LITHUANIA'S SEVENTH NATIONAL COMMUNICATION

under the United Nations Framework Convention on Climate Change

Vilnius 2017

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Foreword

The Ministry of Environment is delighted to present Lithuania's 7th National Communication under the United Nations Framework Convention on Climate Change (hereinafter – UNFCCC).

Climate change is one of the major threat and challenge of our time. The climate change issues are particularly worrying: Lithuania is already facing increased intensity and frequency of extreme weather events (heat waves, storms and floods), leading to reduced crop yields, loss of biodiversity, impact of economy and human health. We understand that without actions today, in the future – it will be more difficult and costly. That's the reason why Lithuania is investing in efforts to understand climate change impacts and has already taken significant steps to identify and address climate change mitigation and adaptation. The actions taken are presented in this National communication.

Lithuania undertook the target to reduce its greenhouse gas (hereinafter – GHG) emissions by 8% below 1990 level during Kyoto Protocol first commitment period 2008-2012. This target has been overachieved reducing more than 55% it's GHG emissions over the first commitment period. In 2012 Lithuania together with other EU Member States and Iceland undertook 20/30% GHG emissions reduction below 1990 level commitment for the second Kyoto Protocol period from 2013 till 2020.

Lithuania signed and ratified the Paris Agreement in 2016. Under the Paris Agreement Lithuania jointly with the EU and its Member States took a binding target of at least a 40% domestic reduction in economy wide GHG emissions by 2030 compared to 1990, by implementing the EU legal acts for the EU climate and energy policy targets till 2030, mainly through the EU emission trading system (EU ETS) and Efforts Sharing Regulation, as well as Clean Energy Package legislation. Moreover, cooperating with the EU Member States and other countries, Lithuania will promote the development of a low-carbon and climate-resilient economy in order jointly to reduce GHG emissions by 80-90% by 2050 and achieve climate neutrality in the second half of this century. The target will be delivered implementing the EU legal acts on 2030 climate and energy targets by all economy sectors, with the reductions in the Emission trading system (ETS) and non-ETS sectors amounting to 43% and 30% respectively by 2030 compared to 2005.

In order to ensure the implementation in the international agreements and the EU legal acts defined targets for Lithuania, in 2012 the Parliament of the Republic of Lithuania approved the National Strategy for Climate Change Management Policy which lays down the targets and objectives for climate change mitigation and adaptation by 2050. The Lithuanian legally binding short-term climate change mitigation targets by 2020 are:

- achieving that GHG emissions of EU ETS sectors do not exceed 8.530 million tonnes of CO_2 eq.;
- achieving that non-ETS sectors meet their annual GHG emission targets and do not exceed 15.240 million tonnes of CO_2 eq. by 2020;
- achieving that the share of renewable energy resources (RES), by comparison with the overall final energy consumption of the country, accounts for minimum 23%;
- reducing energy consumption by 1.5% every year (reducing energy consumption in 2020 by 17% as compared to 2009);
- reaching in 2020, no less than 0.38% of the country's GDP is assigned for the implementation of short-term climate change mitigation targets.

The Strategy also lays down indicative medium-term climate change mitigation targets that Lithuania will contribute towards the implementation of the EU GHG emission reduction targets: reducing GHG emissions by 40% by 2030 and by 60% by 2040. The indicative long-term target of the Strategy is to reduce GHG emissions by 80% by 2050, compared to 1990 levels.

To implement this Strategy, in 2013 the Government approved the Interinstitutional Action Plan on the implementation of the targets and objectives for 2013-2020 of the National Strategy for Climate Change Management Policy, which defines measures for the reduction of GHG emissions and adaptation to climate change in all the sectors of Lithuanian economy, including industry, energy, agriculture, development of residential areas, transport, health care, waste management, etc. This Plan is subject to annual updating. The Plan approved 2016 defines measures for 2017-2019.

The implementation of the Plan is coordinated by the Ministry of Environment. The Ministries of Finance, Energy, Transport and Communications, Economy, Education and Science, Agriculture and the Interior, as well as municipalities, the Research Council of Lithuania, state research institutions and universities, companies, entities, organisations and other persons participate in the implementation of the measures within their competence and allocating funds for their implementation of the measures. While drawing up sectorial development programmes, interinstitutional action plans or other planning documents for their respective management areas, the ministries shall mainstream the targets and objectives for climate change mitigation and adaptation set out in the Strategy, in order to provide for specific measures to implement those targets and objectives and to ensure close interinstitutional cooperation.

The 7th National communication is prepared in accordance with “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications” (Decision 4/CP.5) and taking into account remarks by the UNFCCC expert review teams, provided in the Report of the in-depth review of the 6th National Communication of Lithuania (FCCC/IDR.6/LTU). The 7th National communication focus primarily on activities during the four-year period 2014-2017, including data for National GHG Inventory Report 2017.

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EXECUTIVE SUMMARY

1 EXECUTIVE SUMMARY

1.1 National Circumstances

Lithuania is an independent democratic parliamentary republic. The State power is executed by the Seimas (the Parliament), the President and the Government, the Judiciary inclusive.

The territory of the Republic of Lithuania covers 65 302 km^2. Lithuania borders with Latvia, Belarus, Poland, Russia and the Baltic Sea. The coastal length of Lithuania makes 90.7 km.

At the beginning of 2017, the estimated resident population of Lithuania amounted to 2 847.9 thousand, i.e. by 40.7 thousand (1.4%) less than at the beginning of 2016. In 2005-2016, the resident population declined by 507.3 thousand, or 15.1%. The decline in the resident population is caused by negative net international migration and the natural decrease. Average density of population in Lithuania is 43.6 persons/km^2.

Lithuania is the country of lowlands with the highest hills not reaching 300 meters height. Agricultural land covers about 52.4% of the total land area of the country. The Lithuanian woodland occupies about 33.5% of the country's territory and protected areas – 17.6%.

The climate in Lithuania varies from marine to continental. The average annual climatic standard of weather temperature is 6.9ºC. In 2011-2016 compared to 1981-2010 it increased by 0.7°C, which shows climate warming. From 1981, the year 2015 was the warmest with the average annual air temperature in Lithuania of 8.3°C.

Over the last decade the country's economy and macro-economic indicators tended to increase steadily. The growth has been caused by the anchored market economy in the country. Lithuania's accession to the European Union in 2004 also had influence on the above. The main economic activity in Lithuania is service sector, followed by industry and construction.

From 1990 to 2016 total primary energy consumption in Lithuania decreased by almost 55%. Oil and oil products were the most important fuel in Lithuania over the previous decade. At present natural gas is the most important fuel in the Lithuanian primary energy balance. The share of natural gas was fluctuating about 28.4% over the period 2000-2016.

78.4% of Lithuania's energy consumption comes from imports. This is mainly due to the dependence of natural gas, crude oil and NGL from Russia. For natural gas, however, the LNG Terminal in Klaipėda, which was put in operation in December 2014, has allowed for significant diversification of gas import.

Contribution of renewable energy sources into the country's primary energy balance during the period 1990-2016 is increasing. During the period 1990-2016 primary energy supply from renewable sources increased by 4.6 times with an average annual growth of 6%. Lithuania has undertaken, according to Directive of the European Parliament and of the Council No 2009/28/EC on the promotion of the use of energy from renewable sources, to increase the renewable sources share in the final national energy consumption up to 23% by 2020. Lithuania has already reached the 23% target: in 2016, the share of renewable energy sources in the total energy balance of the country exceeded one fifth, accounting for 25.46%. Currently the main domestic energy resource is solid biomass, the second largest renewable energy source is wind energy.

Lithuanian transport sector is one of the most promising sectors of the national economy. The mission of the national transport system is to ensure the harmonious public mobility and transport of goods, and to increase the country's competitive capacity in international markets. Lithuania is centrally located between three sizeable markets: Western Europe, the Nordic countries, and the Eastern markets of Russia and the Commonwealth of Independent States (CIS). Transport and logistics sector accounts for about 12.3% of GDP (largest share of GDP in EU).

Road transport is one of the main branches of transport sector. More than a half of added value is created by road transport, 46% of turnover is generated. National passenger transport by road dominates: it accounts for 99% of total national passenger transport. In 2015, fuel consumption in road transport amounted to over 1.6 million tonnes, of which 80% – road diesel, 13% – motor gasoline, 8% – liquefied gas.

Lithuanian industry sector accounts for a significant share of gross value added in the country's economy. Dominating industry in Lithuania is manufacturing. Manufacturing constituted 90% of the total industrial production (excluding construction) in 2016. Four most important subsectors within manufacturing cumulatively produced 64% of production: manufacture of food products and beverages, manufacture of refined petroleum products, manufacture of wood products and furniture, manufacture of chemicals and chemical products.

In 2016 more than 67% of Lithuania's population lived in towns and cities. Between 1950 and 2016, the number of urban population increased more than 60%. Accordingly, more land is used for housing, infrastructure and services. The average useful floor area per capita amounted to 33.6 m^2. The Renovation of the multi-apartment buildings programme is one of the country's priority projects aimed at increasing energy efficiency of the most heat-intensive multi-apartment buildings.

Agriculture sector has a great influence on the development of Lithuanian rural area as 33% of residents live in countryside. More than a half of Lithuania's land is suitable for agriculture. In 2016 the proportion of crop production and animal production in the total agricultural production made up 63.5% and 36.5% respectively.

The total forest land area covered 33.5% of the country's territory in 2016. Since 2003, the forest land area has increased by 141.5 thousand ha corresponding to 2.2% of the total forest cover. Coniferous stands prevail in Lithuania, covering 55.8% of the forest area.

The total amount of waste generated annually in Lithuania is about 5 million tonnes. Major part of waste is generated in industrial sector of which about 100 kt – hazardous waste. Annual municipal waste generation is a bit more than 1 million tonne. In 2015, municipal waste generation in Lithuania remained just slightly below the EU average (448 kg/year/inhabitant compared to around 477 kg on average). In 2015 in Lithuania is recycled 23%, composted 10%, incinerated 12% with energy recovery and disposed in landfills 55% of municipal solid waste.

1.2 Greenhouse gas inventory information

Lithuania as a Party to the UNFCCC and the Kyoto Protocol is committed to provide annually information on national anthropogenic GHG emissions by sources and removals by sinks for all GHG not controlled by the Montreal Protocol. As a member of the European Union, Lithuania has also reporting

obligations under the EU Regulation No 525/2013 of the European Parliament and of the Council on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

National Inventory Report (NIR) covering the inventory of GHG emissions of Lithuania is being submitted to the UNFCCC secretariat annually, in compliance with the decision 24/CP.19 "Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to Convention" (FCCC/CP/2013/10/Add.3). GHG inventory is compiled in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006).

The data used in Lithuania's 7th National Communication is in accordance with its NIR that was submitted in 2017 to the Secretariat of the UNFCCC. This submission covers the inventory of GHG emissions of Lithuania for the period 1990-2015.

The total Lithuania's GHG emission (excl. LULUCF) amounted to 20 096.2 kt CO_2 eq. in 2015. The emissions have decreased by 58.2% comparing with the base year. The base year is 1990 for the greenhouse gases CO_2, CH_4, N_2O and 1995 for the F-gases HFC, PFC, SF_6 and NF_3.

GHG emission trends, including and excluding LULUCF, are presented in a figure below.

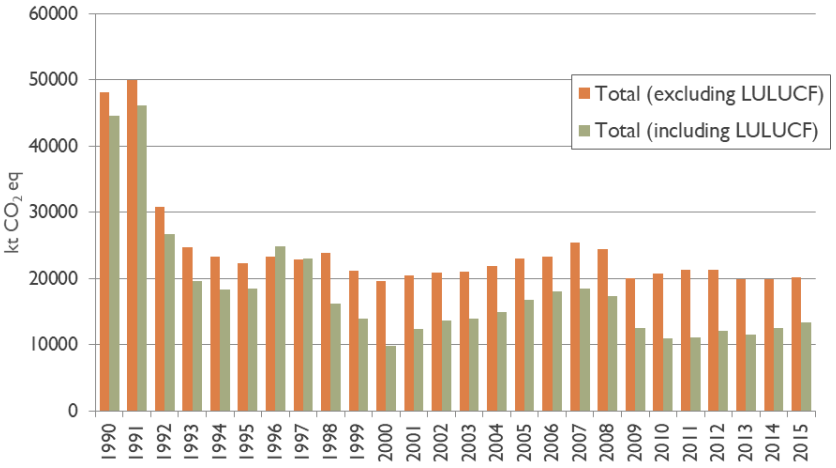

Figure 1-1. Emission trends for aggregated GHG emissions in 1990-2015

The most significant source of GHG emissions in Lithuania is energy sector with 55% share of the total emissions in 2015. Main contributors in energy sector are energy industries and transport sectors. In 2015 these sectors composed 15.7% and 25.4% of the total national GHG emissions respectively.

Agriculture is the second most significant source and accounted for 22.9% of the total emissions. Emissions from industrial processes contributed 16.9% to the total GHG emissions, waste sector – 5.2%.

The most important greenhouse gas is CO_2 as it contributed 65.4% to the total national GHG emissions expressed in CO_2 eq. in 2015, followed by N_2O (15.4%) and CH_4 (16.8%). HFCs, SF_6 and NF_3 amounted together to 2.4% of the total GHG emissions (excl. LULUCF) in Lithuania.

Greenhouse gas inventory system

The main institutions involved in GHG inventory system in Lithuania are the Ministry of Environment, the Lithuanian Environmental Protection Agency, State Forest Service and sectoral experts from Permanent GHG Inventory preparation working group.

Ministry of Environment of the Republic of Lithuania is a National Focal Point to the UNFCCC and is designated as single national entity responsible for the national GHG inventory. It has overall responsibility for the national system of GHG inventory and is in charge of the legal, institutional and procedural arrangements for the national system and the strategic development of the national inventory.

Lithuanian Environmental Protection Agency (EPA) under the Ministry of Environment is GHG inventory QA/QC manager and responsible for compilation of the Lithuania's National inventory report (NIR), accomplishment of cross-cutting issues such as key categories analysis, overall uncertainty assessment, analysis of GHG emission trends. EPA establishes and operates GHG inventory archive, where all GHG inventory supporting reference materials are stored. Since 2014 submission personnel of EPA is also responsible for calculation of industrial processes and product use (IPPU) sector and agriculture sector (agricultural soils part) emissions.

The State Forest Service (SFS) under the Ministry of Environment compiles the National Forest Inventory (NFI) and the forest information system, carries out monitoring of the status of the Lithuanian forests, collects and manages statistical data etc. In the GHG inventory preparation process it is responsible for calculations of emissions and removals of LULUCF sector and Kyoto Protocol activities under Article 3, paragraphs 3 and 4.

Permanent GHG Inventory preparation working group was established in 2011 by the Governmental Resolution No 683. The working group consists of representatives from scientific institutions, which are responsible for respective sectoral GHG emissions estimates: Institute of Physics (transport), Lithuanian Energy Institute (energy), Institute of Animal Science (livestock), Aleksandras Stulginskis University (LULUCF, except forestry), Centre for Environmental Policy (waste).

The annual GHG inventory preparation follows the work schedule for reporting. Lithuania has to submit GHG inventory to the European Commission by 15th January and update estimates by 15th March annually. GHG inventory to the UNFCCC secretariat shall be submitted by 15th April annually.

The methodologies, activity data collection and choice of emission factors are consistent with the 2006 IPCC Guidelines. The quality requirements set for the annual inventories – transparency, consistency, comparability, completeness and accuracy are fulfilled by implementing consistently the QA/QC plan and procedures.

National Registry

The Lithuanian GHG Registry has been completely operational since 2005 until 20 June 2012 when the EU Member States' national GHG registries were consolidated to the Union Registry. The Registry shares the same infrastructure technologies as other 28 national registries of the Consolidated System of EU registries (CSEUR) platform.

The National GHG Registry is operated in accordance with the Commission Regulation (EC) No 389/2013 of 2 May 2013 establishing a Union Registry pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Decisions No 280/2004/EC and No 406/2009/EC of the European

Parliament and of the Council and repealing Commission Regulations (EU) No 920/2010 and No 1193/2011. The competent authority of the GHG Registry is the Ministry of Environment. The Lithuanian Environmental Investment Fund (LEIF) has been assigned the functions of the national administrator, and the registry central administrator is the European Commission.

1.3 Policies and measures

The Lithuanian climate change policy is developed in line with the targets and objectives laid down in the international agreements under the UNFCCC, the EU strategic documents and legislation. Lithuania is working with other EU member states to achieve a global Paris agreement compatible with the goal of limiting the rise in temperature to no more than 2 °C above pre-industrial levels.

The Ministry of Environment of the Republic of Lithuania is the main institution responsible for the development of climate change policy and its implementation in Lithuania. Also issues related to the development and implementation of the climate change policy are carried out by Ministry of Finance, Ministry of Energy, Ministry of Economics, Ministry of Transport and Communications, Ministry of Agriculture, Ministry of Health and institutions supervised by the relevant ministries. Institutions supervised by the Ministry of Environment, which are responsible for climate change issues: Environmental Protection Agency, State Forest Service, Lithuanian Hydrometeorological Service.

The main goals of climate change policy in Lithuania are as follow:

- ensure Lithuania's contribution to global climate change mitigation, ensuring balance of environmental and economic interests;
- promote Lithuania's ability to evaluate climate change impacts;
- promote Lithuania's ability to adapt to climate change, extreme impacts;

The climate change policy in Lithuania is based on the EU climate change policy. The main national strategic documents and programmes which include targets and objectives related to climate change mitigation are: The Strategy for the National Climate Change Management Policy, Lithuania's Progress Strategy 2030, The National Reform Programme, National Energy Independence Strategy. Targets and objectives of the climate change mitigation and adaptation are being mainstreamed into the sectorial development programs, such as the Multi-Apartment Building Renovation Programme, the Programme on the Increase of Energy Efficiency in Public Buildings, the Action Plan on Energy Efficiency, the Programme on Investment promotion and Industrial Development for 2014-2020, the National Programme for the Heating Sector Development for 2015-2021, the National Programme on Renewable Energy Source Development, the National Programme on Transport Development for 2014-2022, the State Waste Management Plan for 2014-2020, the Rural Development Programme for Lithuania 2014-2020 and other strategic documents. Economic and financing instruments are applied in order to implement targets set in the Strategy for the National Climate Change Management Policy and sectorial strategies: the EU emissions trading system (ETS) from which revenues of auctioned allowances are earmarked to the Special Programme for Climate Change, the EU structural and investment funds for 2014–2020: the Cohesion Fund, the European Agricultural Fund for Rural Development via the Rural Development Programme for Lithuania 2014–2020, the JESSICA Holding Fund, Energy Efficiency Fund. Lithuania intends to use 22.6% of the EU structural and investment funds (EUR 1.9 billion) for the climate related investments.

Lithuania has signed the Paris Agreement on 22 April 2016 and ratified on 30 December 2016. Under the Paris Agreement Lithuania will implement economy-wide national targets in line with the EU legal acts on 2030 climate and energy targets reducing GHG emissions in EU ETS and non-ETS sectors amounting to -43% and -9% respectively by 2030 compared to 2005.

Detailed information about Lithuania's national system for reporting on policies and measure and sectorial (Energy, Industry, Agriculture, Waste, LULUCF) policies and measures are presented in Chapter 4. Actions should be introduced in all levels of national and local government, businesses and society, which means that climate policy must be integrative.

1.4 GHG Projections

Human economic activities are among the key sources of GHG emissions. This is primarily linked with fuel combustion for energy production, but also other processes of human economic activities have a fairly great significance as well.

In Chapter 5 are presented sectorial projections for GHG emissions that were prepared in 2017, submitted on 15th of March, 2017 and resubmitted in May, 2017 for the European Commission. In order to improve GHG projections, in 2016 Lithuanian Energy Institute prepared the Methodological guidance for the preparation of GHG emission projections. This guidance is based on an integrated approach to the long-term development of the economic sectors, with account of the EU climate change and energy objectives by 2030 and targets by 2050, and also on the existing situation and possibilities. GHG emissions in Lithuania have been projected for the years 2015, 2020, 2025, 2030, 2035. 2014 was chosen as a base year (latest confirmed National GHG Inventory Report data). Projections are divided into the following sectors: energy (including transport); industrial processes (including F-gases); agriculture; waste; land-use, land-use change and forestry (LULUCF). Two scenarios are presented: assessing existing climate change mitigation measures (WEM) and additional measures that are planned (WAM), but have not been implemented or adopted.

Transport and agriculture sectors have been identified as the most GHG emissions reduction-efficient sectors. Based on the projections, carbon dioxide emissions will continue to grow in the transport sector, as this sector is rapidly developing and, besides, the vehicle fleet is getting outdated. In this sector, road transport emissions account for 90%, of which 80% come from motor vehicles. The majority of the GHG emissions in the agriculture sector originates agriculture soils and digestive processes. Based on the projections, the share of GHG emissions will not change a lot during the projected period and agriculture soils subcategory will remain the largest source of the emissions in agriculture sector. It is projected that in 2030 GHG emissions from agriculture soils will contribute 57% and from livestock (enteric fermentation and manure management categories) – 42% to total agriculture GHG emissions. The implementation of additional measures could result in lower GHG emissions in 2035 if compared WAM and WEM scenarios. Total historical and projected GHG emissions in Lithuania are presented in the figure below:

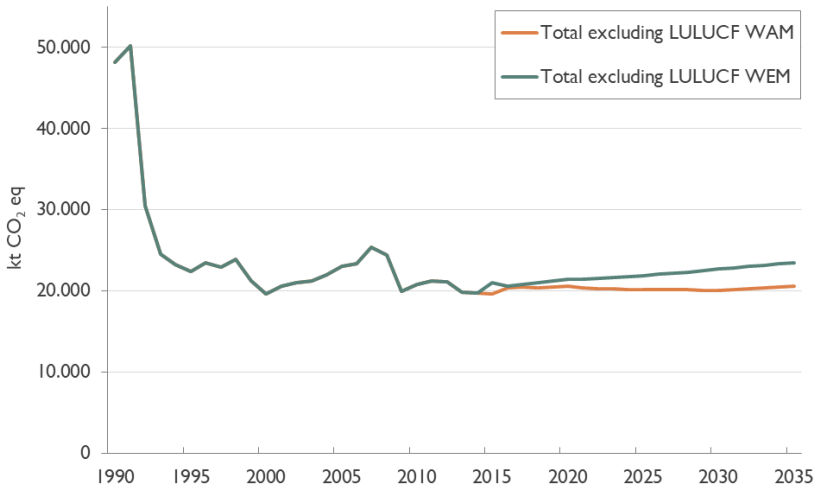

Figure 1-2. Historical and projected GHG emissions

GHG emission depends, on the volume of economic activities and carbon intensity of economy. Total projected emissions for year 2020 have decrease comparing projections in Sixth and Seventh National Communication reports. Noticeable changes are visible in all sectors – in agriculture, LULUCF, energy, industry and waste sectors projected emissions have decreased. Since Sixth National communication report Lithuania improved GHG projections calculations.

All non-ETS sectors will have to duly contribute for the purpose of achieving the GHG emissions targets. In order to reduce these emissions, additional measures should be applied. Such measures include sustainable farming, crop rotation, rational and regulated use of synthetic fertilizers and replacement of synthetic fertilizers by organic fertilizers, expansion of perennial meadows in order to improve soil fertility, manure handling, review of subsidies and tax concessions. Thus, with a view to reducing GHG emissions from economic activities, it is necessary to deal with the restructuring of economic activities and increase their effectiveness. This requires introducing less polluting technologies, using cleaner primary energy resources, shifting towards the use of renewable energy resources, searching for cleaner and more balanced transport options, seeking sustainable land use and agriculture, ensuring more sustainable urban development, reducing the discharge of pollutants from all economic sectors and guaranteeing the funding for the introduction of measures related to climate change mitigation.

1.5 Vulnerability assessment, climate change impacts and adaptation measures

According to results of the climate projections research carried out at Hydrology and Climatology Department of Vilnius University, based on climate projection RCP8.5 scenario, which represents highest changes, the average annual temperature in Lithuania can increase by almost 6°C. According to RCP2.6 scenario the 2°C threshold in Lithuania will be exceeded in the first half of the 21st century and after it the air temperature will not change considerably. To summarize, it is expected that global temperature increase by 2°C compared to the pre-industrial levels in the middle of the 21st century, and in Lithuania about 15-20 years earlier. By 2035 the average annual precipitation should increase by 1.6-4.0%. Even more significant changes in precipitation are projected in the late-21st century, when average annual

precipitation may increase by 3.7-13.5%. During 21st century in Lithuania daily air temperature fluctuations will increase and the number of hot days (>30°C) and warm nights (>15 and >18°C) will increase as well. Thus, possibly heat waves will increase in frequency and intensity (they will last longer and will reach higher air temperatures). Number of extremely cold days will decrease more slowly.

Based on the results of previous studies in Lithuania the Baltic Sea coast region is mostly vulnerable to climate change. Coast, coastal ecosystems, as well as local population are mostly affected by sea level rise, storm and hurricane winds, sea and Curonian Lagoon water warming and salinity changes.

Climate change will have an impact on our everyday life worldwide and in Lithuania too. In the long term, the future climate is dependent on the future emissions of greenhouse gasses and other substances that influence the climate. The development in GHG emissions is especially dependent on these factors: demographic development, the spread of implementation of energy-efficient technologies and the socio-economic development. The changing climate with rising temperatures, increase in extreme weather events (storms, floods, windfalls), rising river levels, will have impact on all sectors and society life. Impacts of climate change will directly or indirectly affect agriculture, forestry, water resources and fisheries, energy, transport infrastructure, construction and building sector, biodiversity, health, social impacts, economy, tourism and private sector.

Adverse and beneficial impacts caused by climate change are expected, but in order to minimize the risks caused by the climate change need to plan and implement adaptation measures. Projects, programmes and conferences related to the impacts of climate change have contributed to the development of Lithuanian adaptation policies and also supported the development of the national adaptation strategy.

1.6 Financial resources and transfer of technology

Lithuania's aim to ensure financial and technological support for the implementation of climate change mitigation and adaptation measures in other countries, also cooperating with other countries in developing climate change-oriented projects is determined in various legal acts:

- Law on Development Cooperation and Humanitarian Assistance;
- Law on financial instruments for climate change management;
- Inter-institutional action plan of implementation of objectives and tasks of the National climate change management policy strategy for 2013-2020;
- National Interinstitutional Development Cooperation Action Plan for the period 2017-2019 and updated for the period 2018-2020.

Lithuanian institutions responsible for financial support to developing countries in the field of climate change mitigation and adaptation through are: the Ministry of Environment through the funding from the Climate Change Special Programme, the Ministry of Foreign Affairs which administrates development cooperation projects and the Ministry of Finance that makes contribution to international funds and programs including EPTATF.

1.7 Research and systematic observation

The total funding for research and development in 2016 in Lithuania constituted EUR 286.1 million. The funding in 2016 increased by 45% comparing with 2005.

At the highest level, Lithuanian science, technology and innovation policy is set by the Seimas (Parliament) and the Government of the Republic of Lithuania. The Research Council of Lithuania serves as an advisory body to the Seimas and the Government. The Lithuanian STI policy governance structure is based on a dual ministry model, with the Ministry of Economy responsible for innovation and industrial research policy, and the Ministry of Education and Science responsible for higher education and public sector research policy.

