacionalinis energetikos ir klimato planas Viešos konsultacijos Regioninės konsultacijos Identifikuoja priemones ir finansavimą Grįžtamasis ryšys apie įgyvendinimą Nacionalinis klimato kaitos komitetas Komitetą sudaro 21 atstovas iš ministerijų, savivaldybių, tyrimų ir mokslo, pramonės ir nevyriausybinių organizacijų	Working group Working group consisting of 19 representatives from the Office of the Government, ministries and Statistics Lithuania Information for the plan National Integrated Plan for Energy and Climate Public consulting Regional consulting Identify measures and funding Implementation feedback National Climate Change Committee The Committee consists of 21 members representing ministries, municipalities, research, scientific and industrial organisations and NGOs

Fig. 1.3.1. Process of preparing the national plan

Involvement of the national Parliament

The national Parliament (Seimas) is directly involved in drafting and implementing the National Plan, adopting legislation and approving the State budget, which allocates funds to ensure the implementation of the objectives of the Energy Union. It should be noted that on 21 June 2018 The Seimas approved the renewed National Energy Independence Strategy, which was the basis for the preparation of the National Plan. In addition, a renewed National Strategy for the Climate Change Management Policy is planned for early 2020.

In preparing the draft National Plan, the Seimas also carried out regular parliamentary control:

- on 28 November 2018, the draft National Plan was presented to the Seimas European Affairs Committee;
- on 22 May 2019, the status of the preparation of the National Plan and the current situation as well as subsequent updating plans were introduced to the Seimas Energy and Sustainable Development Commission;
- on 10 July 2019, the Seimas Environmental Protection Committee discussed the European Commission's recommendations on the draft National Plan submitted to the European Commission in December 2018;
- on 20 November 2019, information on the draft National Plan and progress in drafting it was presented to the Seimas Environment Protection Committee, the Energy and Sustainable Development Commission and the European Affairs Committee.

Involvement of local and regional authorities (municipalities)

Involvement of local and regional authorities is essential for the preparation and implementation of the National Plan. Municipalities make an important contribution to reducing greenhouse gas emissions through the establishment of sustainable urban mobility plans, their participation in the implementation of the Covenant of Mayors, and their contribution to achieving the RES targets set out in the specific plans for district heating. Therefore, a representative of the Association of Lithuanian Municipalities,

representing 60 Lithuanian municipalities and districts, was included in the interinstitutional working group for the preparation of the National Plan. On 22 January 2019, members of the Lithuanian Association of Municipalities, i.e. mayors of cities and districts, were presented with the strategic national orientations in the development of the energy sectors, and municipalities were invited to actively contribute to their implementation. Between September and October 2019, the draft National Plan was presented to 7 of the 10 Lithuanian Regional Development Councils (Alytus, Kaunas, Marijampolė, Panevėžys, Telšiai and Utena), inviting representatives of the municipalities to actively submit comments during the public consultation.

Consultation with stakeholders and the public

Two public consultations with stakeholders and the public were organised in the course of the preparation of the Lithuanian Integrated National Action Plan on Energy and Climate. The first public consultation was conducted in Lithuanian and English from December 2018 to May 2019 over the dedicated national consultation platform *E.citizen*[15]. The updated draft plan was presented to the National Climate Change Committee on 16 June 2019.

The second phase of consultation took place in November 2019 through an online public consultation platform[16] and a series of Climate Change Week events (22–29 November). At these events, social partners and social organisations in each sector were able to discuss issues regarding the National Plan. Over 30 organisations and individuals responded to the public consultation. Following extensive and intensive discussions with the public and stakeholders, the National Plan was complemented by alternative policy measures, which are presented in Chapter 3 for each sector as a separate set of measures. Alternative policy measures have not been taken into account in the calculations in Part B, but will be considered as an alternative to the elements of the PPM scenario prior to their adoption in legislation in order to achieve the national energy and climate policy objectives with the most efficient set of measures.

Consultation with other Member States

Other EU Member States were closely consulted in the preparation of parts of the National Plan dealing with transboundary impacts or requiring regional solutions. This was done in particular through existing regional and bilateral cooperation formats: regular meetings of representatives of Lithuania, Latvia and Estonia in the Committee of Senior Energy Officials of the Baltic Council of Ministers, plenary meetings of the Baltic Energy Market Interconnection Plan Group, described in more detail in section 1.4.

The draft National Plan was also presented at the Nordic-Baltic Energy Conference in Tallinn on 27-28 September 2018[17] and 24-25 October 2019 [18] and the presentation of the German National Plan in Berlin on 9-10 April 2019 was attended.

Progress in the preparation of national plans was discussed at several meetings of the Committee of Senior Energy Officials of the Baltic Council of Ministers held on 31 January 2018, 9 April 2018, 30 October 2018, 18 April 2019, 29 August 2019 and 6 November 2019, also at the meetings of the Baltic Council of Ministers' Environment Ministers held on 23-24 May 2018 and 30-31 October 2019.

[15] https://epilietis.lrv.lt/lt/konsultacijos/viesoji-konsultacija-del-integruoto-nacionalinio-energetikos-ir-klimato-plano
[16] http://epilietis.lrv.lt/lt/consultations/view_item/id.163

[17] Nordic-Baltic stocktaking on the Energy Union and preparations for implementation of the new governance system", 27-28 September 2018, Tallinn.
[18] Good governance, policy design and solutions towards 2030, 24–25 October 2019, Tallinn

Recommendation from the European Commission

On 18 June 2019, the European Commission published recommendations on[19] the draft Lithuanian National Plan submitted to the Commission in December 2018. These recommendations were further discussed with representatives of the European Commission at a meeting on 22 June 2019. The European Commission has recommended that Lithuania should:

- draw attention to the lack of measures to ensure a 9% reduction in GHG emission from sectors not covered by the EU ETS;
- specify the measures needed to achieve the ambitious 2030 RES target and the measures to achieve the 15% RES target in the transport sector;
- increase reductions in final and primary energy consumption in 2030;
- submit plans for the phasing out of fossil fuels;
- provide in the National Plan an analysis of the interaction with air quality and air pollution policies, showing the impact of different scenarios on air pollution;
- reduce the level of energy poverty.

Other recommendations relate to the increased completeness of parts of the National Plan (detailed measures to contribute to energy security, liberalisation of electricity prices), the need for investment, future forecasts, and performance of macroeconomic and social impact assessments.

In the European Semester cycle, the European Commission also assessed Lithuania's energy and climate trends. The 27 February 2019 European Commission's report on Lithuania[20] notes that Lithuania has made substantial progress in improving the security of energy supply, as well as achieving the overall RES and GHG emission targets for the current year. However, reiterating the recommendations for the National Plan, it noted that more effort were needed to meet the energy efficiency target and to increase the share of RES in the transport sector. The European Commission has therefore recommended (among other things) that Lithuania focus on innovation, energy and resource efficiency, sustainable transport and energy interconnections in 2019 and 2020.[21]

The recommendations made by the European Commission were considered in detail by the Lithuanian authorities and taken into account in the final draft of the National Plan. The National Plan has been updated by adding measures to ensure GHG reductions in non-ETS sectors; energy consumption projections for 2030 have been reduced; measures to achieve the ambitious RES target in 2030 have been specified, including the RES target in the transport sector; plans for phasing out fossil fuel subsidies, reducing energy poverty have been identified, etc.

Additionally, the 2021-2027 Operational Programme for investment from European Union Funds, currently being drafted, is directly linked to the implementation of the Commission's recommendations by envisaging investments from EU Funds' in the implementation of the following tasks, for example:

- promotion of energy efficiency measures;
- promotion of renewable energy;
- developing smart energy systems and grids, as well as local energy storage solutions;

[19] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate- plans
[20] https://ec.europa.eu/info/publications/2019-european-semester-country-reports_en
[21] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1560258494533&uri=CELEX%3A52019DC0515

- developing a sustainable, climate resilient, advanced, secure and intermodal trans-European transport network (TEN-T).
- developing sustainable, climate resilient, advanced and intermodal national, regional and local mobility, including improved access to TEN-T and cross-border;
- promoting sustainable mobility and intermodal urban mobility.
- promoting climate change adaptation, risk prevention and disaster resilience;
- promoting biodiversity, green infrastructure in the urban environment and reducing pollution.

1.4 Regional cooperation in preparing the plan

An important element of regional cooperation for Lithuania is the achievement of the EU energy and climate change objectives and the implementation of the Energy Union, mainly the energy security and internal energy market dimensions. The main forms of regional cooperation within which the content of the National Plan has been regularly coordinated are two: the Working Party of the Baltic Energy Market Interconnection Plan ('BEMIP') and the Baltic Council of Ministers.

BEMIP

Lithuania is actively participating in the implementation of the Baltic Energy Market Interconnection Plan. Its main objective is to create a properly functioning and integrated energy market and the necessary energy infrastructure, as well as to achieve a competitive, sustainable and secure energy market in the Baltic Sea region. Currently, a priority project at EU level – the connection of the Baltic States' electricity system to the continental European network for synchronous operation (synchronisation project) - is being addressed in substance.

The issues relating to the development of the regional gas market in the Baltic States and Finland are being coordinated within the Regional Gas Market Coordination Group set up under the BEMIP initiative in 2015, composed of representatives of the Finnish, Estonian, Latvian and Lithuanian ministries, national regulatory authorities, transmission system operators, LNG terminal operators and distribution system operators.

Specific plenary meetings (expert level) of the BEMIP High Level Group took place on 15 April and 16 September 2019 to discuss regional cooperation aspects identified in the National Energy and Climate Change Plans of EU Member States.

Baltic Council of Ministers

The synchronisation project, the project for gas pipeline interconnection between Poland and Lithuania (GIPL), electricity imports from third countries and other relevant issues are regularly discussed and coordinated with regional partners (Latvia, Estonia and Poland) in the Committee of Senior Energy Officials of the Baltic Council of Ministers and bilateral consultations between representatives of Lithuanian and Polish energy ministries, as well as in close cooperation with the European Commission. Progress in the preparation of national plans was discussed at several meetings of the Committee of Senior Energy Officials of the Baltic Council of Ministers on 31 January 2018, 9 April 2018, 30 October 2018, 18 April 2019, 29 August 2019 and 6 November 2019, also at the 23-24 May 2018 and 30-31 October 2019 meetings of Environment Ministers of the Baltic Council of Ministers. At these meetings, the Baltic States agreed that

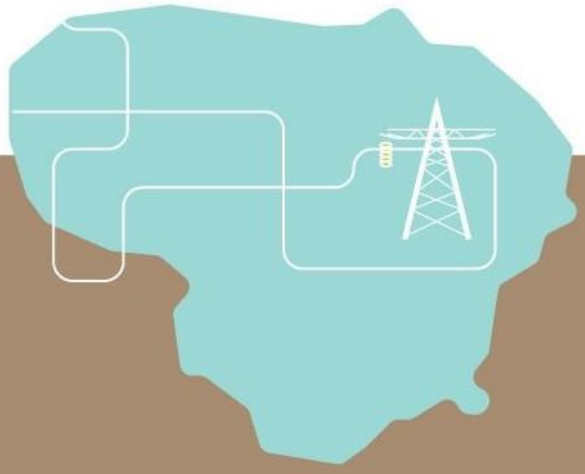
the sharing of information on the National Plans is an important part of the successful preparation and implementation of the plans and therefore close cooperation in the preparation and implementation of the National Plans will continue.

All these elements of regional cooperation are included in the National Plan and are mentioned in more detail in the relevant Chapters 2 and 3.

KEY:

SECTION A: NATIONAL PLAN

A SKIRSNIS:
NACIONALINIS
PLANAS



2. NATIONAL OBJECTIVES AND TARGETS

2.1 Dimension Decarbonisation

2.1.1 GHG emissions and removals

Lithuania is implementing GHG emission reductions on the basis of the National Strategy for the Climate Change Management Policy (hereinafter referred to as 'NSCCMP'), which sets short-term (until 2030), indicative medium-term (until 2040) and long-term (until 2050) targets and objectives for climate change mitigation.

Lithuania signed and ratified the Paris Agreement in 2016. Under the Agreement, Lithuania, together with the EU and its Member States, has made a binding commitment to reduce GHG emissions from all sectors of economy by at least 40% by 2030, compared to 1990, using EU's internal efforts.

In sectors covered by the EU Emissions Trading System (EU ETS), in which Lithuanian operators participate together with operators from other EU Member States participating in the EU ETS, emissions must be reduced by 43% compared to the 2005 levels.

Non-ETS sectors (transport, agriculture, waste management, industrial enterprises engaged in other activities or fuel burning installations with boilers with installed capacity below 20 MW (small district heating enterprises), public sector buildings, households, fisheries, construction, services and other sectors) will have to comply with Lithuania's annual emission reduction limits (t CO_2 eq.) and achieve at least a 9% reduction in 2030 compared to 2005.

Lithuania's strategic objective in climate change mitigation is to ensure sustainable development and to make sure that the national economy grows fast and GHG emissions decrease; and, together with the EU and its Member States, to pursue the long-term objectives of the Paris Agreement on temperature stabilisation through socially equitable, competitive, innovative technology-based and cost-effective restructuring of all sectors of the economy, with a view to neutralising the impact of GHG by 2050. The assessment criterion to be applied in the monitoring of this strategic target is the quantity of GHG emissions per GDP unit (t CO_2 eq/EUR 1 million GDP).

Implementation of the strategic objective of climate change mitigation will aim:

- To contribute to the EU's short-term climate change mitigation targets by 2030: to reduce GHG emissions by at least 40% by 2030 compared to 1990 through an internal EU effort.; to reduce GHG emissions in sectors covered by the EU ETS by 43% and in sectors not covered by the EU ETS by at least by 30% compared to 2005;

- To ensure implementation of Lithuania's short-term climate change mitigation targets by 2030: together with operators from other EU Member States, to reduce GHG emissions in sectors covered by the EU ETS by 43% compared to 2005 and to reduce GHG emissions in sectors outside the EU ETS by 9% compared to 2005; to ensure that at least 0.9% of the country's GDP is allocated to the implementation of short-term climate change mitigation targets in 2030 and that the share of the population contributing to environmental protection is at least 50% in 2030;

- To ensure the implementation of Lithuania's main indicative medium-term and long-term climate change mitigation targets: in the medium term, to reduce GHG emissions by 70 per cent compared

to 1990, and in the long term, to reduce GHG emissions by 80 per cent compared to 1990 and to cover 20 per cent with sinks from LULUCF.

GHG emissions in sectors outside the EU ETS are to be reduced by 9%. In the waste sector, at least a 40% GHG emission reduction compared to 2005 is to be achieved through reduction and efficient waste management. In the sector of non-centralised energy production (small combustion plants) and use (households, services, etc.), a reduction of at least 15% in GHG emissions compared to 2005 is expected. For other sectors, a uniform GHG reduction target of 9% has been set. Transport and industry will be the most challenging sectors, as they need to cut their GHG emissions by more than a third (see Table 2.1.1.1).

Table 2.1.1.1. Relative GHG emission reduction targets for individual non-ETS sectors in 2021–2030, %

Non-ETS sector	Average annual change (from the 2016-2018 average until 2030), %	Target compared to 2005, %
Transport	-3.6	-9.0
Agriculture	-1.3	-9.0
Industry (including industrial combustion)	-3.9	-9.0
Waste management	-0.9	-40.0
Sectors of non-centralised energy production (small combustion plants) and use (households, services, etc.)	-0.9	-15.0
Total non-ETS sectors	**-2.3**	**-9.0**

Meanwhile, the land use, land use change and forestry sectors (LULUCF) have been included in the EU's reduction targets for the period 2021–2030 as a flexibility instrument. Lithuania will be able to offset 6.5 million tonnes of CO_2 eq to meet the GHG emission reduction target for sectors not participating in the EU ETS through the LULUCF Flexibility Instrument for the period 2021–2030 if GHG removals in the LULUCF sector is higher than the emissions from the said sector. In the case of GHG emissions from the LULUCF sector, they will have to be covered by annual GHG allowances of non-ETS sectors.

Given the importance of climate change management and in order to maintain a leading position at international level in the fight against climate change, the EU aims to neutralise the effects of GHG emissions by 2050.

The policy vision for climate change management foresees that by 2050 Lithuania will have achieved climate neutrality of its national economy, ensured the resilience of the sectors and ecosystems of the national economy to the environmental changes brought about by climate change and developed a competitive, socially just low-carbon economy through sustainable financing and investment, created new green jobs, introduced eco-innovation technologies, achieved an increase in the efficiency of energy generation and consumption as well as the use of renewable energy sources in all sectors of the national economy (energy, industry, transport, agriculture etc.).

Short-term (until 2030), indicative medium-term (until 2040) and long-term (until 2050) targets and objectives for climate change adaptation are set out in the NCCPs. The strategic objective of the Lithuanian policy for the adaptation to environmental changes caused by climate change is to reduce the existing and

potential sensitivity of the country's ecosystems and national economy and to strengthen the capacity to adapt through the introduction of measures, cost-effective reduction of risks and damage, the preservation and improvement of resilience to climate change, in order to ensure the creation of favourable conditions for the sustainable development of public life and economic activities.

Implementation of the strategic objective of climate change will aim to:

- provide all residents living in flood risk areas with flood protection equipment in 2030;
- to keep the share of climate-related economic losses per year within 0.08% of the national GDP;
- to make sure that by 2030 the share of foreseen dangerous, natural and catastrophic meteorological phenomena in the total number of actual phenomena would be at least 89%.

The strategic objective of climate change adaptation will be implemented through measures in climate sensitive sectors (agriculture, energy, transport, industry, forestry, ecosystems and biodiversity, landscape, public health, water resources and coastal area, urbanised areas, etc.). These measures are described in more detail in Section 3.1.1. .

2.1.2 Renewable energy

Lithuania's commitment to achieve 23% of RES in final energy consumption in the EU by 2020 was met as early as 2014. Lithuania is implementing the development of RES on the basis of the NEIS, which sets long-term energy targets. The strategy sets targets for the share of RES in gross final consumption of energy and in the heat, transport and electricity sectors by 2050 (Table 2.1.2.1). It should be noted that achieving the 2030 targets requires full implementation of the planned policy measures as described in Sections 3.1.2. and 5.1.

Table 2.1.2.1: RES share in gross final consumption of energy and in relevant sectors

	2017	2018	2020 [22]	2020 [23]	2022	2025	2027	2030	2050
RES share in gross final energy consumption,%	26.04	24.21[24]	–	30	32.70	36.45	39.75	45	80
RES-E share in final energy consumption in electricity sector, %	18.25	18.41	21.29	30	25.55	31.48	36.70	45	100
RES-T share in final energy consumption in transport sector[25]	4.29	4.33	4.33	10	6.69	9.23	11.46	15	50
RES share in heat and cooling sectors[26]	46.50	47.30	50.9	–	53.9	63.1	66.9	67.2	–
Of which RES share in DH	68.7	67.5	71.7	70	78.8	89.3	91.3	90	100
A reference point of the total increase in the share of energy from renewable sources between the respective Member State's binding 2020 national target, and its contribution to the 2030 target, %	–	–	–	–	18	43	65	–	–

Given that from 2015 there was no RES-E development due to the achievement of the targets set by Lithuania in 2020 and it was only renewed in 2019 by holding the first technologically neutral auction, the 30% target set by the NEIS will not be achieved in 2020; therefore, in setting Lithuania's obligations, the RES-E is specified taking into account the electricity generation volume for 2020, forecast in the light of the current situation. The integration of renewable energy sources into the transport sector is inefficient and too slow, and a Law on Alternative Fuels currently being drafted and the transposition of Directive 2018/2001 are expected to speed up the process.

From a historical perspective, the increase in the share of RES in gross final consumption of energy will be mainly influenced by the growth of RES in the heating and cooling sector, which makes the largest contribution to gross energy consumption (Table 2.1.2.2).

[22] Expected achievement.

[23] NEIS target

[24] Taking into account statistical transfer to Luxembourg

[25] The RES-T objectives are pursued by reference to the energy content of transport fuels, without applying the multipliers laid down in Directive 2018/2001.

[26] As the NEIS does not establish an overall objective for RES in the heating and cooling sectors, a projected value following the implementation of all planned policy measures is specified here.

Table 2.1.2.2. RES contribution of each sector to final energy consumption, 2018, ktoe and %

	ktoe	%
Gross final RES consumption in the heat and cooling sector	1166.9	80.8
Gross final RES consumption	197.6	13.7
Gross final RES consumption in transport sector	79.8	5.5
Total consumption of RES	1444.4	100

The share of RES in gross final consumption of energy is to be achieved by increasing the share of RES in the electricity, transport and heating/cooling sectors.

Electricity sector

As of 2015, following the allocation of the full promotion quota provided for in the Law on Energy from Renewable Sources for the period until 2020, support to RES-E was suspended, resulting in a slight slowdown in the development of RES-E. In 2018, the share of RES-E in final energy consumption was 18.41%, and new promotional auctions to promote the development of RES-E were launched at the end of 2019, and therefore their outcome is likely to be visible only in 2023, when the winners of the auction will build the power plants and start generating electricity. The main measures used in Lithuania to promote the development of RES-E by 2020 are financial incentives for prosumers, which will have a negligible impact on the development of RES-E, and it is therefore likely that the 30 % target set by the NEIS will not be achieved in 2020.

The objective set for 2030 is to increase the share of RES-E in gross final electricity consumption to 45%. Wind energy is expected to remain the main resource for electricity generation, accounting for at least 70%, while solar energy will account for 3%, biofuels 9%, hydropower 8% and biogas 2% (Table 2.1.2.3).

Table 2.1.2.3 Trajectory of projected RES-E with planned policies and measures, ktoe[27]

	2020	**2022**	**2025**	**2027**	**2030**
Final electricity consumption, ktoe	897	863	850	844	878
Hydropower plants, ktoe	42.6	42.6	42.6	42.6	42.6
Wind power plants, ktoe	98.4	98.4	247.1	307.3	382.5
Solar power plants, ktoe	5.9	7.4	36.6	62.4	74.0
Biofuel power plants, ktoe	25.1	47.5	50.1	50.1	47.5 50.1

[27] Estimates based on the objectives in Table 2.1.2.1 of Chapter 2.1.2

Biogas plants, ktoe	10.9	10.9	10.9	10.9	10.9
Cogeneration power plant for industrial and municipal waste	7.2	20.7	20.7	20.7	20.7
RES-E, ktoe	190.1	227.5	384.8	445.0	520.2

For the period from 2020 to 2030, it is estimated that investments in wind and solar power generation plants will be most attractive to investors due to their economic attractiveness and easy installation.

The share of RES-E will be pursued by maintaining existing generating capacities, modernising them and installing new ones (Figure 2.1.2.4).

Lithuania has been developing RES since the construction of the first hydro and wind power plants in 2002.

Given that hydropower plants have a useful life of between 30 and 50 years, it is estimated that they will not require modernisation in the 2020–2030 period. Also, taking into account the fact that the development of hydroelectric power plants in Lithuania is limited by environmental legislation, it is estimated that the development of these plants will not take place in the period 2020-2030.

Wind power plants have a useful life of around 20 years and 40 plants with a total installed capacity of 163.71 MW should be upgraded in order to maintain the existing capacity until 2020. The increase in wind power plant capacities could start in 2023 if wind power plants win the auction launched in September 2019. The total installed capacity of new wind power plants is estimated to increase to 1,322 MW between 2020 and 2030.

In 2003, the first biogas plants started operating, with a useful life of 15 to 20 years. In this context, 14 biogas plants with a total installed capacity of 14,886 MW should be modernised in order to maintain their existing capacities. Given that biogas use is expected to be transport-oriented, it is estimated that the development of these power plants in the electricity sector will not be carried out in the 2020-2030 period.

In 2007, the construction of the first biomass power plants, having a useful life of around 15 years, began. In this context, 9 biomass plants with a total installed capacity of 73.46 MW should be modernised in order to maintain their existing capacity. An increase in the capacity of new biomass power plants is expected in 2021 once the biomass power plant currently under construction is launched.

The expansion of solar power plants started in 2011 and it is estimated that they will not require modernisation in the 2020–2030 period given their useful life of around 20 years. Active energy consumers will be the main contributors to the development of new solar power plants. The installed capacity of solar power plants is expected to increase to 117 MW between 2020 and 2030.

Table 2.1.2.4. RES-E electricity generation capacity[28]

	2020		2021-2022		2023-2025		2026-2027		2028-2030	
	Upgraded	New	Upgraded	New	Upgraded	New	Upgraded	New	Upgraded	New
Wind power plants, MW	–	–	0.16	–	1.025	692	51.87	280	110.41	350
Hydropower plants, MW	–	–	–	–	–	–	–	–	–	–
Solar power plants, MW	–	–	–	18	–	339	–	300	–	135
Biomass power plants, MW	–	–	5	73	29.75	5	18.71	–	20	–
Biogas power plants, MW	–	–	0.185	–	4.077	–	–	–	10.624	–

Similarly, in order to promote active consumers of electricity (for details see Section 3.2), able to use the electricity generated for their own needs and to and receive market-based compensation for the surplus power supplied to the grid, active participation of local communities in making investments in co-ownership of RES installations will be promoted. The NEIS has ambitious targets for the development of active electricity consumers:

- 2% compared to the total number of consumers by 2020;
- 30% compared to the total number of consumers by 2030.

Transport sector

The transport sector is aiming at a gradual shift towards cleaner fuels and electricity, and therefore, in line with the EU's commitments, the aim is to achieve a 10 per cent RES share by 2020 and a 15 percent RES share by 2030 (Table 2.1.2.5). However, Lithuania, like other Member States, is struggling to achieve the RES-T target for 2020 due to relatively high investment in the renewal of the vehicle fleet, which consists mainly of almost 1.5 million cars, 69% of which are diesel cars, with an average age of 15 years.[29] For this reason, it is likely that the 2020 target will not be achieved by 2020 and the share of RES-T will be around 5 per cent.

More active steps are now being taken to promote the growth of the share of RES-E, with higher mandatory blending rates coming into force on 1 January 2020, and the drafting of the Alternative Fuels Law, which will set out the guiding principles for promoting the use of alternative fuels and less polluting vehicles. The focus will be on the use of advanced liquid and gaseous biofuels of generation II and the electrification of the vehicle fleet and the rail system. The said Law also seeks to establish a clear long-term perspective for market participants in the transport sector and to provide alternatives for the transitional period.

[28] The outcomes of the PPM modelling scenario are presented, assuming the implementation of all planned policy measures
[29] Data from VĮ Regitra.

Table 2.1.2.5. Estimated trajectories of energy production from RES by technology in the transport sector, without applying the multipliers laid down in Directive 2018/2001, ktoe[30]

	2020	2022	2025	2027	2030
Projected consumption in road transport, ktoe	1932	1791	1621	1488	1253
Bioethanol, ktoe	17.5	17.1	15.7	14.2	10.9
Biodiesel, ktoe	70.5	68.8	54.9	43.9	25.6
Biogas, ktoe	–	–	14.6	41.7	81.5
Electricity RES, ktoe	1.6	3	14.7	28.5	56.9
RES-T, ktoe	89.6	88.9	99.9	128.3	174.9

Heat and cooling sector

The most important goal for Lithuania in the heat sector is a consistent and balanced upgrading (optimisation) of district heating systems, ensuring efficient heat consumption, reliable and economically attractive (competitive) supply and production, enabling the introduction of modern and environmentally friendly technologies, using local and renewable energy sources and ensuring flexibility of the system and a favourable investment environment. In line with good practices in EU countries, Lithuania needs to promote transition to the fourth generation (4G) district heating by integrating solar power plants into the district heating networks and promoting the use of surplus and waste heat for heating buildings.

In Lithuania, the district heating system is an integral part of the overall energy sector, closely linked to the electricity system, fuel supply and other systems in terms of technological and energy flows. All Lithuanian cities have well-developed district heating systems, which supply heat to about 53% of all buildings in the country and 76% in the cities.[31] The main consumers of district heating services are residents living in multi-apartment buildings.

The total installed capacity of heat generating installations in the district heating systems is 9,582 MW. Lithuania will aim at a 90% share of district heating from renewable and local energy sources in total district heating by 2030. Private households are projected to consume 647 ktoe of fuel in 2020 and 643 ktoe in 2030 for heating purposes.

The efficiency of heat and hot water production technologies in the decentralised sector is relatively low and there is considerable potential for energy savings. Conversion of primary energy sources is also possible in this sector, which can significantly improve access to heating for residents and encourage more efficient use of renewable energy sources, some of which could be used in other sectors.

The combined share of RES in the heating and cooling sector will reach around 50% by 2020, with heat produced from local biofuels accounting for the largest share. Additional policy measures (such as the deployment of solar and heat pumps, low temperature heating, use of waste heat) are expected to reduce the demand for all fuels as energy efficiency increases and centralisation of decentralised heat generation continues. Due to the specificity of the building stockpile, the energy demand of the cooling sector in Lithuania is negligible. As the share of new buildings with cooling systems in the national building stockpile

[30] Outcomes of the PPM modelling scenario under the assumption that all planned policy measures will be implemented
[31] https://lsta.lt/wp-content/uploads/2019/10/LSTA_apzvalga_2018.pdf

increases, energy demand in this sector is likely to increase.

Table 2.1.2.6. Estimated trajectories of energy production from RES by fuel type in the heating and cooling sector, ktoe[32]

	2020	2022	2025	2027	2030
Energy demand for decentralised heat generation	1303.0	1337.1	1506.0	1535.1	1506.0
Decentralised heat production from RES	647.2	630.0	627.9	645.3	643.0
Coal for decentralised heat production	183.5	179.3	138.4	95.8	88.8
Petroleum products for decentralised heat production	144.5	143.5	138.0	130.9	129.0
Use of natural gas for decentralised heat production	554.5	539.8	522.2	510.6	495.8
Energy demand for district heating	1,072.8	1,028.0	952.1	916.8	876.6
Heat for district heating, originating from RES	655.8	707.1	878.0	889.8	863.0
District heating, incl. Waste heat	904.1	868.3	828.8	709.9	764.2
District heating for own needs	9.2	8.9	8.5	8.2	7.8
District heating loss on the supply line	117.6	113.0	108.0	104.1	99.4
Share of energy from renewable sources in total heat supply, %	**50.9**	**53.9**	**63.5**	**66.9**	**67.6**
Share of energy from renewable sources in district heating, %	**71.5**	**78.7**	**86.9**	**91.3**	**90.9**

Lithuania's targets in the heating and cooling sector are ambitious, but are closely linked to energy efficiency – energy demand will go down both in both decentralised and district heating by 2030. New technologies (heat pumps, modern biofuel boilers, etc.) and renovation of multi-apartment buildings will have a major impact. If the planned additional measures are implemented, a higher share of RES in heating and cooling than currently foreseen may also be achieved. It should be noted that the achievement of the 2030 targets requires full implementation of the planned policy measure, as described in sections 3.1.2. and 5.1.

According to Directive 2018/2001/EU[33] of 2018 on the promotion of the use of energy from renewable sources (RED II), Lithuania has assessed the necessity to build new infrastructure for district heating and cooling produced from renewable energy sources in order to achieve the national target. In accordance with the above Directive, in order to promote the use of renewable energy in the heating and cooling sector, each Member State should endeavour to increase the share of renewable energy in that sector by an indicative 1.3 percentage points as an annual average calculated for the periods 2021 to 2025 and 2026 to 2030, starting from the share of renewable energy in the heating and cooling sector in 2020, expressed in terms of national share of final energy consumption and calculated in accordance with the methodology set

[32] Outcomes of the PPM modelling scenario under the assumption that all planned policy measures will be implemented
[33] https://eur-lex.europa.eu/legal-content/LT/TXT/HTML/?uri=CELEX:32018L2001&from=EN#d1e2914-82-1

out in Article 7, without prejudice to Article 23(2) of the Directive. That increase should be limited to an indicative 1.1 percentage points for Member States where waste heat and cooling are not used. Member States should, where appropriate, give priority to the best available techniques. When calculating its share of energy from renewable sources in the heating and cooling sector and its annual average increase in accordance with that share, each Member State:

- may include waste heat and cooling up to a maximum of 40% of the average annual increase;
- where its share of energy from renewable sources in heating and cooling is higher than 60%, may count any such share as fulfilling the average annual increase;
- here its share of renewable energy in the heating and cooling sector is above 50% and up to 60%, may count any such share as fulfilling half of the average annual increase.

The centralised cooling energy supply network is not developed in Lithuania. Residential and commercial premises are cooled on an individual basis for the production of cooling energy using electricity. The preliminary annual cooling energy demand in Lithuania is estimated at 5 to 6 TWh. The demand was established on the assumption that the cooling demand in Lithuania is ~60 kWh/m^3 per year, taking climatic conditions into account, but in order to develop this sector it is necessary to consider that this would only be useful if only buildings already equipped with a centralised (common mechanical) ventilation system, i.e. offices, shopping centres and new high-energy multi-apartment buildings, were connected to the network, as investments in old multi-apartment buildings would be unreasonably high in order to benefit from centralised cooling energy supply. In that case, the annual cooling energy demand would be reduced to 2-3 TWh.

Priority axes for improving regulatory market conditions in the heating sector for the period 2021–2030:

- The establishment of a regulatory environment conducive to attracting investment and providing a non-discriminatory environment for all actors in the district heating market;
- Increasing transparency in the biofuels market;
- Promoting the supply of heat produced by district heating, in buildings and giving priority to urbanised areas in order to reduce air pollution;
- Assessment of the current situation and the prospective evolution of heat supply in the decentralised sector, with rational development trends, taking into account changes in heat production technologies that increase the efficiency of heat production and consumption;
- Assessment of the current situation in the cooling energy sector, performance of a prospective analysis and setting guidelines for the most rational solutions for cooling energy provision.

Technical tasks for solution implementation:

- Feasibility assessment and, where economically justified, introduction of waste heat collection and use technologies, technologies using solar and heat energy, heat pumps, low-temperature heating and heat storage facilities for district heating;
- Introduction of a remote metering system for district heating;

- Rational development of high-efficiency cogeneration plants to increase the availability of local electricity generation;

- Timely upgrading (when replacement or building of new ones is no longer justified economically and/or due to environmental aspects) of:
    a. existing biofuel combustion plants or, where economically justified, cogeneration installations, with a view to maintaining the balance of renewable energy sources;
    b. existing heat transmission installations and their systems in order to reduce heat losses and to allow optimal development of the heat transmission network;
    c. heating facilities in buildings and/or heating and hot water systems, providing technical conditions, where economically justified, for individual regulation of heat consumption by each consumer.

The market for biofuels

The Lithuanian heat sector is becoming increasingly dependent on factors forming the Lithuanian biofuel market as it moves towards renewable energy. The Lithuanian Law on the Energy Resources Market stipulates that heat suppliers, participants in the heat auction and joint heat and power producers using biofuels to produce electricity and/or heat must give preference to the energy resources exchange by purchasing all the quantities of biofuels needed to produce electricity and/or heat.

In the second quarter of 2019, the Lithuanian biofuel market had 46 DH enterprises, 18 independent heat producers (IHP) and 98 biofuel suppliers. The biofuel exchange Baltpool had 420 participants, including 41 DH companies and 34 IHPs. Concentration of the Lithuanian biofuel market, according to the Herfindal-Hirschman Index (HHI) in terms of the volume of biofuel sold by biofuel suppliers, is low. The concentration level in the biofuel market since 2015 Q2 did not exceed 1,000 under the HHI (the market is considered to be competitive with an HHI below 1,500).

The State authorities supervising competition and formulating competition policy in the energy sector must strive to keep the level of concentration in the Lithuanian biofuel market to a minimum, which means that it is important for the State that, in the national biofuels market:

- the concentration level under the HHI remains below 1,000;

- the biofuel supplier with the largest market share and its affiliated undertakings do not hold more than 20% of the total biofuel market share and three-fourths of the biofuel market consist of products of at least 15 unrelated suppliers;

- the balance between domestic production of biofuels and imports of biofuels from third countries is sustainable and optimal, allowing a high level of competition and low market concentration to be maintained in the long term;

- promote the use of biofuels produced and supplied in an ecological and sustainable manner (certificates confirming best forest management practices to ensure product quality and sustainability throughout the biofuel production and supply chain).

Currently, indigenous biofuels are used, which are purchased by DH companies via the biofuel exchange

Baltpool.[34] Depending on the price situation in the market, price increases create an incentive to import biofuels from third countries where they are cheaper, such as Belarus.

Table 2.1.2.7. Estimated trajectories of heat production from RES, ktoe[35]

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Firewood and wood waste for fuel (DH)	640	640	715	715	715	752	752	752	752	752	752	752	752
Firewood and wood waste for fuel (decentralised heat production)	637	660	675	666	654	642	636	625	615	605	595	595	594
Total:	**1277**	**1300**	**1390**	**1381**	**1370**	**1394**	**1388**	**1377**	**1366**	**1356**	**1347**	**1346**	**1345**

On the basis of the submitted data on biofuel demand modelling, the Ministry of the Environment carried out an expert assessment and instructed the Ministry of Energy[36] that, given the expected increase in the demand for wood and fuel wood waste (by roughly 100 ktoe per year until 2030, compared to 2018), such quantities would easily be satisfied from local resources merely by starting to use the forests reserved for the restoration of property rights, also through more extensive and efficient use of the wood resources currently cut (logging waste, etc.).

The Ministry of the Environment also noted that imports of biofuel products (granules, chips, sawdust) increased by an average of 50 tonnes each year (mainly from Belarus), but that these products were not used exclusively for energy purposes (production of panels, etc.). If imports of wood fuel fall drastically and all quantities have to come from local sources, there may be a need to increase the volumes of felling, but the principle that the amount of timber harvested must not exceed the annual increment and must be in line with the principles of sustainable forest management will in any case be observed. It was also noted that an increase in the demand for wood for energy purposes would not change the ratio of wood used in industry to energy.

As regards the impact of the use of biomass from forests on the GHG absorption of LULUCF, it should be noted that the LULUCF Regulation (EU) 2018/841 does not restrict a country's need and potential for using wood for the production of biofuels. The ratio between wood used for the production of products and wood used for energy purposes is fixed only for the purpose of calculating the reference level (forecasting future production of harvested wood products). If, in the future, due to the demand for biofuels, greater volumes of domestic wood harvests are used for energy production in one way or another and less wood is used for the production of products, this will have an impact on the reduction in GHG removals in the category of wood harvested. It is noted that the supply of biomass from logging waste for energy purposes will have no impact on GHG absorption in the LULUCF sector since felling residues are not accounted for separately again; the total volume felled is included in the calculation of the volume change and the calculation GHG absorption/emissions due to respective volume change. In the light of the above, it can be concluded that no significant impact on the LULUCF sector is foreseen.

2.2 Dimension Energy efficiency

[34] https://www.baltpool.eu/en/

[35] Projection of the demand for RES in heat production, presented by the Ministry of Energy to the experts of the Ministry of the Environment on 5 September 2019, which served as a basis for the assessment of the adequacy of local biofuel resources.

[36] 2 October 2019 Letter No (12)-D8(E)-2416 of the Ministry of the Environment

Increasing energy efficiency is one of the key priorities in the energy area until 2050 and is enshrined in the National Energy Independence Strategy adopted in 2018. Lithuania attempts to continuously and consistently increase energy efficiency, introduce new and less energy-intensive technologies, increase consumer awareness and alter consumer behaviour. The industry, building and transport sectors have the greatest potential for energy efficiency improvement in terms of the cost-effectiveness of efficiency measures. The main objective of the Strategy in the field of energy efficiency is to ensure that by 2030 primary and final energy intensity is 1.5 times and by 2050 about 2.4 times below the 2017 level. The main sectors with the highest energy-intensity are transport, services, households and industry, and their consumption projections are presented in Table 2.2.1. It should be noted that achieving the EE targets for 2003 requires full implementation of the planned policy measure, as described in sections 3.2 and 5.1.

Table 2.2.1. Primary and final energy consumption projections up to 2030, ktoe

	2017	2020	2022	2025	2027	2030
Primary energy consumption	6,461	6559	6429	6087	5836	5461
Final energy consumption	5342	5570	5328	5045	4837	4526
Industry	1028	1061	1022	978	949	933
Transport	2071	2236	2112	1959	1832	1600
Services sector	634	650	632	587	569	540
Households	1,456	1469	1408	1369	1342	1308

The NEIS identifies the following EE targets for 2030 and 2050:

- to reduce primary and final energy intensity 1.5 times by 2030, compared to 2017;
- to reduce primary and final energy intensity 2.4 times by 2050, compared to 2017.

In order to achieve those targets, Lithuania has identified the following priorities:

- To promote integrated renovation of multi-apartment and public buildings (giving priority to renovation of residential neighbourhoods) and save 5-6 TWh of energy by 2030.
- To rapidly develop energy-efficient and energy-efficient industries and deploy and purchase state-of-the-art and environmentally friendly technologies and equipment.

To increase energy efficiency in the transport sector by renewing the vehicle fleet, moving to modern and efficient public transport, optimising transport and alternative fuel infrastructure, electrifying it or using alternative fuels.

In line with the requirements of Article 7 of the Energy Efficiency Directive (EU) 2018/844, a binding target for Lithuania for the year 2030 has been calculated. According to the available Eurostat data, the final energy consumption was 5,099 ktoe in 2016, 5,347 ktoe in 2017 and 5,549 ktoe in 2018 according to Statistics Lithuania. The average three-year final energy consumption in Lithuania is 5,331 ktoe. The binding target for 2030 is 27.279 TWh.

As the buildings sector accounts for a significant share of final energy consumption, Lithuania is making considerable efforts to improve the energy performance of buildings. Around 5,000 multi-apartment buildings, or 750,000 m^2 in building area, are expected to be refurbished by 2030, saving about 5.5 TWh of energy. Efforts will also be devoted to the renovation of public buildings. According to 2018 data, Lithuanian central government authorities owned about 2.3 million m^2 of buildings. Reform of the central government buildings sector is underway and the volumes of renovation of public buildings are growing. The total area of central government buildings is projected to decrease to 1.8 million m^2 by 2021. The obligation imposed by Article 5 of the Energy Efficiency Directive to renovate 3% of central government buildings annually by

2030 would amount to about 510 000 m^2.

Lithuania is currently developing a long-term national strategy for the renovation of the public and private residential and non-residential building sector, which includes an overview of the existing building stockpile, the identification of technical, economic and physical measures and methods, and an implementation plan to convert all public and private residential and non-residential buildings to near zero-energy buildings by 2050.

2.3 Dimension Energy security

Based on the strategic objective of integration into the energy systems of the European Union and promoting harmonious, competitive and efficient development of the energy sector, efforts are being made to implement the essential elements of the NEIS, namely energy independence, competitiveness and sustainable development. By becoming an EU member in 2004, Lithuania joined the single EU framework, becoming part of the EU's single economic market, which enabled r rapid growth of the Lithuanian economy and other areas of national significance. However, in the energy context, the conditions remain almost unchanged as Lithuania has remained systematically and infrastructurally linked to the Russian energy system. Following the definitive closure of Unit 2 of Ignalina Nuclear Power Plant on 31 December 2009, Lithuania's dependence on a single external energy supplier has been further reinforced. Considering that it did not have energy interconnections with the EU mainland and that all natural gas and most of electricity were purchased from a single monopolistic supplier, Lithuania started implementing infrastructure projects of regional importance to interconnect the Lithuanian and EU energy systems. The goal is therefore to continue the activities undertaken, to make proper use of the potential of projects of strategic importance that have been completed or are still in progress, in particular through integration into the energy systems of the EU, and to promote harmonious, competitive and efficient development of the energy sector, thereby reducing the influence of a single (monopolistic) energy supplier: by increasing the use of local and renewable resources, developing competitive local energy generation capacities and diversifying imports of energy resources that cannot be replaced by local sources.

Electricity sector

The Lithuanian electricity system is connected to the Belarussian, Russian, Latvian, Polish and Swedish electricity systems. It should be noted that at present the Lithuanian-Latvian-Estonian-Belarussian electricity systems are part of the IPS/UPS system operated by the Russian electricity system operator. However, Lithuania and the Baltic States are seeking to become an independent part of the decentralised European electricity system and to move towards transparent European standards of electricity system management. In this context, particular attention is devoted to the Synchronisation Project, which would synchronise the Baltic States' electricity systems with the continental European network. The Synchronisation Project is defined in all strategic documents.

Lithuania remains dependent on imported energy. This is best reflected in the energy dependency rate, which was 74.7% in 2018 and increased 1.8 percentage points compared to 2017 and is still well above the European Union (EU) average (55.1% in 2017). Lithuania imports most of its electricity. Electricity demand in Lithuania was 13.1 TWh in 2018. In 2018, almost three quarters of electricity was imported and 3.5 TWh produced to meet Lithuania's needs. Electricity production in the country decreased by 16.1%, representing 62.8% of total electricity production from renewable energy sources in 2018. The main reasons why more

electricity is imported than produced are economic, i.e. electricity is imported from wherever it is the cheapest.

Under NEIS, electricity imports will be replaced by local electricity generation: it is planned that electricity generation in Lithuania will account for 35% of total final electricity consumption in 2020 (65% will be imported), 70% (30% imported) in 2030, and 100% in 2050.

The electricity transmission system operator AB LITGRID, which is responsible for the reliable operation of the electricity transmission system in accordance with the procedure established by law, prepares an annual development plan for the 400-110 kW networks of Lithuanian electricity system (hereinafter referred to as the '10-year electricity transmission network development plan'), the aim of which is to anticipate possible changes in electricity and power needs, generating powers and generation in the long term, to anticipate the scope of development and restoration of the transmission network and to determine indicative investments, in view of the current situation of the electricity system and decisions.

Capacity mechanism

Secure supply of electricity is a key element of the European Union's climate change and energy policy. The latter includes a number of basic elements, one of which is the adequacy of the electricity system, underlining the need to ensure sufficient capacities and grid capacity to meet the electricity needs of consumers by assessing the availability of generating sources and interconnections and the load characteristics of electricity networks.

Based on the probability assessment of the adequacy of the Lithuanian electricity system carried out in 2018 by Kaunas University of Technology for the periods 2019–2024 and 2025–2030, a lack of available reliable capacity to ensure the adequacy of the Lithuanian electricity system reaching the expected loss of load expectation (LOLE) has been identified as 8 h per year as of 2025 (after desynchronisation from the IPS/UPS system), which increases to 29.5 h per year under the PPM scenario. [37]

In order to ensure the adequacy of the Lithuanian electricity system and to reduce the likelihood of loss of load to 8 h under the PPM scenario, a **capacity mechanism** is currently being developed in Lithuania to ensure reliable operation of the Lithuanian electricity system and an adequate level of security of electricity supply after 2025 (after the electricity system has been de-synchronised from the IPS/UPS system). The capacity mechanism being developed is expected to ensure effective competition in the electricity sector while minimising the burden on electricity consumers. The planned capacity mechanism will be technologically neutral, as it will be open to both existing and future electricity-generating electrical installations to be installed (built) by participants in the capacity auction before the capacity submission period as well as to installations operated by storage and independent electricity demand aggregators.

The capacity mechanism being developed will allow the initiation of a procedure for the provision of economically and technically feasible capacities.

Natural gas sector

Lithuania does not have its own natural gas resources, therefore all natural gas consumed in Lithuania is imported. Since the start of operation of the Klaipėda Liquefied Natural Gas (LNG) terminal in 2014, sources of supply have diversified and Lithuania is able to obtain sufficient natural gas from international LNG markets. Annual consumption of natural gas in Lithuania is about 2.4 billion m^3. Around a half of the natural gas consumed in Lithuania is consumed by AB Achema, the largest producer of nitrogen fertilisers and other industrial chemical products in the country, and the largest plant of this kind in the Baltic States.

[37] https://www.entsoe.eu/outlooks/midterm/

The construction of a liquefied natural gas terminal in Klaipėda at the end of 2014 ended the decades-long natural gas monopoly in Lithuania and enabled competition. Lithuania is now able to independently secure gas supply for itself (and to supply significant quantities to the countries of the Baltic region) through the LNG terminal alone in the event of disruption of supply from Russia or lack of competitiveness. Around 50% of the natural gas consumed in Lithuania is imported each year via the Klaipėda liquefied natural gas terminal. These substantial changes in the natural gas sector led to the disappearance of the difference in import prices of EUR 10/MWh and above between the Lithuanian market and the Western European natural gas markets, and Lithuania, previously one of the EU Member States paying the highest prices for natural gas imports, became one of EU Member States paying the lowest prices for imported natural gas. Taking into account the results achieved, the global dynamics of the liquefied natural gas market and the potential of the regional natural gas market to ensure a competitive and reliable supply of natural gas, it is strategically important for Lithuania to ensure long-term continuity of Klaipėda liquefied natural gas terminal. In 2018, the Seimas adopted a decision providing that Lithuania will ensure the long-term supply of LNG after 2024 by purchasing a LNG storage tank. This allows the operational costs of the Klaipėda LNG terminal to be spread over the whole of the LNG terminal's expected operational life, rather than over the 10-year lease period of the LNG storage tank as is currently the case.

Although Lithuania currently has an alternative source of natural gas supply, the LNG terminal, it is not yet connected to the continental European gas pipeline network. The Gas Interconnection Poland-Lithuania (GIPL) project is currently under way which will enable Lithuania, Latvia and Estonia, as well as Finland (it should be noted that by the end of 2019 the Balticconnector pipeline will connect the Finnish gas networks with the Estonian gas networks) with the gas networks of continental Europe. GIPL will integrate the gas markets of the Baltic States and Finland into the single EU gas market, create access to alternative sources and routes of gas supply and increase the competitiveness of the gas market as well as security and reliability of gas supply by creating both additional gas transmission capacities and the possibility of EU solidarity mechanisms in the event of an emergency, allowing more flexible and efficient use of Polish and Lithuanian LNG terminals and transmission networks, increasing the liquidity of gas trade in the Baltic States' and Polish trading zones, and strengthening their regional role.

Oil sector

Oil is found in Lithuania, but the quantities are not large, so virtually all consumption is imported. It should be noted that Lithuania has the only oil refinery in the Baltic States and therefore imports of crude oil are more than sufficient for Lithuania's needs. The design capacity of the oil refinery of AB ORLEN Lietuva is 15 million tonnes of oil per year. In order to make better use of the production capacity, other feedstock such as gas condensate, heavy fuel oil and medium distillates are also processed.

In the past, Lithuania was supplied with oil via an oil pipeline, but with the launch of the reverse import-export terminal in Būtingė, a feedstock supply alternative has emerged. In the event of an interruption of oil supply by pipeline, AB ORLEN Lietuva supplies raw material via the Būtingė terminal. Its annual design capacity is 14 million tonnes of oil per year.

In recent years, the country's consumption of petroleum products has been around 2.1 million tonnes. The domestic market is dominated by petroleum products of AB ORLEN Lietuva and only a small proportion of certain types of oil products are imported from other countries. Rail or road transport may also be used to supply petroleum products. Lithuania has the full technical capacity to diversify the supply of oil and petroleum products.

As mentioned above, the potential of the Lithuanian oil sector fully meets the needs of the country's oil

consumers. The majority of petroleum products produced in the country are supplied to foreign markets. Lithuania currently has the full technical capacity to both export to and import oil and petroleum products from various countries and sources around the world. The country has accumulated sufficient State stocks of petroleum products to protect against petroleum product supply disruptions.

For more than two decades already, the oil sector has been operating under market conditions, i.e.:

- there are no legal restrictions on the import of fuel from EU countries or from third countries;
- the prices of petroleum products are not regulated by the State (with the exception of liquefied petroleum gas supplied to group installations);
- for petroleum products, only the rates of excise duty and the value added tax are fixed by the State;
- it should be noted that mandatory quality indicators for petroleum products have been established but there are entry or import quotas.

Supply security and stockpiles

The Law on Electricity[38] establishes the foundations for safe and secure operation of the electricity system and the generation, transmission, distribution and supply of electricity.

Article 23(1) of that Law provides that the electricity transmission system operator is responsible for the stability and reliability of the operation of the electricity system, the performance of the national balancing function in the territory of the Republic of Lithuania, the provision of system services, the operation, maintenance, management and development of interconnections with the electricity systems of other countries, by reducing the capacity constraints in the transmission networks and taking into account the needs of electricity system and electricity grid users.

Article 76(1)(2) of the same Law stipulates the National Energy Regulatory Council should cooperate with foreign national energy regulators to ensure that the transmission system operator has one or more integrated system(s) at regional level covering two or more Member States for capacity allocation and for ensuring the security of the electricity network.

The supply of electricity in the event of an emergency is limited or suspended in accordance with the Rules of Electricity Supply and Use[39].

The Lithuanian natural gas transmission system, operating in normal mode, is able to ensure the supply of natural gas without restrictions, and once the LNG terminal in Klaipėda is operational, natural gas can be supplied to the country from alternative sources. As a result, risks to gas supply are significantly reduced, in particular due to geopolitical factors. An alternative gas supply also reduces the risk of gas supply due to technical failures.

On 25 October 2017, the European Parliament and the Council adopted Regulation (EU) 2017/1938 concerning measures to safeguard security of gas supply and repealing Regulation (EU) No 994/2010 ('the Regulation concerning measures to safeguard security of gas supply'), the objective of which is to safeguard the security of gas supply by ensuring the proper and continuous functioning of the internal market in natural gas, by allowing for exceptional measures to be implemented when the market can no longer deliver the gas supplies required and by providing for the clear definition and attribution of responsibilities among natural gas undertakings, the Member States and the Union regarding both preventive action and the reaction to concrete disruptions of gas supply. This Regulation also provides transparent mechanisms, in a

[38] Reference to the Lithuanian Law on Electricity: https://www.e-tar.lt/portal/lt/legalAct/TAR.F57794B7899F/mouDoNqiIt

[39] Approved by Order No 1-38 of the Minister for Energy of the Republic of Lithuania of 11 February 2010 on the approval of the Rules of Power Supply and Use.

spirit of solidarity, for the coordination of planning for, and response to, an emergency at Member State, regional and European Union levels. The Ministry of Energy has been designated and notified as the competent authority for the implementation of the measures provided for in this Regulation.

In assessing the capacity of the transmission system to deliver gas to customers in the event of a supply disruption, the calculation of the N-1 criterion established in the Regulation concerning measures to safeguard security of gas supply has shown that this security of gas supply indicator is met in Lithuania.

The supply of petroleum products in the event of an emergency is carried out in accordance with the Plan for the application of restrictions on the supply and use of petroleum products[40]. It lays down measures to stabilise the supply and/or consumption of petroleum products when an energy emergency is declared as a result of a reduction in the supply of petroleum products to such an extent as to endanger the safety, health or economic activity of the population.

According to EU and Lithuanian legislation, the country's stockpiles of petroleum products and oil must be sufficient to cover most of the following needs: 90 days of average daily net imports or 61 days of average daily inland consumption. A part of the stockpiles consist of special stockpiles held and managed by the State enterprise Lithuanian Energy Agency (hereinafter referred to as the 'Agency') at the expense of the State, and the amount accumulated by the Agency must be sufficient for at least 30 days, based on the average daily domestic consumption in the preceding calendar year. The remainder of the reserve is accumulated by the obliged undertakings.

2.4 Dimension internal energy market

2.4.1 Electricity interconnectivity

In 2014, the European Council set a target for electricity interconnection between EU Member States of at least 10% of the total electricity generation capacity installed in a Member State by 2020 and 15% by 2030. Projects of common interest should contribute to this objective. The nominal interconnection capacity of the lines should be 30% at peak load and the nominal interconnection capacity of the lines should be at least 30% of the installed renewable energy capacity. It should be stressed that all these indicators are met in Lithuania – the level of interconnection of electricity systems is more than 60% and the nominal capacity of interconnectors during peak load and the nominal capacity of interconnectors in terms of installed renewable energy generation capacity is more than 60%[41].

Due to historical factors, Lithuania's high voltage electricity transmission grid is directly interconnected with the high voltage grids of Latvia, Belarus and the Kaliningrad Region of Russia. These interconnections allow extensive exchanges of power with those neighbouring systems. The main challenge for Lithuania and all Baltic countries is to integrate their energy systems into the common European electricity market and to start synchronising with the European mainland electricity grid by 2025. New interconnectors with Sweden (NordBalt – 700 MW) and Poland (LitPol Link – 500 MW) were installed and launched at the end of 2015 and in early 2016. Together with the Estlink I (350 MW) and Estlink II (650 MW) between Finland and

[40] Approved by Order No 1-107 of the Minister for Energy of the Republic of Lithuania of 24 May 2013 on the approval of the Plan for the application of restrictions on the supply and consumption of petroleum products.

[41] TYNDP 2018 Regional Insight Report North-South Interconnections East: https://tyndp.entsoe.eu/Documents/TYNDP%20documents/TYNDP2018/consultation/PCI%20Region/ENTSO_TYNDP_2018_NSI_EAST.pdf

Estonia, the total amount of Baltic States' transfer capacity with other Member States is 2,200 MW , and this constitutes around 23% of interconnectivity level.

In 2016, the price difference on the wholesale market was EUR 7.1/MWh between Lithuania and Sweden (electricity is cheaper in Sweden), EUR 6.1/MWh between Lithuania and Poland (electricity is cheaper in Lithuania) and EUR 0.5/MWh between Lithuania and Latvia (electricity is cheaper in Latvia). It is intended that this difference between the different wholesale markets not exceed EUR 2/MWh. This requires sufficient technical connection capacity to allow electricity to flow from a cheaper area to a more expensive one. Thus, when the price increases in one area, it decreases in another.

For the competitiveness of the Lithuanian economy and to attract foreign investment, it is important that the average final electricity price for business and industrial consumers be lower compared to other Scandinavian, central and eastern European countries in the EU. According to Eurostat's data for 2017, Lithuania ranked 9th in terms of the lowest average final electricity price for business and industrial consumers in Scandinavian and Central and Eastern European countries (EU Member States). It is important for Lithuania to improve this rate and to move up to positions 1–3.

2.4.2 Structure of energy transmission

In order to fulfil the elements of the Energy Union, namely energy security and integration into the internal energy market, the following main electricity and gas transmission infrastructure projects are currently being implemented, which are also included in the NEIS and most of them have the highest status that can be granted to a project in Lithuania, i.e. projects recognised by the Government as economic projects of national importance:

Electricity

Synchronisation project

At present, the Synchronisation Project is the most important one in the field of electricity in Lithuania. Lithuania, Latvia and Estonia are the only EU Member States whose electricity systems operating synchronously with the Russian IPS/UPS (Integrated Power System/Unified Power System) system, which includes the networks in Russia, Belarus, the former USSR and the Baltic States. Under the agreement between the BRELL countries (Belarus, Russia, Estonia, Latvia and Lithuania), the current management and frequency regulation of the IPS/UPS system (and hence the Baltic electricity networks) is ensured by a central control centre operated by the Russian electricity system operator. However, as EU Member States, the Baltic States have to link their energy objectives and targets to the strategic objectives of the EU's common energy policy, one of which is to create a fully integrated electricity system market at the economic and technological (interconnection) level. The aim is therefore to disconnect from the IPS/UPS system and synchronise with continental European electricity networks (CENs). Synchronisation is seen as one of the key goals of the EU energy policy. This project is included within the European Energy Security Strategy and the EU Energy Union as a project of common interest and of critical importance to the EU energy security. The goal of Baltic States' synchronisation with the continental European networks by 2025 is also included in the reinforced BEMIP. 13 June 2019, the Lithuanian Parliament adopted the Law on the Connection of the Lithuanian Power System with the Continental European Power System for Synchronous Operation and related legislation. They lay down the basic conditions for organising and implementing the synchronisation process. The La provides that the synchronisation project and the related infrastructure projects will be granted the status of projects of special national significance. This will allow faster implementation of spatial planning procedures for synchronisation projects, the identification of easements and the rapid

implementation of environmental impact assessment procedures. The project's measures are described in more detail in section 3.4.2.

Natural gas

Gas interconnection Poland-Lithuania (GIPL)

In the field of natural gas, the most important project currently under way is the gas interconnection between Poland and Lithuania (GIPL), which will connect the Baltic States and Finland with the single EU gas market, increase security of supply and diversification of supply routes in the region, promote greater liquidity in the regional market and competition between suppliers, and enable a more efficient use of the liquefied natural gas terminal in Klaipėda. The project is due to be completed by the end of 2021. The estimated length of the gas pipeline is around 508 km, of which 165 km will be in Lithuania, with a maximum capacity of 2.4 billion m^3/year from Poland and 1.9 billion m^3/year from Lithuania. The project is implemented by the Lithuanian natural gas transmission system operator AB Amber Grid and the Polish natural gas transmission system operator GAZ-SYSTEM. The project is included in the list of projects of common interest and its implementation is supported by the Connecting Europe Facility (CEF).

Project for enhancement of Latvia-Lithuania interconnection(ELLI)

A project to enhance the capacity of the Latvia and Lithuania gas interconnection (ELLI) is also being implemented currently. This project will modernise the gas pipelines on the Latvian territory in order to increase the pressure to 50 bar (now 40 bar) and expand the Kiemėnai gas monitoring station in Lithuania. The aim of this project is to ensure sufficient capacity between the Baltic States and other European countries, to make use of alternative sources of gas supply and transport routes for the countries of the region, to increase security of gas supply, to contribute to the creation of the internal energy market, to increase market integration and competition, as well as to strengthen energy solidarity between EU countries. This will also facilitate the use of the Latvian Inčukalns underground gas storage facility. By integrating the gas markets of the Baltic States into the single EU gas market, this interconnection will become an important part of the route linking the European and Eastern Baltic markets. The project is implemented by the Latvian natural gas transmission system and underground natural gas storage operator AS Conexus Baltic Grid and the Lithuanian natural gas transmission system operator AB Amber Grid. The project is included in the list of projects of common interest and has received support from the Connecting Europe Facility (CEF).

Projects of local importance to improve the reliability of the Lithuanian electricity and natural gas transmission systems are envisaged in the National Plan for the Implementation of Electricity and Natural Gas Transmission Infrastructure Projects[42]. These projects receive investment from the European Union (the activities financed are described in more detail in Section 3.3.). The strategy papers include the 10-year development plans for operators (both transmission and distribution), which provide for major projects, development and investment by operators.

2.4.3 Market integration

On 5 June 2019, the European Parliament and the Council adopted amendments to the Electricity Directive and the Electricity Regulation[43]. These changes are part of the Clean Energy Package and are also referred

[42]National Plan for the implementation of electricity and natural gas transmission infrastructure projects, approved by Government Resolution No 2014 of 22 July 476 approving that Plan.

[43] Regulation (EU) 2019/943 on the internal market in electricity and Directive 2019/944 of the European Parliament and of the Council of

to as the Fourth EU Energy Package due to their importance and scope. Through this legislation, EU Member States have agreed to foster the integration of their national markets and the cooperation of system operators at EU and regional level, to address recurring barriers to the completion of the internal market in electricity (e.g. high degree of regulatory intervention, barriers to the supply of electricity on an equal footing) and to cooperate closely with each other on all issues related to the establishment of an integrated electricity trading region.

Priority national targets and tasks for the development of electricity markets 2021–2030:

- to adapt the electricity system to variable and distributed generation of electricity from renewable sources;
- to establish an electricity market system that rewards flexibility and innovation;
- to develop measures encouraging investment in the development of secure and competitive local energy production and in the development of measures to ensure the adequacy of the electricity system;
- to promote competitive price formation by enabling consumers to choose dynamic price agreements, allowing them to respond to price signals in real time and to manage their energy consumption;
- to coordinate national energy policies with the neighbouring Member States and exploit the potential of the integration of balancing markets and cross-border energy trading;
- to promote fair competition and easy access for energy suppliers in order to allow consumers to take advantage of the opportunities of a liberalised internal market in energy.

2.4.4 Energy poverty

A key aspect of a sustainable internal market is the availability of energy services to all citizens in order to ensure the basic needs and health of consumers. However, Lithuania faces the problem of energy poverty, where it is difficult or impossible for residents to enjoy adequate heating of their homes or access to essential energy services such as lighting or transport.[44]

Energy poverty is caused by four main problems: energy inefficiency, high energy prices and low household incomes, as well as lack of consumer awareness. The problem of energy poverty is also reflected in energy poverty indicators (see Table 2.4.4.1):

- According to the EU income and living conditions survey[45], more than a quarter (27.9%[46]) of the population could not afford adequate heating of their homes in 2018. This is the second highest rate among the EU Member States, which is much worse than the EU average of 7.4%.
- In Lithuania, 17.1% of households spent a large part of their income on energy in 2016. This indicator shows the percentage of households in which the share of energy expenditure (electricity, gas, other fuels, heat) in disposable income was more than double the median share of energy expenditure.

5 June 2019 concerning common rules for the internal market in electricity and amending Directive 2012/27/EU.

[44] European Economic and Social Committee, 2011/C 44/09.

[45] https://www.energypoverty.eu/sites/default/files/downloads/observatory-documents/19-06/member_state_report_-_lithuania.pdf

[46] Eurostat, Inability to keep home adequately warm - EU-SILC, 2019. (In Lithuania, about 1,560 million households are billed for energy every month.

Table 2.4.4.1. Energy poverty dynamics in Lithuania, %[47]

	2011	2012	2013	2014	2015	2016	2017	2018
Share of residents in households unable to afford to keep home adequately warm(LT)	36.2	34.1	29.2	26.5	31.1	29.3	28.9	27.9
Share of residents in households unable to afford to keep home adequately warm (EU)	9.8	10.8	10.7	10.2	9.4	8.7	7.8	8.1

EU data also point to hidden energy poverty, where households may spend too little and not acquire sufficient services. According to Statistics Lithuania, 14.9% of Lithuanian households experienced hidden energy poverty in 2016. More specifically, the indicator of hidden energy poverty shows the percentage of households whose energy expenditure was less than 50% of the median energy expenditure.

Energy poverty affects socially vulnerable groups in particular: seniors, children, people with chronic diseases, single parents, and the unemployed. Tackling this pressing social challenge requires a comprehensive political approach combining social and environmental policies.

In order to address energy poverty, the National Progress Programme 2021–2030 sets the target of "reducing energy poverty among the population", identifying three national indicators with targets for 2025 and 2030 (see Table 2.4.4.2).

Table 2.4.4.2. Energy poverty targets for 2030 under the current National Progress Programme 2021–2030

Impact indicator	Initial situation (year)	Interim value for 2025	Target vale for 2030	Data source	Body responsible for providing data
Share of the population unable to keep home adequately warm	28% (2018)	23%	17%	Statistics Lithuania	Ministry of Social Security and Labour
Share of households spending a large share of income on energy	17.1% (2016)	15%	10%	Statistics Lithuania	Ministry of Economy

In order to achieve the mentioned objectives, Lithuania is taking integrated measures, described in more detail in Section 3.1.4), covering the areas of energy efficiency, household income, energy prices and consumer information. Lithuania, and another eight EU countries, launched the EU-funded Horizon 2020 project 'STEP – Solutions to Tackle Energy Poverty in 2019'.[48] The main objective of STEP is to alleviate energy poverty by encouraging changes in consumer behaviour. The measures of the project and the national measures to address energy poverty take into account financial support (reimbursement of deprived people for part of the costs of heating and water in housing, public support for renovation/modernisation of multi-

[47] Ibid

[48] More information: https://www.stepenergy.eu/

apartment buildings by reimbursing credit and interest payments), improve the energy performance of buildings and equipment and raise consumer awareness.

2.5 Dimension Research, innovation and competitiveness

In order for Lithuania to evolve from an energy technology importer into an energy technology producer and exporter, it is necessary to promote the experimental and industrial development of the most promising energy technologies as well as innovation incubators, research and pilot implementation of research results in practice. Research and development in the field of energy in Lithuania and the products developed must be integrated into industrial production and become part of Lithuanian exports, thus contributing to the economic growth of the country. Lithuania needs to identify energy research and innovation priorities at national level and focus on them to create a competitive advantage. There are currently two strategic documents setting out guidelines for national policies to promote research and innovation in the context of the Energy Union, namely the National Energy Independence Strategy and the Smart Specialisation Strategy.

Objectives set out in the National Energy Independence Strategy

One of the four strategic areas established by the strategy adopted in 2018 (in addition to Competitiveness, Reliability, Climate Change Impact and Reduction of Ambient Air Pollution (Energy Saving and Green Energy)) is Participation of the country's businesses in efforts towards energy progress (innovation). In this context, the objective has been set for Lithuania to evolve from an energy technology importer into an energy technology developing and exporting country. The goal for Lithuania is to become a centre of information technology and cybersecurity solutions for energy, biomass and biofuel technologies, solar and wind energy technologies, geothermal technologies, energy market development, changes of electricity system operation, development of new electricity system management approaches and implementation of energy projects.

Taking into account the specificities and needs of the Lithuanian energy sector, the strategic objectives, and the existing and desirable competencies, the following priority areas of energy research and development have been identified:

- Planning the prospective development of the energy sector, and energy economy;
- Modernisation of existing energy production technologies to take account of new challenges and requirements;
- Development and network integration of new technologies for low greenhouse gas and ambient air emissions and climate change energy generation and storage; integration into the EU's strategic value chains;
- Power generation technologies from indigenous and renewable energy sources;
- Electrical system performance analysis and improvement of electrical system management;
- Technologies for distributed energy production, smart grids, and production and use of new viable forms of energy
- Ensuring security and quality of electricity supply, vulnerability of electricity systems and

optimisation of operating modes;

- The functioning of electricity markets, power mechanisms and active involvement of consumers in the functioning of the electricity system and markets;
- Energy and cyber security, reliability of energy equipment and systems, and resistance to cyber attacks.

The National Energy Independence Strategy of Lithuania also stipulates that in order to promote the development of energy innovation and the use of energy competences and the results of research and development in other areas of the economy, also to stimulate export growth and creation of new forms of business in the country:

- Synergies between scientific and academic institutions, energy companies and engineering industry companies will be enhanced by promoting cooperation in different forms (including international cooperation), through investments from the EU framework programme for research and innovation Horizon 2020, national and other programmes, developing digital energy innovations and improving technologies in Lithuanian energy, thereby strengthening the Lithuanian research and innovation ecosystem;
- Partnerships and support programmes will be developed between energy companies and engineering industry companies to foster cooperation in the development and application of digital energy innovation and technological development, with a view to closer cooperation between energy businesses and education institutions;
- Tax measures will encourage investment in the technological development of the production of solar, wind, biomass, biofuels and other renewable energy sources, the improvement of production, the acquisition of technology and the development of a centre of excellence, and the development of liquefied natural gas technologies and a centre of excellence;
- Involvement of engineering industry companies in the development and market integration of new liquefied natural gas technologies, technological equipment and means of transportation will be promoted;
- Development of new energy production technologies, including energy from renewable energy sources, distributed energy production, smart grids and their integration into the energy system will be promoted;
- The production of electricity storage technologies will be encouraged by attracting investment in the production of these technologies in Lithuania;
- Possibilities for offshore wind energy technology production by attracting investment in the production of these technologies in the Klaipėda port will assessed;
- Technologies for the production and use of local energy sources will be developed, produced and exported;
- Information technology solutions to optimise the energy sector will be promoted and tested in Lithuania and the export of such products will encouraged;
- Energy facilities and infrastructure construction companies will be strengthened in order to increase their added value, promote the export of services and innovation of such companies;

- Production of solar technologies will encouraged by establishing Lithuania as the largest centre of excellence and exporter of solar technologies in the Baltic and Nordic region.

An addition promising area in order to promote the development of energy innovation and the use of energy competences and the results of research and development in other areas of the economy, also to stimulate export growth and creation of new forms of business in the country is the use of hydrogen in energy, industry and transport.

It is also necessary to further develop carbon capture, use and storage technologies and to analyse their applications in Lithuania. The European Innovation Fund will provide support estimated at EUR 10 billion over the period 2020 to 2030 for five strategic areas, two of which are directly related to CO_2 storage.

Objectives of the Smart Specialisation Programme

In order to focus resources on the areas with the highest potential, in 2014 Lithuania adopted the Smart Specialisation Strategy 2014–2020 (final target values to be set for 2023).

3 of the 7 research, development and innovation (RDI) priorities of this programme are relevant for the National Plan:

The priority "Energy and Sustainable Environment“ is important in the efforts ensure clean, reliable and intelligent energy for the consumer. Progress in this area will help to achieve the goal of Lithuania and, at the same time, Europe as a whole becoming a leader in renewable energies.

This priority includes rapid development of alternative energy sources, alternative fuels and energy-saving technologies, which would increase energy efficiency in end-use, boost Lithuania's competitiveness in clean energy technologies and open up potential for growth and jobs. Areas of implementation of the priority "Energy and Sustainable Environment“:

- enhancing interoperability between distributed and centralised generation, networks and energy efficiency;
- meeting the needs of existing and new end-users, and strengthening energy efficiency and smartness;
- development of the use of renewable biomass and solar energy sources and the recycling of waste for energy recovery.

The priority "Intelligent, clean, interlinked transport" must contribute to the national challenge of reducing the impact on climate change in the transport sector, where GHG emissions have only been growing so far.

In order to achieve the objectives of the National Plan in the field of transport, the introduction of clean, environmentally friendly and environmentally sustainable transport technologies is expected to reduce the negative impacts of the transport system on climate and nature (air pollution, noise), while reducing the transport sector's dependence on fossil fuel and energy imports. Innovative solutions for intelligent transport systems and autonomous transport are needed to achieve a breakthrough. Changing mobility paradigms requires the development and application of new mobility models and the integration of engineering, information technologies, means of communication, flow management, data processing and other solutions. Joint interdisciplinary projects should increase the competitiveness of the products being developed on the market and the efficiency of the entire transport system. Areas of implementation of the priority "Intelligent, clean, interlinked transport“:

- intelligent transport systems;

- technologies/models for the management of international transport corridors and for the integration of transport modes.

The priority "New production processes, materials and technologies" is important to ensure efficient and sustainable business development and the introduction of digital solutions and new technologies in industry, thereby increasing productivity and added value. Increasingly demanding energy efficiency, safety, durability and other requirements for materials and structures around the world are constantly increasing the need for RDI activities and enabling businesses to engage in innovative activities. The size of the sector also makes it possible to increase international competitiveness much more, not only by achieving certain physical or mechanical characteristics of the composite materials and structures being developed, but also by reducing their production costs. The implementation of the priority is particularly relevant in the context of industry digitalization (Industry 4.0).
Areas of implementation of the priority 'New manufacturing processes, materials and technologies':

- photonic and laser technologies;
- advanced materials and structures;
- flexible technologies for product development and production.

Implementation of all measures under the Smart Specialisation Programme across all priorities is expected to produce the following results, in 2023:

- investment in RDI in Lithuania will increase to 1.9% (from 1.04% of GDP in 2015);
- employment in knowledge-based sectors will reach 13.6% (9.7% in 2017);
- the number of patent applications will double (150 applications in 2023);
- The number of small and medium companies using new products or processes will double (40% in 2023);
- the number of innovative SMEs will double (35% in 2023).

National targets for the promotion of clean energy technologies

The current situation, national targets and measures to promote investment in innovative technologies for the development of clean, renewable sources and energy efficiency are also covered in a number of other strategic documents:

- *The strategy Lithuania 2030 and the National Progress Programme* implementing that Strategy envisaged enhancing business incentives to invest in green technologies. (In addition, the National Progress Programme 2021–2030, which is currently being developed, sets a target of RDI funding from all sources in Lithuania at a minimum 2% of GDP by 2030).
- The *Sustainable Development Strategy* envisages the introduction of cleaner production methods, promotion of recycling of secondary raw materials and building recycling capacities as one of the more important tasks of industrial development.
- *The Industrial Development Programme* covers the need promote energy efficiency in industry, increased use of renewable sources of energy as well as introduction of technologies reducing carbon dioxide emissions.
- *The 2014-2020 Programme for Promotion of Investment and Industrial Development* aims at energy efficiency and increasing the use of RES.

The objectives set out in those documents are described in more detail in the part 'Sector of industry and industrial processes' in subsection 3.1.1. 'GHG emissions and removals' of section 3.1 'Dimension Decarbonisation'. This part also includes achieved and projected GHG emission reduction targets.

Trends of research into climate change processes

An important factor for climate change mitigation and adaptation in all sectors of the economy is RDI development by creating favourable investment conditions for risk assessment and training of qualified professionals. Insufficient GHG reductions in individual sectors may be caused by new technologies that are too costly or underdeveloped, and by insufficient practical applications. In order to promote RDI, the European Commission has proposed a new EU research and innovation programme 'Horizon Europe', one of the priorities of which is climate change. 35% of this programme would be devoted to promoting the development of GHG zero-emission technologies. Research required in Lithuania in the sectors of agricultural and land use, land use change and forestry:

- alternatives to the cultivation of annual crops;
- breeding of low-methane bovine breeds;
- change in the composition of feedingstuffs;
- the possibility of changing land use in order to increase the absorption of GHG in biomass and/or soil;
- industry-appropriate low GHG production techniques;
- circular economy solutions'
- identification of ecosystem changes, invasive species, etc.

Lithuania is carrying out research on climate change, but there is no uniform system for publishing the results of the research. Cooperation between science and business is needed to increase the practical application of RDI.

National targets concerning competitiveness

In order to ensure that Lithuania actively participates in the processes of the fourth industrial revolution and to ensure industrial competitiveness while achieving ambitious climate targets, the Ministry of Economy and Innovation pursues the following objectives:

- To promote active digitisation of industry, thereby increasing international competitiveness;
- To promote an efficient industrial transformation towards a circular economy;
- To promote the integration of industry into European strategic value chains (9 selected strategic value chains for European development were officially announced by the EC at the end of January 2019[49]). The strategic value chains related to the National Energy and Climate Change Plan and relevant for Lithuania are the following:
    - batteries;
    - interconnected, clean and self-contained vehicles;
    - low-carbon industry;
    - hydrogen technologies and systems.

[49] https://ec.europa.eu/growth/content/stronger-and-more-competitive-eu-industry-president-juncker-open-2019-eu-industry- days_en

KEY:
SECTION A: NATIONAL PLAN

A SKIRSNIS:
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PLANAS

3. POLICIES AND MEASURES

This chapter describes the policies and measures to be taken to achieve the national objectives and targets set out in Chapter 2. The policy measures presented are divided into three groups:

- **Existing policy measures** (hereafter referred to as 'EPM'), as set out in the **brown** tables, are already approved by legislation and have clear implementation mechanisms and secured funding. The impact of the EPM package and externalities on the achievement of national targets is described as an EPM scenario in Chapter 4.
- **Planned policy measures** ('PPM') presented in the **green** tables are proposed as complementary measures to the EPM package to achieve the 2030 targets, but are not currently approved by legislation or strategic planning documents and/or their implementation depends on the availability of different sources of funding. The impact of PPMs on the achievement of national targets has been assessed by modelling the PPM scenario, which is described in detail in Chapter 5.
- **The alternative policy measures** presented in **a separate list for each sector** were additionally included in the National Plan, taking into account the proposals made in the public consultation. They have not been taken into account in the calculations in part B, but these measures will be considered as an alternative to the elements of the PPM scenario in order to achieve the national targets prior to approval thereof in the legislation.

Planned and/or alternative policy measures will be adopted in 2020 and beyond, transposing them into sectoral development programmes or other strategic planning documents and/or other legislation. Planned and alternative policy measures, prior to their inclusion in sectoral development programmes or other strategic planning documents and/or other legislation, will be assessed in terms of their financial, economic, social and environmental benefits, choosing the most efficient set of measures and the means of their implementation that will ensure the achievement of the objectives and targets of the 2021-2030 energy and climate change management policy.

The results of the policies adopted and implemented will be regularly monitored and compared with forecasts. In the event of underperformance, consideration will be given to ways of replacing ineffective measures with more effective measures and/or increasing the scope of the measures chosen, the economic and legal signals to encourage the preferred conduct of market players and consumers will be reinforced and/or brought forward, and the public will be consulted on changes to the policy and measures. To this end, an inter-institutional working group will be set up to regularly analyse the results of the monitoring of the indicators of the National Plan, to discuss the effectiveness of the implementation of the measures under the approved policy and the need for additional policy measures, and to consult the public.

3.1 Dimension Decarbonisation

3.1.1 GHG emissions and removals

Climate change mitigation objectives are closely linked with the goals defined in National Energy Independence Strategy (NEIS), the National Renewable Energy Resources Development Strategy, the Lithuanian Housing Strategy, the Law on Energy from Renewable Sources and the Energy Efficiency Action Plan 2017-2019.

The Lithuanian progress strategy Lithuania 2030[50] highlights the need for joint work to tackle problems in the areas of sustainable development, environment, energy, transport, economy and strengthening of democracy, but does not detail specific directions. There is a strong focus on social responsibility and green growth.

In this section, policies and measures are grouped and presented on a sector-by-sector basis. The detailed measures and policies needed to achieve this will be discussed for each GHG emitting sector and for each sector where improvement in removals is required, taking into account the long-term vision and objective of a low-carbon economy and ensuring a balance between GHG emissions and removals under the Paris Agreement.

Presented below are the policies and measures covering non-ETS and LULUCF sectors which were implemented to reach the 2020 targets and which will be continued to achieve more ambitious GHG emission reduction targets by 2030. Based on the national GHG projections, it was determined that Lithuania might face difficulties in attaining non-ETS targets due to the projected GHG emissions increase in the transport and agriculture sectors. Thus, additional measures have planned for the period 2021-2030 to increase GHG emission reduction.

Transport sector

The Sustainable Development Strategy stresses that, following the restoration of independence, the eco-efficiency of transport in Lithuania increased: energy consumption per Gross Domestic Product ('GDP') unit dropped approximately in half, while atmospheric emissions of pollutants went down by more than 2.5 times, yet this is more related to GDP growth itself.

The National Transport Development Programme 2014-2022 has, among others, objectives to increase the mobility of goods and passengers, to improve the corridors of the EU Trans-European Transport Networks as well as their connections with national and local transport networks, to increase the energy efficiency of transport, to reduce the adverse impact of transport on the environment and to improve traffic safety. It contains an analysis of the potential future development of road, rail, maritime, inland waterways and air transport.

Objective 3.2.1 of the Progress Programme, 'Developing modern transport infrastructure and sustainable mobility', is important from the standpoint of climate change. The directions foreseen for the implementation of the target are aimed at increasing the attractiveness of public transport, reducing urban congestion by improving infrastructure, improving land transport by developing missing links, improving intermodality, developing pedestrian and cycling infrastructure, introducing and developing environmental measures, reducing CO_2 and other measures. All these measures also ensure that the negative environmental effects of the transport sector are reduced. However, it is also important to note that some of the areas of implementation of the objective, in particular

those intended to develop and modernise the urban street network and reduce traffic congestion; to develop the insufficient land transport infrastructure connections with other EU States and third-country transport networks, and other areas related to infrastructure improvement, also increase road transport on account of the establishment of better conditions.

[50] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.425517

The programme also identifies the main targets for the development of infrastructure in order to use alternative energy sources in transport, including electricity. It is expected that by 2025 there will be 46,066 electric cars in in Lithuania. Lithuania also has drafted strategic documents for the long term; for example, according to the NEIS, the energy intensity of transport will be reduced by 2.4 times in comparison with the current level in the transport sector by 2050.

In the transport sector, it is necessary to transform the old car fleet (currently the average age of passenger cars in Lithuania is 15 years) into a newer and more efficient one, to use vehicles powered by alternative fuels, to promote innovative transport technologies, the use of clean vehicles and the mobility of electric vehicles in all modes of transport. According to the data of VĮ Regitra for 1 November 2019, 1,313 pure M1 and N1 class electric vehicles were registered in Lithuania. This represents less than 1% of the total fleet (approx. 1.5 million). The number of electric cars is increasing, with an average of about 30 each month. The majority of electric cars registered in the country are used electric cars.

There are currently two main incentives for choosing an electric vehicle: the availability of specially designated lanes in Vilnius and the reduction of parking and entry fees in Lithuanian cities. For easier identification, electric vehicles are also given vehicle registration plate numbers consisting of a combination of two letters and four digits, the first of which must be the letter "E".

Electric vehicle recharging infrastructure in Lithuania was first established and developed in five major Lithuanian cities and resorts, as well as in the main trans-European road network ("TEN-T Core Network"), i.e. alongside international motorways (public highways) E85 and E67, and later alongside other roads belonging to the TEN-T network, approximately every 50 kilometres, in order to ensure electric vehicle connections between cities.

In 2014–2019, 25 public high-capacity electric vehicle recharging stations were installed on the Vilnius-Klaipėda motorway, the Vilnius-Panevėžys motorway and other highways of national importance. The information system www.eismoinfo.lt provides information on the type, status and real-time availability of recharging access for these electric vehicles.

Many municipalities in Lithuania have provided for electric car recharging points in their existing or future plans for sustainable urban mobility. 17 Lithuanian municipalities have taken advantage of the EU investment opportunity to install electric vehicle recharging points by the end of 2020 (a total of 56 electric vehicle recharging stations are planned: 33 high power and 23 regular power).

This public recharging infrastructure for electric vehicles (located alongside roads and in municipalities) is being established and developed in accordance with approved European Union standards, yet it also enables recharging other types of electric vehicles (combined stations with three types of access: AC, DC (Combo2) and DC (CHAdeMO)).

The capital currently has around 130 electric car recharging stations, more than a half of which were established through private sector initiatives. The private sector is also planning the development of electric vehicle recharging infrastructure, not only in cities, but also along national roads.

However, due to the increase in GHG emissions in the transport sector, achieving 9% savings compared to 2005 requires reducing the GHG emissions by nearly a third. The National Plan provides for a wide range of measures to achieve this.

Table 3.1.1.1 Existing policy measures in the field of transport

EXISTING POLICY MEASURES				
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**	**Total GHG reduction effect, thou t CO_2 eq 2021-2030**
T1. Renewal of urban and suburban public transport fleets by promoting vehicles running on alternative fuels and electricity	Purchase of 200 city and suburban buses running on alternative fuels and electricity and installation of infrastructure	2021-2030	Ministry of Transport and Communications, Ministry of the Environment, municipalities	4.9
T2. Electrification of railways	Electrification of 814 km of railways. 70% of freight traffic will be carried by electrified railways	2018-2027	Ministry of Transport and Communications	1115
T3. Implementation of sustainable urban mobility plans (SUMP)	Implementation of SUMP measures to reduce the use of fossil fuel-powered vehicles	2018-2030	Municipalities Ministry of Transport and Communications, Ministry of the Environment, Ministry of Energy,	1524
Total effect of measures				2643.9 thou CO_2 eq

T1. *Renewal of urban and suburban public transport fleets by promoting vehicles running on alternative fuels*
Renewal of the public vehicle fleet with vehicles powered by alternative fuels and electricity is carried out. Also the installation of infrastructure for alternative fuels such as LNG and electrical infrastructure such as stationary units in bus fleet areas.

T2. *Electrification of railways.* Renewal of railway infrastructure: 814 kilometers of railway will be electrified and account for 70% of freight carriage by rail.

T3. *Implementation of sustainable urban mobility plans.* Implementation of measures in the Sustainable Urban Mobility Plans (SUMP) that will promote walking, cycling, public transport and the use of alternative fuels. The implementation of all SUMPs is estimated to require 2.2 billion, some of which will be funded

from EU structural funds in 2021-2027.

Table 3.1.1.2. Planned policy measures in the transport sector up to 2030

PLANNED POLICY MEASURES				
Measure	Scope and results/effect envisaged	Implementation period	Entities responsible for implementing the policy	Total GHG reduction effect, thou t CO_2 eq 2021-2030
T4. Promoting RES in the transport sector (RES 12-16)	(1) increasing share of generation II (advanced) biofuels in total consumption: 0.2% by 2022	2018-2030	Ministry of Energy, Ministry of the Environment, Ministry of Transport and Communications	545.2
	(2) Production and supply of biomethane gas to the transport sector 81.5 ktoe by 2030		Ministry of Energy Ministry of Agriculture Ministry of the Environment Ministry of Transport and Communications	
	(3) Promotion of purchasing of commercial vehicles powered by compressed natural gas (about 680 buses or other vehicles.		Ministry of Transport and Communications Ministry of the Environment, Ministry of Energy, Municipalities	
	(4) Biogas producers registered in the register of guarantees of origin: 100% by 2030		Ministry of Energy, Ministry of the Environment, Ministry of Agriculture	*
	(5) Obligation for natural gas suppliers, aimed at delivery of 92.72 million cubic meters of biomethane gas in 2030		Ministry of Energy, National Energy Regulatory Council	

T5. Implementation of the objectives of the EU White Paper	No more polluting cars in cities by 2050	2011-2050	Ministry of Transport and Communications	The measure will have an effect after 2030. PPM road transport projections were prepared based on this target
T6. Developing and promoting economic and ecological driving skills.	5% of drivers will start driving, reducing fuel consumption by 3.7%	2021-2030	Ministry of Transport and Communications, Lithuanian Transport Safety Administration, Lithuanian Road Administration, Municipalities	204.4
T7. Promoting the purchase of cleaner vehicles	The efficiency of newly purchased cars will improve by 42%	2020-2030	Ministry of the Environment, Ministry of Transport and Communications, Ministry of Finance, Municipalities	281.6
T8. Implementation of E-tolling for freight transport	60 lorries and an average of 5.5 buses per year from the lower Euro standard to the higher Euro standard	2021-2027	Ministry of Transport and Communications	20.4
T10. Restriction of access to designated urban areas for vehicles with ICE	The number of vehicles powered by ICEs will be reduced or converted to zero emissions. The reduction in passenger cars will be 5% over the whole period.	2023-2030	Municipalities Ministry of Finance, Ministry of the Interior, Ministry of Transport and Communications, Ministry of the Environment	602.8
1. Creation of a Sustainable Mobility Fund	The Fund is a primary and necessary instrument for the implementation of other instruments	2022-2030	Ministry of Finance, Ministry of Transport and Communications, Ministry of the Interior, Ministry of the Environment	*

T12. Renewal of the transport fleet through green procurement and ensuring minimum procurement objectives in the field of transport	In green procurement, the share of clean cars in the total fleet should not be smaller than: for categories M1, M2 and N1 - 60% on 31 December 2025 and 100% in 2026-2030; for categories N2 and N3 - 8% on 31 December 2025 and 16% in 2026-2030; for category M3 - 80% on 31 December 2025 and 100% in 2026-2030	2022-2030	Ministry of Transport and Communications, Ministry of Energy, Public Procurement Office, Ministry of the Interior, Lithuanian Government, Municipalities	69.3
T13. Promoting the use of electric vehicles and developing the recharging infrastructure	Electric vehicles will account for 10% of annual class M1 purchase transactions (registered and re-registered cars) in 2025 and 50% in 2030.	2022-2030	Ministry of Transport and Communications, Ministry of Finance, Ministry of the Environment, Ministry of Energy, municipalities	532
T14. Construction of new cargo vessels and barges	54.5 million tonne-kilometres will be transferred from road transport to inland waterway transport	2021-2030	Ministry of Transport and Communications	57.1
T15. Construction of new passenger ships	Increased passenger flows in waterborne transport (0.6 million passenger-km) will reduce passenger flows in road transport accordingly	2021-2027	Ministry of Transport and Communications	0.2

T16. Replacement of existing inland cargo vessels, passenger vessels, fishing vessels and other inland waterway vessels, and upgrading of other mechanisms related to the replacement of those vessels	Conversion of existing power plants into less polluting power plants or conversion of diesel or petrol-powered plants into LNG, electricity or renewable energy-powered plants	2021-2025	Ministry of Transport and Communications, Ministry of Agriculture	*
T17. Development and/or upgrading of inland waterway infrastructure, including ports and landing places	The measure would allow the development of cargo shipping on the Kaunas-Klaipėda route and create the possibility of developing cargo shipping on the Kaunas-Grodno route, including intermediate points on these routes.	2021-2030	Ministry of Transport and Communications	*
T18. Establishment and implementation of a system of tax incentives	Establishment and application of a system of tax incentives for inland waterway transport and port dues concessions for vessels running on alternative fuels.	2021-2022 development and introduction of the system by 2030.	Ministry of Transport and Communications, Ministry of the Environment	*
T19. Support for the purchase of commercial vehicles fuelled by liquefied natural gas	Around 1000 vehicles subsidised per year	2021–2030	Ministry of Transport and Communications, Ministry of the Environment, Ministry of Energy	1,425
T20. Annual car pollution charge	5% of newly purchased petrol and diesel cars will be converted to zero-emission vehicles per year.	2023	Ministry of the Environment Ministry of Transport and Communications Ministry of Finance State company Regitra	2,671.2

T21. Differentiation of the vehicle registration/re-registration charge according to the level of pollution	Will reduce CO2 emissions by 3.5% per year	2021	Ministry of the Environment Ministry of Finance Ministry of Transport and Communications, State company Regitra	2,147.6
T22. Marking of vehicles according to the level of pollution	Marking of vehicles based carbon dioxide emissions, enabling more efficient implementation of other measures related to the determination of the emissions level, would ensure rapid identification of the vehicle group to which the vehicle belongs	2021-2030	Ministry of the Interior, Ministry of Transport and Communications State company Regitra /entities performing vehicle roadworthiness test	*
T23. Establishment of the LNG distribution system	Installation of 2 LNG stations. The sales of LNG per station are estimated at 792 tonnes per year.	2018-2030	Ministry of Energy, Ministry of Transport and Communications	3.2**
T24. Traffic congestion reduction through traffic organisation solutions	All measures are seen as being complementary to each other and simultaneously contributing to the reduction of the number of trips, while cutting fuel consumption by 1.8 times	2021-2030	Ministry of Transport and Communications Municipalities	424.2
T25. Reduction of traffic congestion through spatial planning solutions		2021-2022	Ministry of the Environment Ministry of Transport and Communications Municipalities	
T26. Promoting flexible working hours and remote work		2021-2030	Ministry of Social Security and Labour, Public sector bodies, Municipalities	

T27. Elimination of pollution tax concessions for operators engaged in individual activities	GHG emissions are decreasing by 2% per year due to the elimination of subsidies for fossil fuel extraction and consumption	2021-2030	Ministry of the Environment, Ministry of Finance	194.4
T28. A concession for the purchasers of N1 electric vehicles	Electric vehicles will account for at least 30% of annual class N1 purchases by 2025; 100% by 2030	2020-2030	Ministry of Transport and Communications, Ministry of Finance	61.4
T29. Promotion of zero-emission taxi and ridesharing service providers	The measure will change 2% of taxis and ridesharing vehicles into zero emission vehicles	2021-2030	Ministry of Transport and Communications Ministry of the Environment Municipalities	8.3
T30. Development and implementation of a cross-cutting study on public transport in Vilnius city	Strategic optimisation will reduce CO_2 emissions from buses by 12.64%	2021-2030	Vilnius City Municipality, Ministry of Transport and Communications, Ministry of the Environment, Ministry of Energy	201.7
T31. Broad social dissemination, public information, habit building and pilot projects to reduce fossil fuel consumption	Fuel consumption by affected population will decrease by 3.7% as a result of the measures	2021-2030	Ministry of Transport and Communications, Ministry of the Environment, Ministry of Energy, Ministry of Health, Ministry of Economy and Innovation, Ministry of Education and Science, municipalities	8**

T32. Improving access to and use of public transport	The measures reduce fuel consumption by 3.7%.	2021-2030	Municipalities Ministry of Transport and Communications, Ministry of the Environment, Ministry of Energy	5.2**
Total effect of the measures				10,505.7 thou t CO_2 eq

***** The impact of the measure is not assessed as it does not directly reduce GHG emissions, yet the measure is essential for the successful implementation of the other measures planned.

**The measure does not significantly reduce GHG emissions directly, but is essential for the successful implementation of the other measures planned.

T4. *Promotion of the RES use in the transport sector.* This measure is identical to RES measures 12 to 16 and is intended to:

- Promote the use of advanced (generation II) liquid biofuels (biodiesel and bioethanol) not produced from food and feed crops, in line with sustainability criteria, by progressively increasing the obligation for fuel suppliers to blend them with mineral fuels. As a result, the share of advanced liquid biofuels in total consumption will increase to 0.2% in 2022.

- Promote the emergence of sustainable biomethane gas production and supply chain guarantees through regulatory and financial instruments by encouraging public transport fleets to use gas from renewable sources. The projected volumes of production and consumption for 2030 are 81.5 ktoe.

- Promote the biogas guarantees of origin market so that 100% of biogas producers are registered in the guarantees of origin register in 2030.

T5. *Implementation of the objectives of the EU White Paper.* As a result, there should be no polluting cars in cities by 2050. This requires the development of a long-term plan for the promotion electric vehicles and electric vehicle recharging infrastructure, defining the targets and measures to that end.

T6. *Developing and promoting economic and ecological driving skills.* Reduced fuel consumption due to changes in driving skills achieved through training on economical and ecological driving, education, advertising, etc. Social advertising and other measures will reach 5% of drivers, reducing fuel consumption by 3.7%.

T7. *Promoting the purchase of cleaner vehicles.* A financial incentive will be offered for 4.8% of transactions. Of these, 50% will benefit from the incentive and the efficiency of newly purchased cars will improve by 42%. The amount of financial support will be EUR 1,000.

T8. *Introduction of E-tolling for freight transport.* As a result of the toll, 60 lorries and an average of 5.5 buses will be changed from the lower Euro standard to the higher Euro standard per year.

T9. *Introduction of incentives for combined freight transport.* To encourage intermodal unit carriers to opt

for combined transport instead of transporting intermodal units by road. By 2030, 5% of freight will be shifted to combined transport. This will reduce GHG emissions by 19% compared to road transport only.

T10. *Restriction of access to designated urban areas for vehicles with ICEs.* Creation of urban low-emission zones is planned, in which the traffic of both diesel and petrol-powered vehicles will be limited. The number of ICE-powered vehicles will be reduced or they will be replaced by zero emission vehicles. The reduction in the number of passenger cars will be 5% over the whole period.

T11. *Creation of a Sustainable Mobility Fund.* The Fund is the primary and necessary instrument for the implementation of other instruments. The fund should consist of all funds from targeted pollution taxes and be aimed at promoting cleaner transport (incentives for the installation of recharging points for electric vehicles, purchase of zero-emission vehicles, parking of zero-emission vehicles, social distribution and habit building). The mentioned measures are included and assessed individually, with no final list or scope.

T12. *Renewal of the transport fleet through green procurement and ensuring minimum procurement objectives in the field of transport.* Changes in the legal framework are planned to increase the use of clean vehicles and reduce the share of conventionally fuelled vehicles by implementing the minimum procurement targets: by 31 December 2025, in green procurement the share of clean passenger vehicles (categories M1, M2 and N1) in the total vehicle fleet must be at least 60%, the share of clean heavy duty vehicles (categories N2 and N3) in the total vehicle fleet must be at least 8% and the share of clean buses (category M3) in the total fleet must be at least 80%; by 31 December 2030, in green procurement the share of clean passenger vehicles (categories M1, M2 and N1) in the total fleet must be at least 100%, the share of clean heavy duty vehicles (categories N2 and N3) in the total fleet must be at least 16% and the share of clean buses (categories M3) in the total fleet must be at least 100%

T13. *Promoting the use of electric vehicles and developing the recharging infrastructure.* It is intended that electric vehicles should account for 10% of annual class M1 purchase transactions (registered and re-registered cars) in 2025 and 50% in 2030.

Facilitating electric vehicle acquisition, electric vehicle subsidising and increasing the availability of electric vehicle recharging infrastructure through the following instruments:

- Purchase allowance for pure electric vehicles (indicative amount fixed at EUR 4,000 for a new vehicle and EUR 2,000 for second-hand electric vehicles up to 5 of age);
- Allowance for the purchase/installation of semi-public and private normal power recharging points for electric vehicles (up to 22 kW and up to EUR 250);
- Allowance for the purchase/installation of public high power recharging points for electric vehicles in problematic or commercially unattractive locations by national roads and in the cities (up to 50 kW – EUR 5 000 000; up to 100 kW – EUR 10 000);
- The obligation to install recharging points for electric vehicles in new or reconstructed buildings and parking lots (at least 2 access points per 10 parking spaces);
- The obligation to install electric vehicle recharging points at new or reconstructed filling stations belonging to filling station networks and located by national roads.

T14. *Construction of new cargo vessels and barges.* Under the measure, vehicles for the carriage of goods would be prepared or built. This would shift part of the cargo from the polluting road transport to cleaner

inland waterway transport. Proposed funding is up to 30% (up to 50% for LNG vessels or self-propelled barges), while the rest of the required funding would come from own funds. 54.5 million tonne-kilometres will be transferred from road transport to inland waterway transport.

T15. *Construction of new passenger ships.* It is assumed that the construction of new vessels and barges and the development of passenger transport by waterway will allow modern waterborne transport to contribute to GHG savings. Increased passenger flows in waterborne transport (0.6 million passenger-km) will reduce passenger flows in road transport accordingly. New vessels should be fuelled by LNG or RES. Proposed funding is up to 30% (up to 50% for LNG vessels or self-propelled barges), while the rest of the required funding would come from own funds.

T16. *Replacement of existing inland cargo vessels, passenger vessels, fishing vessels and other inland waterway vessels, and upgrading of other mechanisms related to the replacement of those vessels.* Many of the power stations installed on board inland waterway vessels in Lithuania, consisting of main and auxiliary engines, are highly polluting. This measure would provide for the conversion of existing power plants into cleaner power plants or conversion of diesel or petrol power plants into power plans fuelled by LNG, electricity and renewables

T17. *Development and/or upgrading of inland waterway infrastructure, including ports and landing places.* There are currently only a few places suitable for cargo handling in Lithuania from Kaunas to Klaipėda (Marvelė cargo pier, Jurbarkas former inland waterway port with the Mituva Canal, and the Klaipėda State Seaport) that need to be further expanded or reconstructed. The infrastructure suitable for the transport of goods above Kaunas to the state border with Belarus is scarce and must be developed. The measure would allow the development of cargo shipping on the Kaunas-Klaipėda route and create the possibility of developing cargo shipping on the Kaunas-Grodno route, including intermediate points on these routes. Loading sites, warehouses, special fixed and mobile equipment must be installed at these loading points. The infrastructure would be used for the transport, loading and storage of goods and for serving passenger ships and passengers.

T18. *Establishment and implementation of a system of tax incentives* Establishment and adaptation of a system of tax incentives for inland waterway transport would provide practical incentives for carriers to develop their freight and passenger transport business, which would significantly improve the chances of reducing air pollution. Opportunities to build new and upgrade old ships, as well as incentives for their use, can significantly reduce land transport of freight and encourage passenger transport business, which would improve mobility opportunities in cleaner transport, and encourage the introduction of advanced, cleaner technologies in inland waterway transport. Port dues concessions would also apply to ships running on alternative fuels and ensure pollution reduction in the Klaipėda State Seaport.

T19. *Support for the purchase of commercial vehicles fuelled by liquefied natural gas.* To grant subsidies to businesses in order to compensate the cost of purchasing vehicles for them. The plan is provide a single non-repayable flat-rate subsidy for around 1,000 vehicles per year.

T20. *Annual car pollution charge*. Higher environmental taxes as well as the annual vehicle tax depending on the level of emissions have been found to encourage the replacement of cars by cleaner ones, which are taxed less heavily. Each year, 5% of newly purchased petrol and diesel cars will be replaced by zero-emission vehicles.

T21. *Differentiation of the vehicle registration/re-registration charge according to the level of pollution.* The

pollution-dependent registration/re-registration charges for new and used cars will reduce CO_2 emissions by 3.5% per year, as this will encourage the purchase of less polluting vehicles.

T22. *Marking of vehicles by level of pollution.* Carbon labelling of vehicles will lead to more efficient implementation of other measures related to the determination of emissions levels and will ensure rapid identification of the vehicle group to which the vehicle belongs. Vehicles would be marked with special stickers indicating the group to which they belong and the data would be included in the database with the vehicle registration numbers. Newly registered vehicles would be marked at the time of registration of the vehicle, while vehicles already registered would be marked at the time of the mandatory roadworthiness test of the vehicle.

T23. *Establishment of the LNG distribution system.* Installation of a liquefied natural gas distribution system to supply refuelling points for liquefied natural gas; installation of 2 LNG stations, which will be supported by covering 50% of the installation costs. The sales of one LNG station are estimated at 792 tonnes per year.

T24. *Traffic congestion reduction through traffic organisation solutions.* Traffic organisation changes through traffic planning measures (flow distribution, rush hour traffic restriction) and /or smart traffic management technologies (smart traffic lights, crossings, etc.) help to reduce congestion and fuel consumption. 35% of all vehicles are driven in the cites of Vilnius, Kaunas and Klaipėda. It is estimated that 50% of them experience traffic jams. In traffic congestion, vehicles consume 1.8 times more fuel.

T25. *Reducing traffic congestion through spatial planning solutions.* Making recommendations to municipalities covering spatial planning solutions that will contribute to efficient traffic management (optimal layout of public transport stops, development of commercial areas according to traffic intensity, etc.).

T26. *Promoting flexible working hours and remote work.* Education and information for employers and workers on the use of flexible working time options (remote work, flexible opening and closing hours, additional days off, etc.) helps to reduce the number of trips to and from work.

T27. *Elimination of pollution tax concessions for operators engaged in individual activities.* To abolish the concessions for the tax on pollution from mobile sources applicable to natural persons engaged in individual activities within the meaning of the Law on Personal Income Tax and using private vehicles in their activities.

T28. *Allowance for the purchase of N1 electric vehicles*. Electric vehicles will account for at least 30% of annual class N1 (light commercial vehicles) purchases (new and second-hand vehicles first registered and re-registered) by 2025 and 100% by 2030 . Class N1 vehicles with ICE will not be registered as of 2030.

T29. *Promotion of zero-emission taxi and ridesharing service providers***.** The obligation for taxi and ridesharing providers to direct orders to the drivers of zero-emission vehicles first, using telephone or application. Orders received by taxis and ridesharing companies (their operators / administrators) should be directed first to drivers of zero-emission vehicles providing those services by phone or application, only later to others; at airports and bus and railway stations, zero-emission taxis enjoy priority in queues. The measure will change 2% of taxis and ridesharing vehicles into zero emission vehicles.

T30. *Development and implementation of a cross-cutting study on public transport in Vilnius city*. An integrated study on the Vilnius city's public transport network and fleet will be developed to optimise public transport lines and adapt them to zero emission public transport. It is planned to explore all transport lines

in order to ensure rapid and convenient transportation in the expanding city and its access roads. Development of trolleybus lines and reduction of the use of diesel buses in the downtown is envisaged. A study on other alternative zero emission fuels for passenger transport was also carried out with a view to urban applications and the most suitable vehicles and required infrastructure have been proposed for the establishment of the necessary infrastructure. A study will be implemented in 2023–2030. Strategic optimisation will reduce CO_2 emissions from buses by 12.64%

T31. *Broad social dissemination, public information, habit building and pilot projects to reduce fossil fuel consumption.* Changing the behaviour of residents and their habits through education and opinion formation (training, publicity, presentations, advertising, promotion, etc. in kindergartens, schools, universities, for residents, public, municipal and private enterprises and organisations, etc.). Impact factor: 5% of the affected population reduces fuel consumption by 3.7% as a result of the measures.

T32. *Improving access to and use of public transport.* The following measures will be implemented:

- Revision of public transport routes and/or introduction of new ones in response to changing societal needs with a view to more actively reducing the number of vehicles in the city;
- Step-by-step introduction of free public transport (reimbursement of tickets) to regulate urban traffic (free public transport for primary school children, then for school children, then for students and seniors).

Alternative policy measures in the transport sector. These measures were additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not taken into account in the calculations in part B, but these measures will be considered as an alternative to the elements of the PPM scenario in order to ensure at least the same effect on the achievement of the national targets prior to approval thereof in the legislation (see Section 3 for more details). Alternative policy measures:

1. Alternative policy measures to promote renewable fuels are outlined in Section 3.1.2 .
2. Development of alternative fuel filling points on inland waterways and in the Klaipėda State Seaport.
3. To strengthen the control of fuel suppliers to reduce GHG intensity of fuels placed on the market by 6% compared to the overall EU target for 2010 (under Article 7a of the Fuel Quality Directive).

Financing of planned measures in the transport sector[51]. The bulk of the investment is directed towards the promotion of electric vehicles and the development of electric vehicle recharging infrastructure, low-emission vehicles, inland waterway transport and other measures in the transport sector. The total financial requirement of the sector amounts to EUR 3,752.66 million, of which EUR 2,798.96 million should be public funds and EUR 953.7 million private funds. The public portfolio will mainly consist of the 2021-2027 EU funds, LIFE IP, State and municipal budgets, the Climate Change Programme, and the ERDF.

Sector of industry and industrial processes

In Lithuania's progress strategy Lithuania 2030, one of the smart economy initiatives is to increase business incentives to invest in green technologies, goods and services. It also highlights the need for advanced, resource-efficient and environmentally friendly technologies and products to reduce climate change in other sectors and industry. One of the indicators measuring the success of the Smart Economy Initiative is atmospheric greenhouse gas emissions (CO_2 equivalent) in million tonnes per GDP unit targeted for

[51]Indicative funding requirement.

reduction. The climate change mitigation measures and indicators in the strategy are closely linked to the other sectors analysed.

The Sustainable Development Strategy draws attention to the current situation in Lithuania, where a number of companies use obsolete technologies and substances that are hazardous to human health. According to the vision, thanks to the introduction of the latest technologies distinguished for efficient use of resources, smaller negative environmental effects and cleaner production methods in the areas of production and services, environmental pollution will not be linked to economic growth and will grow much slower than production. Promotion of recycling of secondary raw materials and recycling capacity building is highlighted as one of the more important objectives in industrial development.

The progress programme identifies green procurement as well as the creation of incentives for business to invest in green technologies, goods and services as one of its objectives. The horizontal principles in the programme also include the components of sustainable business development, and one of the areas of change is to promote an environmentally friendly business culture and the development of a green market by encouraging the introduction of energy- and resource-efficient processes and technologies in enterprises, to promote the recovery of energy and materials through the development of technologies and production methods that recycle waste, reduce the use of natural resources and ensure waste prevention.

The Industrial Development Programme covers the need promote energy efficiency in industry: increased use of renewable sources of energy as well as introduction of technologies reducing carbon dioxide emissions. It stresses that EU assistance could help raise the efficiency of energy production and consumption as well as the use of renewal energy sources, thus reducing greenhouse gas emissions.

The National Air Pollution Reduction Plan identifies industry as one of the main pollutants (with a particular focus on oil refining and storage and transportation of petroleum products). In 2015, 19% of total SO_2 emissions came from the industrial sector.

The Lithuanian Industrial Digitisation Roadmap 2019–2030[52] provides various measures for the improvement and digitisation of the industrial sector. The document primarily focuses on improving and developing the industry itself, irrespective of its positive or negative potential environmental impact.

The Ministry of Economy and Innovation of the Republic of Lithuania is currently preparing a roadmap for transition to a circular economy, the results of which are expected in 2021. Once these documents are approved, concrete measures will be developed to implement the principles of circular economy.

The objective of the F-gas Regulation[53] is to reduce fluorinated GHG emissions. This Regulation establishes rules on containment, use, recovery and destruction of fluorinated greenhouse gases, and on related ancillary measures; imposes conditions on the placing on the market of specific products and equipment that contain, or whose functioning relies upon, fluorinated greenhouse gases; imposes conditions on specific uses of fluorinated greenhouse gases; and establishes quantitative limits for the placing on the market of hydrofluorocarbons.

The 2014-2020 Programme for Promotion of Investment and Industrial Development is intended to increase energy efficiency and the use of RES. The implementation of this programme is financed from the EU structural funds. According to the NEIS, the promotion of low energy consumption in subsectors and the

[52] https://inovacijos.lt/media/industry%20digitalization%20ROADMAP%20pre-final%20draft.pdf
[53] https://eur-lex.europa.eu/legal-content/LT/TXT/?uri=CELEX%3A32014R0517

application of eco-innovative technologies are expected to result in electricity savings of around 620 GWh by 2025.

Lithuania has also introduced requirements for fluorinated gases, which will reduce total emissions of fluorinated gases by two thirds in 2030 compared to 2014 levels. They prohibit the sale of fluorinated gases on the market in certain circumstances where alternatives are available. Between 2018 and 2020, quotas for legally placing HFCs on the EU market were reduced to 63% of the 2015 levels Lithuania implements the EU F-gas regulation through four domestic orders issued by the Minister for the Environment. In 2018, Lithuania ratified the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, which is intended to provide universal protection against the effects of HFCs, and started the process of progressive reduction of HFCs as of 2019. Lithuania will achieve the objectives of the Kigali Amendment to the Montreal Protocol by implementing the requirements of the F-Gas Regulation.

Table 3.1.1.3. Existing policy measures in sector of industry and industrial processes up to 2030

EXISTING POLICY MEASURES				
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**	**Total GHG reduction effect, thou t CO_2 eq 2021-2030**
P1. Introduction of alternative fuels in industrial enterprises	To replace fossil fuels by alternative fuels in industrial enterprises	2019-2027	Ministry of Economy and Innovation	372.5
P2. Implementation of the Regulation on fluorinated greenhouse gases	The Regulation is aimed at cutting total EU emissions from F- gases by two thirds by 2030 compared to the 2014 level.	2015-2030	Ministry of the Environment	6520
P3. Implementation of the Kigali Amendment	Reduction of HFC consumption	2019-2032	Ministry of the Environment	

P4. Relief for services in the public interest (SPI) for industrial enterprises (EE5.)	A support mechanism to finance the implementation of energy efficiency improvement measures in all major industrial enterprises in Lithuania. Annual energy efficiency measures that will lead to energy savings of around 100 GWh are planned	2021-2030	Ministry of Energy, Baltpool	*
P5. Incentives for investment and innovation.	Corporate income tax relief for investment and innovation	2021-2030	Ministry of Finance	*
Total effect of the measures				**6,892.5 thou CO_2 eq**

***** The impact of the measure is not assessed as it does not directly reduce GHG emissions, yet the measure is essential for the successful implementation of the other measures planned.

P1. *Introduction of alternative fuels in industrial enterprises.* Industrial enterprises plan to increase alternative fuel combustion capacity by replacing up to 90% of fossil fuels with an alternative. The measure is targeted at companies participating in the EU ETS.

P2. *Implementation of the Regulation on fluorinated greenhouse gases* The implementation of the provisions of the F-Gas Regulation will reduce emissions from the use of F-gases by two thirds by 2030 compared to 2014 levels, due to the prohibitions in the Regulation on the use of F-gases with a GWP>2500 from 2020, the prohibitions on the placing on the market of new equipment containing HFCs with a high GWP and the phasing out of the current method for the allocation of quotas for such gases.

P3. *Implementation of the Kigali Amendment.* The provisions of the Kigali Amendment to the Montreal Protocol intended to reduce the use of HFCs are already being implemented and will be complied with through the implementation of the F-Gas Regulation and national legislation.

P4. *SPI relief for industrial enterprises.* A support mechanism to finance the implementation of energy efficiency improvement measures (recommended in the energy efficiency audit reports) in all major industries in Lithuania. Companies will receive compensation for implementation of energy efficiency measures. Energy efficiency measures to be implemented are expected to result in energy savings of around 100 GWh annually and 5.5 TWh by 2030.

P5. *Incentives for investment and innovation*. Current corporate income tax exemptions for investment and innovation: to promote entrepreneurship, as of 1 January 2018 a one-year corporate tax holiday is granted to small start-ups by exempting them from corporate income tax in their first year of their operation; to promote innovation, incentives are targeted at companies that develop the latest technologies in their activities and then use them to generate income in their activities:

1) triple deduction of R&D costs – three deductions from revenues are allowed for the costs incurred by enterprises in carrying out R&D work (normally costs are deducted only once);

2) accelerated depreciation of assets used for the purpose of R&D: the price of acquisition of fixed assets used for the purpose of R&D can be written off as costs within two years (normally such write-offs are done in three to eight years);

3) a preferential tax rate for the commercialisation of R&D: an additional benefit has been established for companies investing in R&D since 2018 in the form of a reduced corporate income tax rate of 5% for the commercialisation of inventions created in R&D activities (on profits from the use or disposal of assets created in R&D activities).

Table 3.1.1.4. Planned policy measures in the sector of industry and industrial processes up to 2030

PLANNED POLICY MEASURES				
Measure	Scope and results/effect envisaged	Implementation period	Entities responsible for implementing the policy	Total GHG reduction effect, thou t CO_2 eq 2021-2030
P6. Industrial deployment of renewable energy sources (AEI6)	Renewable energy sources will be distributed in industry as follows: 70% of electricity and 30% of heat	2023-2030	Ministry of Energy, Ministry of Economy and Innovation	71.9
P7. Reduction of the use of coal, coke and lignite.	The subsidy will be abolished as from 2024.	2024-2030	Ministry of Finance	
P8. Reducing the use of F-gases in businesses	GHG reduction by 30%	2021-2030	Ministry of the Environment	136.01
P9. Promoting the substitution of polluting technologies with cleaner ones.	GHG reduction by 22%	2021-2030	Ministry of Economy and Innovation	667.9

P10. Introduction and promotion of technological eco-innovation	GHG reduction by 20%	2021-2030	Ministry of Economy and Innovation	178.9
P11. Implementation of modern technologies				
P12. Introduction and promotion of non-technological eco-innovation	One company having introduced non-technological eco-innovations would cut GHG by around 38 t CO_2 eq on average	2021-2030	Ministry of Economy and Innovation	1.5
P13. Promoting investment in product/packaging/service design solutions				
P14. Promoting the transformation of traditional industries	GHG reduction by 20%	2021-2030	Ministry of Economy and Innovation	15.1
P15. Promoting digitisation of industry	GHG reduction by 20%		Ministry of Economy and Innovation	
P16. Improving energy efficiency in enterprises:	A financial instrument that enables companies to implement energy efficiency improvement measures identified in the energy audit. Planned subsidies for energy savings and annual savings of around 100 GWh	2021-2030	Ministry of Energy	
Total effect of the measures				1,071.31 thou CO_2 eq

P6. *The use of renewable energy sources in industry*. The aim is to increase the production and consumption

of RES in industrial enterprises. The measure will have an impact on the combustion of fuels in industry and construction in the non-ETS sector. Renewable energy sources will be distributed in industry as follows: 70% of electricity and 30% of heat. The measure is the same as in the energy section of AEI6.

P7. *Reduction of the use of coal, coke and lignite*. The measure is targeted at industries not participating in the EU ETS. As coal is the most polluting fossil fuel in terms of GHG emissions, the proposal is to abolish the subsidy as from 2024.

P8. *Reducing the use of F-gases in businesses.* The measure is aimed at encouraging undertakings to acquire new equipment or to replace old equipment using technological alternatives other than fluorinated gases or using low-GWP gases. In providing financial support for the purchase and installation of cooling equipment, priority should be given to those applicants who plan to purchase equipment using lower-GWP coolants. In view of other countries' experience, this measure is expected to lead to a 30% reduction in greenhouse gas emissions.

P9. *Promoting the replacement of polluting technologies with cleaner ones.* The measure is targeted at the participants of the EU ETS. It is intended to partly finance projects for the replacement of polluting production technologies by less polluting ones, the implementation of BATs, etc. On average, BATs and other technology improvement solutions based on the best practices are expected to reduce GHG emissions by 22%.

P10. *Introduction and promotion of technological eco-innovation.* The measure is intended for small and medium-size enterprises. In order to reduce the negative effects of climate change and greenhouse gas emissions, investment in tangible assets (installations, technologies) is envisaged, which reduces the negative environmental impacts of economic activities, promotes industrial symbiosis and ensures a continuous environmental impact, i.e. investments in cleaner production innovations (implementation thereof) with rational use of resources and pollution prevention techniques (e.g. process modernisation/optimisation to reduce negative environmental impacts and/or to conserve natural resources, lean production, reuse/recycling of waste, use of waste heat (recovery, regeneration), separation of flows, etc.). On average, technological eco-innovation can reduce greenhouse gas emissions by around 20%.

P11. *Implementation of modern technologies.* Adapting existing and developing new production and service provision capacities for the production of new and existing products and provision of services. Financing will encourage companies to invest in the acquisition and deployment of new production technology lines, modernisation of existing production technology lines, installation of companies' internal engineering networks necessary for the deployment of new production technology lines or the modernisation of existing ones, and the deployment of modern and efficient technologies in service sectors; financing is also intended to ensure the functioning of the listed production and service delivery capacities.

P12. *Introduction and promotion of non-technological eco-innovation.* The objective of the measure is to encourage micro, small and medium-sized enterprises (SMEs) to implement non-technological eco-innovations in order to help solve environmental problems. Introduction of environmental management systems in accordance with international standards and/or performance of technological and/or environmental audits of production, ecodesign and eco-labelling are planned. One company having implemented non-technological eco-innovations is expected to reduce GHG emissions by around 38 t CO2 eq.

P13. *Promoting investment in product/packaging/service design solutions.* Encouraging companies to invest in product / service design solutions in order to increase the attractiveness of the company's products or services and thus the demand and productivity of the company.
Financial support for projects to develop innovative packaging designs that reduce waste in industry.

P14. *Promoting the transformation of traditional industries.* Encouraging the transformation of traditional industries through the deployment of technologies relevant for industrial innovation and growth as a whole – the promotion/deployment of Key Enabling Technologies (KETs) in the production processes of micro, small and medium-sized enterprises (SMEs). The measure covers nanotechnologies, micro-electronics and nanoelectronics, including semiconductor electronics, new materials, biotechnology and photonics. These technologies include flexible production systems and digital technologies. Technological development solutions are expected to reduce GHG emissions by 20%

P15. *Promoting digitisation of industry.* Performance of technological audits of industrial SMEs to assess the digitisation potential and prospects of industrial SMEs' production processes and/or technological monitoring of the implementation of the provisions on technological audits (technology advisory services); deployment of industrial SMEs' production process equipment with integrated digitisation technologies, based on the recommendations from the technological audit performed.

P16. *Improving energy efficiency in enterprises.* In order to improve the energy efficiency of businesses, Lithuania has planned a financial instrument that will encourage companies to implement energy efficiency improvement measures identified in the energy audit. It is planned to provide a subsidy for the energy savings achieved and to save 100 GWh annually and close to 5.5 TWh by 2030.

Alternative policy measures in the sector of industry and industrial processes. These measures were additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not assessed in part B of the calculations, but these measures will be considered as an alternative to the elements of the PPM scenario in order to achieve at least the same effect on the achievement of the national targets prior to their adoption in the legislation (see Section 3 for more details). Alternative policy measures:

1. Assessment of CO_2 capture, use and storage chain alternatives. To carry out a feasibility study on the application of CO_2 capture, use and storage technologies in Lithuania. Also, to carry out a detailed analysis of the feasibility and usefulness of projects implemented with other countries of the EU common economic area (to the geological structures of which the CO_2 captured in Lithuania could be exported).

Financing of planned measures in the sector of industry and industrial processes[54]. The bulk of the investment is directed towards the introduction and promotion of technological eco-innovation, the deployment of modern technologies and the digitisation of industry. The total need for funding for the sector is EUR 875.8 million, of which public funding amounts to EUR 341.53 million and private funding to EUR 534.3 million. The public portfolio will mainly consist of EU Structural Funds 2021-2027, Invest EU, LIFE and the Climate Change Programme.

Agricultural sector

[54]Indicative funding requirement.

In assessing the impact of EU support for agriculture and rural development on sustainable development, the National Progress Programme highlights the positive impact of investments to modernise farms, on the environment and labour productivity, and on the development of organic farming.

The long-term objectives set out in the Sustainable Development Strategy for the agricultural sector include the creation of an economically efficient and competitive agriculture, based on farming with a lower environmental impact; development of eco-farms and production of high-quality certified agricultural and food products; conservation of natural resources. The main long-term tasks for the agricultural sector are the following:

- to intensify the development of ecological crop production and animal husbandry;
- to promote effective development of biofuel production.

The 2014-2020 Lithuanian Rural Development Programme (the 'RDP') identifies a priority list of 24 needs. As many as 7 needs are directly related to climate change mitigation.

The National Air Pollution Reduction Plan states that pollution is increasing due to the use of inorganic nitrogen fertilisers and therefore 'particular attention should be paid to measures reducing the use of inorganic nitrogen fertilisers (including urea)'. The measures provided for in the plan concern both the livestock and crop sectors.

Most of the sectoral agricultural programmes will be updated in 2020, and the development of livestock and crop production is planned until 2027.

In the agriculture sector the main focus is on the more effective and precise use of mineral nitrogen fertilizers and the education of farmers. The Lithuanian Rural Development Programme 2014-2020 promotes the growth of the agricultural sector based on technologies that are territorially and environmentally balanced, climate-friendly, climate change- resilient, competitive and innovative. It also promotes sustainable farming (25 000 ha), development of organic farming (110 000 ha), crop rotation, rational use of the mineral fertilizers, and replacement thereof with organic fertilizers. The total budget of the programme was EUR 1.978 billion. 36% of all funds were allocated for climate change mitigation (this amount included the previous programming period). However, the assessment of recent GHG inventories shows an upward trend in CO_2 emissions and action will be taken to contribute to GHG reduction targets in the development of new agricultural policy solutions. The political guidelines of the EU Common Agricultural Policy also pay close attention to this. Since 2014 In Lithuania, biogas power plants producing biogas by processing manure from livestock farms have gained momentum. Another important mitigation activity is the protection of waters against nitrate pollution (such as the implementation of the EU nitrates directive and its latest amendment (1137/2008)), which contributes to reducing N_2O emissions. Lithuania will prepare a National Strategic Plan for the Common Agricultural Policy for the period 2021-2027.

Table 3.1.1.5. Planned policy measures in the agricultural sector up to 2030

PLANNED POLICY MEASURES

Measure	Scope and results/effect envisaged	Implementation period	Entities responsible for implementing the policy	Total GHG reduction effect, thou t CO_2 eq, 2021-2023
A1. Implementation of the recommendations of the Code of Good Agricultural Practice	To Improve farmers' knowledge of the implementation of the recommendations of the Code of Good Agricultural Practice	2021-2030	Ministry of Agriculture	*
A2. Granting of one-off compensatory support to farms for long-term commitments relating to climate change mitigation.	A 30% reduction in the use of mineral N fertilisers per 60,000 ha area.	2021-2030	Ministry of Agriculture	65.4
A3. Dissemination of knowledge and advice to farmers and fisheries on environmentally friendly and climate-friendly practices	To improve the knowledge of farmers and fisheries on the application of advanced technologies and operational solutions that reduce GHG emissions	2021-2030	Ministry of Agriculture	*
A4. Investment support for the introduction of climate-friendly farming methods in livestock farms	300,000 m^3 of pig manure and 350,000 m^3 of cattle manure and slurry are used for biogas production; 250 000 m^3 of slurry is used to fertilize the fields by direct insertion into land; 50 000 m^3 of slurry is used to fertilize the fields by direct insertion into land; to promote the introduction of slurry acidification technologies	2021-2030	Ministry of Agriculture	410.7
A5. Granting of one-off compensatory support to farms for long-term commitments relating to climate change mitigation	No mineral fertilizers used in a 60 ha area	2021-2030	Ministry of Agriculture	185.8

A6. Improvement of mandatory requirements for the use of slurry and manure	1 million ha area	2021-2030	Ministry of Agriculture	156.6
A7. Promotion of partial change of the composition of animal feed by reducing methane and nitrogen emissions	To inform farmers about the impact of certain changes in the composition feed on GHG emissions while maintaining productivity	2021-2030	Ministry of Agriculture	*
A8. Balanced use of mineral fertilisers	Use of mineral N fertilizers will be reduced by 15%	2021-2030	Ministry of Agriculture	1,557.2
A9. Promoting environment-friendly and sustainable farming practices	Promote good practices in environment-friendly and sustainable farming	2021-2030	Ministry of Agriculture	5.2
A10. Informing farmers about climate change mitigation potential (GHG quantities) at farm level	Providing advice to farmers on energy efficiency improvement	2021-2030	Ministry of Agriculture	*
A11. Promoting of more productive, disease and climate-resilient livestock and fish breeding	To inform farmers and fisheries about opportunities to breed or acquire more climate friendly and productive livestock and fish breeds	2021-2030	Ministry of Agriculture	*
A12. Review of fuel consumption technological cards and excise-free fuel allocations	20% reduction in fuel consumption	2021-2030	Ministry of Agriculture	1,423.7
A13. Promoting no-till technology	650 ha area	2021-2030	Ministry of Agriculture	438.3

A14. Abolition of environmentally harmful tax concessions for transport used in agricultural activities	Higher rates are imposed on all off-road mobile machinery, including agricultural machinery, in respect of their fuel consumption and emission of pollutants.	2021-2030	Ministry of Finance	6.4
A15. Increase in the tax on air pollution from stationary sources	Increase in the tax on pollution by livestock and poultry farming enterprises	2021-2030	Ministry of the Environment, Ministry of Finance,	196.5
A16. Reducing the use of fossil fuels in agriculture, forestry and fisheries	Fuel consumption reduction by 5.7%	2021-2030	Ministry of Agriculture	28.4
Total effect of the measures				4,474.34 thou CO_2 eq

* The impact of the measure is not assessed as it does not directly reduce GHG emissions, yet the measure is essential for the successful implementation of the other measures planned.

A1. *Implementation of the recommendations of the Code of Good Agricultural Practice.* The Code of Good Agricultural Practice aims to minimise negative impacts on soil, water, air and the climate; the innovations will be introduced farmers.

A2. *Granting of one-off compensatory support to farms for long-term commitments relating to climate change mitigation*. To increase the areas covered by environmentally friendly actions: extension of crop areas not using mineral N fertilizers. A 30% reduction in the use of mineral N fertilisers per 60,000 ha area.

A3. *Dissemination of knowledge and advice to farmers and fisheries on environmentally friendly and climate-friendly practices.* By providing advisory services, to improve the knowledge of farmers and fisheries on the application of advanced technologies and operational solutions that reduce GHG emissions.

A4. *Investment support for the introduction of climate-friendly farming methods in livestock farms*. Investments will focus on energy-efficient and GHG reducing equipment and technologies. The aim is to increase the efficiency of plant fertilisation with mineral fertilisers (according to actual plant needs and ensuring all qualitative soil parameters) and to apply slurry acidification as well as slurry insertion into the soil. Targets: 300,000 m^3 of pig manure and 350,000 m^3 of cattle manure and slurry are used for biogas production; 250 000 m^3 of slurry is used to fertilize the fields by direct insertion into the land; 50 000 m^3 of slurry is used to fertilize the fields by direct insertion into the land; to promote the introduction of slurry acidification technologies.

A5. *Granting of one-off compensatory support to farms for long-term commitments relating to climate change mitigation.* The aim is to increase the areas covered by environmentally friendly actions (extended areas not using mineral N-fertilisers): mineral N-fertilisers are not used in a 60 ha area.

A6. *Improvement of mandatory requirements for the use of slurry and manure*. To modify the requirements for the application of slurry and manure in order to reduce GHG emissions from manure applied to the fields. Introduce a requirement to insert the applied manure within 4 hours, thus enabling a reduction in the use of mineral nitrogen fertilisers and the resultant GHG emissions from manure and mineral N fertilisers. The measure is expected to affect an area of 1 million ha.

A7. *Promotion of partial change of the composition of animal feed by reducing methane and nitrogen emissions.* To inform farmers about the impact of certain changes in the composition of feed on GHG emissions while maintaining productivity: changes in the feeding of pigs, limited changes to the composition of feed for cattle; to reduce methane emissions from cattle, to inform cattle farmers on the potential for diversification of the composition of animal feed, improving the quality of feed and, at the same time, cattle productivity (e.g. by conversion of conventional wheat and barley straw into maize, sorghum, etc.), reducing the quantity of carbohydrates and replacing them by unsaturated fats in feed; to introduce nitrogen additives with slowly digestible compounds of nitrogen into feed, to reduce the protein content in feed for dairy cows and to avoid overfeeding.

A8. *Balanced use of mineral fertilisers.* To develop a system of balanced fertilisation with efficient and reduced use of mineral fertilisers (per harvest unit or per hectare of crop area): to oblige farms to provide data on the use of mineral fertilisers at the farm (by active substance); to develop a methodology for fertilization planning to serve as a basis for calculating the optimal fertiliser content per crop area and require farms to prepare fertilisation plans for mineral and organic fertilisers. The use of mineral N fertilisers on arable land would decrease by 15%

A9. *Promoting environment-friendly and sustainable farming practices.* To publicise good practices in environment-friendly and sustainable farming. To make farmers aware of the implementation of eco-schemes based on direct support measures under the CAP Strategic Plan and other policy instruments. It is planned to organise field days and information campaigns on soil-friendly technologies; to fertilise based on actual plant needs, postponing spring fertilisation; to carry out local (targeted) fertilisation and the opportunities and benefits of reducing mineral fertiliser use.

A10. *Informing farmers about climate change mitigation potential (GHG quantities) at farm level*. Providing advice to farmers on energy efficiency, animal husbandry or crop technology in order to define, and advise on, GHG emission reduction in production and on a given farm.

A11. *Promoting of more productive, disease and climate-resilient livestock and fish breeding.* To inform farmers and fisheries about opportunities to breed or acquire more climate friendly and productive livestock or fish breeds. Priority focus on the dairy farm sector. It is also important to inform farmers about the need for cattle disease prevention, timely appointments with a veterinarian, methods to keep the livestock facilities clean, etc.

A12. *Review of fuel consumption technological cards and excise-free fuel allocations.* Reduced quantities of fuel exempt from excise would lead to 20% savings in fuel consumption.

A13. *Promoting no-till technology.* At the end of the period, no-till technology will be applied in a 650,000 ha area, which will reduce fuel consumption and the quantities consumed by 40%.

A14. *Abolition of environmentally harmful tax concessions for transport used in agricultural activities*. Higher rates are imposed on all off-road mobile machinery, including agricultural machinery, in respect of their fuel

consumption and emission of pollutants.

A15. *Increase in the tax on air pollution from stationary sources*. Increase in the tax on pollution by livestock and poultry farming enterprises.

A16. *Reducing the use of fossil fuels in agriculture, forestry and fisheries*. Choosing the right implements according to the power of the tractor and applying the principles of eco-driving. The reduction in fuel consumption due to the introduction of the measure over the whole period is 5.7%

Financing of planned measures in the agricultural sector[55]. Most of the investment goes to promoting the use of no-till technology, providing support to farms for long-term climate change mitigation commitments, and investing in climate-friendly farming practices on livestock farms. The sector's total funding requirement is EUR 766 million, of which public funding totals EUR 627 million and private funding EUR 139 million, while direct payments will amount to EUR 256 million. The public portfolio will mainly consist of the EAFRD and the EAGF for 2021-2027.

Waste management sector

The Sustainable Development Strategy emphasizes that ineffective application of the 'polluter pays' principle to waste management will not lead to an effective waste management system and failure to ensure a universal, high-quality and affordable public service of municipal waste management may increase pollution by waste. The vision emphasises that a regional waste management system will be developed and primary sorting of waste will considerably reduce the flows of waste to dumpsites and increase recycling.

The National Progress Programme mentions that, with a view to rational use of natural resources, ensuring the quality of public utility services in the environmental sector would contribute to improving the quality of life. A specific objective of the programme is dedicated exclusively to the waste sector: improving water management and waste and air quality management systems. The objective is to manage wastewater in a way that reduces environmental pollution, with attention also devoted to preventing waste generation from other economic activities, so that the volumes of waste from production and other economic activities do not grow or at least grow much slower (twice as slow) than production. The aim is to recycle or reuse as much waste as possible and to encourage the use of technologies and production methods that reduce the use of natural resources and/or prevent waste.

The Industrial Development Programme emphasises the need to encourage companies to jointly implement the principles of industrial symbiosis in the region, which enable saving of raw materials and waste reduction. It is estimated that, as a result of these measures, the proportion of recycled or otherwise utilised waste from manufacturing and other economic activities (apart from phosphogypsum waste) is likely to increase from 90 per cent in 2012 to 92 per cent in 2020.

The Waste Management Plan identifies opportunities and threats related to waste management in Lithuania, stressing that the implementation of waste prevention measures at national level will reduce waste generation and the quantities of unused waste, rationalise the use of natural resources and materials, and reduce the risk of negative impacts of waste on public health and the environment. The order of waste prevention and management priorities is applied taking into account the general environmental protection principles of caution, sustainability, technical feasibility and economic viability, protection of resources as

[55]Indicative funding requirement.

well as the overall environmental impacts.

One of the objectives of the Waste Management Plan 2014–2020 is to reduce GHG in the waste sector By 2020, the reuse and recycling of waste such as paper, metal, plastic and glass from households and from other sources with similar waste streams should be increased to a minimum of 50% of the total waste quantity. Recycling and other recovery of municipal waste should increase to at least 65% of the total amount of municipal waste. By 2020, municipal biodegradable waste disposed of in landfills should make up no more than 35% of municipal biodegradable waste generated in 2000. This Plan is scheduled to be updated in the middle of 2020 to cover the 2021--2027 period.

An equally important aspect of reducing GHG emissions in the waste sector is waste prevention. The plan sets a target of a quantity of municipal waste per capita not exceeding the European Union average and a quantity of production waste per GDP unit.

The National Waste Prevention Programme covers all waste streams, but priority is given to reducing the generation of packaging, waste electrical and electronic equipment, biodegradable waste, hazardous waste and construction waste. It is the said priority waste streams that have the greatest negative impact on the environment and public health and/or generate significant quantities compared to other waste streams.

The implementation of the National Waste Prevention Programme will reduce the growth of waste generation, negative impacts of waste on the environment and public health, the presence of harmful substances in materials and products etc., and the implementation of the measures foreseen in the Action Plan will also achieve the main objective of reducing the growth of waste generation and unused waste, rational use of natural resources and materials, and reducing the risk of negative impacts of waste on public health and the environment.

It should be noted that the waste sector is currently undergoing a number of changes designed to reduce its negative environmental effects. Until now, most of the waste has been disposed in landfills, but various measures are being implemented which should contribute to the reduction of the quantities landfilled waste.

Table 3.1.1.6 Existing policy measures in the waste sector up to 2030

EXISTING POLICY MEASURES				
Measure	Scope and results/effect envisaged	Implementation period	Entities responsible for implementing the policy	Total GHG reduction effect, thou t CO_2 eq, 2021-2023
K1. Reduction of landfilling	By 2020, recycling and other recovery of municipal waste should account for at least 65% of the total amount of waste	2015-2020	Ministry of the Environment	204.7

	Landfilled biodegradable municipal waste should not account for more than 35% of biodegradable municipal waste compared to 2000	2013-2020	Ministry of the Environment	801.5
	Recovery of methane gas (CH_4) from landfills for energy production	2013-2020	Ministry of the Environment	1,096
	Incineration of waste in cogeneration plants	2020-2030	Ministry of the Environment	*
Total effect of the measures				2,102.2 thou CO_2 eq

* The GHG effect has been incorporated into other instruments.

Table 3.1.1.7. Planned policy measures in the waste management sector up to 2030

PLANNED POLICY MEASURES				
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**	**Total GHG reduction effect, thou t CO_2 eq, 2021-2023**
K2. Creating financial incentives to promote repair activities	Will reduce consumption of items and landfill waste by 0.5% per year	2021-2030	Ministry of the Environment	43.2
K3. Food waste reduction	Food waste will be reduced by 10%.	2021-2030	Ministry of the Environment	91.8
K4. Improvement of waste sorting skills among residents	Recycling of municipal waste will increase by 15% of the municipal waste generated	2021-2030	Ministry of the Environment	111.4

K5. Enhancing the capacity of environmental authorities and economic operators to properly identify and classify hazardous waste	Development of a uniform methodology for the identification of hazardous waste for environmental authorities and economic operators. Providing training for environment professionals on the identification and classification of hazardous waste and company consulting. Organisation of training for company representatives on the identification and classification of hazardous waste.	2021-2030	Ministry of the Environment	*
Total effect of the measures				246.4 thou CO_2 eq

* The impact of the measure is not assessed as it does not directly reduce GHG emissions, yet the measure is essential for the successful implementation of the other measures planned.

K2. *Creating financial incentives to promote repair activities.* Establishment of financial incentives to encourage repairing of bicycles, shoes, leather goods, clothing, furniture, etc. by considering the possibilities of alleviating the tax burden in order to encourage not discarding and re-use of old items. The measure will reduce waste landfilling by 0.5% per year.

K3. *Prevention of food waste reduction.* Raising public awareness and promoting behavioural change through social campaigns using the media, social networks, online and other information channels on the problem of food waste and it can be avoided (consumption patterns, sorting of food waste, separate collection, recovery, etc.). Creation and promotion of a mobile application about food nearing its best-before date but safe and suitable for consumption. Food waste will be reduced by 21%.

K4. *Improvement of waste sorting skills among residents.* Raising public awareness of the possibilities, benefits, different waste disposal sites and sorted waste through various information channels and instruments. Development, regular updating and promotion of a mobile interactive application to encouraging waste sorting among the public (involving all municipalities). The quantities of sorted and recycled waste are expected to increase as the residents' waste sorting skills and the conditions for sorting improve. Due to the presentation of new information, the amount of municipal waste recycled will rise by 15% of the amount of municipal waste generated. The information covers both theoretical information on the benefits and environmental impacts of recycling and practical information on where and how residents can sort waste.

K5. *Enhancing the capacity of environmental authorities and economic operators to properly identify and classify hazardous waste.* Development of a common methodology for the identification of hazardous waste for environmental authorities and economic operators. Providing training for environment professionals on the identification and classification of hazardous waste and company consulting. Organisation of training for business representatives on the identification and classification of hazardous waste.

Funding of planned measures in the waste management sector[56]. The bulk of the investment is directed towards waste reduction and sorting prevention. The total financial requirement of the sector amounts to EUR 5.1 million, of which EUR 4.9 million will come from public funding. The public portfolio will mainly consist of funds from the EU Structural Funds 2021-2027 and the Waste Management Programme.

The sector of land use, land use change and forestry

The Lithuanian progress strategy 'Lithuania 2030' mentions that Lithuania is renowned for its rich nature and it must be important for Lithuanians to preserve and develop natural heritage and to use resources wisely. Initiatives for fundamental change in the area of the smart economy aim at ensuring the stability of ecosystems and protecting biodiversity through sustainable development of forestry.

The National Strategy for Sustainable Development examines the possibilities of afforestation of more fertile soils in the LULUCF sector, identifies the need to use economic and administrative measures to ensure successful recultivation of used up quarries and peat bogs and maintenance of abandoned old farm buildings and provides for the possibility of creating conditions for landscape protection, management, use and planning by drawing up a national landscape management plan. Spontaneous renaturalisation and a targeted increase of the Lithuanian forest area as well as other perennial vegetation areas, rational development of protected areas and the nature framework, as well as their integration into the international ecological networks will help to protect landscape and biodiversity, slow down processes of soil erosion and strengthen ecological stability of territories. According to the mission, implementation of the Lithuanian Programme for Forest Area Expansion will not only facilitate the use of unproductive farmland, but also supplement the missing elements of the nature frame, and, upon establishment of the necessary links, to facilitate the integration of the Lithuanian system of protected territories into the European ecological networks.

The National Forest Sector Development Programme 2012–2020 aims to increase forest cover to 34.2% of the territory by 2020 through afforestation of uncultivated land and financial incentives for reforestation activities. During the period covered by the Lithuanian Rural Development Programme, i.e. 2007-2013, 17 200 ha were afforested and 8400 ha were afforested in 2014–2016. The draft National Programme for the Development of the Forestry Sector 2021–2030, which is due to be drawn up by the end of 2020, will aim to promote sustainable forest management and increase the absorption potential of the LULUCF sector.

The objective of the Landholding Programme is to improve the structure of agricultural holdings and to reduce the areas of abandoned land. Measures have been put in place to achieve that objective: restoration of productive abandoned land to good agricultural condition, including land reclamation work (assessment criterion:90 ha of restored farmland in 2020); preparation of low-productivity areas not suitable for agricultural activity for afforestation, including nature frame formation, and creation of an ecologically stable landscape.

[56] Indicative funding requirement.

Table 3.1.1.8. Existing policy measures in the LULUCF sector up to 2030

EXISTING POLICY MEASURES				
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**	**Total GHG reduction effect, thou t CO_2 eq 2021-2030**
L1. Restoration of forests damaged by fire and natural disasters	Support for the restoration of forests damaged by fires and other natural disasters	2007-2030	Ministry of the Environment, Ministry of Agriculture	*
L2. To promote short rotation coppice	Support for short rotation coppice cultivation (biomass)	2014-2020	Ministry of Agriculture, Ministry of Energy, Ministry of the Environment	**
L3. Planting Restoration forests and damaged forests	By 2020, 30 000 ha of new afforested areas from 2011 inclusively; national forest cover: 34.2% in 2020.	2018-2020	Ministry of the Environment, Ministry of Agriculture, National Paying Agency, State Forest Service	-1,064
Total effect of the measures				**-1,064 thou CO_2 eq**

* The impact of the measure is not assessed as it does not directly reduce GHG emissions, yet the measure is essential for the successful implementation of the other measures planned.

** The effect of the measure can be seen in the energy sector.

Table 3.1.1.9. Planned policy measures in the LULUCF sector up to 2030

PLANNED POLICY MEASURES				
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**	**Total GHG reduction effect, thou t CO_2 eq 2021-2030**

L3. Afforestation and restoration of damaged forests	Afforestation or conservation of spontaneous forest stands, 8 ha area per year	2021-2030	Ministry of the Environment, Ministry of Agriculture	-2091
L4. Promote the use of biomass for energy production	Additional production of wood biofuels from logging residues	2021-2030	Ministry of Energy, Ministry of the Environment, Ministry of Agriculture	**
L5. Restoration of wetlands in arable peatlands and protection of their "green bed" (perennial grass cover).	8,000 ha of wetlands will be restored	2021-2030	Ministry of Agriculture	-524.9
L6. Assessment of the possibility and potential outcome of growing perennial crops (i.e. trees and shrubs) on agricultural land	To identify criteria and areas (agricultural area) where it is appropriate to expand the cultivation of perennial crops.	2021-2030	Ministry of Agriculture	-23.9
L7. Promotion of perennial crops (priority: tree and shrubs)	8000 ha of arable areas will be converted into perennial crop areas	2021-2030	Ministry of Agriculture	
L8. Cultivation of herbaceous plants (grassland) in organic soils and the promotion of sustainable use thereof.	8,000 ha will be restored	2021-2030	Ministry of Agriculture Ministry of the Environment	-716.5

L9. Inventorying spontaneously afforested non-forest land as forest and conservation thereof	Reimbursement of costs of the costs of inventorying forest land as forest (preparation of necessary documentation for the afforestation permit and cad astral measurements)	2021-2030	Ministry of Agriculture, Ministry of the Environment	-460.2
L10. Redevelopment of stands and shrubs	Redevelopment rate: 1500 ha/year	2021-2030	Ministry of Agriculture, Ministry of the Environment	Measure will have an effect past 2030
L11. Promotion of green bedding on agricultural land.	400 ha / year	2021-2030	Ministry of Agriculture	-89.4
L12. Promotion of planting of landscape elements at the edges of cultivated fields	200 ha / year	2021-2030	Ministry of Agriculture	
L13. Promoting the optimised use of grassland and pastures.	200 ha / year	2021-2030	Ministry of Agriculture	
L14. Granting of one-off compensatory support to farms for long-term commitments (ECO scheme of 'experimental' impact) relating to climate change mitigation.	An area of 650 ha will be covered	2021-2030	Ministry of Agriculture	-500.5
L15. Protection of organic soils	A natural water level inhibiting GHG emission will be restored and/or maintained in a 1,000 ha area of organic soil.	2021-2030	Ministry of Agriculture	-189.8

L16. Promoting green public procurement	Introducing additional environmental criteria for public procurement to promote the use of wood and wood articles/products in the construction sector	2021-2030	Ministry of the Environment	*
L17. Determination of the national indicators of GHG emission / carbon stock changes	To establish national indicators of GHG emission / carbon stock changes in order to update GHG emission/absorption inventory and identify the most appropriate GHG emission reduction and absorption improvement measures in the LULUCF sector	2021-2030	Ministry of the Environment	*
L18. Promotion of intermediate crops	To encourage farmers to adopt intermediate crop production practices.	2021–2030	Ministry of Agriculture	*
Total effect of measures				**-4,596.2 thou t CO_2 eq**

* The impact of the measure is not assessed as it does not directly reduce GHG emissions, yet the measure is essential for the successful implementation of the other measures planned.
** The effect of the measure can be seen in the energy sector.

L3. *Afforestation and restoration of damaged forests.* To support afforestation and reforestation activities and restoration of degraded forest land. In the period 2021-2030, new areas will be afforested and areas of spontaneous afforestation will be conserved at a rate of 8 ha per year.

L4. *To promote the use of biomass for energy production*. Additional production of wood biofuels from logging waste.

L5. *Restoration of wetlands in arable peatlands and protection of their "green bed" (perennial grass cover).* To identify areas of former wetlands where it is appropriate to restore wetlands, specifying the effectiveness of such wetlands in GHG removal. To promote the restoration of drained marshes (wetlands) through the abandonment of arable farming, the restoration of appropriate water levels and the maintenance of ecosystems through sustainable economic activities. The additional area of wetlands to be restored by 2030 will be the same as the one restored to date, 2%, i.e. 8,000 ha in wetland areas with organic soils.

L6. *Assessment of the possibility and potential outcome of growing perennial crops (i.e. trees and shrubs) on agricultural land.* To identify criteria and agricultural areas where it is appropriate to expand the production of perennial crops. Also, the range of perennial crops to be cultivated, identifying their purpose of such

crops and assessing the economic/ecosystem benefits for agricultural production.

L7. *Promotion of perennial crops (i.e. trees and shrubs).* To promote the cultivation of perennial crops on farms through the CAP strategic plan and other incentives. 8,000 ha of arable land will be converted to grassland throughout the 2021-2030 period.

L8. *Cultivation of herbaceous plants (grassland) in organic soils and the promotion of sustainable use thereof.* In the early stage (until 2025), to reduce the extent of organic soil tillage by promoting the restoration, conservation and regular maintenance of the green bedding of organic soils (cover of perennial herbaceous plants) and use the resulting product based on the value chain of bioeconomy and circular economy. In the second stage (from 2025), to implement measures to restore the natural level of water in the drained organic soils in order to turn organic soils into CO_2 sinks and develop sustainable wetland farming in them. 8,000 ha, or 7.6%, will be restored .

L9. *Inventorying spontaneously afforested non-forest land as forest and conservation thereof.* Reimbursement of the costs of inventorying forest land as forest (preparation of necessary documentation for the afforestation permit and cadastral measurements).

L10. *Restructuring of stands and shrubs.* Restructuring of stands and shrubs of low-absorption potential in order to create sustainable forest ecosystems, while increasing the absorption potential of forests, with the application of financial incentives. Redevelopment rate: 1,500 ha/year.

L11. *Promotion of green bedding on agricultural land.* Encourage farms to sow intermediate crops or undersowing in crop areas: planting of green bedding at field edges and gardens, undersowing and intermediate crop cultivation to cover the soil with plants for as long as possible, and green bedding planting in buffer strips by the water bodies. Estimated planting rate: 400 ha per year.

L12. *Promotion of planting of landscape elements at the edges of cultivated fields*. In CAP strategic instruments, to give priority to encouraging farms to plant landscape elements (hedges and other plants) with high GHG absorption capacity at the edges of cultivated fields. Estimated planting rate: 200 ha per year.

L13. Promoting the optimised use of grassland and pastures. In CAP strategic instruments, to give priority to encouraging livestock farms: to extend the grazing period and thus to reduce manure production in barns, to prolong the maintenance of temporary grassland and pastures without tillage, and to develop extensive grasslands for a balanced increase in livestock density, promoting grass productivity in less fertile regions. Estimated planting rate: 400 ha per year.

L14. *Granting of one-off compensatory support to farms for long-term commitments (ECO scheme of 'experimental' impact) relating to climate change mitigation.* By 2030, the no-ill technology will be applied to a 650,000 ha area .

L15. *Protection of organic soils.* A natural water level inhibiting GHG emission will be restored and/or maintained in a 1,000 ha area of organic soil. (Assessment of the status of organic soil in certain areas will be followed by a revision of the area of organic soils in which a natural water level will be restored and no land reclamation work can be encouraged).

L16. *Promoting green public procurement.* To introduce additional environmental criteria for public procurement in order to promote the use of wood and wood articles/products in the construction sector.

L17. *Determination of the national indicators of GHG emission/carbon stock changes.* To establish national

indicators of GHG emission / carbon stock changes in order to update GHG emission/absorption inventory and identify the most appropriate GHG emission reduction and absorption improvement measures in the LULUCF sector.

L18. *Promotion of intermediate crops.* To encourage farmers to adopt intermediate crop production practices. In the measures under the RDP, to give priority to operators growing intermediate crops from 15% of arable land, increasing the payments according to the area of intermediate crops.

Alternative policy measures in the LULUCF sector. These measures were additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not taken into account in the calculations in part B, but these measures will be considered as an alternative to the elements of the PPM scenario in order to ensure at least the same effect on the achievement of the national targets prior to approval thereof in the legislation (see Section 3 for more details). Alternative policy measures:

1. Promotion of carbon accumulation in forest stands by forming more productive forest areas through sustainable forestry measures.
2. To develop an action plan for the protection of organic soils in agricultural land against erosion and for turning organic soils into GHG sinks. Prepare an action plan (Ministry of the Environment and Ministry of Agriculture) to determine the most effective way to restore peatlands.
3. To introduce a GHG charge per tonne of peat extracted.
4. To develop an action plan for the conversion of drained and unused 'abandoned" peatlands into GHG sinks.

Funding of planned measures in the LULUCF sector**.** EUR 102.1 million from the Lithuanian Rural Development Programme will be allocated in direct payments for the implementation of these measures.

Horizontal climate change management policies

It should be noted that the need for State interventions to achieve the National Targets as well as the cost of implementing the National Plan can be significantly reduced by reinforcing horizontal climate change management policies that would enhance coordinated action by public bodies, municipalities and the private sector as well as public awareness and engagement.

Table 3.1.1.11. Horizontal measures to manage climate change.

PLANNED POLICY MEASURES				
Measure	Scope and results/effect envisaged	Implementation period	Entities responsible for implementing the policy	Total GHG reduction effect, thou t CO_2 eq 2021-2030
H1. Integration of the evaluation of the effect on GHG emissions into the legislative process	To amend the legislation governing the legislative process in order to ensure that new and amended legislation, taking its subject-matter into consideration, is subject to environmental impact assessment, including	2021-2030	Ministry of the Environment, Ministry of Justice	N/A

	GHG emissions			
H2. Extending the scope of green procurement and increasing public sector obligations	Expansion of the scope of green procurement including, but not limited to, green electricity and heat (according to guarantees of origin), low-emission transport services, building purchasing or renting for public use (highest energy efficiency classes), waste management (mandatory sorting infrastructure), etc.	2021-2030	Ministry of the Environment, Ministry of the Interior	N/A
	To amend legislation with a view to ensuring that municipalities and public bodies carry out as many procurements as possible in accordance with green procurement criteria			
H3. Mandatory application of climate adaptation criteria to new infrastructure projects	To amend legislation to ensure that all new infrastructure projects are subject to climate change adaptation requirements	2021-2030	Ministry of the Environment, Ministry of Economy and Innovation, Ministry of Transport and Communications, Ministry of Energy	

H4. Increasing municipal involvement in the climate change management policy	To establish attractive mechanisms for the implementation of the climate change management policy in order to encourage Regional Development Councils and individual municipalities to contribute effectively to the achievement of the national targets	2021-2030	Ministry of the Interior, Ministry of the Environment	
H5. Integration of climate change into all programs in the education system	With a view to changing societal behaviours, to ensure that education related to climate change is included into education programs at all levels and higher education curricula	2021-2030	Ministry of Education, Science and Sport, Ministry of the Environment	
H6. Increasing public awareness and involvement in the climate change management policy	Raising public awareness on climate change, pollution and public health through innovative and intensive communication based on research	2021-2030	Ministry of the Environment	
H7. Implementation of development cooperation projects (climate change) in developing countries	For the implementation of climate change adaptation and mitigation measures in third countries in line with European Union legislation, the Convention on Climate Change, the Kyoto Protocol and other international agreements	2021-2030	Ministry of the Environment, Ministry of Foreign Affairs, Ministry of Finance	

H8. Promoting research on climate change mitigation and adaptation	To expand climate change research, to ensure the research and development as well as innovation in the sphere of climate change; to attract funds from the business sector for research and development and innovation in the sphere of climate change;	2021-2030	Ministry of Education, Science and Sport, Ministry of Economy and Innovation, Research Council of Lithuania, Ministry of the Environment	

Alternative horizontal measures of the climate change management policy. These measures have been additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not assessed in part B of the calculations, but these measures will be considered as an alternative or addition to the elements of the PPM scenario in order to achieve at least the same effect on the achievement of the national targets prior to their adoption in the legislation

1. Strengthening of economic signals to achieve the desired behaviour of market participants and consumers: in the light of the progress of clean technologies, to abolish the tax concessions for fossil fuels as soon as possible, implement the 'polluter pays' principle, design fiscal policies so as to provide economic incentives to reduce the impact on climate change, and introduce eco-innovations and effective adaptation measures.
2. A reform of the tax system by replacing the current pollution and other taxes with a universal CO_2 tax in non-ETS sectors. Introducing such a tax would allow the market to discover the most efficient solutions for reducing CO_2 by itself and could modify the planned but not necessarily the most effective State interventions through specific greening measures.
3. To amend legislation with a view to ensuring that municipalities and public bodies carry out only green procurement.