In 2015, the Lithuanian Government approved the programme on the implementation of the research, development and innovation priority areas and their priorities (Smart Specialization Programme) and Action plans for implementation of the priorities. The overall aim of this programme is to develop policy instruments that would include both horizontal and subject measures necessary to achieve a substantial breakthrough in the six priority fields that Lithuania had identified as main areas for research, development and innovation. One of the priority areas of the Smart Specialization Programme is "Energy and sustainable environment", which has close links to influencing climate change. The main priorities of the "Energy and sustainable environment" priority area are the following: smart systems for energy efficiency, diagnostic, monitoring, metering and management of generators, grids and customers; energy and fuel production using biomass/waste and waste treatment, storage and disposal; technology for the development and use of smart low-energy buildings – digital construction; solar energy installations and technologies for using them for the power generation, heating and cooling.

National Research Programs (hereinafter – NRPs) are competitive scientific programs, which enable to solve problems of state and society and increase the international competitiveness of Lithuanian science. The purpose of the NRPs is to bring together Lithuania's scientific potential and financial resources, to initiate new research and to coordinate already existing research in order to solve a given problem. One of the five National Research Programmes approved by the Research Council of Lithuania in 2013 provides competitive funding for research in a climate change research field. The NRP "Sustainability of agro-, forest and aquatic ecosystems", approved by the Government of the Republic of Lithuania started in 2015 and is expected to end in 2021. Overall budget is EUR 6.6 million. This Programme replaced the previously existing programme "The Ecosystems in Lithuania: Climate Change and Human Impact". The purpose of the programme is to understand and be able to forecast the general effects of climate change and the intensive use of ecosystem resources, and to obtain new fundamental and empiric knowledge to enable the avoidance of threats related to these effects. The 1st call for proposals for 2015-2018 period launched with about EUR 3.96 million in total for the financing of the programme research projects. During the period 11 projects have already started. Lithuanian Scientific institutions participating in the projects are: Aleksandras Stulginskis University, Lithuanian Energy Institute, Lithuanian Research Centre for Agriculture and Forestry, Nature Research Centre, Vilnius University, Vytautas Magnus University, Lithuanian University of Health Sciences.

A large number of research institutes and universities carry out research on climate change impacts, adaptation and mitigation in Lithuania: marine and inland water management and protection, climate change in peatlands, energy sector development research, modelling of long-term GHG emission reduction strategies, use of renewable energy sources, assessment of geothermal energy resources,

sustainable forestry and global changes, resistance of plants to drought and cold, sustainable animal production systems etc. Lithuanian scientific institutions also actively involved in research activities in support of the national greenhouse gas inventory and projections development.

Lithuanian GCOS related activity is coordinated by the Lithuanian Hydrometeorological Service under the Ministry of Environment. It performs climate observations, analyzes climate changes, provides information and actively participates in the activities of Eastern and Central European working groups.

1.8 Education, training and public awareness

Lithuanian population and government pays more and more attention to the issue of climate change, and the topic comes more and more popular in public debates or in the press. Numbers of awareness-raising campaigns were launched for the environment and global warming in particular at the various political levels in the country. Climate change is already anchored in the education and public awareness practices of the Lithuanian Government and these practices are continuously being developed.

Education

The responsibility for the coordination of education lies with the Ministry of Education. The relevant legislative provisions are the Education Act, the Vocational Education and Training Act and the Higher Education Act along with the relevant ordinances.

The education and higher education studies which are offered by Lithuanian scientific institutions have successfully integrated various aspects of climate change issues. School children and students have a lot of possibilities to broaden their knowledge in sustainable development, analysis of ecosystems sensitivity, management of resources, environmental impact assessment, adapting to climate change, modelling and forecasting of climate change. Also climate change education is possible through public awareness campaigns and projects organised by different organisations.

Public outreach

Communication about climate change is performed by different ministries organizations, each within the sphere of their own responsibilities and tasks. A lot of work has also been performed at the local level – 14 municipalities have joined the Covenant of Mayors, and thereby assumed the obligation to reduce by 2020 the GHG emissions by 47.5% (as compared to 1990 baseline). The Guidance for the Lithuania's municipalities on mitigation and adaptation to climate change was developed in October 2017. Lithuania has also participated in education cooperation projects, financed projects and initiatives which raise awareness of climate change.

Non-governmental organizations (NGOs) are also important in the development of climate change policy. NGOs organize events related to climate change, participate in the development of national and international legislation, preparing publications about climate change.

More and more people are grasping the importance of individually contributing to the protection of the environment, including combating climate change. The "Let's Do It!" clean-up campaign, "Velomarathon", "Earth hour", "European Mobility week", "European Week for Waste Reduction" and other campaigns can be a good examples of a civic initiatives in Lithuania.

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NATIONAL CIRCUMSTANCES

2 NATIONAL CIRCUMSTANCES

2.1 Government structure

The governance of the Republic of Lithuania is performed by the Seimas (Parliament), the President of the Republic and the Government as well as the Judiciary according to the Constitution of the Republic of Lithuania (enacted by citizens of the Republic of Lithuania since 25 October 1992).

The Constitution of the Republic of Lithuania lays down that the Seimas of the Republic of Lithuania consists of 141 representatives of the Nation, who are elected for a four-year term. The Seimas debates, adopts and passes laws, gives or does not give its assent to the candidate proposed by the President of the Republic for the post of the Prime Minister (head of the Government), supervises the activities of the Government, approves the State Budget and supervises its execution, establishes state taxes, calls elections to municipal councils, and ratifies international treaties of the Republic of Lithuania. The Seimas forms committees for consideration of draft laws and standing and other ad hoc commissions for resolving issues of narrower scope.

The Government consists of the Prime Minister and ministers. The Government represents the executive power in Lithuania. It resolves public issues by taking majority-vote decision in its sittings. The Government has the right of legislative initiative at the Seimas. The Government adopts resolutions on Seimas draft laws and other proposals submitted to the Seimas. The Government among the other responsibilities executes laws and resolutions of the Seimas concerning the implementation of laws as well as decrees of the President; coordinates ministries and other governmental agencies; drafts a public budget and submits it to the Seimas; executes the public budget.

There were 14 ministries in the Republic of Lithuania in 2017. The ministries are set up to formulate public policy, as well as to organize, coordinate and monitor its implementation in areas assigned for minister's competence.

The Ministry of Environment as the main institution forming the country's state policy of environmental protection, forestry, utilization of natural resources, geology and hydrometeorology, territorial planning, construction, provision of residents with housing, utilities and housing, as well as coordinating its implementation, has made a significant contribution to climate change regulation. Having assessed the data of environmental observations, taken into consideration the conclusions of scientific institutions and the public opinion and following the existing strategic documents and preparing the legal bases, the goals of the Ministry of Environment and its subordinate institutions are as follows:

- To implement the principle of sustainable development;
- To set preconditions for rational utilization, protection and restoration of natural resources;
- To ensure provision of information about the state of environment and its forecasts to the public;
- To create conditions for the development of construction business and the provision of residents with housing;
- To ensure a proper environmental quality, taking into account the norms and standards of the European Union.

After the Seimas ratified the UNFCCC (1995) and the Kyoto Protocol (2002), most of the obligations of international agreements implementation and the related policy-making responsibilities lied down on the Ministry of Environment and number of other ministries and institutions supervised by relevant ministries

are involved in the implementation of this policy. The Ministry of the Environment is the national focal point to the UNFCCC. More information about the institutional framework of Lithuania's climate policy is presented in Section 4.2.

2.2 Population

Generally, changes in population are considered to be one of the factors that influence energy consumption and dynamics of GHG emissions accordingly.

The population of Lithuania takes a declining trend. At the beginning of 2017, the estimated resident population of Lithuania amounted to 2 847.9 thousand, i.e. by 40.7 thousand (1.4%) less than at the beginning of 2016. In 2005-2016, the resident population declined by 507.3 thousand, or 15.1%. The decline in the resident population in 2016 was caused by negative net international migration and the natural decrease. The impact of negative net international migration accounted for 74.2% of the total decline.

In 2005-2016, due to negative net international migration, the population declined by 365.1 thousand (72% of the total decline), due to the natural decrease – by 142.2 thousand (28% of the total decline).

The highest negative net international migration was recorded in 2010. The increase in the number of emigrants was influenced by an obligation for usual residents of the country to pay compulsory health insurance contributions, laid down in the Law on Health Insurance of the Republic of Lithuania; it also gave an impetus for those already living abroad to declare their departure.

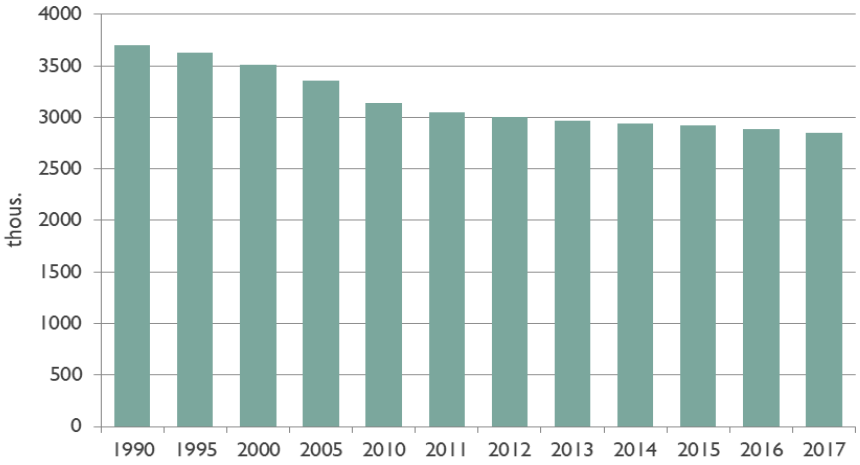

Fig. 2-1. Number of population in Lithuania in 1990-2017, thous.

At the beginning of 2017, 1 911.1 thousand (67.1%) residents of Lithuania lived in cities and towns, 936.8 thousand (32.9%) – in rural areas. In 2005-2016, the urban resident population decreased by 14.4, the rural resident population – by 16.5%.

At the beginning of 2017, population density in Lithuania was 43.6 persons per square kilometre (at the beginning of 2005 – 51.4 persons).

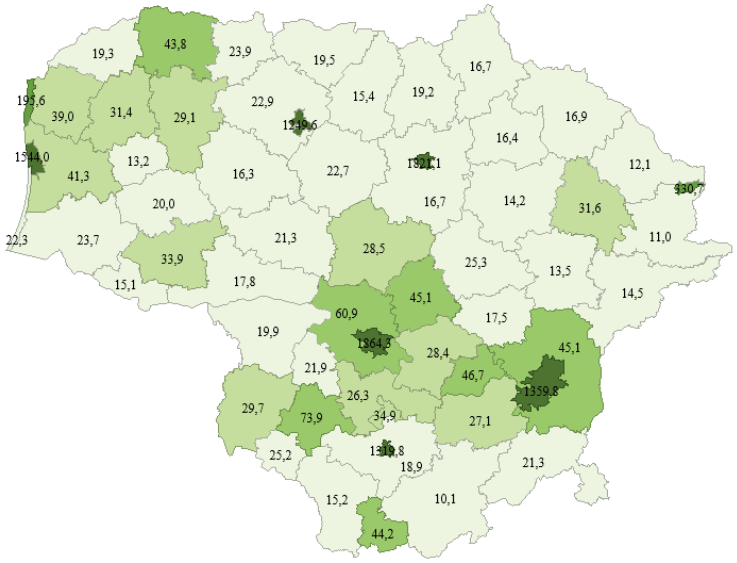

Figure 2-2. Map of population density in Lithuania in 2017, inh./km^2

The number of women in Lithuania was by 223.5 thousand higher than that of men (1 535.7 thousand and 1 312.2 thousand respectively) at the beginning of 2017. Women accounted for 53.9% of the total resident population; there were 1 170 women per 1 000 men (at the beginning of 2005, 53.4% and 1 148 respectively).

In 2016, life expectancy at birth for men was 69.5 years, for women – 80 years (in 2015, 69.1 and 79.6 years respectively). In 2016, the difference between life expectancy at birth for men and for women was 10.5 years.

2.3 Geographic profile

Lithuania is a Central European country on the eastern coast of the Baltic Sea. The size of the territory is 65 302 km².

The current coordinates of borders of Lithuania's territory are between 53°54' and 56°27' Northern latitude, and between 20°56' and 26°51' Eastern longitude. From East to West the territory of Lithuania goes up to 373 km, from North to South – 276 km. Our country has borders with five neighbouring countries. In the North, Lithuania has 588 km long border with Latvia, in the East and South – 660 km long border with Belarus. The neighbouring countries in the south-west are Poland (the length of border is 103 km) and Russian Federation (273 km). More than three quarters of the Lithuanian borders stretch along rivers and lakes. Lithuanian economic zone in the Baltic Sea (6 400 km³) meets the Swedish waters. The length of Lithuanian coast is 90.6 km.

Lithuania is the region of plains. The highest hill is 293.8 m above the sea level. The country's territory consists of clayey plains (55.2% of the country territory), sandy plains (17.8%), hilly moraine uplands (21.2%), coastal plains (2.2%) and river valleys (3.6% of territory).

More than half of the Lithuanian land is suitable for agriculture, i.e. the land area used for agricultural production. Changes in land use since 1990 are shown in Table 2-1. The areas of forest land, grassland and settlements have increased, while the areas of cropland, wetlands and other land have decreased.

Table 2-1. Land uses (based on the 2006 IPCC Guidelines land uses classification) in 1990 and 2015, ha

Land use	1990	2015	Change
Forest land	20 613.7	22 059.57	6.55%
Cropland	24 260.33	21 388.56	-13.42%
Grassland	13 076.78	14 778.27	11.5%
Wetlands	3 630.66	3 410.99	-6.44%
Settlements	3 243.23	3 542.79	8.46%
Other land	475.3	119.82	-296.68%
Total	65 300	65 300	-

According to the State Forest records, in 2016 the forested areas accounted for 33.5% of the total area. Currently, there are 249.1 thousand private forest owners in Lithuania, owning 873 thousand ha of forest. Private forests make up 39.9% of all forests.

After the restoration of independence, the area of protected areas of Lithuania has been rapidly increasing; from 1990 to 2015, it increased from 327.1 to 1 147.4 thousand ha and reached 17.6% of the country's territory. At present, the system of protected areas in Lithuania consists of 3 state strict nature reserves, 2 cultural strict reserves, and 1 small strict reserve, 5 national parks, 30 regional parks, 402 state reserves and 112 municipal reserves.

Rivers in Lithuania occupies an area of 332 km^2, namely 0.5% area of the country. Lithuania has 22.2 thousand rivers and streams (waterways), with the total length of 76.8 thousand km. The longest river is Nemunas (its length in the country is 475 km), Neris (235 km), Šešupė (209 km).

Lithuania has 2 585 lakes and 1 039 reservoirs (ponds) with the area exceeding 0.5 ha. The total area of lakes amounts to 886.9 km^2. The deepest Lithuanian lake is Tauragnas, with the maximum depth of it 62.5 m.

Small (up to 50 ha) swamps are predominant. Among the vestigial are mostly wetland mires (71%) and wetland bogs important from geo-ecological approach (22%).

The country has sought and examined 17 types of mineral resources. In 2015 the following valuable mineral resources were registered in Lithuania: oil, therapeutic peat, peat, limestone, dolomite, opoca, sapropel, anhydrite, plaster, chalk marl, travertin, clay, sand and gravel.

2.4 Climate profile

The Lithuanian climate is formed and affected by the global factors and local geographical circumstances. Key features of the climate depend on the geographical location of the territory. Lithuania is located in the northern part of the temperate climate zone. The second global factor is the prevailing westerly airflow. Lithuanian territory, as the whole European region, lies in the area of influence of the Atlantic Ocean and westerly air flow, with air temperature, precipitation and runoff patterns, sea level and other parameters being largely determined by the North Atlantic Oscillation.

In accordance to Boris P. Alisov climate classification, the most of Lithuania territory is assigned to the south-western sub-region of the continental forest region of the middle latitudes of the Atlantic Ocean. Only the Baltic Sea coastal region is closer to the climate of Western Europe and the climate can be attributed to individual Southern Baltic climate region.

Temperature

The average annual temperature in Lithuania is 6.9°C. In 2011-2016 compared to 1981-2010 it increased by 0.7°C, which shows climate warming. The most striking trends of annual temperature warming are in the north-eastern part. Mostly temperature increased in autumn months by 0.9°C above 1981-2010 average. From 1981, the year 2015 was the warmest with the average annual air temperature in Lithuania of 8.3°C. In Figure 2-3 average annual air temperature is presented.

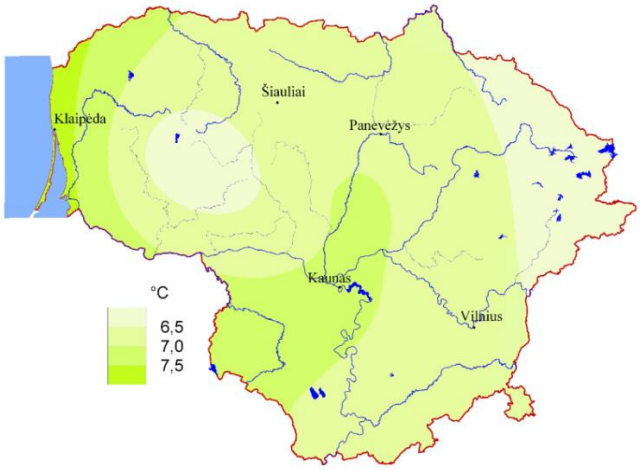

Figure 2-3. The average annual air temperature in 1981-2010 years, °C

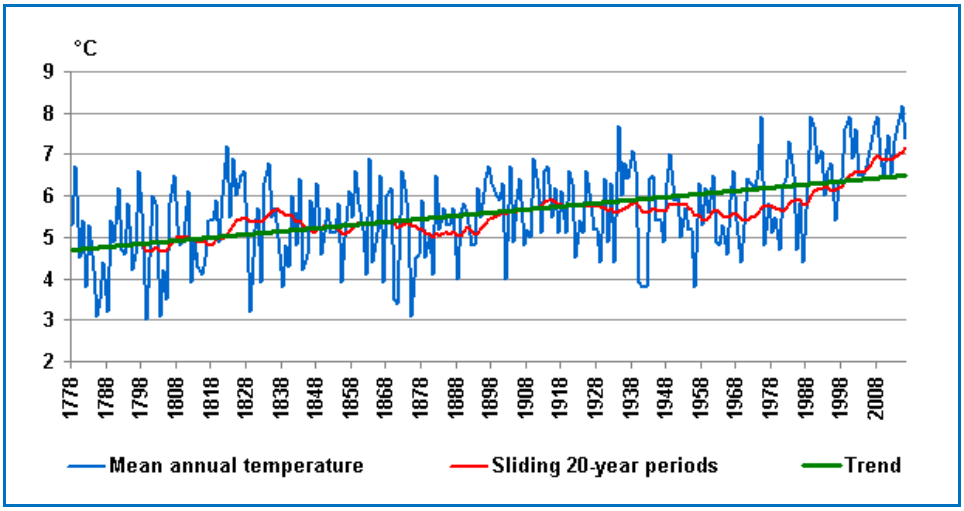

Figure 2-4. The average annual air temperature in Vilnius 1778-2016, °C

The average annual air temperature in Vilnius in 1778-2016 is presented in Figure 2-4. Air temperature rising trend is greatest from the second part of 20th century.

The hottest month in Lithuania is July; the coldest is January and February. In the period from 1981 to 2010, the average temperature in July was about 17.9°C and in January, February – about -3.2°C. In the period from 2011 to 2016 the average temperature in July was about 18.6°C, in January – about -4.2°C and in February was -2.7°C (Figure 2-5).

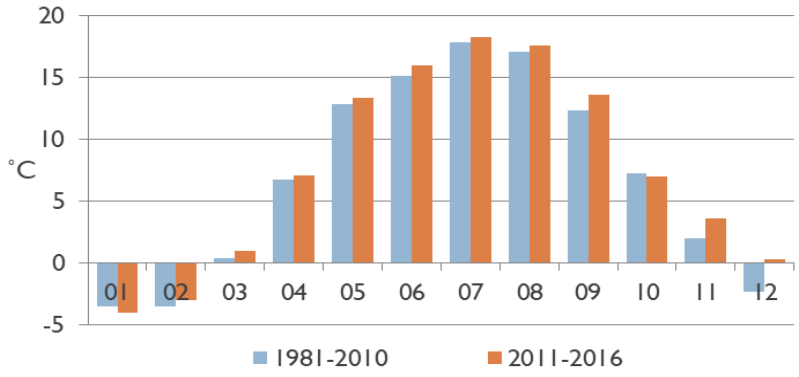

Figure 2-5. Average monthly temperature in Lithuania in 1981-2010 and 2011-2016, °C

At the end of the twentieth century the number of extremely hot days increased with the daily maximum air temperature equal to or above 30°C. In 1981-2010 about 3-4 days per year maximum temperature was equal of higher than 30°C. Their probability in 2011-2016 compared to 1981-2010 increased till 2 times and now amounts to 3-8 days per year. The highest probability is in southern and south-western Lithuania. Meanwhile, frosty days when the daily minimum air temperature drops to -20°C and below have decreased significantly: if in the period of 1981-2010 an average of 4-7 days during winter in the East of Lithuania occurred, in the recent years they occurred for only 1-7 days per season. It was found out that the change in the probability of extremely hot and cold days originated mainly due to higher rates of recurrence of anticyclone processes during the summer and less frequent in winter.

Precipitation

The 1981-2010 climatic normal precipitated rainfall is 694 mm. More precipitation drops in west side (Figure 2-6). Year 2010 was particularly rainy – 849 mm which is 122% of climatic normal. The most humid was warm period of the year. In 2011 summer rainfall significantly exceeded the average multi-annual rainfall: fell 306 mm – 133% of climatic normal (climatic normal – 229 mm).

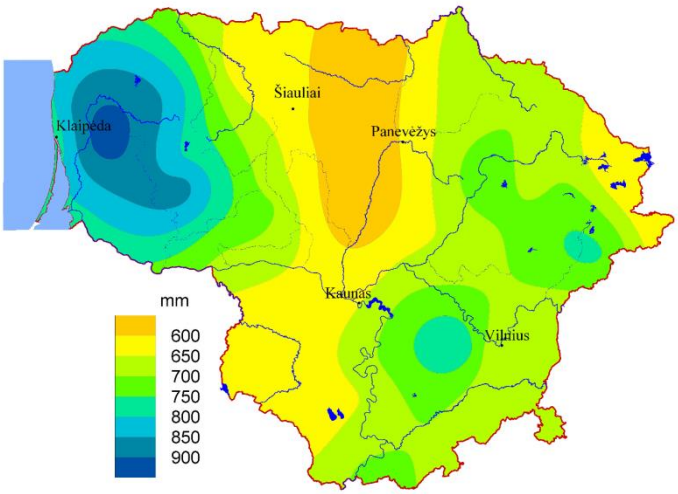

Figure 2-6. The average annual precipitation in 1981-2010 years, mm

In Figure 2-7 is presented the average annual rainfall in Vilnius, 1887-2016. Lithuania is an excess irrigation area with increasing recurrence of summer drought (year 1992, 1994, 2002, 2006). Due to the climate change, precipitation patterns in Lithuanian territory are changing differently – in some places it is increasing, elsewhere decreasing (however, these changes are not very large). But there is the tendency that precipitation is increasing in Lithuania during the cold season and decline in the warm season. The share of liquid precipitation in the cold period is increasing (Figure 2-7).

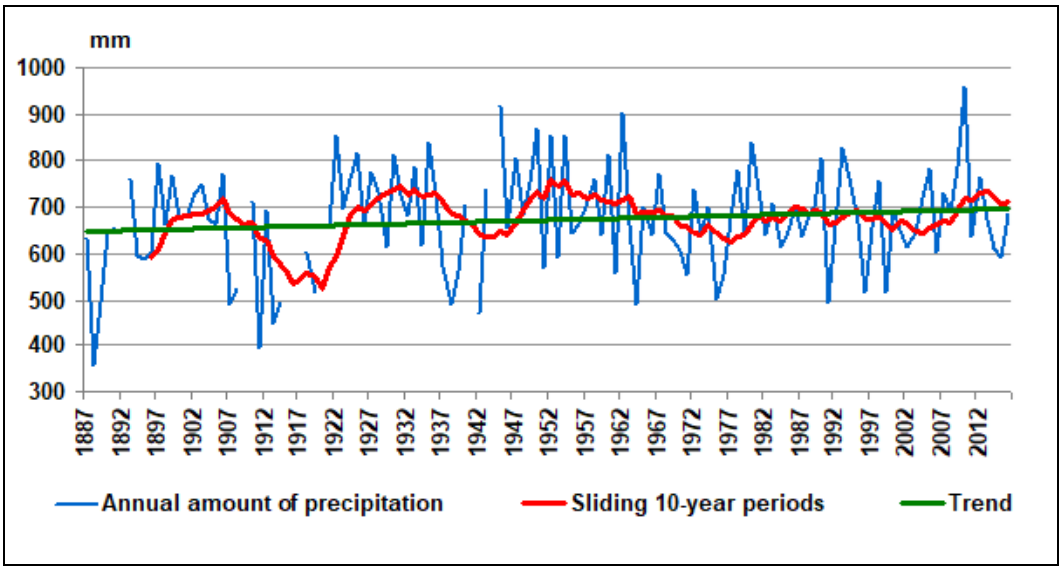

Figure 2-7. The average annual rainfall in Vilnius in 1887-2016, mm

Solar radiation

The longest sunshine duration per year occurs in the Curonian Spit and at the seaside (about 1 993 hrs.) (Figure 2-8). Towards the east it decreases up to 1 691 hours. The most sunny months are from May to August (an average of 264-285 hours), the least sunny – from November to January (an average of 28-38 hours).

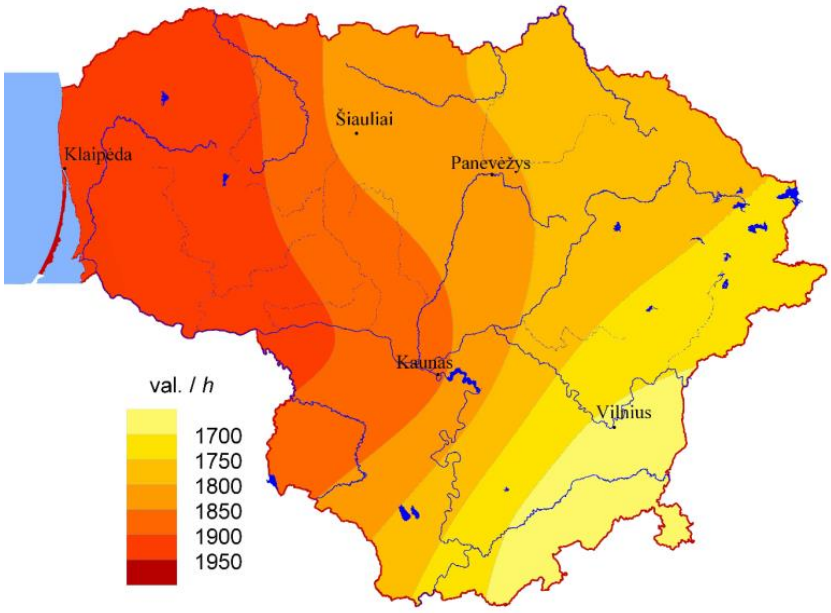

Figure 2-8. Duration of sunny hours in 1981-2010 years

The number of sunny hours in 2011 increased by 10% compared average of 1981-2010. This year duration of sunshine was about 2 040 hours – 192 hours longer than climate normal, which is 1 851 hours. In Lithuania the average general solar radiation to the horizontal surface during the year is about 3 600 MJ/m^2 (half less than the equatorial areas). However, the quantity per year is distributed very unevenly: in June solar radiation amounts to 17% and in December it makes just 1% of the annual volume. The largest amount of solar radiation goes to the south-west of the country (3 690 MJ/m^2), while the lowest – to cloudy western part of the Žemaičiai highland (about 3 520 MJ/m^2). Total solar radiation in 2014 and 2015 was about 10-20% higher and in 2016 year 20% lower than 1981-2010 average.

Wind

The strongest winds blow from November to January (at the seaside 5-6 m/s, elsewhere 3-4 m/s), the weakest – from May to September (the seaside 3-4 m/s, elsewhere 2-3 m/s). Most, by 0.5-1.1 m/s, winds weaken in Klaipėda in the late summer and autumn (Figure 2-9).

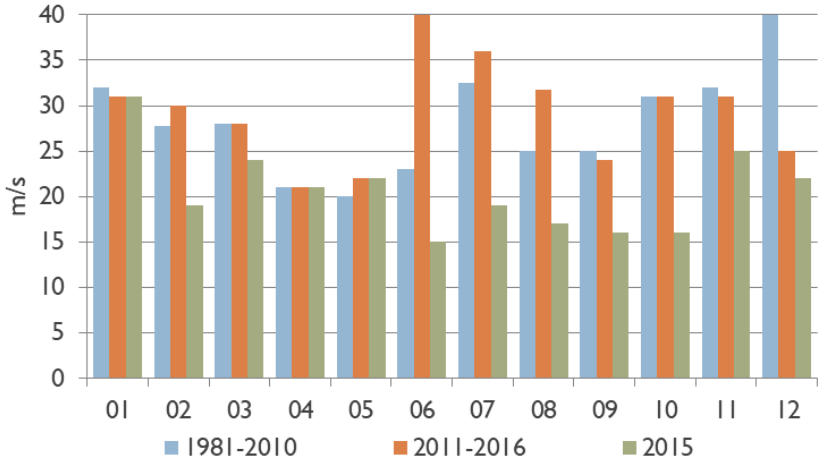

Figure 2-9. Average of maximum wind gusts speed at the seaside in the period of 1981-2010, 2011-2016 and in 2015, m/s

When wind speed increases to 15 m/s it is perceived as a serious meteorological event. 15 m/s and stronger wind blows on average for 46 days per year at the seaside. Compared to the multi-annual data, the year 2015 maximum wind speed at the seaside was lower almost in all months (Figure 2-9).

The maximum wind gusts speed at the Baltic Sea can reach 35-40 m/s and in other places of Lithuania – 25-28 m/s. Analyzing the maximum wind speeds during the period of 1981-2016 no significant changes have been identified in their long-term trends. However, it should be noted that during the period of 1999-2016 at the seaside six wind cases with wind speed stronger than 30 m/s were recorded. This is the reason to believe that the frequency of winds with hurricane strength may continue to increase as a result of climate warming (Figure 2-9).

In autumn and winter the most often south, south-west and west winds are blowing; while in summer west and north-west winds dominate.

2.5 Economic profile

Lithuania has experienced substantial political and economic changes since regaining its political independence in 1990. Vast economic reforms include price liberalisation and privatisation of small and medium enterprises during the period from 1991 to 2000. National currency was implemented in 1992-1993 which allowed controlling inflation via national monetary policy. During the first decade of market reforms the institutional aspects of the transition was of the biggest national and international concern and culminated with a granting of a functional market economy status upon EU accession in 2004. On 1st January, 2015, Lithuania became the 19th country to adopt the euro.

The country's economy and macro-economic were the main indicators which described the development of the country over the last decade. During the period from 2000 the most rapid economy development was witnessed in 2003 (GDP growth, compared with the previous year, amounted to 10.5%), after recovery from the Russian crisis (in 1999 GDP decreased by 1.1%). In the later years, GDP growth was slightly slower, but exceeded 7% annually. In 2007 the growth of GDP rocketed and reached 11.1%

comparing with 2006. Lithuania was among the most rapidly developing countries in the EU during this period. The global economic recession in 2008 affected Lithuania as well followed by GDP growth just by 2.6% and its decrease to negative factor in 2009 (-14.8%). The annual estimates of macroeconomic indicators for 2011 show an economic revival – GDP grew by 6%. In the latest years (2012-2016), GDP growth was moderate, reaching 3% value on average. Strong household consumption, supported by robust real wage growth, investment and increasing exports are the main GDP growth drive. Lithuania has reached decoupling emissions from economic growth. In the period 1990-2015 GDP increased by 38% and GHG emissions were reduced by 58%.

In the Figure 2-10 below GDP and GHG emission index alteration is shown since 1990 to 2015.

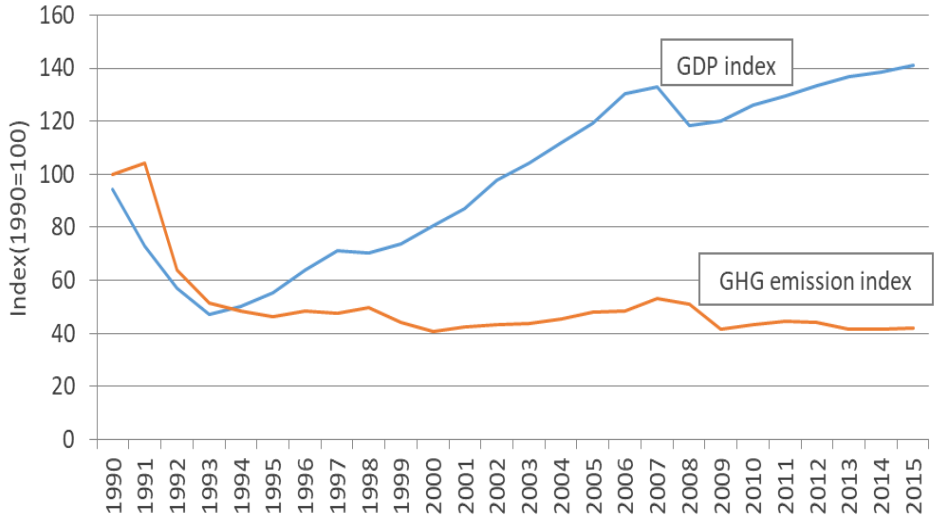

Figure 2-10. GDP and GHG emission index of Lithuania in 1990-2015

In the first quarter of 2017, as compared to the same period of the previous year, Lithuania's GDP growth accelerated to 4.1% and reached EUR 9.2 billion at current prices. The economic growth driven by the household consumption and investments, meanwhile strong domestic market and investment activities climbed imports of goods. The main factors behind the growth in household consumption related to the positive labour market developments, wage growth and favourable credit conditions. The main restricting factor was decline in gross fixed capita formation in public sector, largely related to the slower than expected absorption of funds from the new EU financial framework 2014-2020.

Inflation rate in Lithuania has been constantly changing (Figure 2-11). Since 2000, it has been rapidly decreasing, in 2003 it was even a deflation, but in 2004 inflation began to rise again in 2006 and reached the highest value in 2008 before the crisis. In the figure below the annual inflation in December compared with December of the previous year in per cent is presented.

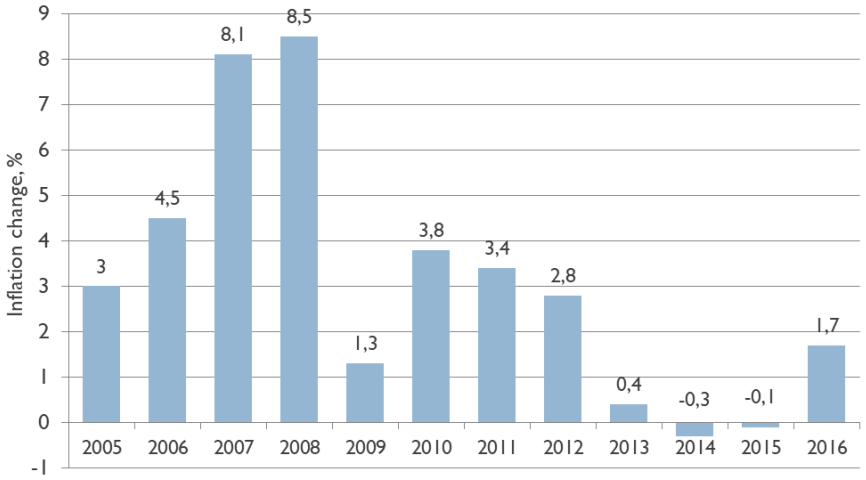

Figure 2-11. Annual change in inflation, %

Gross value added (GVA) by the type of economic activity is presented in the Figure 2-12. The main economic activity in Lithuania is service sector, followed by industry and construction. Industry contains mining and quarrying, manufacturing, electricity, gas and water supply. The slight increase of the GVA share of services sector is observed during 2005-2015 period.

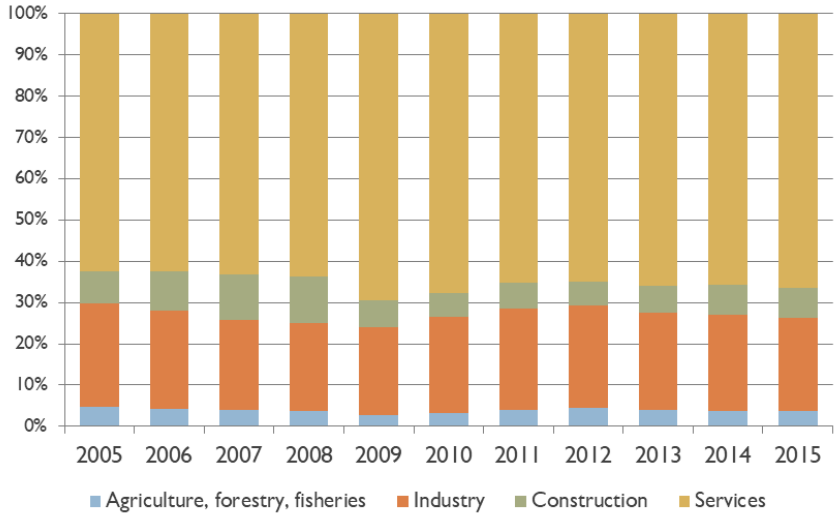

Figure 2-12. Structure of gross value added by economic sector, %

In 2015, according to the final data obtained from customs declarations and Intrastat reporting data, exports from Lithuania amounted to EUR 22 903.9 million in terms of commodity value, imports to Lithuania – EUR 25 399.5 million. Exports of goods of Lithuanian origin amounted to EUR 13 531.8 million. In 2015, compared to 2014, exports and imports decreased by 6% and 1.9% respectively.

In 2015, the largest share in exports and imports fell within mineral products (16.5% and 21.4% respectively), machinery and mechanical appliances, electrical equipment (14.8% and 17.9% respectively), products of the chemical and allied industries (10.8% and 12.1% respectively). As for the goods of Lithuanian origin, the largest share in exports fell within mineral products (21.8%),

miscellaneous manufactured articles (11%), products of the chemical and allied industries (9%), prepared foodstuffs, beverages, spirits and vinegar, tobacco and manufactured tobacco substitutes (7.8%).

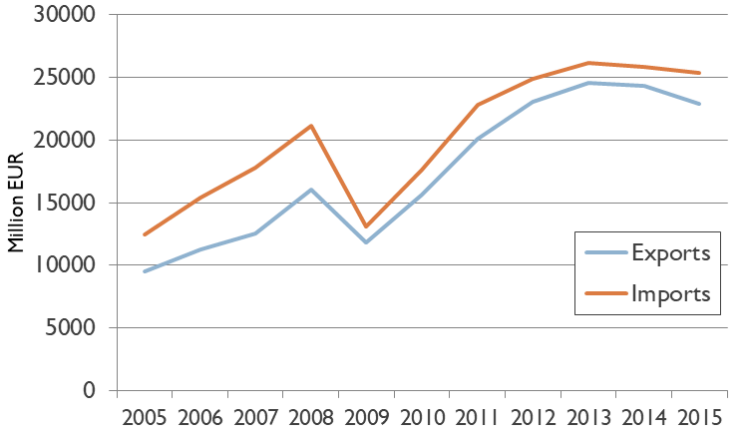

Figure 2-13. Lithuania's imports and exports in 2005-2015, EUR million

In 2015, the most important partners in exports were Russia (13.7%), Latvia (9.9%), Poland (9.7%), and Germany (7.8%), in imports – Russia (16.3%), Germany (11.5%), Poland (10.3%), and Latvia (8.3%).

The biggest proportion of goods was exported to the EU member states – 61.3% of total exports from Lithuania (exports to CIS countries made up 24%). The biggest proportion of imports was also from the EU member states – 67.7% of total imports to Lithuania (imports from the CIS countries accounted for 21.9%).

2.6 Energy

From 1990 to 2016 total primary energy consumption in Lithuania decreased by almost 55%. Oil and oil products were the most important fuel in Lithuania over the previous decade. Since 2000 their share in the primary energy balance has been fluctuating about 31.5% with the smallest portion of 23.7% in 2003 and the largest share of 38.9% in 2016. The major factors influencing changes in the role of oil products were decreasing consumption of heavy oil products for production of electricity and district heat and growing consumption of motor fuels in the transport sector. In 2010 due to the closure of Ignalina Nuclear Power Plant (NPP) the share of oil products increased to 36.2%. In the latest years the large share of oil products is caused by growing demand of motor fuel in transport sector. Dynamics of primary energy consumption in Lithuania during 1990-2016 is presented in Figure 2-14.

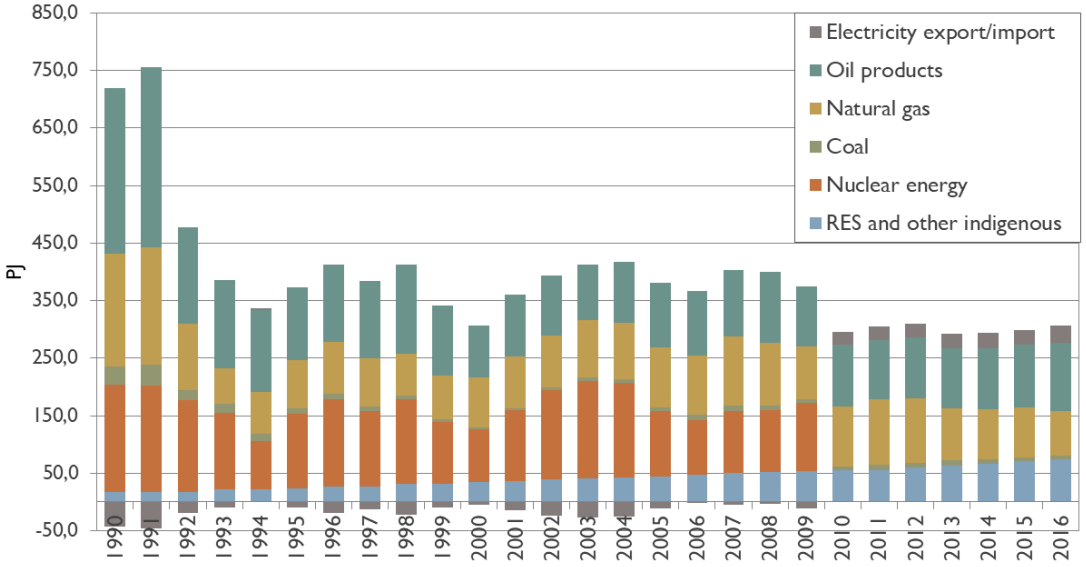

Figure 2-14. Primary energy consumption in Lithuania

At present natural gas is the most important fuel in the Lithuanian primary energy balance. The share of natural gas was fluctuating about 28.4% over the period 2000-2016. Total consumption of natural gas decreased owing to reduction of its use for non-energy needs (mineral fertilizers production) in 2008 and 2009. The consumption of natural gas started to decrease since 2011 and in 2016 its share was 25.1% in the balance of primary energy consumption.

During the period 1990-2009 the share of nuclear energy was very high and amounted about 33.3%. Nuclear fuel helped to increase the security of the primary energy supply, especially in the power sector. It is important to note that a large portion of electricity generated by this power plant was exported. Lithuania during the last decade was a net exporter of electricity and for instance in 2004 more than 37% of electricity generated by Ignalina NPP was exported to neighboring countries. During the process of accession into the EU, one of the country's obligations was a decision on the early closure of Ignalina NPP. In 2014, the share of electricity generated by all Lithuanian power plants was about 37% in the balance of gross electricity consumption and 63% of electricity necessary to meet internal requirements was covered by electricity import.

Over the period 2000-2016 the share of coal in the primary energy balance was fluctuating about 2.1% with the lowest value of 0.8% in 2001 and the highest value of 3.26% in 2013.

Comparison of the primary energy consumption structure in 1990 and in 2016 is presented in Figure 2-15.

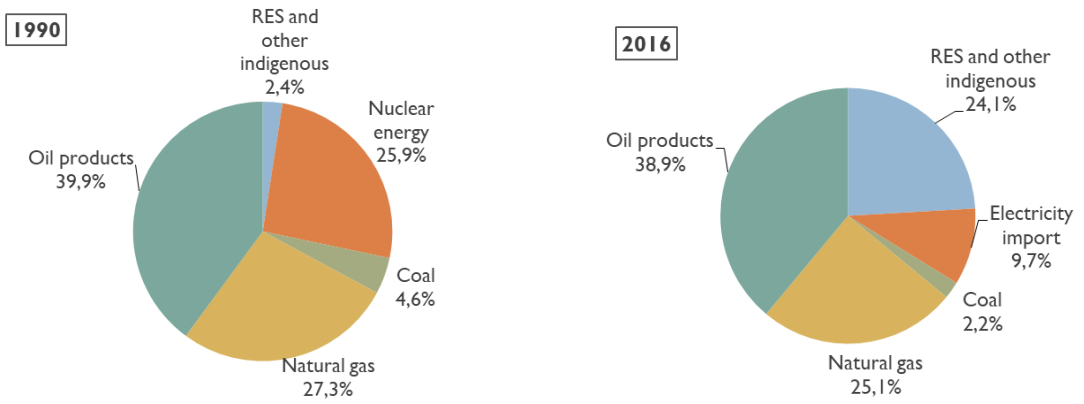

Figure 2-15. Structure of primary energy consumption in Lithuania

Indigenous energy resources in Lithuania are rather scarce. Certain contribution into balance of indigenous resources is originated from local oil, peat and energy of chemical processes.

78.4% of Lithuania's energy consumption comes from imports. This is mainly due to the dependence of natural gas, crude oil and NGL from Russia (82.6% and 82.9% of imports from non-EU countries, respectively). For natural gas, however, the LNG Terminal in Klaipėda, which was put in operation in December 2014, has allowed for significant diversification of gas import. The Klaipėda LNG terminal significantly enhanced security of natural gas supply for all consumers in the Baltic States by providing an alternative gas supply source. The terminal regasification capacities are sufficient to cover around 90% of all current demand of the Baltic States.

Contribution of renewable energy sources into the country's primary energy balance during the period 1990-2016 is increasing. During the period 1990-2016 primary energy supply from renewable sources increased by 4.6 times with an average annual growth of 6%.

Lithuania has undertaken, according to Directive of the European Parliament and of the Council No 2009/28/EC on the promotion of the use of energy from renewable sources, to increase the renewable sources share in the final national energy consumption up to 23% by 2020. Lithuania has already reached the 23% target: in 2016, the share of renewable energy sources in the total energy balance of the country exceeded one fifth, accounting for 25.46%.

The consumption of renewable energy sources by energy forms are presented in Figure 2-16. Currently the main domestic energy resource is solid biomass. Solid biomass accounted for 82.6% in the balance of renewable energy sources in 2016. The second largest renewable energy source is wind energy. In 2016, a share of wind energy was 6.7%. Liquid biomass (bioethanol and biodiesel) accounted 3.9% of total renewable energy. Hydro power is fluctuating and currently provides 2.7% in the balance of renewable energy sources. The shares of biogas, municipality waste (renewable), solar energy and geothermal energy were 2.2%, 1.4%, 0.4% and 0.1% in 2016, respectively.

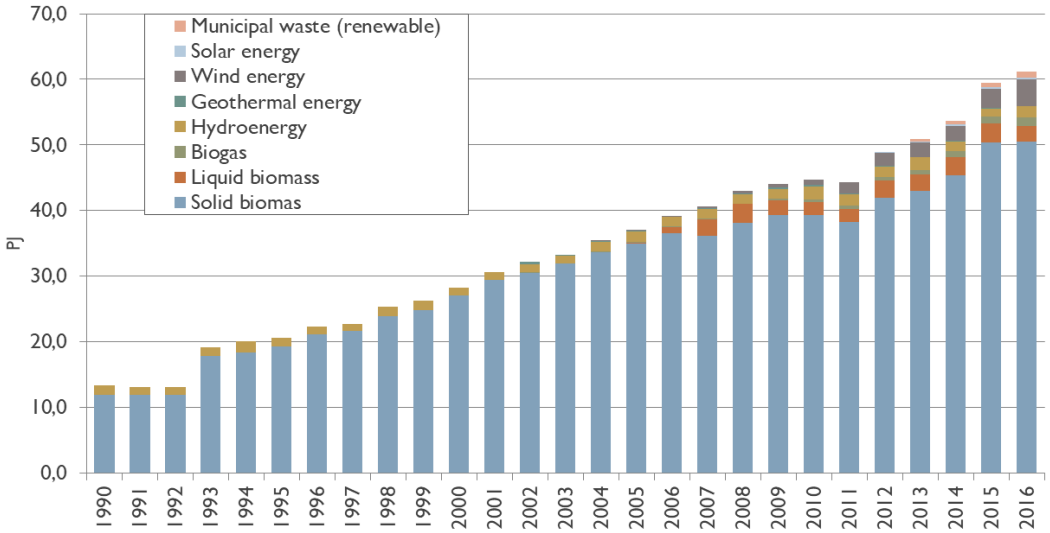

Figure 2-16. Consumption of renewable energy in Lithuania

Ignalina NPP played a key role in the Lithuanian energy sector producing up to 70-80% of the electricity. Even after the closure of unit 1 at the end of 2004 this power plant was dominating in the electricity market – its share in the balance of gross electricity generation in 2009 has been almost 70.7%. Therefore the most important internal changes in the Lithuanian energy sector in 2010 are related with the final closure of Ignalina NPP (Figure 2-17). After the closure of Ignalina NPP Lithuanian Thermal Power Plant (Lithuanian TPP) is the major electricity generation source. Lithuanian TPP can cover up to 50-60% of the gross internal consumption. But the cost of electricity production at this power plant is high due to high price of natural gas. Thus, currently more than half of required electricity is imported from neighboring countries.

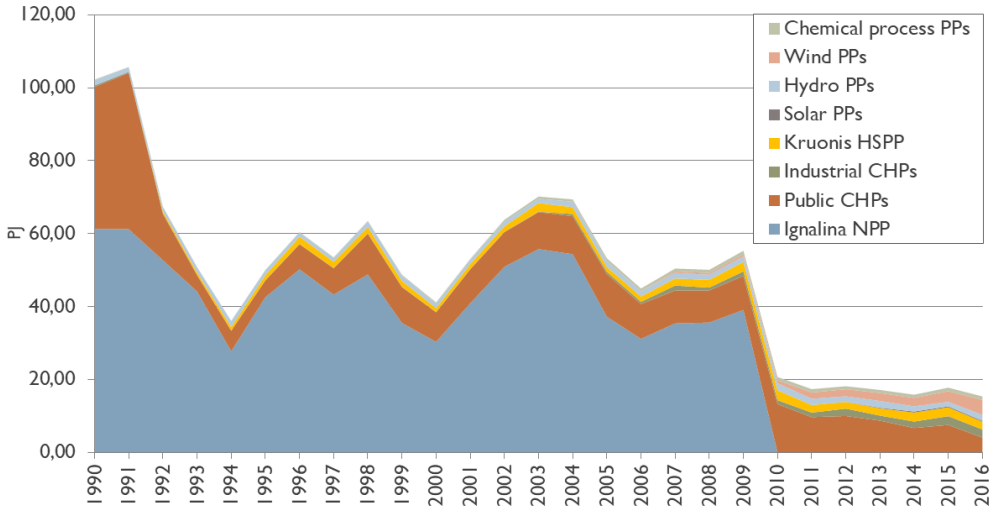

Figure 2-17. Structure of electricity generation in Lithuania

Baltic Energy Market Interconnection Plan (BEMIP) was signed in 2009 seeking to diverse and ensure the electricity supply to the Baltic States. Connecting the Lithuania, Latvia and Estonia to neighboring EU countries and the internal market is the main priority of the BEMIP Action Plan. This priority requires the

full implementation of the internal market rules in order to enable the three Baltic States to participate into the EU electricity market. Interconnection between Lithuania and Poland (project LitPol Link) is fully in line with the EU energy policies and National energy strategies in the region. The 500 MW power link connecting Lithuania and Poland was put into operation in December 2015. By 2020, the LitPol Link will start operating at a 1 000 MW capacity.

The European Commission through the European Energy Programme for Recovery provides funding for the construction electricity interconnection between the Lithuania and Sweden (NordBalt). NordBalt is a planned submarine power cable between Klaipėda in Lithuania and Nybro in Sweden. The aim of the project is to promote trading between Baltic and Nordic electricity markets, also to increase the security of power supply in both markets. Electricity transmission started in 2016.

Taking into consideration general EU energy policy, the country's energy policy is focused on gradual increase of consumption of renewable energy resources and increase of energy efficiency.

Green electricity generation has been almost stable and fully dominated by hydropower in Lithuania during the period 1990-2000 (Figure 2-18). Since 2000 green electricity generation portfolio became more diversified and renewable electricity generation volume was increasing on average by 12% per year. In 2016, electricity generation from renewable energy sources was dominated by wind power, generating about 54.4%, hydro power producing 21.7%, and biomass, biogas and municipal waste amounted about 20.7% of green electricity. Solar electricity contribution to the structure of green electricity production was 3.2% in 2016. In total 7.52 PJ (2 088.6 GWh) of green electricity was produced in 2016.