Strategies, plans and measures for adaptation to climate change

In Lithuania, the most climate sensitive sectors are agriculture, public health, energy, industrial, transport and communication infrastructure, forestry, ecosystems, biodiversity, landscape and water resources and the coastal area; urbanised areas are important. Successful adaptation to climate change requires not only the contribution of the state, but also the initiative of municipalities and residents and cooperation with scientists. There is a need to raise awareness of emerging threats among residents, farmers and entrepreneurs and to promote preventive protection against the damage caused by climate change.

It is important to coordinate disaster risk, emergency and natural phenomena management, prevention, warning systems and rescue actions under the United Nations Sendai Framework for Disaster Risk Reduction 2015-2030 and climate change adaptation measures. The impact of climate change is often felt not only at national level but also locally, and the contribution of municipal authorities to the fight against climate change is therefore necessary and essential. Climate phenomena can affect individual regions differently, so municipalities have to come up with the most appropriate response to the challenges they face. If climate change poses a threat to the region as a whole, the neighbouring municipal administrations can, in cooperation with each other, find an optimal way to mobilise available resources and address the negative consequences. At municipal level, it is easier to build close communities where good examples of climate

change mitigation or adaptation can be shared and promoted. The targets and objectives of climate change adaptation entail the avoidance of threats, dangers and risk factors identified in the National Security Strategy and contribute to the implementation of the priorities and objectives of the national security policy.

The National Strategy for the Climate Change Management Policy 2013–2050 is currently being developed. This is an integrated Strategy, which covers both adaptation to climate change and climate change mitigation policies. The strategic objective of the Lithuanian policy for the adaptation to environmental changes caused by climate change is to reduce the existing and potential sensitivity of the country's ecosystems and national economy and to strengthen the capacity to adapt through the introduction of measures, cost-effective reduction of risks and damage, the preservation and improvement of resilience to climate change, in order to ensure the creation of favourable conditions for the sustainable development of public life and economic activities.

The strategic objective will be implemented through adaptation measures in climate change- sensitive sectors (agriculture, energy, transport, industry, forestry, ecosystems and biodiversity, landscape, public health, water resources and the coastal zone, urbanised areas, etc.). The strategic objective will be pursued along the main pathways:

- Regional cooperation in implementing adaptation measures in specific areas. Possible ways of reconciling the different interests of the regions, making efficient use of available resources and thus achieving an optimal choice of instruments are sought.

- Compatibility and synergy of climate change mitigation and adaptation measures. Innovative solutions to the challenges ahead can offer significant economic opportunities in terms of technological development and new environmental products and services, which can help to improve the quality of life.

- To promote RDI and strengthen the knowledge base on climate change impacts, vulnerabilities and climate change adaptation capacity. State and municipal institutions must promote cooperation among scientific, business and financial institutions in order to provide the most cost-effective solutions minimising risk and damage;

- Gathering knowledge and sharing of good practices and examples on climate change phenomena and damage caused by them. Research and systematic monitoring, data collection, modelling of scenarios and forecasting of climate change effects in Lithuania should be carried out on an ongoing basis. This information should be easily accessible to interested parties and to the implementers of the measures;

- The role of local authorities and the local community in the planning and implementation of climate change adaptation measures is important, as it enables the territory concerned to adapt better to the natural, social or other characteristics of that region and to find optimal measures.

Short-term targets and objectives for climate change adaptation in the sectors most sensitive to climate change:

- The target in agriculture is to improve the resilience of the agricultural sector to climate change.

- The goal of forestry, ecosystems, biodiversity and landscape protection is to preserve and enhance

the sustainability of natural ecosystems and the value of ecosystem services.

- In the public health sector to goal is to reduce the negative effects of climate change on human health.
- The objective of protecting water resources and the coastal zone is to reduce the effects of rising water levels and natural disasters on the quality of surface water, groundwater and the Baltic Sea.
- In the energy, transport and industrial sectors, the goal is to improve engineering infrastructure resistance to threats posed by climate change.

Short-term cross-sectoral targets for climate change adaptation:

In urban areas the objective is to carry out sustainable planning of small town and urban areas and spaces based on a nature-based approach and solutions.

The objective in the area of emergency and natural disaster management is to ensure coordination between state and municipal authorities responsible for planning disaster risk, emergency and natural phenomena management, prevention, warning systems and rescue actions and climate adaptation measures.

In the area of collection and dissemination of data and information, the objective is continuous monitoring and assessment of risks, sensitivity and adaptability in individual sectors of the economy, forecasting and modelling of climate change scenarios on the Lithuanian territory and in individual regions.

The indicative medium-term (until 2040) and long-term (until 2050) objectives for climate change adaptation are to further monitor and study the vulnerability of the country's ecosystems and economy, to strengthen the capacity to adapt, to plan measures, to minimise risks and damage effectively, and to maintain and enhance resilience to climate change. The main tasks for the achievement of the set objective are as follows:

- To ensure coordination of the planning of disaster risk management, emergency and natural phenomena management, prevention, warning systems, rescue and climate change adaptation measures.
- To promote cooperation with international organisations and other countries in the fields of climate change adaptation, loss and damage, emergency and natural phenomena management.

The Lithuanian National Risk Analysis updated in 2018 provides an assessment of risk factors with the greatest impact and likelihood. The following phenomena have been identified as posing a very high risk to Lithuania:

- natural, catastrophic and meteorological phenomena (catastrophic effects on the operation of the transport system);
- epizootics (African swine fever) (very significant impact on property and environment);
- flooding (very significant impact on property and the environment and on the functioning of the transport system);
- epidemics and/or pandemics (very significant impact on human life and health and provision of health care services);
- major industrial accident (catastrophic effects on human life and health).

Of the said five factors, at least two can be directly linked to climate change. Drought, forest and peat fires,

which can also be linked to climate change, are also among the factors of lesser impact but of high and very high probability.

Table 3.1.1.11. Planned policy measures to adapt to climate change by 2030

PLANNED POLICY MEASURES				
Sector	**Measure**	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**
Water resources	Ensure the functioning of the flood risk management system	Regular updating of flood risk management plans	2021-2030	Ministry of the Environment (Environmental Protection Agency, Lithuanian Hydrometeorological Service)
Water resources	To implement flood risk management projects	To implement flood prevention measures identified in risk management plans (including green infrastructure measures)	2021-2030	Ministry of the Environment, municipalities
Water resources	To implement water resource management and protection projects	Regular upgrading of the monitoring system for surface waters and groundwater and studies to assess the impact of climate change and climate change resilience of water bodies.	2021-2030	Ministry of the Environment (Lithuanian Geological Survey, Environmental Protection Agency)
		To implement the water body improvement projects foreseen in the river basin management plans (renaturalisation of rivers, removal of obstacles to fish migration, biomanipulation measures, rehabilitation and installation of bogs and wetlands, installation of sedimentation ponds, etc.)	2021-2030	Ministry of the Environment (Environmental Protection Agency)

Water resources	To implement rainwater treatment projects	By 2030, to modernize and improve surface wastewater (rainwater) infrastructure in urban areas (including through green infrastructure measures) in order to protect these areas from the risks of excess water from rainfall and melting snow and to prevent pollutant leakage to the environment (surface water)	2021-2030	Ministry of the Environment, municipalities
Water resources	To reduce the negative effect of rising water levels and extreme weather events on the quality of surface water and groundwater	Regular improvement of water resource management to enhance the status of water bodies Studies on the status of surface water and groundwater bodies, identification of remedial measures, improvement of regulation, monitoring and control	2021-2030	Ministry of the Environment (Environmental Protection Agency)
Water resources	To improve the resilience of wastewater treatment infrastructure to rainfall and climate change	Reconstruction of wastewater infrastructure required due to excessive infiltration of rainwater into wastewater networks	2021-2030	Ministry of the Environment (Environmental Protection Agency)

Forestry, ecosystems, biodiversity and landscape	To enforce the protection of protected species and habitats	To prepare and implement regulatory instruments for the conservation and management of protected species and habitats and control of invasive species by 2030. To encourage land owners to exterminate invasive species and reduce their spread in the most sensitive ecosystems. Continue research and monitoring of protected species and habitats	2021-2030	Ministry of the Environment (State Service for Protected Areas)
Forestry, ecosystems, biodiversity and landscape	Protection and sustainable use of biodiversity and ecosystems through an evaluation mechanism for ecosystem services	To establish the legal preconditions for integrating the assessment of ecosystem services and ensure their application in decision making in order to halt biodiversity and ecosystem loss and the loss of natural benefits due to climate change	2021-2030	Ministry of the Environment
Forestry, ecosystems, biodiversity and landscape	Preparation of the Coastal Zone Management Programme	To prepare a Coastal Zone Management Programme	2021-2030	Ministry of the Environment
Forestry, ecosystems, biodiversity and landscape	Implementation of coast management measures in the coastal zone	To implement coastal zone management projects, increasing coastal resilience to the effects of climate change	2021-2030	Ministry of the Environment

Forestry, ecosystems, biodiversity and landscape	Consolidation of the nature framework and creation of green infrastructure in degraded agricultural areas	In areas of intensive economic use, to ensure a good state of the natural framework (stable geo-ecological potential), promote the restoration of natural landscapes and ecosystems, enhance landscape and biodiversity, and ensure the quality of ecosystem services order in order to increase the resilience of these areas.	2021-2030	Ministry of the Environment (State Service for Protected Areas), Ministry of Agriculture, municipalities
Forestry, ecosystems, biodiversity and landscape	Rehabilitation and protection of wetlands by ensuring their resilience and the provision of services essential for adaptation	Restoration of damaged wetlands (not used in agriculture and not having agriculture potential) is carried out by restoring an appropriate hydrological regime, preservation of these ecosystems in order to increase their resilience to climate change and to ensure the provision of their ecosystem services necessary for adaptation to climate change .	2021-2030	Ministry of the Environment
Forestry, ecosystems, biodiversity and landscape	Increasing forest resilience	To promote the development of young stands, stand structure and outer food formation as well as non-clear cutting in order to develop stands of diverse ages and species that are more resilient to climate change	2021-2030	Ministry of the Environment

Forestry, ecosystems, biodiversity, landscape	Implementation of measures to prevent fire and natural disasters in forests	To introduce measures to prevent fires and natural disasters in forests, including but not limited to the creation or adaptation of the necessary forest infrastructure.	2021-2030	Ministry of the Environment
Forestry, ecosystems, biodiversity and landscape	Promoting sustainable forestry activities in the context of climate change in private forests	To provide advice, information and training to private forest owners on sustainable forestry issues in the context of climate change and to promote collaboration and cooperation.	2021–2030	Ministry of the Environment, Ministry of Agriculture
Forestry, ecosystems, biodiversity, landscape	Preparation or updating of spatial planning documents and their implementation	By 2030, to develop or update and implement planning documents for areas important for the protection of species and habitats in which the most climate change-sensitive and vulnerable species and natural habitats of EU interest can be detected and for protected areas. To regularly carry out the spatial planning process for the review of the regime for the protection and use of protected areas, adjustment of boundaries, compensation and land redemption	2021-2030	Ministry of the Environment (State Service for Protected Areas)

Forestry, ecosystems, biodiversity, landscape	Forest research	To carry out research and experimental work on forests in order to increase the resilience of forests to climate change, the choice and selection of resistant genotypes of tree species, the dissemination of research results and use thereof in the field of forestry	2021–2030	State Forest Service, Institute of Forestry of the Lithuanian Research Centre for Agriculture and Forestry Ministry of the Environment
Transport	To reduce the impact of extreme weather events on transport infrastructure elements and road surfaces	Improvement of road infrastructure by 2030	2021-2030	Ministry of Transport and Communications
Transport	To ensure continuous improvement of the road weather information system	Regular improvement and updating of the road weather information system	2021-2030	Ministry of Transport and Communications
Transport	Creating tools for the identification of problematic road sections	To develop instructions that will provide a single model for evaluating the most precipitation-sensitive roads and their sections in to identify where floods and high water events have occurred in recent years (or any other period) and to identify critical points where floods have occurred more than once.	2021-2022	Ministry of Transport and Communications, Lithuanian Road Administration, municipalities

Transport	Adaptation of several technical regulations to climate change	To review and update the provisions of the technical regulations for transport infrastructure (roads, bridges, land works, cableways, railways, ports, etc.) in the light of the changing climate and increasing natural disasters and the need to adapt to change	2021-2022	Ministry of the Environment, Ministry of Transport and Communications, Lithuanian Road Administration, Lithuanian Transport Safety Administration, State company Klaipėda State Seaport Administration, AB Lietuvos geležinkeliai airports
Transport	To reduce the impact of extreme weather events on airport infrastructure	Improvement of airport infrastructure by 2030	2021-2030	Ministry of Transport and Communications
Infrastructure	Improving the resilience of electricity distribution infrastructure to climate and environmental impacts, including the replacement of overhead lines by underground cable	Replacement of overhead power lines with underground ones, prioritizing replacement of unreliable and accident-prone lines, wooded areas, and voltage quality improvement solutions to enhance their resilience to climate change	2021-2030	Ministry of Energy, economic operators
Infrastructure	Reducing the vulnerability of the energy sector	To carry out research and assess the vulnerability of the energy sector to climate change, assess risks and identify vulnerabilities	2021-2030	Ministry of Energy, economic operators

Infrastructure	Amendment of regulations	By 2030, regulatory instruments must be amended taking into account the fact that the design of the structures must comply with current and future climatic conditions.	2021-2030	Ministry of the Environment
Infrastructure	Upgrading the waste infrastructure	Upgrading waste infrastructure to increase its resilience to climate change	2021-2030	Ministry of the Environment
Agriculture	Promotion of farm animal insurance	To promote the development of farm animal insurance so that the insurance system covers the majority of farm animals and contributes to efficient risk management and minimization of losses resulting from risks to farm animal health	2021-2030	Ministry of Agriculture
Agriculture	Promotion of crop and plant insurance	To support crop and plant insurance so that the insurance system can effectively manage the risks and losses associated with the effects of adverse climatic conditions on agriculture.	2021-2030	Ministry of Agriculture
Agriculture	Promotion of new agricultural risk management tools	To shape the legal environment and develop support instruments in order to encourage the development of new agricultural production risk management tools (such as agricultural risk management funds, income stabilization tools, mutual assistance funds, etc.)	2021-2030	Ministry of Agriculture

Agriculture	Selection and cultivation of varieties of agricultural crops resistant to climate change	To constantly ensure the selection of agricultural plant species resilient to climate change and promote their breeding.		Ministry of Agriculture
Agriculture	Development of advanced land drainage systems	To identify farmland areas where it is appropriate to install smart drainage instead of the existing drainage system. To support the installation of modern drainage systems in designated areas which allow drainage of excess moisture during wet periods and the accumulation of moisture during dry periods	2021-2029	Ministry of Agriculture
Agriculture	Analysis and evaluation of polyculture (diversified) farming	To identify land use criteria (and areas where necessary) where it is appropriate to expand polyculture (diversified) farming	2021	Ministry of Agriculture
	opportunities	To identify the range of different species of plants (including perennial plantations) to be grown on strips of appropriate width for their best symbiosis, leading to better production results in sustainable ways. To identify the economic/ecosystemic benefits of growing such plants for agricultural production		

Agriculture	Promotion of polyculture (diversified) farming	To encourage farmers to develop polyculture (diversified) farming. To prioritize operators engaged in diversified farming and/or other incentives in the investment measures under the RDP.	2022-2030	Ministry of Agriculture
Agriculture	Improving the use of water for irrigation purposes in agriculture	To encourage the introduction of efficient irrigation systems (e.g. drip irrigation) in the agricultural sector to save water resources	2021-2029	Ministry of Agriculture
Agriculture	Climate change adaptation consulting in the area of agriculture	By 2027, to develop an infrastructure for informing and consulting farmers and municipality specialists on climate change adaptation		Ministry of Agriculture
Agriculture	To ensure continuous improvement of the agro-meteorological observation network and forecasting system	Regular improvement and updating of agro-meteorological observations, provision of agro-meteorological forecasts and regular monitoring and forecasting of plant diseases and pests.		Ministry of Agriculture, Ministry of the Environment

Agriculture	Promoting organic farms and production of national quality products ('NQP') under the National Agri-Food Quality Scheme by increasing the demand for organic products and NQPs	To expand the range of organic products supplied for children's nutrition and produced under the National Agri-Food Quality Scheme, in the framework of the Procedure for organising child nutrition. To encourage the use of at least 60% organic products and NQPs to feed children in pre-school education establishments.	2021-2030	Ministry of Agriculture, Ministry of Health Care
Agriculture/ aquaculture	Development of organic farming (including aquaculture)	To increase the areas and output of organic farming	2021-2029	Ministry of Agriculture
Public health	Development of green infrastructure in urban environment	To create high-quality and multifunctional green spaces (providing various ecosystem services), other green infrastructure elements in city and town areas most sensitive to climate change and in the neighbourhood of hospitals, preschool and general education establishments as well as elderly care establishments. Developing green infrastructure elements based on demand and benefit at different levels, from building to urban district.	2021-2030	Municipalities
Public health	Installation of water stations	Installation of fountains and other water dispensers for refreshment and filling up in the most heat-sensitive areas.	2021-2030	Municipalities

Public health	Improvement of the systems for phenological observations and for monitoring and forecasting airborne pollen concentrations	By 2030, to improve the network of phenological observations and the pollen monitoring and forecasting system	2021-2030	Ministry of the Environment (Lithuanian Hydrometeorological Service), Ministry of Health, Šiauliai University
Public health	Promotion of tick-borne disease prevention	To subsidize tick-borne encephalitis vaccination to at least for the most vulnerable age groups (children under 18 and persons over 65) and to provide information on alternative tick protection methods for those who cannot be vaccinated	2021-2030	Ministry of Health and relevant bodies subordinate to it
Public health	Establishment and operation of an interinstitutional working group on tackling the effects of climate change on public health	An interinstitutional working group aimed at increasing the climate change resilience of the Lithuanian population, developing action plans and making proposals for legislation or various studies	2021-2030	Ministry of Health and relevant bodies subordinate to it Ministry of the Environment and relevant bodies subordinate to it municipalities
Public health	Raising awareness health professionals' awareness of the effects of climate change on human health	To organize seminars, lectures and training to inform health professionals about climate change and its health effects	2021-2030	Ministry of Health and relevant bodies subordinate to it

Public health	Raising public awareness of climate change and its threats to human health	To create a short digital animated social advertisement about climate change and health threats posed by it for television, websites and social networks; short promotional texts for TV screens in public transport and for city video screens in public spaces; to prepare large informational/promotional posters for distribution in bus or trolleybus stops.	2021-2030	Ministry of Health, Ministry of the Environment
Emergency management	To upgrade the weather emergency notification system	By 2025, to upgrade the weather forecasting and warning system using impact-based warnings, where the alert level is determined based on the damage anticipated		Ministry of the Environment (Lithuanian Hydrometeorological Service)
Emergency management	Improvement and development of the alert and information infrastructure	Upgrading and strengthening of the capability to respond to the consequences of extreme natural phenomena caused by climate change	2021-2027	Ministry of the Interior
Emergency management	Strengthening of fire and rescue forces	Provision of machinery and equipment for the fire and rescue forces	2021-2027	Ministry of the Interior
Urbanized areas	Preparation of adaptation plans in municipalities	Preparation of adaptation plans for individual municipalities		Ministry of the Environment

Urbanized areas	To evaluate climate change sensitivity of Lithuanian territories by municipality	To evaluate and categorize the climate change sensitivity of the Lithuanian territory by individual municipalities and the necessary adaptation measures		Ministry of the Environment
Intersectoral objective	To ensure continuous improvement of the hydrometeorologic al monitoring network and forecasts	Regular upgrading of the hydrometeorological monitoring system and improvement of forecasts		Ministry of the Environment (Lithuanian Hydrometeorological Service)
Intersectoral objective	Providing climate projections and scenarios and planning appropriate adaptation measures	Regular updating of climate scenarios and projections and review and updating of adaptation measures based on those scenarios and projections		Ministry of the Environment
Intersectoral objective	Consulting for businesses on climate change adaptation	By 2030, to set information and consulting services for businesses to help them adapt to climate change		Ministry of Economy and Innovation, Ministry of Transport and Communications, Ministry of the Environment, Ministry of Energy, Ministry of Health, Ministry of Agriculture

Intersectoral objective	Participation in international cooperation	To constantly participate in the international cooperation for climate adaptation and in the development of an international climate adaptation policy		Ministry of the Environment
Intersectoral objective	Stimulating research to determine the effects of climate change	To carry out research to assess the impact of climate change		Ministry of the Environment

Alternative policy measures for adaptation to climate change. These measures have been additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not assessed in part B of the calculations, but these measures will be considered as an alternative to the elements of the PPM scenario in order to achieve at least the same effect on the achievement of the national targets prior to their adoption in the legislation (see Section 3for more details). Alternative policy measures:

1. Promotion of aquaculture resource insurance

Funding of planned climate change adaptation measures[57]. A total of EUR 3,303.3 million is needed, of which EUR 260.4 million for the water sector, EUR 247 million for forestry, ecosystems, biodiversity and landscape, EUR 850 million for transport, EUR 666 million for infrastructure, EUR 1,073.1 million for agriculture, EUR 125 million for public health, EUR 68.1 million for emergency management and EUR 13.6 million for intersectoral objectives. The main sources of public funds in 2021-2030 will consist of the 2021-2027 EU fund (European Regional Development and Cohesion Funds) investments, electricity and heat tariffs, Climate Change Programme, Waste Management Programme, State and municipal budgets.

Regional cooperation on climate change. The implementation of the Paris Agreement and the EU's climate and energy targets for 2030 are periodically discussed in the various Baltic Assemblies attended by members of the Lithuanian, Latvian and Estonian parliaments, in committees, at Prime Minister-level summits, in the Baltic Council of Ministers and in the meetings of groups of senior officials, as well as in the forums for the implementation of the European Union’s Strategy for the Baltic Sea Region.

3.1.2 Renewable energy

In Lithuania, the development of RES in the electricity, transport and heat sectors is promoted through financial instruments (State budget allocations, Climate Change Programme funds, EU support funds, revenue from statistical energy transfer or joint projects, tax incentives) and non-financial instruments (obligations, informational and regulatory measures).

[57]Indicative funding requirement.

Electricity sector

The development of RES in the electricity sector aimed at a 45% RES share by 2030 is based on the following principles:

- Gradual integration of renewable energy sources into the market: the most cost-effective technologies must be developed, taking into account technology maturity and considering the trends in their near future development.
- Affordability and transparency: the renewable energy promotion scheme must be designed based on market principle, with a minimum market distortion and ensuring a minimum financial burden on energy users as well as clarity and a non-discriminatory competitive environment;
- Active participation of energy consumers: with the increasing share of renewable energy sources in the total energy balance, it is necessary to promote decentralized electricity generation, enable consumers to use energy from renewable energy sources for their own needs and receive market-based compensation for the surplus energy supplied to the grid; it is also necessary to introduce solutions to manage consumer behaviour and energy demand and supply.

In order to achieve the RES objectives, measures have already been adopted to increase the share of RES in the electricity sector (Table 3.1.2.1).

Table 3.1.2.1. Existing policy measures for RES in the electricity sector up to 2030

EXISTING POLICY MEASURES			
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**
AEI1. Support scheme for electricity produced from RES	Annual increase in RES-E by 2.5 TWh until 2025	2020-2025	National Energy Regulatory Council ('VERT'), Ministry of Energy
AEI2. Financial support for prosumers (EU support)	Annual increase in RES-E by 0.075 TWh until 2024	2018-2024	Ministry of Energy, Ministry of the Environment
AEI3. To implement projects for co-generation plants using local and renewable sources of energy, with priority given to Vilnius and Kaunas	Annual increase in RES-E by 0.4 TWh until 2023	2014-2023	Ministry of Energy

AEI1. Support scheme for electricity produced from RES

Although RES technologies are constantly improving and equipment costs are declining, power generated from RES in the new installations is not yet able to compete in the market, so energy generation from RES is being incentivised and this will continue up to a limit that is economically and technically acceptable for the country, with a view to active participation of producers of RES-E at market conditions, or until the production of RES-E reaches the market price. Currently Lithuania has approved a support scheme[58] covering the following support measures:

- A price premium for RES-E;
- Priority transmission of RES-E;
- Exemption of electricity producers operating a power plant with a capacity below 500 kW from responsibility for balancing the produced electricity and/or reserving the power plant's generating capacity during the incentive period.

The specified incentives are only applicable where a producer participates in a technology-neutral auction and, if successful, offers the lowest price premium. The winner of the auction enjoys support measures for a period of 12 years, and the price premium offered by it, or a part thereof, is paid as follows:

1) The price premium won at the auction, where the sum of the next day's hourly price on the exchange and the price premium won at the auction is lower than or equal to the maximum price set by the VERT;

2) A portion of the price premium won at the auction, calculated as the difference between the maximum price set by the VERT and the next day's hourly price on the exchange, which may not be higher than the price premium won at the auction where the sum of the next day's hourly price on the exchange and price premium won at the auction exceeds the maximum price set by the VERT.

The producer will not receive the price premium won at the auction in the following cases:

- If the next day's hourly price on the exchange is higher than or equal to the highest price;
- If the next day's hourly price on the exchange is less than or equal to zero for 6 hours or longer;
- If the producer actually generates the amount of electricity allocated in the auction.

The producer who has won the auction undertakes to produce the amount of electricity offered at the auction for a period of 12 years.

The first auction to meet the 2030 target began on 2 September 2019[59], distributing 0.3 TWh of electricity. The auction is scheduled to end in 2020. March. Given the construction time of the power plants, which may take more than 3 years, the auction results are expected to be visible in 2023.

Considering the 2025 electricity generation target of at least 5 TWh of electricity from RES, the amount of electricity produced from RES in 2018, which was 2.2 TWh, the 0.3 TWh amount to be auctioned during the auction launched on 2 September 2019, also taking into account the climatic conditions and the development of electricity consumers, the Lithuanian Government approved an timetable for 2020-2022, setting out the dates of the auction notice and the planned amounts of RES-E to be distributed, which will be subject to the following support measures:

Table 3.1.2.2. 2020-2022 auction timetable

[58] http://enmin.lrv.lt/en/sectoral-policy/renewable-energy-sources/auctions
[59] https://www.vert.lt/en/Pages/Auctions.aspx

Opening of the auction	Annual quantity of electricity produced from RES to be auctioned
29 May 2020	0.7 TWh
5 April 2021	0.7 TWh
19 April 2022	0.7 TWh

The auctions will be organized according to an approved timetable until the interim 2025 target of 5 TWh of RES-E annually is attained. In the event that 2025 the target is reached before 2025, with power plants being constructed without support, auctioning will be halted and the need for continued support will be assessed.

In order to determine the effectiveness of the support scheme applicable in Lithuania and the continued need for it, the Government-authorized institution performs a technological, economic and social evaluation of RES technology development and the support scheme at least every 5 years, taking into account the possible impact of a modification to the support scheme. Based on this assessment and taking into account the objectives set by the NEIS in the field of RES and the actual amount of electricity from RES, make a decision on the further development of RES within the established support scheme.

AEI2. Financial support for prosumers. Promoting active participation of electricity consumers in the market, a scheme for generating electricity was created in 2015. The target for 2030 is to have 30% of the producing consumers compared to the total number of electricity consumers.

In order to ensure that the electricity generating scheme is available to all electricity consumers, the acquisition of the power plant is funded from European Union Structural Funds and the National Climate Change Program. As of 2019, prosumers received EUR 323 per kW in support. In total, it is planned to invest more than EUR 16 million from EU funds by 2023, with four invitations being planned during this period.

AEI3. To implement projects for co-generation plants using local and renewable sources of energy, with priority given to Vilnius and Kaunas. In December 2016, the Vilnius cogeneration plant received a loan of EUR 190 million from the European Investment Bank (EIB), backed by the European Fund for Strategic Investments (EFSI), a key element of the Investment Plan for Europe. The Vilnius cogeneration unit will produce about 0.3 TWh of electricity. The total electrical capacity of the power plant will be about 92 MW . The boiler will only use municipal waste left over from sorting and not suitable for recycling. The other two biofuel boilers, with a capacity of about 3 times that of the waste boiler, will use biofuels.

No support was granted to the Kaunas cogeneration plant. A high-efficiency waste-fired cogeneration power plant with electrical capacity of around 26 MW will be built. Municipal waste remaining after sorting and not suitable for recycling, non-hazardous industrial waste and sludge from water treatment plants will be used. Such a capacity will allow electricity generation of around 175 GWh per year.

At the same time, in view of the ambitious RES-E targets for 2030, new measures are planned (Table 3.1.2.3.).

Table 3.1.2.3. Planned policy measures for RES in the electricity sector up to 2030

PLANNED POLICY MEASURES			
Measure	Scope and results/effect envisaged	Implementation period	Entities responsible for implementing the policy

AEI4. Financial support for investment in low-capacity power plants	Annual increase in RES production by 0.03 TWh	2022-2025	Ministry of Energy
AEI5. RES development in the Baltic Sea	Additional RES capacity between 350 MW and 1400 MW [60]	2019-2030	Ministry of Energy, Lithuanian Energy Agency
AEI6. Industrial deployment of renewable energy sources (70% electricity, 30% heat)	Additional RES capacity: 42 MW	2021-2027	Ministry of Energy, Ministry of Economy and Innovation
AEI7. Use of RES in public and residential buildings (EU support)	Additional RES capacity: 50 MW	2021-2030	Ministry of the Environment
AEI8. Financing of energy generation from RES and storage solutions, including prosumers; RES communities (EU support)	Annual increase in RES production by 0.81 TWh	2021-2027	Ministry of Energy
AEI9. Integration of RES into transmission and distribution networks	Integration of additional installed capacity of 1,944.5 MW of RES-E into existing electricity transmission and distribution networks	2021-2030	TSO (LITGRID), DSO (ESO and others)

AEI4. *Financial support for investment in low-capacity power plants* Preparations are underway for investment in individual low-capacity power plants, with priority being given to power plants built by renewable energy communities. Support will be granted through a tendering procedure from the revenues generated by implementing the agreements on statistical energy transfers between Lithuania and Luxembourg and/or other Member States. The first tendering procedure is expected to take place in 2020.

AEI5. *Development of RES-E in the Baltic Sea.* Studies were launched in November 2018 to assess the development and operation of power plants using RES in the Baltic Sea and to determine the installed capacities of these plants. After carrying out the studies and taking into account the ensured adequacy of the Lithuanian electricity system, the synchronisation of the Lithuanian electricity system with the European electricity system and the results of the cost-benefit analysis, a decision will be taken by 2021 on the parts of the Baltic Sea where it is appropriate to organise a tender for the development and operation of RES and the installed capacity of these power plants. The Government should adopt the Procedure for organising

[60] The newly installed power may vary depending on the Government's decision on the development of RES at sea.

tenders and issuing permits by February 2021. Construction of power plants in the Baltic Sea can only be carried out after winning a tender granting access to such activities. A tendering procedure for the development and operation permit should be organised by early 2022. The successful tenderer must obtain the construction permit within 3 years of the date of receipt of the development and operation permit and must obtain the permit to generate electricity within 6 years from the date of receipt of the development and operation permit. Taking into account the duration of tendering procedures and the construction of the power plants, electricity generation is expected to begin after 2028. In order to connect the planned wind farm in the Baltic Sea to the transmission network, a 330 kV substation should be built at sea, a new cable line should be built up to the Darbėnai substation and new 330 kV transmission lines Darbėnai -Mūša-Panevėžys should be installed.

AEI6. *Industrial deployment of renewable energy sources.* Installation of capacity for energy generation from renewable energy sources and development of new technologies for a more effective use of renewables and introduction thereof in industrial enterprises in order to use energy for the internal needs of the enterprises and to enable the supply of excess energy to other industrial enterprises or its transfer to centralised energy networks. The measure was financed during the period 2014–2020 from European Union funds (Renewable energy sources for industry LT+) and it is expected to continue in the next funding period, focusing on micro, small, medium and large industrial enterprises. The amount of funding for a project depends on the size of the company and the manner in which eligible costs are determined:

- 80% of eligible expenditure for micro and small companies;
- 60% of the eligible costs for a large company (intensity determined in accordance with the provisions of the EU Block Exemption Regulation).

In view of the ambitious objectives in the field of RES, it is important to ensure the existence of this instrument also in the 2021–2027 financing period. It is planned that 70% of this measure will be allocated to the development of RES in the electricity sector and the remaining 30% will go to the heat sector.

AEI7. *Use of RES in public and residential buildings.* The Climate Change Programme provides financial incentives for the use of renewable energy sources (sun, wind, geothermal energy, biofuel, etc.) in public and residential buildings (for different social groups).

AEI8. *Financing of energy generation from RES and storage solutions.* In view of the ambitious objectives in the field of RES, it is planned to promote the use of RES by granting EU support in 2021–2027. EU support will be granted to the installation of low-power plants generating electricity from renewable sources which belong to prosumers, energy communities, businesses or individual energy consumers. The need for EU support funds, possible measures in this area of activity, the need for funds and the expected results are currently being assessed.

AEI9. *Integration of RES into transmission and distribution networks*. The target is a 45% share of RES in the electricity consumption. The total power increase of RES between 2021 and 2030 is expected to be 1,944.5 MW . Such an increase will require measures to integrate new producers safely and reliably into electricity transmission and distribution networks. It is estimated that seven 110 kV substations and three 330 kV substations would need to be built to connect these RES capacities to the transmission network; it is also estimated that reconstruction of distribution networks and the introduction of new technologies to ensure voltage quality (controlled transformers and voltage regulators) would be required.

Additional support measures contributing to the development of RES-E:

– RES-E exemption from the excise duty. Electricity produced from RES is exempt from the excise duty. This provision applies to both electricity produced in Lithuania and imported electricity.

– Guarantees of origin for RES-E. Guarantees of origin are issued to RES-E producers. Guarantees of origin are also be issued to RES-E producers who have won the auction and receive the electricity price premium.

– RES purchase and sale contracts. RES producers are allowed to sell electricity to final customers under contracts for the purchase and sale of electricity from renewable sources without holding the licence of an independent electricity supplier. Such producers will still have to comply with the requirements for an independent electricity supplier.

Alternative policy measures for RES in the electricity sector. These measures have been additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not taken into account in the calculations in part B, but these measures will be considered as an alternative to the elements of the PPM scenario in order to ensure at least the same effect on the achievement of the national targets prior to approval thereof in the legislation (see Section 3 for more details). Alternative policy measures:

1. To assess the regulatory conditions for the generation and consumption of non-subsidised electricity;
2. To amend legislation by obliging municipalities and public bodies to purchase only green electricity from 2022 onwards (certified by certificates of origin).

Funding of planned measures in the RES-E sector[61]**.** Most of the investments related to the use of renewable energy sources in the electricity sector are intended to develop RES capacity and to prepare the grid for the integration of large quantities of RES. Only a small part of the funds is intended to cover the costs of electricity generation. The total financial requirement of the sector amounts to approximately EUR 1,870 million, of which EUR 1,167 million will come from public funding and EUR 703 million from private funding. The public portfolio will mainly consist of 2021–2027 EU Structural Funds, revenue from services provided in the public interest (SPI funds), the electricity tariff, revenue from statistical transfers, and the Modernisation Fund.

Transport sector

Development of RES in the transport sector aimed at a 15% RES share by 2030 is based on the following principles:

- Competitiveness: ensuring a diversified supply of petroleum products and alternatives and effective competition between market players;
- Integration (transformation): integration of alternative fuels by reducing dependence on imported fossil fuels, increasing energy efficiency and reducing pollution.

The RES-T objectives are pursued by reference to the energy content of transport fuels, without applying the multipliers laid down in Directive 2018/2001.

In order to achieve the RES objectives, measures have already been adopted (Table 3.1.2.4) to increase the share of RES in the transport sector.

Table 3.1.2.4. Existing policy measures for RES in transport sector up to 2030

EXISTING POLICY MEASURES

[61]Indicative funding requirement.

Measure	Scope and results/effect envisaged[62]	Implementation period	Entities responsible for implementing the policy
AEI10. Mandatory blending of biofuels into mineral fuels	The share of biofuels in final energy consumption in transport: 5.9% in 2030; of which biodiesel 5.67% (137.7 ktoe) and bioethanol 0.23% (5.58 ktoe)	From 2011	Ministry of Energy, fuel suppliers
AEI11. Excise duty concession for biofuels	Share of biofuels produced from food and feed crops in final energy consumption in transport: 7%	From 2010	Ministry of Finance

AEI10. *Mandatory blending of biofuels into mineral fuels.* Fuel sales points must sell the following fuels meeting the Lithuanian or European standards:

- petrol containing a minimum of 10% of biofuel (blending into A98 petrol is optional);
- diesel containing at least 7% of biofuel (from 10 April to 10 November);
- Arctic diesel grades 1 and 2 may contain no biofuels during the winter period;
- in the transitional periods (10–20 November and March 10 to April 10), diesel must contain at least 5% of biofuels (with a tolerance of -0.5%).

AEI11. *Excise duty concession for biofuels.* Biofuel and fuel blends complying with the requirements laid down in the Law on Excise Duty and the standards EN 14214 and CEN/TS 15293 adopted by the European Committee for Standardization are subject to an excise duty rate reduced in proportion to the percentage of impurities of biological origin in the biofuel and fuel blend.

Additional support measures contributing to the development of RES-T. Guarantees of origin for gases produced from RES. The guarantee of origin is issued at the request of a producer of gas from RES per unit of energy (1 MW h). The guarantee of origin must be used within 12 months of the date of generation of the corresponding unit, otherwise it becomes invalid. The system of guarantees of origin for biogas allows identification, registration and monitoring of the origin of the gas produced, and enables gas producers and consumers to know whether the gas they produce and consume is produced using RES.

New measures are also planned in view of the ambitious RES-T targets (Table 3.1.2.5).

[62]The RES-T objectives are pursued by reference to the energy content of transport fuels, without applying the multipliers laid down in Directive 2018/2001.

Table 3.1.2.5. Planned policy measures for RES in the transport sector up to 2030

PLANNED POLICY MEASURES			
Measure	**Scope and results/effect envisaged[63]**	**Implementation period**	**Entities responsible for implementing the policy**
AEI12. Support for operating costs of generation II biodiesel through mandatory blending.	An additional share of generation II biodiesel would appear on the market. 50% of all biodiesel would be generation II biodiesel	2020-2030	Ministry of Energy, Ministry of Agriculture
AEI13. Support for financing generation II bioethanol production facilities	Additional 6.45 ktoe of generation II bioethanol would enter the market	2020-2030	Ministry of Energy, Ministry of Agriculture
AEI14. Investment support for biomethane plant facilities	New production capacity, securing supply of 81.5 ktoe of biomethane annually	2020-2030	Ministry of Energy, Ministry of Agriculture, Ministry of the Environment
AEI15. Support for the purchase of public, utility or other commercial vehicles fuelled by compressed natural and/or biomethane gas	Vehicles that will consume 81.5 ktoe of biomethane gas	2020-2030	Ministry of Transport and Communications, Ministry of Energy, Ministry of the Environment

[63]The RES-T objectives are pursued by reference to the energy content of transport fuels, without applying the multipliers laid down in Directive 2018/2001.

AEI16. Obligation imposed on operators of natural gas stations, supplying gas for direct consumption in transport.	Obligation covering the supply of biomethane gas, estimated at 92.7 million cubic meters of gas.	2024-2030	Ministry of Energy National Energy Regulatory Council

AEI12. *Support for operating costs of generation II biodiesel through mandatory blending.* Reducing the operating costs of producers and ensuring the competitiveness of the product on the market is expected to result in additional quantities of generation II biodiesel. Half of all biodiesel consumption in 2030 would come from generation II feedstock. Different tariff measures would be applied to compensate producers for the price difference of generation II biodiesel. The price of the measure was calculated on the basis of a subsidy of EUR 0.55 per litre.

AEI13. *Support for financing generation II bioethanol production facilities.* Promotion of generation II bioethanol production in Lithuania could lead to a share of generation II bioethanol in the fuel mix, estimated at 6.45 ktoe. It is assumed that, with the help of the incentive, facilities for the production of generation II liquid biofuels from straw, which currently has the highest potential, will be installed.

AEI14. *Investment support for biomethane plant facilities* Biomethane gas production facilities, including biogas treatment facilities, would be financed. In order to meet the domestic demand, new production capacities are necessary by 2030 to ensure the production of 81.5 ktoe of biomethane gas per year. A one-off subsidy for production facilities could amount to a 73% intensity.

AEI15. *Support for the purchase of public, utility or other commercial vehicles fuelled by compressed natural and/or biomethane gas.* In order to ensure that the biomethane gas output (81.5 ktoe) is consumed in the transport sector, purchasing of gas-fuelled public transport vehicles is encouraged. The measure proposes respective amendments to the public procurement legislation, requiring that municipalities, when purchasing public transport services, should stipulate that the service provider must carry passengers using buses adapted to run on biomethane gas. The measure would compensate for the price difference between vehicles running on natural gas and those running on liquid fuel.

AEI16*. Obligation imposed on operators of natural gas stations, supplying gas for direct consumption in transport.* In order to ensure parallel demand for and supply of biomethane gas, and given the projected increase in natural gas consumption in the transport sector, suppliers of natural gas for direct consumption in the transport sector would be obliged to supply a fixed amount of gas from renewable energy sources. The intensity of the obligation would be measured in terms of the quantity and price of biomethane on the market.

Alternative policy measures in the transport sector: These measures have been additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not taken into account in the calculations in part B, but these measures will be considered as an alternative to the elements of the PPM scenario in order to ensure at least the same effect on the achievement of the national targets prior to approval thereof in the legislation (see Section 3 for more details). Alternative policy measures:

1. Gradual increase of obligations for fuel suppliers. When supplying fuel to final consumers, fuel suppliers must ensure that biofuels make up an appropriate proportion in the fuel supplied. A gradual increase in biofuel blending obligations is foreseen in order to achieve a share of 15% of

renewable energy sources in the transport sector in 2030. Without prejudice to fuel quality requirements, the aim will be to increase the quantity of first-generation biofuels in total fuel consumption in terms of energy value, but within the 7% limit for biofuels made from raw materials for food set by the Law on Energy from Renewable Sources. In addition, a fixed proportion of fuel supplied by fuel suppliers will have to consist of advanced (generation II) biofuels starting in 2022 and this obligation will be gradually increased until 2030 to a minimum of 3.5% set in Directive 2018/2001.

2. Reorientation of biogas power plants for biomethane gas production. Currently Lithuania only has biogas production facilities intended for electricity and heat production, and in order to maximise the potential of biogas, re-orientation of biogas use for electricity and heat production towards biogas treatment and supply to natural gas networks will be proposed. Such a measure would allow the fastest possible deployment of existing infrastructure and the expected emergence of biomethane gas on the Lithuanian market in 2022. The measure would consist of investment support for the construction and installation of biogas treatment plants in the already existing biogas plants.
3. Revision of the quality requirements for natural gas in the context of biomethane gas supply to networks. In order to facilitate the connection of biomethane gas producers to natural gas networks, the need for minimum adjustments to the current natural gas quality requirements applicable to the producers and suppliers of natural gas and biogas will be assessed. Taking into account the aspects of biomethane gas production and cleaning, the aim is to avoid any additional barriers for producers in connecting to natural gas networks and making efficient use of the production capacity, but first of all, it is necessary to assess the impact on consumers, economic operators and international standards. Changes to the qualitative requirements must not disrupt the activities of household customers, economic operators using gas in their production processes or the transboundary transfer of gas.

Financing of planned RES measures in the transport sector[64]. The sector's investments focus on the development of infrastructure for the production of biomethane and alternative fuels, the partial reimbursement of the costs of production of alternative fuels for producers and the promotion of the acquisition of vehicles fuelled by biomethane. The total funding requirement of the sector amounts to EUR 385 million, of which EUR 1,167 million will come from public funding. Available sources of public funds: 2021–2027 EU Structural Funds, State and municipal budgets, and the Climate Change Programme.

Heat and cooling sector

Individual households mainly use the cheapest heating fuel on the market, i.e. biomass. Development of RES in the heating and cooling sector with a view to a 90% RES share in district heating and domestic heat production by 2030 is based on the following principles:

- Transparency: to ensure that heat supply activities are managed in an efficient, transparent and non-discriminatory manner between the operators in the heat economy market and its users, including the purchase of energy resources in the most transparent and competitive manner, at the lowest cost to the final consumer;
- Competitiveness: rational use of the investments needed to ensure the reliable supply of environment-friendly heat to consumers at an affordable price, ensuring the ability of district heating to compete with alternative means of heat supply;
- Efficiency: establishment of regulatory principles to encourage the introduction of technical and

[64]Indicative funding requirement.

management solutions in the systems of central heat supply undertakings to ensure reliable and least costly supply of heat to the final consumer;

- Progress: adapting the system to different, environment- friendly and cost-competitive innovative technologies in the heat production, supply and consumption chains.

Table 3.1.2.6. Existing policy measures for RES in the heat sector up to 2030

EXISTING POLICY MEASURES			
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**
AEI3. To implement projects for co-generation plants using local and renewable sources of energy, with priority given to Vilnius and Kaunas	Rated (nominal) heat output of newly installed high-efficiency cogeneration units: 317 MW ; electrical installed capacity of newly installed high-efficiency cogeneration units: 127 MW.	2018-2023	Ministry of Energy, Ministry of Finance, Ministry of the Environment, Ignitis Group
AEI17. To upgrade and/or replace worn biofuel boilers with other technologies using RES	Improving incentive regulation to enable heating companies to build up the resources needed for modernisation. Nominal heat output of the replaced installations: 600 MW	2018-2030	Ministry of Energy

AEI18. To promote the use of biofuels for heat generation in district heating systems	Improving incentive regulation to enable heating companies to build up the resources needed for modernisation. Additional RES production capacity: 70 MW	2018-2023	Ministry of Energy
AEI19. Promote the use of RES in DH for heat generation by assessing the potential for using solar technologies, heat pumps and heat storage facilities in DH systems	Nominal heat output of the new installations: 20 MW	2021-2030	Ministry of Energy
AEI20. To carry out the assessment of the current situation and further developments in the supply of heat in the decentralised sector	A study has been completed and necessary legislation has been adopted to create a favourable regulatory environment for gradual transition of individually heated households (dwellings) to clean and low greenhouse gas emission technologies or their entry into the DH system	2019-2021	Ministry of Energy
AEI21. To review existing requirements for reserve heat generation capacity and for fuel reserves	Heat suppliers using natural gas who pay the security component should not additionally accumulate fuel reserves	2019-2021	Ministry of Energy
AEI22. Promotion of small-scale biofuel cogeneration	5MW electrical and 20MW thermal capacity. 0.03 TWh of electricity per year	2019-2022	Ministry of Energy, municipalities
AEI23. To upgrade and/or modernise the heat transmission network and its installations/elements	To upgrade and modernise worn out heat transmission networks	2015-2023	

AEI24. Prospective analysis of the development of the cooling sector in Lithuania	To assess the current situation in the cooling sector, carry out a prospective analysis and establish guidelines setting out the most rational solutions for cooling supply; draw up a map of the national territory showing the existing locations for district heating and cooling supply, including infrastructure for district heating and cooling supply in the network	2020-2021	Ministry of Energy
AEI25. To perform a general inventory of the heating installations in households/homes.	Data have been collected data on the methods of heating households/homes, 100%	2019–2022	Municipalities, Statistics Lithuania Ministry of Energy, Ministry of the Environment

Existing (enabling) policy measures in the heat and cooling sector:

- establishment of a regulatory environment conducive to attracting investment and providing a non-discriminatory environment for all players in the district heating market;
- increasing transparency in the biofuels market;
- promotion of district heating in buildings, giving priority to urbanised areas in order to reduce air pollution;
- reducing the share of heat prices controlled and set unilaterally by the national regulator (transferring part of the responsibility from VERT to municipal councils);
- increasing the number of new heat customers connected to district heating (DH).

Table 3.1.2.7 Planned measures for RES in the heat sector up to 2030

PLANNED POLICY MEASURES			
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**
AEI26. New biofuel combustion plants in district heating	Biofuel boilers: additional capacity of 70 MW up to 2030	2021-2030	Ministry of Energy, municipalities
AEI27. Promote the use of RES in district heating (using solar technologies, heat pumps and/or heat storage)	Nominal thermal capacity of the new installations: 200 MW up to 2030	2021-2030	Ministry of Energy, municipalities
AEI28. Promotion of the use of heat from waste generated by industry, the waste sector or due to cooling energy in district heating	Waste heat in district heating will amount to 0.45 TWh (15% of potential) per year up to 2030.	2021-2030	Ministry of Energy, Ministry of Economy and Innovation, Ministry of the Environment, Statistics Lithuania
AEI6. Industrial deployment of renewable energy sources (70% electricity, 30% heat)	Additional RES heat generation capacity: 18 MW	2021-2030	Ministry of Economy and Innovation
EE7. Replacing boilers with more efficient technologies	By 2030, 50 000 domestic boilers will be replaced in households and other heat efficiency improvement measures will be implemented, including heat pumps, resulting in savings of at least 200 GWh per year	2021-2030	Ministry of Economy, Environmental Projects Management Agency
AEI29. Modernisation of the heat metering system	All heat meters must be replaced by remote sensing by 2027.	2021-2027	

EE7. Replacing boilers with more efficient technologies. For a description see Section 3.2. 'Dimension Energy consumption'.

AEI26. *New biofuel combustion plants in district heating.* In Lithuania, biofuels are already used in most municipalities. In 2017, RES already accounted for 68.7% of district heating and more than 46% of total heating and cooling. Coal and gas oils are still used in some municipalities. The measure is designed to convert their heating sectors for RES.

AEI27. *To promote the use of RES in district heating (using solar technologies, heat pumps and/or heat storage).* Heat pumps are already used in other countries and have proved their worth in terms of energy efficiency. As the period is 2021–2030, there is no technology-specific focus. Implementation of the most cost-effective solution will be supported.

AEI28*. To promote the use of heat from waste generated by industry, the waste sector or due to cooling energy in district heating.* This heat is generated by chemical processes in the production companies in any case, so considering that in theory its potential in Lithuania is about 3 TWh per year, it is planned to use part of it in the district heating sector. Full utilisation is not possible as part of the industrial facilities are located in areas too far away from heat consumers. The priority in the heat sector is collection, storage and efficient use of energy from the environment and waste energy emitted into the air by power plants, industrial installations and buildings. Waste heat from thermal power stations can be used to heat buildings.

AEI20*.* To carry out the assessment of the current situation and future developments in the supply of heat in the decentralised sector and to create a favourable regulatory environment for gradual transition of individually heated households (dwellings) to clean and low greenhouse gas emission technologies or their entry into the DH system A study has been completed and appropriate legislation has been adopted.

AEI21*. Existing requirements for reserve heat generation capacity and for fuel reserves have been reviewed*. Heat suppliers using natural gas who pay the natural gas security component will not be required to store reserve fuel. The security component already ensures security of supply.

AEI23*. To upgrade and/or modernise the heat transmission network and its installations/elements.* Worn out heat transmission networks have been upgraded and modernised.

AEI25. To perform a general inventory of household/home heating installations. To inventory equipment used for heating households.

AEI29. *Modernisation of the heat metering system.* The EU Internal Market Directive (2009/72/EC) and its revised version (2016/0380(COD)) require all heat meters to be replaced by remote sensing by 2027 in case of a positive cost-benefit analysis.

Planned (enabling) policy measures in the heat sector:

- establishment of a regulatory environment conducive to attracting investment and providing a non-discriminatory environment for all players in the district heating market;
- promoting transparency and competition in the biofuels market, ensuring a low level of market concentration;
- ensuring an optimum and sustainable balance between domestic production of biofuels and imports of biofuels from third countries , which allows a high level of competition and low market concentration in the long term;
- promotion of the use of environmentally and sustainably produced and supplied biofuels (use of certificates confirming best forest management practices for biofuel origin guarantees, ensuring product quality and sustainability throughout the biofuel production and supply chain);
- promotion of district heating in buildings, giving priority to urbanised areas in order to reduce air pollution;
- assessment of the current situation and the prospective evolution of heat supply in the decentralised

sector, with rational development trends, taking into account changes in heat production technologies that increase the efficiency of heat production and consumption;

- assessment of the current situation in the cooling energy sector, performance of a prospective analysis and establishment of guidelines for the most rational solutions for cooling energy provision;
- feasibility assessment and, where economically justified, introduction of waste heat collection and use technologies, technologies using solar and heat energy, heat pumps, low-temperature heating and heat storage facilities for district heating;
- rational development of high-efficiency cogeneration plants to increase the availability of local electricity generation;
- timely upgrading of existing (or construction of new) biofuel combustion plants or cogeneration plants, existing heat transmission installations and their systems, heating stations in buildings, and heating and hot water systems;
- Other specific measures are used to ensure the development of the RES, facilitating the development processes of the RES, reducing the administrative burden and promoting active energy consumers.

Alternative policy measures in the heat sector: These measures have been additionally included in the National Plan, in line with the proposals received during the public consultation. Their effect is not taken into account in the calculations in part B, but these measures will be considered as an alternative to the elements of the PPM scenario in order to ensure at least the same effect on the achievement of the national targets prior to approval thereof in the legislation (see Section 3 for more details). Alternative policy measures:

1. To gradually limit and attempt to fully eliminate the consumption of coal and petroleum products in the heat sector by 2030 through economic and legal measures.
2. From 2022, to restrict the connection of newly built (planned) buildings to natural gas networks and the possibility of heating with other fossil fuels in the areas of DH networks by amending the Lithuanian Law on the Heat Sector accordingly by the beginning of 2021.
3. To establish a green heat certification and guarantee of origin system by the end of 2020.
4. To amend legislation by obliging municipalities and public bodies to purchase only green heat from 2022 onwards (certified by certificates of origin).

Funding of planned RES measures in the heat sector[65]. The sector's investments are intended for the modernisation and development of heat generation and transmission infrastructure. The largest portion of investments will be allocated for the development of generation capacity from RES and only a relatively small portion for the modernisation of heat transmission infrastructure. The total financial requirement of the sector amounts to EUR 570 million, of which EUR 382 million will come from public funding and EUR 188 million from private funding. Available sources of public funds: EU Structural Funds 2021-2027, the heat tariff, the Climate Change Programme and the Life Programme.

General/specific measures to promote RES development:

Point of contact

Legislative amendments are being made obliging public institution Lithuanian Energy Agency to advise and provide methodological assistance to potential operators in the electricity sector on all issues related to the establishment and construction of power plants using RES, i.e. to assist in the entire process related to the establishment of a power plant, from the selection of the power plant's capacity and type, choice of the type of operations in the electricity sector (production, production and consumption, electricity prosumer

[65]Indicative funding requirement.

activity) to obtaining permits and sale of energy.

Simplification of administrative procedures

Potential electricity prosumers and persons wishing to produce electricity for their own use and for the needs of the household, without supplying electricity to the grid, enjoy simplified procedures for the installation of power plants up to 30 kW. Such persons are not required to apply for the authorisation to develop electricity capacity or for the electricity generation permit. They may start operations by informing the electricity network operator.

Organisation of information provision and training

State and municipal authorities, bodies and undertakings have the obligation, within the limits of their competence, to prepare, deliver and make public information on the procedures for issuing permits, licences or certificates, the procedures for examining certification applications, assistance to applicants and support schemes. Within their remit, ministries are responsible for developing and implementing appropriate public information and awareness-raising campaigns, providing advice, and developing educational programmes on the practical uses and benefits of developing and using RES.

Exchange of experience in the use of RES between public authorities, bodies, undertakings, organisations and private entities are organised and examples of good practices are publicised.

The general programmes for formal education include knowledge and skills in the field of RES use, benefits and technological solutions. Research, education of the public, training for civil servants and vocational training in the field of RES are being promoted. The use of pilot projects is encouraged.

- Information on support measures, legal information, organisations, statistics and other information related to the development and use of RES is published on the website www.avei.lt.
- Information on the issuance of certificates for operation of energy installations and on certificate holders is available at https://vei.lrv.lt/lt/veiklos-sritys/energetikos-irenginiu-eksploatavimo-veiklos- atestatu-isdavimas-1.
- Education programmes on the benefits and practical possibilities of using RES are included in the curricula of Lithuanian general education schools as well as Lithuanian universities and non-university higher education institutions.

Contracts for the purchase and sale of electricity from RES

The legislation lays down the general principle that producers may sell electricity to final customers under contracts for the purchase and sale of electricity from renewable sources. A study is currently planned to identify the minimum requirements applicable to contracting parties; legal, administrative and regulatory obstacles to the conclusion of such contracts; and recommendations for removing these obstacles and creating of more favourable conditions. The study is expected to be completed in the first half of 2020.

Prosumers (use of energy from RES)

– *Electricity prosumers.* Natural and legal persons planning to produce electricity in solar, wind and biomass power plants with an installed capacity of not more than 500 kW can become the producing consumers.

Prosumers are able to ‘store’ the electricity produced by them and not consumed for their own or household use and in the electricity networks from April 1 of the current year to March 31 of the following year. The

producer is charged the grid access fee for the amount of electricity 'stored' and received back from the electricity networks[66]. The amount of electricity supplied to the grid in excess of the electricity consumed by the prosumer during the storage period is not carried over to the next storage period.

Prosumers may establish their own power plants or purchase them on the basis of bilateral contracts from third parties, thus making it possible for the occupants of multi-apartment buildings to become prosumers. Also, the power plant of the prosumer may be remote from the electricity consumption point. In this case, the power plant must be owned or managed by the prosumer.

It is envisaged that the prosumer scheme enabling the 'storage' of electricity produced and not consumed for prosumers' own or household needs in the electricity grid will be continued until 1 April 2040

Assessment of the established conditions will be carried out in accordance with Directive 2018/2001.

In order to promote the development of prosumers, the Prosumers Alliance, made up of representatives of RES business associations and consumer organizations, is being created.[67] The aim of the Alliance is to promote small green energy focused on residents and business by promoting consumer education and awareness of green energy and the possibility of owning and generating electricity. In addition, all partners in the Alliance are expected to offer high-quality and competitive products and services. Yet another goal is to intensify cooperation in search of innovative solutions that would help to accelerate the development of small green energy in Lithuania.

Renewable energy communities (RES-E consumption)

The Ministry of Energy together with the Office of the Government of the Republic of Lithuania carried out a public consultation to identify the main obstacles and drivers for establishing renewable energy communities. The main obstacles to the establishment of renewable energy communities were identified as:

- the traditional reluctance of the country's urban and regional residents to unite into communities;
- it is difficult to create a community for multi-apartment buildings where apartment owners make unanimous decisions in the communities that unite them;
- securing a bank loan;
- protected areas;
- complex legal requirements;
- frequently changing legal framework;
- lack of space in major cities to build power plants. The following stimulating factors were also

identified:

- closer cooperation by the distribution system operator;
- application of incentives;
- leadership by public administrations (consulting, practical examples);
- assistance and coordination by public bodies.

[66] https://www.vert.lt/atsinaujinantys-istekliai/Puslapiai/elektros-energija-gaminanciu-vartotoju-naudojimosi-elektros-tinklais- paslaugu-kainos.aspx.

[67] The founding documents of the Prosumers Alliance were signed by representatives of the Lithuanian Confederation of Industrialists, the Lithuanian Solar Energy Association, the National Energy Association of Lithuania and the Alliance of Lithuanian Consumer Organisations.

More information on the results of the public consultation can be found here

In the light of the observations received during this public consultation, the Law on Energy from Renewable Sources was amended and a scheme for renewable energy communities was created. A renewable energy community is defined as a legal status accorded to a public body which fulfils the specified criteria and which owns and develops installations for the production of energy from renewables in a defined area and has the right to use them to produce energy, to consume and store it in energy storage facilities and sell it.

Participants in the renewable energy community may be natural persons, small or medium-sized businesses and/or municipalities, of which:

1) at least 51 per cent of the voting members or shareholders are natural persons whose place of residence is declared in the municipality in which the construction or installation of the power generating unit(s) is planned, or in the subdistricts of another municipality adjacent to this municipality;

2) each member or shareholder has a maximum of 20 percent of the voting rights in another energy company.

Renewable energy communities are entitled to participate in the auctions without the obligation to produce and supply to the grids the total amount of electricity they have won in the auction. The communities may also carry out any activity in the energy sector subject to authorization.

In order to facilitate the establishment of renewable energy communities, municipalities are obliged to evaluate and make public the locations where a renewable energy community's energy production facilities may be built or installed.

Opportunities for facilitating the transfer of electricity within the renewable energy community are currently being assessed.

Regional cooperation

In the field of RES, regional cooperation is focused in the field of electricity on issues such as opening of support, joint projects and a joint support scheme. Lithuania is also open for the statistical transfer of energy to other Member States or, if necessary, for statistical reception of energy from another Member State.

Statistical transfer. It is estimated that the measures specified will be sufficient to reach the target of 45% by 2030, so currently no energy surplus is projected hat Lithuania could transfer to other Member States.

Lithuania already has experience in bilateral cooperation in transferring surpluses to other Member States: in October 2017 it became the first Member State to sign a cooperation agreement with Luxembourg on the transmission of statistics on renewable energy sources.

Since Lithuania's share of RES will reach and exceed the target of 45% by 2030, it is ready to enter into agreements with other Member States on the statistical transfer of a specified amount of RES from the Republic of Lithuania to another country. Similarly, if the measures imposed are not sufficient to reach the 45% target by 2030, the Lithuanian Seimas may decide to accept a statistical amount of RES from another Member State. This transfer or acceptance may take place through the European Union renewable energy development platform.

Opening of support. Lithuania has opened its support scheme to other Member States. Another Member State may participate in the auctions organized in Lithuania that allocate an annual amount of electricity

generation and a price premium for electricity produced from renewable energy sources. The auctions organized in Lithuania are open to a Member State having a direct electrical link with the Republic of Lithuania, having concluded an agreement with the Republic of Lithuania and committed to allowing Lithuanian natural and/or legal persons and/or other organizations or their units intending to build or equip power plants in Lithuania to participate in the distribution of assistance organized in that Member State. In the case of an agreement with another Member State, the quantity to be auctioned is calculated on the basis of: the quantity of electricity imported during the preceding calendar year from the Member State seeking to participate in the auction; the share of RES in electricity production in the Member State wishing to participate in the auction in the previous calendar year; total final electricity consumption in the Republic of Lithuania in the previous calendar year; the planned annual volume of electricity generation to be auctioned as specified in the timetable.

Joint projects and joint support scheme. Lithuania is open to agreements with other Member States on joint projects or joint support schemes.

3.1.3 Other elements of the dimension

Policies and measures affecting the EU ETS sector

All the policies and measures listed in section 3.1.1. affect to some extent the operators of stationary installations and aircraft operators participating in the EU ETS. In 2018, 86 fixed installations and 1 aircraft operator carried out activities falling within the scope of the EU ETS in Lithuania. Most of these installations are small district heating units. However, this sector is covered by two measures P7. Promoting the substitution of polluting technologies with cleaner ones and P1. Alternative fuel installations at AB Akmenės cementas.

In 2017, emissions from the EU ETS sectors in Lithuania amounted to 6.28 kt CO_2 eq. EU-level mechanisms in the ETS sector, such as the Market Stability Reserve, and funds for innovation and modernisation will affect EU and Lithuanian operators in the ETS sector, encourage them to invest in modernising production by introducing new energy-efficient technologies or by switching to RES.

As the main measures in the ETS sector are a fuel switch from conventional (gas, oil etc.) to RES (biomass mostly), energy efficiency (building renovation and other) is affected by the targets and objectives set in the National Energy Independence Strategy (2018). Electricity savings in industry will amount to 1 TWh by 2030. Over the 10-year period, energy efficiency improvement measures will result in energy savings of 35 TWh and GHG emissions will be reduced to 1,144 kt CO_2 eq. It is projected that the use of RES will increase by 45%from 1,102 ktoe in 2012 to 1860 ktoe in 2030. As a result, the consumption of natural gas in the energy sector will be reduced in ktoe.

Policies and measures to achieve low emission mobility

All the policies and measures listed in section 3.1.1. to some extent have an impact on the promotion of low-emission mobility. Measures T7, T8, T13, T14 and T29 and tax measures T21 and T22 contribute the most to that end.

Energy subsidies

Lithuania will aim to reduce polluting and wasteful energy consumption by 2025, as well as tax incentives for fossil fuels that lead to market distortions. In total, thirteen energy subsidies have been identified in

Lithuania:

1. A reduced excise duty rate on heating gas oils;
2. A reduced rate of excise duty on coal, coke and lignite used for business purposes;
3. A reduced rate of excise duty on natural gas used as heating fuel for business use;
4. A reduced excise duty rate on marked diesel for agricultural use;
5. Excise duty exemption for petroleum gases and gaseous hydrocarbons for household use;
6. A reduced rate of excise duty on electricity used for business purposes;
7. Excise duty exemption for natural gas used for combined heat and power generation;
8. Excise duty exemption for electricity, if supplied to household customers and beneficiaries;
9. Excise duty exemption for natural gas supplied to household customers and beneficiaries;
10. Excise duty exemption for electricity produced from renewable energy sources;
11. Excise duty exemption for natural gas used as engine fuel;
12. Concessions for biofuels;
13. A reduced 9% VAT rate applied to the supply of heat for the purposes of heating dwellings and water supplied to dwellings.

It has been decided to phase out or reduce some of the above subsidies (see Table 3.1.3.1). Some of the subsidies, such as the exemption of natural gas supplied to household customers and beneficiaries from the excise duty, are essential for the well-being of the population. More detailed information on subsidies is provided in section 4.6.

Table 3.1.3.1. Planned restriction of subsidies

Subsidy	Restriction of subsidy	Implementation period
Pollution tax reduction for agricultural operators	Phasing out	By 2024
Pollution tax reduction for operators engaged in individual activities	Phasing out	By 2022
Reduced rate of excise duty on **marked diesel** used in agriculture	Gradual reduction of the quota and concession	By 2025
Reduced rate of excise duty on **heating gas oils**	Phasing out	From 2022
Reduced rate of excise duty on **coal**, coke and lignite used for business purposes	Phasing out	From 2024
A decreased rate of excise duty on **natural gas** used as heating fuel for business use;	Phasing out	From 2025

3.1.4 Energy poverty

In order to achieve a holistic solution to energy poverty, existing and planned measures are divided into four groups relating to energy efficiency, energy prices, low household incomes and consumer awareness (see Table 3.1.4.1).

Table 3.1.4.1. Existing policy measures to alleviate energy poverty in Lithuania

EXISTING POLICY MEASURES			
Measures selected	**Description of the measure**	**Implementing period**	**Responsible body**
Measures of financial support and legal protection			
EN1. Reimbursement of domestic heating costs	Deprived residents are reimbursed a part of the costs of domestic heating which exceeds 10%* of the difference between the person's/family's income and the State-supported income per person/family ('SSI', EUR 120) * 20% prior to 1 June 2017	From 1995	Ministry of Social Security and Labour
EN2. Payment of the loan taken out for the renovation/modernisation of multi-apartment buildings as well as interest on behalf of persons eligible for reimbursement of domestic heating costs	Reimbursement of the loan and interest for an owner of an apartment in a multi-apartment building who has carried out or is carrying out a project supported by the State or the municipality for the renovation/modernisation of the multi-apartment building and who is entitled to reimbursement of domestic heating costs.	Since 2009	Ministry of Social Security and Labour
EN3. Reimbursement of drinking and hot water costs	Reimbursement of drinking water costs is granted when the costs exceed 2% of the income; reimbursement of water costs is granted when the costs exceed 5% of the household's/family's income.	From 1995	Ministry of Social Security and Labour
EN4: Legal protection of vulnerable consumers	The legal framework covers cases where the supply or transmission of electricity to vulnerable customers cannot be restricted or discontinued, as well as more favourable debt repayment conditions (see section 3.4.3 for details).	From 2002	Ministry of Economy
Energy efficiency measures			

EE2. Renovation/modernisation of multi-apartment buildings	TO renovate a multi-apartment building to class C and save 40% of energy. By the end of 2030, around 5,000 multi-apartment buildings should be renovated, which means that nearly 500 multi-apartment buildings will be renovated each year.	Since 2012	Ministry of the Environment, Housing Energy Efficiency Agency
EE7. Replacing boilers with more efficient technologies	By 2030, 10 000 domestic boilers will be replaced in households and other heat efficiency improvement measures will be implemented	From 2019	Ministry of the Environment, Ministry of Energy
EE11. Renovation of private houses	Financial incentive for private house owners to renovate their homes. To renew 1,000 private houses and save 13.5 GWh of energy annually.	From 2012	Ministry of Economy, Environmental Projects Management Agency
Energy prices			
ERK20. Deregulation of retail electricity prices for domestic consumers (excluding socially vulnerable ones)	During three phases of market liberalisation between 2021 and 2023, final electricity prices would no longer be regulated for household customers and they would have to choose an independent electricity supplier. Socially vulnerable consumers are exempted. This enables the development of a competitive market and ensures the protection of vulnerable consumers (see y section 3.4.3 for more details).	2021-2023	Ministry of Economy
EN5. National-level portal for energy consumers	The National Energy Regulatory Council (VERT) publishes information on energy prices from different suppliers (http://energetikosabc.lt/en)	From 2018	Ministry of Economy, VERT
Consumer information measures			
EE6. Agreements with energy suppliers on consumer education and consulting on energy issues	Energy suppliers will ensure the implementation of the scope of consumer education and consulting and of measures provided for in agreements concluded between them or through other persons.	2017-2030	Energy suppliers, Ministry of Energy
EN6. Information on the reimbursement of domestic heating and water costs and calculator	Information on applicable reimbursement of domestic heating and water costs, including the domestic heating cost reimbursement calculator, can be found in the Family Social Support Information System (SPIS) at http://www.spis.lt/, along with information on available social support.	From 2017	Ministry of Social Security and Labour

Table 3.1.4.1. Planned policy measures to alleviate energy poverty in Lithuania

PLANNED POLICY MEASURES			
Measures selected	**Description of the measure**	**Implementing period**	**Responsible body**
Legal safeguards			
EN7. Review of the Law on Energy	To review and update the Law on Energy accordingly in order to extend the criteria for the protection of vulnerable energy consumers, such as a higher cold temperature point when consumers may be disconnected	2019-2021	Ministry of Economy
Energy efficiency measures			
EN8. Prioritisation of buildings with socially vulnerable residents in renovation projects	In the selection of buildings to be renovated and upgraded, if buildings score the same number of points under the other selection criteria, priority is given to buildings housing socially vulnerable persons.	From 2019	Ministry of Energy, Ministry of the Environment
EE8. Modernisation of indoor heating and hot water systems in multi-apartment buildings	A financial instrument that will encourage building owners to upgrade old elevator-type heat units into newer single-circuit heat units. Up to 30% of the investment costs will be reimbursed and around 250 heating substations will be upgraded annually.	From 2019	Ministry of Economy, Environmental Projects Management Agency
Consumer information measures			
EN9. Energy poverty and efficiency consultations are included in the social services catalogue	Extension of the catalogue of social services to include consultation on energy poverty and energy efficiency which would be provided by social workers in direct contact with the consumers experiencing energy poverty	From 2021	Ministry of Social Security and Labour
EN10. Obligations of energy suppliers concerning the prevention of energy poverty	Obligation for energy suppliers to include minimum information on eligibility for energy poverty assistance in reminders on unpaid bills received by customers who have delayed payments	From 2021	Ministry of Economy
EN11. Updating the national energy portal for consumers	Development of a price comparison tool for energy providers and updating of information on energy poverty to provide energy consultants and consumers with	2021-2030	Ministry of Energy, Ministry of Social Security and Labour

	information on solutions		

Household income and protection of vulnerable consumers

The first step towards protecting vulnerable groups in society is to ensure social guarantees, including support. The main social guarantee for vulnerable consumers is social assistance in cash for deprived people who cannot afford to keep their homes adequately warm. The Ministry of Social Security and Labour is currently applying financial support measures to address energy poverty:

- deprived residents are reimbursed a part of the costs of domestic heating which exceeds 10%* of the difference between the person's income and the State-supported income per person/family (in 2019, State-supported income was EUR 120). (EN1.)
- If the owners of an apartment in a multi-apartment building are carrying out or have already carried out a project supported by the State and/or the municipality for the renovation/modernisation of a multi-apartment building, the apartment owners are fully reimbursed for the monthly loan and interest payments due during and outside the heating season over the repayment period specified in the loan contract (EN2.)
- Drinking water costs and hot water costs are also reimbursed for deprived people: reimbursement of drinking water costs is granted when the costs exceed 2% of the income; reimbursement of hot water costs is granted when the costs exceed 5% of the income. (EN3.)

Reimbursement of heating and water costs (hot, drinking) has been chosen because these services represent the largest share of a family's housing costs. The domestic heating costs reimbursement is granted irrespective of the type of heating, i.e. which type of fuel (wood, gas, etc.) is used to heat the dwelling. Reimbursement is available not only to those who have declared their place of residence in that housing unit but also to its tenants, thus ensuring that all persons in need of assistance can receive it.

Additional legal safeguards for vulnerable customers (EN4.) cover cases where[68] the supply or transmission of electricity to vulnerable customers cannot be restricted or discontinued, as well as more favourable debt repayment conditions. For example, failure by vulnerable customers to pay electricity bills may not result in discontinuation of supply if the amount owed to the distribution system operator or supplier by those vulnerable customers is or was equal to or less than 3 basic social benefits; nor may it be discontinued on Fridays, Saturdays, Sundays, public holidays or the day before a public holiday or when the average daily air temperature is below -15 °C or above +30 °C. There are plans to extend this measure by setting a higher air temperature threshold (EN7.) (For details see section 3.4.3. on market integration.)

Energy efficiency

Over the last couple of decades, Lithuania has seen a significant difference between newly constructed energy efficient homes and the majority of households in old buildings. In old multi-apartment buildings, heat is distributed inefficiently and unevenly, and technical reasons prevent heat control in the apartments; the temperature on some floors (upper or lower) is below the minimum hygiene standards even during the

[68] Law on Electricity of the Republic of Lithuania: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.106350/asr?positionInSearchResults=17&searchModelUUID=d0be70a9-254d-4ec7-a183- 101f436cb116

heating season.

Energy efficiency can help alleviate energy poverty. Appropriate measures are divided into the following groups: improving the energy performance of buildings and equipment, and changes in consumer behaviour. it should be noted that the breakdown of the household indicator in Table 3.1.4.2 shows that energy poverty in Lithuania is a particularly serious problem for families living in urban areas. In addition, families living in apartments are particularly vulnerable to energy poverty, so particular attention should be paid to multi-apartment buildings and their inhabitants.

	Lithuania	EU
Average	28.9	7.8
Urban	37.7	7.9
Rural	21.9	8.0

3.1.4.2. Table Inability to keep home adequately warm in 2016,%

Measures in the area of building and equipment efficiency include renovation of buildings (EE2 and EE11.) and replacement of boilers with more efficient technologies (EE7.). In future, financial instruments will promote the modernisation of indoor heating and hot water systems in multi-apartment buildings (EE10.) with a view to further progress. (For a more detailed description of these and related measures, see section 3.2. on energy efficiency).

Energy prices

High energy prices are another possible cause of energy poverty. In Lithuania, opportunities for technological progress and the promotion of a competitive market are taken into account to ensure energy prices that meet consumers' needs (see sections 2.4.3 and 3.4.3. for more details).

Lithuania, as a small, open economy, purchases all imported energy resources at global market prices, but wages are lower than in western European countries, so energy poverty in various forms affects a considerably larger proportion of the population. The National Energy Independence Strategy sets the objective of phasing out the regulation of electricity retail prices. The aim is to make regulation of retail prices of electricity through social tariffs and requirements possible in exceptional cases, thus protecting socially vulnerable electricity consumers and not exacerbating energy poverty in the country (ERK20.).

In the area of energy poverty, a measure related to market liberalisation is also relevant, enabling consumers to compare offers from different suppliers and to choose the best deal (EN5.). The competitive market dimension, including the imminent liberalisation of the electricity market, is described in more detail in section 3.4. .

Consumer awareness

Consumer awareness and consciousness and related behavioural changes play an important part in reducing energy poverty. Accordingly, a well-informed consumer may find it easier to obtain financial support, take measures to improve energy efficiency or, following the liberalisation of the market in Lithuania, choose the most suitable energy supplier.

Accessibility of information on benefits to consumers is also ensured in order to make cost reimbursement available to the society's vulnerable groups (EN6.) Currently, information on reimbursement of domestic heating and water costs, including an interactive calculator, can be found in the Family Social Support Information System (SPIS) at http://www.spis.lt/ [69] along with information on available social support (social benefits and reimbursement, student social support for schoolchildren, social services, etc.).

Agreements with energy suppliers on informing customers about the services they provide (EE6.) are an additional measure to increase consumer awareness of energy efficiency (EE6.). In the period 2017-2030, energy suppliers will ensure the implementation of the scope of consumer education and consulting and of the measures provided for in agreements concluded between them or through other persons.

In the context of energy poverty measures, synergies between the public sector and non-governmental organizations are important to ensure the continuity of the measures. Accordingly, taking into account the activities carried out in the course of the STEP project[70] , additional measures are planned:

- Inclusion of energy poverty and efficiency advice in the catalogue of social services (EN9.). Extension of the catalogue of social services to include advice on energy poverty and energy efficiency by social workers in direct contact with consumers affected by energy poverty. Appropriate social worker training to provide them with energy counselling qualifications.
- Ensuring early intervention – obligations of energy suppliers concerning the prevention of energy poverty (EN10). This means imposing an obligation on energy suppliers to include minimum information on eligibility for energy poverty assistance in reminders on unpaid bills received by customers who have delayed payments
- Improved access to information on energy poverty following the updating of the national energy portal for consumers (EN11.). Development of a price comparison tool for energy suppliers and updating of information on energy poverty to provide energy consultants and consumers with information on solutions. This tool will help consumers to choose a cheaper supplier and take additional energy efficiency measures, thereby reducing energy costs.

Policy coherence

It is important to note that energy poverty policies and measures aim at policy coherence and promote a cross-sectoral approach, which is most evident from the combination of energy efficiency and financial support measures.