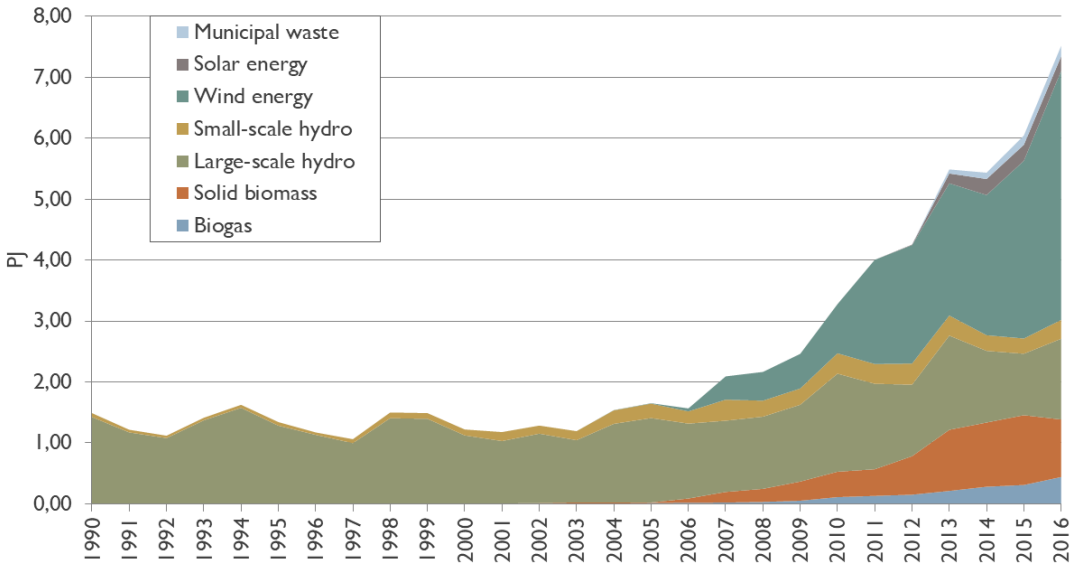

Figure 2-18. Green electricity production in Lithuania

Many factors had influence on changes of energy consumption: deep economic slump in 1991-1994, fast economic growth over the period 2000-2008, dramatic reduction of economic activities in all branches of the national economy and the closure of Ignalina NPP in 2009, a significant increase of energy prices, an increase of energy efficiency and other reasons.

Total final energy consumption (excluding non-energy use) in 1990 amounted to 405.26 PJ. In 1991-1994 final energy consumption decreased approximately by 2 times (Figure 2-19). During the period 2000-2008 the final energy consumption was gradually increasing by 3.5% per annum.

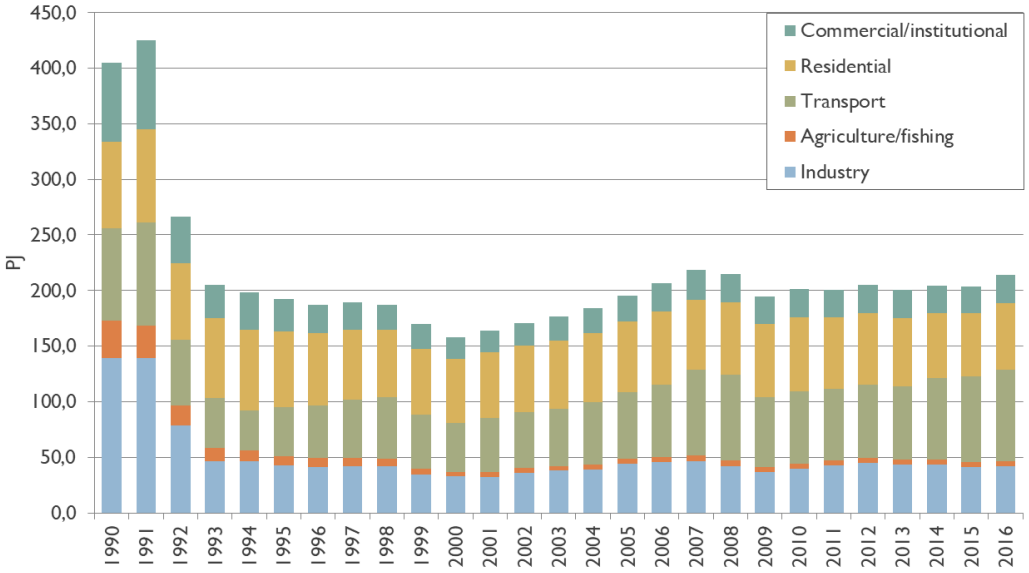

Figure 2-19. Final energy consumption in Lithuania

In 2009, total final energy consumption was by 9.5% less than in the previous year, and the most severe impact of the economic recession was in construction and transport sectors. As a result of recovering Lithuanian economy, final energy consumption started to increase from 2010. During 2012-2015 the final energy consumption remained rather stable.

Currently the transport sector is the largest energy consuming sector. In 2016, transport sector accounted 38.5% in the total final energy consumption. Residential sector accounted 28.1% of total final energy consumption, industry – 19.6%, commercial/institutional – 11.7% and agriculture/fishing – 2.1%.

During the transition to market economy period significant improvements in the energy efficiency has been achieved due to replacement of the old energy intensive technologies by the new innovative technologies in the industry and implementation of various energy efficiency improvement measures in other sectors of the economy.

2.7 Transport

Lithuanian transport sector is one of the most promising sectors of the national economy. The mission of the national transport system is to ensure the harmonious public mobility and transport of goods, and to increase the country's competitive capacity in international markets.

Though small in size, Lithuania boasts a 21 000 kilometer road system, which is known to be the best in the region. Lithuania is committed to investing EUR 145 million into the Via Baltica international highway system, and EUR 100 million into four public logistics centers.

The current total length of the railway lines is 1 868.8 km: of which 1 745.8 km are of 1 520 mm wide track gauge, and 123 km are of 1 435 mm wide track gauge. Railways of 1 520 mm track gauge extend to the other Baltic States and Commonwealth of Independent States (CIS) countries, track gauge of 1 435 mm railways connect Lithuania with Poland, and Poland with other Western and Central European countries.

The northern-most ice-free port in the Baltic Sea is capable of handling over 40 million tonnes of cargo annually. Klaipėda is a multipurpose, universal, deep-water port with 26 stevedoring companies, and an annual handling capacity of 650 000 TEUs. It operates year-round, 24 hours/day, 7 days/week, and fully complies with ISPS Codes.

Lithuania has three strategically located international civilian airports located in Vilnius, Kaunas and Palanga. These airports offer excellent facilities for passenger and cargo traffic. With the longest runway of the three (3 500 meters), Šiauliai International Airport is also involved in significant cargo transport.

Lithuania is centrally located between three sizeable markets: Western Europe, the Nordic countries, and the Eastern markets of Russia and the CIS countries. Lithuania has also become one of the EU's primary transport hubs. Transport and logistics sector accounts for about 12.3% of GDP (largest share of GDP in EU), employing around 106 thousand workers or 11.4% of total employment. 7 584 companies were active in the sector at the beginning of 2016, 99.4% of them were SMEs.

In 2015 the turnover of transport and logistics sector amounted to EUR 7.48 billion. It was 2.2% less than a year ago. Transport services exported to more than 110 countries around the world. Around 60% of exports revenue is generated by road transport.

The total number of freight tonne-kilometres (excluding sea transport) in Lithuania during 2000-2016 increased by 55%. In domestic freight transport rail transport is predominant, for international freight transport – the road transport represents a highest share (Table 2-2). Inland waterway and air freight transport takes only negligible share of total freight transport in Lithuania.

Table 2-2. Freight carried by all modes of transport in 2000-2016, million tonne-kilometres

	2000	**2005**	**2010**	**2014**	**2015**	**2016**
Domestic transport	2 680	5 563	5 673	6 282	6 414	6 615
Rail	1 144	3 424	3 376	3 513	3 500	3 643
Road	1 535	2 137	2 292	2 768	2 913	2 970
Inland waterway	1	1	4	1	1	1
Air	0.0	0.0	-	-	-	-
International transport	17 469	27 219	27 741	36 660	34 605	38 557
Rail	7 774	9 033	10 054	10 794	10 537	10 147
Road	6 234	13 770	17 106	25 299	23 572	28 004
Oil pipeline	3 457	4 406	579	567	496	406
Air	4	10	3	1	1	0.2
Total	20 149	32 782	33 414	42 943	41 019	45 171

In 2016, 49.3 million tonnes of goods were handled in Klaipėda State Seaport and Būtingė Terminal, which is by 76.6% more than in 2005 and by 7.8% more than in 2015. In 2005-2016, an average annual increase of 5.3% was observed.

In 2016, the number of passengers carried by all modes of transport amounted to 386.2 million, which is by 14.8% less than in 2005 and by 3.7% less than in 2015. In 2005-2016, an average annual decrease of 0.9% was observed. In 2016, compared to 2015, passenger transport by air grew by 9%, by sea – by 4.9%,

by rail – by 4.8%. Meanwhile, a decrease was observed in passenger transport by inland waterways – by 7.1%, and by road – by 3.8%.

Road transport is one of the main branches of transport sector. More than a half of added value is created by road transport, 46% of turnover is generated.

Between 2005 and 2015, the final energy consumption in transport recorded an average annual increase of 2.9 %, slightly higher than the 2.7% average annual increase of the GDP.

Generally, the total number of road vehicles is increasing. According to the data of the Lithuania Statistics the largest part of road vehicles account for passenger cars (86.09%). Other vehicles are freight vehicles, special vehicles, semitrailers, motorcycles, buses and trolleybuses (13.9%). Detailed Lithuania Statistics information provided in the table below.

Table 2-3. Number of registered road vehicles at the end of the year in 2000-2016

	2000	**2005**	**2010**	**2012**	**2013**	**2014**	**2015**	**2016**
Passenger cars	1 172 394	1 455 276	1 691 855	1 753 407	1 808 982	1 205 668	1 244 063	1 298 737
of which personal	1 097 797	1 342 972	1 554 270	1 607 678	1 653 676	1 082 308	1 112 167	1 145 301
Personal cars per 1000 population	315	395	509	541	562	370	385	402
Buses	15 069	14 839	13 261	12 649	12 606	6 937	6 856	6 926
Trolleybuses	474	472	467	458	457	434	430	400
Lorries	88 346	10 6247	113 113	113 505	115 367	76 169	78 115	81 258
Road tractors	10 267	16 239	20 808	25 430	27 671	23 510	24 781	28 138
Trailers	6 479	12 852	20 400	21 676	22 401	14 709	14 962	15 141
Semi-trailers	9 875	16 590	23 819	29 483	31 168	25 256	25 565	27 855
Special purpose road vehicles	11 798	11 526	14 598	14 798	14 845	10 562	10 521	10 348
Motorcycles	19 842	24 027	38 995	43 605	45 983	23 374	26 651	28 784
Mopeds	NA	NA	17 276	20 644	21 169	9 789	11 102	10 929

The state enterprise Regitra deregistered vehicles whose compulsory technical inspection or vehicle owner's compulsory civil liability insurance expired by 1 July 2014 (implementing the amendment to Order No 260 of 25-05-2001 of the Minister of the Interior of the Republic of Lithuania on the approval of the Rules for the Registration of Motor Vehicles and Their Trailers). For this reason, in 2014, against 2013, the number of all vehicles registered in the country markedly decreased.

In 2016, national passenger transport by road dominated: it accounted for 98.6% of total national passenger transport. Passenger transport by rail accounted for 0.9, by other modes of transport – for less than 1%.

In 2015, fuel consumption in road transport amounted to over 1.6 million tonnes, of which 79.9% – road diesel, 12.6% – motor gasoline, 7.5% – liquefied gas (Fig. 2-20). In recent years, diesel fuel has been gaining in popularity: in 2015, compared to 2014, the consumption thereof grew by 9.1%. Motor gasoline consumption grew by 2.3, liquefied gas consumption – dropped by 5.2%.

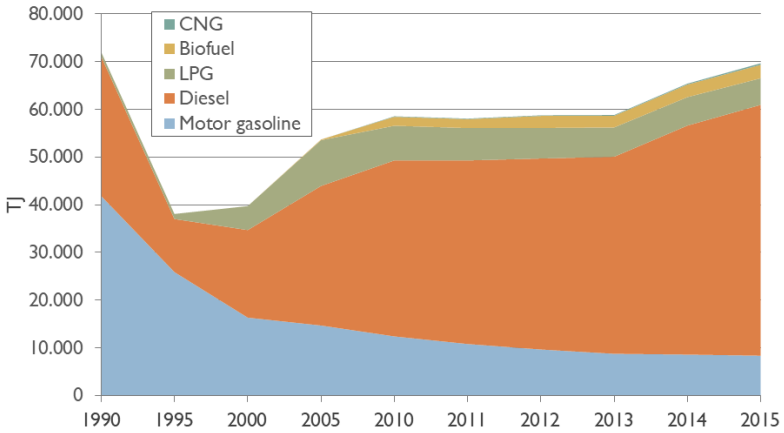

Figure 2-20. Use of fuels in Lithuania in 1990-2015

Transport sector is among the main polluters, therefore a lot of attention is paid for implementation of respective measures to reduce pollution from mobile pollution sources. These measures are described in Chapter 4.

2.8 Industry

Lithuanian industry sector accounts for a significant share of gross value added in the country's economy. Division of the country's economy as per the classifier of economic activity indicates that on the first level industry consists of four activities: manufacturing; extracting industry (mining and quarrying); supply of electricity, gas and steam; supply of water, sewerage, waste management and remediation activities. After the economic recession in early 1990s, Lithuania's industrial production and economy started to grow, as reflected by the growth of the GDP. Lithuania was struck by the global economic crisis causing significant reduction in industrial production in 2009. Economic recovery started from 2010 and the industrial production increased.

Dominating industry in Lithuania is manufacturing. Manufacturing constituted 90% of the total industrial production (excluding construction) in 2016 (Figure 2-21).

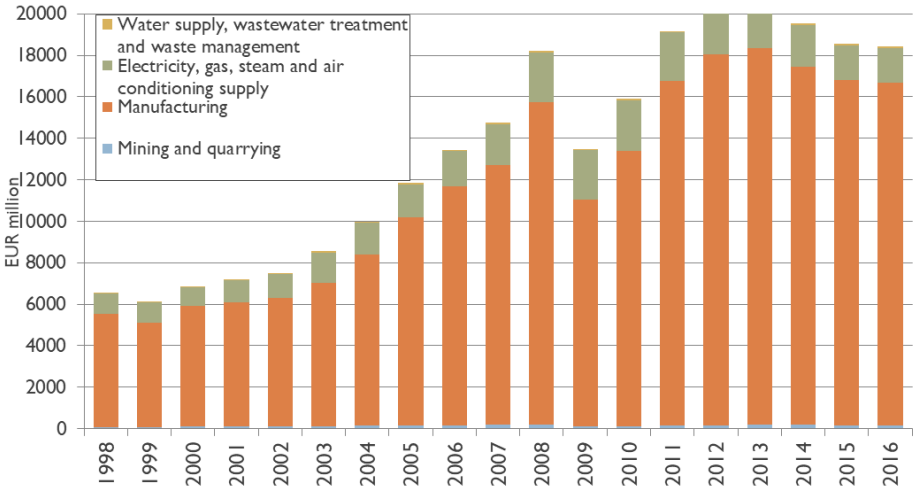

Figure 2-21. GVA per economic activities in Lithuania in 1998-2016, EUR million

In 2016 four most important subsectors within manufacturing cumulatively produced 64% of production:

- Manufacture of food products and beverages (20%);
- Manufacture of refined petroleum products (19%);
- Manufacture of wood products and furniture (15%);
- Manufacture of chemicals and chemical products (10%).

Share of the main sectors in manufacturing products in Lithuania is presented in Figure 2-22 below.

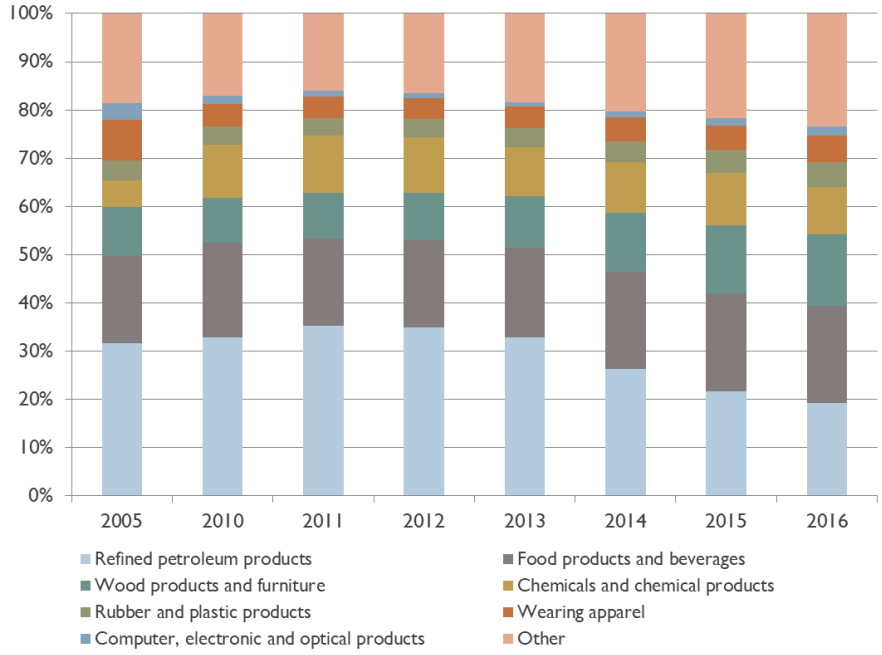

Figure 2-22. Share of production in manufacturing industry, %

2.9 Housing and construction

In 2016 more than 67% of Lithuania's population lived in towns and cities. Between 1950 and 2016, the number of urban population increased more than 60%. Accordingly, more land is used for housing, infrastructure and services.

In 2016 the stock of dwellings amounted to 95.8 million m^2 of useful floor area (58.6 million m^2 – in urban, 37.2 million m^2 – in rural areas). Private property accounted for 98.5%, state and municipal property – for 1.5% of the total stock of dwellings. Useful floor area in individual houses amounted to 51.7 million m^2, or 54% of the total stock of dwellings. Useful floor area in blocks of flats amounted to 44.1 million m^2, or 46% of the total stock of dwellings. The average useful floor area per capita amounted to 33.6 m^2: in urban areas – 30.7 m^2, in rural areas – 39.7 m^2. Data on the distribution of housing in the country are listed below.

Table 2-4. Housing in 2000-2016, million m^2

	2000	2005	2010	2011	2012	2013	2014	2015	2016
Urban areas	50.6	51.3	53.4	54.2	54.5	54.9	55.2	56.2	58.6
Rural areas	28.9	29.5	30.3	31.0	31.3	31.9	32.4	33.1	37.2
Total	79.5	80.8	83.7	85.2	85.8	86.8	87.9	89.3	95.8
Average useful floor area per capita, m^2	22.8	24.6	27.4	28.4	28.9	29.5	32.2	32.9	33.6

In 2016, the volume of construction work carried out within the country amounted to EUR 2.3 billion. In 2016, the construction of civil engineering structures accounted for 41.2% of the total construction work carried out within the country (EUR 939.7 million). The bulk of construction of civil engineering structures was comprised of road and street construction and repair. In 2016, according to the type of work, new construction accounted for the largest share of the total construction work carried out within the country – 47.5%, repair and other construction – 28.6%, reconstruction – 23.9%.

In aiming for better maintenance of the existing housing (public) stock and insurance of its longer exploitation period, existing legislation has to provide favourable conditions for modernization and maintenance of the existing buildings stock and to encourage the private sector and also various financial institutions to participate in these activities.

The Renovation of the multi-apartment buildings programme is one of the country's priority projects aimed at increasing energy efficiency of the most heat-intensive multi-apartment buildings. This program is funded by the state aid, municipalities, the EU structural funds, population and other resources. The expected results of these investments include 30 thousand families living in renovated homes with significantly reduced energy consumption (by around 60% in average) and smaller energy bills. Until now, about 1 000 loan agreements have been signed with the final recipients, 750 multi-apartment buildings (over 19 thousand households) have already been renovated, around 400 buildings are under renovation and another 700 buildings are in the pipeline.

In Recommendations on the main Lithuania's Republic energy strategic directions approved in 2016, it is foreseen to incentivize comprehensive modernization of multi-apartment and public buildings (priority giving for the quartered renovation) and to renovate 25% of buildings stock till 2020 (2.6-3 TWh accumulative saving of energy) and 50% of buildings stock till 2030 (5-6 TWh accumulative saving of energy).

In Lithuania all new buildings starting from 2021 shall fulfill nearly zero energy buildings (A++ class buildings) requirements. All new public buildings shall fulfill nearly zero energy buildings requirements starting already from 2018. The energy performance requirements for the energy performance class are not obligatory for existing buildings, but it is planned to add the option of energy efficiency class A in the investment plans of the modernization projects of multi-apartment buildings.

The Ministry of Environment is responsible and preparing draft Comprehensive Plan of Territory of the Republic of Lithuania for 2030 and guidelines for 2050. The main Plan's goals to promote sustainable low carbon, climate resilient Lithuania's economy development will ensure an efficient use, maintenance, renovation and modernization of existing housing and public buildings, as well as efficient energy performance. The conditions of the existing housing stock and public buildings will improve, with its value being preserved and increased where possible, the dwellings will be adjusted to the new needs of households. Using legal, public awareness raising and educational measures, awareness of the housing owner and the capacity to duly manage and maintain their real estate will be developed.

2.10 Agriculture

Agriculture is a source of economic wealth which supply food and energy resources. This sector has a great influence on the development of Lithuanian rural area as 33% of residents live in countryside.

Significant reforms were introduced in early 1990s, particularly after the restoration of independence. The reform included the re-establishment of private ownership and management in the agriculture sector. Legislation defined dismemberment of the collective farms, but they did not definitively ensure their replacement by at least equally productive private farms or corporations. Agricultural production decreased by more than 50% from 1989 to 1994. The farms were broken into small holdings, averaging 8.8 ha in size, often not large enough to be economically viable.

In recent years Lithuanian economy has experienced a lot of structural changes – contribution of industrial and services sectors have increased rapidly, however, agriculture remains one of the most important sectors in export, and also it provides income to the tenth of Lithuanian population.

More than a half of Lithuania's land is suitable for agriculture. According to the data of Statistics Lithuania as of 1 January 2017 the total land area was 6 528.6 thousand ha; total area of land intended for agricultural purposes made 3 421.5 thousand ha, of which arable land – 3 052.9 thousand ha; orchards and berry gardens – 13.8 thousand ha; meadows and natural pastures – 354.8 thousand ha.

In 2016, agricultural production at current prices totalled EUR 2.3 billion. Compared to 2015, the volume of total agricultural production decreased by 6.2% (of which crop production – by 7.7%, animal production by 3.5%). The decrease in crop production was due to a less abundant harvest of cereals (15.6%). Animal production decreased due to a 6.4% decrease in milk yield.

Table 2-5. Main agricultural production in Lithuania

	2000	**2005**	**2010**	**2014**	**2015**	**2016**
Grain, thous. t	2 730.7	2 870.0	2 866.8	5 324.1	6 521.4	5 757.1
Rape, thous. t	415.8	201.2	416.7	501.5	512.2	399.4
Sugar beet, thous. t	881.6	798.5	706.7	1 014.4	619.5	933.5
Potatoes thous. t	1 791.6	894.7	476.9	468.5	399.2	351.5
Vegetables, thous. t	329.4	369.2	188.6	274.8	215.9	236.2

Fruit and berries, thous. t	111.1	110.7	44.0	70.2	87.1	79.2
Meat (carcass weight), thous. t	186.4	238.6	221.2	253.0	270.1	254.9
Milk, thous. t	1 724.7	1 861.6	1 736.5	1 795.1	1 738.5	1 627.7
Eggs, million pcs.	692.0	864.1	829.6	806.1	786.2	788.9
Wool (physical weight), t	30	44	109	236	256	305

In 2016 the proportion of crop production in the total agricultural production made up 63.5%, of which cereals – 33.4%, fodder crops – 8.4%, rapeseed – 5.4%, leguminous crops – 4.8%. The proportion of animal production made up 36.5%, of which milk yield – 17.2%, animal and poultry breeding – 14.2%.

The biggest proportion of gross agricultural production (72.3%) was produced on farmers' and family farms: 81.5% of total crop and 56.2% of total animal production. Farmers mainly cultivated cereal crops (36.8% of the total agricultural production produced on farmers' farms); milk yield on farmers' farms accounted for 18.2% of their agricultural production. Agricultural companies mainly bread animals – 32.6% of their agricultural production (of which pigs – 16%, poultry – 13.7%) and cultivated cereals – 24.4%.

On 1st of January 2017 there were 695 thousand of cattle, 664 thousand of pigs (Table 2-6). The number of all livestock categories has fallen steadily since the 2000, except for sheep and poultry. The number of cattle has decreased by 22.7%, pig number has fallen by 29.1% since 2000.

Table 2-6. Number of livestock and poultry in Lithuania as of 1st of January, thous. heads

	2000	**2005**	**2010**	**2014**	**2015**	**2016**	**2017**
Cattle	897.8	792.0	759.4	713.5	736.6	722.6	694.8
of which dairy cows	494.3	433.9	374.6	315.7	314.0	300.5	285.8
Pigs	936.1	1073.3	928.2	754.6	714.2	687.8	663.9
Sheep	13.8	49.0	52.5	99.6	123.9	147.1	163.6
Goats	24.7	22.1	14.7	13.8	13.0	13.5	13.4
Horses	74.9	63.6	49.0	22.2	18.2	17.3	16.3
Poultry	6 372.6	8 419.4	9 308.7	9 761.6	10 218.4	9 369.6	10 098.9

data source: Statistics Lithuania

2.11 Forestry

The total forest land area by the 1st January 2016 was 2 186.7 thousand ha, covering 33.5% of the country's territory (Fig. 2-23). Since 2003 the forest land area has increased by 141.5 thousand ha corresponding to 2.2% of the total forest cover. During the same period, forest stands expanded by 107.3 thousand ha to 2 058.3 thousand ha. Since 2003 average forest area per capita increased from 0.59 ha to 0.76 ha.

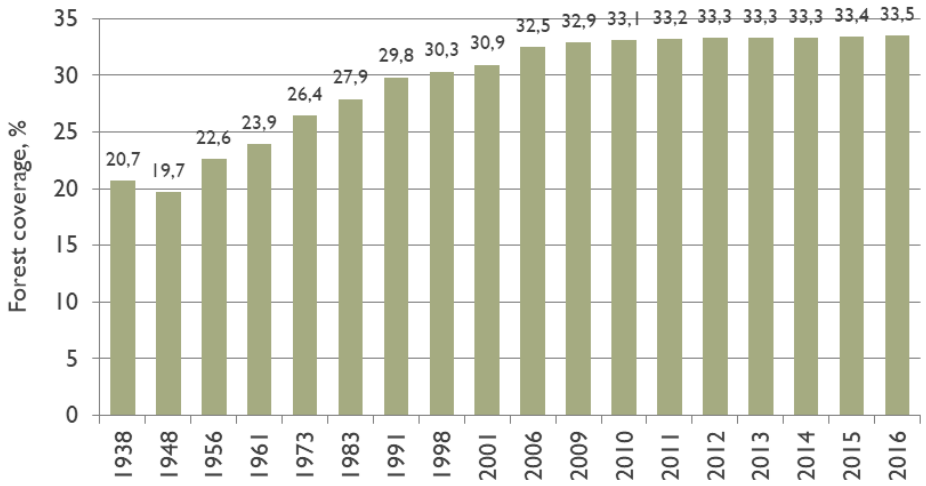

Figure 2-23. Forest cover changes in Lithuania, %

Occupying 1 148.4 thousand ha, coniferous stands prevail in Lithuania, covering 55.8% of the forest area. They are followed by softwood deciduous forests (835.9 thousand ha, 40.6%). Hardwood deciduous forests occupy 74 thousand ha (3.6%).

The total area of softwood deciduous forest land increased by 137.4 thousand ha over the last thirteen years. The area of hardwood deciduous has decreased by 18.6 thousand ha (mainly due to dieback of ash stands) and coniferous forest by 11.5 thousand ha. Scots pine occupies the biggest share in Lithuanian forests – 716 thousand ha. Compared to 2003, the area of pine expanded by 4.5 thousand ha. Norway spruce stands covers 430 thousand ha, with a decrease of 15.3 thousand ha. Birch stands covers the largest area among deciduous trees. Since 2003, it increased by 65.5 thousand ha and reached 457.7 thousand ha by the 1st January 2016 (Figure 2-24).

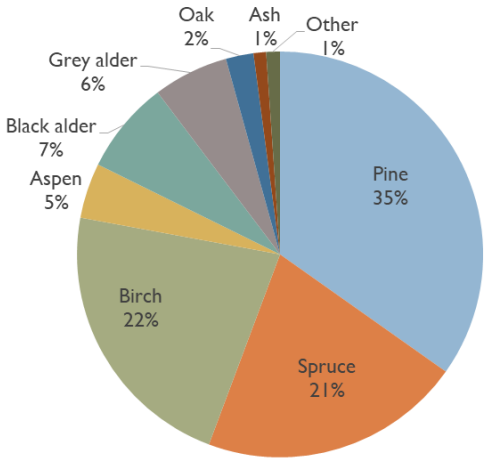

Figure 2-24. Forest stands area by dominant tree species as of 1st January 2016, %

In 2016 around a half of all forest land in Lithuania was of State importance – 1088.5 thousand ha. The registered area of private forests is 838.5 thousand ha. The estimated area of private forests is 873 thousand ha. By 1st January 2016 the number of private forest owners amounted to almost 249.1 thousand, a forest estate averaging 3.4 ha.

According to NFI data, since 2003 total growing stock volume increased from 453.4 million m³ up to 537.0 million m³. Pine stands accumulated growing stock of 221.0 million m³. In a period of thirteen years they accumulated 41.0 million m³. The growing stock in spruce stands increased from 75.8 to 91.2 million m³.

All Lithuanian forests are distributed into four functional groups. In the beginning of 2016, the distribution of forests by functional groups was as follows: group I (strict nature reserves) – 26.5 thousand ha (1.2%); group II (ecosystem protection and recreational) – 266.5 thousand ha (12.2%); group III (protective) – 333.4 thousand ha (15.2%); and group IV (commercial) – 1 560.3 thousand ha (71.4%).

Over 1990-1995 felling rates in all Lithuanian forests (irrespective of their ownership) were unstable, but still slightly increasing and reached the peak in 1995 with the total of 9.43 million m^3 of living trees felled. After 1995 felling were decreasing to 7.71 million m^3 of living trees felled in 1997 and then started to increase again. The highest point over the whole accounting period was reached in 2003 (10.34 million m^3 of living trees felled) and then started slightly to decrease until 2012 (8.05 million m^3 of living trees felled). Over the past years, marginal increase in forest felling is observed (8.67 million m^3). Changes in total forest felling (living trees) for the period of 1990-2015 are presented in the Figure 2-25.

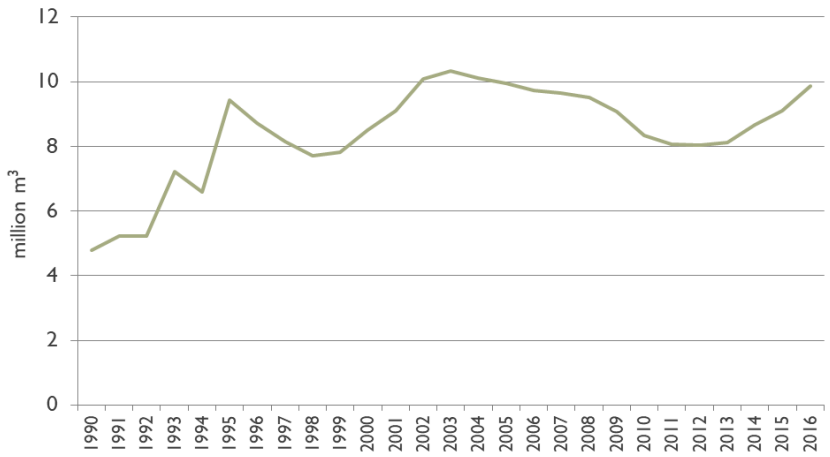

Figure 2-25. Total forest fellings (living trees) in all forests irrespectful of their ownership, 1990-2016

2.12 Waste

Waste and wastewater management is one of the most important priorities of the national environmental management in Lithuania. The objectives set in this sector are to create ecologically and economically feasible management system for hazardous and non-hazardous waste, to decrease waste flows and adverse impact of waste on environment and human health, to ensure rational waste recovery for recycling and energy generation.

The total amount of waste generated annually in Lithuania is about 5 million tonnes. Major part of waste is generated in industrial sector of which about 100 kt hazardous waste. Annual municipal waste generation is a bit more than 1 million tonne.

In early 1990s there were about 1000 landfills and dumps in Lithuania. In late 1990s waste management strategies were developed foreseeing development of waste management infrastructure including construction of new regional landfills complying with EU requirements, closure of existing landfills and dumps and provision of necessary equipment required for safe and efficient operation of waste management facilities.

During the reorganization of waste management infrastructure, all landfills and dumps not in line with the environmental protection and public health safety requirements were closed. The disposal of waste in the old landfills was stopped in 2009 and since then all waste is disposed of in 11 regional non-hazardous waste landfills.

In order to encourage waste recovery and recycling and to minimize disposal in the landfills, regional waste management systems were equipped with appropriate waste management facilities including bulky waste collection sites, green waste composting sites, etc. Currently, there are 54 biodegradable waste collection areas in Lithuania. Recovery of landfill gas started at 2 landfills in 2008. Currently landfill gas is recovered in 3 operating and 6 closed landfills.

In 2015, municipal waste generation in Lithuania remained just slightly below the EU average (448 kg/year/inhabitant compared to around 477 kg on average). In 2015 in Lithuania is recycled 23%, composted 10%, incinerated 12% with energy recovery and disposed in landfills 54% of municipal waste. During the last five years, Lithuania increased waste recycling almost by 5%, boosted composting by more than 9%, while waste incineration went up by more than 11% and the volume of waste in landfills declined by more than 24%, however disposal in landfills remained Lithuania's main treatment option of municipal waste.

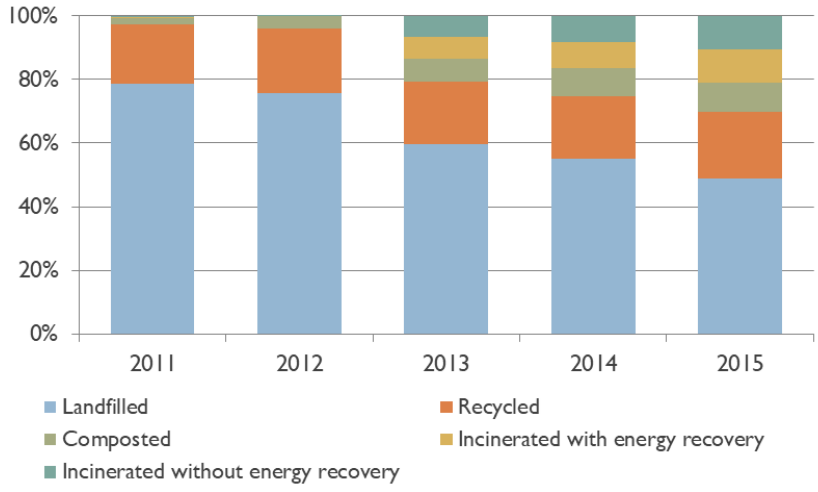

Figure 2-26. Municipal waste treatment in Lithuania in 2011-2015, %

According to data provided by municipalities[1], waste collection services were provided to 94.8% of population. Differences between provision of services in cities, towns and rural areas are decreasing. In 2012-2014, waste collection services were provided to 97% of population in towns and cities with population exceeding 1000 inhabitants and to 94% of population in small towns and villages with population less than 500 inhabitants.

EU structural and investment funds are an important source of funding for improved waste management system in Lithuania. In 2007-2013 EUR 190 million were invested into waste management projects, including construction of 9 regional mechanical and biological waste treatment plants, remediation of 341 old landfills/dumpsites, construction of numerous bulky waste collection and green waste composting sites, extension of separate waste collection system (210 000 containers for recyclable and biodegradable waste).

In the 2014-2020 period EUR 87.2 million investment from EU Cohesion Fund is planned to support further development of the separate collection of waste, modernization of capacities to prepare waste for recycling, reuse or other recovery (sorting lines, other equipment), and modernization of the waste management information system and monitoring.

In order to improve heat and energy efficiency, make more efficient use of local and renewable sources in heat energy production facilities and reduce CO_2 emissions two higher efficiency cogeneration power plants using biomass and municipal waste (non-recyclable municipal waste with energy potential) of 360 thousand t/y (incinerating 30% of municipal waste) for energy production will be built in Vilnius and Kaunas in the period 2017-2020. In Vilnius power plant energy savings per unit shall be 43.6% for the waste-to-energy unit (around 440 GWh per year) and 38.9% for the biomass unit (around 640 GWh per year). The waste-to-energy unit is expected to reduce CO_2 emissions by more than 90 thousand t/y and biomass unit is expected to reduce CO_2 emissions by more than 340 thousand t/y.

Wastewater collection and treatment, as well as the effective utilization of sewage sludge, are tasks of great importance for growing populations, rapidly developing industry and pollution reduction efforts aimed at curbing the harmful by-products generated by such processes.

In most cases in Lithuania industrial wastewater is discharged to centralized municipal sewage collection networks and treated together with the domestic wastewater in centralized municipal treatment plants.

According to the information provided by the Lithuanian Water Suppliers Association[2] fraction of industrial wastewater exceeds 50% in six of 38 agglomerations with population equivalent more than 10 thousand. On average, industrial wastewater comprises about 20% of the total load of municipal wastewater treatment systems in Lithuania.

Wastewater in Lithuania is treated in aerobic treatment systems with minimum CH_4 generation. However, significant part of population still does not have connection to public sewerage systems and emissions from sewage collected from septic tanks are significant.

Treated household and production/technological wastewater discharged into the surface water bodies in 2015 amounted to 164.4 million m^3. Major improvements in wastewater treatment quality took place over the entire decade and in the last years the amount of wastewater treated according to requirement reached

[1] Data collected by Environmental Protection Agency

[2] Lithuanian Water Suppliers Association. Certificate on municipal wastewater treatment plant capacity assessment, 2011.03.04.

a very high level of more than 90%, though in 2002 level was barely 21%. Over the decade the trends were determined by construction of the new wastewater treatment facilities and reconstruction of the existing ones.

According to statistical data, the amount of accumulated sewage sludge in the country reached 82 thousand t/year dry weight in 2016. Of that, approximately 60% is stored in storage plants and landfills, 14% is used in agriculture, and 26% is composted.

Development of the Lithuanian sewage sludge management infrastructure took place during the period of 2007-2013 with the aim of treatment of around 80% of the locally produced sewage sludge using modern technologies, where the sludge would be managed in digestion, dewatering and composting facilities. By 2016, using EU structural funds 50 new sewage sludge treatment plants were constructed (including reconstructed old plants that did not ensure adequate waste water treatment).

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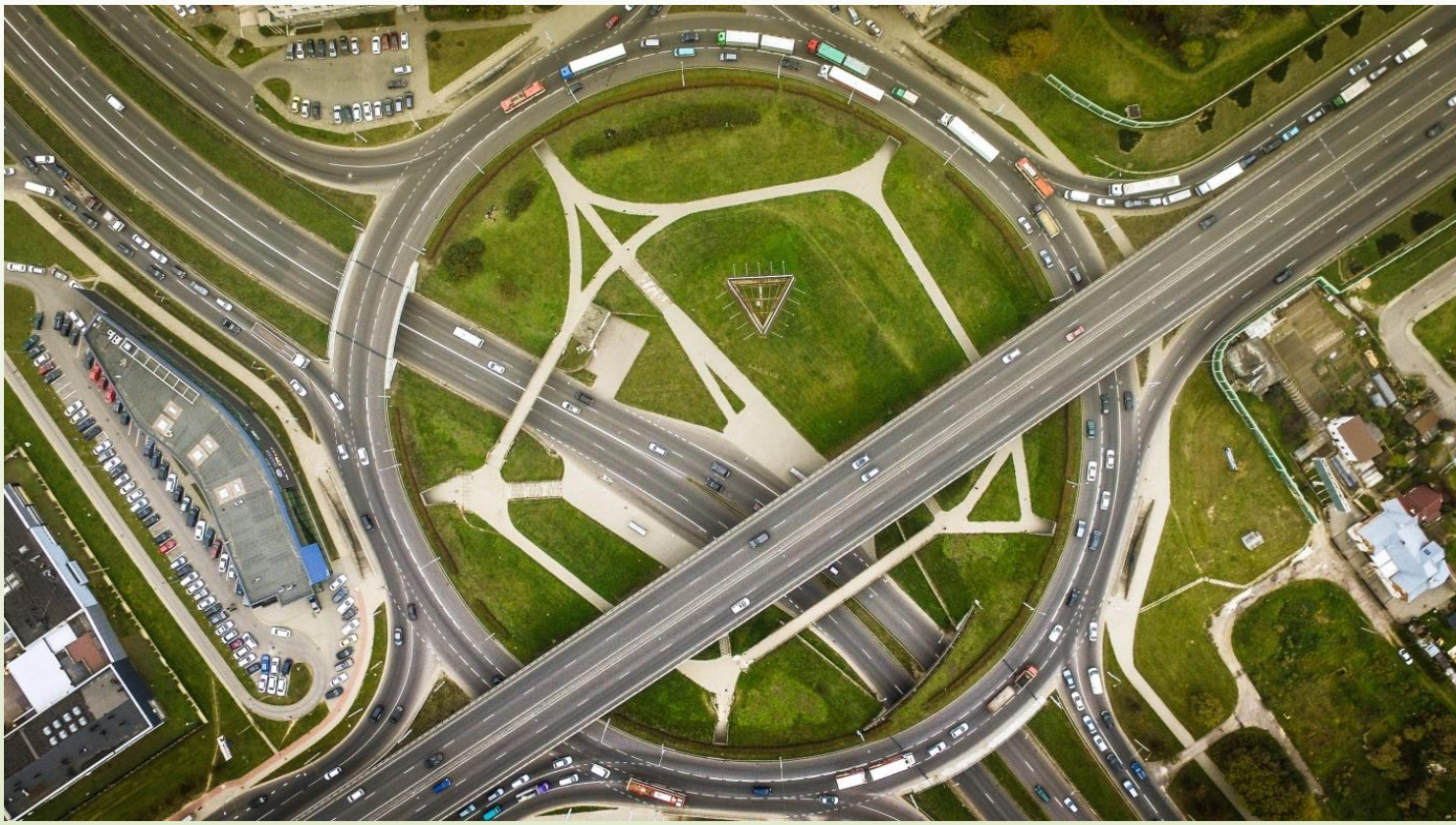

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GREENHOUSE GAS INVENTORY INFORMATION

3 GREENHOUSE GAS INVENTORY INFORMATION

Lithuania provided GHG inventory data for the first time in its first National Communication under the UNFCCC in 1996. Since 2004, inventory data is reported using common reporting format (CRF) and from 2006 using CRF Reporter software, developed by the UNFCCC secretariat. In 2006 for the first time complete time series 1990-2004 have been estimated and submitted to the European Commission and the UNFCCC secretariat together with Lithuania's Initial Report under the Kyoto Protocol.

The data used in Lithuania's 7th National Communication is in accordance with its National Inventory Report (NIR) that was submitted in 2017 to the Secretariat of the UNFCCC in compliance with the decision 24/CP.19 "Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to Convention" (FCCC/CP/2013/10/Add.3). This submission covers the inventory of GHG emissions of Lithuania for the period 1990-2015. It has been also submitted to the European Commission in compliance with European Parliament and the Council Regulation (EU) No 525/2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC. The NIR includes description of the methodologies and data sources used for estimating emissions by sources and removals by sinks, and review of their trends.

3.1 Greenhouse gas emissions trends

3.1.1 General greenhouse gas emissions trends

In 2015, Lithuania's total GHG emissions amounted to 20 096.2 kt CO_2 eq. excluding LULUCF. GHG emission level drastically fell down in 1992 and remained steady at approx. 22 Mt CO_2 eq. during the last 23 years (Figure 3-1).

A significant decrease in 1992 was caused by the collapse of Soviet economy, which led to the transition from a centrally-planned economy to a market-based economy by restructuring manufacturing industries, energy industries and agriculture. Upon its independence from the Soviet Union in 1990, after 50 years of annexation, Lithuania inherited an economy with high energy intensity. A blockade of resources, imposed by USSR during 1991-1993 led to a sharp fall in economic activity, as reflected by the decrease of the GDP in the beginning of nineties. The economic situation improved in the middle of the last decade and GDP has been increasing until 1999 (during 1999-2000, GDP decreased due to the economic crisis in Russia) and GDP continued increasing from 2001 to 2008.

In the beginning of 1990s, mostly fossil fuel was combusted in manufacturing industries, energy industries and agriculture. A comparison of annual general fuel balances in the period of 1990-2015 shows a significant decrease of use of fuel oil (e.g. from about annual quantity of 57 800 TJ in 1990-1991, to 19 307 TJ in 1992, to about 17 200 TJ in 1993-1994 and 13 126 TJ in 1995, to less than 600 TJ since 2008), also a decrease of use of coal, petrol, natural gas, but increase of use of wood. Decrease of use of fuel oil first of all was influenced by environmental requirements: since 1 January 2004 consumption of sulphurous fuel oil was forbidden and it was followed with the stricter requirements since 2008. As elimination of sulphur from fuel oil was not economically efficient for companies, these requirements led

to the shift of fuel oil to other fuel types (e.g. natural gas), resulting in a considerable decrease in annual GHG emissions.

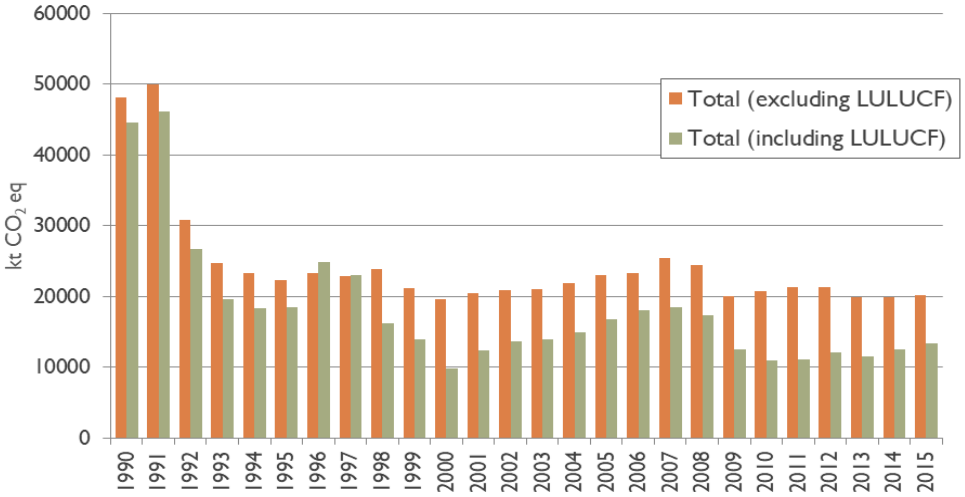

Figure 3-1. GHG emissions 1990-2015, kt CO_2 eq.

Last considerable decrease in 2009 was related with the economic crisis in Europe, while after 2009 GHG emissions stabilized at approx. 20 Mt CO_2 eq.

Comparing with 2014 the total GHG emissions have increased by 1.1% (excl. LULUCF) in 2015.

The composition of GHG emissions by sector in 2015 is presented in Figure 3-2.

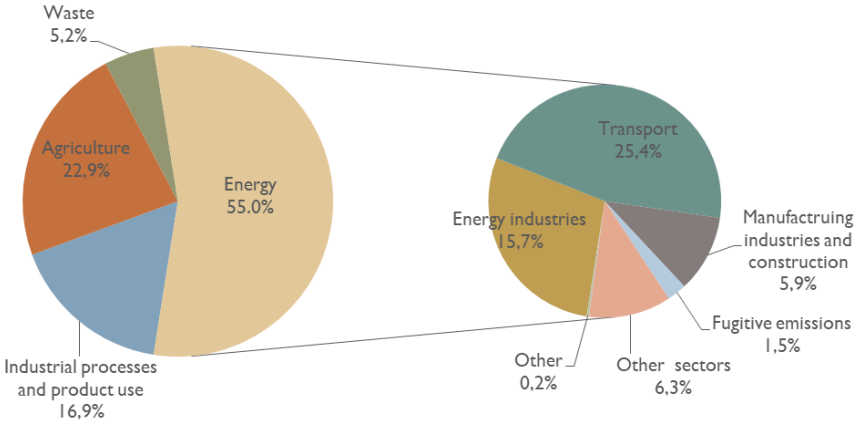

Figure 3-2. The composition of Lithuanian GHG emissions (%) by sector (excl. LULUCF) in 2015

Energy sector is the most significant source of GHG emissions in Lithuania with 55% share of the total emissions (excl. LULUCF) in 2015. Emissions from energy include CO_2, CH_4 and N_2O GHG.

CO_2 emission from energy sector contained 79.3% of the total national CO_2 emissions (excl. LULUCF) in 2015. The main categories are energy industries and transport which contribute 29.7% and 48.4% to the

total national CO_2 emission (excl. LULUCF) respectively. Comparing with 2014 CO_2 emissions from energy sector have increased by 0.004% in 2015. The emissions of CH_4 have increased by 1.5% and N_2O emissions decreased by 0.1%.

The second most important source of GHG emissions is agriculture sector accounting for 22.9% of the total national GHG emissions (excl. LULUCF). This sector is the most significant source of CH_4 and N_2O emissions accounting for 56.4% and 85.1% of the total CH_4 and N_2O emissions, respectively. The main source of CH_4 emissions is enteric fermentation contributing 86% to the total agricultural CH_4 emissions. Agricultural soils are the most significant source of N_2O emissions accounting for 92.4% of the total agricultural N_2O emissions. Comparing with 2014 GHG emissions in agriculture sector have increased by 1.6% in 2015.

Emissions from industrial processes and product use amounted to 16.9% of the total GHG emissions (excl. LULUCF) in 2015. The main categories are: ammonia production, nitric acid production and cement production. Ammonia production is the largest source of CO_2 emissions in industrial processes and product use sector contributing 15.4% to the total national CO_2 emissions (excl. LULUCF) in 2015. Nitric acid production is the single source of N_2O emissions in industrial processes sector and accounts for 8.3% in the total national N_2O emissions (excl. LULUCF) in 2015. GHG emissions in 2015 from industrial processes and product use sector have increased by 6.9% comparing with 2014.

Waste sector accounted for 5.2% of the total GHG emissions in 2015 (excl. LULUCF). The solid waste disposal on land is the second important source of CH_4 emissions. It contributes 23.8% to the total CH_4 emissions (excl. LULUCF). There was 7.1% reduction in CH_4 emission from waste sector in 2015 comparing with 2014.

3.1.2 Greenhouse gas emissions trends by gas

GHG emissions trends by gas in CO_2 eq. are presented in the Figure 3-3 below and reflect the main tendencies of GHG level in general.

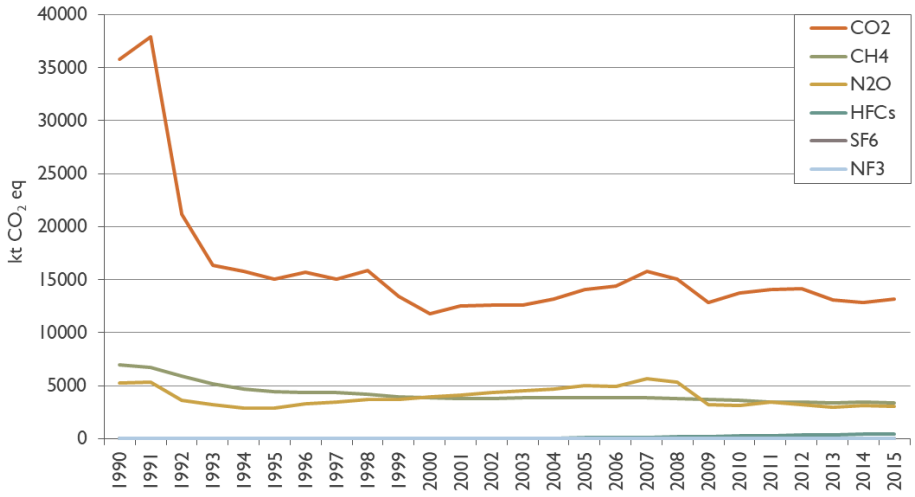

Figure 3-3. Trends of GHG emissions by gas kt CO_2 eq (excl. LULUCF) 1990-2015

The most important GHG in Lithuania is carbon dioxide. In 2015, the actual CO_2 emission (excl. LULUCF) was 63.3% lower than the emission in 1990. Comparing with 2014 CO_2 emissions increased by 2.1% including LULUCF and 17.5% excluding LULUCF. The largest source of CO_2 emissions is energy sector which contributes around 79.3% of all CO_2 emissions. Comparing with 2014 CO_2 emission from energy sector in 2015 have slightly increased by 0.004% wherein CO_2 emission from the energy industries decreased by 0.8% and emissions from transport increased 5.5%.

Distribution of CO_2 emissions in 2015 by the main sectors and subsectors is shown in Figure 3-4.

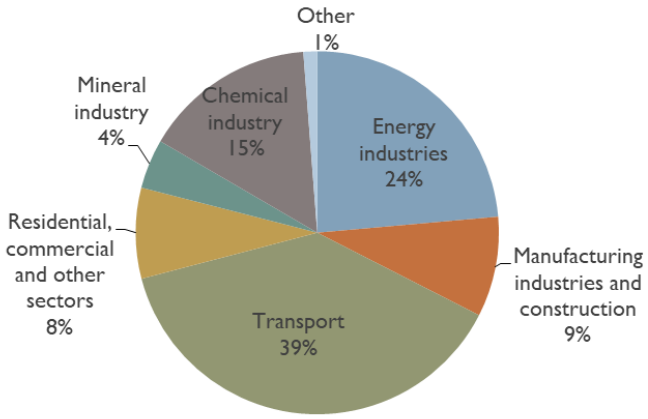

Figure 3-4. Distribution of CO_2 emissions by sector in 2015

Methane is the second most important GHG accounting for 16.8% in the total national GHG emissions (excl. LULUCF). The largest sources of methane emissions are: agriculture sector, contributing with 56% in 2015, waste sector – 29% and fugitive emissions from oil and natural gas operations – 9% (Figure 3-5). The emissions from agriculture derive from enteric fermentation and manure management contributing with 48% and 8% respectively of the total national CH_4 emission (excl. LULUCF).

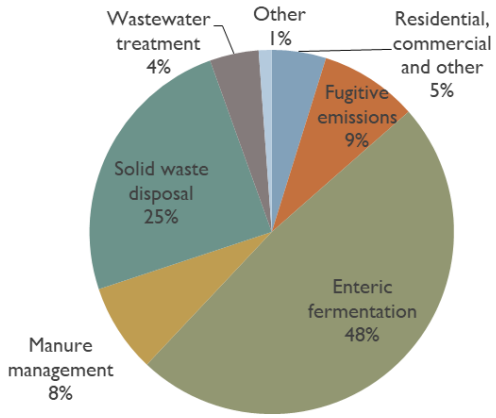

Figure 3-5. Distribution of CH_4 emissions by sector in 2015

Nitrous oxide is accounting for 15.4% in the total national GHG emissions (excl. LULUCF). Agriculture is the main source of N_2O emissions which contributed 85% to the total N_2O emissions in 2015. N_2O emissions from agriculture sector have increased by 2.4% comparing with 2014.