For example, persons who are reimbursed for heating costs have a duty to keep their costs to a minimum and to contribute to energy efficiency. The Law of the Republic of Lithuania on Cash Social Assistance to Low-income Residents[71] stipulates that apartment owners in multi-apartment who apply for reimbursement of the cost of heating the dwelling must participate in the meeting for the consideration and adoption of a decision on the implementation of the project for the renovation of the multi-apartment building, if such a decision is considered and adopted, and participate in the implementation of the project. Where a person does not respect the above obligation, his/her access to reimbursement of the home heating costs is restricted if the project for the renovation (modernisation) of the multi-apartment building did not begin a result of his/her action or omission.

[69] http://www.spis.lt/Skaiciuokles/BustoSildymoIslaiduKompensacijos

[70] The STEP project, described in more detail in section 2.4.4 , is carried out in 8 EU countries and aims to alleviate energy poverty by encouraging changes in consumer behaviour.

[71] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.215633/asr

An identical process is followed when choosing the buildings for renovation. In the selection of buildings to be renovated and upgraded, if buildings score the same number of points under the other selection criteria, priority is given to buildings housing socially vulnerable persons. Such processes improve the compatibility between measures and bring mutual benefits in terms of energy efficiency and protection of vulnerable groups.

3.2 Dimension Energy consumption

Increasing energy consumption efficiency in Lithuania by 2030 will be implemented in accordance with the following principles:

- cost-effectiveness: in achieving energy efficiency improvement targets, priority should be given to the most cost-effective energy efficiency improvement measures;
- active education and training of energy consumers: as energy consumers can contribute to energy efficiency improvement objectives by changing their behaviour and habits, education and training of energy users must be strengthened;
- competition: enabling investors in energy efficiency improvement to compete with each other for the implementation of the most economically advantageous projects, in fulfilling energy efficiency obligations or competing for incentives provided by the State.

In order to meet the target under Article 7 of the Energy Efficiency Directive 2012/27/EU, which adds up to 27.279 Twh, Lithuania plans to implement existing energy efficiency improvement measures and plans new energy efficiency measures to ensure the achievement of the energy efficiency target by 2030 (see Table 3.2.1).

Table 3.2.1. Existing policy measures in the energy efficiency sector up to 2030

EXISTING POLICY MEASURES				
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**	**Energy savings in TWh. 2021-2030**

EE1. Impact of higher excise duties and taxes on fuel consumption	Lithuania has a value added tax rate of 21% on fuel, which is 6 percentage points higher than the EU minimum of 15%. Petrol is subject to a higher excise duty of 21% (+ EUR 0.08/l), and liquefied petroleum gas – 243% (+EUR 0.18 /l). The combined effect of higher taxes and excise duties is a price increase of 14.7% for petrol, 5.2% for diesel and 64.7% for liquefied petroleum gas compared to the levels prescribed by the European Union.	2021-2030	Ministry of Energy, Ministry of Finance, Ministry of the Environment	6 TWh
EE2. Renovation/modernisation of multi-apartment buildings	To renovate a multi-apartment building to class C and save 40% of energy. By the end of 2030, around 5,000 multi-apartment buildings should be renovated, which means that nearly 500 multi-apartment buildings will be renovated each year.	2021-2023	Ministry of the Environment, Housing Energy Efficiency Agency	1.9 TWh
EE3. Renovation of public buildings	To renovate a public building to class C and to renovate about 960,000 m^2 of public building area by 2030	2021-2023	Ministry of Energy, Ministry of the Environment	0.19 TWh
EE4. Agreements with energy suppliers on consumer education and consulting.	Energy suppliers will ensure the implementation of the scope of and measures of consumer education and consulting provided for in agreements concluded between them or through other persons (including the introduction of smart metering).	2021-2030	Energy Suppliers, Ministry of Energy	3 TWh 300 kt
EE5. SPI relief for industrial enterprises.	A support mechanism to finance the implementation of energy efficiency improvement measures in all major industrial enterprises in Lithuania. Annual energy efficiency measures leading to energy savings of around 100 GWh are planned	2021-2030	Ministry of Energy Balticpool	5.5 TWh 550 kt

EE6. Energy saving agreements with energy companies.	Energy companies will save energy according to the levels of energy specified in the energy savings agreements (either on their own or through others) by applying cost-effective energy efficiency improvement measures at the final energy customers' facilities (installations, equipment, transport)	**2021-2030**	**Ministry of Energy Energy enterprises**	5.5 TWh
EE11.	Modernisation of street lighting systems	2021-2023	Ministry of Energy, Public Investment Development Agency	0.071
Total effect of measures				**22.16 TWh**

Table 3.2.1. Planned policy measures in the energy efficiency sector up to 2030

PLANNED POLICY MEASURES				
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**	**Energy savings in Twh, 2021-2030**
EE2. Renovation/modernisation of multi-apartment buildings	TO renovate a multi-apartment building to class C and save 40% of energy. By the end of 2030, around 5,000 multi-apartment buildings should be renovated, which means that nearly 500 multi-apartment buildings will be renovated each year.	2023-2030	Ministry of the Environment, Housing Energy Efficiency Agency	3.6 TWh
EE3. Renovation of public buildings	To renovate a public building to class C and to renovate about 960,000 m^2 of public building area by 2030	2023-2030	Ministry of Energy, Ministry of the Environment	0.36 TWh

EE7. Replacing boilers with more efficient technologies	By 2030, 50 000 domestic boilers will be replaced in households and other heat efficiency improvement measures will be implemented, resulting in savings of at least 200 GWh per year	2021-2030	Ministry of Economy, Environmental Projects Management Agency	11 TWh
EE8. Modernisation of indoor heating and hot water systems in multi-apartment buildings	A financial instrument that will encourage building owners to upgrade old elevator-type heating systems into newer single-circuit heating systems. Up to 30% of the investment costs will be reimbursed and some 250 heating substations will be upgraded annually, leading to 10 GWh energy savings per year	2021-2030	Ministry of Economy, Environmental Projects Management Agency	0.55 TWh
EE9. Improving energy efficiency in enterprises	A financial instrument that enables companies to implement energy efficiency improvement measures identified in the energy audit. Planned subsidies for energy savings and annual savings of around 100 GWh	2021-2030	Ministry of Economy, Environmental Projects Management Agency	5.5 TWh

EE10. Renovation of private houses	Financial incentive for private house owners to renovate their homes. To renew 1,000 private houses and save 13.5 GWh of energy annually.	2021-2030	Ministry of the Environment Ministry of Energy, Public Investment Development Agency	0.74 TWh
EE11.	Modernisation of street lighting systems	2023-2030	Ministry of the Economy, , Public Investment Development Agency	0.039
Total effect of measures				**21.78 TWh**

Brief descriptions of energy efficiency measures are given below:

EE1. *Excise duties and fuel taxation.* In order to increase energy efficiency in the transport sector, Lithuania has introduced higher excise duties and VAT on fuels, i.e. petrol, liquefied natural gas and diesel. Lithuania has a value added tax rate of 21% on fuel, which is 6 percentage points higher than the EU minimum of 15%. Petrol is subject to a higher excise duty of 21% (+ EUR 0.08/l), and liquefied petroleum gas – 243% (+EUR 0.18 /l). The combined effect of higher taxes and excise duties is a price increase of 14.7% for petrol, 5.2% for diesel and 64.7% for liquefied petroleum gas compared to the levels prescribed by the European Union. Taking into account the volume of fuels sold in Lithuania (petrol, diesel and liquefied natural gas) and demand elasticity, as well as the experience of other countries (Sweden, Spain, Germany and Estonia) in calculating the impact of increasing energy efficiency by means of tax instruments on fuel consumption, it is projected that 6 TWh of energy savings will result from higher taxes and excise duties on fuel in 2030.

EE2. *Renovation of multi-apartment buildings.* Lithuania will continue to prioritise the renovation of multi-apartment buildings and seek to reduce heating costs for consumers and improve living conditions in multi-apartment buildings. The implementation of the Programme for the renovation of multi-apartment buildings will continue and nearly 500 multi-apartment buildings will be renovated each year, with energy savings of 100 GWh. Priority will be given to multi-dwellings which were constructed in accordance with the technical standards of the Construction Regulation in force before 1993. After renovation, the building should qualify for class C and 40% savings should be achieved in the building's energy consumption. By the end of 2030, around 5,000 multi-apartment buildings should be renovated under this measure, saving 5.5 TWh of energy.

EE3. *Renovation of public buildings.* The current Programme for improving the energy performance of public buildings envisages targets for State-owned public buildings up to 2030. Around 510,000 m^2 in central government public building area and around 450 000 m^2 in municipal public building area are expected to be renovated by 2030. According to the current legal framework, public buildings must reach a minimum class C after renovation. Around 10 GWh of energy will be saved annually and the overall energy savings from this measure will come to 0.55 TWh approximately.

EE4. *Agreements with energy suppliers on consumer education and consulting.* Continued efforts will be made to increase consumer awareness and change their habits in the field of energy consumption, therefore the provisions of the Law on Increasing Energy Efficiency concerning agreements with energy suppliers on consumer education and consulting will extend beyond 2020. According to this Law, energy suppliers are obliged to conclude agreements with the Ministry of Energy of the Republic of Lithuania (hereinafter referred to as the 'Ministry of Energy') on consumer education and consulting.

Agreements on consumer education and consulting must include:

- the scope and timetable of consumer education and consulting;
- the procedure for reporting on the scope of consumer education and counselling (form of report, reporting periods);
- information on consumer education and consulting measures;
- the duration of the agreement and the procedure, and the possibility of extending it;

Energy suppliers will ensure the implementation of the scope of consumer education and consulting and of measures provided for in agreements concluded between them or through other persons. Newly established energy suppliers must sign agreements with the Ministry of Energy on consumer education and consulting within 6 months of the date of establishment. This measure is expected to lead to energy savings of 3 TWh due to changes in consumer behaviour.

EE6. *Energy saving agreements with energy companies.* The Law on Increasing Energy Efficiency sets out a legal framework for energy saving agreements. According to the Law, electricity and gas transmission systems and distribution system operators in which at least 1/2 of the voting rights in the general shareholders meeting are held by the State, either directly or through State-controlled companies (hereinafter referred to as 'State-controlled operators'), have an obligation towards the Ministry of Energy to make public the agreements on energy saving. Other energy companies must also conclude energy saving agreements with the Ministry of Energy.

The energy savings of energy companies will be determined in proportion to the final energy to be delivered to consumers over the last few years.

Energy saving agreements include the following elements:

- the energy savings/GHG reductions to be achieved by the energy company and the timetable for those savings;
- the procedure for reporting on energy savings (form of report, reporting periods);
- information on energy efficiency improvement measures that will ensure mandatory energy savings;
- financial investment indicators for energy efficiency improvement measures and the methodologies for calculating them;
- the duration of the agreement and the procedure, and the possibility of extending it;

Energy companies are required to save energy according to the levels of energy specified in the energy savings agreements (either on their own or through others) by applying cost-effective energy efficiency improvement measures at the final energy customers' facilities (installations, equipment, transport). This

measure is expected to result in annual savings of around 100 GWh and 5.5 TWh by 2030.

EE7. *Replacing boilers with more efficient technologies.* The measures set out in the plan will achieve the main target: by 2030, 50 000 domestic boilers will be replaced in households and other heat efficiency improvement measures will be implemented, resulting in savings of at least 200 GWh per year or 11 TWh by 2030. The plan is to upgrade 5,000 boilers in households annually.
This measure will compensate up to 50% of the costs of replacing inefficient individual boilers with individual boilers using more efficient technologies for households not connected to the district heating system.

EE5. *SPI relief for industrial enterprises.* A support mechanism to finance the implementation of energy efficiency improvement measures (recommended in the energy efficiency audit reports) in all major industries in Lithuania. Companies will be reimbursed for the implementation of energy efficiency measures. Energy efficiency measures to be implemented are expected to result in energy savings of around 100 GWh annually and 5.5 Twh by 2030.

EE8. *Modernisation of indoor heating and hot water systems in multi-apartment buildings.* A financial instrument that will encourage building owners to upgrade old elevator-type heating systems into newer single-circuit heating systems. Up to 30% of the investment costs will be reimbursed and around 250 heating substations will be upgraded annually. This would lead to annual energy savings of around 10 GWh, or 0.55 TWh by 2030.

EE9. *Improving energy efficiency in enterprises.* In order to improve the energy efficiency of businesses, Lithuania has planned a financial instrument that will encourage companies to implement energy efficiency improvement measures identified in the energy audit. It is planned to provide a subsidy for the energy savings achieved and to save 100 GWh annually and close to 5.5 TWh by 2030.

EE10. *Renovation of private houses.* Financial incentive for private house owners to renovate their homes. It is planned to renew 1,000 private houses each year and save 13.5 GWh of energy. Up to 30% of the investment costs will be reimbursed. Total energy savings by 2030 will amount to 0.742 TWh.

EE11. *Modernisation of street lighting systems.* Financial assistance to encourage the modernisation of street lighting systems. The aim is to replace and renew about 25% of all luminaires or about 65,000 luminaires by 2030 in Lithuania. Renewal of one luminaire is expected to result in annual electricity savings of around 250 kWh and total electricity savings of around 0.11 TWh by 2030.

Energy efficiency improvement measures in the transport sector.

Measures T1, T2 and T3 implemented in the transport sector are listed in Table 3.1.1.1. 'Existing policy measures in the field of transport' and measures T12 and T13 are listed in Table 3.1.1.2. “Planned policy measures in the transport sector up to 2030’ will contribute to energy efficiency targets. The detailed impact of these measures on the achievement of the energy efficiency targets is specified Annex 2.

Renovation of buildings

Lithuania is currently developing a draft national strategy for long-term support for the renovation of the public and private residential and non-residential building sector and plans to submit the final version of the strategy in accordance with the deadlines set out in the Energy Performance of Buildings Directive.

To increase and improve the renovation of public buildings, the use of energy services in the public sector

will continue to be promoted. The Public Investment Development Agency currently plays a key role in promoting and publicising the use of energy services in the public sector. The established Energy Efficiency Fund provides loans or guarantees to energy saving service providers carrying out projects for the renovation of public buildings and upgrading of street lighting through the energy service model. The Fund encourages investment in energy efficiency improvement projects by granting preferential loans for the modernisation and renovation of central government public buildings as well as guarantees for loans granted by commercial banks for the upgrading of street lighting. The Fund amounts to EUR 79.65 million.

The main source of information for the public sector is the Energy Efficiency Fund, which finances and advises public building managers wishing to renovate their buildings based on the energy service model. Both the Ministry of Energy and the Public Investment Development Agency organise seminars to disseminate information and encourage public building managers to upgrade buildings based on the energy services model. According to the plan, these activities will continue until 2030.

Lithuania has identified potential barriers to the use of energy efficiency contracts up to 2020 and has adopted measures to remove these barriers. No additional barriers preventing the use of energy efficiency contracting have been identified at present.

Publicity of energy efficiency measures

In order to increase the scope of energy efficiency improvement, the Law on Increasing Energy Efficiency has established the publicity principle, according to which competent authorities administering energy efficiency improvement measures publicly disseminate information to all market actors, including financial institutions. For example, the Public Investment Development Agency publicly disseminates and coordinates with financial institutions the information on the upgrading and financing of multi-apartment and public buildings and street lighting (for details see www.vipa.lt) and, for example, prior to the adoption of a street lighting financial instrument, the Public Investment Development Agency coordinated it separately with financial institutions. At present the Ministry of Economy and Innovation is publicly disseminating information on available energy efficiency improvement measures in the industrial sector[72] to all relevant market actors, including financial institutions. The implementation of these measures will continue until 2030.

Improving energy efficiency in electricity and gas infrastructure

In 2015, Lithuania carried out an assessment of the energy efficiency potential of gas and electricity infrastructure and prepared plans for the introduction of energy efficiency measures. These plans were successfully implemented until 2020. Some of the projects are ongoing and will be implemented after 2020. According to available estimates, Lithuania has updated its plans for the modernisation of the gas and electricity transmission and distribution network until 2030.

Table 3.2.2. Measures envisaged in electricity and gas transmission networks

[72] For more details see http://eimin.lrv.lt/lt/veiklos-sritys/es-parama-1/2014-2020-m/energijos-efficiency measures

No	Infrastructure project	Funding sources envisaged	Project status and implementation timetable	Social and economic benefits of the project
1.	Reconstruction of 330 kV and 110 kV transformer substations and/ or switch yards and power lines	Investments from EU Structural Funds	Transmission network transformer substations, switch yards and power lines are renovated and upgraded on a regular basis.	Ensuring the security of supply of electricity to consumer facilities, increasing security of power supply, reducing the costs of operations and operational management as well as development and modernisation of smart grids will lead to more efficient and secure use of energy and increase market integration of renewable energy sources.*
2.	Installation of software for the efficient management of gas flows and interactive exchange of information between transmission system operators and system users	Investments from EU Structural Funds	Purchase and installation of equipment in 2019–2021	Increased energy efficiency and implementation of smart gas flow management systems

Also, a 10-year investment plan of AB Energijos skirstymo operatorius ('ESO') was approved in 2019 and will cover the period from 2019 to 2028. It focuses on the modernisation of the electricity and natural gas networks. One part of the plan concerns the adaptation of smart technologies. The plan includes the following key measures:

Installation of smart meters. By the end of 2023, ESO plans to install smart meters for its customers who consume about 90% of the electricity distributed. Smart meters will be installed in stages, starting with largest electricity consumers, followed by other consumers. For natural gas customers, smart meters will be introduced if the cost-benefit analysis yields a positive result. Final decisions have not yet been taken, but the scenario of installing smart meters for customers using natural gas for heating is being considered.

In addition to smart meters, there are plans to implement a smart metering system for meter management and reliable data collection, storage and analysis. '*Upgrading of the information systems*'. In order to optimise the number of information systems (IS) required by ESOs as well as their operation and maintenance costs, system upgrades and functionality development are planned. Major projects; Installation of the Distribution Network Management System (DMS). Currently, controllers use several information systems simultaneously to manage the network. With the help of the new DMS, controllers will monitor and manage the gas and electricity network in real time in one system. This will make it much easier to locate the fault and restart the power supply more quickly. Introduction of the Geographic Information System (GIS) ESO currently operates

separate GIS systems for electricity and gas networks with outdated technologies and limited deployment of new functionalities. The aim is to introduce a single GIS system that enables ESO engineers to perform equipment maintenance faster, to plan necessary investments and network maintenance, to schedule the connection of new customers faster and to manage electricity losses more efficiently. Introduction of a digital asset management system. The different gas and electricity network maintenance systems currently available to ESO are outdated and their potential for further interconnection and development is limited. The new asset management system for maintaining, managing, planning, maintaining and collecting information on ESOs' infrastructure is expected to be more flexible and efficient.

Installation of a power network management decision-making IS based on BigData. By increasing the amount of remotely monitored and controlled equipment, ESO will collect more network operation parameters. The information gathered will make it possible to analyse the data, improve network maintenance processes and extend the useful life of the asset. The following measures are envisaged: 1. A fault prediction system which, based on network status and weather data, helps identify and prevent network vulnerabilities. 2. A Data Hub to allow customers, suppliers, network operators and other market actors to easily exchange data (access to historical data, switching suppliers, contract information management, consumption data, etc.). 3. A network load management system enabling customers to provide services to network operators and enabling customers to obtain financial incentives at peak network load.

The main benefit of the programme is to enable customers to make decisions on energy efficiency and reduction of energy costs based on available accurate data on their consumption.

Financing of planned measures in the energy efficiency sector[73]. The sector requires the largest additional investments. Additional funds are mainly planned for the modernisation of buildings. Considerable investment is needed to improve efficiency in enterprises and public infrastructure (upgrading street lighting). The total financial requirement of the sector amounts to approximately EUR 2,405 million, of which around EUR 810 million will come from public funding and around EUR 1,595 million from private funding. Energy efficiency measures are applied and implemented in different sectors and therefore have different sources of funding. The public portfolio will mainly consist of the 2021–2027 EU Structural Funds, the Climate Change Programme, State and municipal budgets, and the Life Programme.

3.3 Dimension Energy security[74]

Measures to ensure security of electricity supply

On 1 January 2019, the total installed capacity of the Lithuanian power system was 3,684 megawatts (MW), of which:

- the installed capacity of thermal power plants is 1,915 MW ;
- the installed capacity of waste-to-energy power plants is 22 MW ;
- the installed capacity of the hydroelectric power plants is 1,028 MW ;
- the installed capacity of wind power plants is 533 MW ;
- the installed capacity of other RES power plants is 186 MW .

The following changes in power generation are expected in 2019-2028:

- the 60 MW units at the Kaunas Cogeneration Power Plant will be decommissioned in 2020;
- a power plant of 101 MW total power (21.7 MW waste and 79.2 MW biomass) will be launched in Vilnius in 2020;
- the cogeneration power plant of UAB Kaunas Cogeneration Plant with an installed capacity of

[73]Indicative funding requirement.
[74]Policies and measures must reflect the 'Energy efficiency first' principle.

26 MW burning non-hazardous waste and biomass in Biruliškės village, Kaunas district, will be launched in 2020; the Petrašiūnai Power Plant (8 MW) will be decommissioned in 2022;

- the 6 MW TG-2 unit of AB Lifosa will be decommissioned in 2026, and the possibility of replacing it with a new 20 MW turbo generator in 2025 is being considered;
- The installed capacity of power plants using RES in 2028: 252 MW for biofuel power plants, 180 MW for solar power plants, 1,000 MW for onshore wind power plants and 128 MW for hydropower plants.
- Given that a detailed study on the possibilities of wind energy development in the Baltic Sea will be prepared and the conditions for the implementation of the projects will be examined in 2021-2022 at the initiative of the Ministry of Energy, the development of wind farms (with a 700 MW - 1,400 MW capacity) is envisaged in the maritime territory after 2025. Assuming that only terrestrial wind farms will be developed until 2025 and that maritime wind farms parks will be developed alongside after 2025, the total wind farm capacity will increase to 1,700 MW in 2028.

In order to adequately prepare for changes in the electricity system as the country's energy sector's dependence on fossil fuels is being reduced, the markets are integrating and energy production from RES is growing, the electricity transmission system operator is organising a study on energy development in Lithuania, which will formulate scenarios for the development of the Lithuanian electricity sector up to 2050, conduct an assessment of the adequacy of the electricity system and present technical, economic and legal measures for the efficient functioning of the electricity system in the development scenarios envisaged. The study will assess global trends, anticipate possible long-term development scenarios and plan in advance the measures and resources needed to implement the objectives and achieve greater synergies between different energy sources. Potential synergies between electricity, natural gas and heat through the integration of renewable energy sources will also be identified.

Kruonis Pumped Storage Plant. When the load on the energy system is low and there is a lot of cheap surplus energy (for example, at night time), the units of the Kruonis Pumped Storage Plant ('PSP'), operating in pump mode, lift water from the Kaunas Reservoir to the artificial upper 303 ha basin located 100 m above the Kaunas Reservoir water level. During the day, when energy demand increases, the Kruonis PSP can operate as a conventional hydroelectric power plant. For the prevention of and response to systemic accidents, it is important that the Kruonis PSP units can provide rapid backup power – they are capable of connecting to the network at full capacity in less than 2 minutes. Kruonis PSP units are ready to automatically descend from the emergency control scheme and compensate for power shortages. Other equally important functions of the Kruonis PSP are system load balancing, voltage and frequency regulation, and black start capability.

Currently, there are four hydraulic units installed in Kruonis PSP but the original design of the power plant provides the possibility of constructing another four units. In order to maintain reliable local generation, expansion is envisaged by building a fifth 225 MW asynchronous hydraulic unit. According to the technical characteristics, the hydraulic unit would be able to operate at a 110-225 MW capacity in pump mode and at a 55-225 MW capacity in generator mode. The project is being implemented in the context of the development of renewable energy sources (RES) in the region. A new unit of the Kruonis PSP would address one of the main challenges posed by the development of RES worldwide, namely the need for flexible, real-time management of imbalances in wind power production. As countries in the region increase the share of RES in electricity generation, the demand for this service will increase ever more. With the emergence of new production capacity, a higher base production and a need for reserves are anticipated. The major share

of the secondary reserve of true power will ensured by the flexible units of the Kruonis PSP. Although the existing capacity of 900 MW is sufficient for the operation of the power plant under current market conditions, its further development is important for ensuring the country's energy independence and competitiveness by maintaining sufficient and reliable domestic generation capacity. A new, more efficient unit would allow much more flexibility in real time to make up for electricity shortages or surpluses in the market. The project is included in the List of projects of common interest and receives support from the CEF for socio-economic and technical studies.

The market for reserve power services. Article 23(1) of the Law on Electricity provides that the electricity transmission system operator is responsible for the stability and reliability of the operation of the electricity system, the performance of the national balancing function in the territory of the Republic of Lithuania, the provision of system services, including the power reserve, the operation, maintenance, management and development of interconnections with the electricity systems of other countries, by reducing the capacity constraints in the transmission networks and taking into account the needs of electricity system and electricity grid users. According to Article 2(39) of the Law on Electricity, the reserve capacity service is the generation potential (capacity) of electricity, which must be ensured continuously by the service providers throughout the year. In order to meet this requirement, a market for reserve power services has been created in Lithuania.

Isolated operation of the electricity system. In accordance with the provisions of the Law on the Integration of the Electricity System of the Republic of Lithuania into the European electricity systems, the Lithuanian electricity transmission system operator has to establish, for each calendar year, the emergency, prevention and response system services, which include preparedness to ensure isolated operation of the electricity system and are necessary for the implementation of synchronisation of the electricity system, in order to ensure preparedness for isolated operation of the electricity system in emergencies prior to connection to the continental European electricity grid for synchronous operation.

European regulation on crisis prevention and management.
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 ('Regulation (EU) 2019/941') was adopted on 5 June 2019. Regulation (EU) 2019/941 establishes a common framework of rules on how to prevent, prepare for and manage electricity crises, bringing more transparency in the preparation phase and during an electricity crisis and ensuring that measures are taken in a coordinated and effective manner. Member States are obliged to draw up risk preparedness plans, and Regulation (EU) 2019/941 sets out common principles for crisis management in the electricity sector. The adoption of this Regulation and the equivalence of this system with that of the natural gas sector will have a positive impact on the security of the Lithuanian electricity system and on crisis prevention. In accordance with the provisions of Regulation (EU) 2019/941, risk preparedness plans should be approved and published by 5 January 2022.

Measures to ensure security of natural gas supply

In accordance with EU and national legislation, Lithuania accumulates fuel reserves and, therefore, in the event of a natural gas supply disruption, it is possible to supply household customers with natural gas through the connection between the Lithuanian and Latvian gas pipeline systems, using the gas reserves in the pipelines and having disconnected all other customers. Gas suppliers have accumulated sufficient quantities of natural gas for gas supply to vulnerable customers. Most of the reserve gas supplies are stored in the Inčukalns underground natural gas storage facility in Latvia.

A risk assessment is being carried out in Lithuania in accordance with the Regulation concerning measures to safeguard security of gas supply and, on the basis of the results of this assessment, preventive action and emergency plans are being established and approved by order of an the Minister for Energy of the Republic of Lithuania. The summary of the risk assessment and the preventive action and emergency management plans are published on the website of the Ministry of Energy[75] and in the Register of Legislation[76]. These plans also establish a regional dimension whereby Member States assist each other in the event of a natural gas emergency by diverting gas flows to customers protected by a neighbouring country affected by the emergency.

The Regulation concerning measures to safeguard security of gas supply lays down an infrastructure standard (N-1), describing the technical capacity of the gas infrastructure to meet total gas demand in a defined area of application of the (N-1) formula in the event of a disruption of the operation of one of the largest gas infrastructures on a day of exceptionally high gas demand, which occurs once every 20 years based on statistical probability. Based on the calculation of the N-1 criterion, the risk assessment has shown that this target of gas supply reliability in Lithuania has been met and equals 117%. The construction of the gas pipeline to Poland will raise the value of the N-1 criterion to 214% and the increase in the capacity of the Lithuanian-Latvian gas interconnector will raise the value of the N-1 criterion to 272%. It should be noted that Lithuania did not meet this standard prior to the start of operations of the LNG terminal (37.1%).[77]

It should be noted that the National Preventive Action Plan for Security of Natural Gas Supply[78] includes obligations for natural gas transmission system operators and distribution system operators to draw up emergency energy preparedness plans. All natural gas undertakings have such plans.

The Procedure for supplying consumers with energy and/or energy resources in the event of an emergency[79] regulates the supply of energy and energy resources to consumers in the event of an emergency, as well as emergency preparedness and management. The Procedure states that emergency preparedness plans include the following measures:

- ensuring the operation of enterprises in the event of an emergency;
- ensuring the best possible supply of energy resources and energy to consumers;
- use of alternative energy sources;
- reduction of the consumption of energy resources and energy in the enterprise;
- limitation of the supply of energy resources and energy to consumers.

Natural gas stocks are maintained at a level sufficient for the following cases: a 30-day period of exceptionally high gas demand (coldest period); or extreme temperatures in a peak period of seven days, which occurs once every 20 years based on statistical probability; or a period of at least 30 days in average winter conditions in the event of disruption of one of the largest gas infrastructures. AB Lietuvos energijos

[75] http://enmin.lrv.lt/lt/veiklos-sritys-3/gamtines-dujos/teises-aktai-lietuvos-gamtiniu-duju-sektorius

[76] https://www.e-tar.lt/portal/lt/legalAct/TAR.6A808030EFF4/as

[77] Prepared based on the 2018 study "Risk assessment of natural gas supply disruptions in Lithuania and modelling of possible scenarios", commissioned by the Ministry of Energy and carried out by UAB Ekotermija.

[78] Order No 1-241 of the Minister for Energy of the Republic of Lithuania of 28 November 2012 approving the National Plan for preventive action to safeguard security of natural gas supply and the National Plan for natural gas supply emergency management approved the National Plan for preventive action to safeguard security of natural gas supply.

[79] Approved by Resolution No 12 of the Government of the Republic of Lithuania of 13 January 2003 on the approval of the Procedure for supplying consumers with energy and/or energy resources in the event of an emergency.

tiekimas has entered into an agreement with the Latvian gas storage system operator, AB Conexus, for the storage of natural gas stocks in the Inčukalns underground natural gas storage facility.

It should also be noted that energy security in the field of natural gas will be enhanced by the Gas Interconnection Poland-Lithuania (GIPL) and Enhancement of Latvia-Lithuania interconnection (ELLI) projects, discussed in more detail in section 2.4.2 .

Oil stocks

The accumulation, storage and renewal of reserve energy resources is provided for in Article 29 of the Law on Energy. It requires energy undertakings with heat and/or power generation installations with a capacity exceeding 5 MW and producing heat or electricity for sale to have reserve energy resources. They are accumulated, stored and renewed by energy companies and other funds. Their quantities must be sufficient for at least 10 days. The most common stocks are biofuels, heavy fuel oil, shale oil and diesel. Natural gas is not considered as a backup fuel in any of the enterprises storing fuel stocks. Backup fuel stocks must be maintained during the cold season of the year. During the warm period of the year (1 April to 31 October), the energy backup requirements and quantities are determined by the energy undertakings themselves.

Council Directive 2009/119/EC of 14 September 2009 obliging Member States to maintain stocks of crude oil and/or petroleum products requires that the total oil stocks maintained at all times within the EU Member States correspond, at the very least, to 90 days of average daily net imports or 61 days of average daily inland consumption, whichever of the two quantities is greater. In Lithuania, special stocks of petroleum products are stored and managed at the expense of the State. These stocks must be sufficient for at least 30 days, on the basis of average daily domestic consumption during the previous calendar year. The remainder of the stocks is accumulated by the obliged undertakings.

The accumulation of these stocks is ensured by the public institution Lithuanian Energy Agency, which also ensures that the quality of petroleum product stocks complies with the mandatory requirements for the quality of petroleum products. Stocks of petroleum products are held at the Subačius oil terminal, which was built in 1964. After Lithuania regained its independence, the terminal has been constantly upgraded, and since 2012 it has been operated by AB Klaipėdos nafta.

Regional cooperation

The Regulation concerning measures to safeguard security of gas supply groups Member States according to the main sources of natural gas supply. Lithuania belongs to 2 groups: Belarus and North-Eastern Europe. Countries in the same group are obliged to perform joint risk assessment and joint regional chapters of preventive action and emergency management plans. These chapters cover the main aspects of emergency cooperation between Member States connected by natural gas pipelines.

Other forms of cooperation are described section 1.4.

Financing instruments at national level

It should be noted that projects benefiting from CEF investments are described in more detail in section 2.4.2, and the funding plans for them are described below.

It is also noteworthy that, according to the 2013–2020 Operational Programme for investment from the European Union Funds envisages investments to increase the security and reliability of networks:

For electricity transmission networks, support is provided to the construction of new advanced electricity transmission lines that will ensure reciprocal transmission of electricity through inter-system connections Lithuania-Poland (LitPol Link) and Lithuania-Sweden (NordBalt), upgrading (restoration) of existing lines, ensuring security of electricity supply to customers, as well as construction of new advanced transformer substations and switch yards and the reconstruction (upgrading) of existing ones, replacement of overhead power lines with underground ones to ensure security of electricity supply to both existing and new customers and contributing to the integration of RES into the Lithuanian electricity system.

Following the implementation of the project listed above, the electricity transmission networks will comply with the standards of Regulation (EU) No 347/2013 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure (a network that can integrate in a cost efficient manner the behaviour and actions of all users connected to it, including generators, consumers and those that both generate and consume, in order to ensure an economically efficient and sustainable power system with low losses and high levels of quality, security of supply and safety).

For electricity distribution networks, investments are made in the modernisation and development of electricity distribution networks and in the deployment of advanced technologies. Under this measure, investments are made in upgrading the substations, distribution points and lines of the medium and low voltage distribution network through the installation of new equipment and/or network elements with additional technical and functional characteristics of equipment and/or network elements for the management of the smart grid. Support is also provided for smart grid management systems, including, but not limited to, the installation of data transmission and remote control facilities in switch yards and transformer substations, installation of their control systems and the installation of smart metering and their control systems.

Following the implementation of these projects, the electricity transmission networks will comply with the standards of Regulation (EU) No 347/2013 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure (an network that can integrate in a cost efficient manner the behaviour and actions of all users connected to it, including generators, consumers and those that both generate and consume, in order to ensure an economically efficient and sustainable power system with low losses and high levels of quality, security of supply and safety).

For gas transmission networks, investments in advanced gas transmission network systems. Investments are made in the internal gas transmission networks necessary to ensure security of gas supply and integration of the Lithuanian gas systems into the internal market of the European Community. Investments are also intended for measures to improve security of gas supply and energy efficiency: installation of software and hardware for the efficient operation of the transmission system, installation of metering and gas quality assessment tools and telemetry, and installation and upgrading of gas distribution and compressor stations.

For gas transmission networks, investments in an advanced gas transmission network system a made. Projects for gas distribution network looping and the installation of controlled valves are funded. This creates smart grid technologies to ensure the reliability of natural gas distribution and to expand

management options. It is planned to support projects for the introduction of smart metering of natural gas by improving the ability of customers to control their gas consumption and enhancing system management capabilities.

Ongoing projects to connect markets are inseparable from the projects listed in both section 2.4.2 and the section above. While the implementation of the main strategic projects (electricity connections between Lithuania and Poland and between Sweden and Lithuania) were financed from above mentioned sources, reinforcement of internal electricity transmission grids is being financed from 2014-2020 EU structural funds. In this respect, around EUR 69 million will be allocated for upgrading and expanding internal electricity transmission networks. EUR 53 million euros have been allocated for the gas transmission networks.

It is noteworthy that, pursuant to the 2013–2020 Operational programme for investment from the European Union, electricity and natural gas transmission system projects are defined in the National Plan for electricity and natural gas transmission infrastructure projects[80].

Funding under CEF

The strategic projects in which Lithuania participates are described in greater detail in section 2.3 and are included in the list of projects of common interest and are eligible for funding from the Connecting Europe Facility (CEF). Table 3.3.1 provides information on the funds intended for their implementation:

Table 3.3.1: Funding of energy security projects

No	Project title	Total project value, EUR	Estimated amount of funding for the project part in Lithuania, up to EUR
1.	Synchronization between the Baltic States' energy system and the networks of continental Europe	~1.5 bn	~125 m (Stage I)
2.	Gas interconnection Poland-Lithuania	~558 m	~136 m (construction and issuance of permits)
3.	Studies on the field of poles and infrastructure of the Kruonis Pumped Storage Plant (Kruonis PSP)	~78 thou	~39 thou
4.	Project for enhancement of the Latvia-Lithuania interconnection(ELLI)	~10.3 m	~2.35 m

3.4 Dimension Internal energy market[81]

[80]National Plan for the implementation of electricity and natural gas transmission infrastructure projects, approved by Government Resolution No 2014 of 22 July 476 approving that Plan.

[81]Policies and measures must reflect the 'Energy efficiency first' principle.

3.4.1 Electricity infrastructure

It should be noted that the connectivity aspect in Lithuania is satisfactory (see section 2.4.1), therefore no specific measures are foreseen to improve it, but Lithuania is still not in the synchronous zone with the continental European networks, therefore one of the most important strategic objectives for the Lithuanian electricity sector is the connection of the Lithuanian electricity system with the continental European networks for synchronous operation and full integration into the European electricity market. The main volumes and parameters of network development are therefore proposed in such a way as to ensure the implementation of existing strategic objectives and guidelines and to avoid unnecessary investment. The synchronisation project is covered in more detail in sections 3.4.2. and 2.3 .

See section 1.3 on regional cooperation and see section 3.3 on funding.

3.4.2 Energy transmission infrastructure

Electricity sector

The medium-term adequacy forecast[82] by the European Network of Transmission System Operators for Electricity (ENTSO-E) predicts that in 2025 the Loss of Load Expectation (LOLE) in Lithuania will increase to 29.5 hours per year under the PPM scenario. Lithuania aims to limit the Loss of Load Expectation (LOLE) to a maximum of 8 hours per year. To achieve this, a capacity mechanism is being developed in Lithuania to ensure reliable operation of the Lithuanian electricity system and an adequate level of security of electricity supply after 2025.

In Lithuania, capacity adequacy is mainly influenced by interconnections between systems, their reliability and availability, and particular attention is paid to the operation of interconnectors and the development and deployment of regional market mechanisms.[83] The capacity mechanism described in more detail in section 2.3, covering load adjustment instruments, storage facilities and other tools, will contribute to the reliable operation of the system[84]. New reliably available local power generation capacities could also contribute to ensuring competitive local power generation.

Litgrid is currently conducting a pilot battery project to test the potential of battery storage systems under realistic operating conditions of the Lithuanian power system. The test results will help you to evaluate the applications of such batteries and to determine the technical parameters of these devices that best meet the system needs. The project is being implemented to increase frequency management and to ensure system stability and security. Battery storage systems can contribute to maintaining the required level of inertia (function of synthetic inertia) and to ensuring very fast reserves of control power, which would contribute to improving system adequacy in the preparation for synchronous operation with continental European networks. A total of 11 areas where such a battery system could be useful have been identified, most of which are related to frequency management, as well as rapid compensation of power changes, management of network congestion, improvement of energy quality and a dynamic stability and emergency reserve.

[82] https://www.entsoe.eu/outlooks/midterm/
[83] https://enmin.lrv.lt/uploads/enmin/documents/files/LEES_adekvatumo_vertinimo_santrauka.pdf
[84] 'storage facilities' are those facilities where electricity can also be stored and supplied to the grid or which can be converted into another type of energy and returned to the grid as electricity (including electric batteries, the Kruonis Pumped Storage Plant, capacitors, compressed air or hydrogen storages).

In implementing the synchronisation project, covered in more detail in section 2.3, the Government of the Republic of Lithuania has approved the following specific electricity projects as an integral part of this project:

- expansion of the LitPol Link interconnection, including actions from the ordering of equipment needed for reconstruction (extension) of the power transmission line and the 330 kV Alytus transformer substation, scheduled for the fourth quarter of 2019, to the completion of the contract work of reconstruction/expansion scheduled for the fourth quarter of 2020;
- reconstruction of the 330 kV power line from the Lithuanian Power Plant to Vilnius, which is ongoing and is planned to be completed in the fourth quarter of 2020;
- optimization and preparation of the north-eastern Lithuanian power transmission network for synchronous operation with the continental European power system, including the dismantling of the Lithuanian section of the disconnected 750 kV cross-border transmission line LN705 (interconnection with the Republic of Belarus), reconstruction of the 330 kV transformer substation in Utena, reconstruction of the 330 kV transformer substation of the Ignalina NPP and relocation of the installations of the 330 kV transformer substation of the Ignalina NPP to the Lithuanian Power Plant's switch yard – ongoing and scheduled to be fully completed in 2020;
- construction of the 110 kV power line Pagėgiai-Bitėnai, which is ongoing and is planned to be completed in the second quarter of 2020;
- expansion of the 330 kV Bitėnai Transformer Substation, which is ongoing and scheduled for completion in the fourth quarter of 2019;
- construction of the 330 kV power line Vilnius-Neris, for which special spatial planning and environmental impact assessment processes have just been initiated and should completed by the end of 2021, while the start of operation of the newly constructed power line is scheduled for the fourth quarter of 2025;
- construction of the 330 kV power Kruonis PSP-Bitėnai, for which spatial planning and environmental impact assessment processes will start before the end of this year, while the start of operation of the newly constructed power line is scheduled for the fourth quarter of 2025;
- construction of the 330 kV power line Darbėnai–Bitėnai, for which spatial planning and environmental impact assessment processes will start before the end of this year, with the start of operation of the newly constructed power line scheduled for the first quarter of 2025;
- construction of the 330 kV switch yard 'Mūša' for which spatial planning and environmental impact assessment processes will start before the end of this year and the start of operation of the newly constructed switch yard is scheduled for the second quarter of 2025;
- construction of the Harmony Link (submarine cable) link with the Republic of Poland. Synchronization until 2025 will take place using the existing Lithuanian-Polish connection (LitPol Link) and laying a new submarine cable between these countries, the Harmony Link. It is planned to construct an offshore connection of high-voltage direct current (HVDC) and up to 700 megawatts (MW), a HVDC land cable, as well as a 330 kV converter station with a switch yard in Darbėnai, Kretinga district. In Lithuania, the project will cover the national territorial waters of in the Baltic Sea, the municipalities of Palanga town and Kretinga district. The Harmony Link cable project will be implemented by the Polish electricity transmission system operator PSE and the Lithuanian electricity transmission system operator AB LITGRID. This project expects to receive support from the CEF (the project is also on the list of projects of common interest, after the Synchronization project). The project is planned to be implemented in several phases, including studies on the implementation of the interconnector project to be completed in the third quarter of 2021, spatial planning on the Lithuanian side, the solutions of which should be implemented and registered in

the fourth quarter of 2022, as well as interconnector design, equipment manufacturing and construction contract work from the fourth quarter of 2023 to the scheduled start of operation of the interconnector (offshore cable) in the fourth quarter of 2025;

- construction of the 330 kV switch yard 'Darbėnai' for which spatial planning and environmental impact assessment processes are scheduled to be completed in the fourth quarter of 2022, while and the start of operation of the newly constructed switch yard is scheduled for the second quarter of 2025.

The project is on the list of projects of common interest to be supported by the CEF.

Gas sector

The gas transmission infrastructure part includes the following national strategic initiatives:

- to acquire a floating storage regasification unit (FSRU);
- to build a gas interconnector between Poland and Lithuania (GIPL project);
- to upgrade and develop the natural gas transmission system by installing smart remote control system equipment and optimizing system capacity;
- to implement the EU gas network codes;
- to increase enhance the Latvia-Lithuania interconnection (ELLI project);
- to upgrade and develop the natural gas transmission system by installing smart remote control system equipment and optimizing system capacity;
- to deploy smart metering devices for natural gas customers (on condition of positive results of the cost-benefit analysis).

For regional cooperation, see: 1.4. section. For funding, see also sections 3.3 and 2.3 concerning CEF projects.

3.4.3 Market integration

The Lithuanian energy sector will undergo major changes up to 2030. They will primarily take place in the electricity sector, where a growing share of decentralized generation will require major structural changes. Ongoing technology-neutral auctions increase the share of local power generation each year, but also create additional challenges such as system balancing. With the introduction of smart meters a growing number of prosumers, a legal framework is being developed for the aggregator mechanism, which, having three different types of users, would create preconditions for demand-side response and avoid a part of the peaks in the electricity demand market. To analyse the possibilities of connecting/integrating electricity and gas markets, an analysis of applicability and relevance of power-to-gas technology for Lithuania will be carried out, the economic, legal and technical issues of the technology's applicability will be addressed, potential product consumers will be questioned and a technology review will be prepared in 2020. The NEIS Action Plan 2021-2022 envisages a feasibility study to assess the transformation of the Lithuanian natural gas sector in the context of adapting to an economy based on clean energy production.

DSO is developing a data hub, which will be implemented in several steps:

- a standard for electricity suppliers will be developed and introduced by 2020, modifying the existing information technology systems;
- a joint platform for data collection and exchange (data hub) will be created by 2023.

All the measures envisaged will increase market liquidity, the share of domestic generation, ensure security of supply, help maintain national competitiveness, and reduce the impact of energy transition for citizens and businesses.

The tables below present existing and planned measures for the market integration policy, grouped according to the targets adopted in the NEIS Action Plan.

Table 3.4.3.1. Existing measures of the market integration policy up to 2030

EXISTING POLICY MEASURES			
Measure	**Target**	**Implementation period**	**Entities responsible for implementing the policy**
To increase the share of domestic energy production and reduce dependence on energy imports			
ERK1. To ensure that electricity from third countries with unsafe nuclear power plants cannot enter the electricity market of the Republic of Lithuania directly	Share of electricity imports from third countries with unsafe nuclear power stations in the country's total import balance: 0%	2018-2020	Ministry of Energy, Ministry of Foreign Affairs, VERT
ERK2. To strive for an EU-wide level playing field in electricity trade with third countries	An agreement between the EU and the Baltic States has been reached to establish a level playing field in electricity trade with third countries	2018-2020	Ministry of Energy, Ministry of Foreign Affairs, VERT
ERK3. To ensure that decisions and recommendations in the field of nuclear safety and environmental protection of are adopted by the EU and international organizations regarding the construction of a nuclear power plant in the Astravets district, Belarus, in line with the interests of Lithuania	Decisions and recommendations have been adopted by the EU and international organizations in the field of nuclear safety and environmental protection regarding the construction of a nuclear power plant in the Astravets district, Belarus, in line with the interests of Lithuania	2009-2030	Ministry of Foreign Affairs, Ministry of Energy, Ministry of the Environment

ERK4. To develop and implement a long-term capability mechanism	For the purpose of ensuring electricity market (100%), to enter into cooperation agreements for the development of reliable and affordable local electricity production under market conditions and/or to distribute the support for the implementation of the required measures by means of an auction	2018-2020	Ministry of Energy, AB LITGRID, UAB EPSO-G, VERT
To ensure optimal conditions for the consumption of electricity, natural gas and heat			
ERK5. To seek the fullest possible integration of the natural gas markets of the Baltic States and Finland (where economically beneficial for Lithuanian gas consumers)	To align the pricing elements in the zone of the natural gas transmission entry/exit points (between the Baltic States and Finland). To coordinate the choice of options by the Baltic States and Finland for the implementation of the natural gas network codes, including the principles of balancing, capacity allocation, congestion management, interoperability and data exchange.	2018-2022	Ministry of Energy, VERT, AB Amber Grid
ERK6. To ensure, in line with the principles of sustainable development, a transition towards clean energy production for the industries, businesses and households consuming natural gas	To prepare a feasibility study to assess the transformation of the Lithuanian natural gas sector in the context of adapting to an economy based on clean energy production	2021-2022	Ministry of Energy

ERK7. To increase the liquidity of the natural gas exchange	Trade volume at the Lithuanian Natural Gas Exchange trading platform: 4 TWh/year	2020-2022	Ministry of Energy, UAB GET Baltic
ERK8. To speed up the process of connecting the consumer's electrical installations to the electricity and natural gas distribution networks	The average waiting time for connection to the electricity distribution network is 33 calendar days and to the natural gas distribution networks 45 calendar days.	2015-2025	Ministry of Energy, AB Energijos skirstymo operatorius other natural gas distribution operators
ERK9. To ensure optimal power reserve, adequate fuel stockpiles and reliable heat supply to consumers as well as proper operation of boilers in households	To review existing requirements for reserve heat generation capacity and for fuel stockpiles	2020-2021	VERT, Ministry of Energy
ERK10. To increase the number of new heat customers connected to the DH system	Improving incentive regulation to enable heating companies to build up resources required for DH development. To establish a time limit for the heat supplier to connect a heat consumer to DH upon request of the heat consumer in the DH areas identified in the special plans of the heat sector, subject to a positive economic assessment	2021-2022	Ministry of Energy
ERK11. To reduce maintenance costs of the Klaipėda LNG terminal	The security component of natural gas supply not exceeding EUR 35 million per year.	By 2025	Ministry of Energy, AB Klaipėdos nafta VERT

ERK12. To upgrade and/or modernise the heating substations and/or heating systems in multi-apartment buildings, private houses and/or public buildings	The number of modernised heat substations and/or heating systems: 2,000	2019-2022	Ministry of the Environment, Ministry of Economy
ERK13. To upgrade and/or modernise the heat transmission network and its installations/elements	1,000 km of modernised district heating networks 12 km of newly built district heating networks	2018-2030	Ministry of Energy, heat suppliers
ERK14. To integrate the heat and drinking and/or hot water remote data reading system into the smart electricity and natural gas metering systems (subject to positive results of the cost and benefit analysis)	50% of remote data reading systems of heat, drinking and/or hot water consumers connected to smart electricity and natural gas metering system	2020-2027	Ministry of Energy, Ministry of the Environment AB Energijos skirstymo operatorius, heat suppliers, drinking water suppliers
ERK15. To upgrade and develop the natural gas transmission system by installing the devices of the smart remote control system and diagnostics in gas pressure control facilities	The number of natural gas consumers connected to intelligent distribution systems: 37,000 The length of pipelines built: 45 km	2022-2025	Ministry of Energy, AB Energijos skirstymo operatorius
ERK16. Reconstruction of main gas pipelines	The length of pipelines reconstructed: 32 km	2018-2022	Ministry of Energy, AB Amber Grid
ERK17. To deploy smart metering devices for natural gas customers (subject to positive results of the cost-benefit analysis)	The number of consumers equipped with smart accounting: 125 678	Up to 2030	Ministry of Energy, VERT AB Energijos skirstymo operatorius

ERK18. To implement the project for gas interconnection Poland and Lithuania (GIPL)	Increased throughput to 74 GWh per day to Lithuania and up to 58 GWh per day to Poland The achieved natural gas import route diversification (IRD) index for 2021: 3,793	2019-2021	Ministry of Energy, AB Amber Grid
ERK19. Project for enhancement of the Latvia-Lithuania interconnection(ELLI)	Increased throughput to 130.47 GWh per day to Latvia and up to 119.5 GWh per day to Lithuania The achieved natural gas import route diversification (IRD) index for 2024: 3,420	2017-2024	Ministry of Energy, AB Amber Grid
To ensure an advanced electricity market			
ERK20. To deregulate retail electricity prices for domestic consumers (excluding socially vulnerable consumers)	Electricity price cap regulation eliminated	2019-2023	Ministry of Energy, VERT
ERK21. To promote aggregation of electricity demand and generation	Innovative energy start-ups offering services in the market are independent aggregators of electricity demand and generation	2019-2021	Ministry of Energy
ERK22. To develop and implement a standard for the exchange of data between electricity consumers and electricity suppliers by modifying existing information technology systems	A standard for the exchange of data between electricity consumers and electricity suppliers has been developed and implemented	2014-2020	Ministry of Energy, AB Energijos skirstymo operatorius

ERK23. To improve/ensure security of electricity supply to industrial customers in defined industrial areas	SAIFI - 0.74 times, SAIDI - 75 min.	2018-2027	Ministry of Energy, AB Energijos skirstymo operatorius
ERK24. To promote the development of smart grids	Network digitization and automation, introduction of smart metering and smart devices	2019-2023	Ministry of Energy, AB Energijos skirstymo operatorius
ERK25. To provide appropriate technical and market organization conditions for RES generators to participate in system balancing, regulation and other network services	To update the feasibility study on the connection of power plants using RES to the 330-110 kV electricity grid by 2030 and develop an action plan for the integration of RES into the electricity market To promote the integration of RES producers into the electricity market by enabling RES producers to provide regulatory energy, systemic grid services and other services,	2020-2030	Lithuanian Energy Agency, LITGRID AB, Ministry of Energy

Table 3.4.3.2. Planned market integration policy measures up to 2030

PLANNED POLICY MEASURES			
Measure	**Scope and results/effect envisaged**	**Implementation period**	**Entities responsible for implementing the policy**
Increasing the flexibility of the energy system			

ERK26. To promote market integration of energy storage facilities and services	Consumers and market participants have the possibility to store the electricity generated by them or to sell the electricity on the market and participate in all electricity markets, contributing to the flexibility of the electricity system	2021-2030	Ministry of Energy
ERK27.1. To promote the development of opportunities for the development of cross-border balancing markets	Increased competition in the market for electricity balancing services	2021-2030	Ministry of Energy, LITGRID, VERT
ERK27.2. To promote cross-border electricity trade	To coordinate national energy policies with neighbouring Member States and exploit opportunities for cross-border electricity trade	2021-2030	Ministry of Energy
ERK28. Implementation of the Kruonis Pumped Storage Plant (PSP) Unit 5 construction project	Development of the Kruonis PSP by building a fifth 225 MW hydraulic unit (110-225 MW in pump mode and 55-225 MW in generator mode)	2020-2025	Ministry of Energy, Ministry of Finance, Ignitis Group
To promote competition in energy trading markets			
ERK29. To promote transparency in electricity supply activities	To oblige electricity suppliers to upload a comparison of submitted plans to a public tool for comparing electricity supply prices	2022-2024	Ministry of Energy, VERT, ESO, electricity suppliers
	To create a centralised database allowing electricity suppliers to access the data of consumers who have given their consent		

ERK30. To increase the attractiveness of the Lithuanian retail electricity market for electricity suppliers operating in the EU (except for those supplying electricity generated in unsafe nuclear power plants)	To set up a standardized and short process for a new supplier to start retail electricity supply and to simplify the conditions for the supply of electricity to household customers	2021-2027	
ERK31. To promote competitive energy pricing	Consumers are able to choose dynamic price agreements. Consumers are able to respond to price signals in real time and manage their power consumption	2021-2024	Ministry of Energy, VERT
ERK32. An optimal balance between domestic production of biofuels and imports of biofuels from third countries would be sustainable and optimal, allowing a high level of competition and low market concentration to be maintained in the long term.	Biofuel market concentration level under HHI <1000 The market share of the largest biofuel supplier (and its affiliates) <20% The number of unrelated suppliers with a 75% share in the market for biofuels >15 Imported quantity of biofuels <20%	2020-2030	Ministry of Energy, Competition Council, VERT
ERK33. To promote the use of biofuels produced and supplied in an ecological and sustainable manner	A scheme for the issue of RES guarantees of origin for fuel used in the DH sector has been established (certificates confirming best forest management practices to ensure product quality and sustainability throughout the biofuel production and supply chain).		Ministry of Energy, Balticpool Lithuanian Association of Heat Suppliers

Funding of measures planned in the market sector[85]. Additional investment is needed mainly in the heat sector to build capacity for production from RES, to install equipment and to conduct a study on the transition of gas-consuming sectors to generation from clean sources. The total financial requirement of the sector covering gas, heat and electricity amounts to approximately EUR 51 million, of which around EUR 31 million will come from public funding and around EUR 20 million from private funding. Available sources of public funds: EU Structural Funds 2021-2027, the heat tariff, the Norwegian Financial Mechanism and the Life Programme.

ERK30. *To increase the international attractiveness of the Lithuanian retail electricity market*. To establish a standardized and short process for a new supplier to start retail electricity supply activities; to simplify the conditions of electricity supply for household customers; to establish a centralized database allowing electricity suppliers to access the data of consenting consumers; to oblige electricity suppliers to upload a comparison of submitted plans to a public tool for comparing electricity prices; to standardize the price section of electricity supply offers and bills, improving consumer information and understanding of the electricity market and promoting price competition; to standardize the process for changing the retail electricity supplier by shortening it to the shortest practicable time.

ERK21. *Aggregation of electricity demand and generation.* Independent demand aggregators wishing to participate in the provision of electricity balancing and reserve power services will mobilize electricity consumers and generators interested in responding to electricity market supply and demand signals and incentive payments from the transmission system operator by offering opportunities to reduce or increase their electricity consumption and to change one's normal power consumption mode. Demand-side management measures will not only make for more efficient use of electricity, but will also optimize the use of the capacities of the transmission and distribution networks and generation. Independent aggregators will contribute to the flexibility of the Lithuanian electricity system and encourage the development of new and innovative energy start-ups.

ERK26. *To promote the integration of electricity storage facilities and services into the electricity market.* 'Energy storage' means the postponement of the final use of electricity in the electricity system to a point after its production or conversion of electricity into a form of energy that can be stored, storage of such energy and the subsequent conversion of such energy into electricity or into a different energy carrier. Consumers and market participants will be enabled to consume, store and sell the electricity generated by them on the market and to participate in all electricity markets, contributing to the flexibility of the electricity system through energy storage.

The electricity system in Lithuania is changing fundamentally. The growing share of electricity from renewable energy sources in the electricity generation basket forces system operators to integrate both renewable and conventional power plants in a responsible manner. Consumer behaviour and market access are becoming increasingly important, and consumers are being motivated to adapt their electricity consumption to real market prices and the situation in the system.

When installing smart meters (smart metering of natural gas under ERK17. is treated as a part of measure EE4.), lays down requirements for smart metering, which include not only remote reading but also functionalities related to improving the quality of services.

The expected rapid development of electric vehicles and renewable energy technologies will have a major impact on the functioning of electricity systems. Therefore, customers who are able to adapt to changing

[85]Indicative funding requirement.

conditions will play an increasingly important role in ensuring sound management of electricity systems and rational investments in distribution systems. Incentives will be available to customers who are able to change consumption patterns flexibly and contribute to a more stable functioning of the systems.

Lithuanian DSO is implementing a prosumer development plan that removes bureaucratic barriers for prosumers to connect to electricity networks. Consumers operating solar power plants produce electricity for their own use and participate actively in the exchange process with the DSO. Currently, more than 2,500 consumers produce electricity in this way in Lithuania.[86]

The traditional customer becomes not only a consumer, but also a producer of energy. Renewables and self-generation are the future of energy, a trend that is growing in all advanced countries where the decentralisation of infrastructure is gaining momentum.

At the DSO's suggestion, preconditions, development and production permits and in some cases projects are no longer required, the cost of connecting prosumers to the networks has been reduced, enterprises are allowed to become prosumers, the capacity limitation requirements have been revised, the financial incentives for solar installations have been modified, control accounting has been eliminated, and the investments needed for the sustainable integration of prosumers are provided for in the DSO's investment plan. The aim is to create a sustainable ecosystem for prosumers and ensure its sustainable development. The development of small energy aimed at consumers who produce electricity themselves is one of the priority activities of the Lithuanian Ministry of Energy.

Virtual power plants and demand-side management technologies are another important tool. Artificial intelligence and other innovations are changing this area and consumers are no longer passive and can become active players in the market. Technologies such as virtual power plants or electricity demand-side management devices in some cases bring monetary benefits.

A virtual power plant is perceived to be composed of many different types of customers – domestic customers, electric cars and businesses - who can change their consumption and production behaviour according to their needs.

A survey carried out by the international consultancy E4tech in Lithuania showed that a household consumer providing virtual power plant services in Lithuania could potentially earn up to EUR 300–400 in additional income per year. The British market model was used for the calculations.[87]

Ignitis group, the largest State-controlled holding of energy undertakings, has invested in Moixa, a British company that develops battery and virtual power plant technologies. Another investment was also made in the Estonian start-up Fusebox, which is developing a platform to help businesses change their electricity consumption behaviour.

The Plan of implementing measures for the Lithuanian National Strategy for the Development of Renewable Energy Sources[88] provided for the design and implementation of support schemes to facilitate the use of renewable energy sources, prioritising projects with the highest impact at the lowest cost and ensuring that any potential investor can participate in renewable energy activities through transparent, simple, non-discriminatory and public selection procedures.

According to the Law of the Republic of Lithuania on Electricity,[89] a vulnerable electricity consumer is a household electricity consumer who receives (himself and/or through persons residing with him) and/or is

[86] https://www.eso.lt/download/208922/gaminan%C4%8Di%C5%B3%20vartotoj%C5%B3%20statistika%202019-10-18.pdf
[87] https://nlea.lt/data/public/uploads/2019/05/elektros-energijos-ir-gamtiniu-duju-rinku-apzvalga_2019-geguze.pdf
[88] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.377162/asr
[89] Law of the Republic of Lithuania on Electricity: https://www.e-tar.lt/portal/lt/legalAct/TAR.F57794B7899F/mouDoNqiIt

entitled to social assistance in cash in accordance with the Law of the Republic of Lithuania on Cash Social Assistance to Low-income Residents and who, in accordance with the procedure laid down in this Law and its implementing legislation, is entitled to additional guarantees available for vulnerable consumers. Additional measures to protect the rights and legitimate interests of vulnerable consumers:

- vulnerable customers may not be subjected to restriction of and/or disconnection from electricity supply and/or transmission for failure to pay the bill for the electricity transmission service or other related services within a specified period in full or in part, if the amount owed to the distribution system operator or supplier by those vulnerable customers is or was equal to or less than 3 basic social benefits, except in the cases provided for in Article 71 and Article 72 (1) and (3) of the Law on Electricity;
- failure by vulnerable customers to pay for the electricity supplied or to pay, in full or in part, for the electricity transmission service or other related services within the prescribed period may not result in termination of electricity supply and/or transmission on Fridays, Saturdays, Sundays, public holidays or the day before a public holiday or when the average daily air temperature is below -15 °C or above +30 °C, except in the cases provided for in Article 71 and Article 72 (1) and (3) of the Law on Electricity. In such cases, supply to the customer may be terminated on the day after the situations referred to in this paragraph have ended, provided that the vulnerable customer has been warned in accordance with the procedure laid down in the Electricity Supply and Use Rules and other legislation implementing the Law on Electricity;
- vulnerable customers have the right to settle with the distribution system operator or the supplier by the last day of the month following the calendar month during which the transmission and/or supply of electricity or other related services to the customer takes place, except where extended time limits for payment have been agreed upon at the request of the vulnerable customer;
- in the case of vulnerable customers connecting electrical equipment to the electricity networks managed by the distribution system operator, where the connection fee exceeds EUR 600, 60 per cent of the fee is be paid within 10 calendar days of the signing of the service contract to connect the consumer and the remaining part of the fee is paid within 10 calendar days of the completion of the contract work. Provision of the connection service begins when the vulnerable consumer has paid the first instalment of the connection service fee. The distribution system operator notifies the vulnerable customer of the completion of the works specified in the works contract and provide him with the necessary documents for payment in accordance with the procedure laid down in the connection service contract;
- in the event of failure by vulnerable customers to pay for the electricity supplied or to pay, in full or in part, for the electricity transmission service or other related services within the prescribed time limit, no default interest can be charged for 3 months from the date of expiry of the time limit.

The NEIS sets the objective of phasing out the regulation of electricity retail prices (ERK20). The aim is to make regulation of electricity retail prices through social tariffs and subject to certain requirements possible only in exceptional cases, thus protecting socially vulnerable electricity consumers and not exacerbating energy poverty in the country. With the liberalization of the market for non-household customers, they are under an obligation, while household consumers have the right, to choose an independent electricity supplier. It is planned that, subject to a political decision:

- As a first step, regulation of the final price of electricity will be eliminated as of 1 January 2021 in respect of household customers whose actual electricity consumption exceeds 5,000 kWh during the period from 1 June 2019 to 31 May 2020, as well as for all household customers whose facilities are connected to medium voltage grids, and to relevant communities and community organisations and associations This would not apply to vulnerable consumers, that is to say to those who receive social assistance.

- As a second step, final electricity price regulation would be eliminated as of 1 January 2022 in respect of all household customers with an actual electricity consumption of more than 1,000 kWh between 1 June 2020 and 31 May 2021, excluding vulnerable customers.

- As a third step, as of 1 January 2023, final electricity prices would no longer be regulated for all household customers and they would have to choose an independent electricity supplier.

The Law on Electricity of the Republic of Lithuania[90] stipulates that the electricity demand-side management service provider is the person responsible for ensuring that the actual maximum permitted power of a group of electricity consumers corresponds to the sum of maximum permitted powers set by those consumers and the transmission system or distribution system operator.

The DSO must ensure non-discriminatory conditions of access to distribution networks for electricity network users and electricity demand-side management service providers, taking into account the technical and electricity demand-side management capabilities.

In fixing the caps for transmission, distribution and public supply services and assessing the prices and tariffs submitted by the network operators, the NRA ensures that transmission and distribution system operators are granted appropriate incentives, over both the short and the long term, to increase electrical energy efficiency by enabling the introduction of smart grids, to ensure system security through the provision of systemic services to network users, to develop demand-side management and demand-side response services, as well as to foster the integration of the electricity market and security of supply and to support the related research activities. With a view to improve electrical energy efficiency, when setting the transmission and distribution service price caps and evaluating the prices and rates submitted by the service providers, the NRA assesses the decrease in the operating costs of transmission system and distribution system operators due to the demand, the introduction of demand-side response measures and the development of generation capacity, including savings from the provision of electricity transmission or distribution services or the reduced network investment costs and the optimal operation of the network

Regulation of the prices of electricity transmission, distribution and public supply services must be without prejudice to electricity demand-side management, demand-side response, development of electricity capacity and development of services, including:

- shifting electricity consumption by consumers from peak times, taking into account electricity production from renewable energy sources, electricity from cogeneration and the development of generation capacity;

- electricity savings through demand-side response and with the help of electricity demand-side management service providers;

- reducing electricity demand with the help of energy saving service providers;

- connection of power plants to networks of appropriate voltage;

[90] Lithuanian Law on Electricity: https://www.e-tar.lt/portal/lt/legalAct/TAR.F57794B7899F/mouDoNqiIt

- connection of power plants closer to the places of consumption;
- electricity storage.

The Single Baltic-Nordic balancing market is a balancing area coordinated by Baltic and Nordic countries in 2018. In order to develop a common Baltic reserve balancing market for manual activation frequency recovery and to harmonize electricity balancing principles in the Baltic States, the Baltic transmission system operators developed a common Baltic reserve balancing market for manual activation frequency recovery and a Baltic electricity imbalance accounting model (hereinafter referred to as 'the Model'). The single Baltic balancing market has been operational since January 2018. The barrier for entry into the Baltic balancing market has been reduced by lowering the minimum bid volume to 1 MW.

Agreement on the development of a regional gas market model in the Baltic States and a common entry/exit tariff regime. The Regional Gas Market Coordination Group (RGMCG) established in 2015 under the BEMIP initiative consists of representatives of ministries of Finland, Estonia, Latvia and Lithuania, national regulatory authorities, transmission system operators, LNG terminal operators and distribution system operators. The RGMCG's engagement in the development of the regional gas market plays an important role in pursuing the goals set by the BEMIP. Since January 2015, the RGMCG has achieved a number of short- and medium-term milestones in its work by improving the regional gas market in the eastern Baltic Sea.

A study on the development of the Finnish-Baltic regional gas market has been completed. The results of the study were taken into account in the follow-up actions by the RGMCG. These actions were included in the Action Plan for the creation of a regional gas market for the next 3–4 years. This Action Plan sets out the necessary measures to ensure the functioning of the regional gas market in the eastern Baltic Sea, namely:

- establishment of a common tariff area between Finland, Estonia and Latvia (FINESLAT) (from 2020);
- a common balancing zone of Estonia and Latvia (from 2020);
- planned accession of Lithuania to the common area.

3.5 Dimension Research, innovation and competitiveness

Section 2.5 of this Plan, entitled 'National objectives and targets', describes the strategy papers, targets and actions setting out guidelines for national policies to promote energy research and innovation: National Energy Independence Strategy, Smart Specialisation Programme, and actions implemented by the Ministry of Economy and Innovation. In assessing existing and /or planned policies and measures to promote energy and climate innovation, this section describes the options planned in the strategy papers and provided by the relevant funds.

Measures implementing the objectives under the National Energy Independence Strategy (NEIS)

In order to achieve the objectives of the NEIS adopted in June 2018, the Plan of implementing measures for NEIS adopted in December 2018 provides for the following energy research, experimental development and innovation measures:

Table 3.5.1. Policy measures in the research, innovation and competitiveness sector up to 2030 included in

the Plan of implementing measures for National Energy Independence Strategy

Measure	Scope and results/effect envisaged	Implementation deadline
The objective of the NEIS Implementation Plan is to ensure an advanced electricity market		
To develop and implement a common data storage and exchange platform	A common platform for data storage and exchange has been developed and implemented	2023
The objective of the NEIS Implementation Plan is to develop an intelligent and sustainable electricity system		
To deploy smart metering devices for electricity customers (subject to positive results of the cost-benefit analysis)	Percentage of installed electricity meters in the total number of consumers	2023
To install (modernize and expand) smart distribution networks of electricity	Approximately 200 upgraded transformer substations and distribution points	2027
To modernise and expand the electricity grid system through the deployment of advanced and innovative technologies	32 newly built or reconstructed transformer substations built and 350 km (inclusive) of built/reconstructed power lines	2023
The objective of the Plan of implementing measures for the NEIS is to implement LNG-related innovation in Lithuania		
To encourage the involvement of the engineering industry undertakings in the development and market integration of new LNG technologies, technological equipment and means of transportation	–	Continuous
The objective of the NEIS Plan of implementing measures is to promote the development and network integration of technologies, including RES, distributed energy and smart grids, by attracting investment in the production of these technologies in Lithuania		
TO analyse the potential for the production of wind energy technology components in Lithuania	A feasibility study on the production of wind energy technology components in Lithuania has been completed	2022
To attract to Lithuania an investor in electric vehicle batteries or other high value-added industrial investor and to create the preconditions/conditions for the establishment of a plant in Lithuania	–	2025
The objective of the Plan of implementing measures for NEIS is to promote research and development in the field of RES as well as technology export		

To promote research and development in the field of RES through financial assistance. Funds resulting from international agreements on statistical transfers will also be allocated for the implementation of this measure.	–	Continuous
The objective of the Plan of implementing measures for NEIS is to strengthen the Lithuanian energy research and innovation ecosystem		
To create a legal environment for testing innovative energy products and business solutions in a new regulatory sandbox for energy innovation	300 innovative energy products and business solutions tested in the regulatory sandbox for energy innovation	2030
Establishment of a facility providing low-value grants or start-up loans in the field of energy technology innovation (product manufacturing)	60 undertakings receiving support to start-ups	2022
To encourage innovation by regulated energy undertakings, by identifying sources of innovation funding in such activities	Share of revenue from regulated activities	0.1% in 2020 0.3% in 2022 0.5% in 2025
The total amount allocated to the measures covered by the Plan of implementing measures for NEIS for the period 2020 to 2022 is **EUR 774.679 million.**		

Measures to promote innovation in business and the public sector

The Ministry of Economy and Innovation encourages businesses and the public sector to contribute to energy efficiency improvement or climate change mitigation by developing and/or implementing innovations.

Table 3.5.2. Measures to promote innovation in business and the public sector

Measure	Scope and results/effect envisaged	Implementation deadline
'Eco-inovacijos LT'	To encourage SMEs to introduce non-technological eco-innovation, i.e. to introduce environmental management systems, perform production technology and/or environmental audits and apply ecodesign principles in product design	2018-2023

'Eco-inovacijos LT+'	To SMEs to introduce technological eco-innovation in order to reduce the negative consequences of climate change and greenhouse gas emissions	2018-2023
'Eksperimentas'	To promote RDI, develop and expand company RDI infrastructure, and promote certification of new products and technologies and related activities	2018-2023
'Intelektas'	To promote RDI, develop and expand company RDI infrastructure, and promote certification of new products and technologies and related activities	2018-2023
'Ikiprekybiniai pirkimai LT'	To stimulate demand for innovation in all areas of public administration. The share of public investment in innovative public procurement is projected to increase steadily up to at least 20% of each ministry's planned public investment in public procurement in 2027.	2018-2023
The total EU Structural Funds foreseen for these measures amount to **EUR 275.269 million.**		

Additional sources of funding (funds) for research and innovation for low-carbon technologies

Table 3.5.3. Sources of funding for research and innovation for low-carbon technologies

Title	Description	Implementation deadline	Total
Agreement with Luxembourg on the transfer of statistical quotas for renewable energy sources (RES)	Investments will be made in areas related to RES and improvement of energy efficiency. These funds will be allocated to the development of RES capacity in the field of electricity and for RES-related research	From 2020	EUR 1.5 m

The Energy Research Programme of the Nordic Energy Research (NER) platform of the Nordic Council of Ministers and the three Baltic States' ministries responsible for energy	Intra-Baltic and Baltic Nordic energy research projects are funded. Research topics currently identified include: (a) decarbonisation of transport; (b) energy performance in buildings and industry; (c) analysis of energy systems; (d) challenges and opportunities for regional electricity interconnections/market	2018-2022	EUR 2.3 m
Ignitis Group Smart Energy Venture Capital Fund	The Intelligent Energy Risk Capital Fund held by Contrarian Ventures invests in start-ups developing new energy technologies	From 2017	EUR 5-10 m

Measures to promote industrial competitiveness

Section 2.5 of this Plan describes the objectives formulated by the Ministry of Economy and Innovation to promote industrial competitiveness. The objectives are pursued by means of the measures listed in Table 3.5.4.

Table 3.5.4. Industrial competitiveness measures

Measure	Scope and results/effect envisaged
A national industry digitalisation platform for collective leadership 'Pramonė 4.0' has been developed	Key objectives of the platform: **(i)** to facilitate concerted cooperation between industry, business, academia and public authorities in order to increase the added value of the industrial sector, encourage the introduction of digital processes in industry, ensure the international competitiveness of Lithuanian industry and contribute to faster growth of the Lithuanian economy; **(ii)** to ensure that every company in Lithuania can take full advantage of the benefits of digital innovation by improving products, enhancing processes and adapting the existing business models to the needs of the digital age;
Guidelines and action plan for digitisation of Lithuanian industry in 2019–2030 have been developed.	The aim is to encourage the digitisation of industry. Deployment of digital technologies and processes by enterprises will optimise energy efficiency through resource use and waste volumes, thus contributing to national energy and climate targets.
A project has been prepared to implement the 'Plan for Transition to Circular Economy in Lithuania' in 2019–2020.	Within the framework of the European Commission's project on industrial transformation in the regions, the Ministry of Economy and Innovation aims to facilitate business investment in new zero-waste technologies, and stimulate widespread industrial modernisation by exploiting the opportunities offered by European programmes.

Corporate income tax relief (P5)	There are 3 corporate tax incentives for companies investing in RDI and 1 for companies investing in technological upgrading: - triple deduction of R&D expenditure; - accelerated depreciation of fixed assets used for R&D; - a reduced corporate income tax rate of 5% on profits from the commercialisation of R&D assets; - a reduction of the taxable profit by the full amount invested in technological upgrading. With a view to a more robust development of R&D activities, additional attention will be paid to simplifying administrative procedures for companies seeking a corporate tax incentive, as well as to raising awareness of the incentives.

Measures under the Smart Specialisation Programme

The total amount allocated by the State (including EU structural support) to the Smart Specialization Programme is EUR 679 million. In addition, R&D investments by private business is expected to reach about EUR 260 million.

20.7% of the entire budget of the Smart Specialization Programme (EUR 68 million) will go to the area of energy and environmental sustainability.

3.5.1. Measures under the Smart Specialisation Programme

Measure/priority	Scope and results/effect envisaged	Implementation deadline	Funds allocated (EUR million)
Energy and sustainable environment	Enhancing interoperability between distributed and centralised generation, networks and energy efficiency Meeting the needs of existing and new end-users, and strengthening energy efficiency and smartness; Development of the use of renewable biomass and solar energy sources and the recycling of waste for energy recovery	2014-2023	25.97

'Smart, clean, connected transport'	deployment of an intelligent transport system Deployment of technologies/models for the management of international transport corridors and for the integration of transport modes	2014–2023	14.55
'New production processes, materials and technologies'	Photonic and laser technologies Advanced materials and structures Flexible technologies for product development and production.	2014–2023	68.80

SET-Plan is a technological pillar of the EU energy and climate policies

Lithuania has not been an active participant in the SET-Plan since 2014, however, taking into account the orientations defined in the National Energy Independence Strategy and the Smart Specialisation Programme, the following actions/themes would be the most relevant for Lithuania in the scope of the SET-Plan:

Action 1: existing renewable technologies integrated into the system;

Action 3: new technologies and services for consumers;

Action 4: resilience and security of the energy system;

Action 6: energy efficiency for industry;

Action 8: renewable fuels.

The most active energy research institution in Lithuania, which is also a member of the SET-Plan, is the Lithuanian Energy Institute (LEI). The Lithuanian Energy Institute is a technical research centre dedicated to research in the areas of security of energy supply analysis, development of energy planning methods, fuel cells and hydrogen, renewable energy sources, thermal physics and fluid mechanics, nuclear safety, assessment of structural integrity of components and structures and simulation of complex energy systems.

The LEI participates in the SET-Plan Action (theme) 10: 'Maintaining a high level of safety of nuclear reactors and associated fuel cycles during operation and decommissioning, while improving their efficiency', also in the joint research programme for Energy System Integration of the European Energy Research Alliance (EERA) established at the initiative of the SET-Plan, thereby cooperating with authorities in other countries within the scope of the said initiatives.

In addition, the Institute has extensive experience in international projects, including work for the IAEA, Horizon 2020, FP5, FP6, FP7, Phare, Intelligent Energy Europe, COST, Eureka, Leonardo da Vinci, INTERREG III, the Baltic Sea Region Programme , South Baltic Cross-border Co-operation Programme and the Nordic Energy Research Programme.

KEY:
SECTION B: ANALYTICAL BASIS

B SKIRSNIS: ANALITINIS PAGRINDAS

4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES[91][92]

[91] 'Current situation' means a situation as described based on the data of the day of submission of the national plan (or the latest available data). Existing policies and measures include the policies and measures being implemented and adopted. 'Policies and measures adopted' means the policies and measures on which an official Government decision was adopted prior to the date of submission of the National Plan and a clear commitment has been made to implement them. 'Policies and measures being implemented' means policies and measures which, at the date of submission of the national plan or progress report, fulfil one or more of the following conditions: directly applicable European Union legislation or national legislation is in force, one or more voluntary agreements have been concluded, and financial and human resources have been allocated.