The second significant source of N_2O emissions is nitric acid production. It contributes 8% to the total N_2O emissions. Figure 3-6 shows the distribution of N_2O emissions in 2015 by the main sectors and subsectors.

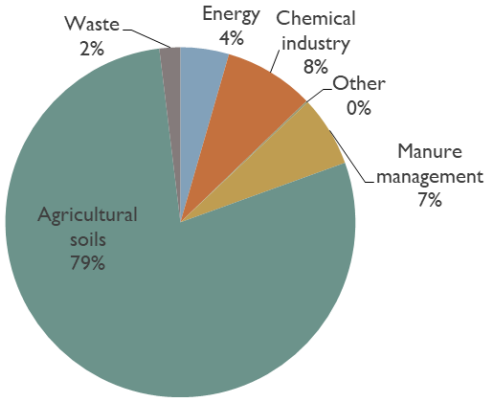

Figure 3-6 Distribution of N_2O emissions by sector in 2015

The F-gases contribute 2.4% to the total national GHG emissions in 2015. The emissions of F-gases have increased significantly during 1993-2015. A key driver behind the trend has been the substitution of ozone depleting substances (ODS) by F-gases in many applications. Figure 3-7 shows the trend of F-gases emissions during the period 1993-2015.

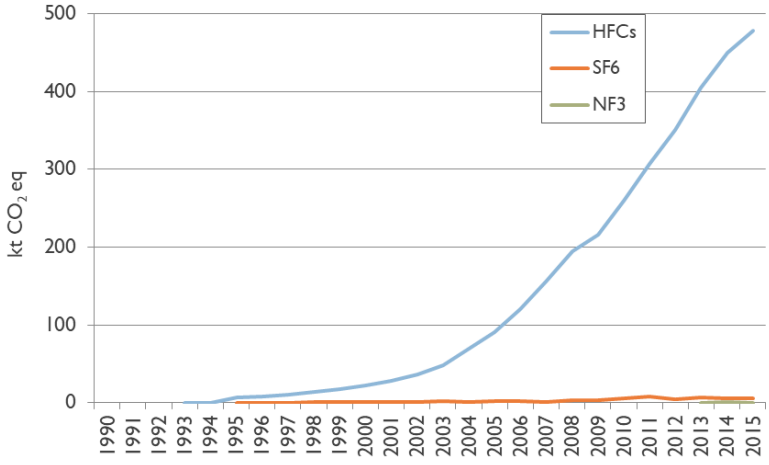

Figure 3-7. Emission trends for F-gases for the period 1993-2015 (kt CO_2 eq.)

3.1.3 Greenhouse gas emissions trends by sector

The trends of GHG emissions by sector expressed in CO_2 eq. are presented in Table 1.

The most significant source of GHG emissions in Lithuania is energy sector with 55% share of the total emissions in 2015. Agriculture is the second most significant source and accounted for 22.9% of the total emissions. Emissions from industrial processes contributed 16.9% of the total GHG emissions, waste sector – 5.2%.

Table 3-1. Greenhouse gas emissions/removals by sector during the period 1990-2015, kt CO_2 eq.

GHG source and sink categories	Energy	IPPU	Agriculture	LULUCF	Waste	Total (including LULUCF)	Total (excluding LULUCF)
1990	33 107.7	4 502.7	8 853.5	-3 511.9	1 576.7	44 528.7	48 040.6
1991	35 175.0	4 535.1	8 673.7	-3 840.0	1 602.4	46 146.2	49 986.2
1992	19 881.6	2 689.8	6 607.2	-4 009.2	1 571.6	26 740.9	30 750.1
1993	16 003.5	1 759.3	5 362.2	-5 143.0	1 593.4	19 575.4	24 718.4
1994	15 044.2	1 955.9	4 750.6	-4 921.3	1 549.4	18 378.8	23 300.1
1995	14 062.4	2 243.1	4 442.4	-3 795.3	1 578.3	18 530.8	22 326.1
1996	14 519.4	2 633.1	4 613.6	1 516.0	1 577.3	24 859.4	23 343.4
1997	14 052.4	2 596.4	4 648.5	142.8	1 579.5	23 019.6	22 876.8
1998	14 734.4	3 003.7	4 536.2	-7 613.5	1 565.4	16 226.2	23 839.7
1999	12 361.0	2 939.2	4 272.8	-7 232.3	1 539.9	13 880.5	21 112.8
2000	10 808.2	3 094.4	4 157.0	-9 820.5	1 540.8	9 779.8	19 600.3
2001	11 434.5	3 342.6	4 054.6	-7 981.6	1 583.7	12 433.8	20 415.4
2002	11 525.7	3 515.2	4 226.8	-7 262.4	1 573.7	13 579.0	20 841.4
2003	11529.9	3 597.8	4 339.9	-7 164.1	1 561.4	13 864.8	21 029.0
2004	12 162.9	3 787.2	4 387.7	-6 991.2	1 532.8	14 879.4	21 870.5
2005	13 042.0	4 108.6	4 420.5	-6 328.3	1 496.7	16 739.6	23 067.8
2006	13 116.6	4 367.4	4 396.1	-5 372.9	1 460.6	17 967.8	23 340.7
2007	13 367.7	6 144.9	4 488.5	-6 974.7	1 435.8	18 462.2	25 437.0
2008	13 186.3	5 475.5	4 340.2	-7 045.5	1 421.8	17 378.3	24 423.8
2009	11 922.8	2 294.4	4 381.1	-7 472.1	1 376.2	12 502.5	19 974.6
2010	12 874.7	2 239.2	4 329.2	-9 901.1	1 339.4	10 881.3	20 782.5
2011	12 029.0	3 719.5	4 345.4	-10 228.0	1 250.6	11 116.6	21 344.6
2012	12 071.3	3 565.4	4 379.5	-9 217.1	1 211.7	12 010.8	21 228.0
2013	11 419.7	3 000.4	4 357.3	-8 504.5	1 170.6	11 443.6	19 948.1
2014	11 049.6	3 176.9	4 529.7	-7 332.0	1 113.0	12 537.1	19 869.1
2015	11 057.1	3 396.6	4 600.3	-6 705.0	1 042.2	13 391.2	20 096.2
2015/1990, %	**-66.6**	**-24.6**	**-48.0**	**90.9**	**-33.9**	**-69.9**	**-58.2**

Energy

Energy sector is the most significant source of GHG emissions in Lithuania with 55% share of the total emissions (excl. LULUCF) in 2015. Emissions from energy include CO_2, CH_4 and N_2O.

Emissions of total GHG from energy sector have decreased almost 3 times from 33 107.7 kt CO_2 eq. in 1990 to 11 057.1 kt CO_2 eq. in 2015 (Figure 3-8). Significant decrease of emissions was mainly due to economic slump in the period 1991-1995. During the fast economic growth over the period 2000-2008 GHG emission in energy sector was increasing about 2.5% per annum. The global economic recession

had impact on GHG reduction in energy sector by 9.6% in 2009. The closure of Ignalina NPP and GDP increase had impact on GHG increase by 8% in 2010.

During the period 1990-2015 the share of transport sector significantly increased. In 1990 transport sector accounted for 17.6% of total GHG emission in energy sector whereas in 2015 – 46.2%. This growth is influenced by the rapid increase of the density of transport routes and the number of road vehicles.

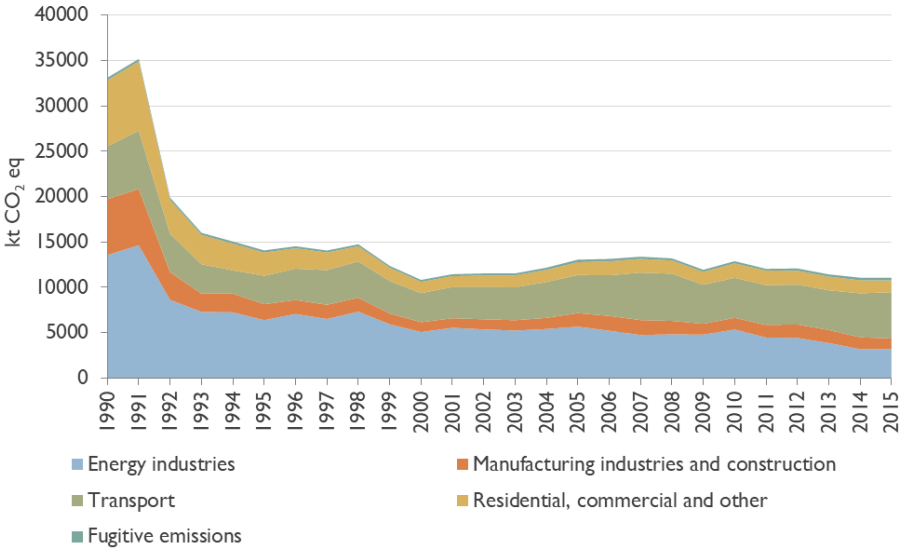

Figure 3-8. Trend of GHG emissions in energy sector during the period 1990-2015

The increase of GHG emissions from fugitive sources is mainly caused by the increase of CH_4 emissions from natural gas distribution, reflecting the increase of the length of natural gas pipelines. Since 2000 GHG emissions from this subsector was increasing by average 3.2% per annum.

Industrial Processes and Product Use

Emissions from industrial processes and product use (referred to as non-energy related ones) amount to 16.9% of the total emissions (excl. LULUCF) in 2015. Emissions from industrial processes and product use include CO_2, N_2O and F-gases emissions. Emissions of total GHG from the industrial processes and product use sector have decreased from 4 502.7 kt CO_2 eq. in 1990 to 3 396.6 kt CO_2 eq. in 2015 (Figure 3-9).

CO_2 emissions from ammonia production contributed 15.3% to the total national CO_2 emissions (excl. LULUCF) in 2015. The lowest emission of CO_2 was in 1993 due to decrease of the ammonia production and the peak of CO_2 emissions were in 2007 when the ammonia production increased. Comparing with 2014 CO_2 emissions increased by 7%.

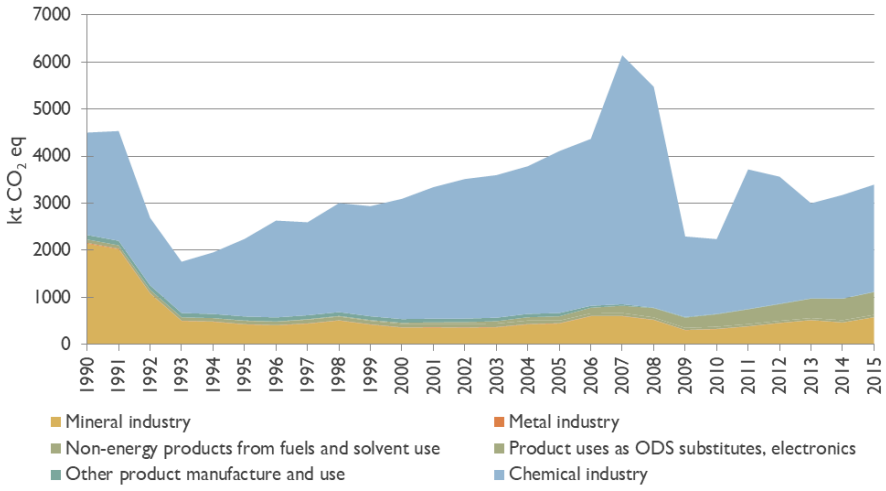

Figure 3-9. Trend of GHG emissions in industrial processes and product use sector during the period 1990-2015

Nitric acid production is the single source of N_2O emissions in industrial processes sector and accounts for 8.3% in the total national N_2O emissions (excl. LULUCF) in 2015. N_2O emissions had been increasing since 1995 and reached its peak in 2007. After the installation of the secondary catalyst in nitric acid production enterprise in 2008 the emissions of N_2O dropped drastically till 2010 and started to increase because of the increase of production capacity. After 2011 emissions began to decrease because the project ("Nitrous Oxide Emission Reduction Project at GP Nitric Acid Plant in AB Achema Fertiliser Factory) of catalyst installation has been finished. Comparing with 2014 nitric acid production increased by 4.7%, however N_2O emissions decreased by 28.6%.

Agriculture

Agriculture sector is the second most important source of GHG emissions in Lithuania contributing 22.9% to the total GHG emission (excl. LULUCF). The emissions from agriculture sector in 2015 include CH_4, N_2O and CO_2 emissions. Emissions of total GHG from agriculture sector have decreased 1.9 times from 8 853.5 kt CO_2 eq. in 1990 to 4 600.3 kt CO_2 eq. in 2015 (Figure 3-10).

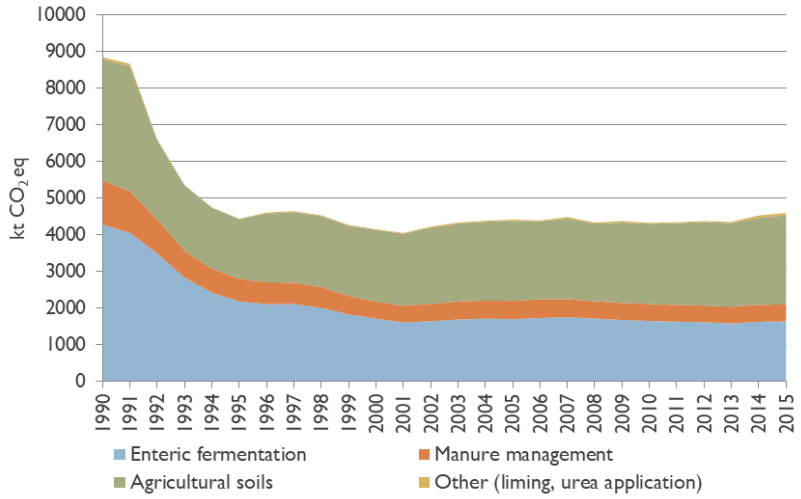

Figure 3-10. Trend of GHG emissions in agriculture sector during the period 1990-2015

Emissions from agriculture sector decreased substantially in the beginning of 1990s. The agriculture sector contributed 24% of the national GDP in 1992 and employed 19% of the labour force. Lithuania's agriculture, efficient according to the past soviet standards, produced a huge surplus that could not be consumed domestically. Lithuania was producing crops, developing livestock farming and food processing industry. Crops accounted for 1/3 and livestock for 2/3 of the total value of agricultural output. Lithuanian agricultural production was high enough to allow the export of about 50% of the total output.

Significant reforms were introduced in the early 1990s, particularly after the restoration of independence. The reform included the re-establishment of private ownership and management in the agriculture sector. Legislation defined dismemberment of the collective farms, but they did not definitively ensure their replacement by at least equally productive private farms or corporations. Agricultural production decreased by more than 50% from 1989 to 1994. The farms were broken into small holdings, averaging 8.8 ha in size, often not large enough to be economically viable.

Agriculture sector is the most significant source of the CH_4 and N_2O emissions accounting for 56.4% and 85.1% in the total CH_4 and N_2O emissions, respectively. The emissions of CH_4 and N_2O from agriculture sector decreased by 61.2% and 32.4% compare to the base year, respectively. The reduction of CH_4 emissions is mostly caused by the decrease in total number of livestock population.

The major part of the agricultural CH_4 emission originates from digestive processes. Enteric fermentation contributes 48.5%, manure management – 7.9% to the total national CH_4 emissions.

Agricultural soils are the most significant source of N_2O emissions accounting for 78.6% in the total national N_2O emissions.

LULUCF

The Land Use, Land-Use Change and Forestry (LULUCF) sector for 1990-2015 as a whole acted as a CO_2 sink except in 1996 and 1997 when emission constituted to 1 516 kt CO_2 eq. and 142.8 kt CO_2 eq. (Figure 3-11). That is explained by sudden spruce dieback that caused huge losses in trees volume, in Lithuania's spruce stands, which has direct impact on biomass calculations and on CO_2 balance from this sector.

Lower removals from LULUCF sector in 2015 comparing with 2014 has been mainly caused by decreased mean annual volume change from forest land (from 4.7 million m^3 in 2014 up to 3.6 million m^3 in 2015). For instance, total removals in forest land decreased to 8,898 kt CO_2 in 2015 comparing with 9 262 kt CO_2 removed in the previous year.

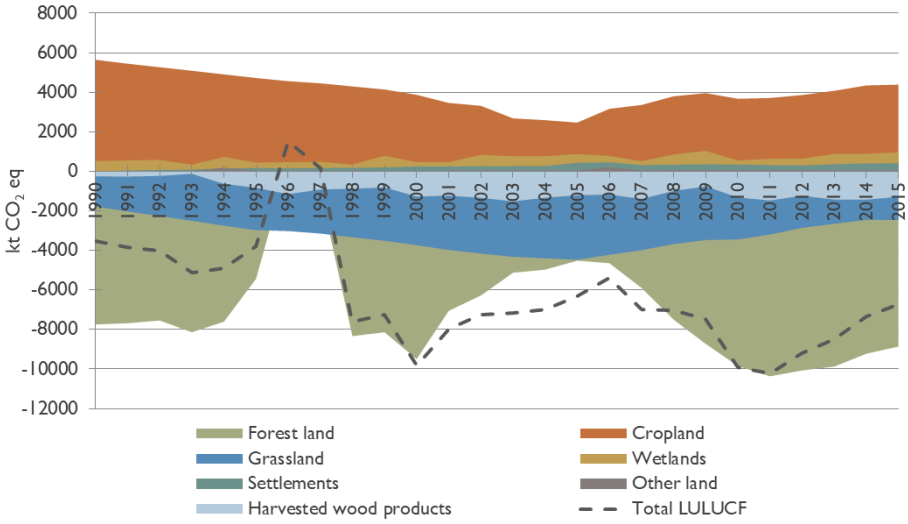

Figure 3-11. Total GHG emissions/removals from LULUCF sector for the period 1990-2015

Waste

The waste sector accounted for 5.2% of the total greenhouse gas emissions in 2015 (excl. LULUCF). The emissions from waste sector included CO_2, CH_4 and N_2O emissions. Emissions of the total GHG from waste sector have decreased from 1 576.7 kt CO_2 eq. in 1990 to 1 042.2 kt CO_2 eq. in 2015 (Figure 3-12).

Solid waste disposal on land including disposal of sewage sludge is the largest GHG emission source from waste sector. It contributed around 77% of the total GHG emission from waste sector in 2015 (73.9% excluding disposal of sewage sludge). GHG emissions occurring due to solid waste and sewage sludge disposal on land were increasing slightly from 1990 to 2003 and then started to decrease due to reduction of disposed waste, extraction of landfill gas, anaerobic digestion of sewage sludge.

Certain increase of emissions was observed from 2001 to 2003 and was caused mainly by disposal of large amounts of organic sugar production waste. In later years the producers managed to hand this waste over to farmers for use in agriculture and GHG emissions declined.

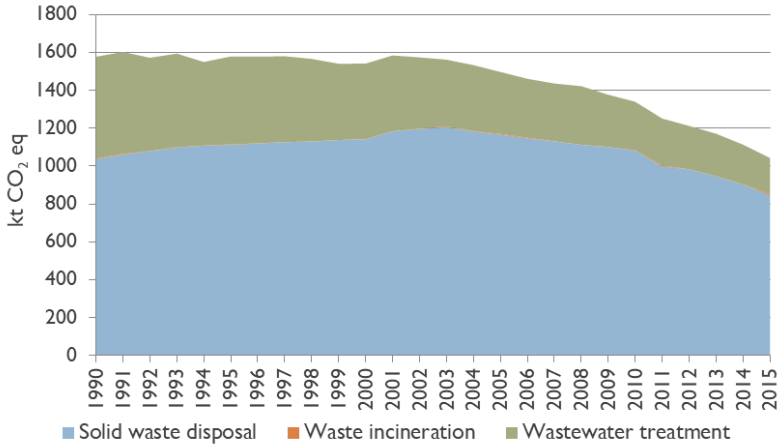

Figure 3-12. Trend of GHG emissions in waste sector during the period 1990-2015

Wastewater treatment and discharge contributed around 18.4% of GHG emissions from waste sector in 2015. Wastewater in Lithuania is treated in aerobic treatment systems with minimum CH_4 generation. However, significant part of population still does not have connection to public sewerage systems and emissions from sewage collected from septic tanks are significant.

KP-LULUCF

Removals and emissions resulting from forestry related activities (afforestation (A), reforestation (R) and deforestation (D)) are addressed in Article 3.3 of the Kyoto Protocol. Reporting under this article was mandatory during the first Kyoto Protocol commitment period (2008-2012) and shall be mandatory accounted and reported during the second commitment period. Article 3.4 includes the following activities: forest management, cropland management, grazing land management and revegetation. For the first commitment period Lithuania had chosen to elect forest management (FM). Lithuania continues to account emissions and removals from FM activity as it is an obligatory activity in the second commitment period. The obligatory accounting period for UNFCCC for cropland management and grazing land management activities begins on 1st January 2021.

Net removals from Article 3.3 activities for the first commitment period were -117.41 kt CO_2 eq. in 2012. Second commitment period has started with total removals of -64.41 kt CO_2 eq. in 2013. Afforestation and reforestation resulted in net removals of -219.84 kt CO_2 eq. and deforestation – net emissions of 213.43 kt CO_2 eq., whereas in 2015 afforestation/reforestation rates were higher and deforestation – significantly lower (A/R – net removals of -288.89 kt CO_2 eq., D – net emissions of 26.63 kt CO_2 eq.), which resulted in total removals of -262.26 kt CO_2 eq. from A/R/D activities.

The area subjected to A/R was 44.59 thousand ha in 2015. There could be two moments distinguished in the time series of 1990-2015 describing the A/R trend line (Figure 3-13). The first time period of human induced afforestation/reforestation has started in 1990-2000 and is the consequence of the restoration of Independency in 1990s. Forest expansion was the key priority among politicians therefore afforested and reforested areas constituted to more than 500 ha annually. But this number was steadily decreasing from 1994. After the spruce dieback which hardly hit the Lithuanian forest in 1994, afforestation and reforestation rates again returned to the 1990s level. Another two huge increases in A/R area were recorded in 2001-2007 and 2009-2011. Increase in afforestation/reforestation activities in State Forest Enterprises since 2001 was the result of increased funding for such activities while increase of afforestation/reforestation since 2009 is mostly due to the introduction of EU support for such activities for private land owners.

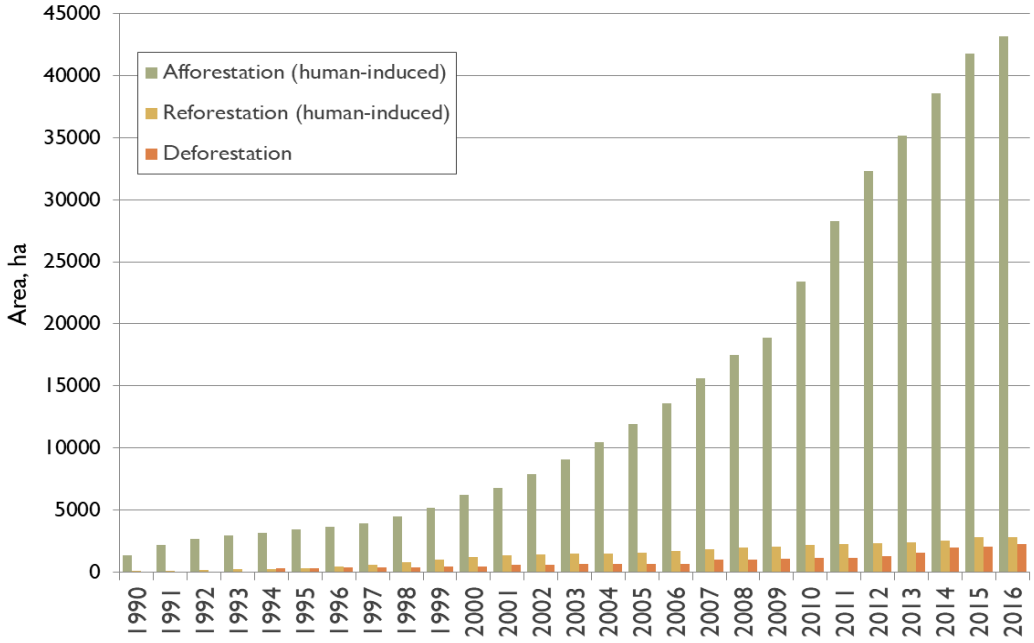

Figure 3-13. Cumulative area of afforestation, reforestation and deforestation, 1990-2016

In the beginning of 2016, deforested area since 1st of January 1990 was 2 022.8 ha. Deforestation was mainly caused by the forest area conversions to settlements (road building, cities expansion, etc.), other lands (e.g. quarry's) and wetlands (e.g. flooding) land use categories.

Net removals from Article 3.4 activity forest management (FM) were -7 916.8 kt CO_2 eq. in 2015. The area subjected to FM was 2 150.2 thousand ha by the end of the first commitment period and 2 151.6 in the beginning of the second commitment period, expanding up to 2 161.4 thousand ha in 2015.

3.2 National systems in accordance with Article 5, paragraph 1, of the Kyoto Protocol

3.2.1 Institutional arrangements for greenhouse gas inventory preparation

Detailed institutional set up for GHG inventory preparation is presented in Lithuania's National Inventory Report 2017, Chapter 1.2.1. Basic elements are presented further in this chapter.

The main entities participating in GHG inventory preparation and submission process are:

- Ministry of Environment;
- Environmental Protection Agency;
- Permanent GHG inventory expert working group;
- State Forest Service;
- National Climate Change Committee;
- Data providers;
- External consultants.

The institutional set-up for GHG inventory report preparation and submission is given in Figure 3-14.

Ministry of Environment of the Republic of Lithuania (MoE) is a National Focal Point to the UNFCCC. The Ministry of Environment is designated as *single national entity* responsible for the national GHG inventory. It has overall responsibility for the National System of GHG inventory and is in charge of the legal, institutional and procedural arrangements for the national system and the strategic development of the national inventory. Within the ministry, the Climate Change Policy Division administers this responsibility by supervising the national system. The Division will continue to supervise and coordinate the preparation of the National Inventory Report, including the final review of draft inventory reports.

The contact person in the MoE with overall responsibility for the national inventory is:

Ms. Jolanta Merkelienė
Chief Desk Officer, Climate Change Policy Division
Tel.: +370 706 63672
Fax: +370 706 63663
E-mail: jolanta.merkeliene@am.lt

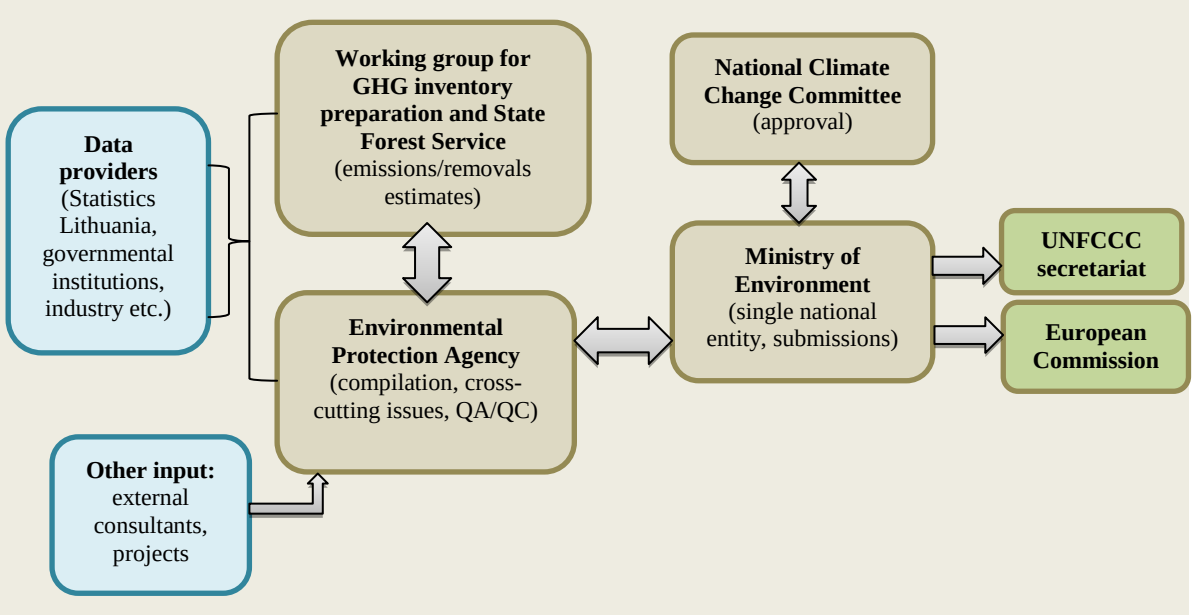

Figure 3-14. Institutional set-up for GHG inventory preparation

The **Lithuanian Environmental Protection Agency (EPA)** under the Ministry of Environment is assigned as an institution responsible for the GHG inventory compilation and QA/QC manager. In 2012 Climate change division was established within the EPA. The EPA responsibilities include: development and implementation of QA/QC plan and specific QA/QC procedures, collection of activity data and emission factors used to calculate emissions, collaboration with sectoral experts on the selection of best available methods complying with IPCC methodology, accomplishment of cross-cutting issues (key categories analysis, overall uncertainty assessment, analysis of GHG trends), establishment of GHG inventory database and archive, where GHG inventory submissions and all supporting reference material is stored and maintained etc.

Since 2014 submission personnel of EPA is also responsible for calculation of emissions and preparation of NIR part of the industrial processes, solvents and other products use sector and agricultural soils part of the agriculture sector.

The EPA is responsible for compilation of the final report based on the sectoral information provided by the experts/consultants – members of **Permanent expert working group** for GHG inventory preparation, which was established in 2012 by the Governmental Resolution No 683. It consists of experts from the Lithuanian Energy Institute, the Institute of Physics of the Centre for Physical Sciences and Technology, the Institute of Animal Science of the Lithuanian University of Health Sciences, Centre for Environmental Policy, The State Forest Service and Aleksandras Stulginskis University. Composition of the Permanent expert working group for the preparation of GHG inventory is shown in Figure 3-15.

Members of the working group are responsible for determination of activity data and emission factors, calculation of emissions/removals on the basis of 2006 IPCC Guidelines, filling CRF tables for corresponding sectors, drafting relevant NIR sectorial chapters, application of sector specific QA/QC procedures.

External experts, independent specialists providing data for the GHG inventory, may also be involved during the inventory preparation process.

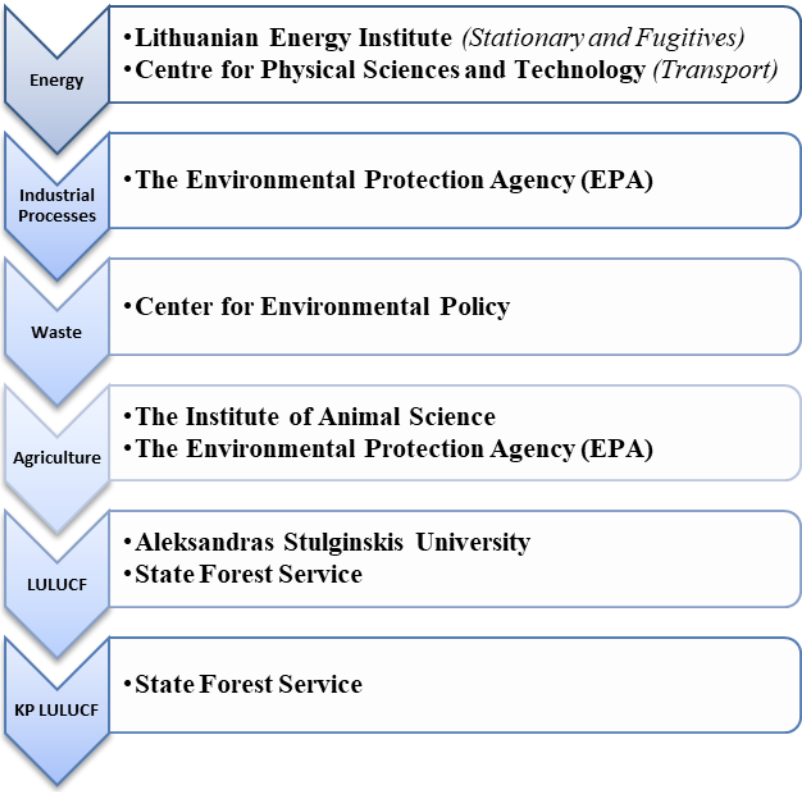

Fig. 3-15 The composition of Permanent expert working group for preparation of GHG inventory in Lithuania

The **State Forest Service** under the Ministry of Environment in the GHG inventory preparation process is responsible for calculations of emissions and removals of LULUCF sector and Kyoto Protocol activities under Article 3 para. 3 and 4. The State Forest Service representative is also a member of Permanent

working group for GHG inventory preparation. The State Forest Service inter alia compiles the National Forest Inventory (NFI) and the forest information system, carries out monitoring of the status of the Lithuanian forests, collects and manages statistical data etc.

Before final submission to UNFCCC secretariat and European Commission, reports are forwarded to the **National Climate Change Committee** for comments and final approval. National Climate Change Committee was established in 2001 in the first instance and periodically renewed (the latest in January 2015). It consists of experts from academia, government and non-governmental organizations (NGOs) and has an advisory role. The main objective of the Committee is to advise on the development and implementation of the national climate change management policy.

3.2.2 Greenhouse gas inventory preparation process, methodologies and data sources used

Work process of preparation and submission of National GHG inventory in Lithuania is organized by performing planned activities. The Figure 3-16 below shows a general overview of the GHG inventory preparation and submission process cycle.

Lithuania has to submit GHG inventory to the European Commission by 15th January and update estimates by 15th March annually. GHG inventory to the UNFCCC secretariat shall be submitted by 15th April annually.

This timeline shows only general activities overview and might be modified according to the reviews scheduled, planned projects, etc.

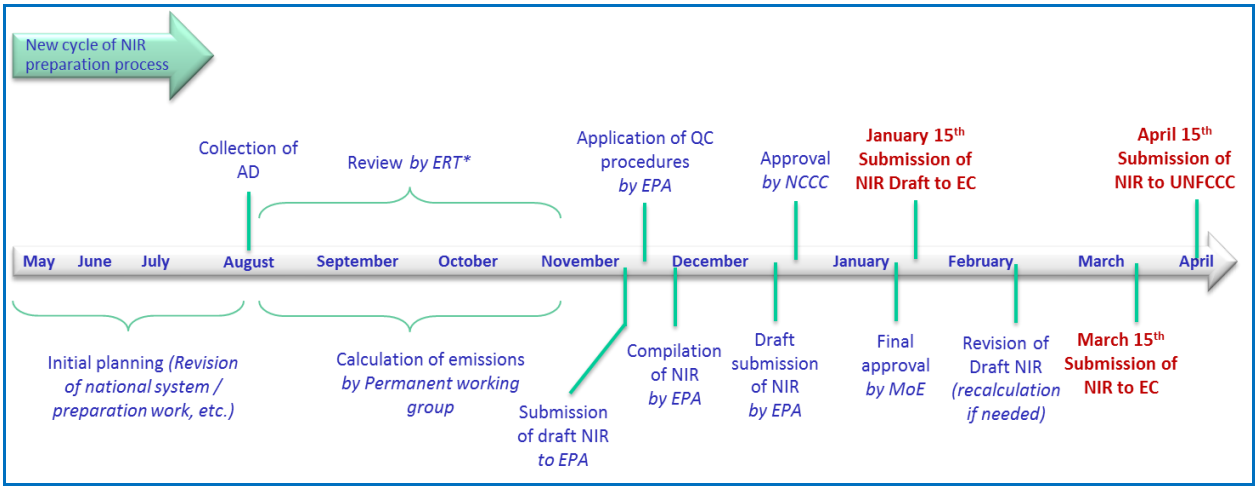

Figure 3-16. General timeline of GHG inventory preparation and submission process

One of the inventory preparation processes is data collection. This process starts with sending official requests to data providers (e.g. industrial companies) and collecting data from official statistical data sources. This process also involves application of QC procedures (conducted by EPA by providing documentation QC protocols) in order to collect all references and evaluation of uncertainty of activity data.

Activity data necessary for the calculation of GHG emissions is collected from published materials and official national and international databases. Not published data is gathered from relevant authorities (institutes, industry companies etc.) on the request of the EPA.

The main data providers for GHG inventory estimation are:

- Statistics Lithuania (Statistical Yearbooks of Lithuania, Sectorial Yearbooks on energy balance, agriculture, commodities, natural resources and environmental protection);
- The State Forest Service under the Ministry of Environment (NFI data, Lithuanian Statistical Yearbooks of Forestry);
- The Environmental Protection Agency (F-gases data, wastewater and waste data).

Table 3-2. Main data sources used in the GHG inventory

Sector	Main data sources
1.A Energy: Fuel Combustion	Energy Statistics database (Statistics Lithuania) EU ETS emission data
1.B Energy: Fugitive Emissions	Energy Statistics database (Statistics Lithuania) Lithuanian Geological Service Individual companies
2. Industrial Processes and Product Use	Individual production plants EU ETS emission data Industrial statistics database (Statistics Lithuania) F-gases database (EPA) Published literature
3. Agriculture	The Register of Agricultural Information and Rural Business Centre of Ministry of Agriculture Agricultural Statistics database (Statistics Lithuania) Regional Waste Management Centres Published literature International Fertilizer Association (IFA)
4. LULUCF/ KP-LULUCF	NFI (National Forest Inventory) Standwise Forest Inventory State Forest Cadaster Lithuanian Statistical Yearbook of Forestry National Paying Agency database on A/R areas Published literature
5. Waste	Waste database (EPA) Water and wastewater database (EPA) Regional Waste Management Centres

Lithuania's GHG emission inventory includes all major emission sources identified by the 2006 IPPC Guidelines with some exceptions, which have a minor effect on the total GHG emissions (insignificant categories in terms of the overall level and trend in national emissions). All Lithuania's territory is covered by GHG inventory.

The GHG inventory is prepared in accordance with IPCC methodology:

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories (*IPPC, 2006*);
- 2013 Supplement to the 2*006 IPCC* Guidelines for National Greenhouse Gas Inventories: Wetlands (*IPCC, 2014*);
- 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (*IPCC, 2014*).

GHG inventory is prepared also taking into account requirements, provided in Regulation (EU) No 525/2013 of the European Parliament and of the Council on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

Simple equations that combine activity data with emission factors are used. Different sources in the transport, agriculture, waste and LULUCF sectors necessitate the use of more complicated equations and models. Advanced and country-specific approaches (Tier 2 and Tier 3 methods) are used wherever possible, as these are designed to produce more accurate emission estimates than the basic (Tier 1) methods.

The choice of methodological tier for the individual categories depends among other things on the significance of the source. The key categories analysis for the GHG inventory is performed according to the 2006 IPCC Guidelines (Approach 1 and Approach 2 level and trend assessment of the key categories) by EPA annually. The analysis covers all of the sources and sinks of the inventory. The Approach 2 methodology makes use of category-specific uncertainty analysis. The categories identified by Approach 2 that are different from categories identified by Approach 1 are treated as key categories.

The level of disaggregation used for the key category analysis is performed by taking into account country-specific issues, specifically, in energy and agriculture sectors key categories are broken down into sub-source categories in order to reflect the level at which the EFs were applied and in order to focus efforts towards methodological improvements on these most significant sub-source categories.

Approach 1 key category (level assessment) with a highest contribution to national total emission in 2015 and 1990 was 4.A.1 Forest land remaining forest land - carbon stock change in biomass (CO_2). Its contribution to national total was 20% in 2015 and 10% in the base year. The second most important source of greenhouse gas emissions in 2015 was 1.A.3.b Road transportation accounting for 12% of the total emissions whereas in the base year it was 1.AA.1.a Public electricity and heat production – Liquid fuel (CO_2) accounting for 9% of the total emissions.

Results of the Approach 1 and Approach 2 Level and Trend key categories analysis are provided in Annex III.

Inventory estimates are periodically recalculated. This occurs for a number of reasons, including revisions in key external data sources and revisions of data due to improvements in the estimation methodology or the inclusion of additional sources, input from the QA/QC activities and recommendations from international review process. Recalculations are conducted in accordance with the IPCC methodology and are reported in NIR of each sector. To ensure the accuracy of the estimates and to maintain consistency of the series through time, recalculations of past emissions estimates are undertaken for all previous years to view the actual difference of recalculation performed.

During 2015-2017 Lithuania participated in several projects to improve the quality of GHG inventory:

- Norway Grants partnership project “Cooperation on GHG inventory” between Lithuania and Norway under the program No 25 „Capacity-building and institutional cooperation between beneficiary state and Norwegian public institutions, local and regional authorities“ has been implemented in 2015-2017. The partner of this program was Norwegian Environment Agency, which is the national entity responsible for GHG inventory preparation in Norway. The objective of this partnership project was capacity building and improvement of the Lithuania’s National

system for the preparation of GHG inventory to comply with the relevant UNFCCC and Kyoto protocol reporting requirements. The main purpose of this project was to share experiences of implementation the new 2006 IPCC Guidelines in GHG inventory.

- In 2016-2017 the Baltic experts network for GHG inventory and projections and PaMs reporting was established, joining experts from Latvia, Lithuania and Estonia (SEED Project S91 "Baltic Expert Network for Greenhouse Gas Inventory, Projections and PaMs Reporting (BENGGI)"). The network was established in order to improve the quality of inventory and projections preparation under EU and UNFCCC in Baltic countries. Networking would allow acquiring necessary knowledge and sharing experience between experts. Baltic countries share similar natural, economic, social and political conditions that influence GHG inventory reporting procedures, as well as reported content.

3.2.3 Quality assurance and quality control

Quality assurance and quality control (QA/QC) is an integral part of the inventory process. The quality requirements set for the annual inventories – transparency, consistency, comparability, completeness, accuracy – are fulfilled by implementing the QA/QC procedures. The outcomes of the QA/QC may result in a reassessment of inventory or category uncertainty estimates and to subsequent improvements in the estimates of emissions and removals.

Lithuanian Environmental Protection Agency has the responsibility for co-ordinating the quality assurance and quality control (QA/QC) process of the greenhouse gas inventory.

As a GHG inventory compiler and QA/QC manager EPA performs general QC procedures which involve check of all the input data, assumptions and data criteria, references provided, emission calculations, units and conversion, consistency between source categories, aggregation and transcription. Besides of general check EPA fills in the checklist for primary data check and QC protocols which record all the corrective actions taken. General control procedures also involve QC of documentation and archiving system. The data providers, sectoral experts are also responsible for the quality of their own inventory calculations and for implementing and documenting the QA/QC procedures. The QC procedures used in Lithuania's greenhouse gas inventory comply with the 2006 IPCC Guidelines.

Category-specific QC checks, including technical reviews of the source categories, activity data, emission factors and methods, are applied on a case-by-case basis by focusing on key categories and on categories where significant methodological and data revisions have taken place.

A QA/QC plan is a fundamental element of a QA/QC system. The Ministry of Environment and the Environment Protection Agency are responsible for the development and update of QA/QC plan. The last update of QA/QC plan was performed in 2016. The quality objectives of the QA/QC plan and its application are an essential requirement in the GHG inventory and submission processes in order to ensure and improve the inventory principles: transparency, consistency, comparability, completeness, accuracy, timeliness and confidence in the national emissions and removals estimates for the purposes of meeting Lithuania's reporting commitments under the UNFCCC and the Kyoto protocol.

The aim of Quality Assurance (QA) procedures is to review the complete GHG inventory by the third party which is not directly involved in preparation of inventory to assess its quality i.e. assure that best available data and methods are used. Review for QA can be applied either for the whole inventory either

for a certain sector. QA procedures for Lithuania's GHG inventory are be applied by performing scheduled international review (UNFCCC review, EU review) or performing national QA procedures.

More detailed information about Lithuanian GHG inventory QA/QC system is provided in the Chapter 1.2.3 of Lithuania's National Inventory Report 2017.

3.3 National registry

General description and background information on the National GHG Registry is included in the Lithuania's Initial Report, submitted to the UNFCCC in 2006. The Lithuanian GHG Registry had been completely operational since 2005 until 20 June 2012 when the EU Member States' national GHG registries were consolidated to the Union Registry.

The Registry of Lithuania operates on a consolidated IT platform and shares the same infrastructure technologies as other 28 national registries of the Consolidated System of EU registries (CSEUR) platform (more information on technical functionalities of the Union Registry is provided in the EU 6th and 7th National Communications).

In April 2011, a 4-eye transaction verification mechanism was implemented as a counter measure against phishing and session hijacking. The Addition of the 4-eye verification mechanism means that for each internal and external transfer of units a confirmation of at least two authorised representatives of an account holder is required. Each initiated transaction in the Registry is finalised after receiving an SMS containing a challenge code.

The log on used to be performed via the European Commission Authentication Service (ECAS) system which was a security gate to enter into the informatics environment of the Commission. On 3 November 2016, the previously used ECAS service was changed to 'EU Login' with the purpose to improve the safety of information contained in the Registry and make the European Commission's main authentication service more user-friendly. New authentication service requires each representative a user to log on to a website by entering an e-mail address and a password, receives an SMS with personal passwords for each transaction. The log on is performed via the European Commission Authentication Service (ECAS) system which is a security gate to enter into the informatics environment of the Commission. Access to the Registry is blocked, if too many incorrect passwords are entered in a row. Actions with the Registry objects (emission allowances and Kyoto units) in the Registry secure zone can be performed only by registered users.

To ensure the safety of information contained in the registry, the identification by user name and password is used. Access to the registry is blocked, if wrong user name and password are entered several times. Actions with the registry objects (emission allowances and Kyoto units) in the registry secure zone can be performed only by registered user.

As required by the annex II.E paragraph 32(a) to decision 15/CMP.1, Lithuania provides the name and contact information of the current registry administrator designated to maintain the national registry:

Ms. Toma Juraitė
Chief Desk Officer, Lithuanian Environmental Investment Fund (LEIF)
Tel.: +370 8216 9599
Fax: +370 5216 9399
E-mail: t.juraite@laaif.lt

3.3.1 Legislation regulating the registry activity

The National GHG registry is operated in consolidated manner with the Union Registry in accordance with the Commission Regulation (EC) No 389/2013 of 2 May 2013 establishing a Union Registry pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Regulation (EC) No 525/2013 and No 406/2009/EC of the European Parliament and of the Council and repealing Commission Regulations (EU) No 920/2010 and No 1193/2011.

Following the Commission Regulation No 389/2013 the Union Registry is administrated by central administrator (the European Commission) in cooperation with the Member States' national administrators. The central administrator ensures that the Union Registry conforms to the functional and technical specifications for data exchange standards. Also, the central administrator operates and maintains the EU Transaction Log (EUTL) in accordance with the provisions of this Regulation.

In order to implement provisions of the Commission Regulation No 389/2013, the Law on Financial Instruments for Climate Change Management was amended on 9 May 2013. The Law lays down the provisions on operation and management of accounts under the jurisdiction of the Republic of Lithuania in the consolidated Union Registry.

The Rules of the Use of the Union Registry were approved by the Order of the Minister of Environment No D1-817 on 6 November 2013. These Rules determine the functions of the national administrator – the Lithuanian Environmental Investment Fund (LEIF), management of accounts in the Union Registry, rights and responsibilities of the EU ETS operators, provisions for use and rendering of accounts' data.

3.3.2 The registry website address and information available in the website

The internet address of the Union Registry changed in 2012 and now it is accessible at:

https://ets-registry.webgate.ec.europa.eu/euregistry/LT/index.xhtml

Implementing Commission Regulation (EC) No 389/2013 with the preference for 28 January 2003 European Parliament and Council Directive 2003/4/EC on public access to environmental information in accordance with the UNFCCC States conference decision No 13/CMP.1, the information on account holdings, account list, transaction information, project list and consult fee is provided in the public zone of the Registry. Confidential information is considered as referred to in Article 110 "Confidentiality" of the Commission Regulation (EC) No 389/2013:

"Information, including the holdings of all accounts, all transactions made, the unique unit identification code of the allowances and the unique numeric value of the unit serial number of the Kyoto units held or affected by a transaction, held in the EUTL, the Union Registry and any other KP registry shall be considered confidential except as otherwise required by Union law, or by provisions of national law that pursue a legitimate objective compatible with this Regulation and are proportionate." Following the Rules

for the Use of the Union Registry approved by the Order of the Minister of Environment No D1-817 on 6 November 2013 data and information on the Union Registry are provided in accordance with Articles 109 and 110 of Commission Regulation No 389/2013, national legislation, the other legal acts and international agreements of the Republic of Lithuania.

REFERENCES

Commission Regulation (EC) No 389/2013 of 2 May 2013 establishing a Union Registry pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Decisions No 280/2004/EC and No 406/2009/EC of the European Parliament and of the Council and repealing Commission Regulations (EU) No 920/2010 and No 1193/2011 (OL 2013 L 122, p. 1).

Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC with the latest amendment by the Decision (EU) 2015/1814 (OL 2015 L 264, p,1).

GHG registry web-site:
https://ets-registry.webgate.ec.europa.eu/euregistry/LT/public/reports/publicReports.xhtml

2006 IPCC Guidelines for National Greenhouse Gas Inventories https://www.ipcc-nggip.iges.or.jp/public/2006gl/

Lithuania's National Inventory report 2017 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php.

Order No D1-817 of the Minister of Environment of the Republic of Lithuania "On the adoption of Rules on the Use of the Union Registry and repeal particular Orders of the Minister of Environment", adopted on 6 November 2013.

Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC (OL 2013 L 165, p. 13)

Report of the individual review of the annual submission of Lithuania submitted in 2016, FCCC/ARR/2016/LTU, 6 March 2017: http://unfccc.int/resource/docs/2017/arr/ltu.pdf

Report of the technical review of the sixth national communication of Lithuania, FCCC/IDR.6/LTU, 14 October 2014: http://unfccc.int/resource/docs/2014/idr/ltu06.pdf.

2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol https://www.ipcc-nggip.iges.or.jp/public/kpsg/index.html

Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention, Decision 24/CP.19 http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf

Rules of the Use of the Union Registry Lithuanian Environment Investment Fund: http://www.laaif.lt

2013 Supplement to the 2*006 IPCC* Guidelines for National Greenhouse Gas Inventories: Wetlands https://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html

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POLICIES AND MEASURES

4 POLICIES AND MEASURES

Lithuania's climate policy is defined in government programmes, legal acts and in National strategy for climate change management. Effective climate change policies require global collaboration and actions. Therefore, the Lithuanian climate policy is based on international agreements: the UNFCCC, the Kyoto Protocol, Paris agreement and the common policies of the EU.

This chapter contains information on the climate change policy making process (including the role of local governments in the context of climate change policy), national GHG targets, strategies for sustainable development, as well as description of the system for monitoring and evaluation of policies and measures over time. Also this chapter covers cross-sectorial policies and measures. Strategies and plans for individual sectors are presented in chapters below.

4.1 The Kyoto Protocol

Lithuania takes part in the global climate change mitigation process and is one of the 195 countries of the world that have ratified the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC entered into force on 21st of March, 1994. The Seimas of the Republic of Lithuania ratified the UNFCCC in 1995. The Kyoto Protocol (KP) was signed in 1998 and ratified in 2002. In accordance with Kyoto Protocol Lithuania has undertaken to reduce its greenhouse gas (GHG) emissions by 8% below 1990 level during the first commitment period 2008-2012 and has fulfilled its obligation reducing more than 55% it's GHG emissions over this period.

At the Doha Climate Change Conference in December 2012, Lithuania as a European Union (EU) Member State together with other parties to the Kyoto Protocol to the UNFCCC adopted the Doha Amendment, establishing a second commitment period of the Kyoto Protocol, starting on 1st January 2013 and ending on 31st December 2020. The Doha Amendment amends Annex B to the Kyoto Protocol, setting out further legally binding mitigation commitments for parties listed in that Annex for the second commitment period, and amending and further laying down provisions on the implementation of parties' mitigation commitments during the second commitment period. The Union and its Member States agreed at the Doha Climate Change Conference to a quantified emission reduction commitment that limits their average annual emissions of GHGs during the second commitment period to 80% of the sum of their base year emissions. The Seimas of the Republic of Lithuania ratified the Doha Amendment of the Kyoto Protocol as well as the EU, its Member States and Island Agreement on the joint implementation of the Doha Amendment of the Kyoto Protocol in 2015.

4.2 The policy making process

The major documents on environment issues are passed by the Seimas of the Republic of Lithuania or adopted by the Government. The relevant measures can be taken at the national and local level. The Ministry of Environment is the main managing authority of the Government of the Republic of Lithuania which forms the country's state policy of environmental protection, forestry, utilization of natural resources, geology and hydrometeorology, territorial planning, construction, provision of residents with housing, utilities and housing, as well as coordinates its implementation. The Ministry of Environment of the Republic of Lithuania is the main responsible and coordinating institution for the development of climate change policy and its implementation in Lithuania.

In Lithuania, climate policy is integrated with the decision-making processes in energy, transport, agriculture, waste, forestry and land-use sectors and territorial planning. Issues related to development and implementation of the climate change policy are carried out by Ministry of Finance, Ministry of Energy, Ministry of Economics, Ministry of Transport and Communications, Ministry of Agriculture, Ministry of Health, Ministry of Interior, Ministry of Foreign Affairs, Ministry of Education and Science and institutions supervised by the relevant ministries. Institutions supervised by the Ministry of Environment, which are responsible for climate change issues: Environmental Protection Agency, State Forest Service, Lithuanian Hydrometeorological Service, Lithuanian Environmental Investment Fund.

The main national strategic document which include targets and objectives related to climate change is **National Strategy for Climate Change Management Policy**, which lays down the targets and objectives for climate change mitigation and adaptation by 2050. The Strategy implements the EU legal acts of the Climate change and energy package till 2020 and replaces the National Strategy for the Implementation of the UNFCCC until 2012. The goal of this Strategy is to develop and implement climate change management policy in Lithuania. Strategy sets the short-term (until 2020), indicative mid-term (until 2030 and until 2040) and long-term (until 2050) goals and objectives in the field of climate change mitigation and adaptation.

For the implementation of goals and objectives of the Strategy, the **Inter-institutional Action Plan on the implementation of the Goals and Objectives for 2013-2020 of the Strategy for the National Climate Change Management Policy** has been approved by the Government Resolution No 366 and it is annually updated. The purpose of the Action Plan is to provide financing for climate change mitigation and adaptation measures foreseen for the implementation of the goals and objectives of the Strategy and to ensure an inter-institutional cooperation. The implementation of the Plan is coordinated by the Ministry of Environment. The Ministries of Finance, Energy, Transport and Communications, Economy, Education and Science, Agriculture and the Interior, as well as municipalities, the Research Council of Lithuania, state research institutions and universities, companies, entities, organisations and other persons participate in the implementation of the measures within their competence and allocating funds for their implementation of the measures. While drawing up sectorial development programmes, interinstitutional action plans or other planning documents for their respective management areas, the ministries shall mainstream the targets and objectives for climate change mitigation and adaptation set out in the Strategy, in order to provide for specific measures to implement those targets and objectives and to ensure close interinstitutional cooperation.