[92] The choice of external factors may be based on the 2016 assumptions made in the EU reference scenario or in other subsequent policy scenarios for the same variables. In addition, when developing national forecasts under the current policy and the impact assessment, a useful source of information can be the performance of individual Member States presented in the 2016 EU baseline scenario and subsequent policy scenarios.

4.1 The projected evolution of the main external influences on the energy system and GHG emissions

Macroeconomic factors

In recent years (2012–2016), the GDP grew moderately and reached an average of 3%, with stronger economic growth recorded in 2017. Compared to 2016, real GDP change was 3.9% of GDP. The GDP changes were driven mainly by the growth in the value added in the services sector and industry between 2015 and 2017. In 2005-2016, Lithuania achieved rapid economic growth and a reduction in GHG emissions. Between 1990 and 2017, GDP grew by 45% and GHG emissions fell by 58%.

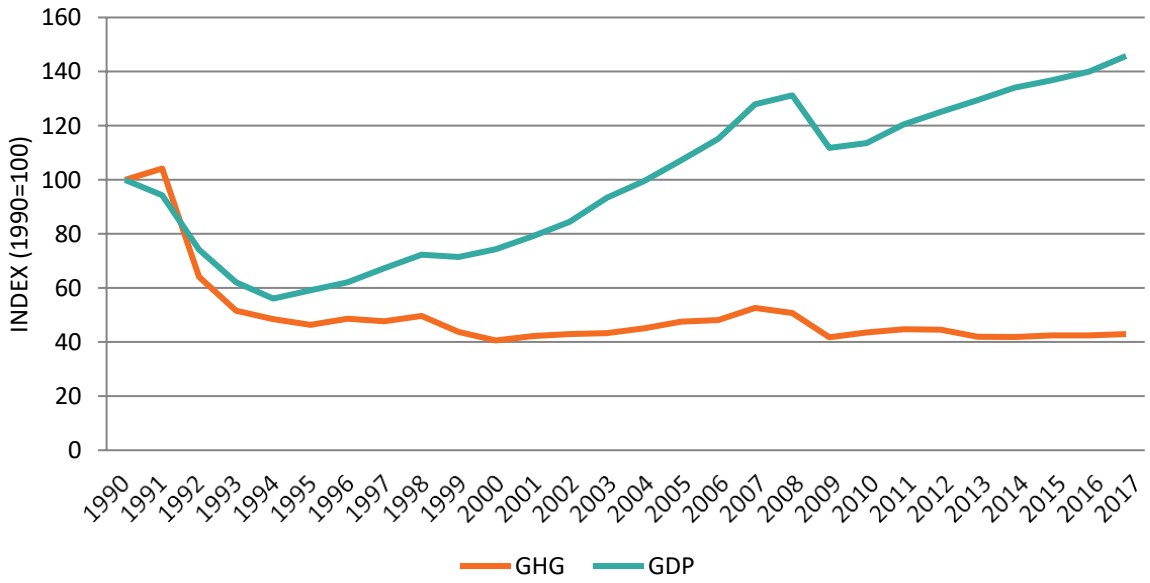


Fig. 4.1.1. GDP and GHG emission indicators for Lithuania, 1990–2017

According to the forecasts of the Ministry of Finance of the Republic of Lithuania, taking into account the changed external environment, Lithuania's GDP is projected to grow at an average annual rate of 2.4% in 2019–2022. This is about 0.8 percentage points above the EU average. GDP is expected to grow by 2.6% in 2019, which is 0.2 percentage points below the estimates made in the autumn of 2018. GDP is expected to grow by 2.4% in 2020, 2.3% in 2021 and 2.3% in 2022.

When the Plan was being devised, the GDP forecast for Lithuania presented by the European Commission and contained in the BENTE (Baltic Energy Technology) study 'Baltic Energy Technology Scenarios 2018', prepared by the Nordic Council of Ministers in 2018[93], was analysed. Taking into account the average GDP growth of 2.4% in 2019-2022, projected by the Ministry of Finance of the Republic of Lithuania, a decision was taken to rely on the GDP projection provided in the BENTE study on account of it being more consistent with the GDP projections of the Ministry of Finance of the Republic of Lithuania for 2019-2022.

[93] http://norden.diva-portal.org/smash/get/diva2:1195548/FULLTEXT01.pdf

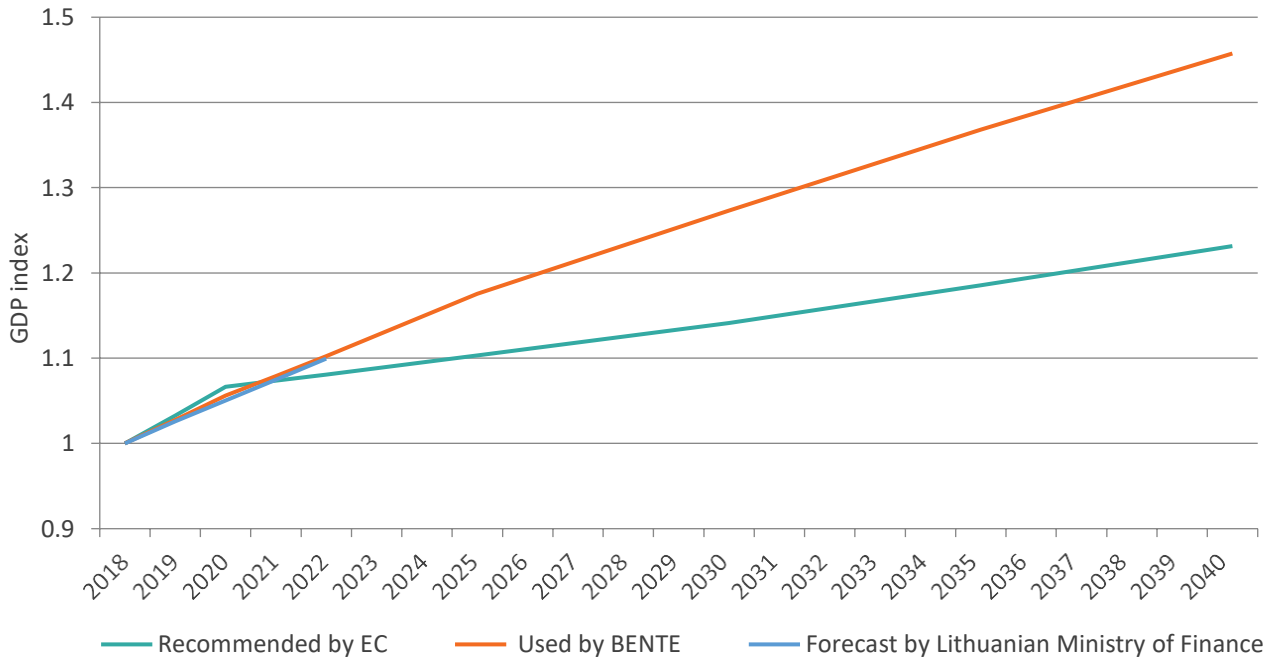


Fig. 4.1.2. GDP forecast for 2018-2040

Domestic demand will continue to be a key driver of the Lithuanian economy. It will be stimulated by Government decisions relating to increasing personal incomes and incentives to invest and the implementation of foreign direct investment and investment projects financed with EU financial support.

From 1992, when Lithuania reached its maximum population of 3,706,000, this indicator decreased by 23% (1.28% on average each year) until 2017. On 1 January 2017, the population totalled 2,848,000. Over 25 years, Lithuania had lost 859,000 residents. Lithuania's overall demographic situation is exacerbated by high emigration, low birth rates and high mortality rates. As a result, the population is declining, the share of children and working-age people in the overall population age structure is decreasing, and the proportion of elderly dependants is increasing. During the period 2018–2040, trends in population decline and population ageing will continue to be monitored in Lithuania.

Lithuania's permanent population is projected to decline, but not as drastically as projected the United Nations' forecasts this year. The projections for the Lithuanian population were based on rather pessimistic assumptions about migration, as they are based on particularly unfavourable developments in the past.

According to Statistics Lithuania, Lithuania had 2 794 000 permanent residents on 1 January 2019. The permanent population decreased by 14,900 (0.5%) in 2018 and by 39,000 (1.4%) in 2017. The main part (78%) of the population decline in 2018 owed to the negative natural population change.

In view of the current situation and considering that emigration is gradually slowing down, the population decline is expected to be more moderate than projected by the European Commission.
It is estimated that Lithuania's permanent population will be 2,789,000 in 2020, 2,727,000 in 2030 and 2,675,000 in 2040.

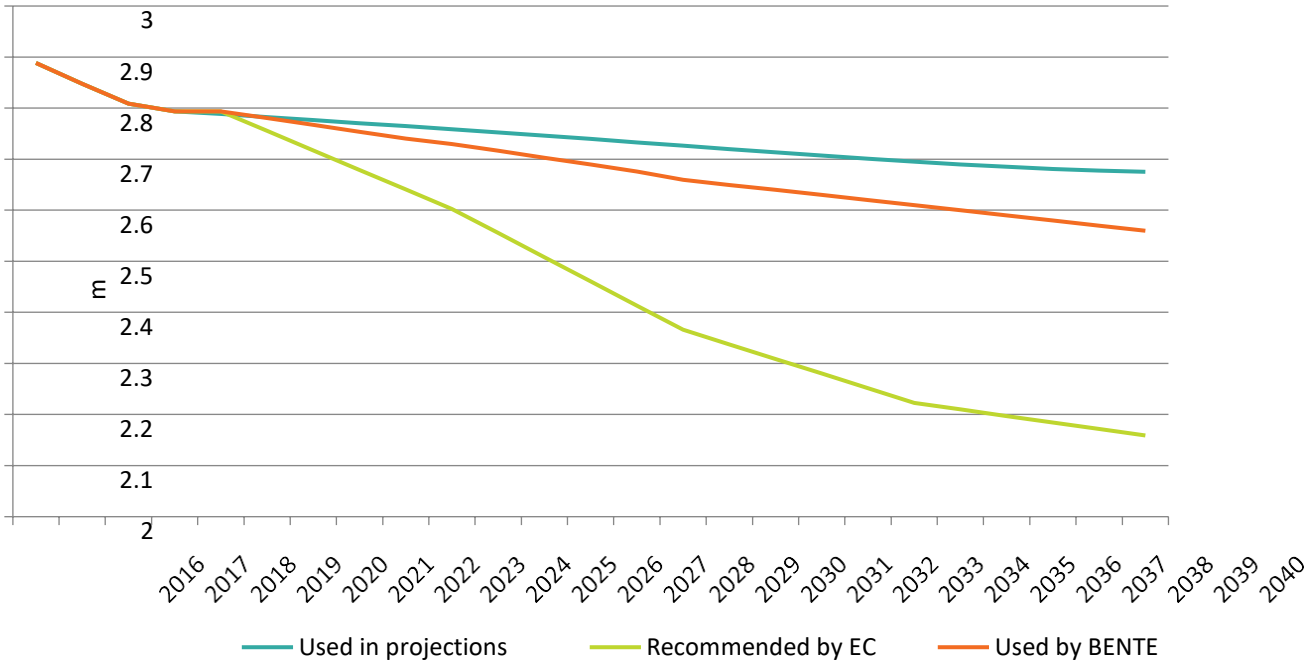


Fig. 4.1.2 Population change in 2016–2019 and projections for 2020–2040

Developments in sectors and technologies

Technology will play a central role in achieving Lithuania's energy policy goals. Lithuania's main objectives in the development of new energy technologies are to reduce existing RES costs and establish better conditions for efficient use of energy, so that Lithuanian industry remains innovative and competitive. Their implementation requires accelerated development of RES, such as biofuel production technologies, wind and solar energy, as well as carbon capture and storage technologies. All this should be achieved together with a better use of energy in conversion processes, buildings, industry and transport. In view of the impact of existing policies on the energy sector until 2040, measures to improve energy efficiency (EE) and promote RES are planned, with the biggest changes anticipated in the energy production and transport sectors.

Energy sector

Existing policy measures will lead to very rapid penetration of RES technologies in the energy sector. In addition to accelerating the development of conventional RES technologies through energy production support schemes, the use of RES enabled energy consumers to become prosumers in 2015. At present, there are almost 3,000 such prosumers in Lithuania with a total installed capacity of almost 23 MW .

Transport sector

In the transport sector, the existing policies and measures will be continued, aiming at a 10% share of biofuels blended in mineral fuels in 2020 (up from 4.33% in 2018), a reduction in excise duties on biofuels, a reduced fee for the connection of biogas production facilities to gas systems, and guarantees of origin for gases produced from RES. These measures will not have a tangible impact on the reduction of energy consumption, but will contribute to the reduction of greenhouse gas emissions. Without additional policy measures, energy consumption in transport would remain virtually unchanged in 2040 and the renewal of the old and polluting Lithuanian passenger car fleet would take time. In the heavy transport subsector, liquefied and compressed natural gas are seen as an alternative to fuel. In the rail and bus subsectors, intelligent solutions are being implemented and partial electrification is planned.

The world is developing autonomous vehicle technologies in the sphere of electric transport, countries are adapting their legal frameworks, creating safety requirements, investing in these technologies and regulating testing. The implementation of sustainable mobility measures is slowing down the growth of passenger cars and reducing their use. Municipal efforts to change urban driving habits (reducing the number of private car trips or replacing them with sustainable mobility solutions) also encourage the choice of trains or buses for interurban trips.

Agricultural sector

Technological progress on Lithuanian farms is not significant, but there are opportunities to apply technologies developed and proven in other countries, such as organic or other environmentally sustainable production; to reduce the use of mineral fertilisers in crop production; to replace fertilisers with other products developed according to new technologies and safer for the environment; to change animal feed rations; to improve the genetics of existing dairy cattle using ECOFEED cattle; to use more advanced techniques and equipment and to apply advanced technologies for manure storage and management, etc.

Industry sector

Existing policy measures in the industrial sector are designed to encourage a shift from fossil fuel use to RES use and energy efficiency improvement. This presents a possibility for energy-intensive businesses to benefit from reduced payments for services in the public interest in the electricity sector related to the production of electricity from renewable energy sources, while undertaking to perform energy audits and to implement some of the recommendations resulting from the audit and the programme to promote energy audits in industrial enterprises. In order to successfully expand and compete on both the domestic and international markets, industrial companies are themselves, without additional incentives, introducing measures to increase EE with a payback period of up to 3 years. The promotion of technological progress in the industrial sector takes place through measures to promote the digitisation of production processes, such as robotics, artificial intelligence solutions, deployment of Internet of Things systems, etc. The industrial F-Gas sub-sector in the EU already has a variety of efficient GHG abatement technologies in commercial refrigeration and air conditioning. The use of these technologies is expected to continue to further reduce the negative environmental impacts of the sub-sector.

Waste management sector

Existing policy measures in the waste management sector are designed for the reduction of landfilling of municipal waste and for waste recycling. New landfills for solid waste disposal, compliant with EU environmental requirements, and mechanical and biological treatment facilities for biodegradable waste have been established, waste-water treatment projects are in progress and waste incineration capacities are being developed. Landfill gas is used for power generation or other purposes.

Household sector

Existing policy measures focus on three main factors affecting energy efficiency in households: buildings, technological equipment and appliances, and consumer behaviour. Under the Programme for the renovation/modernisation of multi-apartment buildings launched in 2005, 2,941 multi-apartment buildings were renovated up to 2018, leading to estimated energy savings of 857 GWh. A renovated multi-apartment building must achieve at least the energy efficiency class C and, at the same time, reduce its energy demand by 40%, and the technological equipment installed must ensure that the required indoor climatic conditions are maintained. As the implementation of the measure continues, the long-term estimate is that at least

500 multi-apartment buildings will be renovated each year.

Reducing energy consumption is strongly influenced by the widespread use of RES technologies in households, in particular heat pumps.

2017 saw a huge leap in the sales of heat pumps. The number of heat pumps sold increased 5.7 times compared to 2016[94].

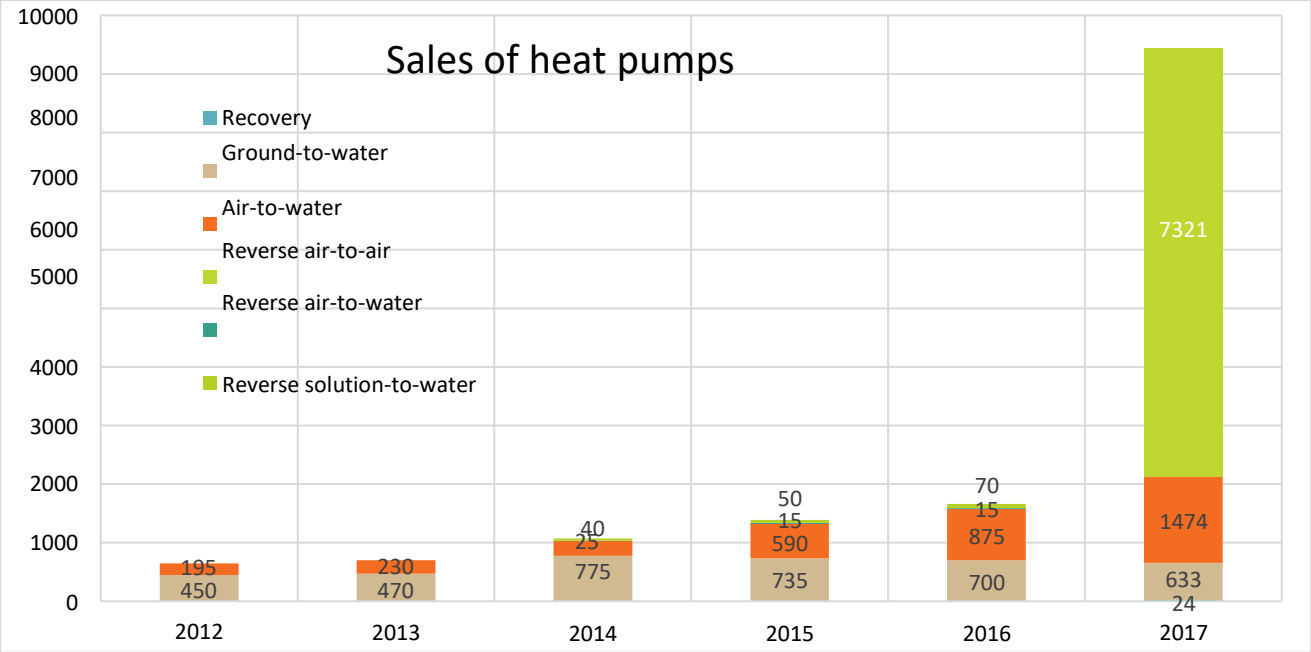


Fig. 4.1.3. Heat pump sales in Lithuania

In view of the continuous progress of energy production technologies and its impact on EE, especially in the household sector, and taking into account the average lifetime of equipment, an assumption is made that the technologies and equipment used are updated every 12 years on average. For this reason, the EE index, reflecting the technological progress of all appliances, is used to calculate the energy consumption of different types of heating and /or cooling equipment, other techniques or household appliances. This is particularly relevant in view of the improving situation in the areas of space heating, hot water preparation, lighting and food storage and preparation.

Services sector

In the services sector, there are two current policy instruments: Agreements with energy suppliers on consumer education and consulting, and Agreements with energy companies on energy saving. The first measure is aimed at changing consumer behaviour. It requires energy suppliers and energy companies to educate and advise energy consumers on ways and means of reducing energy consumption. The measure is expected to generate annual savings of around 300 GWh. The second measure requires energy companies to introduce EE measures for end-users, thereby reducing energy consumption. The measures put in place are expected to save 100 GWh annually. These measures apply as from 2017. The most popular consumer education and consulting measures used by energy suppliers include consulting online and in the press as well as information contained in the bills. Energy companies generally use a smart metering tool for electricity, heat or natural gas.

[94] Based on the date of the European Heat Pump Market and Statistics Report 2018.

Trends in the global energy market

The global climate and energy trends reflect visible changes in energy production and consumption. Achieving the long-term objectives of the Paris Agreement commits States to contribute to reducing greenhouse gas emissions by providing a vision for the development of non-greenhouse gas energy production in their national strategies. Lithuania attaches great importance to energy security, integration and digitisation of energy markets, the diversification of energy sources and production, development of a smart grid, expansion of EE and promotion of RES.

The price of EU ETS allowances is influenced by the overall EU ETS quota. The steadily decreasing number of allowances, combined with the entry into force of the Market Stability Reserve, is estimated by different sources[95] to increase the price of allowances to a peak in 2024 (up to EUR 40/allowance) in the short and medium term. This will be mainly influenced by the Market Stability Reserve[96], which has been operational since January 2019. It addresses in the long term the historical surplus accumulated during the first phases of the EU ETS, as well as the resilience of the EU ETS to new sources of supply and demand imbalances.

In the longer term, the price is projected to fall to EUR 27 by 2028, which may be driven by solutions for energy efficiency, renewables or best available production methods. At the end of the fourth round of EU ETS trading, as part of the system review and in the run-up to the fifth round, the estimated price range is between EUR 15 and EUR 35. This will be influenced by the declining supply of allowances due to the application of the linear reduction factor, which significantly lowers the price cap over time, as well as by global fuel price trends with the decoupling of oil and gas prices and the relative stability of gas prices over the longer term.

The EU ETS is a cornerstone of the EU climate policy and a key instrument for cost-effective GHG reductions. Implemented in periods since 2005, the ETS has shown that carbon pricing and emissions trading are effective measures. Emissions in the system are decreasing as expected, by just over 8% compared to the start of phase 3 (2013–2020). The price of allowances currently fluctuates around EUR 25 per tonne of carbon dioxide equivalent (t CO_2 eq). A 21% reduction is planned in 2020 (compared to 2005).), and by 2030 the ETS review will result in an additional 43% reduction. This will force companies in sectors covered by the ETS to take additional steps to reduce their GHG emissions.

Against this background, and taking into account Lithuania's objectives for EE improvement and RES promotion, as well as the existing and planned measures to achieve them, Lithuania can be expected to successfully meet the 2030 targets. No further analysis of the factors was carried out and the assumptions made were based on the current situation and the evaluations of past trends.

Changes in technology prices

In many countries around the world, RES technologies are the cheapest option for introducing new energy generation technologies. This option will become even more attractive as the cost of solar and wind energy technologies continues to fall. The prices of biofuels, hydropower, geothermal, solar and offshore wind are now at the same level as fossil fuel prices in the period 2010–2018. Since 2014, the global weighted average price of solar electricity has reached the level of fossil fuel electricity prices.

In 2020, onshore wind and solar photovoltaic plants will, without financial support, be cheaper electricity

[95] https://www.i4ce.org/wp-core/wp-content/uploads/2019/05/2019-State-of-the-EU-ETS-Report.pdf
[96] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2015.264.01.0001.01.ENG

generation technologies than the cheapest fossil fuel technologies. Among the electricity generation projects to be developed in 2020, 77% of the capacity of onshore wind and 83% of the capacity of municipal solar photovoltaic power plants will be at prices below those of the cheapest new fossil fuel power plants in auctions and Power Purchase Agreements (PPAs) of the Member States of the International Renewable Energy Agency (IRENA).

In 2018, the global weighted average electricity prices of all commercial generating capacity of RES fell. The cost of electricity in concentrated solar power plants decreased by 26%, in biofuel plants by 14%, in solar photovoltaic and onshore wind power plants by 13%, in hydropower plants by 11%, and in geothermal and offshore wind power plants by 1%.[97] Installations for the production of biofuels, solar photovoltaic and offshore wind turbines for personal use are already cheaper than fossil fuels without additional funding.

An analysis of electricity auctions and power purchase contracts carried out by IRENA in 2018 showed that the global weighted average price of electricity for onshore wind could fall to EUR 0.045/kWh and for solar photovoltaic plants to EUR 0.051/kWh. Calculations carried out a year later showed that the price of electricity of onshore wind farms could fall by a further 8% to EUR 0.041/kWh and that of solar photovoltaic plants by a further 13% to EUR 0.044/kWh.

The global weighted average LCOE for electricity generated by onshore wind plants in 2018, EUR 0.051/kWh, was 13% lower than in 2017 and 35% lower than in 2010, when it was EUR 0,077/kWh. The electricity price of onshore wind power plants is now at a lower level than the price of fossil fuel electricity.

The continued significant decline in the global weighted average LCOE for electricity produced by industrial solar photovoltaic plants continued in 2018. It has fallen by 77% since 2010.

The installed capacity of offshore wind power plants was 4.5 GW in 2018. They were all almost exclusively located in Europe and China. The global weighted average LCOE for electricity generated by offshore wind plants in 2018 was EUR 0.115/kWh, 1% lower than in 2017 and as much as 20% lower than in 2010.

The electricity produced by biofuel plants can be competitive in places where waste from agricultural, forestry or wood processing processes can be used as fuel. In 2018, about 5.7 GW of new electricity generation capacity from biofuels was installed, with a global weighted average LCOE of 0.056 - 14% lower than in 2017.

In setting Lithuania's EE and RES objectives, technological price developments have been taken into account and optimal measures in economic and technological terms have been chosen. Modelling and forecasting for the period 2020–2040 did not involve further analysis of the impact of technology prices. These factors are only taken into account when assessing the availability of individual technologies, the planned budget of EE enhancement or RES promotion policies and average market prices.

[97] IRENA (2019), Renewable Power Generation Costs in 2018, International Renewable Energy Agency, Abu Dhabi

4.2 Dimension Decarbonisation

4.2.1 GHG emissions and removals

Lithuanian GHG emissions (excluding LULUCF) amounted to 20,706 kt CO_2 eq in 2017. GHG emissions decreased by 57% in 2017 compared to 1990 and by 9.8% compared to 2005, excluding LULUCF. Table 4.2.1.1 shows the evolution of GHG emissions over the period 1990–2017.

Table 4.2.1.1. GHG emissions in 1990–2017

Greenhouse gas emissions	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**
	kt CO_2 eq							
CO_2 emissions excluding CO_2 from LULUCF	35810	15053	11880	14192	13964	13335	13368	13628
CO2 emissions including CO2 from the NAME	30613	10972	3181	10328	4815	9288	7158	8142
CH_4 emissions excluding CH_4 from LULUCF	7006	4435	3861	3910	3685	3426	3335	3285
CH4 emissions including CH4 from the LULUCF	7009	4439	3865	3911	3687	3427	3336	3285
N_2O emissions excluding N_2O from LULUCF	5425	2906	3840	4773	3095	3145	3070	3074
N_2O emissions including N_2O from the LULUCF	5557	3046	3974	4909	3260	3310	3247	3263
HFCs	N/A	6	22	89	258	568	732	711
PFCs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Unspecified mix of HFCs and PFCs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SF_6	N/A	0	1	2	6	5	5	8
NF_3	N/A	N/A	N/A	N/A	N/A	0.26	0.20	0.01
Total GHG emissions (excluding LULUCF)	48 242	22 401	19 603	22 966	21 009	20 479	20 510	20 706
Total GHG emissions (including LULUCF)	43 180	18 463	11 042	19 238	12 025	16 599	14 478	15 409
Greenhouse gas emissions by category	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**
	kt CO_2 eq							
1. Energy (excluding indirect CO_2)	33 150	14 118	10 911	13 164	13 153	11 288	11 630	11 599
2. Industrial processes and product use	4482	2223	3075	4108	2237	3510	3344	3638
3. Agriculture	9040	4491	4079	4207	4275	4600	4479	4403
4. Land use, land use change and forestry	-5062	-3938	-8561	-3728	-8983	-3880	-6032	-5296
5. Waste	1570	1570	1538	1487	1344	1080	1058	1065

Greenhouse gas emissions in ETS and non-ETS sectors	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**
	kt CO_2 eq							
EU ETS (from stationary installations)	NA	NA	NA	10044	7979	6845	6160	6283
EU ETS (from domestic aviation)	NA	NA	NA	2	2	2	1	1
EU ETS (total GHG emissions)	NA	NA	NA	10046	7981	6847	6161	6285
Non-ETS, excluding LULUCF	48 242	22 401	19 603	12920	13028	13 632	14 349	14 421
Greenhouse gas emissions in individual energy subcategories	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**	**2017**
	kt CO_2 eq							
1. Energy	33 150	14 118	10 911	13 164	13 153	11 288	11 630	11 599
A. Fuel combustion	32 861	13 833	10 607	12 788	12 655	10 787	11 074	11 074
1. Energy production	13 553	6374	5056	5656	5330	3155	2956	2573
2. Industry and construction	6165	1760	1091	1492	1291	1187	1161	1185
3. Transport	5843	3137	3216	4230	4445	5142	5527	5795
4. Other sectors	7300	2561	1240	1397	1573	1266	1406	1495
5. Military aviation	0.36	0.87	3.50	12	16	36	25	26
B. Unintended fuel releases	289	285	304	377	497	502	555	525
1. Solid fuels	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. Oil and natural gas and other GHG emissions from energy production	289	285	304	377	497	502	555	525

After a significant recession in 1992, triggered by the collapse of the Soviet economy, a transition from a centralised planned economy to market economy by restructuring manufacturing, energy industries and agriculture took place. In 1990, after regaining independence from the Soviet Union after 50 years of annexation, Lithuania inherited an energy-intensive economy. The resource blockade carried out by the USSR in 1991-1993 led to a sharp decline in economic activity, as evidenced by the fall in GDP in the early 1990s. The economic situation improved in the mid-1990s and the GDP grew until 1999, before it slumped again in 1999-2000 due to the Russian economic crisis. The growth resumed in 2001 and continued until 2008.

In the early 1990s, the manufacturing, energy and agriculture mainly relied on fossil fuels. A comparison of the annual aggregate fuel balances for the period 1990–2017 shows a significant decrease in the final consumption of heavy fuel oil (e.g. from an annual level of around 57,800 TJ in 1990–1991 to around 17,200 TJ in 1993–1994, less than 600 TJ in 2008 and less than 500 TJ from 2015), as well as a decrease in the use of coal, petrol and natural gas, but a higher consumption of wood. The reduction in the use of heavy fuel oil was primarily a result of environmental requirements: the use of heavy fuel oil containing sulphur was banned from 1 January 2004 and even stricter requirements entered into force from 2008. As it was not economically viable for companies to remove sulphur from heavy fuel oil, these requirements led to a shift from heavy fuel oil to other fuels (e.g. natural gas) resulting in a significant reduction of annual emissions of

GHGs.

The last significant decrease in 2009 was due to the economic crisis in Europe, and after 2009 GHG emissions stabilised at around 20 Mt CO_2 eq.

Total GHG emissions increased by 1.1% in 2017 compared to 2016 (excluding LULUCF).

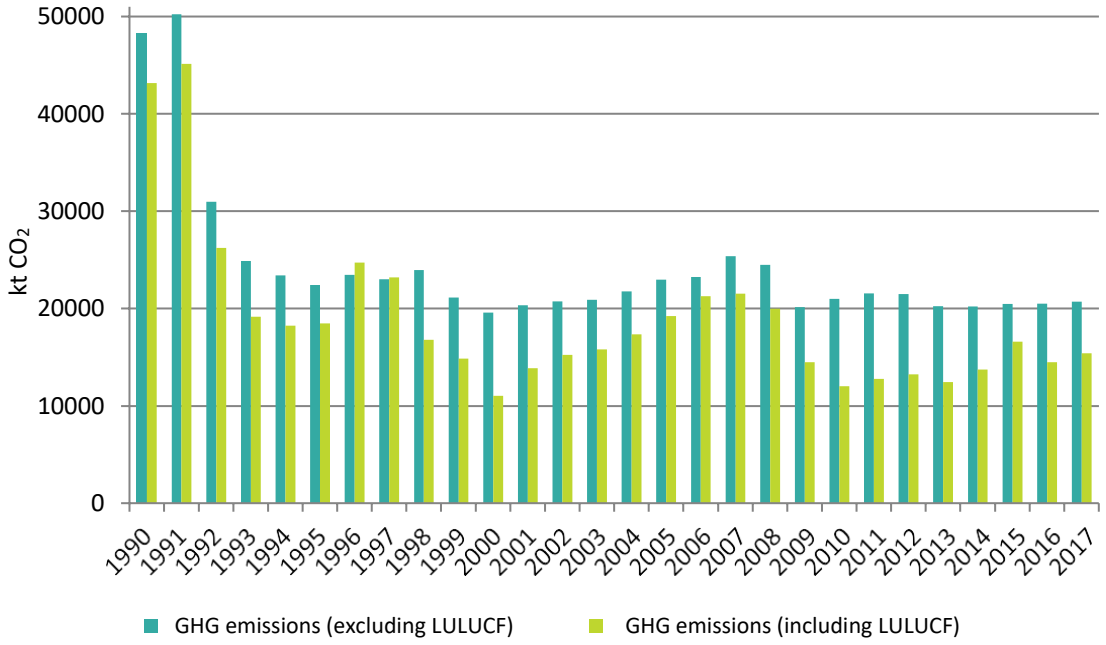


Fig. 4.2.1.1. GHG emission trends in 1990–2017

The energy sector is the largest contributor to GHG emissions, accounting for 55.5% of total GHG emissions in 2017. The energy sector accounted for the largest shares of CO_2 (80% of total CO_2 emissions) and CH_4 (15.5% of total CH_4 emissions) and a small amounts of N_2O (5.8% of total N_2O emissions).

The second sector in terms of GHG emissions is agriculture, which accounted for 21.3% of total GHG emissions. In 2017, the agricultural sector accounted for the largest share of N_2O (84.4% of total N_2O) and CH_4 (54.1% of total CH_4) as well a small amount of CO_2 (0.22% of total CO_2).

The industrial processes and industrial products sector accounted for 17.6% of total GHG emissions, of which CO_2 accounted for 19.7% of total CO_2 emissions and N_2O for 7.6% of total N_2O emissions. One of the main sources of GHG emissions in the industrial processes and products sector is the use of fluorinated GHGs, which accounted for 19.8% of total industrial GHG emissions in 2017.

The waste sector accounted for 5.1% of total GHG emissions in 2017. This sector accounted for the largest share of CH_4 (30.4% of total CH_4 emissions) and a small amount of N_2O (2.1% of total N_2O emissions).

Figure 4.2.1.2 shows the distribution of GHG emissions by sector in 2017.

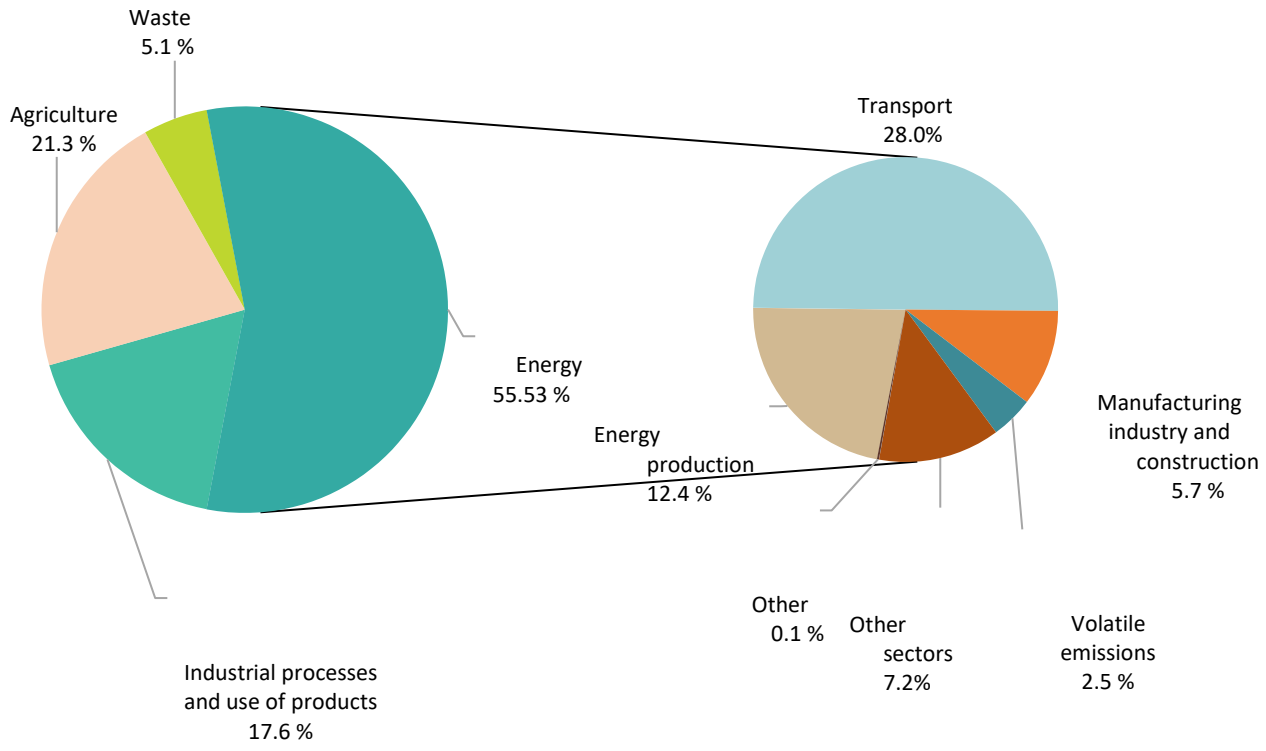


Fig. 4.2.1.2. Breakdown of Lithuania's GHG emissions by sector (excl. LULUCF) in 2017

In Lithuania, non-EU ETS sectors account for a larger share of GHG emissions than EU ETS sectors do. Between 2005 and 2017, this share increased from 56% to 70% of total GHG emissions (Figure 4.2.1.3).

In 2017, GHG emissions from sectors participating in the EU ETS amounted to 6,283 kt CO_2 eq, or 30% of total GHG emissions, and GHG emissions in non-ETS sectors totalled 14,421 kt CO_2 eq , or 70% of national GHG emissions. In 2017, GHG emissions in ETS sectors decreased by 37% compared to 2005, and GHG emissions in non-ETS sectors exceeded the GHG quota by 0.1%. It should be noted that as from 2013 the chemical industry, with 3.4 million tonnes of CO_2 eq in non-ETS sectors, has been classified as an ETS sector and therefore the change in GHG emissions in non-ETS sectors is considered positive (increased), although it is negative (decreased) based on actual data.

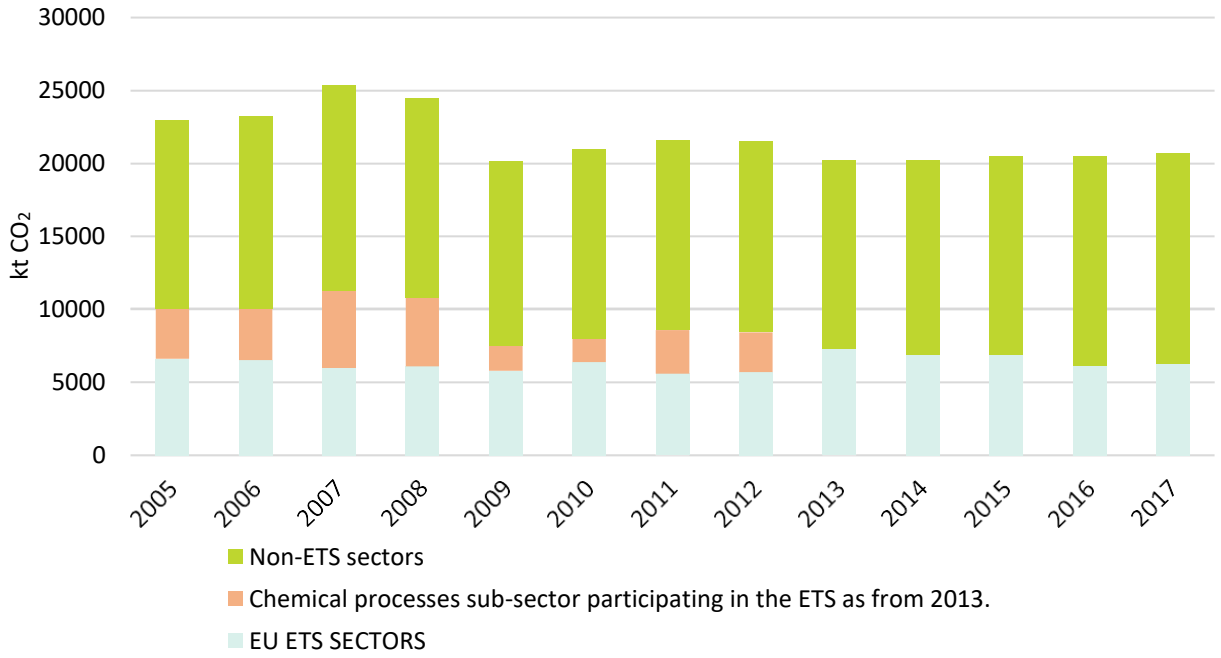


Fig. 4.2.1.3. Trends in total GHG emissions in 2005–2017, divided based on ETS sectors and non-ETS sectors

Projections of sectoral developments under existing policy instruments

GHG emission projections for the energy sector were made using the LEAP model. GHG emissions in non-energy sectors were projected on the basis of projections of operational data for the sectors concerned. Table 4.2.1.2 shows the projected GHG emissions for the period 2020 to 2040.

Table 4.2.1.2. GHG emissions in 2005 and 2017 and projected GHG emissions in 2020-2040 (with existing policies and measures)

Greenhouse gas emissions	2005	2017	2020	2025	2030	2035	2040
	kt CO_2 eq						
CO_2 emissions excluding CO_2 from LULUCF	14192	13628	14253	13940	13649	13451	13318
CO_2 emissions excluding CO_2 from LULUCF	10328	8142	12366	13635	14828	15954	16869
CH_4 emissions excluding CH_4 from LULUCF	3910	3285	3041	2792	2596	2501	2422
CH_4 emissions including CH_4 from LULUCF	3911	3285	3041	2792	2596	2501	2422
N_2O emissions excluding N_2O from LULUCF	4773	3074	3155	3173	3180	3199	3218
N_2O emissions including N_2O from LULUCF	4909	3263	3324	3342	3349	3368	3387
HFCs	89	711	569	354	201	133	92
PFCs	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Unspecified mix of HFCs and PFCs	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SF_6	1.7	8	8	8	8	8	8
NF_3	N/A	0.01	0.1	0.1	0.1	0.1	0.1

Total GHG quantity (excluding LULUCF)	22966	20706	21026	20266	19634	19292	19059
Total GHG quantity (including LULUCF)	19238	15409	19308	20131	20982	21964	22779
Greenhouse gas emissions by category	**2005**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
	kt CO_2 eq						
1. Energy (except the transport sector)	8934	5778	5646	5181	5020	5012	4989
2. Transport	4230	5821	6194	6325	6186	5982	5861
3. Industrial processes and product use	4108	3638	3929	3710	3557	3489	3447
4. Agriculture	4207	4403	4399	4364	4303	4346	4379
5. Land use, land use change and forestry	-3728	-5296	-4663	-3877	-3329	-3042	-2772
6. Waste	1487	1065	857	686	567	463	382
Greenhouse gas emissions in ETS and non-ETS sectors	**2005**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
	kt CO_2 eq						
EU ETS (from stationary installations)	10044	6290	6687	6289	6153	6126	6100
EU ETS (from domestic aviation)	2	1	1.9	2	2	2.1	2.2
EU ETS (total GHG emissions)	10046	6291	6689	6291	6155	6128	6102
Non-ETS, excluding LULUCF	12920	14595	14551	14167	13650	13303	13075
Greenhouse gas emissions from the LULUCF sector under EU Regulation 2018/841 UNFCCC			**2021–2025**		**2026–2040**		
	kt CO_2 eq						
GHG emission inventoried in LULUCF (credits if negative): EU/LULUCF (2021-2030)	N/A	N/A	-31135		-26258		
Greenhouse gas emissions in individual energy subcategories	**2005**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
	kt CO_2 eq						
1. Energy	13164	11599	11840	11506	11206	10994	10851
A. Fuel combustion	12788	11074	11310	10996	10703	10491	10348
1. Energy production	5656	2573	2355	1987	1898	1906	1902
2. Industry and construction	1492	1185	1187	1230	1190	1136	1136

3. Transport	4230	5795	5142	6168	6299	6160	5957
4. Other sectors	1397	1495	1531	1494	1483	1466	1449
5. Military aviation	12	26	26	26	26	26	26
B. Unintended fuel releases	377	525	530	510	503	503	502
1. Solid fuels	N/A	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other GHG emissions from energy production	377	525	530	510	503	503	502

The analysis of the GHG projections showed that CO_2 emissions from the transport sector will increase until 2023 as the sector is developing rapidly. Subsequently, due to expected improvements in vehicle efficiency, sustainable urban mobility plans and changes in the use of vehicles, GHG emissions in the transport sector are projected to decrease. The road transport sector accounts for 95% of total GHG emissions from transport, 80% of which is accounted for by passenger cars. GHG emissions in the industrial sector result technological processes where substantial reductions in GHG emissions from production are hardly possible. Therefore, reductions in industrial GHG emissions are expected to result mainly from the reductions in fluorinated greenhouse gas emissions due to the implementation of Regulation (EU) No 517/2014. The dynamics of GHG emissions in the agricultural sector depend on the quantities of mineral and organic nitrogen fertilisers used, the number of farm animals, crop yields and crop areas. No changes are projected in the distribution of GHG in the agricultural sector up to 2030. Agricultural soils will account for 56% and intestinal fermentation for 32% of total agricultural GHG emissions. The waste sector is expected to reduce GHG emissions as a result of an improved waste management system and increasing public awareness.

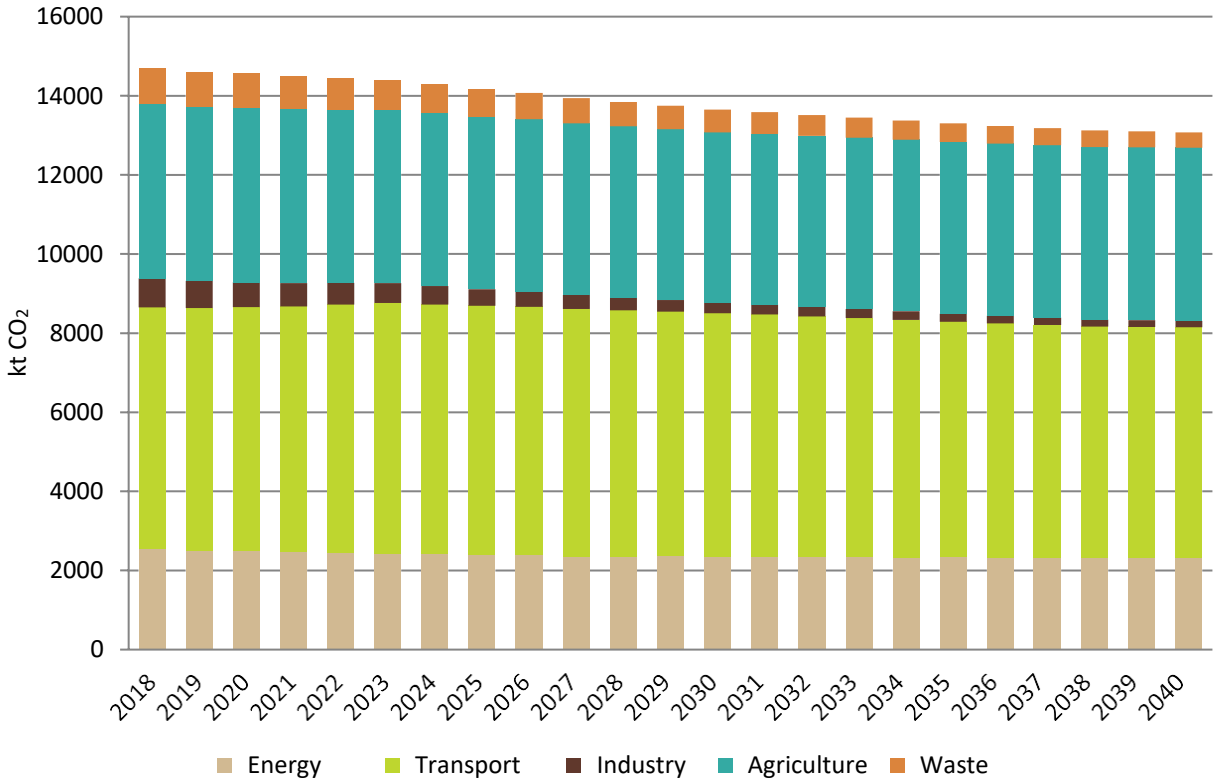


Fig. 4.2.1.4. GHG emission trends in 2018–2040 by non-ETS sector

GHG emissions from sectors not covered by the EU ETS will continue to account for the largest share in the future. The main sources of GHG emissions are energy, transport and agriculture. Figure 4.2.1.4 shows projected GHG emissions by non-ETS sector.

The projected GHG emissions from sectors participating in the EU ETS are presented in Table 4.2.1.3. The projections do not take into account the changes in the allowance price, except for the gas pipeline transport and services (state company Ignalina Nuclear Power Plant) sub-sectors, where GHG emissions are relatively low (not more than 11 kt CO_2 eq in total).

Table 4.2.1.3. GHG projections for 2020–2040 in ETS sectors

	2020	2025	2030	2035	2040
GHG emissions, kt CO_2 eq	6689	6291	6155	6128	6102

Energy

GHG projections for the energy sector have been made on the basis of projections of combustible fuels in individual sub-sectors as calculated under the LEAP modelling tool. Fugitive emissions of natural have been calculated on the basis of modelled gross natural gas consumption. Emissions have been calculated on the basis of the methodology set out in the 2006 IPCC Guidelines[98].

Average electricity demand is projected to fall by 9.3% by 2030 and then increase by 3.4% by 2040,

[98]2006 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change (IPCC).

eventually reaching a total of 9.720 GWh in 2040, which may lead to slightly lower GHG emissions in the energy sector. The reduction in electricity consumption is due to energy efficiency measures such as smart meters, publicity/education, SPI concession for industry, technological progress, etc. After 2030, when energy efficiency measures expire, electricity consumption will start to grow.

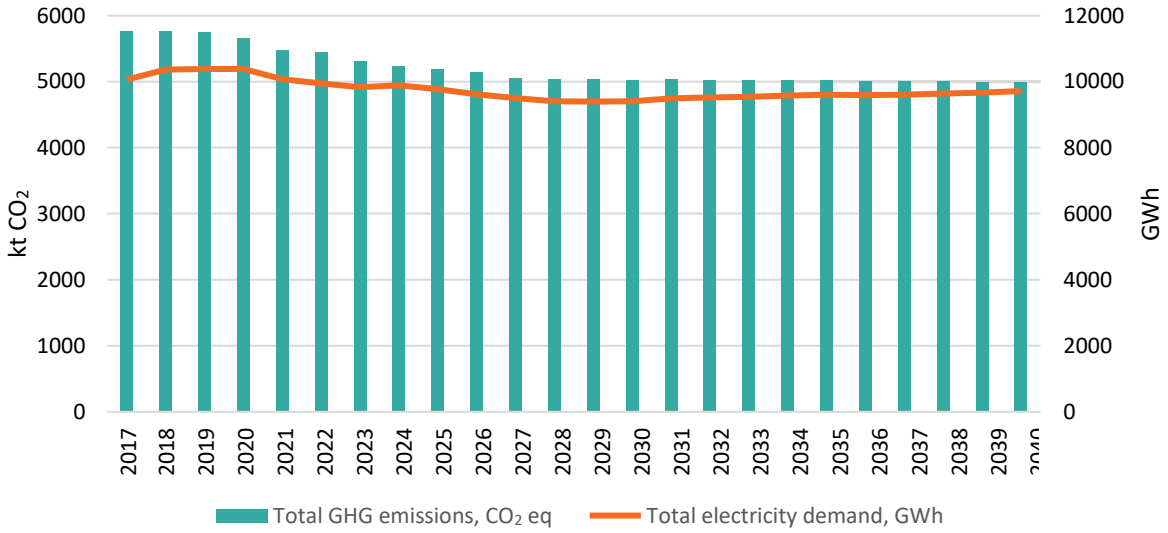


Fig. 4.2.1.5. Projected total electricity demand and GHG emissions in the energy sector (excluding the transport)

The refining, industry and construction and household sub-sectors are expected to remain the main sources of GHG emissions in the energy sector Conversely, in the district heating and electricity generation sub-sector, GHG emissions are expected to decrease by more than a half and their impact is likely to subside significantly.

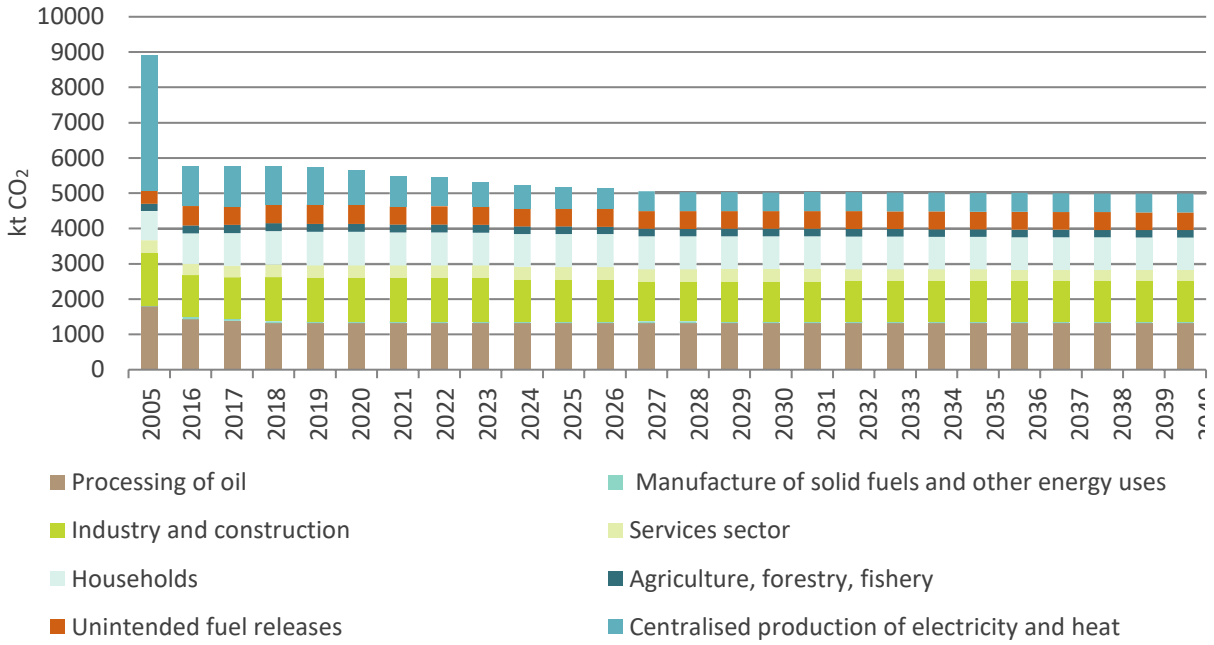


Fig. 4.2.1.6. Historical and projected GHG emissions, kt CO_2 eq (excluding the transport sector)

Overall, GHG emissions in all sub-sectors will decrease or remain stable compared to 2017. It is estimated that increased energy consumption efficiency and use of biomass will reduce fossil fuel consumption by 13% and final energy consumption by 1.9% by 2040, leading to lower GHG emissions in this sector.

Transport

GHG projections for the transport sector are based on forecasts on road transport, freight and passenger turnover and fuel consumption (domestic aviation and rail transport). These activity data for GHG projections have been provided by the Ministry of Transport and Communications of the Republic of Lithuania. Fuel consumption for the transport of natural gas by pipeline has been calculated on the basis of gross natural gas consumption modelled based the LEAP modelling tool. Emissions have been calculated on the basis of the methodology set out in the 2006 IPCC Guidelines[99].

The total number of internal combustion engine vehicles is projected to grow by 2.9% per year until 2023 and subsequently growth is expected to slow down to 0.5% per year until 2030 as a result of the planned sustainable urban mobility plans. Taking into account the demographic situation in Lithuania (population decline), the number of vehicles with internal combustion engines is also projected to decrease by 0.5% per year between 2030 and 2040 (from 1.81 million road vehicles in 2030 to 1.71 million in 2040). This development will lead to a corresponding trend in GHG emissions in the transport sector.

Historical and projected GHG emissions from transport subsectors in 2005-2040, kt CO_2 eq, are specified in Figure 4.2.1.7.

[99]2006 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change (IPCC).

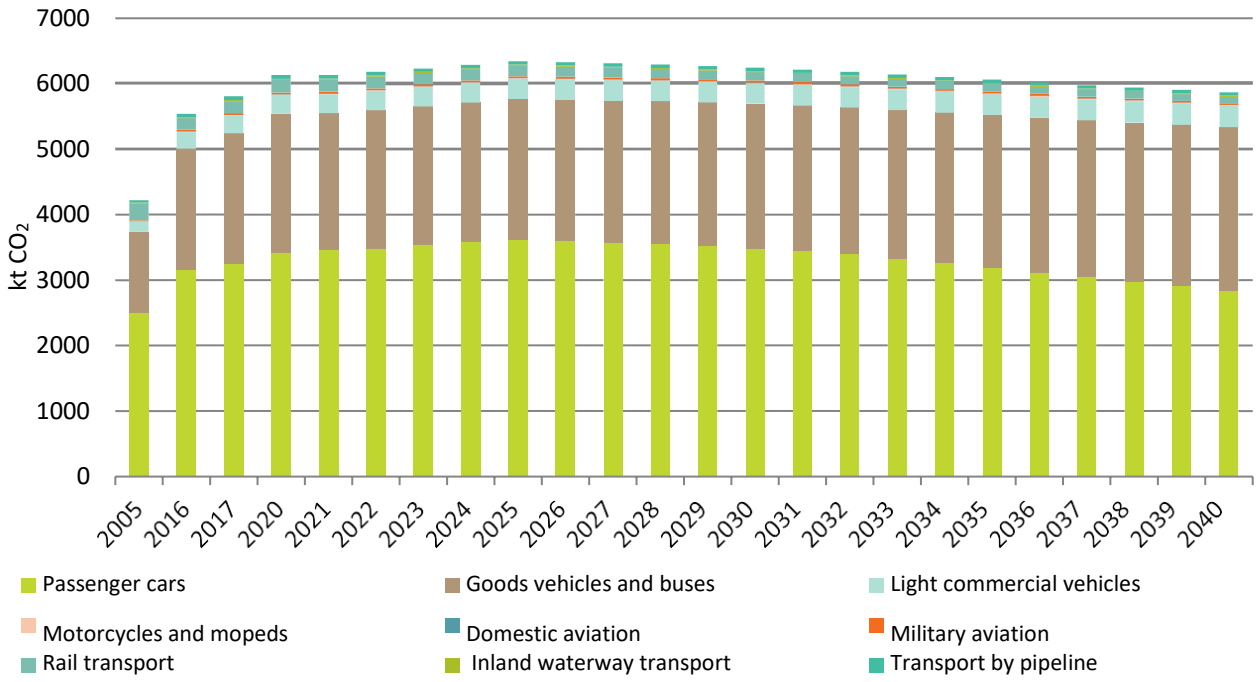


Fig. 4.2.1.7. Historical and projected GHG emissions in the transport sector by category

Compared to 2005, GHG emissions in all transport sub-sectors will increase or remain stable, with the exception of the rail sector, where electrification is currently underway. It is estimated that electrification of railways will reduce fossil fuel consumption by 29.9% by 2030 (and 47.2% by 2040), leading to lower GHG emissions in this sector.

The road transport subsector is estimated to remain the main source of GHG emissions in the transport sector, accounting for 95% of GHG emissions in the transport sector in 2017 and 96.6% in 2040.

Industrial processes and product use

Projections of GHG emissions from industrial processes and products using existing policies and measures (EPM) are based on data on production levels (activity data) provided by major industrial producers (of cement, glass, lime, ammonia and nitric acid). Projected data for the years 2020, 2025, 2030, 2035 and 2040 were provided by industrial enterprises. Interim data have been interpolated. The projection of fluorinated GHG emissions is based on macroeconomic indicators (GDP and population projections) and the projected number of vehicles, including restrictions and prohibitions laid down by Regulation No 517/2014[100] and Directive 2006/40/EC[101]. GHG emission projections were calculated the using [102] the methods provided by the IPCC in 2006.

The main sources of GHG emissions in the industrial processes and products sector are the chemical industry, the production of mineral products and the use of fluorinated GHGs (Figure 4.2.1.9).

According to the data provided by chemical industry (ammonia and nitric acid production) enterprises,

[100] Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006

[101] Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/156/EEC

[102] 2006 Guidelines for National Greenhouse Gas Inventories, Intergovernmental Panel on Climate Change (IPCC)

trends in GHG emissions between 2020 and 2040, without taking ETS price changes into account, will remain stable due to consistent production capacities and fuel consumption will decrease slightly in the same period.

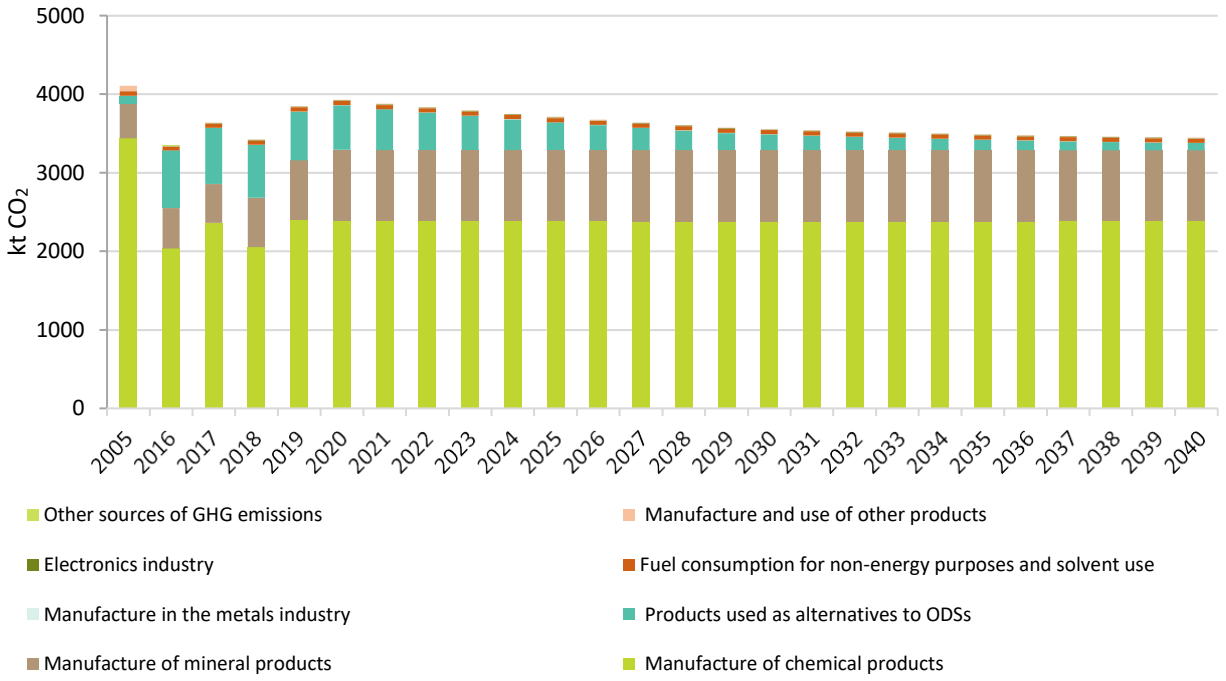


Fig. 4.2.1.8 Actual and projected GHG emissions in industry by category

Emissions from the production of mineral products are based on projections by industrial companies, taking into account the expected maximum production capacities and the best available techniques in accordance with their environmental permits. Cement production accounts for a large proportion of GHG emissions in the mineral products category. According to the data provided by a company, cement production will increase up to 2020 and from 2020 production will remain stable until 2040.

Emissions from the use of fluorinated gases are expected to gradually decrease as a result of the implementation of the requirements of Regulation 517/2014. GHG emissions are projected to decrease from 719 kt CO_2 eq in 2017 to 209 kt CO_2 eq in 2030 and 100 kt CO_2 eq in 2040. The most significant reductions will be achieved by replacing HFC-134a in car conditioning systems with alternative gases with a VAP<150 and by replacing R-404A in commercial refrigeration equipment with gases having a VAP<2500 by 2022 and with gases with a VAP<150 after 2022.

Compared to 2005, the industrial processes and products sector is projected to show a modest GHG emission reduction of 13% and 16% in 2030 and 2040, respectively. The main source of GHGs in the industrial processes and products sector is the chemical industry (an ETS sector), which is expected to remain the largest source of GHGs in the industry in the future.

Agriculture

Projections of GHG emissions from the agricultural sector under existing policies and measures (EPM) are based on the number of domestic animals, dairy cattle productivity indicators, the distribution of manure management systems for the main categories of livestock, the amount of mineral and organic N fertilisers used, the yield of main crops and the yield area used to lime soils. Activity data for GHG projections have

been provided by the Ministry of Agriculture of the Republic of Lithuania. GHG emissions have been calculated on the basis of the methodology provided in the 2006 IPCC Guidelines[103].

The evolution of livestock numbers over the forecast period has been assessed in the light of historical fluctuations in livestock numbers, prevailing market prices, demand and exports. Quantities of mineral and organic (compost and sewage sludge) N fertilisers and materials for soil calcination have been estimated taking into account the changes in crop area. Forecasts of crop yields have been estimated on the basis of crop yields and estimated crop areas. Forecasts of crop area have been calculated on the basis of historical data, the world market situation and the development of agro-biotechnology. Due to the unfavourable trading conditions and the structure of agricultural production, the crop areas of barley, triticale, rye, summer rape and potatoes are expected to shrink.

Compared to 2005, GHG emissions in the agricultural sector are projected to increase by 2% by 2030. GHG emissions will increase by 4% by 2040 (compared to 2005). Agricultural soils are the main contributor to GHG growth in the agricultural sector. This category is expected to remain the largest source of GHGs in agriculture in the future.

Emissions from agriculture by separate agricultural categories are shown in Figure 4.2.1.10.

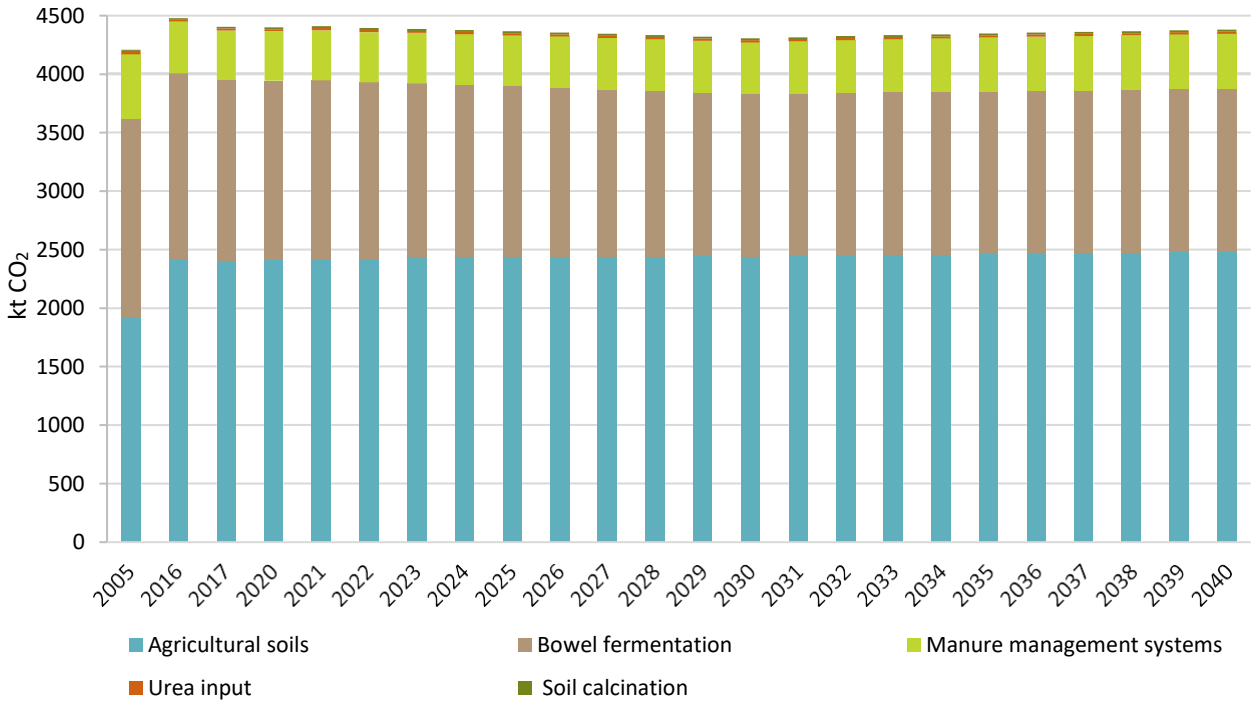


Fig. 4.2.1.10. Actual and projected agricultural GHG emissions by category

Land use, land use change and forestry (LULUCF)

Projections of GHG emissions and removals from the land use, land use change and forestry sector under existing policies and measures (scenarios with existing measures) were developed on the basis of the data collected during the National Forest Inventory ('NFI') in 2002-2017 and other data used in the GHG inventory

[103]2006 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change (IPCC).

report. The main data used for the forecasts are land use category areas, tree volume increment and volume change, tree stem volume cut in Lithuanian forests and dead tree stem volume.

Land use category areas and changes between categories are forecast based on the data provided in the Lithuanian National GHG Inventory Report [104] for 2019. On the basis of data on newly planted and self-expanding forest areas in 2013–2017, forest land area is projected to increase by an average of 3,200 ha annually. Accordingly, the area of productive land, grassland and pastures is projected to decrease as a result of the conversion of this land to forest land. The ratio of productive land to grassland and pastures is projected to remain the same as in 2013-2017. Greenhouse gas emissions from waters and bogs, built-up areas and other land areas are projected on the basis of GHG emissions recorded in 2013–2017.

The total volume of Lithuanian trees, the volume increase, the volume of felled and naturally dying trees are forecast taking into account the change in the forest volume increment inventoried by the NFI in 2002–2017 and its use. These data were used as a reference point for the estimation of total growth and its structure (main use, intermediate use, dead tree volume and volume change) in 2018–2040. **Gross stand growth** for the years 2007 to 2017 is estimated on the basis of NFI data and is projected as the product of the area forecast for the tree species concerned and the average annual volume increment over the period 2018–2040. The annual stand volume growth is slightly decreasing due to their ageing. The projected overall growth remains fairly stable, averaging between 20.51 and 20.04 million m^3 per year. The decreasing tree volume growth primarily owes to changes in the structure of the tree age classes: recently, the middle-aged stands occupying the largest areas and generating the largest volume and carbon accumulation have been ageing, which leads to increasing areas of older and more mature stands with lower volume growth and GHG uptake. Based to the current level of use and regeneration of pine forests, the largest reduction in the volume growth of these stands is anticipated. Reductions in growth are also projected due to the large area of mature stands and the small area of juvenile stands, as both the ageing stands and juvenile stands have a lower growth rate than the most productive middle-aged stands. The projected increase in the volume of felling relates both to the increase in the volume of main fellings in mature stands due to the projected increase in the area of mature trees and to the increase in the volume of intermediate felling, in particular thinning, in order to increase forest sustainability and reduce tree deaths and forest losses. **The main forest use** in forests has been estimated as the product of the equivalent area of mature stands to be felled and the average volume of mature stands. An equivalent area of mature stands to be felled each year was calculated on the basis of the age class distribution of each tree species and the use of mature stands over a period of 12 to 15 years. It is estimated that the increase in the volume of main fellings in 2018–2027 will be affected by the restoration of economic activity in roughly 200 000 hectares of forest allocated for property restoration, either by designating these forests as public forests or by restoring private property. In order to reduce the volume of dying trees and consequently the forest cultivation losses, a gradual increase in the use of intermediate forests is forecast. **Intermediate forest use is** projected to account for 40-50% of basic forest use, drawing on many years of experience. In view of the increase in primary and intermediate forest use, **general forest use** is bound to increase in all forests of the country from 10.11 million m^3 in 2017 to 11.75 million m^3 in 2040 (Table 4.2.1.4). Thus, due to the projected increase in the volume of stand intermediate fellings, smaller natural losses of trees are anticipated. According to the NFI data, the average annual share of dead trees in the total volume increase decreased from 21% to 18% over the period 2007-2017. Taking into account the anticipated higher intensity of thinning, a corresponding decrease in the volume of dead trees is forecast. Based on trends observed between 2002 and 2017 and the changes in the age structure of forests, changes in stand volume and GHG absorption are expected to

[104] http://am.lrv.lt/uploads/am/documents/files/KLIMATO%20KAITA/Studijos%2C%20metodin%C4%97%20med%C5%BEiaga/NIR_2019_04_15_FINAL.pdf

decrease over 2018-2040 (Table 4.2.1.4). **Growth accumulation** over the forecast period is defined as the difference between the total volume increase and the volume of trees cut and dead. The volume of felled trees and naturally dying trees from the main and intermediate fellings account for between 72% and 75% of the total annual increment in stand volume. Thus, the part of the increment accumulated in the stand accounts for about a quarter of the total increment.

Table 4.2.1.4. Actual and predicted total stand volume growth and tree structure in million m^3

Target		NFI data			Forecasts				
		2007	2012	2017	2020	2025	2030	2035	2040
Gross increment		15.95	19.38	20.51	20.46	20.37	20.26	20.15	20.04
Use, stem volume:	main	5.46	4.84	6.53	6.94	7.63	7.88	7.83	7.76
	intermediate	4.22	3.21	3.58	3.57	3.56	3.68	3.88	3.99
	total	9.68	8.05	10.11	10.52	11.20	11.56	11.71	11.75
Tree deaths		3.34	3.83	3.66	3.61	3.52	3.43	3.33	3.22
Annual accumulation of increment		2.93	7.50	6.74	6.33	5.64	5.27	5.11	5.07

The annual carbon dioxide removals in newly planted forests is calculated separately and added to the projected CO_2 removals in permanent forests. The absorption of CO_2 in new forests has been calculated on the basis of the volumetric change patterns determined on the basis of the volumetric changes in newly planted or naturally occurring wooded areas measured during the National Forest Inventory.

GHG removals by harvested wood products are projected in proportion to the volume harvested by increasing the production of different wood products. The distribution of wood products between different product groups (sawn wood, wood panels and paper products) is forecast to be the same as in the base year (2017).

Table 4.2.1.5. Actual and projected GHG emissions in the LULUCF sector by land use category, kt CO_2 eq

Categories of the LULUCF sector	2005	2016	2017	2020	2025	2030	2035	2040
Forest land	-4251	-8188	-7863	-7040	-6229	-5737	-5541	-5375
Productive land	1744	2425	2738	2851	2851	2851	2851	2 851
Meadows and pastures	-1560	-742	-845	-972	-972	-972	-972	-972
Waters and bogs	888	730	1044	893	893	893	893	893
Enclosed Area	594	706	593	640	640	640	640	640
Other land	49	58	58	64	64	64	64	64
Harvested wood products	-1 210	-1 043	-1 045	-1 123	-1 148	-1 092	-1 001	-896
Total GHG emissions	-3728	-6032	-5296	-4663	-3877	-3329	-3042	-2772

The total GHG removals in the LULUCF sector are projected to reach 3,329 kt CO_2eq in 2030, with a 37% relative reduction in removal compared to 2017, while GHG removals compared with 2005 are expected to decrease by 11%. GHG absorption will decrease by 26% by 2040 (compared to 2005). A forest land category, namely the reduction of carbon removals in stand biomass, is the main contributor to GHG removals in the LULUCF sector.

GHG emissions and removals in the LULUCF sector by land use categories are given in Figure 4.2.1.11.

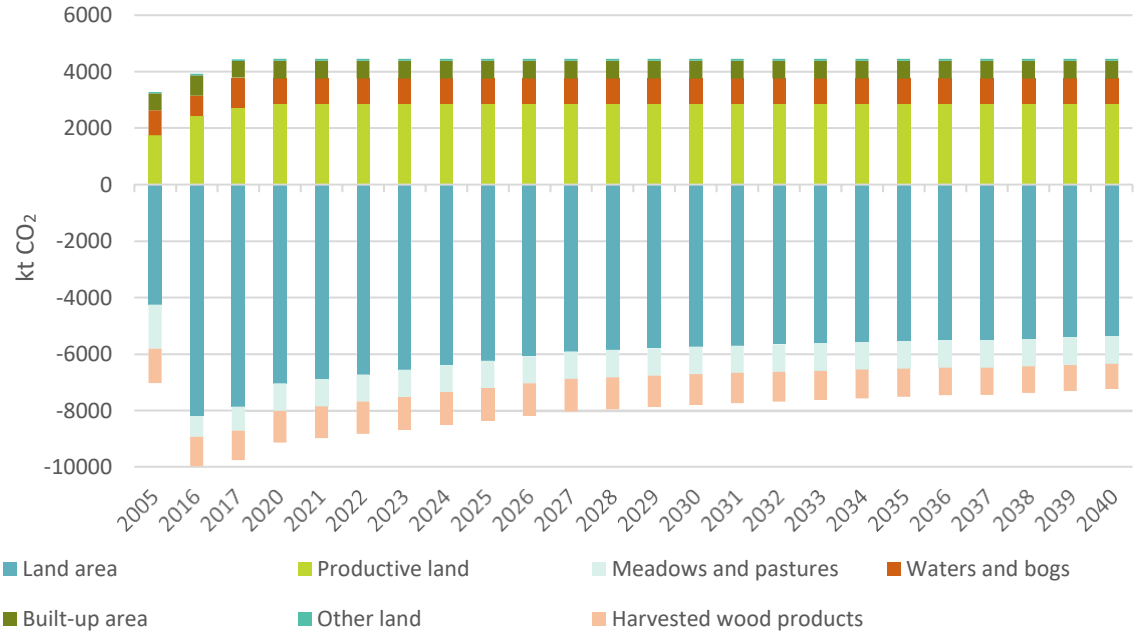


Fig. 4.2.1.11. Actual and projected GHG emissions and absorption in the LULUCF sector by category

In accordance with the commitment under Regulation (EU) No 2018/841, the annual difference in GHG emissions and removals in the LULUCF sector (by applying the special accounting rules provided for in this Regulation) has to be negative, i.e. the sector has to generate more removals than emissions or at least the cumulative quantity of GHG removals and emissions has to be equal to zero. The cumulative quantity of GHG emissions and removals is accounted for by deducting the fixed reference levels from GHG removals or emissions calculated in the categories of annually managed forest land, managed cropland and managed grassland in the period from 2021 to 2030 and adding the quantity of GHG removals or emissions from afforested and deforested land. The reference level for managed forest land means projected GHG removals or emissions from forests, based on forest use tendencies between 2000 and 2009 and the structure of stand age classes for that period. The established indicative reference level of managed forest land (GHG removals of 2,722 kt CO_2 eq / year) will be updated following the review by the European Commission according to the comments received. Reference levels for managed cropland and managed grassland and pastures are the average of GHG emissions/removals between 2005 and 2009. The indicative calculated reference level for managed cropland reaches 3,768 kt of GHG emissions of CO_2 eq/year, and the reference level for managed grassland and pastures is 970 kt of GHG removals of CO_2 eq/year.

Taking account of the accounting rules under Regulation (EU) No 2018/841, to calculate GHG removals and emissions from the LULUCF sector, Lithuania's LULUCF sector is projected to generate a total of -6,227 kt CO_2 eq of GHG removals each year in the period from 2021 to 2025, part of which can be used to meet the GHG emission reduction commitments by the non-ETS sectors. From 2026 to 2030 (during the second commitment period under Regulation (EU) No 2018/841), Lithuania's LULUCF sector is projected to generate a total of -5,252kt CO2e eq of GHG removals each year, part of which can be used to meet the GHG emission reduction commitments by the sectors outside the EU emission trading scheme.

Waste

Projections of GHG emissions from the waste sector under existing policies and measures[105] (EPMs) are based on macroeconomic indicators (GDP and population projections) and the development of municipal waste management infrastructure. GHG emissions have been calculated on the basis of the methods provided in the 2006 IPCC Guidelines[106].

G generation of municipal waste has been estimated by regression analysis on the basis of national statistics (quantity of municipal waste per capita), population and GDP. Municipal waste generation is projected to increase to 1,336 kt in 2030 and 1,396 kt in 2040. It is planned that by 2035 only up to 10% of the total waste generated will be disposed of in landfills, and the same percentage will remain until 2040. Methane formation has been assessed by the FOD (First Order Decay) method[107] presented in the 2006 IPCC Guidelines. The production and collection of biogas from landfills is expected to gradually decrease due to the decreasing waste disposal landfills. Biogas collected from landfills is used to produce heat and electricity and is included in energy forecasts.

The projections for methane and nitrous oxide from composting biodegradable waste have been developed in the light of the existing capacity of mechanical and biological waste treatment plants and the projected home composting. Home composting was assessed on the basis of the number of compost bins distributed and the amount of composted waste (220 kg) per household.
GHG emissions from waste water treatment and discharges have been projected on the basis of anticipated biooxygen consumption, population projections and the share of residents connected to the centralised water and waste water collection systems. The share of connected residents is projected to be 83% in 2030 and 90% in 2040, taking into account the EU-funded infrastructure development projects, reluctance to connect to centralised networks and other conditions.

Waste incineration without energy recovery accounts for only 0.1% of total GHG emissions in the waste sector. Similar amounts of waste incineration are expected to continue in the future. In addition, in order to improve the efficiency of heat and energy consumption, to make more efficient use of local and renewable resources in heat generation plants and to reduce CO_2 emissions, cogeneration plants will be built in Vilnius and Kaunas over the period 2019–2020, which will consume 360 tonnes of biomass and municipal waste per year for energy production, which will account for 30% of all municipal waste.

Analysis of sector projections has shown that GHG emissions are gradually decreasing as a result of the planned expansion of waste sorting, preparation of waste for recycling, waste incineration, modernisation of the capacities (sorting lines, other equipment) for re-use or other recovery and upgrading of the waste management information system and monitoring. Compared to 2005, GHG emissions are projected to fall significantly by 2030 and 2040, 62% and 74% respectively. The highest GHG emission reductions are expected in waste landfilling (69% by 2030 and 82% by 2040 compared to 2005) and waste water treatment and discharge (60% in 2030 and 70% in 2040 compared to 2005).

[105] The measures adopted and implemented are set out in Chapter 3.
[106] 2006 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change (IPCC).
[107] The FOD method assumes that decomposition of organic carbon in waste slowly degrades over several decades to produce CH_4. If the conditions are constant, the rate of CH_4 formation depends only on the amount of carbon remaining in the waste. CH_4 emissions peak in the first few years after removal and gradually decline afterwards.

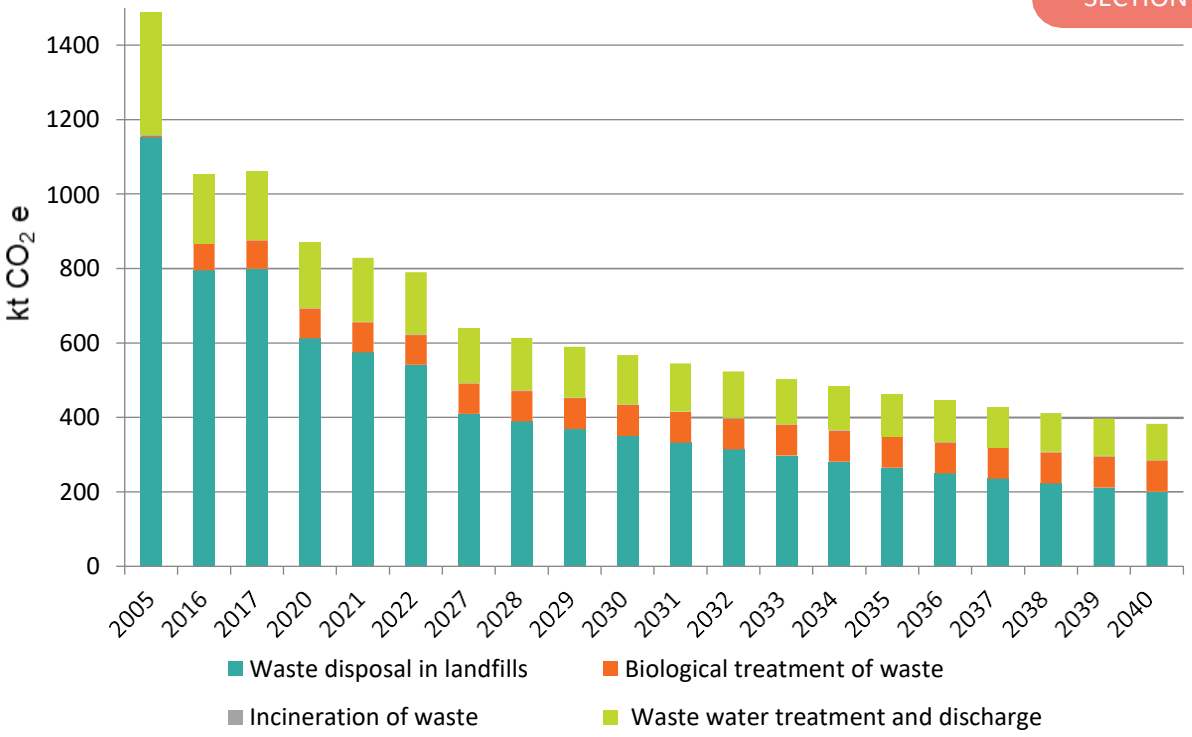


Fig. 4.2.1.11. Actual and projected GHG emissions in the waste sector by category

4.2.2 Renewable energy

The factual situation in the year 2018 is considered as the current situation in defining the level of energy use from renewable sources in various sectors. Specific indicator values are given in Table 4.2.2.1.

Table 4.2.2.1. Current RES share in gross final consumption of energy and in relevant sectors (heating and cooling, electricity, transport)

	2018
Final energy consumption, ktoe	5562.9
RES share in heat and cooling energy production, %	45.3
RES share in DH sector, %	65.0
RES share in electricity production, %	18.4
RES share in gross final consumption of electricity, %	25.0
RES share in gross final consumption of energy in transport, %	4.3

The fuel balance in district heating and the types of technologies used to produce the corresponding energy in 2018 are presented in Table 4.2.2.2.

Table 4.2.2.2. Balance of fuels and technology types in district heating in 2018

	Tech.	Quantity, ktoe	% (based on fuel consumption)
Firewood, wood waste and agricultural waste for fuel	BH, CPP	639.8	59.3
Household waste (RES share)	CPP	19.5	1.8

Industrial waste	CPP	13.4	1.2
Natural gas	CPP, BH	302.4	28.0
Peat and peat briquettes	BH	8.7	0.8
Heating and other gas oils	BH	21.0	1.9
Industrial waste (non-RES)	CPP	13.9	1.3
Household waste (non-RES)	CPP	20.6	1.9
Other biogas	BH	16.9	1.6
Landfill biogas	CPP, BH	9.4	0.9
Sewage sludge biogas	BH	2.7	0.3
Liquefied and other gas oils	BH	1.9	0.2
LPG	BH	7.8	0.7
Coal	BH	1.6	0.1
Electricity	HP, DEH	0	0.0

CPP - cogeneration power plant, BH - boiler house, HP - heat pump, DEH - direct electric heating.

Electricity generation from renewable energy sources and the technologies used are specified in the table. Due to uncompetitive fuel pricing, conventional electricity generation is not currently operational in Lithuania. The country imports most of its electricity (about 70%). The remaining domestic generation consists essentially of RES, dominated by hydro and onshore wind power plants. Recent years have seen significant development of solar power plants. This process owes to the development of the prosumer concept and subsidies directed to this area.

Table 4.2.2.3. Electricity generation from renewable energy sources in 2018

Technology	Quantity, ktoe	%
Hydropower plants	37.1	20.1
Wind farms	98.4	53.3
Solar power plants	5.9	3.2
Biofuel power plants (cogeneration)	25.1	13.6
Biogas power plants (cogeneration)	10.9	5.9
Cogeneration (waste)	7.2	3.9

Construction of two large cogeneration power plants in Vilnius and Kaunas is to be completed in the near future. The power plants will burn household waste (Vilnius and Kaunas) and biofuels (cogeneration unit in the Vilnius power plant). The total installed capacity will be 73 MWe and 163 MWth. Based on the parameters of waste incinerated at the Klaipėda waste incineration plant, it can be assumed that 50% of the household waste stream will be considered as RES.

The evolution of RES-E capacity over the period 2010–2018 is shown in Figure 4.2.2.1.

Key for figure 4.2.2.1:
Offshore wind farms
Hydropower plants >10 MW
Solar (photovoltaic) plants
Biofuel power plants
Biogas power plants
Hydropower plants < 1 MW
Industrial and municipal waste power plants

Hydropower plants 1-10 MW

Fig. 4.2.2.1. Development of RES electricity generation and technologies used

Between 2010 and 2018, the installed capacity for electricity generation from RES increased almost threefold, from 278 MW to 818 MW . The installed capacity of solar photovoltaic power plants has shown the fastest growth, increasing by 11.7 times since their launch in 2012. The installed capacity of wind power plants increased fourfold between 2010 and 2018, that of biofuel power plants increased by 3.2 times and that of biogas power plants almost doubled. The installed capacity of hydropower and cogeneration power plants burning industrial and municipal waste has remained largely unchanged. 65.2% of the installed capacity of all power plants is accounted for by onshore wind power plants, 11% by hydropower plants of >10 MW , and 10% by solar photovoltaic plants.

The above historical data show that the expansion of electricity generation from RES mainly took place through the installation of onshore wind farms. The power curve of onshore wind farms shows that in some periods (2012–2014 and partly 2016–2018) the expansion of the RES did not take place or was rather slow. This is directly linked to the pauses in the application of support mechanisms. The surge in solar power is attributable to the features of the support mechanism, where the power plant builder, having obtained the construction permit, was only allowed to connect the power plant to the grid 2 years after the permit was issued. At a high support rate, the possibility of postponing the installation for two years and the significant reduction in investment costs during this period led to a boom in the deployment of solar power plants. This expansion was seen as unsustainable and further promotion of solar power plants was suspended by political decisions.

Projections of change with existing policies and measures

The energy modelling of existing policy measures in 2030 (with an outlook for 2040) requires discussion of the main measures and their implementation assumptions leading to the development of RES in the sectors concerned.

- AEI1: Support scheme for electricity produced from RES. Around 700 MW of units using RES will be installed over the period of the measure until 2025, which will generate around 2.4 TWh of energy (successive auctions for 0.3, 0.7, 0.7, and 0.7 TWh are planned). This support scheme (technologically neutral auctions) will be used up to a level of RES development economically and technically acceptable for the country or until the production of energy from renewable energy sources reaches the market price. In view of the planned lowest bid auction (lowest premium to the market price), it is likely that the winners of the auction will install onshore wind capacity. In the light of the above, the assessment makes assumptions regarding the investment needs and production volumes.

- AEI2: Financial support to prosumers. The measure was approved in 2018 and is to continue until 2030. The supported activity is the installation of small-scale solar power plants. Around 25 000 consumers are expected to benefit from this support by 2023, setting up units with an installed power of approximately 0.168 GW and generating around 0.075 TWh of energy.

- AEI3: Promoting high-efficiency cogeneration. Under this measure, two high-efficiency cogeneration plants will be built by 2021 in Vilnius (Vilnius cogeneration plant, 'VCP') and Kaunas

(Kaunas cogeneration plant, 'KCP'), where biofuels and municipal waste will be used as fuel. These power plants are essential for achieving the objectives of RES. The electrical capacity of the VCP will be about 92 MW and it will produce about 0.4 TWh of electricity and its thermal capacity will be about 229 MW , covering about 40% of the total heat requirement for Vilnius. The KCP will have an electrical capacity of around 26MW and heat generation capacity of around 70 MW , generating around 0.5 TWh of heat and around 0.17 TWh of electricity.

- AEI4: Support for the construction of biofuel boiler houses. Under the approved measure, biofuel boilers with a capacity of 70 MW, generating approximately 0.42 TWh of heat, will be built in 2023.

- AEI10+A53: Mandatory blending of biofuels into mineral fuels. The measure has been applied from 2011 to ensure that additives of biological origin are added to mineral fuels: at least 7% of biodiesel and at least 5% (10% as from 1 January 2020) of bioethanol per litre or fuel, calculated based on volume. Blending of bio-additives into A98 petrol during the winter period is optional.

- AEI11: Excise duty relief for biofuels. The measure has been in operation since 2010.

- T4: Guarantees of origin for gases produced from RES. The measure has been operation since 2019.

Existing policy measures with the greatest impact on the use of RES include a support scheme for the production of electricity from RES (technologically neutral auctions), generating customers, upgrading of biofuel boilers and replacement of fossil fuel boilers. The obtained modelling results are set out in the table below.

Table 4.2.2.4. RES share in gross final consumption of energy and relevant sectors (EPM)

	2018	2020	2025	2030	2035	2040
Final energy consumption, ktoe	5566.2	5562.9	5459.1	5357.2	5285.9	5243.2
RES share in heat and cooling energy production, %	45.3	50.3	54.2	55.9	54.2	52.5
RES share in DH sector, %	65.0	71.5	80.7	83.2	82.9	83.0
RES share in electricity production, %	18.4	17.6	37.2	44.6	43.7	43.3
RES share in gross final consumption of electricity, %	25.0	26.8	32.2	33.5	33.0	32.4
RES share in gross final consumption of energy in transport, %	4.3	4.7	5.0	5.3	5.6	5.9

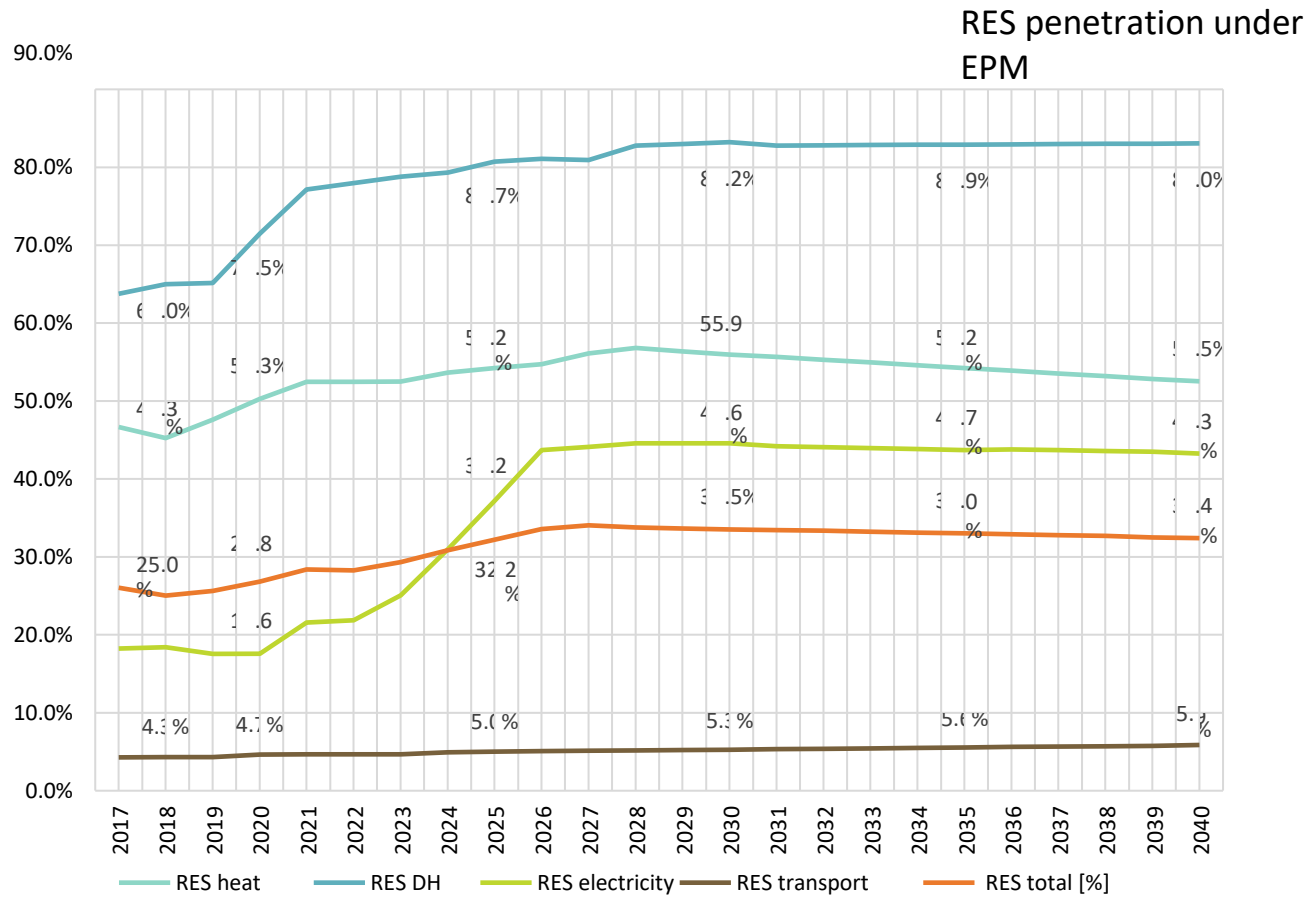


Fig. 4.2.2.2. RES share in gross final consumption of energy and relevant sectors (EPM)

Electricity

Under the EPM scenario, the increase in RES-E capacity between 2021 and 2030 is shown in the table below. It is worth mentioning that the planned development of electricity generation relies exclusively on RES technologies, in particular, solar photovoltaic power plants and the development of onshore and offshore wind farms. The planned development of solar power plants is linked to the development of prosumers and remote prosumers. Meanwhile, the increase in wind power is expected to result (as the most competitive RES technology at the moment) from the competitive process of auctioning for the development of RES in electricity generation.

Table 4.2.2.5. Expansion of electricity generation capacity under the EPM scenario

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Solar plants, MW/year	15.0	3.0	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total solar plants, MW	15.0	18.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
Wind farms, MW/year	0.0	0.0	120.0	292.0	280.0	280.0	0.0	0.0	0.0	0.0
Total wind farms, MW	0.0	0.0	120.0	412.0	692.0	972.0	972.0	972.0	972.0	972.0
Biofuel cogeneration, MW/year	73.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste cogeneration, MW/year	43.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Total cogeneration, MW	116.0	116.0	116.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0

District heating

In the district heating system, a number of changes are foreseen under the EPM during the period under consideration. As mentioned above, the Vilnius and Kaunas cogeneration plants will become fully operational in 2021. The total heat production capacity will be 163 MWth (domestic waste, biofuels). Additional heat production installations with a capacity of 70 MW (biofuels) are planned to be launched in 2023. An additional 15 MWth biofuel combustion capacity is planned for 2024 (as part of the 5 MWe cogeneration installation).

The results of modelling the DH sector are presented in Figure 4.2.2.3.

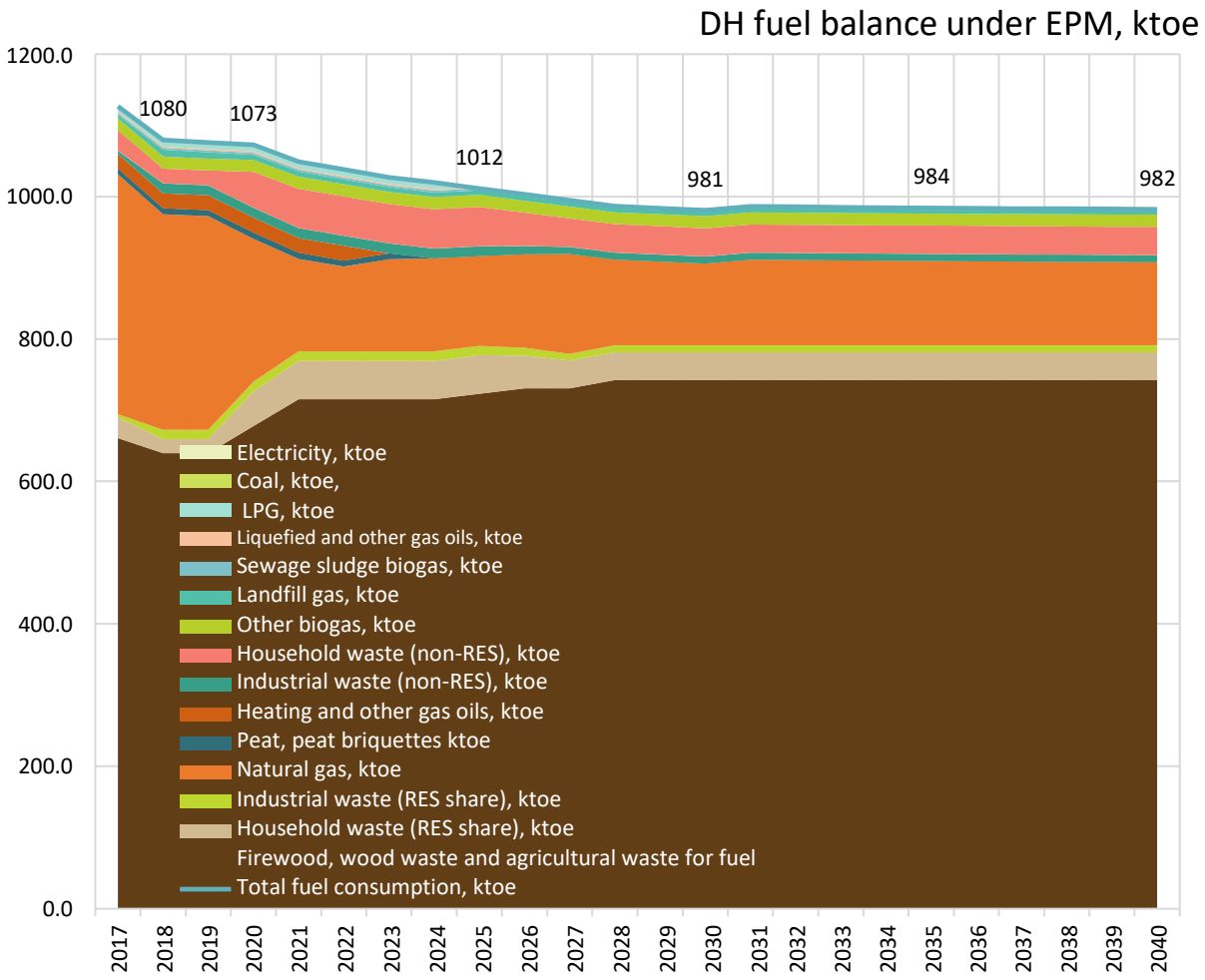


Fig. 4.2.2.3. DH fuel balance forecast under EPM

The graph shows that fuel use for district heating will decrease. This relates in particular to energy efficiency improvement measures (building renovation, consumer awareness raising, digitalisation of metering, etc.) and energy production efficiency improvement.

In 2018, total fuel consumption in the DH sector amounted to 1080 ktoe. In 2030 and 2040, fuel demand will decrease to 981 ktoe and 982 ktoe respectively, i.e. by 9.5%.

Transport

The results of modelling the EPM scenario for the transport sector are shown in Fig. 4.2.2.4.

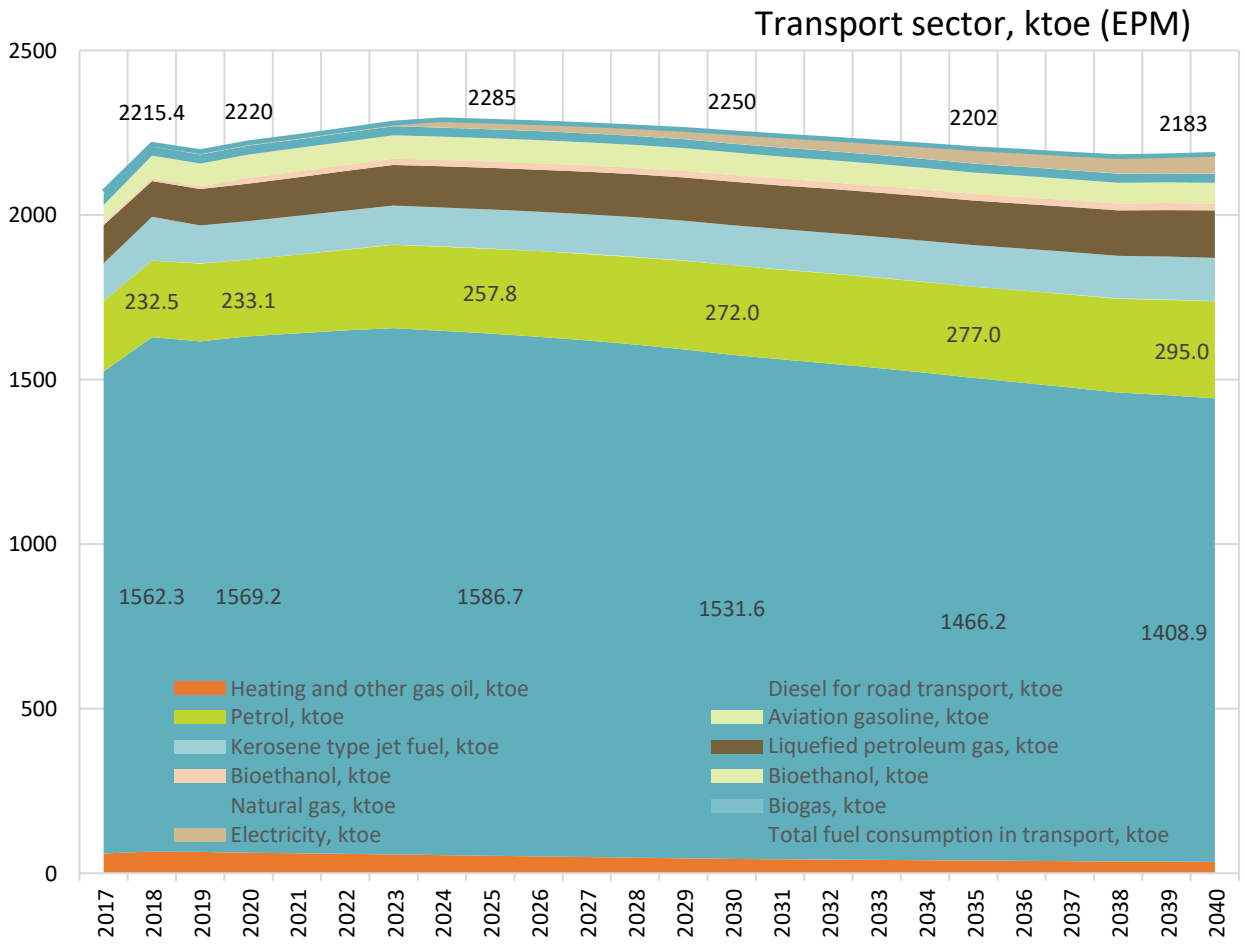


Fig. 4.2.2.4. Results of transport sector modelling under EPM

The results of the EPM scenario show a gradual decline in diesel consumption, with increased use of gaseous fuels instead. The modelling results suggest that the existing policies could contain the growth rates of fuel consumption in the sector, but this is not conducive to a more marked reduction in fuel consumption or a tangible fuel switch.

Figure 4.2.2.5 shows the total final energy consumption in the transport sector (TOTAL consumption in transport; scale on the left, ktoe) and energy consumption from renewable fuels, biodiesel and bioethanol (Y scale on the right side of the chart, etc.). The chart shows electricity in full (the specific share of RES in electricity depends on the RES-E rate achieved in a given year).

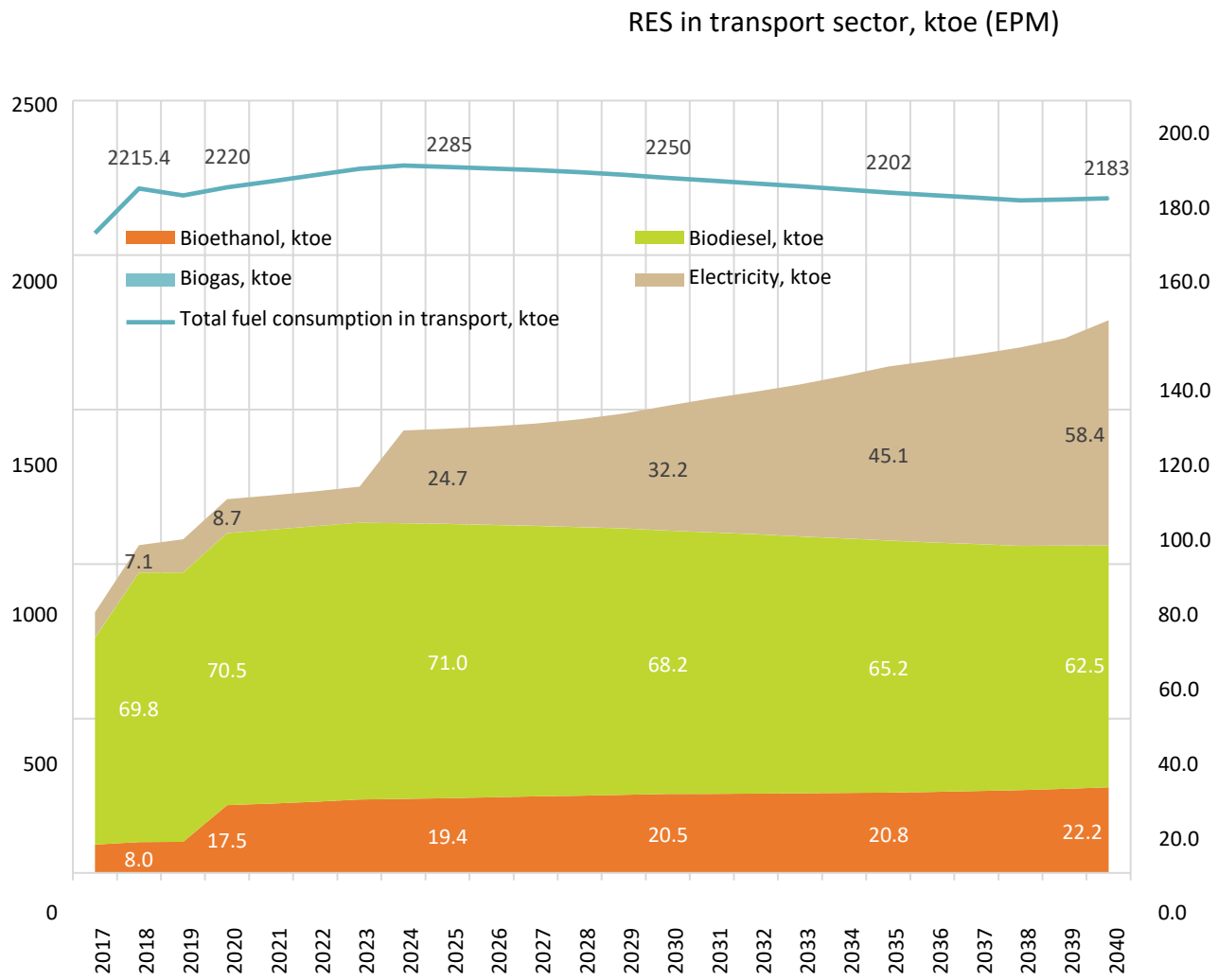


Fig. 4.2.2.5. RES transport sector under the EPM scenario

As can be seen from the above results, the EPM scenario stabilises fuel consumption growth in the transport sector (as observed over the period 2014–2019). The scenario foresees relatively constant use of biodiesel and bioethanol, while the trend of electrification in the transport sector is weak (no tangible challenges for the power generation sector).

4.3 Dimension Energy efficiency

The current level of primary and final energy consumption is reflected in the actual consumption in 2018 for individual sectors of the economy. It is worth noting that the main energy consumers in Lithuania are the transport sector (40% in the final energy consumption mix), households (27%), industry (19%) and services (12%). Other sectors, such as construction, agriculture and fisheries, collectively consume around 3% of final energy.

Table 4.3.1. Current primary and final energy consumption in sectors

	2018	%
Primary energy consumption, ktoe	6558.5	–
Final consumption, ktoe	5566.2	100%
Industrial sector, ktoe	1061.3	19.1%
Household sector, ktoe	1486.0	26.7%
Service sector, ktoe	649.9	11.7%
Transport sector, ktoe	2215.4	39.8%
Other sectors, ktoe	153.6	2.8%

The detailed assessment of the possibilities of high-efficiency cogeneration and efficient district heating in the Republic of Lithuania[108] (hereinafter referred to as the 'Assessment of cogeneration potential') has been prepared on the basis of an integrated analysis of the development and functioning of electricity and district heating and fuel supply systems, carried out using modern mathematical models, evaluating the behaviour of end users in the field of energy efficiency improvement, the requirements, the country's commitments in the field of environmental protection and the aspects of security of energy supply. The Assessment of cogeneration potential analysed heat and electricity generation and supply technologies, heat and electricity generation capacities in 10 major cities as well as Elektrėnai, fuel consumption balances, changes in the prices of fuels used and energy produced and trends in the development of the heat supply system, and described the 9 scenarios analysed and the economic calculations carried out for cogeneration plants.

Primary and final energy consumption projections per sector

Primary and final energy consumption projections are derived from systematic modelling of fuel and energy consumption in the sectors of the Lithuanian economy. The model is based on statistical data reflecting the current energy consumption situation and specific assumptions influencing the energy consumption projections (such as direct energy efficiency improvement measures, energy efficiency improvements, fuel switching, measures to promote changes in consumer behaviour, technological trends observed in the market, etc.). Presented below are the main energy efficiency policy measures applied and their assumptions used in the assessment, which have links to the area of energy efficiency improvement:

- EE2 – Renovation of multi-apartment buildings. Updated in 2014, this measure is implemented until 2020 and is expected to be continued in the longer term. In the EPM scenario, it will extend until

[108] 108 https://ec.europa.eu/energy/sites/ener/files/documents/Lithuania_DOC_88658.pdf

2023. The continuation of the measure is foreseen in the PPM scenario. To renovate 500 multi-apartment buildings each year. This annual rate of modernisation is realistic and consistent with the volume of projects carried out in previous periods. It is assumed that the average heated area of 1 multi-apartment building is equal to 800 m^2. The expected heat savings from integrated renovation will amount to about 70 kWh/m^2.

EE3 – Renovation of public buildings. This measure will be implemented from 2014 and will continue until 2030. The EPM scenario assesses the impact of the measure up to and including 2023. The continuation of the measure is transferred to the PPM scenario. The measure is expected to result in 20 GWh energy savings per year up to 2030 and to renovate about 960,000 m^2 of public building area. Total energy savings will be around 1.1 TWh. Comprehensive renovation of public buildings is expected to deliver heat savings of 80 kWh/m^2.

- EE4 – Agreements with energy suppliers on consumer education and advice. From 2017, energy suppliers must conclude agreements with the Ministry of Energy of the Republic of Lithuania on end-user education and consulting on issues related to improving energy efficiency. By 2030, the measure is expected to save around 300 GWh of energy annually through changes in end-user behaviour. When modelling the realisation of the assumption, the following distribution of annual energy savings was assumed: 50% of the savings will go to industrial end-users and the remainder to households. In terms of energy type, electricity will account for 40% of energy savings, heat for 40% and natural gas for the remaining 20%.

- EE5 – SPI relief for industrial enterprises. This measure was adopted in 2019. It encourages large industrial companies to introduce energy efficiency improvement measures, thereby reducing energy consumption. In return, companies will be allowed to recover part of the SPI funds paid. By 2030, energy savings are expected to be around 100 GWh per year. The assessment of the measure assumes that the energy savings will be distributed as follows: 70% electricity savings, 30% heat savings. Savings are attributed only in the assessment of the energy needs in the industrial sector.

- EE6 – Energy saving agreements with energy companies. As of 2017, energy companies must conclude agreements with the Ministry of Energy of the Republic of Lithuania on energy saving. These agreements require them to introduce EE enhancement measures in end-user facilities. By 2030, this measure is expected to generate annual energy savings of around 100 GWh. It is planned that this measure will apply to the services and industry sectors, assuming that the savings measures will generate 50% electricity and 50% heat savings.

Other EE measures that contribute most to reducing energy consumption include replacing inefficient boilers with more efficient ones using RES, connecting consumers to DH, renovating multi-apartment buildings, renovating public buildings, agreements with energy suppliers on consumer education and consulting, and agreements with energy companies on energy saving, the SPI exemption for industry and the introduction of smart metering. Below is a projection of the evolution of energy needs until 2040.

Primary energy consumption is calculated on the basis of the requirements of the Efficiency Directive by subtracting non-energy use and transformation in other enterprises from gross domestic consumption, i.e. primary energy does not include fuel (imported oil and petroleum products and natural gas) used as feedstock.

Table 4.3.2. Energy consumption projections under the existing energy efficiency policy, measures and programmes (EPM)

	2018	2020	2025	2030	2035	2040
Primary energy consumption, ktoe	6558	6712	6587	6460	6378	6322
Final consumption, ktoe	5566	5563	5459	5354	5286	5240
Industrial sector, ktoe	1061	1061	984	948	948	948
Household sector, ktoe	1486	1478	1413	1403	1386	1360
Service sector, ktoe	650	650	626	601	599	596
Transport sector, ktoe	2215	2220	2285	2249	2202	2184
Other sectors, ktoe	154	154	151	151	152	152

The EPM scenario modelling results show that final energy consumption will be 22.8% lower in 2030 and 30.9% lower in 2040 compared with 2018.

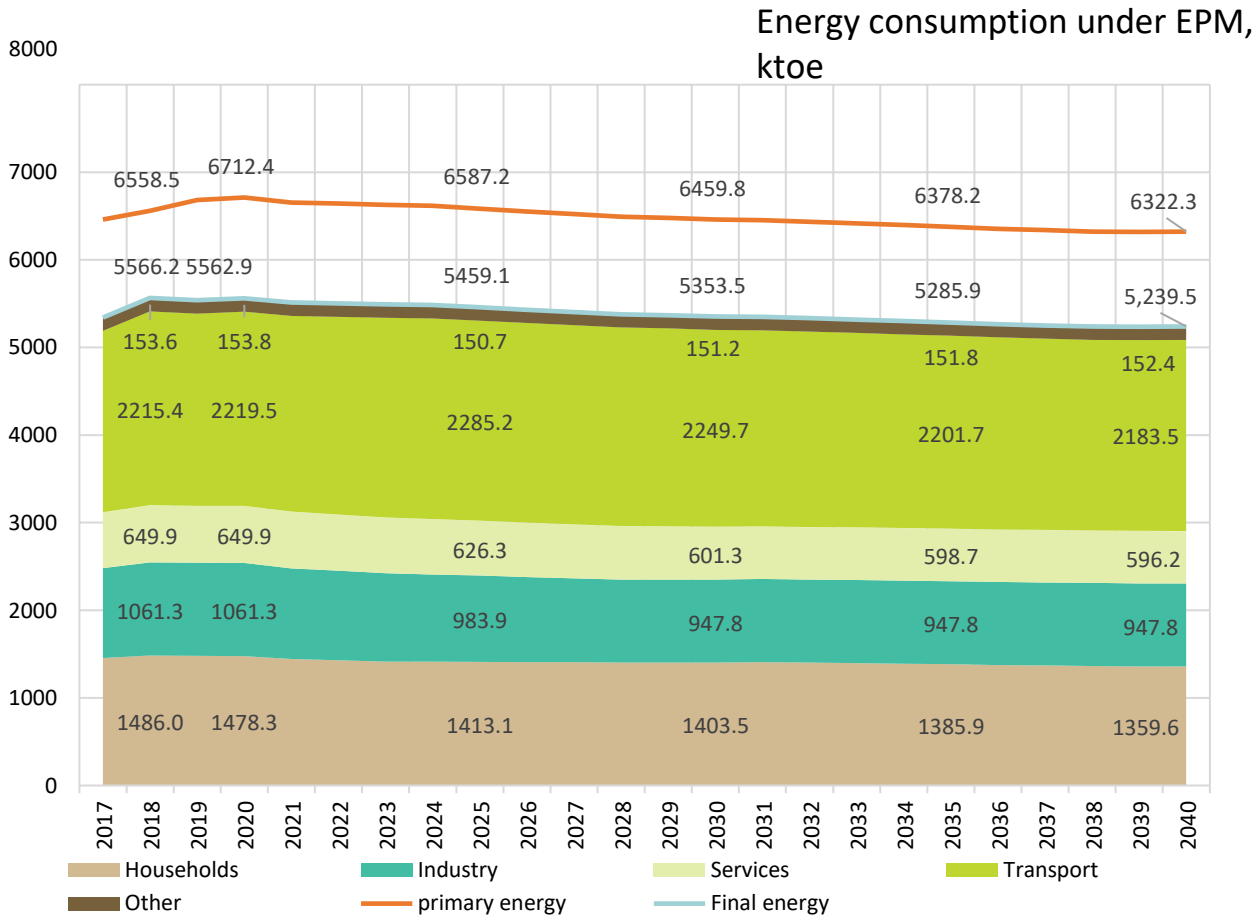


Fig. 4.3.1. Energy consumption in the light of the impact of existing measures (EPM)

Determining primary energy consumption in individual sectors is currently complicated, as more than 70% of Lithuania's electricity consumption is imported from neighbouring countries and its energy mix is unknown, and it is not clear how to estimate waste heat.

Minimum energy performance requirements for buildings are set out in Technical Construction Regulation STR 2.01.02:2016 'Building energy performance planning and certification'. According to the Regulation, the energy performance class of buildings for which the construction permit application was submitted after 1 January 2018, or, when construction permits are not required, the construction works started after 1 January 2018 should be least A+ and, as from 2020, A ++.

The amendment of the Regulation by the Ministry of the Environment in 2019 changed the energy performance requirements for newly constructed buildings as of February 1. The introduction of revised requirements for the standard characteristics of envelopes and engineering systems and minimum cost-optimal calculation data, as well as revised energy performance indicators for specified new buildings in energy performance classes B, A, A+, A++ in residential, public and industrial groups has facilitated the achievement of the building energy classes A, A+ or A++.

The overall fuel consumption in the EPM scenario is shown below (taking RES resources into account).

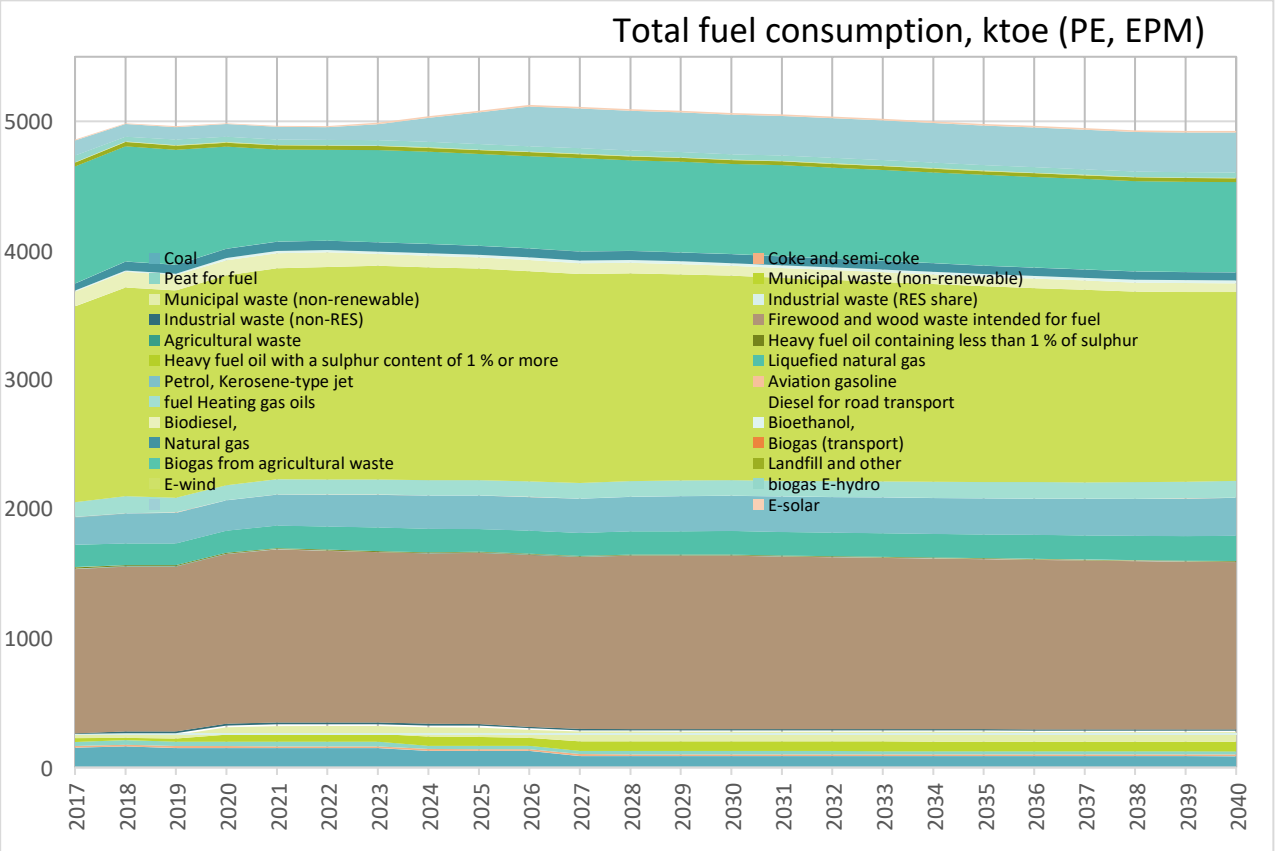


Fig. 4.3.2 Total fuel consumption in the EPM scenario

In the current policy scenario, overall domestic fuel consumption for energy purposes is projected to remain relatively stable. Compared to the actual situation in 2018, overall fuel consumption in the country will increase by 1.6% in 2030, while the projected level of consumption in 2040 slips by 1.2%. It is important to note that in the EPM scenario the modelling assumes that existing policy measures do not provide sufficient economic incentives or regulatory (norms, requirements, rules) system that would lead to a fundamental change in consumer choices for switching from polluting fuels to cleaner or renewable energy sources.

4.4 Dimension Energy security

Table 4.4.1 shows the projected energy mix in Lithuania in 2020, 2030 and 2040. Final consumption of energy types was estimated by subtracting the energy transformed in other plants and energy consumed for non-energy purposes from gross domestic consumption. This means that only the part of energy that is not used as a feedstock for processing was evaluated. The energy mix (final energy) covers more than 80% of all fuels used in Lithuania.

Table 4.1.1. Existing energy mix and projections (EPM)

Fuel type	Consumption, ktoe			% of total consumption		
	2020	2030	2040	2020	2030	2040
Diesel for road transport	1680.9	1590.6	1257.2	24.75	24.04	20.38
Firewood and wood waste intended for fuel	1314.4	1350.5	1305.7	19.35	20.41	21.17
Natural gas	794.7	525.9	496.8	11.70	7.95	8.05
Non-liquefied petroleum gas	353.9	352.2	352.2	5.21	5.32	5.71

Production from chemical prod./ waste	281.0	281.0	281.0	4.14	4.25	4.56
Petrol	259.9	558.9	628.2	3.83	8.45	10.19
Liquefied petroleum gas	159.3	119.2	71.3	2.35	1.80	1.16
Coal	154.6	118.4	117.3	2.28	1.79	1.90
Kerosene type jet fuel	133	133	133	1.96	2.01	2.16
Heating and other gas oils	122.6	90.5	59.3	1.81	1.37	0.96
Wind power	98.4	304.7	304.7	1.45	4.61	4.94
Petroleum coke	94.3	94.8	94.8	1.39	1.43	1.54

Table 4.2.2. Local energy resources (EPM)

Energy resource, ktoe	2020	2030	2040
Primary energy production	2098.3	2365.5	2306.6
RES	*1952.8 (93.1%).*	*2216.5 (93.7%).*	*2159.3 (93.6%).*
Firewood and wood waste intended for fuel	1314.4	1350.5	1305.7
Other installations using energy from chemical processes	301.0	301.0	301.0
Biodiesel - methyl (ethyl) ester	72.8	68.0	53.2
Wind farms	98.4	304.7	304.7
Hydropower plants	42.6	42.6	42.6
Biogas from agricultural waste	20.3	20.3	20.3
Municipal waste (renewable)	49.1	54.1	54.1
Agricultural waste	2.2	2.2	2.2
Industrial waste (renewable)	13.4	13.4	13.4
Bioethanol	8.9	19.2	21.6
Landfill biogas	16.9	16.7	16.6
Solar power plants	5.9	17.1	17.1
Biogas from sewage treatment sludge	6.9	6.7	6.8
Non-renewables	*145.5 (6.9%)*	*149.0 (6.3%)*	*147.3 (6.4%)*
Crude oil	46.2	46.2	46.2
Municipal waste (non-renewable)	50.2	55.2	55.2
Industrial Waste (non-renewable)	13.9	13.9	13.9

Peat for fuel	35.2	33.7	32.0

Nearly all primary energy production in Lithuania comes from RES.

In 2018, the main imported energy sources in the energy mix were crude oil and other primary products for oil refineries (69.7%), natural gas (13.4%), petroleum products (petroleum gas and other petroleum products) (6.6%) and electricity (7.5 percent).

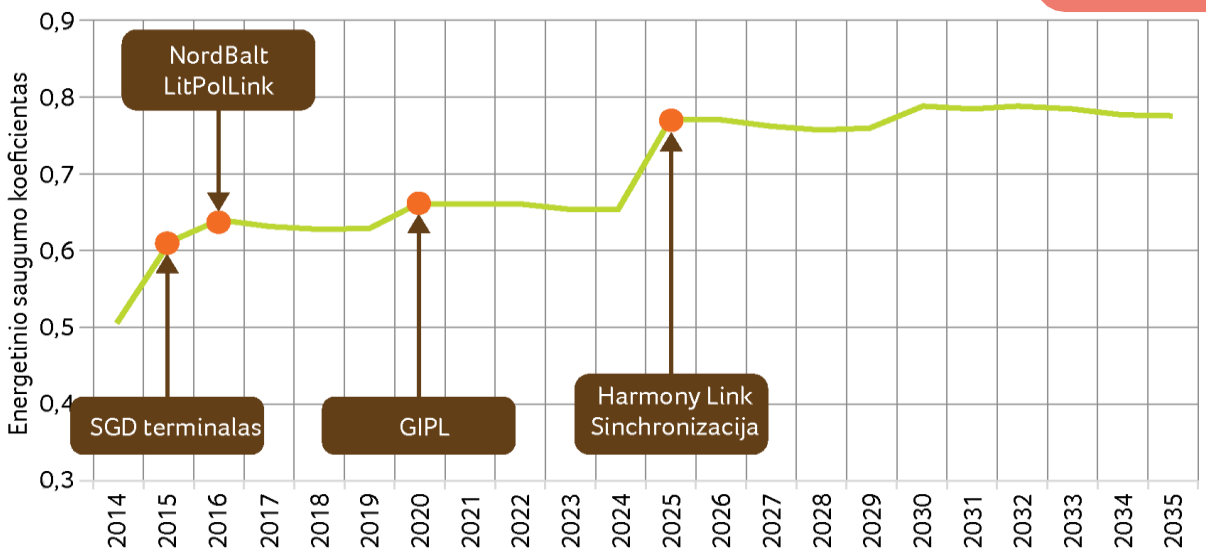
Almost all imports of crude oil and about half of the natural gas imported each year are used for the production of mineral fuels and fertilisers. A sudden increase in the price of crude petroleum and natural gas would have a direct impact on the largest mineral fuel and fertiliser companies, but would not have a significant impact on the Lithuanian energy sector. Due to the LNG terminal and the LitPol Link and NordBalt interconnections, Lithuania's access to energy resources from several different suppliers provides additional opportunities and flexibility to respond to fluctuations in energy prices and reliability of supply.

Energy security coefficient

The energy security analysis uses a methodology to identify and assess energy security in relation to the consequences of disturbance. Resistance to energy system disturbances is expressed by the energy security coefficient. This integral characteristic allows the energy security coefficient of energy systems to be determined both at the moment and over time. The energy security coefficient allows the consequences of disturbance scenarios in energy systems to be assessed from the point of view of energy security. The energy security coefficient depends on the amount of energy not delivered, the increase in energy costs and how long that lasts in each disturbance scenario.

The energy security ratio reflects the level of resilience of energy systems to disturbance. The energy security coefficient is calculated based on the consequences of disturbance (non-delivery of energy and increased energy costs), which indicate system vulnerability. The value of the energy security coefficient varies between 0 and 1. The energy security factor SC is equal to one (maximum) if the energy systems are resistant to disturbances and there is no cost increase or undelivered energy. The energy security coefficient is equal to zero when the energy systems are completely non-resilient to disruption and energy costs increase by more than 100% or 100% of energy is not delivered.[109]

[109] For more detail see the study on energy security in Lithuania by Augutis, J., 'Lietuvos energetikos sektoriaus plėtros tyrimas, 2 dalis Energetinio saugumo analizė', 2015, Lithuanian Energy Institute. Link: http://www.lei.lt/_img/_up/File/atvir/2016/NES/4-Energetinio_saugumo_dalis-2015.11.16.pdf



Key
Energy security coefficient
LNG terminal
NordBalt
LitPolLink
GIPL
Harmony Link Synchronisation

Fig. 4.4.1. Energy security factor

The LNG terminal has had a positive impact on energy security since the start of operations in 2015, with the emergence of an alternative supply of natural gas to the imports of natural gas from a single supplier, a decrease in the price of natural gas and the possibility of ensuring supply of this resource in the event of disruption of imports from Russia. It should be noted that the diversification of energy sources and their supply has a significant impact on energy security, especially if the supply is from a single potential supplier.

2016 saw an improvement in energy security due to the launch of connections with Sweden (NordBalt) and Poland. This is not as big a leap as could be expected from two additional sources of electricity imports, but the same year was marked by loss of installed capacity, namely units 5 and 6 of the Lithuanian Power Plant and temporary shut-down of the Vilnius Third Cogeneration Plant and the Kaunas Cogeneration Plant. Thus, on the one hand, the emergence of electricity interconnections with Sweden and Poland has increased energy security due to electricity imports and the diversification of markets by enabling electricity purchase on a competitive market and import at an affordable price, yet the loss of important generation and reserve capacities has reduced energy security, so that the combination of all these events at an integrated level in the same year has led to a smaller improvement than, for example, the launch of the LNG terminal, because energy security is affected not by one specific component but by a whole range of them.

The gas interconnector Poland-Lithuania (GIPL) is expected to be operational in 2021 (see section 2.4.2 for details on the project). This project has a positive impact on energy security by diversifying gas supply sources and routes and integrating isolated markets of the Baltic States into the single EU gas market. However, there has been no particular improvement in energy security, because from a supply diversification point of view, emergence of a third supplier when two supply alternatives already exist cannot produce the same effect as emergence of a second supply alternative to a single supplier, as was the case in 2015, when the LNG terminal appeared. The GIPL could be considered as a tool for gas export by

exploiting the LNG terminal's potential.

There are plans to transfer the Lithuanian electricity system to synchronous operating mode with the mainland European electricity system from 2025. From the point of view of energy security, for the Baltic States working in synchronous mode with ENTSO-E has a positive effect, as it would completely eliminate certain geopolitical threats, resulting in a quite significant increase in the energy security coefficient, which would be much higher than in previous periods. Since the frequency of the Baltic States' electricity systems is centrally managed and coordinated by a control-room in Moscow, Lithuania, Latvia and Estonia have so far been isolated in the context of energy integration into Europe. The synchronous operation of the Lithuanian electricity system on the Continental European Network (CEN) eliminates a series of threats such as the possibility of „shutting down" the Lithuanian electricity system and leaving consumers completely without electricity for various reasons (for example, aggressive policies of national electricity suppliers against national electricity consumers may even create a risk of military conflict). Disappearance of these threats thanks to synchronisation with CENs in 2025 will have a significant positive impact on the country's energy security. It is noteworthy that in the same year 2025, under all scenarios, a second connection with Poland, Harmony Link, will appear in connection with the synchronous link to CENs. Therefore, it also affects energy security due to increased capacity between Lithuania and Poland.

In the country's energy sector, major projects will have emerged by 2025 raising energy security to an acceptable level (LNG terminal, electricity interconnections with Poland and Sweden, the gas interconnection Poland-Lithuania (GIPL), synchronisation with CENs, development of RES, etc.). From 2025 on, no significant changes are expected in terms energy security because all the strategic projects will have been implemented, as mentioned above. Fluctuations could be expected due to domestic generation[110].

[110] Prepared based on the study on energy security in Lithuania 'Lietuvos energetikos sektoriaus plėtros tyrimas, 2 dalis. Energetinio saugumo analizė, 2015, Lithuanian Energy Institute. Link:
http://www.lei.lt/_img/_up/File/atvir/2016/NES/4-Energetinio_saugumo_dalis-2015.11.16.pdf

4.5 Dimension internal energy market

4.5.1 Electricity interconnectivity

In Lithuania, the level of interconnection of the electricity system already exceeds the EU 2030 target. Since the connectivity objective has been achieved, no measures are foreseen for this purpose. However, taking into account that the Lithuanian electricity system does not work in synchronous mode with CENs, the main objective in the electricity sector is the integration of Lithuania and the Baltic States into CENs in a synchronous mode. This is further described in section 4.5.2.

The maximum capacity in 2030 is estimated at 2389 MW. In this case, the nominal capacity of interconnectors at peak times is expected to be 111% in 2030 and the nominal capacity of interconnectors in terms of installed renewable energy generation capacity is expected to be 91%.

Table 4.5.1.1 shows the estimated installed capacity in 2030 and the available capacity in 2030.

Table 4.5.1.1. Installed capacity projection for 2030[111]

Generation		Installed capacity in MW
Thermal power plants:	**Fuel**	**771**
Lithuanian	Natural gas	445
Vilnius PP3	Natural gas	0
Kaunas	Natural gas	0
Panevėžys	Natural gas	35
Other thermal power plants	Oil, natural gas	291
Pumped storage plant	**Fuel**	**900**
Kruonis PSP	Pumped storage	900
Renewable:		**1278**
Kaunas Hydroelectric PP	Hydro	101
Small HPPs	Hydro	27
Onshore wind farm	Wind	1000
Offshore wind farm	Wind	700
Solar	Solar	180
Biomass		**141**
Vilnius PP2	Biomass	29
Vilnius cogeneration plant (biomass combustion unit)	Biomass	79
Šiauliai PP	Biomass	11
Small biomass	Biomass	22
Biogas:	**Biogas**	**41**
Waste incineration:		**70**
Vilnius cogeneration plant (waste combustion unit)	Waste	22

[111] Source: AB LITGRID.

Klaipėda, Fortum (Lypkiai transformer substation)	Waste	21
Fortum cogeneration plant (Kaunas, Biruliškės transformer substation)	Waste	26
Small waste incineration	Waste	1

Main connections with EU countries in 2030

Table 4.5.2.1. Key interconnections in 2003[112]

Interconnections		Maximum capacity, MW	Market capacity
Nordbalt	HVDC	700	700
Harmony Link	HVDC	700	700
LitPol Link	HVDC	700[113]	0[114]
LV-LT	AC OHL	1,234	950, 800[115]

4.5.2 Energy transmission infrastructure

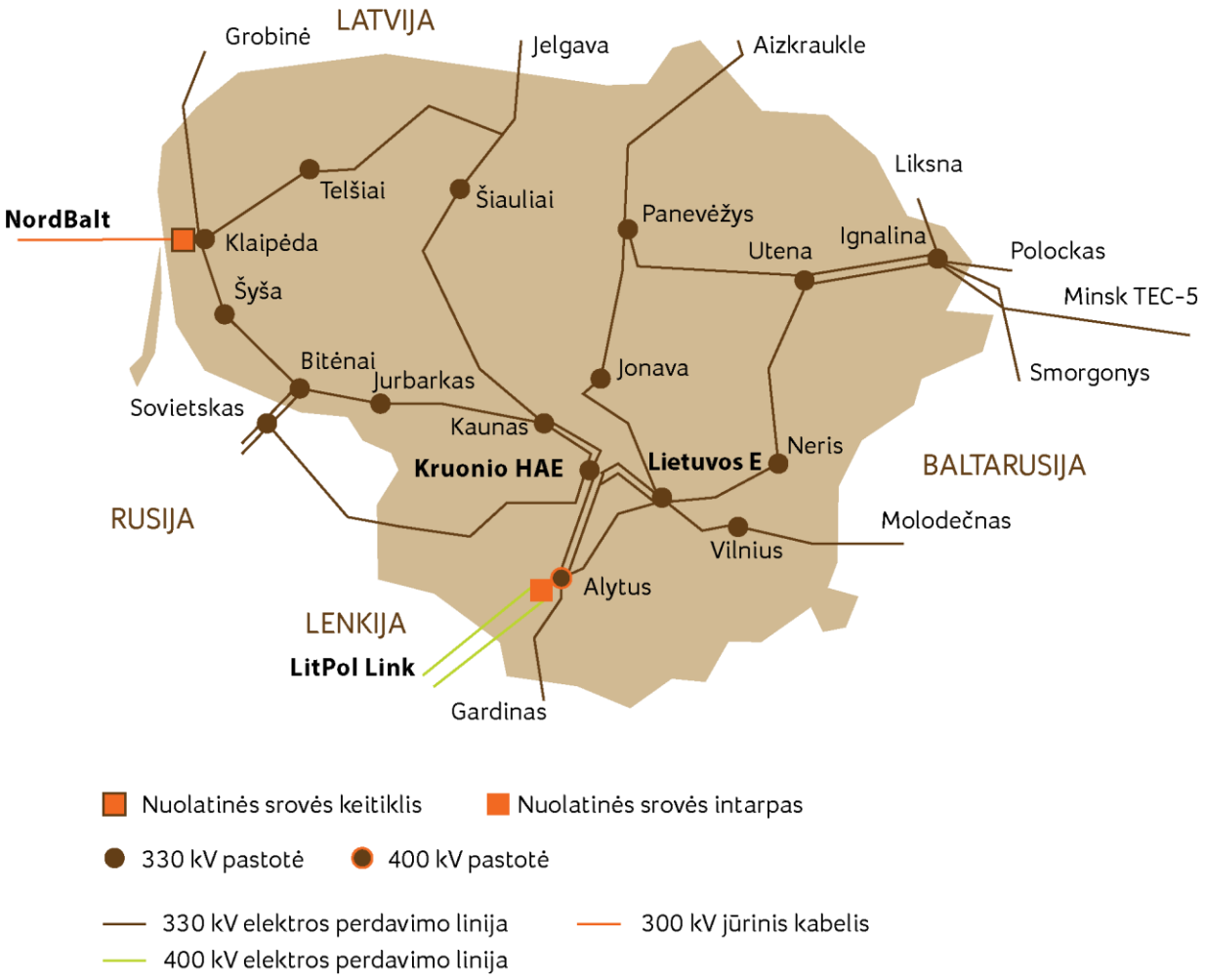
Electricity

The Lithuanian power system is directly connected to five neighbouring power systems (Sweden, Poland, Belarus, Latvia and Russia) by:

- a HVDC connection to the Swedish PS with a capacity from / to the Lithuanian PS of 700 MW ;
- a 400 kV double circuit transmission line to the Polish OS, which runs through a HVDC converter; This converter has a capacity of 500 MW with a section capacity of up to 500 MW to the Lithuanian PS and 500 MW out of the Lithuanian PS;
- four 330 kV and three 110 kV lines connecting to the Latvian PS. The section capacity is 1,500 MW to and 1,200 MW out of the Lithuanian PS;
- five 330 kV and seven 110 kV lines connecting the PS of Belarus. The section capacity is 1,300 MW to and 1,350 MW out of the Lithuanian PS;
- three 330 kV and three 110 kV lines connecting to the Russian (Kaliningrad) PS. The section capacity is 600 MW to and 680 MW out of the Lithuanian PS;

Lithuania has a total of more than 7,200 kilometres of high voltage 110, 330 and 400 kV power transmission lines, including about 400 km of cable lines underground or on the bottom of the Baltic Sea.

[112] Source: AB LITGRID.
[113] It is planned that after synchronisation with CENs the interconnection will be designated to ensure the safety of the electrical system.
[114] It is planned that after synchronisation with CENs the interconnection will be designated to ensure the safety of the electrical system.
[115] From 2025 (after synchronisation with CENs), capacity will vary depending on the direction: 950 MW from Latvia to Lithuania, 800 MW from Lithuania to Latvia.



Key
Grobinė – Grobina
LATVIJA – Latvia
Jelgava –Jelgava
Aizkraukle – Aizkraukle
Liksna – Liksna
Polockas – Polotsk
Minsk – Minsk
Smorgonys – Smorgon
BALTARUSIJA – BELARUS
Molodečnas - Maladzyechna
Gardinas – Grodno
LENKIJA – POLAND
RUSIJA – RUSSIA
Sovietskas – Sovetsk
Kruonio HAE – Kruonis PSP
Lietuvos E – Lithuanian Power Plant
All geographical names in Lithuanian territory – same as in original.
Nuolatinės srovės keitiklis – HVDC converter
Nuolatinės srovės intarpas – HVDC back-to-back station
Pastotė - substation

Fig. 4.5.2.1. Electricity transmission chart and data[116]

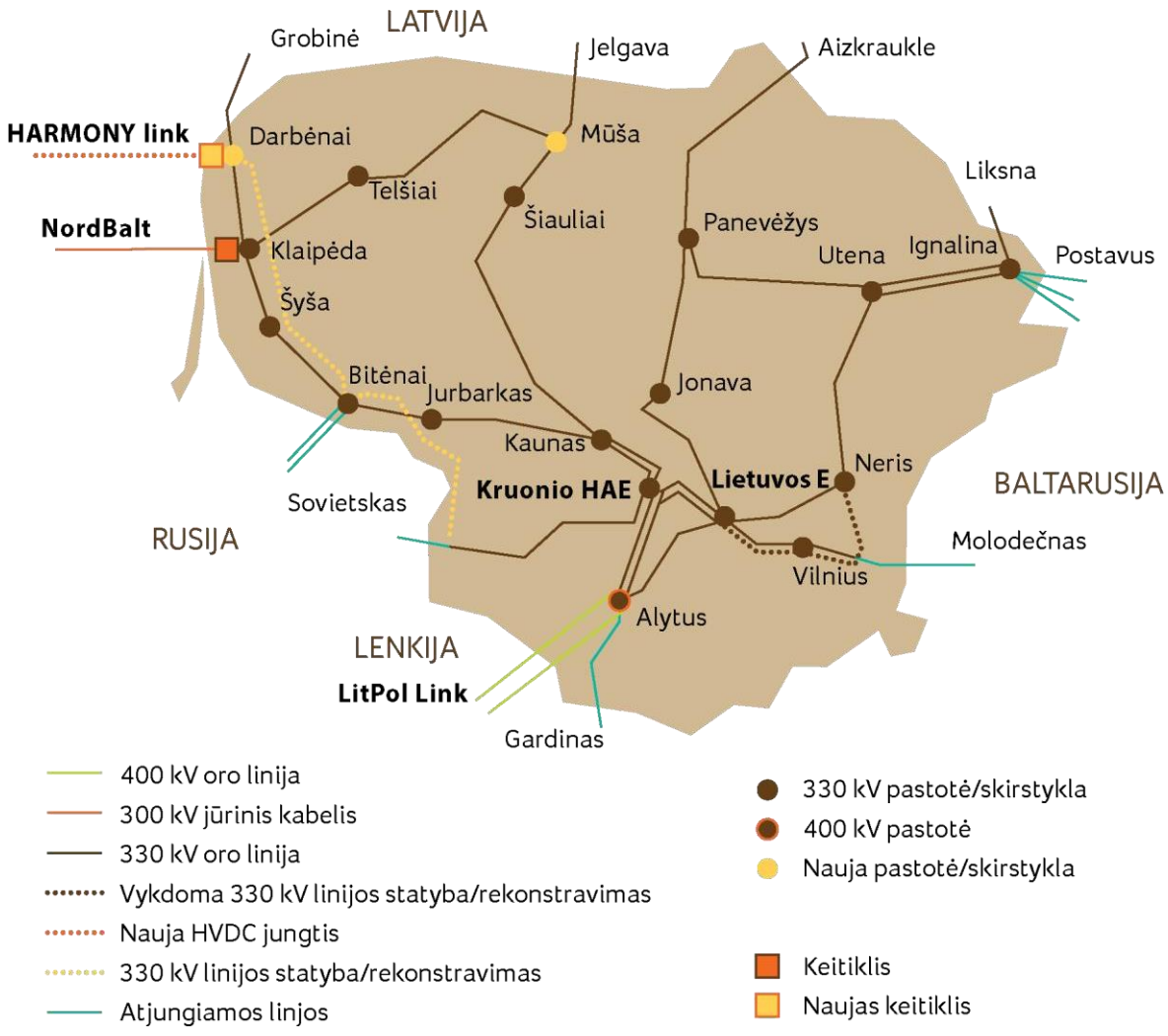
[116] Source: AB LITGRID, https://www.litgrid.eu/index.php/energetikos-sistema/elektros-energetikos-sistemos- informacija/perdavimo-tinklo-schema-ir-duomenys/501

The main objective for the electricity sector is the integration of the Baltic States' (Lithuania, Latvia, Estonia) power system with CENs for synchronous operation and full integration into the Nordic electricity market. The following projects are planned for this purpose:

- conversion of the existing single-circle 330 kV overhead line Lithuanian Power Plant-Vilnius into a double-circle OL is in progress;
- optimisation of the north-east Lithuanian power transmission network (including reconstruction of the 330/100 kV Ignalina NPP and Utena substations and the transportation a controlled bypass reactor to place it in the 330 kV switch yard of the Lithuanian PP) is in progress;
- work to expand LitPol Link is carried out;
- construction of a new 330 kV power transmission line Vilnius-Neris.

In addition to the offshore HVDC cable (the Harmony Link connector, which will include both an offshore cable and an onshore cable and inverter), the new offshore connection to the Polish PS will require:

- building a 330 kV PTL Bitėnai-Kruonis PSP;
- building a 330 kV PTL Darbėnai-Bitėnai;
- building a 330 kV switch yard 'Darbėnai' and connecting a new offshore cable to it;
- building a 330 kV switch yard 'Mūša'.



KEY
Grobinė – Grobina
LATVIJA – Latvia
Jelgava –Jelgava
Aizkraukle – Aizkraukle
Liksna – Liksna
Polockas – Polotsk
Minsk – Minsk
Smorgonys – Smorgon
BALTARUSIJA – BELARUS
Molodečnas - Maladzyechna
Gardinas – Grodno
LENKIJA – POLAND
RUSIJA – RUSSIA
Sovietskas – Sovetsk
Kruonio HAE – Kruonis PSP
Lietuvos E – Lithuanian Power Plant
All geographical names in Lithuanian territory – same as in original.

400 kV oro linija – 400 kV overhead line
300 kV jūrinis kabelis – offshore cable
330 kV oro linija – 300 kV overhead line
Vykdoma 330 kV linijos statyba/rekonstravimas – Ongoing 300 kV line construction/reconstruction
Nauja HVDC jungtis – New HVDC connection
330 kV linijos statyba/rekonstravimas – Construction/reconstruction of a 330 KV line
Atjungiamos linijos – Disconnected lines
330 kV pastotė/skirstykla – 330 kV substation/switch yard
440 kV pastotė - 440 kV substation
Nauja pastotė/skirstykla – New substation/switch yard
Keitiklis – New converter
Naujas keitiklis – New converter

Fig. 4.5.2.2 400–330 kV transmission network in 2028, when the Lithuanian PS will be working synchronously with CENs[117]

Natural gas

The Lithuanian natural gas transmission system is connected to the gas transmission systems of the Republic of Latvia, the Republic of Belarus, the Russian Federation (Kaliningrad region), the Klaipėda LNG terminal and the distribution systems of the operators of the Lithuanian distribution system. The gas transmission system consists of gas transmission pipelines, 2 gas compressor stations, 65 gas distribution stations, 3 metering stations, gas pipeline anti-corrosion protection equipment, data transmission and communication systems and other properties attributed to the transmission system.

The pipelines in operation are 2,115 km in length and 100 to 1,220 mm in diameter. The longest-running gas pipelines were built in 1961. Most of the transmission system has a design pressure of 54 bar.

Depending on the price and contracts, natural gas supply companies choose the source for purchasing natural gas, i.e. they are supplied either from Russia by pipeline across the Lithuanian-Baltic border or via

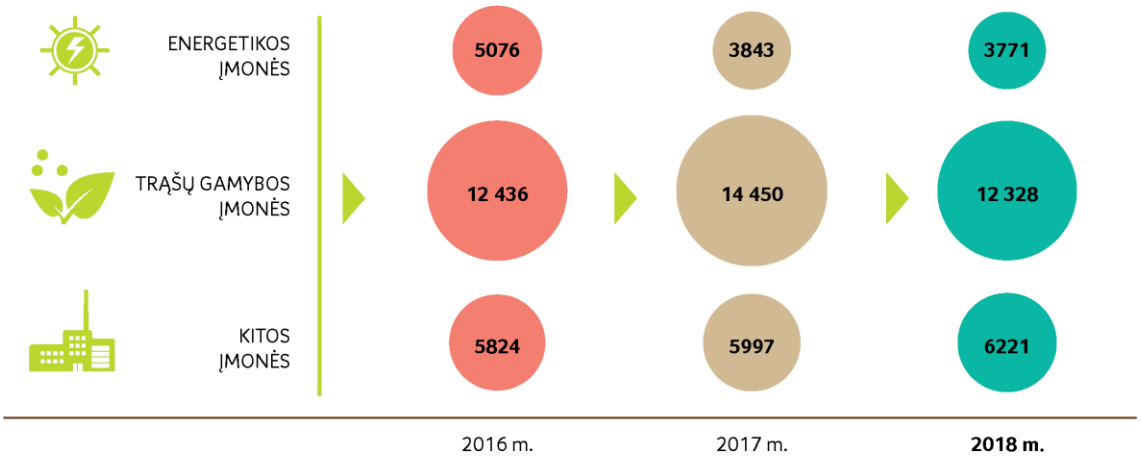
[117] Source: Plan for the development of 400-110 kV networks of the Lithuanian power system in 2019-2028 https://www.litgrid.eu/index.php/tinklo-pletra/lietuvos-elektros-perdavimo-tinklu-10-metu-pletros-planas-/3850

the LNG terminal. Every year since the start of operations of the terminal, the imports have been divided between the said two sources roughly in half.

In 2018, consumers in Lithuania and other Baltic States received 14,351.6 GWh of natural gas from Belarus, 8,830.2 GWh of natural gas from the Klaipėda LNG terminal and 1,842.4 GWh of natural gas from Latvia to Lithuania. 57.3% of the quantity required by those consumers was delivered via the Kotlovka gas metering station from Belarus, 35.3% from the LNG terminal and 7.4% from Latvia via the Kiemėnai GMS.

In 2018, 22,320 GWh of natural gas were transported to the internal outlet for Lithuanian customers. Compared to the year 2017, when 24,290 GWh of natural gas were transmitted, the transmission volumes decreased by 8.1%. 2,308 GWh of natural gas were transferred from the transmission system to Latvia via the Kiemėnai GMS system, which is 11.2% less than in 2017 (2,598.3 GWh).

During the reporting period, 27,832.2 GWh of natural gas were transported to the Kaliningrad region of the Russian Federation (25,663.8 GWh in 2017).

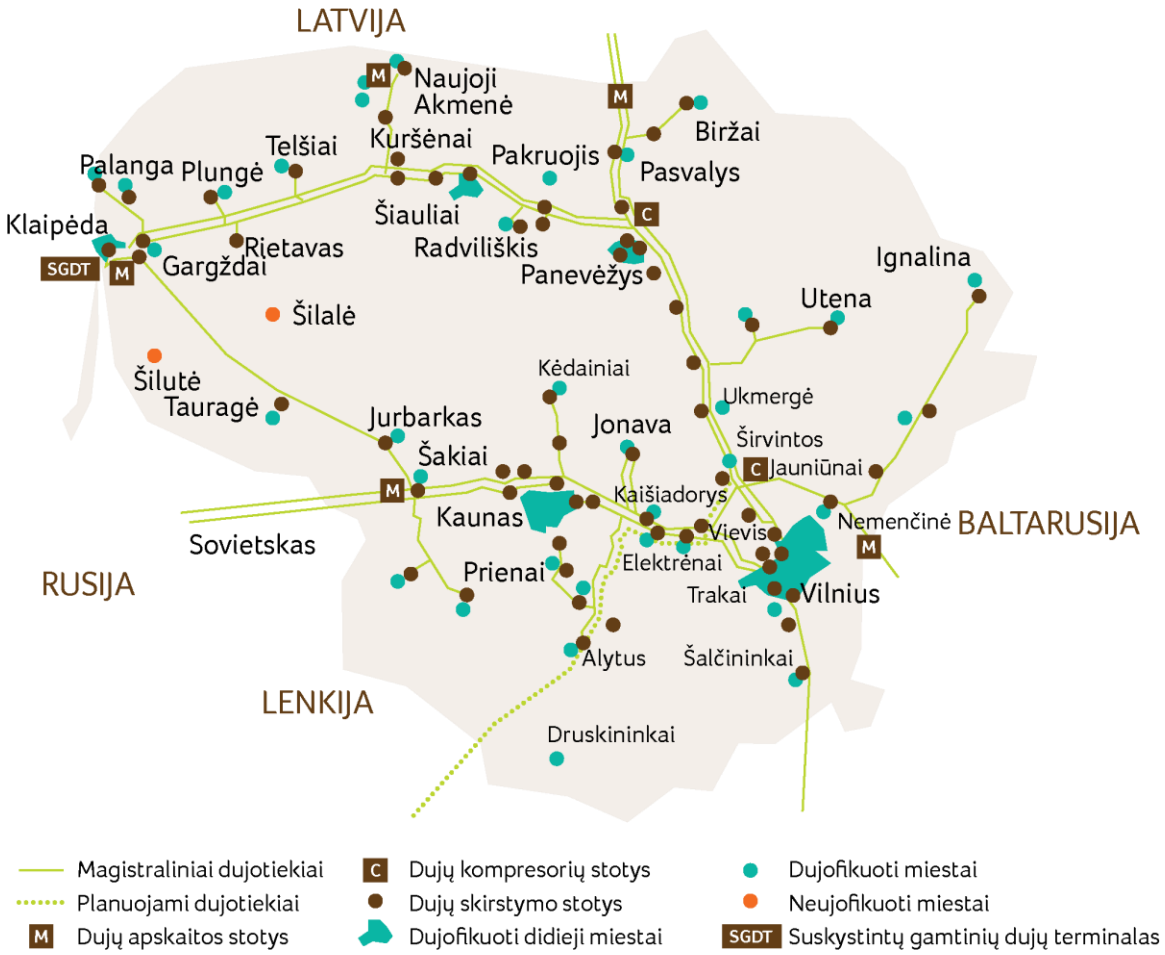


KEY
Energy enterprises
Fertiliser producers
Other enterprises

Fig. 4.5.2.3. Quantities of natural gas transferred by natural gas transmission system users in Lithuania, GWh, 2016–2018. Source: AB Amber Grid Annual Report 2018

Technical capacity of gas pipeline connections to other States' transmission systems and the LNG terminal:

- 325.4 GWh/day at the inlet point through the Kotlovka GMS;
- 122.4 GWh/day at the inlet point via the Klaipėda GMS (at the point of connection of the transmission system to the LNG terminal system);
- 65.1 GWh per day at the inlet point through the Kiemėnai GMS into Lithuania;
- 67.6 GWh per day at the outlet point through the Kiemėnai GMS out of Lithuania;
- 114,2 GWh/day at the outlet point through the Šakiai GMS.



KEY
RUSIJA – RUSSIA
LENKIJA – POLAND
BALTARUSIJA – BELARUS
LATVIJA - LATVIA
Sovietskas – Sovetsk
SGDT – LNGT
All Lithuanian geographical names – as in the original

Magistraliniai dujotiekiai – Main pipelines
Planuojami dujotiekiai – Planned pipelines
Dujų apskaitos stotys – Gas metering stations
Dujų kompresorių stotys – Gas compressor stations
Dujų skirstymo stotys – Gas distribution stations
Dujofikuoti didieji miestai – Cities with gas supply
Dujofikuoti miestai – Towns with gas supply
Nedujofikuoti miestai – Towns without gas supply
Suskystintų gamtinių dujų terminalas – Liquefied natural gas terminal

Fig. 4.5.2.4. Lithuanian natural gas transmission system[118]

The main project envisaged is the gas interconnection Poland-Lithuania (GIPL), described in more detail in section 2.4.2 , which is expected to be implemented by the end of 2021. Also the project for the enhancement of the Latvia-Lithuania interconnection (ELLI), which is also expected to be completed at the

[118] Source: AB Amber Grid, https://www.ambergrid.lt/lt/perdavimo-sistema/Lietuvos-perdavimo-sistema

end of 2021. The project is also described in more detail in section 2.4.2. Other projects of local importance are described in the 10-year network development plan of the natural gas transmission system operator[119]. Basically, the key after 2022 will be to maintain a reliable system, as no new infrastructure projects for diversification or additional gas flows are envisaged.

4.5.3 Electricity and gas markets, energy prices

Electricity

According to the NRA, in 2018 there were 1,621 market players in electricity generation (1,617 in 2017), 1 in transmission, 6 in distribution and 5 in public supply.

From 2017 to 2018, electricity consumption in Lithuania increased by 3.2%, from 12.5 to 12.9 TWh: the amount of electricity supplied to consumers increased by 4.7%, the technological costs of the networks decreased by 10.0%, the amount of electricity needed to charge the Kruonis Pumped Storage Plant (Kruonis PSP) decreased by 12.5%. The installed capacity of power plants edged up by 0.4% in 2018 against 2017, from 3,662.9 to 3,679.2 MW .

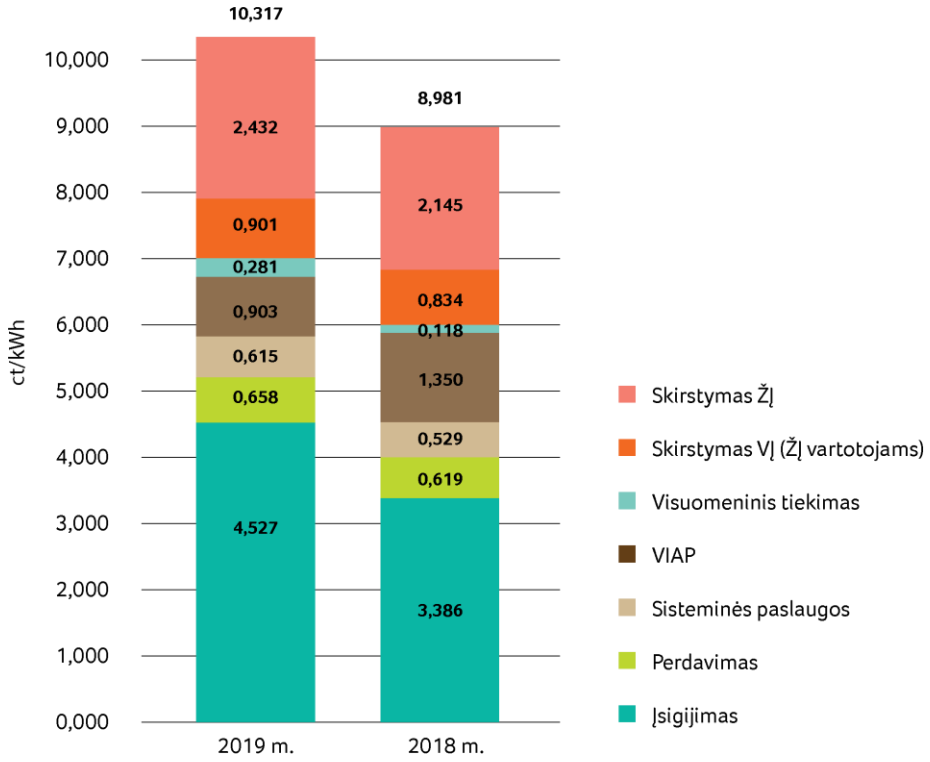
There is one company active in the electricity transmission market, AB LITGRID. In 2018, 11.7 TWh of electricity were supplied to the transmission networks, an increase of 3.9% on 2017. The amount of electricity transferred over transmission networks grew by 3.9% in 2018 compared to 2017, from 10,809.3 to 11,236.2 GWh, while losses in electricity networks and demand for electricity for own use grew by 3.9%, from 421.4 to 437.9 GWh.

At the end of 2018, there were 6 market players in the electricity distribution market: AB Achema, AB Akmenės cementas, AB Lifosa, UAB E Tinklas and UAB Dainavos elektra, which were engaged in distribution activities in their corporate territories, and AB Energijos skirstymo operatorius carrying out distribution activities in the rest of the Lithuanian territory. In 2018 compared to 2017, electricity received into the distribution grids grew by 4.0%, from 9.9 to 10.3 TWh. The amount of electricity distributed to customers connected to the medium voltage (MV) network grew by 3.8%, from 2.87 to 2.98 TWh, while the amount distributed to customers connected to the low voltage (LV) network rose by 3.9%, from 6.40 to 6.65 TWh. Technological losses and own needs in distribution networks grew by 0.7% in 2018 compared to 2017, from 614.7 to 618.8 GWh.

As of February 2019, there were 365 participants on the Nord Pool power exchange, 21 of which were legal entities registered in Lithuania. In 2018 compared to 2017, electricity exchange sales grew by 57.7%, from 3 637.7 to 5 737.1 GWh.

Figure 4.5.3.1 shows the components of an average electricity price.

[119] https://www.ambergrid.lt/lt/perdavimo-sistema/perdavimo-sistemos-pletra/perdavimo-sistemos-pletros-planas



KEY

Skirstymas ŽĮ – LV distribution

Skirstymas VĮ (ŽĮ vartotojams) - MV distribution (to LV consumers)

Visuomeninis tiekimas - Public supply

VIAP - SPI

Sisteminės paslaugos – System services

Perdavimas – Transmission

Įsigijimas - Acquisition

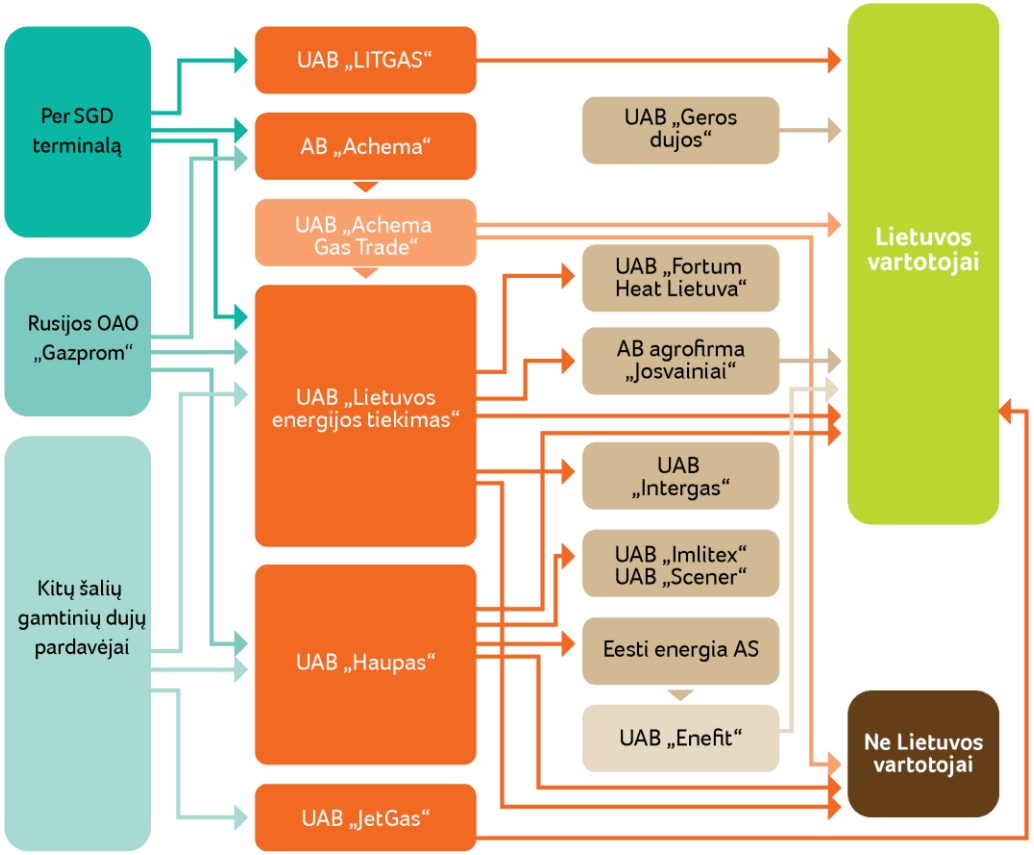
Fig. 4.5.3.1. Average electricity prices in 2018 and 2019, ct/kWh (excl. VAT)[120]

The forecast of developments in the electricity market of Lithuania, including prices, with the existing policies and measures at least until 2040 (incl. 2030), has not been assessed.

Gas

In the natural gas sector, the NRA regulated 44 entities in 2018. Transmission, distribution, storage, LNG regasification, supply and market operator activities are subject to licences or authorisations. At the end of 2018, the licences issued by VERT were held by: the natural gas TSO AB Amber Grid, AB Energijos skirstymo operatorius, AB Achema, UAB Intergas, UAB Fortum Heat Lietuva, the natural gas DSO AB Agrofirma Josvainiai, the LNG regasification company AB Klaipėdos nafta, and the natural gas market operator UAB GET Baltic. 33 companies were licensed to supply natural gas, of which 15 were active. In 2018, VERT issued 9 natural gas supply authorisations, revoked 2 natural gas supply authorisations and suspended 2 natural gas supply authorisations.

Natural gas consumption decreased in Lithuania in 2018, while natural gas transit flows to Russia grew. In 2018, imports of natural gas amounted to 23,451 GWh, which is about 14% less than in 2017 (27,374 GWh). 50,152 GWh of natural gas (0.4% more than in 2017) were transported and 13,894 GWh delivered over the transmission system in 2018. In 2018, consumption in Lithuania amounted to 22 320 GWh, which is 8.13% less than in 2017.



[120] https://www.regula.lt/Puslapiai/naujienos/2018-metai/2018-lapkritis/2018-11-30/komisija-patvirtino-2019-m-elektros- energijos-tarifus-buitiniams-vartotojams.aspx

KEY

Via LNG terminal Russia's OAO Gazprom Other countries' natural gas sellers	UAB LITGAS AB Achema UAB Achema Gas Trade UAB Lietuvos energijos tiekimas UAB Haupas UAB JetGas	UAB Geros dujos UAB Fortum Heat Lietuva AB agrofirma Josvainiai UAB Intergas UAB Imlitex UAB Scener Eesti energia AS UAB Enefit	Lithuanian consumers Non-Lithuanian consumers

Fig. 4.5.3.2. Lithuanian natural gas market structure in 2018[121]

In the natural gas sector, the number of household and non-household customers has been steadily increasing since 2010: In 2018, there were 595,000 natural gas consumers in Lithuania, including 587,600 household and 7,400 non-household consumers. In 2017, there were 575,300 household and 7,200 non-household consumers.

The weighted average import price (EUR/MWh) of natural gas imported into the Lithuanian natural gas supply market is publicly available, and its calculation includes all the quantities of natural gas imported into the Republic of Lithuania and the costs of purchasing natural gas, except for the quantities of natural gas imported by AB Achema and UAB Kaunas Cogeneration Plant and the costs of purchasing natural gas for own consumption as well as the quantities and costs of natural gas supplied from storage facilities located in the Member States of the European Union.

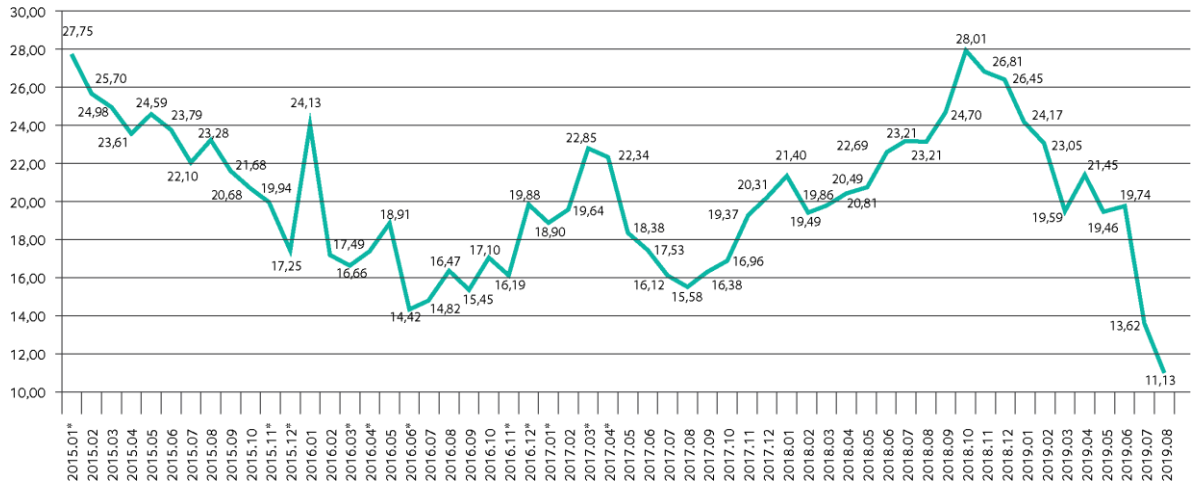


Fig. 4.5.3.3. Weighted average import price of natural gas supplied to the Lithuanian market, EUR/MWh[122]

The forecast of developments in the natural gas market, including prices, was not assessed in Lithuania at least until 2040 (including 2030) under existing policies and measures.

Heat and cooling

In 2018, 18,223 of the 27,833 buildings supplied by district heating systems were multi-apartment buildings (about 701,000 apartments), which accounted for around 72% of the total heat sales. The remaining consumers are budgetary institutions (14%) and business organisations (14%).

[121] https://www.regula.lt/dujos/Puslapiai/duju-rinkos-apzvalga/rinkos-stebesena.aspx

[122] http://www.regula.lt/dujos/Puslapiai/duju-kainos/importo-kainos.aspx

49 State-licensed heat supply enterprises were operating in Lithuania, supplying 8.98 TWh of heat to the networks. There were 17 unregulated and 27 regulated IHPs in the DH production market, which sold 30.8% of the total heat supplied to the grid in 2018.

At the end of 2018, installations with condensing economisers operated by heat supply companies and independent heat producers (IHP) had a total thermal capacity of nearly 1,600 MW. Of these, approximately 600 MW were installed in IHP boilers and power plants.

In 2018, the maximum heat demand of central heat supply systems was 3,128 MW and the minimum was 388 MW.

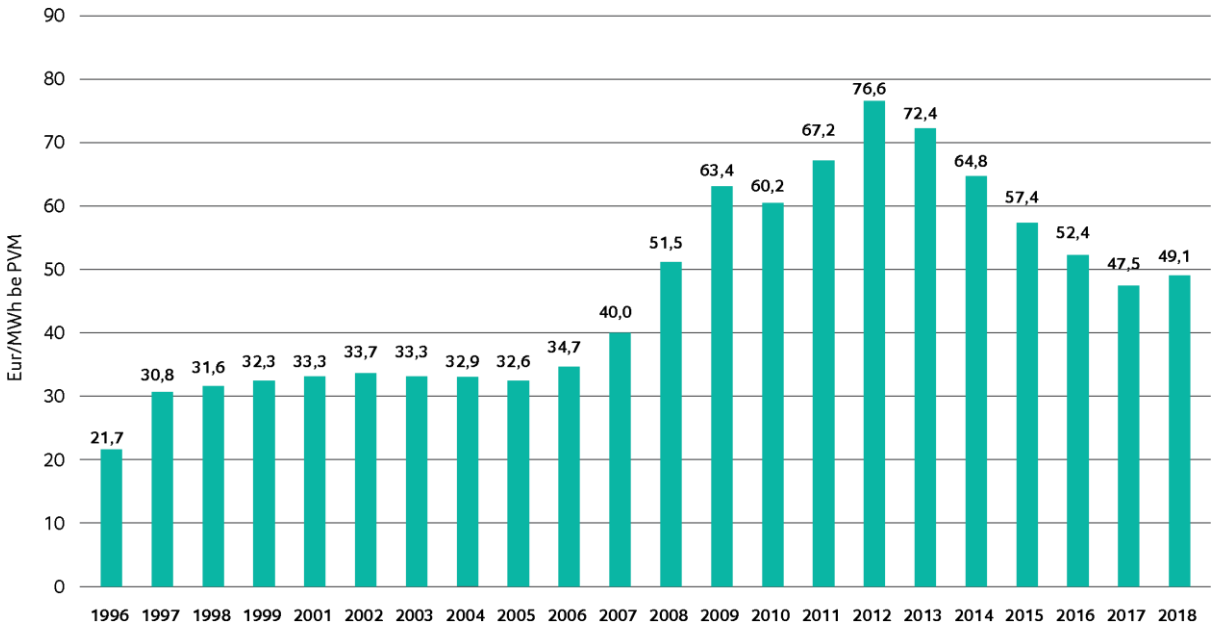


Fig. 4.5.3.4. Changes in the average price of heat in district heating (excl. VAT) in Lithuania[123]

Private households not connected to central heat supply consume on average around 700,000 toe of fuels per year for heat production. This is almost the same amount of fuel as that consumed in 2018 by DH companies and independent heat producers (810,000 toe).

Firewood and wood waste dominated the fuel mix of heat production in households in 2018, accounting for 72%, while natural gas accounted for 15% and solid fuels (coal, peat and briquettes) for 8% of all fuels. About 88%of all fuel is used for space heating and hot water and 12 percent for cooking.

The forecast of developments in the heat and cooling market of Lithuania, including prices, with the existing policies and measures at least until 2040 (incl. 2030), has not been assessed.

4.6 Dimension Research, innovation and competitiveness

Current situation in the low-carbon technology sector

Biomass

[123] https://lsta.lt/wp-content/uploads/2019/10/LSTA_apzvalga_2018.pdf

The biomass energy industry in Lithuania is growing rapidly, with an increasing number of companies entering the production of advanced biofuel technologies. In Lithuania, the profiles of companies producing biofuel technologies are very diverse. Companies, in cooperation with scientists, are constantly improving their equipment, which is why the manufacturers of unique, modern technologies are setting up in Lithuania. Lithuania may have an industrial niche in the production of biomass combustion equipment. This would contribute to the European Commission's roadmap 2050 to make Europe a producer and consumer of green energy and the world leader in innovative green energy technologies.

Companies operating in Lithuania design and manufacture biofuel pellet presses, technology lines for the production of biofuel pellets, biofuel boilers, condensing economizers, furnaces, straw and hay choppers and sawdust briquettes presses and build cogeneration plants, and one of the companies was the first to manufacture and install a steam boiler in Lithuania.

Baltpool, the Lithuanian biofuel exchange, became operational in 2012. 362 members from Lithuania, Latvia and Estonia are trading on it currently. In 2018, the Baltpool model ensures the competitiveness of the biofuels market and a consistent quality of biofuels.

Solar energy

Lithuania has big renewable energy development ambitions and has made significant progress in this area. Companies operating in Lithuania produce and export highly innovative solar modules to foreign markets.

The potential of Lithuanian scientific and educational institutions and businesses in the solar energy field is relatively high. The institutions carry out fundamental and contract-based research in collaboration with Lithuanian and foreign companies and research institutions; highly qualified specialists are being trained. Research related to solar energy, optimisation of combustion processes, energy efficient materials, efficient lighting, industrial biotechnologies, biofuel production, hydrogen technologies and other relevant studies are carried out in Lithuania.

Clustering

Lithuania is developing clusters to stimulate innovation. In addition to Biopower Plants Development Cluster (development of modern, innovative biofuel equipment and technologies for efficient use of biomass) and the Photovoltaic Technology Cluster (development of environmental energy technologies), a number of new ones have been set up. These include the Smart Green City Cluster (promoting the use of new technologies for environmentally friendly solutions), the Cleantech Cluster Lithuania and the Circular Economy Cluster.

The growing number of clusters demonstrates that Lithuanian businesses are becoming more environmentally responsible and understand the benefits of eco-innovation. These clusters are also a sound foundation for the future of Lithuanian circular economy as they already base their operations on energy efficiency and effective use of resources.

Research, technologies and innovation policies

The Ministry of Education, Science and Sport formulates the country's policy on higher education and science. Higher education and RDI are closely linked to all areas of national development. The Government-approved National Programme for the Development of Higher Education, Research and Experimental (Social, Cultural) Development 2013–2020 aims to promote the harmonious development of humans and society, strengthening the country's competitiveness and enabling innovation through the development of higher education and RDI. High quality research contributes to solutions to global challenges as well as

climate change, encourages the involvement of Lithuanian researchers in Horizon 2020 and other international scientific programmes and integration into international RDI infrastructures such as the European Organization for Nuclear Research (CERN).

The Ministry of Economy and Innovation is responsible for the formulation of the technology and innovation policy. The innovation objectives of the various economic sectors (energy systems, industry, transport, agriculture) are included in the overall framework of the innovation policy. Lithuania's innovation policy is currently implemented in the framework of the Lithuanian progress strategy Lithuania 2030, the National Progress Programme 2014-2020 based on the said progress strategy, and the Programme of the Government of the Republic of Lithuania. In addition, different aspects of innovation policy are covered by the Lithuanian Innovation Development Programme 2014–2020. The aim of this programme is to create a legal model to strengthen the innovation potential of the business sector, as well as to develop more effective policies and innovative public sectors, and to stimulate joint activities between business, science and education institutions. One of the measures laid down in the implementation plan of the programme is intended to support eco-friendly, energy efficient and green RDI activities to produce and sell high added-value products. In addition, areas related to energy and sustainable environment are also supported through pre-commercial procurement aimed at developing innovative products in this area.

Horizon 2020

The Lithuanian Energy Institute (LEI) carries out fundamental and applied research and development work in the field of energy at international level for Lithuanian and foreign institutions of science, government and municipalities, and trains the most qualified researchers for research work the field of energy.

The Institute employs 130 energy scientists/researchers and has 11 research laboratories. The Institute has carried out 16 projects under Horizon 2020, with a further 7 projects now under negotiation. Horizon 2020 has provided EUR 1.9 million in funding to the Institute.

European Innovation Scoreboard

In the European Innovation Scoreboard 2019, Lithuania belongs to the group of moderate innovators and ranks 21st in the EU. However, the European Innovation Scoreboard 2019 shows that Lithuania's innovation ecosystem is improving. For several consecutive years Lithuania has maintained a leading position in the EU in terms of long-term progress in the innovation ecosystem: From 2011 to 2018, Lithuania’s Summary Innovation Index increased by 25.7%. This is the best result for the EU. Lithuania's strengths include an innovation-friendly environment, innovation-friendly small and medium-sized enterprises, science-to-business relations and the number of higher education graduates. Lithuania scored the lowest points in the attractiveness of the research system, employment in the knowledge-intensive sector, and intellectual property indicators.

National funding of RDI

In 2018, EUR 396.8 million was allocated to RDI activities in Lithuania. Expenditure on RDI increased by EUR 17.9 million, or 4.7%, compared to 2017. The ratio of RDI expenditure to gross domestic product (GDP) was 0.88% in 2018 (0.90% in 2017). According to the sources of funding, the largest share of RDI expenditure, 34.8%, came from the state budget, 35.5% from business enterprises, 28.1% from foreign funds, and 3.6% from higher education and non-profit institutions.

Number of researchers: 1,588 researchers worked in the technological science area in 2017, calculated on the basis of full-time equivalent (2017).

Number of patents: the Lithuanian Energy Institute mentioned in section 3.5. and the present section has been granted a total of 15 patents, most of them in the field of hydrogen use.

Price elements

In Lithuania, public price caps are set annually, taking into account the approved price caps for services and the electricity purchase price calculated by the public supplier (see Figure 4.6.1). According to Article 43 (2) of the Law on Electricity, from 1 January 2013 onwards, only household consumers and socially vulnerable consumers or groups thereof may purchase electricity at public tariffs.

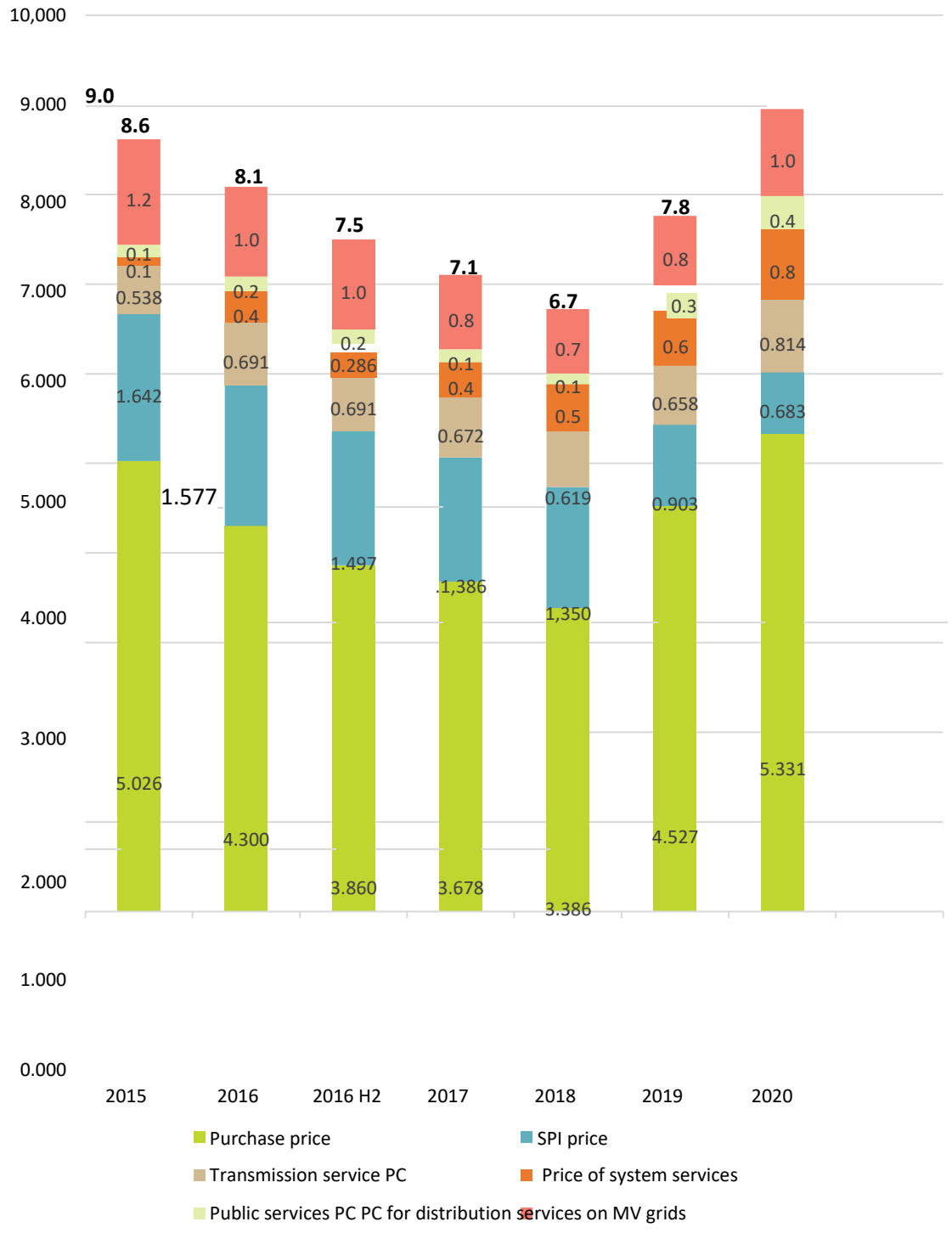


Fig. 4.6.1. Public electricity price caps for household customers purchasing electricity from medium-voltage grids in 2015-2020 (ct/kWh excluding VAT)

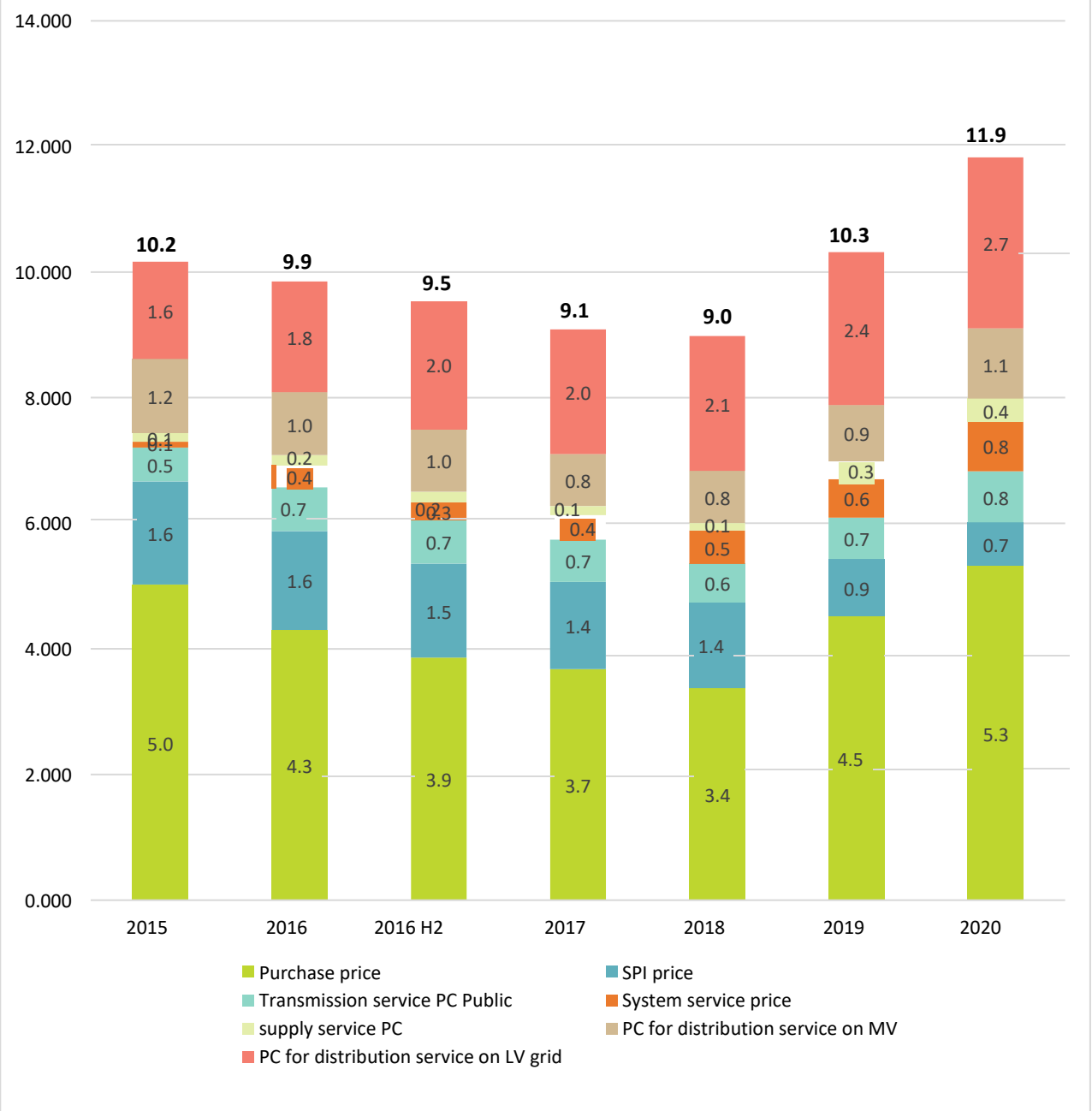


Fig. 4.6.2. Public electricity price caps for household customers buying electricity from low-voltage grids in 2015-2020 (ct/kWh excluding VAT)

Table 4.6.1. Price caps for electricity transmission and distribution services in 2012–2017 (ct/kWh)[124]

Name of regulated service	Provider of regulated service	Price cap for regulated service (ct/kWh)					
		2012	2013	2014	2015	2016	2017

[124]National Commission for Energy Control and Prices – http://www.regula.lt/SiteAssets/newu-materiaga/2017/2017-augustutis/Annual%20Report%20for%20EC%20on%20Lithuanian%20gas%20and%20electricity%20markets_NCC_2017.pdf [Accessed on 26/10/2018].

Power transmission	TSO LITGRID	0.672	0.699	0.639	0.538	0.691	0.672
Power distribution via medium voltage grids	DSO ESO	1.413	1.375	1.297	1.178	1.000	0.830
Power distribution via low voltage grids	DSO ESO	1.856	1.801	1.785	1.550	1.766	1.655

The Agency for the Cooperation of Energy Regulators (ACER) has been analysing the fragmented standard offers of existing gas undertakings available to household customers in EU capitals for several consecutive years.
Similar to the 2017 market monitoring report, the 2018 analysis is based on 11,000 kWh/year consumption[125].

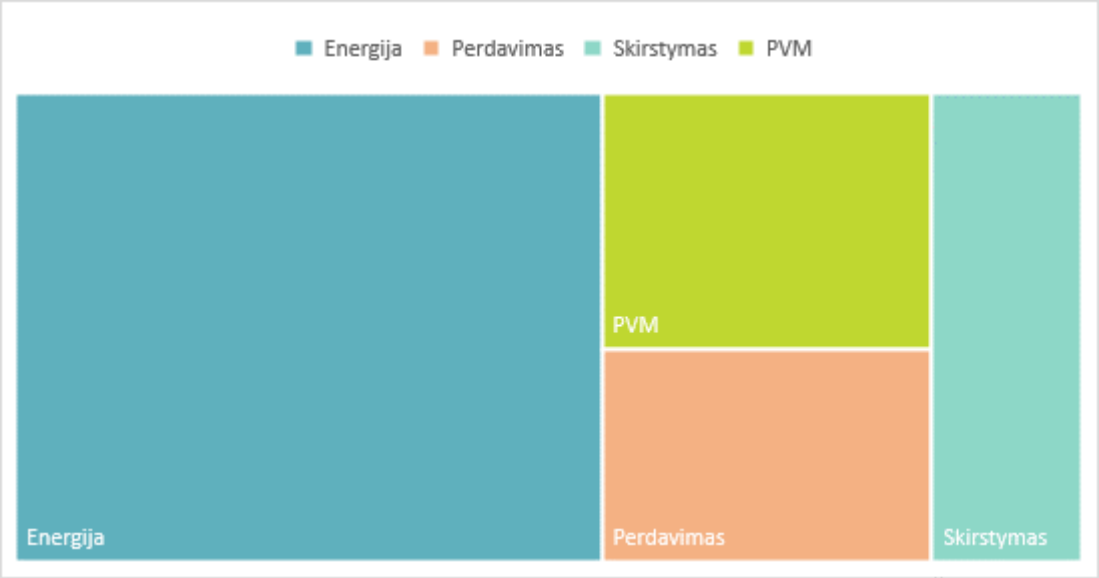


Fig. 4.6.3 The final price of natural gas for households in Lithuania is EUR 452/MWh (2018)

KEY
Energija – Energy
Perdavimas – Transmission
Skirstymas – Distribution
PVM - VAT

Description of energy subsidies, including for fossil fuels

In October 2019, the following tax concessions for fossil fuels were applicable in Lithuania:

1. a reduced rate of excise duty applies to gas oils intended for use in agricultural activities, including aquaculture or commercial fishing in inland waters, for entities engaged in the production of agricultural products (EUR 56 per 1,000 litres of product, within the limits of the quantities of gas

125 https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202018%20-%20Electricity%20and%20Gas%20Retail%20Markets%20Volume.pdf

oils set by the Government per year, while the standard rate of excise duty for gas oils is EUR 347 per 1,000 litres of product).

2. The reduced rate of excise duty applies to gas oils for heating purposes (domestic heating fuel), lubricating oils and liquid fuels (heavy fuel oil) which do not comply with the characteristics set by the Government or an institution authorised by it (EUR 21.14 per 1,000 litres of product, while the standard rate of excise duty is EUR 347 per 1,000 litres of product).
3. Natural gas is subject to an excise duty rate of EUR 23.06 per MWh of product. Natural gas used as motor fuel is exempt from excise duty.
4. Natural gas used as heating fuel is subject to an excise duty rate of EUR 1.08 per MWh of product, while a reduced excise duty rate of EUR 0.54 per MWh is applicable to natural gas for business use.
5. Excise duty exemptions apply to natural gas used for combined heat and power production; gas supplied to household natural gas customers as defined in the Law on Natural Gas, as well as to persons having the status of beneficiaries under the Law on Charity and Support; gas used for technological purposes in natural gas transmission and distribution networks and in the processes of liquefaction of natural gas and re-gasification of liquefied natural gas.
6. Excise duty exemptions apply to energy products used in all forms of electricity generation, also those used for purposes other than motor fuel, heating fuel or engine fuel additives.
7. Excise duty exemptions apply to petroleum gas and gaseous hydrocarbons in household gas cylinders and in bulk which are supplied (used) for household use (petroleum gas and gaseous hydrocarbons are subject to an excise duty rate of EUR 304.10 per tonne of product).
8. Exemption from excise duty applies to aircraft fuel supplied for air navigation purposes (including aircraft fuel for aircraft manufacturing, repair, testing, operation and maintenance), with the exception of aircraft fuel supplied to aircraft for personal use. The exemption also applies to marine fuels supplied for the purpose of navigation in European Union waters (including fishing), with the exception of marine fuels supplied to vessels for personal use.[126]
9. The rate of excise duty on coal used for business purposes is EUR 3.77 per tonne of the product and on coal used for other purposes it is EUR 7.53 per tonne of the product. Coke and lignite used for business purposes are subject to a EUR 4.63 excise duty per tonne of product and those used for other purposes are subject to the rate of EUR 8.98 per tonne.
10. A reduced VAT rate (9%) applies to the supply of heat for the purposes of heating dwellings, to the supply of hot water to dwellings or to the supply of cold water and thermal energy to prepare hot water.[127]

As regards direct grants, it should be stressed that all existing support schemes for projects of strategic importance for Lithuania and the region in ensuring energy security have been approved by the European Commission. They currently include the fixed annual operating costs of the LNG terminal[128], its infrastructure and the interconnector, which are not included in any other prices regulated by the State, and the LNG terminal's reasonable costs for the supply of the necessary quantity are included in the additional component of security of natural gas supply in the price of natural gas transmission.[129]

[126] Lithuanian Law on Excise,https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.154511/asr

[127] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.163423/asr?positionInSearchResults=0&searchModelUUID=053a0ef4-3537-4d4b-ba37- 81e0d3e8fdd4

[128] Lithuanian Law on the Liquefied Natural Gas Terminal, https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.427221/asr?positionInSearchResults=4&searchModelUUID=48884f0c-894d-4f31-9989- d6a5d881996f

[129] VERT Resolution setting the additional component of security of natural gas supply in the natural gas transmission price for 2019 https://e-seimas.lrs.lt/portal/legalAct/en/TAD/c393fca0ef5e11e89d4ad92e8434e309/cjXMwGknaq?jfwid=14shvk5iij

KEY
SECTION B: ANALYTICAL BASIS

B SKIRSNIS: ANALITINIS PAGRINDAS

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES[130]

[130] Planned policies and measures are options under discussion and having a realistic chance of being adopted and implemented after the date of submission of the national plan. The resulting projections under paragraph i of section 5.1. therefore include not only the implemented and adopted policies and measures (projections with existing policies and measures), but also planned policies and measures.

5.1 Impacts of planned policies and measures on the energy system and GHG emissions

This Chapter describes the scenario for the implementation of the planned policies and measures (PPM): the impact of the planned policies and measures on the achievement of the GHG emission reduction targets, the increased use of RES and energy efficiency. It also describes the financing needs and possible sources of financing required for the implementation of the planned policies and the impact on macroeconomics, social dimension and regional cooperation.

5.1.1 GHG emissions and removals

In accordance with Regulation (EU) 2018/842 of the European Parliament and of the Council[131], obligations are laid down for Member States with respect to their minimum contributions for the period from 2021 to 2030 to fulfilling the target for the non-ETS sectors. Lithuania will have to reduce GHG emissions in sectors outside the EU ETS (energy, transport, industry, agriculture, waste) by 9% compared to 2005. In order to achieve this target, Lithuania has foreseen a number of additional measures, which are described in detail in section 3.1.1.

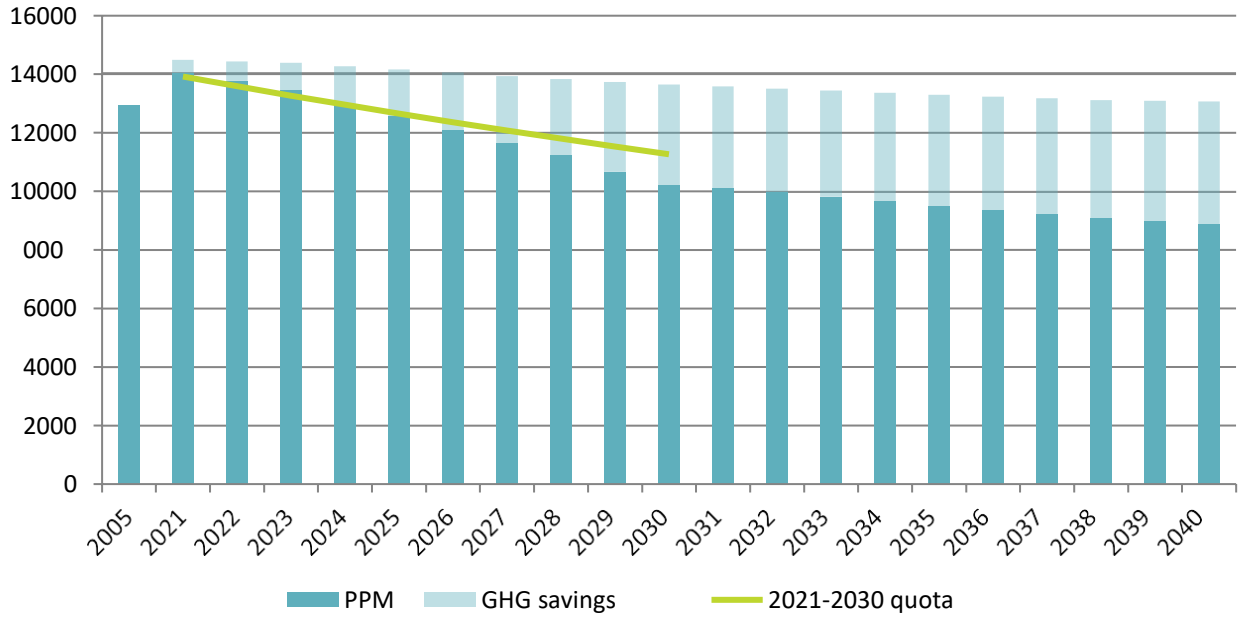


Fig. 5.1.1.1. Projected GHG savings in non-ETS sectors (PPM)

Additional policies and measures in sectors outside the EU ETS will reduce GHG emissions by 25% in 2030, compared to the EPM scenario. GHG emissions will be reduced by 13% in the 2021-2030 period and by 29% in the 2031-2040 period, compared to the EPM scenario. In the transport sector, the planned policies and measures will have the greatest impact on GHG reductions compared to other sectors. The transport sector will reduce GHG emissions by 21% in the 2021-2030 period and by 47% in the 2031-2040 period, compared to the EPM scenario. In other sectors, GHG reductions will be more moderate: 4% to 8% in 2021-2030 and 12% to 29% in 2031–2040.

[131] https://eur-lex.europa.eu/legal-content/LT/TXT/?uri=CELEX%3A32018R0842

Table 5.1.1.1. GHG emissions in 2005, 2017 and projected GHG emissions in the 2020-2040 period (with planned policies and measures)

Greenhouse gas emissions	**2005**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
	kt CO_2 eq						
CO_2 emissions excluding CO_2 from LULUCF	14192	13628	14207	12420	10551	10048	9624
CO_2 emissions excluding CO_2 from LULUCF	10328	8142	12301	11791	10917	11208	10958
CH_4 emissions excluding CH_4 from LULUCF	3910	3285	3040	2721	2477	2347	2236
CH_4 emissions excluding CH_4 from LULUCF	3911	3285	3040	2721	2478	2348	2236
N_2O emissions excluding N_2O from LULUCF	4773	3074	3155	2980	2708	2662	2622
N_2O emissions including N_2O from LULUCF	4909	3263	3323	3148	2877	2831	2791
HFCs	89	711	569	341	176	108	67
PFCs	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Unspecified mix of HFCs and PFCs	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SF_6	1.7	8	8	8	8	8	8
NF_3	N/A	0.01	0.12	0.12	0.12	0.12	0.12
Total GHG emissions (excluding LULUCF)	22966	20706	20979	18470	15921	15174	14558
Total GHG emissions (including LULUCF)	19238	15409	19242	18009	16456	16502	16060
Greenhouse gas emissions by category	**2005**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
	kt CO_2 eq						
1. Energy (except the transport sector)	8934	5778	5632	4895	4606	4577	4544
2. Transport	4230	5821	6161	5168	3655	3159	2748
3. Industrial processes and product use	4108	3638	3929	3619	3376	3308	3266
4. Agriculture	4207	4403	4399	4126	3756	3718	3681
5. Land use, land use change and forestry	-3728	-5296	-4663	-4114	-3936	-4003	-4385
6. Waste	1487	1065	857	662	528	411	318
Greenhouse gas emissions in sectors covered by the ETS and non-ETS sectors	**2005**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
	kt CO_2 eq						
EU ETS (from stationary installations)	10 044	6290	6687	6103	5877	5833	5800
EU ETS (from domestic aviation)	2	1	1.9	2	2	2.1	2.2
EU ETS (total GHG emissions)	10046	6291	6689	6105	5879	5835	5802

Non-ETS excluding LULUCF	12920	14595	14504	12556	10211	9476	8871
Greenhouse gas emissions from the LULUCF sector pursuant to EU Regulation 2018/841 UNFCCC			**2021–2025**		**2026–2040**		
	kt CO_2 eq						
GHG emission inventoried in LULUCF (credits if negative): EU/LULUCF (2021-2030)	N/A		-31316		-27737		
Greenhouse gas emissions in individual energy subcategories	**2005**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
	kt CO_2 eq						
1. Energy	13164	11599	11793	10063	8261	7736	7292
A. Fuel combustion	12788	11074	11263	9537	7711	7185	6742
1. Energy production	5656	2573	2355	1863	1753	1751	1748
2. Industry and construction	1492	1185	1230	1178	1104	1088	1072
3. Transport	4230	5795	6161	5168	3655	3159	2748
4. Other sectors	1397	1495	1491	1302	1173	1163	1148
5. Military aviation	12	26	26	26	26	26	26
B. Unintended fuel releases	377	525	530	527	551	551	550
1. Solid fuels	N/A	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other GHG emissions in energy production	377	525	530	527	551	551	550

However, it should be noted that, in accordance with Regulation (EU) 2018/842, verifications of GHG emissions will be carried out each year and it is therefore essential that the annual emissions do not exceed the allocation. Based on the projections of GHG emissions in non-ETS sectors, GHG emissions will be higher than the projected annual emission allocations in the 2021-2024 period and GHG emissions are forecast to be lower than provided allocations as from 2025.

The sectors of the Lithuanian economy and factors determining changes in GHG emissions are described below.

Energy (without transport)

The planned policies and measures in the energy sector will focus on the development of RES and the improvement of energy efficiency and of the energy market. Under this scenario, electrification processes in transport accelerate the growth of electricity consumption.

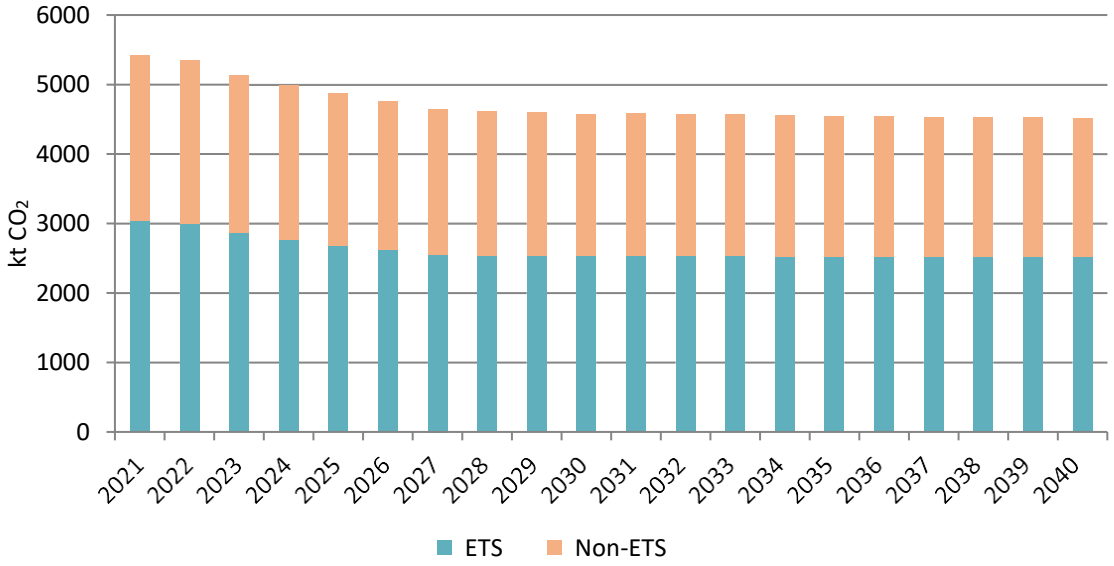


Fig.5.1.1.3. Projected GHG emissions in the energy sector with additional measures

The list of measures and the cumulative GHG reduction effect for the 2021-2030 period with the planned policies and measures are provided in Chapter 3 'Policies and measures'.

The planned additional measures will help reduce GHG emissions in the energy sector by 20% by 2030 compared to 2017.

Compared to 2005, with the planned policies and measures GHG emissions in the energy sector are projected to decrease by 49% in 2030 and remain roughly at the 2030 level in 2040.

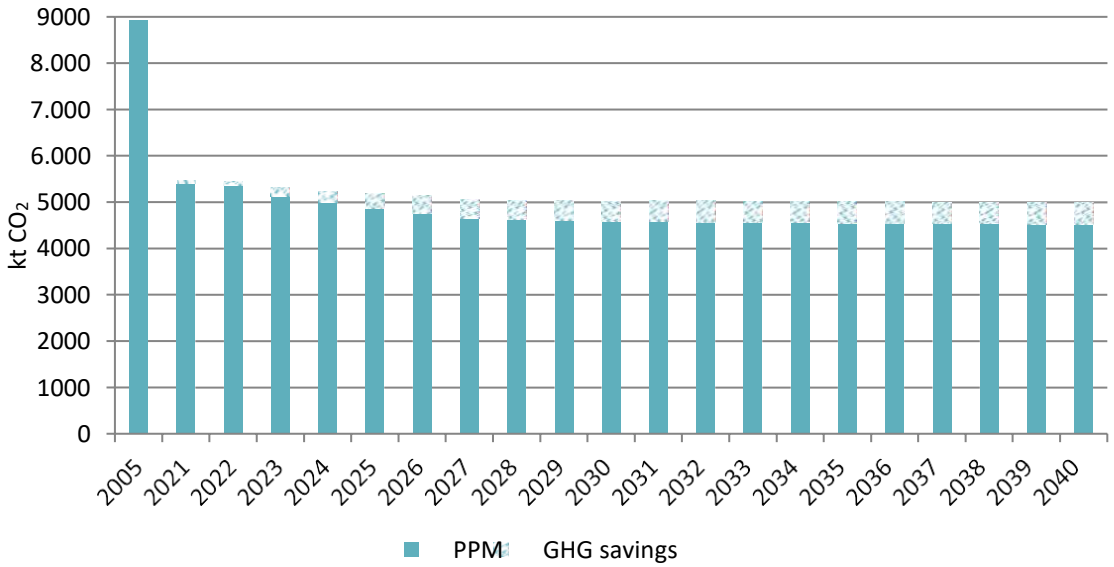


Fig. 5.1.1.4 Projected GHG savings in the energy sector with additional measures

Transport

The planned policies and measures in the transport sector will focus on promoting the use of electric cars and other low-emission vehicles, on car pollution taxes and the efficiency of passenger and freight transport (public and combined transport, habit building). Measures related to car pollution taxes (T21 and T22) will have the greatest impact on reducing GHG emissions.

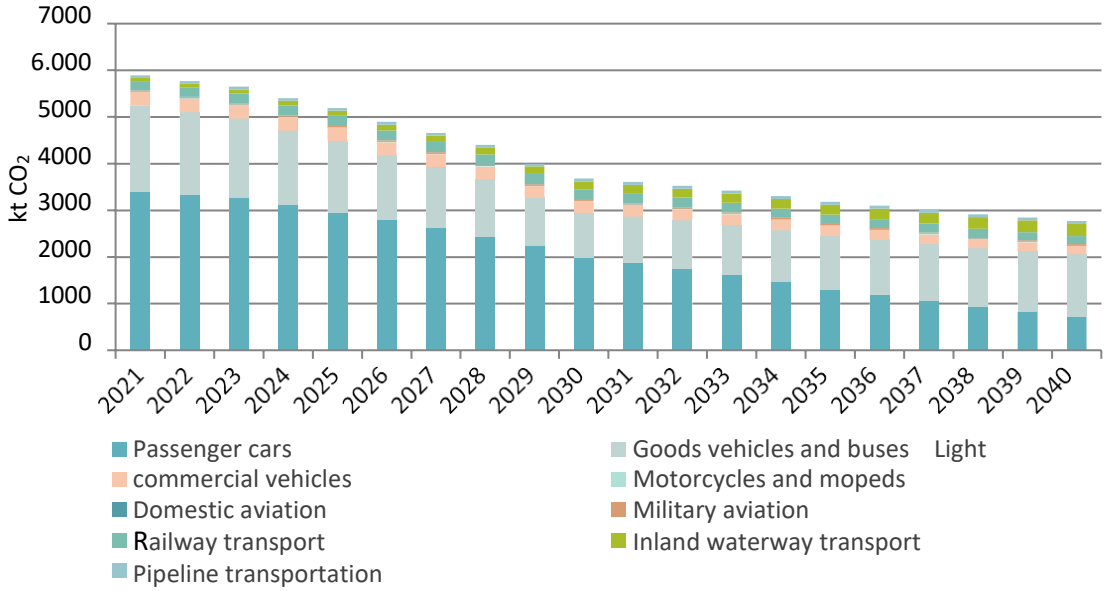


Fig. 5.1.1.5. Projected GHG emissions in the transport sector with additional measures

The list of measures and the cumulative GHG reduction effect for the 2021-2030 period with the planned policies and measures in the transport sector are provided in Chapter 3 'Policies and measures'.

The planned additional measures will help reduce GHG emissions in the transport sector by 40% by 2030 compared to the EPM scenario. With the planned policies and measures, GHG emissions from the transport sector are projected to decrease by 12% in 2030 and by 34% in 2040 compared to 2005.

The effect of the planned additional measures will increase gradually, so by 2024, GHG emissions will be higher than their allocations, but in the subsequent years, when the effect increases in the transport sector as well, the set target is planned to be met.

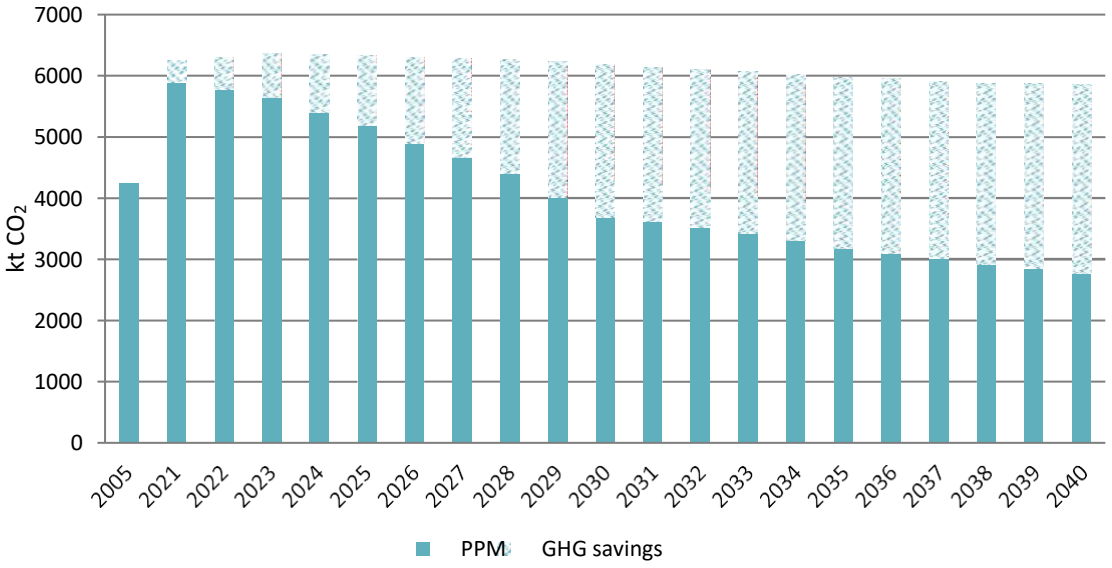


Fig. 5.1.1.6. Projected GHG emissions in the transport sector with additional measures

Industrial processes and product use

The planned policies and measures in the ETS industrial sector, which covers the chemical industry and most mineral industries, will focus on promoting the replacement of polluting technologies with cleaner ones, and in the non-ETS sector they will focus on reducing the use of fluorinated greenhouse gases in businesses, deploying and promoting technological eco-innovation and promoting traditional industrial transformation.

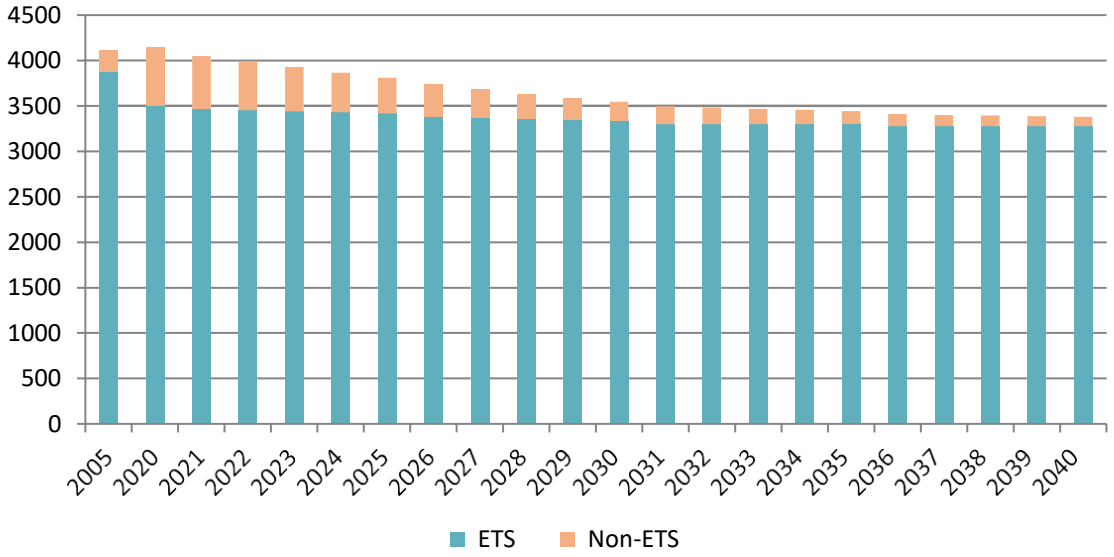


Fig. 5.1.1.7. Projected GHG emissions in the industry sector with additional measures

The list of measures and the cumulative GHG reduction effect for the 2021-2030 period with planned policies and
measures n the industry sector are provided in Chapter 3 ‘Policies and measures’.

The planned additional measures in the industry sector will reduce GHG emissions by 999 kt CO_2 eq from 2021 to 2030, and by 1,803 kt CO_2 eq from 2031 to 2040.

With the planned policies and measures, GHG emissions from the industry sector should decrease by 18% in 2030 and by 20% in 2040 compared to 2005.

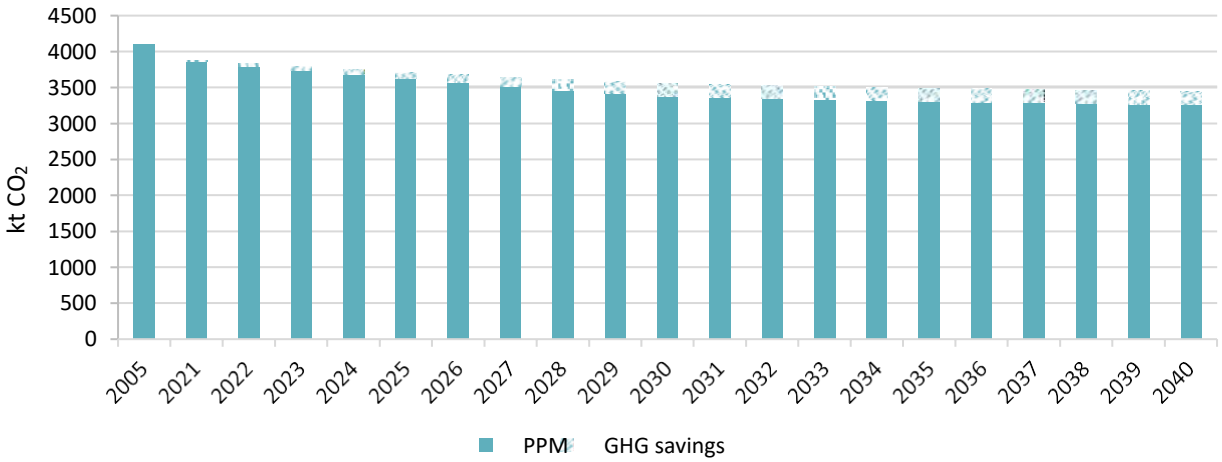


Fig. 5.1.1.8. Projected GHG savings in the industry sector with additional measures

Agriculture

The planned policies and measures in the agricultural sector will focus on promoting environment-friendly and sustainable farming practices, maintaining and improving the agrochemical qualities of soil, and investment support for the introduction of climate friendly farming practices on livestock farms.

The list of measures and the cumulative GHG reduction effect for the 2021-2030 period with the planned policies and measures in the agricultural sector are provided in Chapter 3 'Policies and measures'.

Most of the planned additional measures in the agricultural sector will be aimed at reducing the use of mineral N fertilizers, and considerable attention will also be paid to the promotion of biogas production and the management of the resulting manure using more environmentally friendly methods. Figure 5.1.1.9. shows the GHG emissions from the use of mineral N fertilizers and the GHG savings due to the planned additional measures.

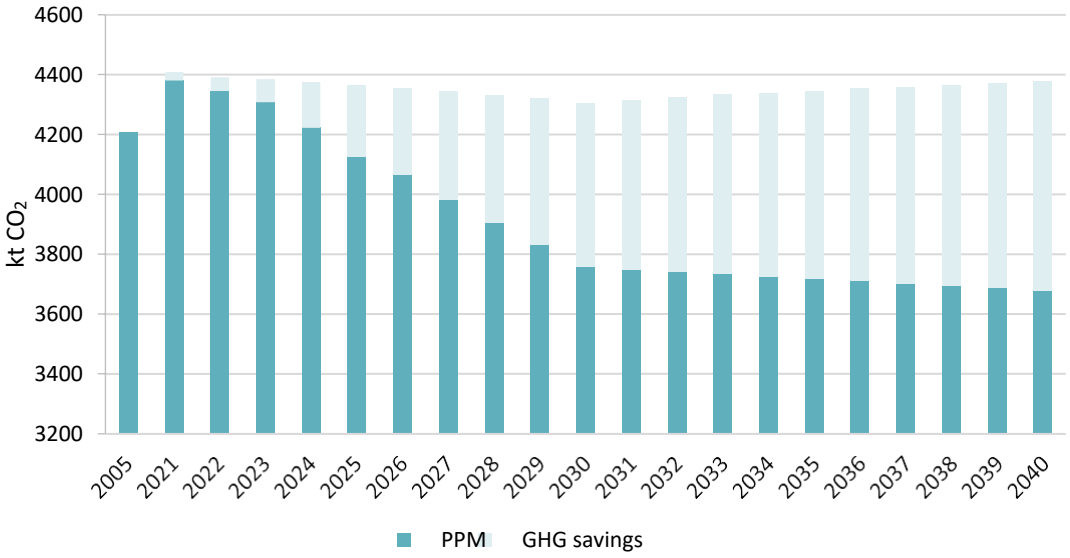


Fig. 5.1.1.9. Projected GHG emissions in the agricultural sector with additional measures

Compared to 2005, the total GHG emissions from the agricultural sector are projected to decrease by 11% in 2030 and by 12% in 2040 due to the planned additional measures.

Land use, land use change and forestry (LULUCF)

The planned policies and measures in the LULUCF sector will focus on increasing GHG absorption by perennial crop biomass through afforestation, shrub restructuring, reforestation (replanting rather than leaving for spontaneous regeneration), and promoting perennial crop production on agricultural land. Also, major attention will be paid to the preservation of permanent grasslands and restoration of wetlands.

The list of measures and the cumulative GHG reduction effect for the 2021-2030 period with the planned policies and measures in the LULUCF sector are provided in Chapter 3 'Policies and measures'.

The projected GHG emissions and removals in the LULUCF sector with additional measures were prepared on the basis of the projected GHG emissions and removals with the existing policies and measures, as described in Chapter 4 'Current situation and projections with existing policies and measures', plus the

assessed impact of planned policies and measures. The impact of the planned policies and measures has been assessed in relation to the estimated area of land use category impacted by the measure and the GHG inventory methods used in the National GHG Inventory Report for the different categories where GHG are generated or absorbed (in live biomass, dead organic matter and soil).

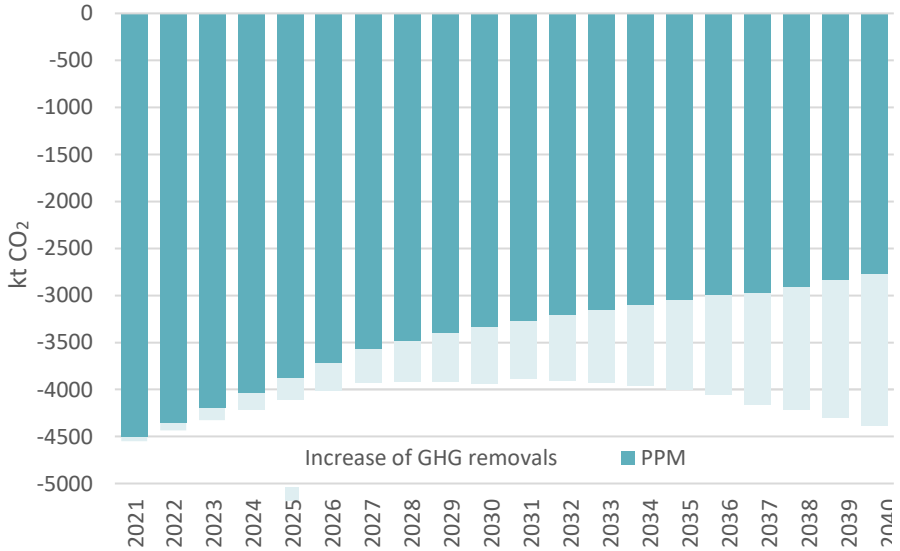


Fig. 5.1.1.10 Projected GHG emissions from LULUCF with additional measures

The planned additional measures will increase GHG removals by 18% in 2030 and by 58% in 2040 compared to the current measures. Compared to 2005, a significant increase in GHG absorption is projected in 2030 and 2040 with the planned policies and measures: 6% and 18%, respectively.

In accordance with the commitment under Regulation (EU) No 2018/841, the annual difference in GHG emissions and removals in the LULUCF sector (by applying the special accounting rules provided for in this Regulation) has to be negative, i.e. the sector has to generate more removals than emissions or at least the cumulative quantity of GHG removals and emissions has to be equal to zero. The cumulative quantity of GHG emissions and removals is accounted for by deducting the fixed reference levels from GHG removals or emissions calculated in the categories of annually managed forest land, managed cropland and managed grassland in the period from 2021 to 2030 and adding the quantity of GHG removals or emissions from afforested and deforested land. The reference level for managed forest land is the projected GHG removals or emissions from forests, based on forest use tendencies between 2000 and 2009 and the structure of stand age classes for that period. The established indicative reference level of managed forest land (GHG removals of 2,722 kt CO_2 eq / year) will be updated following the review by the European Commission according to the comments received. Reference levels for managed cropland and managed grassland and pastures are the average of GHG emissions/removals between 2005 and 2009. The indicative calculated reference level for managed cropland reaches 3,768 kt of GHG emissions of CO_2 eq/year, and the reference level for managed grassland and pastures is 970 kt of GHG removals of CO_2 eq/year.

The quantity of GHG removals and emissions from the LULUCF sector by individual land use category, applying the accounting rules provided for in Regulation (EU) No 2018/841, is presented in Figure 5.1.1.8.

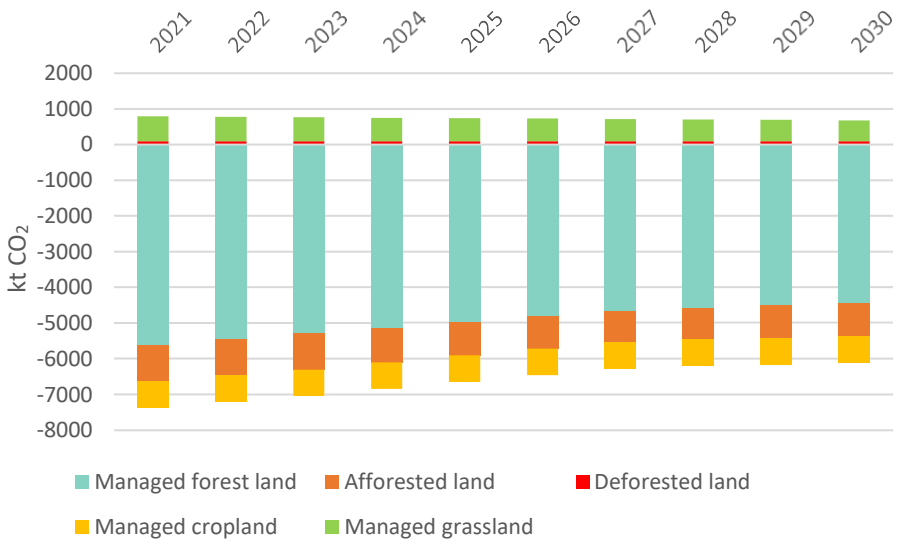


Fig. 5.1.1.11. Projected quantity of GHG emissions and removals in the LULUCF sector by accounting category under Regulation (EC) No 2018/841

Taking account of the accounting rules under Regulation (EU) No 2018/841, to calculate GHG removals and emissions from the LULUCF sector, Lithuania's LULUCF sector is projected to generate a total of -6,263 kt CO_2 eq of GHG removals each year in the period from 2021 to 2025, part of which can be used to meet the GHG emission reduction commitments by the sectors outside the EU emission trading scheme. From 2026 to 2030 (during the second commitment period under Regulation (EU) No 2018/841), Lithuania's LULUCF sector is projected to generate a total of -5,548 kt CO_2 eq of GHG removals each year, part of which can be used to meet the GHG emission reduction commitments by part of the sectors outside the EU emission trading scheme.

As Figure 5.1.1.8 shows, notwithstanding the application of the reference level, after deducting the reference level from the total annual GHG removals from forest land, this category still generates the highest GHG removal that can be used to meet the GHG emission reduction commitments of sectors outside the EU emission trading scheme.

Waste

The planned policies and measures will focus on the prevention of food waste generation and the promotion of waste sorting and reuse. The planned measures focus on educating and informing the public about the problem of food waste and how to prevent it, improving waste sorting skills, creating information websites, applications and interactive maps. All planned measures will reduce the amounts of landfill waste, which will gradually reduce GHG emissions.

The list of measures and the cumulative GHG reduction effect for the 2021-2030 period with the planned policies and measures in the waste sector are provided in Chapter 3 'Policies and measures'.

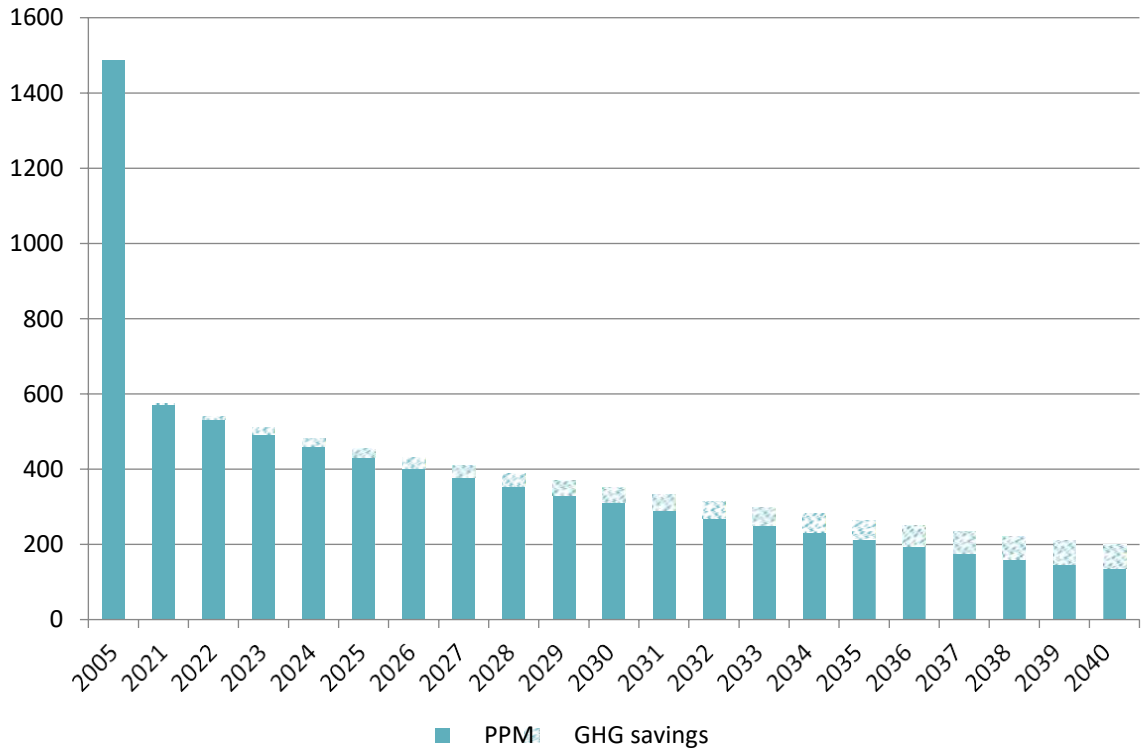


Fig. 5.1.1.12 Projected GHG emissions from waste landfilling with additional measures

The planned additional measures will reduce GHG emissions by 11% in 2030 and by 31% in 2040. The planned policies and measures are projected to result in a significant reduction in GHG emissions in 2030 and 2040, compared to 2005, 64% and 78%, respectively.

EU ETS sectors

In EU ETS sectors, operators from EU Member States (combustion plants above 20 MW , chemical and mineral industries) have been subject to progressively declining allocations with a view to reducing their total GHG emissions by 43% compared to 2005. To achieve this target, additional measures are planned, i.e. the development of renewable energy sources and the replacement of polluting technologies with cleaner ones. The additional policies and measures will reduce GHG emissions from EU ETS sectors by 42% in 2030 compared to 2005.

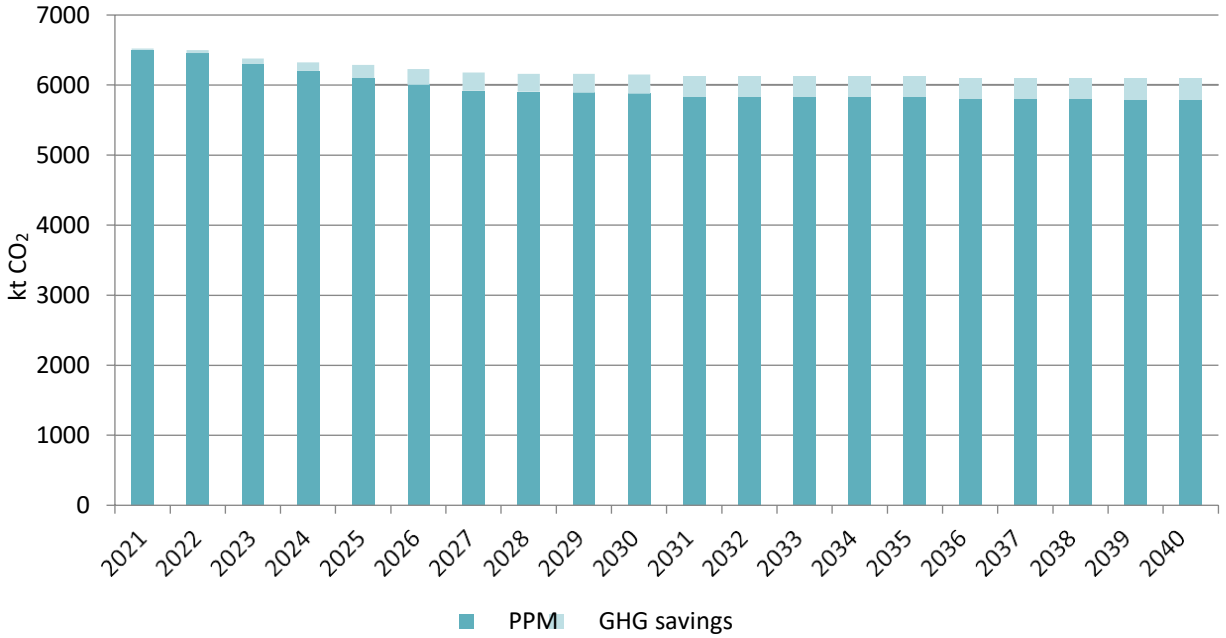


Fig. 5.1.13. Projected GHG emissions from EU ETS sectors (PPM)

The planned policies and measures for EU ETS sectors will reduce GHG emissions by 3% in the period from 2021 to 2030 and by 5% from 2031 to 2040. It should be noted that the projection does not take into account the impact of the price of allowances. In district electricity and heat production, the planned policies and measures will have the greatest impact on GHG reductions compared to other sectors. In the district electricity and heat production subsector, GHG emissions will decrease by 16% in the period from 2021 to 2030 and by 29% between 2031 and 2040. In other sectors, GHG emissions will decline more moderately up to 3% between 2021 and 2030 and up to 5% from 2031 to 2040.

Interactions between existing policies and measures and planned policies and measures

Transport. Existing measure T2 (Electrification of railways) has an impact on planned measure T9 (Introducing incentives for combined freight transport), since the increase in rail freight transport due to measure T9 does not directly increase GHG emissions in rail transport (due to T2 most railways will use electricity rather than fossil fuels). Measure T2 (Renewal of the transport fleet through green procurement and ensuring minimum procurement objectives in the field of transport) is intended to achieve the targets of Directive (EU) 2019/1161 of the European Parliament and of the Council, but the targets of the measure are more ambitious than those of the aforementioned Directive.

Measures T20, T21, T13, T10, T11, T32, T12, T7, T22 and T28 together contribute to a growth in the number of electric vehicles and cover aspects such as car pollution taxes, subsidising their purchase, infrastructure development and social dissemination. The absence of any of these aspects would significantly reduce the planned number of electric vehicles, for example, in the absence of pollution taxes, it would impossible to subsidise the purchase of electric vehicles; with poor infrastructure, electric vehicles would not be attractive. These planned measures contribute to the exiting incentives in relation to electric vehicles: the availability of specially designated lanes for fixed-route transport in Vilnius,as well as the reduction of parking and entry fees in Lithuanian cities. Of the additional measures listed, only T13 and T28 are specifically designed to increase the number of electric vehicles, and all other measures reduce GHG emissions in other ways. Measures related to car pollution taxes (T20 and T21) will have the greatest impact on the reduction of GHG emissions. Without implementing these measures, not only the reduction target will not be met but also a

number of other measures requiring financing from the Sustainable Mobility Fund will not be implemented. All funds from targeted pollution taxes should get into the Fund and be designed to promote the use of cleaner transport.

Industrial processes and product use. The planned measure for reducing the use of fluorinated greenhouse gases in businesses (P8) is a complement to existing policies and measures that are expected to achieve the targets of the Fluorinated Greenhouse Gas Regulation[132] and the Kigali Amendment to the Montreal Protocol.

Planned measure P9 promoting the replacement of polluting technologies with cleaner ones will have an impact on GHG emissions not only from the industry sector but also from energy. GHG savings resulting from the planned measures (P1, P6 and P7) related to fuel combustion in industry and construction are counted towards the energy sector.

Agriculture. Three measures are planned in relation to the use of mineral N fertilizers in the agricultural sector (A2, A5 and A8), which impact each other. The interactions between these measures have been taken into account in the evaluation of these measures. Measures A8 and A5 will have the greatest impact on GHG emissions. Planned measure A4 related to biogas production will have an impact on GHG emissions not only from the agricultural sector but also from the energy sector. GHG savings from the planned measures (A13, A14, A15 and A16) related to fuel consumption by agricultural machinery are included in the sectors or energy and transport. However, without reducing concessions for gas oils for agricultural activities and allocation reductions, there is a risk of failure to achieve the intended effect in other measures, such as the promotion of no-till technology.

Land use, land use change and forestry (LULUCF) sector. Measures L3, L5, L8 and L14 will have the greatest impact on GHG removals in the LULUCF sector. Under measure L3 related to the increase of forest area, in the 2021-2030 period, new areas will be afforested and non-forest land of spontaneous afforestation will be conserved (inventoried as forest land) at a rate of 8 ha per year. This measure contributes to the increase of GHG removals from forest land due to the increasing accumulation of organic carbon in tree biomass, soil and forest floor. Measure L5 concerns the restoration of wetland hydrological regime and natural vegetation as well as avoided emissions due to the drainage and intensive use of organic soils. Measure L8 is also aimed at protecting organic soils by encouraging the conversion of heavily used arable peatlands to permanent grasslands. Measure L14 is aimed at increasing GHG removals from soil by promoting the development of non-till technology in agriculture. The difference between projected GHG emissions and removals with the existing measures and the additional measures in the LULUCF sector is due to the large number of planned measures, which are currently not covered by decisions and are not being implemented. Currently, only the afforestation measure has been approved and implemented under the National Forest Sector Development Programme 2012-2020 that foresees to increase the country's forest cover to 34.2% of the country's territory. The afore-mentioned measure increasing forest cover is included in both projection scenarios, while the measures described in Chapter 3 are included in the projections with additional measures leading to an overall projected increase in GHG absorption (2021-2025) and decrease in GHG emissions in the LULUCF sector in 2026-2040, compared to projections without additional measures.

Waste. The planned policies and measures in the waste sector are complementary to the existing policies and measures that are expected to achieve the objectives of EU legislation (Waste Directive[133], Packaging

[132] https://eur-lex.europa.eu/legal-content/LT/TXT/PDF/?uri=CELEX:32014R0517&from=EN
[133] https://eur-lex.europa.eu/legal-content/LT/TXT/PDF/?uri=CELEX:32018L0851&from=LT

Waste Directive[134], Landfill Directive[135]).

The main objective of the planned policies and measures is to promote waste prevention, reuse and recycling.

5.1.2 Energy Sector: energy from renewable sources and dimension of energy efficiency

Dimension of energy efficiency

When evaluating the energy sector and its transformation in the PPM scenario, it is useful to start with an overview of the projections of changes in energy needs. Below is information on projected changes in energy demand for 2020, 2025, 2030, 2035 and 2040.

The key measures planned to improve energy efficiency (EE) that will reduce energy consumption in the period from 2020 to 2040 are: the use of more efficient products and equipment as technology evolves, transition to low-temperature DH, modernisation of inlet heating substations, improvement of EE in non-industrial sector, implementation of smart metering and use of waste heat. The planned measures and their impact are detailed below.

- EE7: To replace inefficient boilers with other RES technologies or connect them to the district heating system. Under this measure it is planned that by 2030 households will replace 10% of boilers (of 500,000 in total; about 50,000 boilers) with efficient biofuel boilers or heat pumps, or consumer equipment will be connected to DH, and other heat energy efficiency improvement measures will be applied, leading the savings of at least 400 GWh per year.

- EE8: To promote the improvement of the efficiency of the heat transmission network by adapting to low-temperature operation, including the modernisation of heating substations and/or heating and hot water systems. Under this measure, in the period from 2019 to 2030, about 250 inlet heating substations will be modernised and 10 GWh of heat energy will saved each year.

- AEI27: To promote the use of waste heat generated by industry, the waste sector or from cooling energy in the DH sector. When the measure is launched in 2021, the use of waste heat in DH will amount to 0.45 TWh annually by 2030.

- EE10: Renovation of private houses. Under this measure, by 2030 it is planned to renovate 1,000 private houses, saving 0.0135 TWh of energy each year.

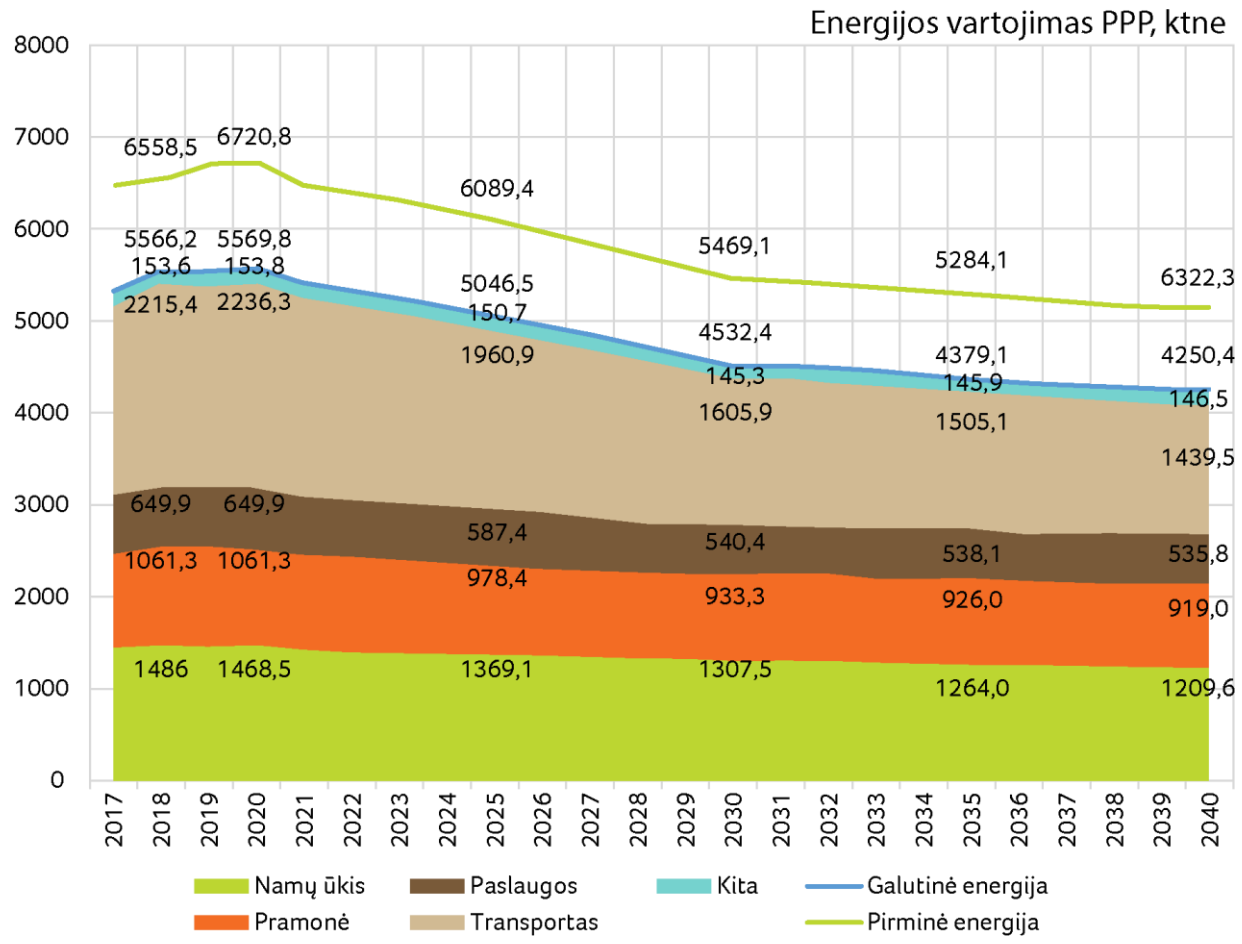
- EE12: Modernisation of street lighting systems. This measure will promote the modernisation of street lighting systems in order to upgrade 25% of all street luminaires in Lithuania. It is planned to upgrade 6,500 street luminaires and save 1.67 GWh each year.

Table 5.1.2.1. Projections for energy consumption through planned energy efficiency policies, measures and programmes (PPM)

	2018	2020	2025	2030	2035	2040

[134] https://eur-lex.europa.eu/legal-content/LT/TXT/PDF/?uri=CELEX:32018L0852&from=LT
[135] https://eur-lex.europa.eu/legal-content/LT/TXT/PDF/?uri=CELEX:32018L0850&from=LT

Primary energy consumption, ktoe	6558.5	6720.8	6089.4	5469.1	5284.1	5128.7
Final consumption, ktoe	5566.2	5569.8	5046.5	4532.4	4379.1	4250.4
Industrial sector, ktoe	1061.3	1061.3	978.4	933.3	926.0	919.0
Household sector, ktoe	1486.0	1468.5	1369.1	1307.5	1264.0	1209.6
Service sector, ktoe	649.9	649.9	587.4	540.4	538.1	535.8
Transport sector, ktoe	2215.4	2236.3	1960.9	1605.9	1505.1	1439.5
Other sectors, ktoe	153.6	153.8	150.7	145.3	145.9	146.5



KEY

Energijos vartojimas PPP, ktne	Energy consumption with PPM, ktoe
Namų ūkis	Household
Pramonė	Industry
Paslaugos	Services
Transportas	Transport
Kita	Other
Galutinė energija	Final energy
Pirminė energija	Primary energy

5.1.2.1. Fig. 5.1.2.1. Energy consumption projection, PPM

The data presented show that in the case of PPM, a final energy saving of 18.6% is achieved by 2030, and a 23.6% reduction in energy consumption is planned for 2040 respectively. Compared to the EPM scenario,

savings in the same periods are 3.8% and 5.9%.

Renewable energy

Electricity production. When assessing the impact of planned policies and measures on the energy sector, it is necessary to emphasise the main projected significant surge in installed capacity in RES production installations: in the period from 2025 to 2035 offshore wind turbines with an installed capacity of 700 MW will be built in the Baltic Sea by 2040, producing about 20.1 TWh of electricity, and significantly increase the share of RES in the electricity production mix. Without this additional RES capacity, Lithuania would not meet its RES target for electricity generation.

The planned measures which will contribute most to the promotion of RES use in the 2020-2040 period are continued support to prosumers, the construction of new cogeneration plants, financial support for small-scale power plants, the RES for industry LT+ programme, and the development of offshore wind turbines in the Baltic Sea.

- AEI2: Financial support to prosumers. The measure was approved in 2018 and is planned to continue until 2030. The supported activity is the installation of small-scale solar power plants. This support will provide 696 MW of installed capacity as from 2024.
- AEI4: Financial support for investments in small-scale power plants. Support in the period from 2022 to 2025 is planned to ensure the production of at least 0.03 TWh of electricity from RES. It is planned to install a 5 MW cogeneration plant using biofuels. At the same time, an additional 15 MW RES heat production flow in DH systems is planned.
- AEI5: RES development in the Baltic Sea. Under this measure, wind turbines of 700 MW will be built in the Baltic Sea. The planned capacity is projected to be achieved in two stages: 350 MW in 2028 and 350 MW in 2031.
- AEI6: The use of renewable energy sources in industry. Under this measure, industrial companies will install about 60 MW of new RES production installations, of which 70% will be for electricity generation and 30% for heat production. Capacities are scheduled to be built and fully operational for 2023.
- AEI7: RES use in public and residential buildings. This measure will encourage public building administrators and home-owners to build RES production installations. It is projected that this measure will add about 50 MW of RES capacity.

Taking into account the EE improvement and RES promotion measures to be introduced by 2040, a significant shift is projected from the use of fossil fuels to RES for energy production. The table below presents a comparison of the EPM and PPM scenarios for assessing the penetration of electricity produced from RES (the RES-E indicator).

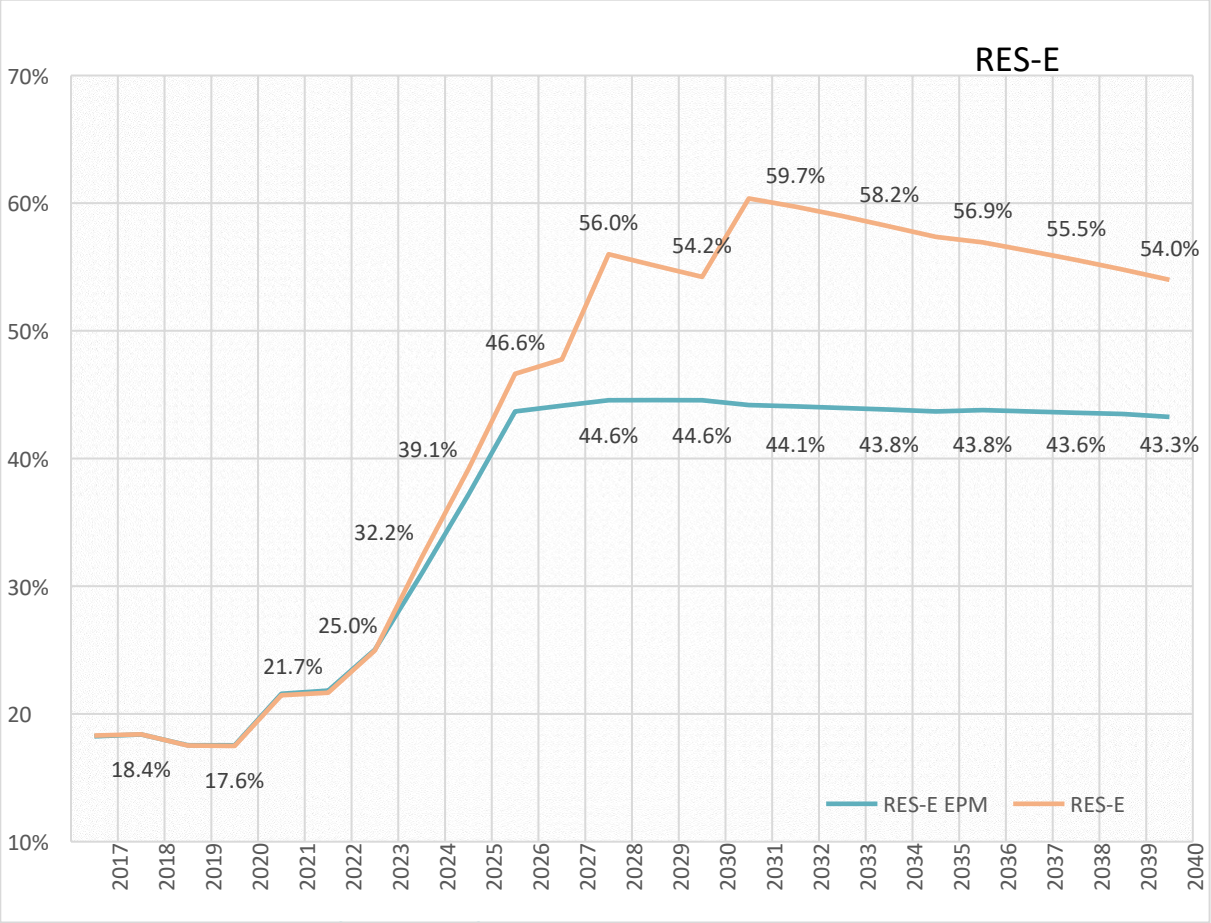


Fig. 5.1.2.2. Penetration of electricity from RES with EPM and PPM

The PPM scenario foresees a relatively high penetration of RES production capacity. It should be noted that in the PPM scenario, electricity generation from RES without the introduction of new capacity tends to decrease. This is because PPM are expected to have a relatively large electrification effect in the transport sector, resulting in a steady increase in electricity demand and, accordingly, when RES capacity does not increase, the total RES amount relatively decreases.

Table 5.1.2.2. shows the new RES capacity with PPM projected in the assessment. The development will include the installation of solar and wind power plants.

Table 5.1.2.2. Development of electricity production from RES with PPM

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Solar plants, MW/year	15.0	3.0	78.0	126	135	165	135	135	0	0
Total solar power plants, MW	15.0	18.0	96.0	222	357	522	657	792	792	792
Wind turbines, MW/year	0	0	120	292	280	280	0	350	0	0
Total wind turbines, MW	0	0	120	412	692	972	972	1322	1322	1322
Biofuel DH plants, MW/year	73	0	0	5	0	0	0	0	0	0
Waste CHP plants, MW/year	43	0	0	0	0	0	0	0	0	0
TOTAL CHP plants, MW	116	116	116	121	121	121	121	1221	121	121

As shown above, at the end of the period, in 2030 (new capacity is not planned in PPM between 2029 and 2030

), the total installed capacity of solar plants will be 792 MW and of wind turbines will reach 1,322 MW , of which 350 MW are planned offshore capacity (start of production is scheduled for 2028).

It is additionally important to mention that Vilnius and Kaunas waste incineration plants, whose commissioning is planned for 2020-2021, have a significant impact on the sector of electricity from RES. The total electricity generation capacity of the power plants is 43 MW and heat output is 130 MW . In addition, the VCP's 70 MW biofuel cogeneration unit will be launched in 2020.

The emergence of new electricity generation capacities in the Lithuanian electricity system will improve the local generation rates, and accordingly contribute to the system reliability and security (by developing system balancing measures in parallel). The chart below shows the situation of the local generation in Lithuania under EPM and PPM scenarios.

KEY
Electricity generation in Lithuania
ElGen LT EPM
ElGen PPM

Fig. 5.1.2.3. Electricity generation scenarios in Lithuania

As the chart shows, under the PPM scenario, the local generation will reach 67% in 2030, while the current local generation level accounts for a mere 30%. The chart does not estimate the potential emerging capacity for balancing the electrical system. At present, it is difficult to determine what specific technologies will be used to balance the system, but it can be assumed that in the short and medium term this function should be performed by gas burning installations and in the long term more innovative energy storage systems can be expected to enter the balancing market.

The heat sector will also change significantly: the share of RES in the district heating balance will grow by almost 30% and already by 2027 should account for slightly more than 91%. This will be largely determined by the VCP and KCP projects, the impact of which will be further strengthened by continued support for small-scale cogeneration plants, and use of waste heat in DH.

Such a share of RES could not be achieved without further implementation of EE measures: the renovation of apartment buildings, public buildings and private houses, replacement of boilers with more efficient or RES technologies, improvement of EE in industrial enterprises and modernisation of street lighting systems.

KEY

RES-DH
RES-DH, EPM
RES-DH, PPM

Fig. 5.1.2.4. Heat sector scenarios for RES

In the case of EEE, the share of RES in the district heating fuel mix increases due to faster energy efficiency

measures and the inclusion of waste heat in the volume of RES. As the Figure shows, the level of RES in DH is slanting at 90%, i.e. 10% of the structure is composed of fossil fuels, of which the main are: the minimum amount of natural gas required for system balancing and covering peaks, non-renewable part of household waste, etc.

The fuel mix for district heating systems in the EEE scenario is presented in Figure 5.1.2.5.

KEY

CŠT balansas PPP, ktne	DH mix with PPM, ktoe
Elektra	Electricity, ktoe
Akmens anglis, ktne	Coal, ktoe
LPG, ktne	LPG, ktoe
Suskystinti ir kiti gazoliai	Liquefied and other gasoil
Nuotekų dumblo biodujos, ktne	Sewage sludge biogas, ktoe
Sąvartynų dujos, ktne	Landfill gas, ktoe
Kitos biodujos, ktne	Other biogas, ktoe
Buitinės atliekos, ktne	Household waste, ktoe
Pramoninės atliekos (ne AEI), ktne	Industrial waste (non-RES), ktoe
Šildymo ir kiti gazoliai, ktne	Heating and other gasoil, ktoe
Durpės ir durpių briketai, ktne	Peat and peat briquettes, ktoe
Gamtinės dujos, ktne	Natural gas, ktoe
Pramoninės atliekos (AEI dalis), ktne	Industrial waste (RES share), ktoe
Buitinės atliekos (AEI dalis), ktne	Household waste RES share), ktoe
Malkos, kurui skirtos medienos ir žemės ūkio atliekos, ktne	Firewood, wood and agricultural waste, ktoe
Viso sunaudota kuro, ktne	Total fuel consumption, ktoe

Fig. 5.1.2.5. DH mix

It can be seen from the DH fuel mix that, unlike in the case of EPM, the PPM scenario shows a much steeper decrease in fuel demands (respectively the heat demand) during the period under review. Compared to the 2018 facts, fuel demand in 2030 and 2040 will shrink by 19.1% and 25.0% respectively. Such a sharp decrease in heat demand is related to the continued building renovation processes in the PPM scenario, the increase in heat pump usage observed in the market and other energy efficiency improvement measures being implemented.

It is worth mentioning that during modelling, natural gas consumption was reduced to the minimum needed to meet peak demand and balance systems. Upon accepting this assumption and following the further decrease in heat demand, biofuels become the balancing line in the fuel mix. This can be observed from 2027, when the minimum amount of natural gas is recorded and the further balancing of production and demand is implemented by reducing the use of biofuels.

Taking into account not only district heat production, but also total heat production in Lithuania (adding volumes of decentralised heat production), the RES indicator for heat is obtained, which shows the proportion of RES in the total mix of fuel used for heating. Changes in this indicator in the cases of EPM and PPM scenarios are presented below.

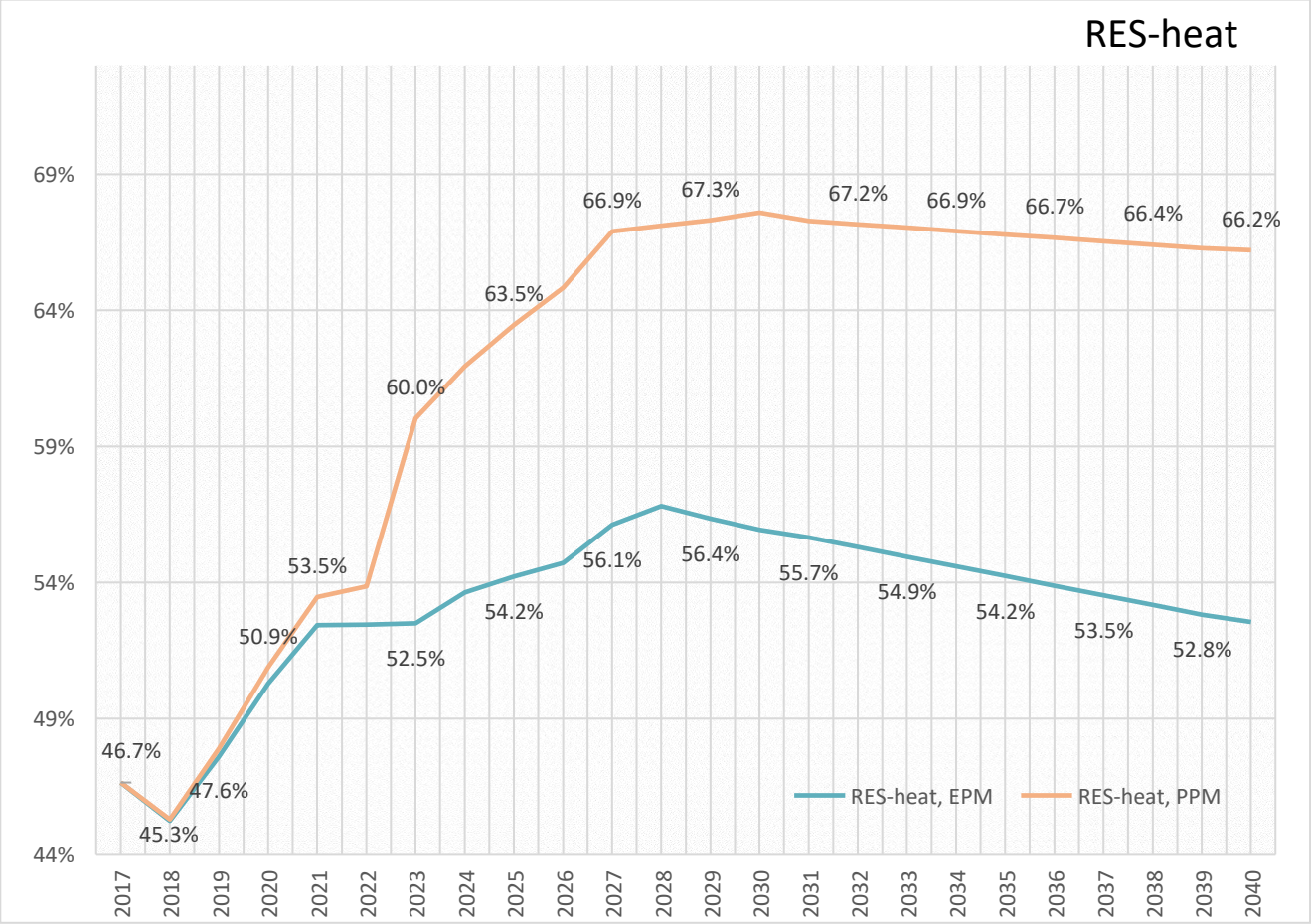


Fig. 5.2.2.6. EPM and PPM scenarios for the RES heat and cooling sector

As mentioned above, the assumption regarding the inclusion of waste heat as RES in the estimation of RES in the EPM and PPM scenarios had the greatest impact. In addition, it is worth noting that the share of RES starts declining steadily in both scenarios in 2007. This is related to the decrease of energy demand for heating and consequently the failure to introduce new RES capacity.

The following assumptions have been evaluated when projecting changes in the share of RES in the **transport sector**:

- AEI10: To increase the mandatory blending of 1st-generation biodiesel to mineral fuels by 5% by volume for a transitional period. The total amount of 1st-generation biodiesel is projected to increase by 30.47 ktoe between 2020 and 2030.

- AEI13: Support for 2nd-generation biofuels: to cover biodiesel operating costs and to finance bioethanol production facilities through mandatory blending. It is projected that by 2030 this measure will produce the following share of biofuels placed on the market: 12.8 ktoe of 2nd-generation biodiesel and 6.45 ktoe of 2nd-generation bioethanol.

- AEI14: Support for the production of biomethane gas: to install plants, to cover operating costs for manufacturers and to purchase of CNG vehicles adapted to run on biomethane gas. It is planned that in the period from 2020 to 2030 new generation capacity would be installed to produce 85.1 ktoe of biomethane gas for use in the transport sector.

The fuel mix structure of the PPM scenario for the transport sector is presented in Fig. 5.1.2.7.

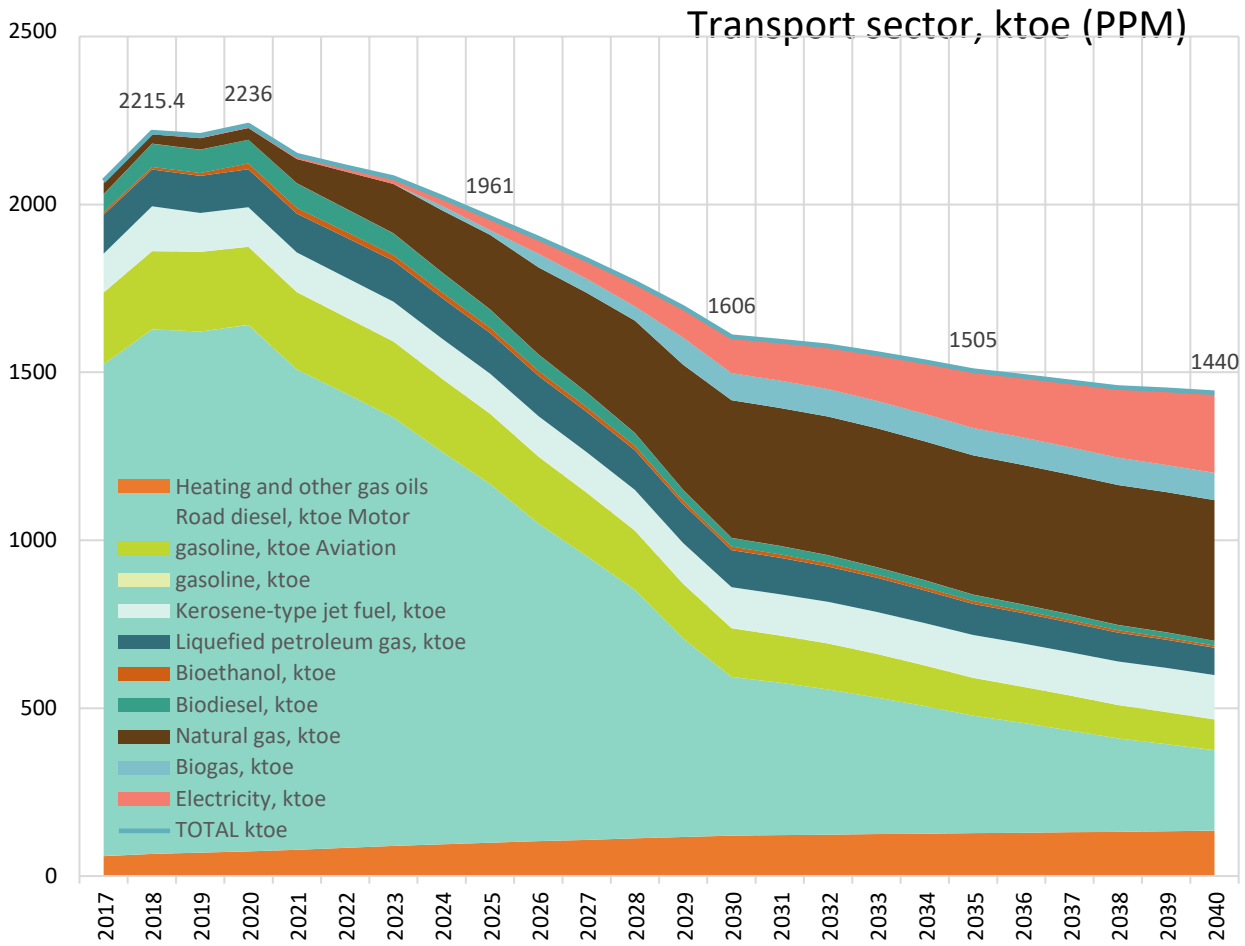


Fig. 5.1.2.7. Fuel mix of the transport sector, PPM

Unlike the EPM scenario, PPM have the ambitious goal of both reducing actual fuel consumption and implementing fuel-switch measures.

As can be seen in the Figure, a rather rapid reduction in diesel consumption is planned, which is to be partially replaced by the use of natural gas and electrification. The projections for the use of RES fuels, distinguishing them from other fuels, are shown in Figure 5.1.2.8.

KEY

AEI transporto sektoriuje, ktne (PPP)	RES in transport, ktoe (PPM)
Bioetanolis, ktne	Bioethanol, ktoe
Biodyzelinas, ktne	Biodiesel, ktoe
Biodujos, ktne	Biogas, ktoe
Elektros energija, ktne	Electricity, ktoe
Iš viso suvartojama kuro transporte, ktne	Total fuel consumption in transport, ktoe

Fig. 5.1.2.8 Evaluation of the use RES fuels in transport with PPM

The RES penetration achieved in the transport sector with the PPM scenario is shown in Figure 5.1.2.9.
It is important to note that in this case the calculations took into account the actual quantities of RES without applying multipliers.

KEY
RES-Transport

Fig. 5.1.2.9. RES penetration in the transport sector using the PPM scenario based on actual RES flows (without multipliers)

In the case of multiplication of RES in the transport sector, RES penetration results would improve. Specific values for RES penetration in the EPM and PPM scenarios with and without multipliers are given in Table 5.1.2.3.

Table 5.1.2.3. RES in the transport sector

RES in the transport sector, %	2018	2020	2025	2030	2035	2040
EPM without multipliers	4.3	4.7	5.0	5.3	5.6	5.9
EPM with multipliers	4.3	4.7	5.3	6.7	8.1	9.5
PPM without multipliers	4.3	4.6	6.2	15.1	19.3	22.9
PPM with multipliers	4.3	4.7	7.2	29.8	47.8	64.6

Table 5.1.2.4. shows the share of RES in gross energy consumption and in the relevant sectors, taking into account the impact of the planned measures.

Table 5.1.2.4. RES share in gross final energy consumption and in relevant sectors

	2018	2020	2025	2030	2035	2040
Final energy consumption, ktoe	5566.2	5569.8	5046.5	4532.4	4379.1	4250.4
RES share in the production of heat and cooling energy, %	45.3	50.9	63.5	67.2	66.8	66.2
RES share in the DH sector, %/target	65.0	71.5 / 70	89.6	90.9 / 90	90.5	90.1
RES share in electricity production, % / target	18.4	17.5 / 35	39.1	54.2/ 45	57.3	54.0
RES share in gross final electricity consumption, % / target	25.4	26.9 / 30	37.7	46.9/ 45	49.5	50.2
RES share in gross final energy consumption in the transport sector (without multipliers), % / target	4.3	4.6 / 10	6.2	15.1 / 15	19.3	22.9

KEY

RES penetration with PPM

RES heat RES DH RES-E RES transport RES total, %

Fig. 5.1.2.10. RES share in gross final energy consumption and in relevant sectors

The data presented show that with PPM the RES targets would be met for heating and cooling, electricity generation and transport. Given the time needed to implement some measures (for example, winning the auction and building wind parks), interim targets for RES-E and RES-T in 2025 may not be achieved. Nevertheless, the PPM effect will offset this effect and the 2030 targets will be achieved (as shown by the modelling results).

The total fuel consumption (including RES) for the EEE scenario is given below.

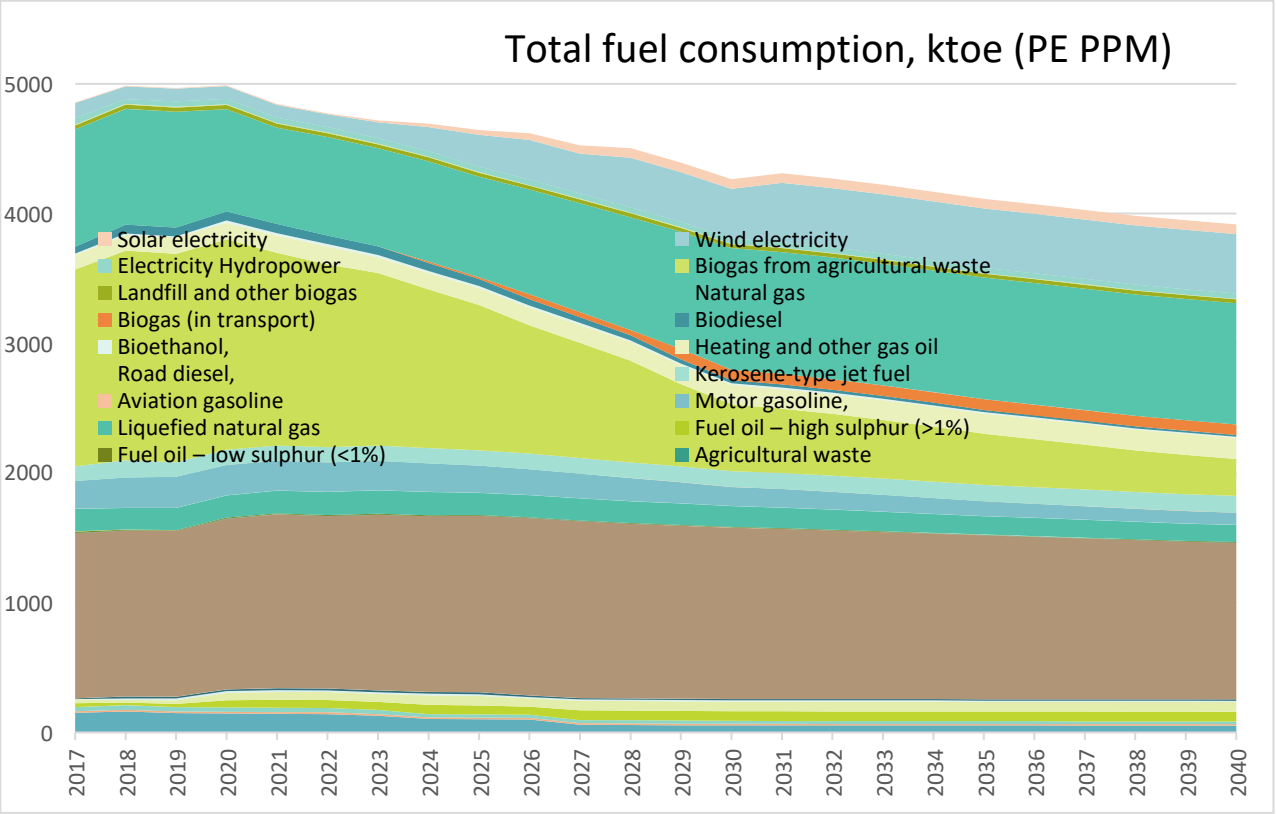


Fig. 5.1.2.11. Total fuel consumption in the PPM scenario

The presented Figure shows that fuel consumption in individual sectors of the economy and the amount of fuel used for electricity and heat production in Lithuania are decreasing in the case of the PPM scenario. Comparing the existing fact, i.e. the fact of 2018, with 2030 and 2040, a decrease of 14.4% and 21.5% is projected, respectively. This is related to the ambitious targets in the transport sector, which plans significant electrification, covering both light-duty and heavy-duty road transport and railway electrification.

In addition, ambitious measures for energy efficiency improvement are planned, which, if successfully implemented, would aim to implement decoupling of economic growth from energy consumption. In the event of success, this would mean that a consistent GDP growth in the country would not lead to automatic growth of energy resources.

5.2 Impact of planned policy measures on macroeconomic indicators

5.2.1 Impact of planned policy measures on macroeconomic indicators

Macroeconomic modelling was used to evaluate the impact of the implementation of planned policies and measures on macroeconomics and social dimension. Two scenarios were modelled in the evaluation: the baseline scenario (using the existing policy and measure package (the EPM scenario)) and the planned policy and measure scenario (the PPM scenario), the impact of which on national energy and climate targets is described in previous sections of Chapter 5. The results of the evaluation reveal the impact of the measures on two different periods: during the implementation of the Plan (2020-2030) and after the implementation of the Plan (2031-2040).

According to a preliminary estimate of funding needs from ministry experts, the implementation of the PPM scenario will cost about EUR 14 billion. The modelling has assumed that about 50% of these funds, or about EUR 7 billion, will be sought from the EU Structural Funds and other external sources, 21% or EUR 3 billion should be allocated from the national budget, while private funds will contribute 29%, or EUR 4 billion. It should be noted that the stated need for external funds significantly exceeds the total amount from EU Structural Funds allocated to Lithuania in the previous financing period, therefore, when modelling the PPM scenario, it was assumed that the remaining funds (about EUR 3.5 billion) would be borrowed on the international financial markets. It should be noted that in such a case, the implementation of the PPM scenario would increase the public debt.

According to the results of macroeconomic modelling, implementation of the planned policies and measures would increase Lithuania's gross domestic product (GDP) and investment. During the implementation of the Plan (2020-2030) Lithuania's GDP would be on average 1.72% higher, and after the implementation of the Plan (2031-2040) would be on average 0.23% higher than without the planned policies. The greatest impact on GDP is projected for 2024, when the implementation of the Plan's measures would result in a GDP increase of 2.25% compared to the baseline scenario (see Fig. 5.2.1). Investments in the PPM scenario would be 8.66% higher than in the baseline scenario.

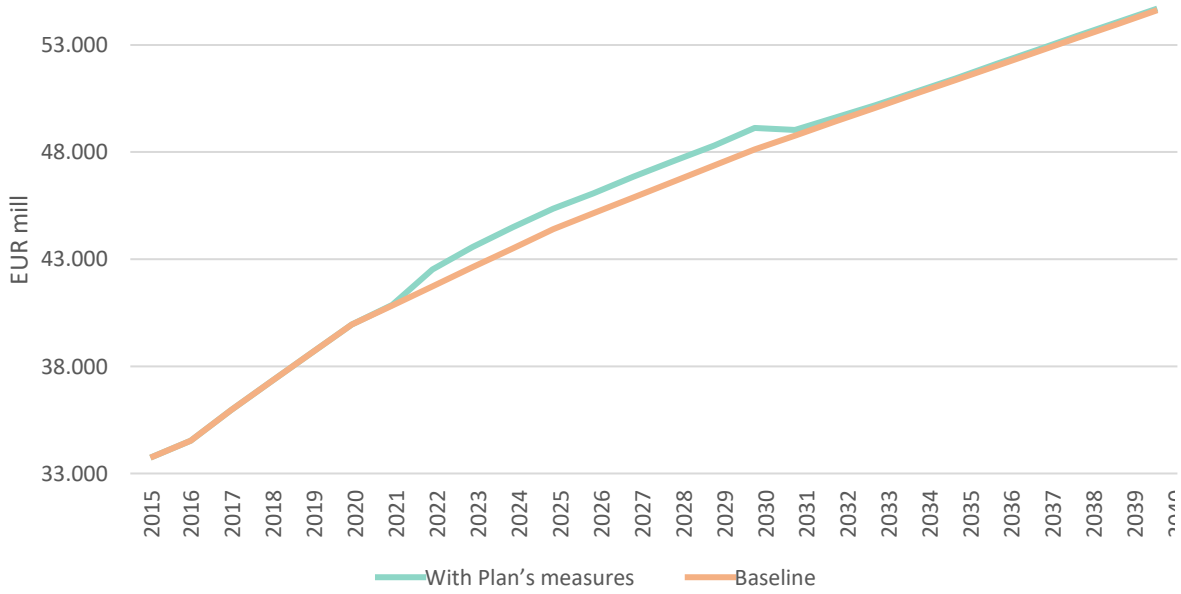


Fig. 5.2.1. GDP projection in the baseline scenario and PPM scenario, EUR million

During the implementation of the Plan (2020-2030), Lithuania's import-export balance (net trade surplus as a percentage of GDP) would be 0.57 percentage points lower than it would have been without the PPM scenario. This results from increased demand for imported capital goods and related services due to the growth of investment activities funded under the Plan, where the full positive effects of PPM scenario interventions have not yet materialised. After the implementation of the Plan (2031-2040), Lithuania's import-export balance would be 0.36 percentage points higher than it would have been had the Plan measures not been implemented. The longer-term increase in the import-export balance would be due to a lower demand for energy imports compared to the baseline scenario.

Macroeconomic modelling reveals the different response of different sectors to the cost of the Plan for the economy (Figure 5.2.2). For example, the construction sector would have a significant positive impact during the implementation of the Plan (2020-2030), as a growth in investment activities funded by the Plan would increase demand for construction services. The manufacturing sector would feel a small negative impact during the implementation of the Plan, in part due to a slight decrease in international competitiveness, because of increased prices of inputs used in production caused by the Plan's costs.

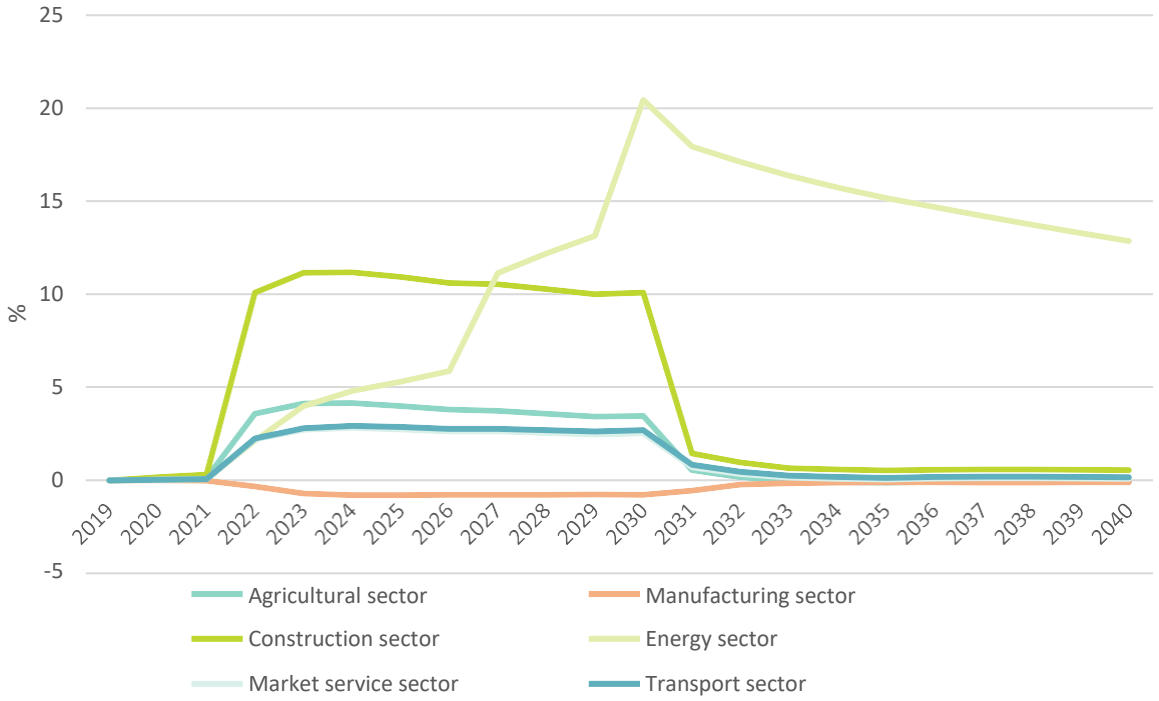


Fig. 5.2.1. *Impact on added value of individual sectors, %*

The energy sector would feel a significant positive impact, both during the implementation of the Plan and in the subsequent period, due to the physical infrastructure created by the measures of the Plan, contributing directly and indirectly to increasing energy production capacity and output of the energy sector. The added value of the Lithuanian energy sector would be 7.19% higher during the implementation of the Plan (2020-2030) and 15.1% higher in the period after the implementation of the Plan (2031-2040) than without the implementation of the PPM scenario. The additional energy production capacity created with the Plan's funds will contribute to this result.

As the country's population is shrinking and ageing, the total number of the employed in the country's economy is likely to continue to decline. Nevertheless, the planned investments could mitigate these negative trends, at least temporarily. The implementation of the planned policy in 2020-2030 would increase the employment rate in Lithuania by 1.56% compared to the baseline scenario. This is a short-term effect that occurs when the operators of the Plan's measures purchase additional services that require additional employment from the private sector. In the period after the implementation of the PPM (2031-

2040), the number of the employed in Lithuania is likely to be on average 0.14% higher than in the absence of the planned policies.

Implementation of the Plan's measures for investments in energy efficiency improvement in dwellings would contribute to the reduction of energy poverty and the share of persons at risk of poverty and experiencing social exclusion in Lithuania. During the implementation of the Plan (2020-2030), the average percentage of disposable income of Lithuanian households for maintaining dwelling would be 0.33 percentage points lower, and in the period after the implementation of the Plan (2031-2040) 0.27 percentage points lower, than without the implementation of the PPM package.

Implementation of the planned policies would contribute to the growth of household income: during the implementation of the National Plan, the average monthly disposable income in cash and in kind per household in all income groups would be about 2.1% higher compared to the baseline scenario and 0.3% higher in the post-plan period than without the implementation of the Plan. During the Plan implementation period, the percentage of persons at risk of poverty or social exclusion in Lithuania would be 0.37 percentage points lower, and in the period following the implementation of the Plan, 0.28 percentage points lower than without the Plan's measures.

5.2.2 Impact of planned policy measures on air pollution

Implementation of the Plan's measures should significantly reduce fuel consumption in road transport and to a lesser extent reduce the combustion of fuels in electricity and heat production, industry, the services sector, agriculture, and households. Landfilling and the use of inorganic nitrogen fertilisers should also be significantly reduced. However, the development of railways and inland waterway shipping is foreseen, which will increase fuel consumption in these sectors. A slight growth in natural gas use at pipeline compressor stations is also expected.

Table 5.2.2.1. Change in nitrogen oxide (NOx) emissions to ambient air, thou. tonnes

Economic area	2020	2025	2030	2035	2040
Road transport	-0.03	-12.49	-25.28	-26.68	-28.13
Rail transport	0.00	0.83	1.39	1.29	1.17
Inland waterway navigation	0.86	2.37	3.88	4.98	6.07
Gas pipelines	0.00	0.01	0.02	0.02	0.02
Energy	-0.04	-0.35	-0.78	-0.91	-1.06
Agriculture: use of synthetic nitrogen fertilisers	0.00	-1.83	-1.83	-1.89	-1.96
TOTAL	0.79	-11.46	-22.59	-23.20	-23.89

Source: Environmental Protection Agency (AAA)

The largest reductions in nitrogen oxides are expected in road transport and in the use of synthetic nitrogen fertilisers in agriculture. Emissions of nitrogen oxides will increase in the rail and inland waterway navigation sectors.

Table 5.2.2.2. Change in emissions of non-methane volatile organic compounds (NMVOC) to ambient air, thou. tonnes

Economic area	2020	2025	2030	2035	2040
Road transport	-0.01	-1.38	-3.22	-3.93	-4.66
Rail transport	0.00	0.07	0.12	0.11	0.10
Inland waterway navigation	0.03	0.08	0.14	0.18	0.22

Gas pipelines	0.00	0.01	0.02	0.02	0.02
Energy	-0.08	-0.34	-0.58	-0.59	-0.61
Waste management	-0.04	-0.11	-0.18	-0.11	-0.10
TOTAL	-0.11	-1.67	-3.71	-4.32	-5.04

Source: Environmental Protection Agency (AAA)

The largest decline in NMVOC is expected in road transport and energy.

Table 5.2.2.3. Change in ammonia (NH3) emissions to ambient air, thou. tonnes

Economic area	2020	2025	2030	2035	2040
Road transport	0.00	-0.06	-0.14	-0.18	-0.22
Energy	0.00	0.00	-0.08	-0.12	-0.18
Agriculture: use of synthetic nitrogen fertilisers	0.00	-1.49	-1.49	-1.54	-1.60
TOTAL	0.00	-1.55	-1.71	-1.85	-1.99

Source: Environmental Protection Agency (AAA)

The largest decrease in ammonia is expected in the use of synthetic nitrogen fertilisers in agriculture, as well as in road transport.

Table 5.2.2.4. Change in particulate matter (PM2.5) emissions to ambient air, thou. tonnes

Economic area	2020	2025	2030	2035	2040
Road transport	0.00	-0.53	-1.10	-1.17	-1.23
Rail transport	0.00	0.02	0.04	0.03	0.03
Inland waterway navigation	0.02	0.04	0.07	0.09	0.11
Energy	-0.03	-0.18	-0.35	-0.40	-0.45
TOTAL	-0.02	-0.64	-1.34	-1.44	-1.55

Source: AAA

The largest decrease in particulate matter (PM2.5) is projected in the road transport and energy.

Table 5.2.2.5. Change in sulphur dioxide (SO2) emissions to ambient air, thou. tonnes

Economic area	2020	2025	2030	2035	2040
Road transport	0.00	0.00	0.01	0.01	0.01
Rail transport	0.00	0.32	0.53	0.49	0.45
Inland waterway navigation	0.22	0.60	0.99	1.27	1.55
Energy	-0.06	-0.43	-0.65	-0.67	-0.70
TOTAL	0.16	0.48	0.86	1.07	1.28

Source: AAA

The planned development of railways and inland waterway navigation will significantly increase sulphur oxide emissions, which will not be offset by reductions in energy.

5.3 Overview of investment needed

Total investments needed to implement the planned policies and measures described in Chapter 3 of the National Plan amount to about EUR 14.1 billion, of which, the indicative amount of public funding would be around EUR 9.8 billion. For GHG emission reduction measures alone, the total funding need would amount to EUR 10.8 billion, of which the need for public funding would account for EUR 6.5 billion (see Table 5.3.1.).

Table 5.3.1. Funding needs for planned policies and measures, 2021–2030

Sector	Total need of funds, EUR million	Need for public funds, EUR million
Energy: energy efficiency	2605	976
Energy: RES development	2304	1428
Transport	4138	2977
Agriculture and forestry	868	729
Industry (incl. the ETS sector)	876	342
Waste management	5	5
Total: GHG reduction measures	10 795	6 455
Adaptation to climate change	3 303	3 303
Total:	**14 098**	**9 759**

This is a preliminary assessment of the financing needs, which will be revised while transferring the Plan's measures to strategic planning documents. In order to increase the share of private capital to 50% during the implementation phase of the National Plan, priority will be given to measures that ensure a greater contribution from the private sector. Planned and alternative policy measures set out in the Plan will be assessed in terms of their financial, economic, social and environmental benefits, choosing the most efficient set of measures and the means of their implementation. It should be noted that the costs of implementing the National Plan can be significantly reduced by bringing forward and reinforcing economic signals to reduce GHG emissions to operators in sectoral markets, including, but not limited to, the earlier phase-out of fossil fuel subsidies, the expansion of the application areas for the 'polluter pays' principle, as well as innovative green finance solutions increasing the contribution of the private sector.

The transport sector is most in need of funding in the PPM package as it accounts for almost 1/3 of total GHG emissions. Reducing GHG emissions requires substantial investment across the sector. The largest amounts of funds are planned for the implementation of measures under the Sustainable Urban Mobility Plans (SUMP), as well as for the promotion electric vehicles and alternative fuels and the development of their infrastructure, electrification of railways, promotion of low-emission vehicles and other measures for transport sector policy measures.

In the energy sector, future investments focus mainly on improving energy efficiency, increasing the use of RES in different sectors of the country and the necessary improvement of the intelligence, reliability and security of energy networks, taking into account the recommendations of the European Commission set out in 'Country Report. Lithuania 2019"[136]. The European Commission recommends Lithuania to:

1. Promote energy efficiency improvement measures.

[136] https://ec.europa.eu/info/sites/info/files/file_import/2019-european-semester-country-report-lithuania_lt.pdf

2. Promote energy from renewable sources.
3. Deploy smart electricity systems and grids, as well as solutions for energy storage at local level.
4. Develop a sustainable, climate-resilient, intelligent, secure and intermodal Trans-European Transport Network (TEN-T).
6. Develop sustainable, climate resilient, advanced and intermodal national, regional and local mobility.
7. Promote sustainable mobility and intermodal urban mobility.
7. Promote climate change adaptation, risk prevention and disaster resilience.
8. Promote biodiversity and green infrastructure in the urban environment and reduce pollution.

Towards achieving the 2030 climate change and energy targets, the main sources of public funds for 2021-2030 will be the 2021-2027 investments of EU funds (the European Regional Development Fund and the Cohesion Fund), electricity and heat tariffs, national budget (the Climate Change Programme and the Waste Management Programme, etc.) and municipal budgets, the Modernisation Fund, the Innovation Fund, the Connecting Europe Facility, the Life Programme, and others.

To a lesser extent, but sources of public funds will also be attracted, such as funds received for public-interest services (SPI funds), funds for statistical transfers, and the Norwegian Financial Mechanism.

The new EU Multiannual Financial Framework 2021-2027 aims to mobilise at least 25% of EU Structural and Investment Funds for climate change targets. The European Regional Development Fund and the Cohesion Fund should contribute to climate change at least 30% and 37% respectively. On this basis, the planned energy policy measures to improve energy efficiency in buildings, enterprises and public infrastructure would be financed by the European Regional Development Fund. The Cohesion Fund would invest more in the development of energy production capacities using RES both in the electricity and heat areas with a view to increasing the intelligence, flexibility and reliability of energy networks, i.e. in order to adequately prepare networks for the ambitious development of RES and its management and balancing, as well as support measures to adapt to climate change. Measures in the agricultural and LULUCF sectors are planned to be financed from the European Agricultural Guidance and Guarantee Fund. The electrification of railways is planned to be co-financed by the Connecting Europe Facility (CEF).

Electricity, gas and heat tariffs would be the second most important source of public funding through projects for the modernisation, smartness and development of public energy infrastructure in electricity and natural gas transmission, distribution and district heating networks. Lithuania, where possible, simultaneously combines the use of this funding source with other funding sources in order to protect consumers from a high financial burden.

The funds allocated to Lithuania under the Modernisation Fund would be used to modernise energy systems, to deploy energy storage solutions in both district heating and electricity transmission and distribution networks, in order to integrate the planned ambitious amounts of RES; and to improve energy efficiency in the sectors of transport, buildings, agriculture and waste (with the exception of energy efficiency related to the production of energy from solid fossil fuels). As from 2021, 2% of all allowances to be auctioned at EU level in the period from 2021 to 2030 will be allocated to this Fund. This would account for EUR 7.75 billion (at a CO_2 price of EUR/t 25), while Lithuania would receive about 2.57% of the Modernisation Fund, which would amount to about EUR 232 million (at a CO_2 price of EUR/t 25) for the period from 2021 to 2030.

In 2009, the Law of the Republic of Lithuania on Financial Instruments for Climate Change Management

established a Climate Change Programme to finance in Lithuania and in third countries climate change mitigation and adaptation projects in order to achieve the goals and objectives of the National Climate Change Management Policy. The Climate Change Programme's funds received for transferred assigned amount units and auctioned allowances, as well as voluntary funds and economic fines of natural and legal persons are administered by the Ministry of the Environment.

In the period from 2021 to 2030, the Climate Change Programme is also planned to be an effective source of national budget investments for financing projects for energy efficiency improvement in multi-apartment buildings, enterprises and the district heating sector, also for promoting the use of RES in the transport sector, implementing development cooperation projects in developing countries, public information and education, research studies, advising and training operators and other persons, as well as for afforestation and reforestation; for the implementation of measures to adapt to and mitigate climate change and other measures to effectively manage climate change policy.

The Waste Management Programme will finance measures in the waste sector to reduce GHG emissions.

It is planned that in 2021-2030 national and municipal budget funds will be needed for the projects to renovate public buildings, implement sustainable urban mobility plans, modernise the street lighting system by improving energy efficiency, and to increase the use of renewable energy sources in the transport sector.

In October 2017, after Lithuania has signed an agreement on statistical transfers with Luxembourg, an additional source of funding opened up for the country to invest EUR 10.5 million resulting from these transfers in areas related to RES and energy efficiency improvement. It is planned to use these funds for the development of RES capacity in the field of electricity and for RES-related research.

Funds from the LIFE Programme and Life IP would be used to finance studies in the energy sector, transition to production from clean sources or to innovative measures in the energy sector, and GHG reduction measures, applied research and innovation in various sectors of the economy.

The creation of a Sustainable Mobility Fund is planned as a measure. The Fund is the primary and necessary measure for the implementation of other measures. The Fund should receive all funds from targeted pollution taxes and be aimed at promoting cleaner transport (incentives for the installation of recharging points for electric vehicles, purchase of zero-emission vehicles, social dissemination and building sustainable mobility habits).

5.4 Impact of planned policies and measures on other Member States and regional cooperation

Projects and initiatives in the field of energy, which have or will have a regional impact:

Synchronisation with the continental European networks

The aim is the development of infrastructure for deeper integration of the electricity market and the synchronous interconnection of the Baltic States' electricity systems with the continental European network (hereinafter, 'synchronisation with CEN').

The importance of synchronisation with CEN for the Baltic States:

- The Baltic States will finally solve the geopolitical risks to the electricity system.
- Lithuania, Latvia and Estonia will take over from Moscow the essential rights and obligations for frequency management of the electricity system.
- Electricity systems in the Baltic States will be governed by uniform and transparent European rules.
- Switching from centralised to decentralised management of the electricity transmission system (diversification of system security risks).

Baltic and regional cooperation in implementing the synchronisation with CEN:

- The June 2007 Communication of the Prime Ministers of Lithuania, Estonia and Latvia recognised the synchronisation with CEN as a common strategic goal for the Baltic States.
- A feasibility study on the integration of the Baltic States into the European Union internal electricity market by 2020 was carried out in autumn 2013 by the Baltic electricity transmission system operators and the Swedish consultancy Gothia Power AB.
- On 5 December 2014, at the meeting of the Baltic Council of Ministers, the Prime Ministers of the Baltic States stressed the importance of synchronising the Baltic States with CEN through the links between Lithuania and Poland and instructed the responsible ministers in the Baltic States to take the necessary steps to ensure the implementation of the project as a matter of urgency.
- Accordingly, on 14 January 2015, the Baltic Ministers responsible for energy signed a Joint Declaration on Security of Energy Supply in which they agreed, inter alia, to work towards a harmonious and timely implementation of the synchronisation with CEN project (with a realistic deadline of 2025).
- The conclusions of the European Council of 20 March 2015 acknowledged that the Baltic States' political agreement to implement synchronisation with continental European networks will contribute to the strengthening of energy security.
- An updated BEMIP plan was signed on 8 June 2015, which included a synchronisation project and the creation of a special High Level Group (BEMIP HLG) and a regional working group on synchronisation.
- On 18 November 2015, the European Commission approved the second list of projects of common interest (PCI), which includes infrastructure projects of importance for synchronisation in the Baltic States (project group for the strengthening of internal networks in Estonia, Latvia and Lithuania) and has separate point dedicated to the joint synchronisation project.
- On 15 December 2015, the European Parliament adopted a resolution on the implementation of the European Commission communication on the 10% electricity interconnection target in the European Union. This resolution recognises that the synchronous operation of the Baltic States with the Russian electricity system will not ensure the efficient functioning of the European electricity market. In this context, the European Parliament calls for further work on Baltic synchronisation with CEN as a matter of urgency and urges stakeholders and ENTSO-E to initiate

the necessary procedures for the extension of the European continental network synchronisation area to the Baltic States.

- On 23 November 2017, the EU third list of projects of common interest was approved, which includes a common synchronisation project and a certain number of projects related to the implementation of synchronisation in the Baltic States for the development of internal electricity system infrastructure.
- On 28 June 2018, a Roadmap was signed at the highest political level between the Baltic States, Poland and the European Commission on the synchronisation of the Baltic States' electricity networks with the continental European electricity network via Poland by 2025. The approved policy guidelines set out the process of synchronising the Baltic States' electricity system with the continental European network by 2025 and identify the specific method (synchronisation via the existing LitPol Link connection, additionally laying an underwater high-voltage direct current (HVDC) cable between Poland and Lithuania and installing synchronous condensers).
- On 23 January 2019, the European Commission provided funding for the synchronisation of the Baltic States' energy system with the continental European networks. The Connecting Europe Facility allocated EUR 324 million to the Baltic States.
- On 20 June 2019, at the meeting of the European Council in Brussels, President of the European Commission Jean Claude Juncker, President of Lithuania Dalia Grybauskaitė, Prime Minister of Estonia Jüri Ratas, Prime Minister of Latvia Arturs Krišjānis Kariņš and Prime Minister of Poland Mateusz Morawiecki signed a political roadmap implementing the synchronisation of the Baltic States' electricity systems with the European networks. It establishes a concrete action plan and the necessary key projects to be implemented by 2025, when the Baltic States will join a secure and reliable European energy system.

  The political roadmap stipulates that: (1) the BEMIP High Level Group will supervise the practical implementation of the project and ensure that the agreed timetable for works is respected; (2) the Baltic and Polish transmission system operators, in close cooperation with ENTSO-E, must implement the key infrastructure projects; (3) discussions must be continued at technical level with Russia and Belarus on the disconnection (desynchronisation) of the Baltic States from the IPS/UPS system without leaving the infrastructure for trade with third countries.

Natural gas market

Cooperation with the Baltic regulatory authorities and transmission system operators will aim to integrate with the gas markets of other countries in the region (in particular, Latvia, Estonia and Finland) by harmonising the legal and regulatory environment in the gas sector, abolishing cross-border transmission tariffs, connecting markets to a common balancing zone, trading gas at one virtual point of sale and ensuring that sufficient gas infrastructure is in place to operate in a single gas market. This would create better access to alternative sources of gas for other countries in the region, facilitate gas trade in the region and allow for greater cross-border gas flows and more efficient use of gas infrastructure, as well as increased competition.

The Klaipėda LNG terminal, launched in December 2014, is capable of securing natural gas supplies for the whole region and created conditions for competition on the Lithuanian natural gas market by importing natural gas from all over the world. Natural gas may be supplied to customers from different suppliers at market prices.

In addition, the implementation of the gas pipeline interconnection project between Poland and Lithuania (GIPL) (2021) will integrate the gas markets of the Baltic States and Finland into the single EU gas market, create access to alternative sources and routes of gas supply and increase the competitiveness of the gas market, increase security and reliability of gas supply in the region by creating both additional gas

transmission capacities and the possibility of applying EU solidarity mechanisms in the event of an emergency, increase the liquidity of gas trade in Polish and Baltic States' trading zones, strengthen their regional role and facilitate the integration of energy produced from RES.

The Latvian-Lithuanian capacity enhancement project (ELLI) (2023) will ensure sufficient capacity between the Baltic States and other European countries, increase security of gas supply in the region, improve integration of the Baltic States' gas markets and the functioning of the regional gas market.

Promoting the use of LNG fuels

We promote the use of liquefied natural gas (LNG) as a clean fuel for heavy-duty transport and transport by ship in Lithuania and throughout the region.

1. Use of LNG in heavy-duty transport (synergies between RES and LNG)

The use of LNG as a fuel is the only clean technology currently available in heavy-duty transport. Compared to light-duty transport, there are no alternative technologies for heavy-duty transport, and pollution reduction decisions have to be taken today. It should be noted that the use of LNG in transport contributes significantly to the reduction of emissions into ambient air. Compared to conventional diesel used in transport, LNG can reduce carbon dioxide emissions by 20% (note: with biomethane CO_2 emissions can be reduced by even more than 85%). It is important to recall that CO_2 accounts for the major share in the composition of greenhouse gases. The use of LNG in transport can reduce other environmental emissions, such as SOx, or NOx, by 99% and 80% respectively, and halve noise pollution.

We note that synergies between renewable energy sources and LNG are some of the prospective areas. Improving energy efficiency in public infrastructure and reducing the intensity of polluting energy in transport through the synergies between RES and LNG would ensure a significant reduction in GHG emissions.

2. Use of LNG in transport by ship

The development and importance of the LNG market in the region are evident. LNG fuel used for ships significantly reduces pollution; therefore, AB Klaipėdos nafta proposes promoting the stevedoring of LNG-powered vessels in the port of Klaipėda.

The issue of reducing air pollution is currently highly relevant at global level. Ambient air pollution is one of the most serious health and environmental issues and, therefore, major attention has to be paid to the reduction of ambient air pollution. In order to reduce the amount of pollutants released into the environment, progress must be made both in Lithuania and in the Klaipėda State Seaport. When evaluating the adverse effects of pollutants, certain preventive measures with the highest added value and targeted reduction of air pollution must be considered and envisaged. Particular attention must inevitably be paid to the reduction of emissions from the maritime transport sector.

It is noteworthy that the reduction of air pollution from ships is particularly relevant at present due to the 0.1% SOx limit on fuel, effective of January 2015, in the zones of the Emission Control Area (ECA), including the Baltic Sea region.

Currently, this limit applies only to ships operating in ECA zones, but as of 2020, it will also apply globally at a concentration of 0.5% SOx in fuels. Stricter requirements have influenced the development of new technologies contributing to the reduction of emissions and the choice of these technologies in the maritime sector. It should be noted that one of the most promising ways of reducing the toxicity of emissions from

ships is to use liquefied natural gas as a less polluting alternative to conventional fuels. The use of LNG ensures that the ship complies with both the SOx requirements and the more stringent NOx requirements.

The use of LNG as a less polluting alternative contributes to the reduction of greenhouse gas and other pollutant emissions into the environment.

It should be noted that the use of LNG as a fuel throughout a ship's life cycle contributes to a significant reduction in GHG emissions. Compared to conventional marine fuels, the use of LNG can reduce GHG, including CO2, emissions by more than 20%. It should be stressed that the use of LNG also contributes to the reduction of other emissions into the environment. Compared to fuel oil, environmental emissions, e.g. SO2 or NOx, are close to zero, i.e. SO2 and NOx emissions decrease by 99% and 90% respectively. The use of LNG also reduces air pollution by 50%.

It is important to note that one typical Baltic cargo LNG-fuelled ship emits around 50 tonnes less of SOx, over 150 tonnes less of NOx and around 2000 tonnes less of CO_2 per year.

Renewable energy

In implementing policies and measures aimed at increasing the share of energy produced from RES in the energy and transport sectors, the Lithuanian designated body (natural gas transmission system operator) authorised to issue, transfer and cancel guarantees of origin for gas produced from RES will, in cooperation with designated bodies in other Member States and organisations in the gas sector in RES, create a favourable regulatory environment for trade in guarantees of origin for RES with other Member States: by harmonising national requirements for guarantees of origin (including sustainability certification) for RES with those of other countries, establishing a European guarantee of origin register scheme, providing methodological support for the development of RES gas production projects in partner countries and establishing other national biomethane registers in EU countries where they are not established.

In the context of the intensive development of RES generation and the significant increase in the share of RES in the overall energy mix, integration into the electricity transport system and balancing of the electricity grid (both at national and regional level) will be addressed through the use of the Power to Gas technologies, the transformation of excess electricity into a gaseous form of energy (hydrogen and methane) and the transport of gas via the transmission/distribution networks to energy storage and consumption sites in cooperation with gas and electricity transmission system operators in neighbouring countries.

Lithuania is also interested in cooperation in developing offshore wind energy projects and harmonising biofuel blends in transport fuels in the region.

Biofuel exchange

Establishing a biofuel exchange platform in Member States across the region:

- will establish a regional platform for an unlimited number of biofuel suppliers;
- standardised biofuel products will facilitate trade between Member States;
- active trade between Member States will help to make the entire EU biofuels market more liquid and accessible;
- will establish a virtual biofuel supply system with the most economically advantageous transactions with the nearest buyer of biofuels as an alternative to a gas or oil pipeline;
- will ensure security of supply by all biofuel suppliers in the region;
- low barriers for new market entrants and a more attractive market for new investors;
- will ensure the sharing and dissemination of information on the biofuels market;

- will ensure the sustainability and CO_2 neutrality of the biofuels supplied.

All these elements will contribute to the achievement of the objectives of the RES Directive and to providing competitive alternative of sustainable and CO2 neutral supply of biofuels to the existing fossil fuel transmission networks (gas or oil).

The biofuel exchange platform will standardise biofuel fuel products and the processes of their delivery. Such product standardisation in the region will not only make it easier and quicker to conclude transactions between Member States, but will also ensure the security of the energy supply chain by diversifying the risk of supply disruptions for all members of the platform without paying additional fees to the platform operator, thus ensuring security of supply without increasing the price of biofuels.

The system of the biofuel exchange platform is programmed in such a way that GPS determines the distance to each buyer based on the location of the supplier (the seller of biofuels may even limit the geography of the activity). Therefore, once the exact transport costs of 1 km have been determined by the biofuel suppliers, the system itself will accurately calculate the biofuel transport costs for each transaction (e.g. biofuels from the same supplier will be offered to different customers at different prices due to different customer locations) and will conclude the most economically advantageous transaction between the nearest biofuel suppliers and customers. This will reduce the CO2 footprint of the transport of biofuels and ensure their sustainability.

The biofuel exchange platform increased the transparency and efficiency of the market in Lithuania, which in turn almost eliminated the price differences for biofuels between neighbouring municipalities. Establishing a common biofuel exchange platform in the region, with biofuel prices not differing by more than 15% between neighbouring Member States in the region, would reduce the transport of biofuels from one Member State to another, thus ensuring the sustainability of biofuels by further reducing the carbon footprint in biomass transport.

By standardising biofuel products, the biofuel exchange platform will also ensure their specifications and compliance and it is expected, therefore, to increase trade in certified biofuel products. By 2030, the aim is to achieve that all biofuels sold in the region are certified, thus ensuring that they are CO_2 neutral, i.e. sustainable.

Standardisation of biofuel products also contributes to ensuring the sustainability of biofuels, as the worst biofuel product sold will encourage the use of all biomass generated (logging residues, industrial by-products, etc.).

Impact on energy prices

The biofuel exchange platform will ensure competition between biofuel producers, as well as clear conditions and trade facilitation, thus not only reducing administrative costs for existing biofuel producers, but also facilitating market entry for new entrants throughout the region. The biofuel exchange platform will also help to determine the true market price of biofuels, which will help market participants to identify the current market situation. All these conditions will lead to decreasing margins for biofuel producers or resellers, i.e. decreasing prices of energy resources, and increasing attractiveness of biofuels as a renewable energy source.

Standardised biofuel products from the biofuel exchange platform will contribute to the vertical integration of individual sectors of the biofuel industry in the region, as the production of the biofuel product traded on the lowest quality platform allows the use of all residues from the wood industry (logging residues, industrial by-products, etc.). Such integration will contribute to the promotion of the wood industry itself throughout

the region.

In many cases, due to a natural monopoly in the district heating sector, heat prices are regulated by the national regulator and are not based on market competition. As a result, buyers of biofuels that produce heat do not have a strong interest in seeking the optimal price for their energy sources. For Member States, the biofuel exchange platform will help to ensure reasonable heat prices for district heating customers, who are usually the lowest income earners.

Regional cooperation

The full functioning of the biofuel exchange platform requires compliance with the legislation of individual Member States, timely exchange of information and rapid resolution of emerging problems in individual Member States (e. g. better projection and resolution of existing ash removal problems), and, accordingly, partners in the region's other countries for which the operator of the biofuel exchange platform is constantly looking are needed. Cooperation is currently maintained with Latvia, Estonia, Denmark and Finland, with planned enlargement to Poland and Germany. By 2030, it is planned to have a partner in all the countries of the Baltic Sea region.