The National Climate Change Committee has been established for advisory purposes on the development of the Lithuanian climate change policy and coordination of its implementation. The National Committee on Climate Change was set up in 2001 in the first instance and renewed in 2015. It consists of experts from government, academia and non-governmental organizations (NGOs) and has an advisory role. The main objective of the Committee is to ensure attainment of the goals related to the restriction of GHG emissions as set in the National Sustainable Development Strategy and implementation of the measures for attaining such goals. Also, the Committee has to coordinate the issues related to formulation and implementation of the national policy on climate change management, to advise on the implementation of the provisions of the UNFCCC and coordinate compliance with the requirements of the Kyoto Protocol and the EU legal acts related to the UNFCCC. Also, the Committee submits proposals regarding the annual priorities for the financing of climate change management

measures under the Special Program for Climate Change, which is set up by the Law on Financial Instruments for Climate Change Management adopted on 7th July 2009.

Since 2010 a Special Program for Climate Change has been developed as it was determined in the Law on Financial Instruments for Climate Change Management. The Program aims to develop an additional funding for climate change management measures. The Program funds are kept in a separate account of the State Treasury. The Program funds are used for increase energy efficiency, use of RES and implementation of the measures of Inter-institutional Action Plan on the Implementation of the Goals and Objectives for 2013–2020 of the Strategy for the National Climate Change Management Policy.

Under requirement of the Regulation (EU) No 525/2013 the main institutions involved in the preparation of the reports on Policies & Measures and GHG emission projections are:

- Ministry of Environment;
- Environmental Protection Agency;
- State Forest Service;
- Data providers.

The Ministry of Environment has overall responsibility for the national system of GHG inventory preparation as well as of PaMs and projections reporting. Environmental Protection Agency (EPA) is responsible for calculation of GHG emissions projections based on activity data received from data providers and the preparation of part on GHG emission projections of the report for energy, industrial processes, agriculture and waste sectors. The State Forest Service (SFS) is responsible for projections preparation of LULUCF sector. The Ministry of Environment requests the data from data providers on adopted, planned and implemented policies and measures by sending out the questionnaires and official letters to the responsible ministries and other institutions, which are obliged to provide information according to the Government Resolution No 388 adopted on 7 April 2004, key industry companies as well as to science research institutions.

Detailed information about policy making process and responsibilities provided in Lithuania's report to European Commission "Policies & Measures and Projections of Greenhouse Gas Emissions in Lithuania 2017".

The right of access to information in official documents is a basic civil right protected by the Lithuanian constitution. All legal acts are placed in the internet portal of the Parliament of the Republic of Lithuania (www.lrs.lt). Also legal acts, reports and information related to the climate change topic are available on the internet portal of the Ministry of Environment of the Republic of Lithuania (www.am.lt).

4.3 National and regional cross-sectorial programmes

The main goals of climate policy are as follow:

- ensure Lithuania's contribution to climate change mitigation, ensuring balance of environmental, social and economic interests;
- promote Lithuania's ability to adapt to climate change and its impacts.

The Lithuanian climate change policy is developed in line with the targets and objectives laid down in the international agreements under the United Nations Framework Convention on Climate Change (UNFCCC), the EU strategic documents and legislation.

The main national strategic documents and programmes which include targets and objectives related to climate change mitigation are presented below.

Lithuania's Progress Strategy 2030 was approved by the Parliament of the Republic of Lithuanian in 2012. It defines the State's vision and priorities for the development and implementation activities until 2030. This is the main guiding policy which should be used while preparing and developing the national sectorial development plans or programs.
The National Progress Programme for 2014-2020 was approved on 28 November 2012 by the Resolution No 1482 of the Government of the Republic of Lithuania for the implementation of Lithuania's Progress Strategy 2030; and the main priorities for the use of the EU funds from the EU's Multiannual Financial Framework 2014-2020 were determined.

As one of the outcomes of Lithuania's Progress Strategy "Lithuania 2030" and the National Progress Programme for 2014-2020, the Lithuanian Innovation Programme 2014-2020 was approved to create a legal model for strengthening innovation potential of business sector, as well as for more effective policy making and innovative public sector and joint activity among business, science and education institutions. One of the measures laid down in the implementation plan of the Lithuanian Innovation Programme 2014-2020 aims to support eco-friendly, energy saving green R&D and innovation activities producing and realizing high added-value products. Moreover, energy and sustainable environment related area is also supported through pre-commercial procurement aiming at creating innovative products in this field.

The National Reform Programme was adopted on 27 April 2011 by the Resolution No 491 of the Government of the Republic of Lithuania. The Programme summarises the main structural reforms that Lithuania projects in its effort to eliminate obstacles to economic growth and achieve the nationally established quantitative targets in the context of **the Strategy "Europe 2020"**. This Programme provides an overview of the present situation in the areas evaluated by the quantitative targets, their projections for 2015 and 2020 and priorities for action planned to achieve the identified national-level objectives. The progress is measured using five quantitative targets and one of them is energy and climate change. The key policy directions in energy and climate change are: increasing the use of RES, improving energy efficiency and limiting GHG emissions.

The measures foreseen for implementation of the National Reform Programme 2020 are set in the sectorial programmes. Programmes are harmonized, e.g., targets related to energy efficiency in one programme are the same as in another. As typically different institutions are involved in implementation of the Strategy, an inter-institutional action plan is drawn in order to set clear actions what should be undertaken in order to implement particular programme. For monitoring and evaluation of progress, institutions shall yearly report about actions in the previous year.

Key climate change management policies

In order to ensure the implementation in the international agreements and the EU legal acts defined targets for Lithuania, on 6 November 2012 by the Decree No XI-2375 the Parliament of the Republic of Lithuania approved the **National Strategy for Climate Change Management Policy** which lays down the targets and objectives for climate change mitigation and adaptation by 2050. The Strategy implements

the EU legal acts of the Climate change and energy package till 2020 and replaces the National Strategy for the Implementation of the UNFCCC until 2012.

The goal of this Strategy is to develop and implement climate change management policy in Lithuania. Strategy sets the short-term (until 2020), indicative mid-term (until 2030 and until 2040) and long-term (until 2050) goals and objectives in the field of climate change mitigation and adaptation.

The Lithuanian legally binding short-term climate change mitigation targets by 2020 are:

- achieving that GHG emissions of EU ETS sectors do not exceed 8.530 million tonnes of CO_2 eq.;
- achieving that non-ETS sectors meet their annual GHG emission targets and do not exceed 15.24 million tonnes of CO_2 eq. by 2020;
- achieving that the share of renewable energy resources (RES), by comparison with the overall final energy consumption of the country, accounts for minimum 23%;
- reducing energy consumption by 1.5% every year (reducing energy consumption in 2020 by 17% as compared to 2009);
- reaching in 2020, no less than 0.38% of the country's GDP is assigned for the implementation of short-term climate change mitigation targets.

The Strategy also lays down indicative medium-term climate change mitigation targets that Lithuania will contribute towards the implementation of the EU GHG emission reduction targets: reducing GHG emissions by 40% by 2030 and by 60% by 2040. The indicative long-term target of the Strategy is to reduce GHG emissions by 80% by 2050, compared to 1990 levels.

The Strategy in English is available on website of the Ministry of Environment of Republic of Lithuania: http://www.am.lt/VI/index.php#a/12869 .

For the implementation of goals and objectives of the Strategy, **the Inter-institutional Action Plan on the implementation of the Goals and Objectives for 2013-2020 of the Strategy for the National Climate Change Management Policy** has been approved by the Government Resolution No 366 and it is annually updated. The purpose of the Action Plan is to provide financing for climate change mitigation and adaptation measures foreseen for the implementation of the goals and objectives of the Strategy and to ensure an inter-institutional cooperation. In 2014 Action Plan with measures for 2015-2017 was adopted by the Resolution No 833 of the Government of the Republic of Lithuania, followed by the latest amendment in 2016 by the Resolution No 846 of the Government of the Republic of Lithuania with measures for 2017-2019.

The implementation of the Plan is coordinated by the Ministry of Environment. The Ministries of Finance, Energy, Transport and Communications, Economy, Education and Science, Agriculture and the Interior, as well as municipalities, the Research Council of Lithuania, state research institutions and universities, companies, entities, organisations and other persons participate in the implementation of the measures within their competence and allocating funds for their implementation of the measures. While drawing up sectorial development programmes, interinstitutional action plans or other planning documents for their respective management areas, the ministries shall mainstream the targets and objectives for climate change mitigation and adaptation set out in the Strategy, in order to provide for specific measures to implement those targets and objectives and to ensure close interinstitutional cooperation.

The National Climate Change Committee has been established for advisory purposes on the development of the Lithuanian climate change policy and coordination of its implementation. The Committee includes 21 representatives of ministries, municipal authorities, research and study, industrial and non-governmental organisations.

The Effort Sharing Decision (EU Decision No 406/2009/EC) has been effective in helping stimulate new national policies and measures for the GHG emission reduction in the sectors not included in the EU ETS in the period 2015-2020. A new legislative proposal "**Effort Sharing Regulation**" was presented by the Commission in July 2016. The draft Regulation sets out binding annual GHG emission targets for all Member States in non-EU ETS sectors for the period of 2021–2030, which maintained binding annual GHG emission limits for each Member State. Emissions limits will be set for each year in the 10 year period up to 2030 according to a decreasing linear trajectory.

Existing flexibilities under the Effort Sharing Decision are retained, and two new flexibilities are added. These are:

- a one-off flexibility to transfer a limited amount of allowances from the EU ETS: covering some emissions in the non-ETS sectors with EU ETS allowances which would normally have been auctioned.
- a new flexibility to use a limited amount of credits from the land use (LULUCF) sector: to stimulate additional action in the land use sector.

The European Parliament adopted its position with respect to the proposed Regulation on 14 June 2017, and the European Council adopted its position in October 2017 and trilogue negotiations are on-going.

Integrated National energy and climate plans

The Commission's Communication on a Framework Strategy for the Energy Union adopted on 25 February 2015 explains that the Energy Union needs an integrated governance and monitoring process, to make sure that energy-related actions at European, regional, national and local level all contribute to the Energy Union's objectives. The national plan take a holistic approach and address the five key dimensions of the Energy Union: energy security; the internal energy market; energy efficiency; decarbonisation; and research, innovation and competitiveness, in an integrated way which recognizes the interactions between the different dimensions. National plan will cover the period from 2021 to 2030, including a perspective until 2050 in order to ensure consistency with long-term policy objectives at the national and EU level. The Ministry of Energy and Ministry of Environment are jointly coordinating the Energy Union governance process within the Government of Lithuania. They have initiated an Inter-ministerial Working Group to support the process of developing the Integrated National Energy Climate Plan (NECP). The Working Group is chaired by the two vice-ministers of the above ministries, on a working level the Ministry of Economy, Ministry of Science and Education, Ministry of Agricultural and Ministry of Transport, Ministry of Foreign Affairs, a Representative of the Prime Minister's office, as well as experts from the various ministries, especially Ministry of Energy and Ministry of Environment are active members of the group. The development of the analytical base is ongoing. National Energy Climate Plan draft should be prepared until 2018 and final plan until 2019.

4.4 Policies and Measures and their effects

This chapter provides information on adopted and planned policies and measures, which contribute to achieve the GHG mitigation targets.

There are several directions of climate change policy where appropriate measures are made to achieve overall goals.

Table 4-1. Climate change policy directions

Climate policy sectors	Goals of sectorial policies related to climate change	Sectorial policy planning documents
ENERGY	- To increase energy efficiency	The National Energy Strategy National Energy Independence Strategy Energy Efficiency Action Plan The Republic of Lithuania Energy efficiency law Multi-apartment Building Renovation (Modernization) Programme Public Building Renovation Programme Order for the development and implementation programs on quarter energy efficiency improvement The Lithuanian Law on Heat Economy
	- To increase the share of renewable energy sources (RES) in the balance of energy sources - To increase share of district heating from RES - To promote of the RES use in industry sector	The National Energy Strategy National Renewable Energy Resources Development Strategy National Renewable Energy Resources Programme for 2016-2020. Recommendations on the main Lithuania's Republic energy strategic directions Multi-apartment Building Renovation (Modernization) Programme
	- To reduce relative consumption of thermal energy per unit of the used dwelling area by up to 30% by 2020	Strategy on dwellings of the Republic of Lithuania
	- To implement energy saving technologies	Law on Energy from Renewable Sources
	- To renovate buildings	Programme of Public building renovation The Programme on Heat industry development in 2015-2021 Program for Increasing the Energy Efficiency of Public Buildings
TRANSPORT	- To promote of RES use in transport sector	The National Programme on the Development of Transport and Communications Law on Energy from Renewable Sources
	- To increase the share of RES (biofuels and electricity) not less than by 10% in all modes of transport in comparison with the final consumption of the energy in the transport sector	Law on Energy from Renewable Sources
		The Order No 3-100 of the Minister of Transport and

	- To promote clean and energy-efficient road transport vehicles.	Communications of the Republic of Lithuania On the adoption of the energy efficiency and environmental protection requirements for the purchasing of road vehicles and setting the cases when the ones are mandatory. Recommendations on the main Lithuania's Republic energy strategic directions
	- To promote the use of bicycles and development of bicycle track's infrastructure	National Programme on the Development of Transport and Communications for 2014-2022
	- To improve road infrastructure	National Programme on the Development of Transport and Communications for 2014-2022
INDUSTRY	- To increase energy-efficiency in industrial process	The Programme for investment incentives and industry development for 2014-2020
	- To prevent emissions of pollutants and GHG	IPPC permits and Pollution permits
	- To ensure a more cost-efficient contribution to achieving the EU's climate objectives by discouraging the use of F-gases	Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006
	- To promote the environmental management system in the manufacturing sectors	The Order No D1-973 of the Minister of Environment on the green procurement implementation measures for 2012-2015
	- To reduce the direct and indirect impact of VOC emissions	The Order No 620 of the Minister of Environment On limitation of emissions of volatile organic compounds (hereinafter – VOC)
	- To reduce energy use in manufacturing industry	Recommendations on the main Lithuania's Republic energy strategic directions
AGRICULTURE	- To ensure environmental requirements for manure management	The Order No D1-367/3D-342 of Ministers of Environment and Agriculture On environmental requirements for manure management
	- To set requirements pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources	The Program for Minimization of Water Pollution Caused by Agriculture activities
	- To introduce Good Agricultural Practice	Lithuania's Rural Development Programme 2014-2020
	- To improve status of ground and surface water bodies, to achieve and maintain good environmental status of the Baltic Sea, to reduce the risk of the floods, to provide quality public drinking water supply and sanitation services and to reduce pollution by waste water.	National Water Area Development Programme 2017-2023
	- To minimize water pollution caused by agriculture activities	The Program for Minimization of Water Pollution Caused by Agriculture activities, adopted on 8th June 2012 by the Order No D1-490/3D-39 of Ministers of Environment and Agriculture.

FORESTRY	- To implement long-term forest economy policy	The National Forest Area Development Program 2012-2020
	- To increase forest area by 3% until 2020.	Lithuania's Rural Development Programme 2014-2020 The National Forest Area Development Program 2012-2020
WASTE	- To implement recycling	National Waste Management Plan for 2014-2020 Circular economy package
	- To ensure that biodegradable municipal waste compose 35% until 2020, (compared with the amount in 2000)	National Waste Management Plan for 2014-2020 Circular economy package
	- To increase biogas extraction	National Waste Management Plan for 2014-2020

Number of measures has been implemented, adopted and planned to fulfill policy goals mentioned above.

The following chapters provide a description of measure according to these directions of action, as well as implemented additions.

4.5 The GHG emissions trading system in Lithuania

The EU Emissions Trading System (EU ETS) is a key climate policy instrument that has been implemented in the EU to achieve its objectives of reducing GHG emissions in a cost-effective manner since 2005. From 2013 the EU ETS covers certain activities that emit carbon dioxide (CO_2), nitrous oxide (N_2O) and perfluorocarbons (PFCs).

EU ETS is established by the Directive 2003/87/EC under which each operator carrying activities under the Directives scope participates each year in a so called "compliance cycle". This yearly cycle includes monitoring GHG emissions, verifying them and reporting to the competent authority. After the reporting is complete the each installation is obligated to surrender EU ETS allowances equal in the amount to the emitted GHG in tonnes during the reporting year.

EU ETS allowances are given for free to the operators which are deemed to be exposed to carbon leakage to third countries. However this allocation is reduced each year to encourage operators to plan for the shortage of allowances and reduce their GHG emissions by modernising their installations. Since 2013 the main principle of allocation is auctions and operators receive just limited amount free allowances and the rest needed amount are obligated to purchase from other operators or auctions of allowances.

Since 2005, Lithuania takes part in European Union Emissions Trading System. Aviation has been included in the EU ETS since 2012, and monitored since 2010. Installations under scope of the EU ETS are required to have a GHG emissions permit, issued by the Environmental Protection Agency in accordance with Order of the Minister of Environment No. D1-231 approved on 29 April 2004 (latest amendments in Order No. D1-169 adopted on 26 February 2015). These permits must be updated if changes to the functioning of the installation occur.

In 2016, 89 installations and 1 aircraft operator from Lithuania carried out activities that fall under the scope of the EU ETS (Fig. 4-2). Most of these installations are small district heating units.

According to Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions (MRR) all 89 installations are divided into 3 categories:

- 82 installations fall under category A (installations that emit less than 50 kt of CO_2 equivalent (CO_2 eq.) per year or low emitters (less than 25 kt of CO_2 eq. per year));
- 4 installations fall under category B (installations that emit more than 50 kt CO_2 eq., but less than 500 kt of CO_2 eq. per year);
- 3 installations fall in category C **(**installations emitted > 500 kt of CO_2 eq.).

In total Lithuanian EU ETS operators emit about 35% of total national greenhouse gas emissions. The majority of GHG is emitted from 3 installations that carry out production of ammonia and nitric acid, petroleum refining and cement production. All operators of stationary installations and aircraft operators in the EU ETS are required to monitor and report their annual emissions in accordance with the MRR. Reported emissions are also affected by obligations under the Accreditation and Verification Regulation (AVR) and must be verified by independent 3rd party verifiers that are accredited by the National accreditation bodies. Any verifier accredited by the EU Member State National accreditation body (NAB) may carry out verification in any EU Member State. In case of Lithuania, all verifications are carried out by verifiers that are accredited by foreign NABs. There are no verifiers accredited by the Lithuanian NAB.

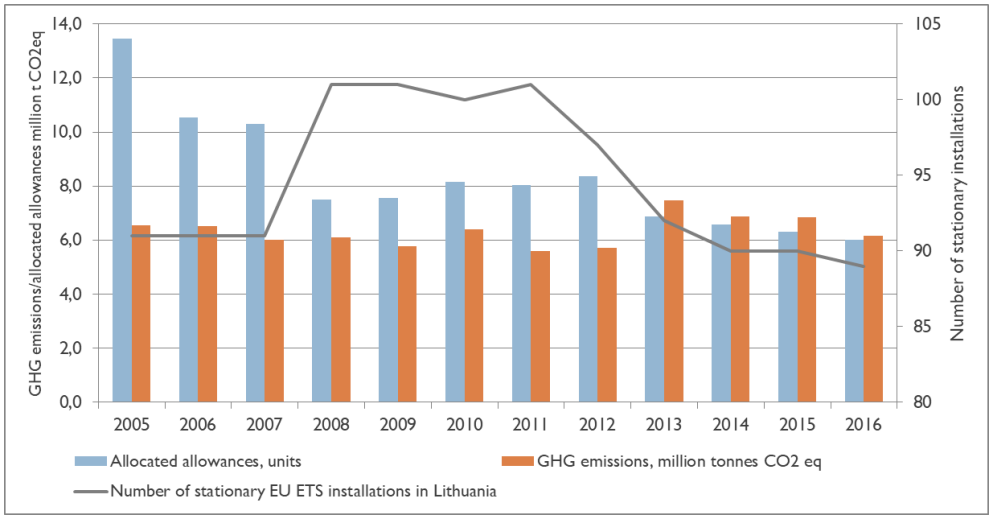


Figure 4-2. Trends of EU ETS in Lithuania

During the first (2005-2007) and second (2008-2012) EU ETS trading periods, emission allowances were allocated on a national level according to EU wide rules. Since the beginning of the third (2013-2020) trading period the allocation was changed and this means that approximately half of the allowances are expected to be auctioned, with this proportion continually rising throughout the trading period. Furthermore, it was decided to decrease the EU ETS total emissions cap by 1.74% yearly so that the target of 21% of GHG reduction by 2020 in EU ETS would be achieved (compared to 2005 GHG emission level).

Starting from the third trading period, no free allocation is given to electricity producer's with the exception for some countries, including Lithuania. Under article 10c of the Directive 2003/87/EB Lithuania is able to allocate free allowance to electricity producers for the transitional period 2013-2019.

For this period Lithuania may allocate 2 853 628 EUAs that are withdrawn from the total Lithuanian auctioning share of allowances. The amount of EUAs that is not allocated under derogation 10c is returned to the Lithuania auctioning share.

Electricity producers that are willing to make use of Article 10c derogation must make investments that are fixed in the National Investment Plan. These investments must directly (i.e. within the installation) or indirectly (i.e. switching into more efficient electricity generating equipment in the installations owned by different operator) contribute to decreasing GHG emissions and this reduction must be verified and measurable. Investments should be related only with the modernization of electricity production, transmission, distribution and consumption and should be additional to investments Member States must undertake in order to comply with other objectives or legal requirements accruing from Union law.

Table 4-2. Number of free allowances issued pursuant to Article 10c

2013	2014	2015	2016
322 449	297 113	269 475	237 230

However, given that any unused Article 10c allocations will be auctioned before the end of the third trading period, this may also lead to increases in auctioning volumes in later years. For example Lithuania in 2015 auctioned additional allowances that could have been allocated for free under Article 10c of the EU ETS Directive. The auctions took place over the third ETS period through the common auction platforms (European Energy Exchange AG) for 25 EU Member States participating in a joint procurement procedure.

Revision of the EU ETS – phase 4 (2021-2030)

In July 2015, the Commission presented a legislative proposal to reform the EU ETS for the period after 2020. European Parliament and Council reached an agreement on the revision of the Directive in November 2017. The annual reduction in the number of allowances of the EU quota will be from the current 1.74% to 2.2% in order to provide the emissions reductions and thus deliver the underlying environmental objective. It is determined further strengthening the EU ETS by temporarily doubling the rate at which allowances are placed in the Market Stability Reserve (MSR) from 2019. This change would allow the MSR to reduce the existing market oversupply of allowances faster.

Since European leaders have agreed to continue free allocation after 2021, the necessary changes to update the relevant rules are also proposed. This includes updated benchmarks to reflect technological progress where necessary, criteria for the future composition of the carbon leakage list and procedures to reflect changes in production.

Several low carbon funding mechanisms are proposed, in particular an Innovation Fund (to support demonstration of innovative renewable energy and low-carbon innovation in industry, as well as carbon capture, use and storage) and a Modernisation Fund (modernising the energy systems of EU Member States with lower GDP).

4.6 National Economic and Financial Instruments for Climate Change Management

Special Programme for Climate Change

The Ministry of Environment of Republic of Lithuania administrates a Special Programme for Climate Change. As it is stated in the Law on Financial Instruments for Climate Change Management (approved by the Parliament in 2009) a Special Programme for Climate Change was developed in order to collect additional funding for climate change management measures. All the Funds are used only for climate change mitigation and adaptation measures nationally and internationally.

The Funds for the Programme are accumulated in a separate account of the State Treasury and is regarded as part of national state budget. The Law states that the sources of financing of the Programme these:

- The funds obtained from the transfer of assigned amount units;
- The funds obtained from the auctioned allowances under the EU ETS;
- The funds obtained from the economic penalties in accordance with the procedure laid down in Chapter VI of this Law;
- The funds donated by natural and legal persons for implementation of the measures aimed at mitigation of climate change;
- Other funds received in legal ways.

The funds of the Programme are used for:

1. Energy consumption and production efficiency enhancement processes: modernization of dwelling houses and public buildings, implementation of other projects permitting most efficient reduction of GHG emissions in the energy, industry, construction, transportation, agriculture, waste management and other fields – at least 40%;
2. Promotion of the use of renewable energy resources, introduction of environment-friendly technologies, including efficient energy production by cogeneration – at least 40%;
3. Implementation of the plan of implementation measures of the Strategy for the National Climate Change Management Policy;
4. Reforestation and afforestation;
5. Provision of information to and education of the public, scientific research and dissemination thereof, consulting and training of operators and other persons on topical issues of management and implementation of the climate change policy, enhancement of energy consumption efficiency, use of renewable energy resources and introduction of environment-friendly technologies;
6. Implementation, in the territory of the Republic of Lithuania and third countries, of measures of adaptation to climate change and mitigation of climate change effects as stipulated under legal acts of the European Union, the UN Convention on Climate Change, the Kyoto Protocol and other international agreements;
7. Implementation of other measures of efficient management of climate change policy which, by means of State assistance, would allow operators and other economic entities whose activities are not included in the list of categories of activities indicated in Annex 1 to this Law to reduce the financial and economic burden of the commitments of GHG emissions reduction. For administration of the Programme and the Union GHG registry.

The general provisions of the management of funds of the Programme are:

- Annual estimates and reports relating to the use of funds of the Programme shall be drawn up and the Ministry of Environment shall administer the funds of the Programme;

- Annual estimates and the Ministry of Environment shall approve the reports relating to the use of funds of the Programme, upon their consideration with the National Committee on Climate Change and the Seimas Committee on Environment Protection;
- The funds of the Programme used during the current budget year shall be used to finance the measures planned for the next year or other measures provided in subparagraphs 3-7 of paragraph 3 of this Article.

Rules for the use of the Special Programme for Climate Change funds were approved by the Order of the Minister of Environment on 6 of April 2010, No. D1-275. Programme's funds are managed by the Ministry of Environment, and Programme's project selection process and monitoring is done by designated institution – Lithuanian environment investment fund (LEIF) and the Housing Energy Efficiency Agency for the multi-apartment buildings modernization projects.

Table 4-3. Approved financial measures under the Special Programme for Climate Change in 2013-2016

Year	Financial measure	Number of projects*	Disbursed proceeds, EUR million**
2013	Modernization of public buildings in order to reduce energy efficiency	66	19.63
	Modernization of private houses in order to reduce energy efficiency	180	0.05
	Installation of biomass boilers up to 10 MW	1	0.52
	Preparation of biomass material from wood waste	4	0.46
	Installation of RES technologies in private houses	225	0.03
	Installation of biomass boilers in public buildings	26	2.83
2014	Modernization of public buildings in order to reduce energy efficiency	8	2.6
	Modernization of private houses in order to reduce energy efficiency	158	0.49
	Installation of RES technologies in private houses	238	0.41
	Installation of RES technologies in public buildings	9	1.23
	Replacement of inefficient biomass boilers with efficient biomass boilers	2	0.77
2015	Installation of RES technologies in public buildings	19	0.4
	Installation of RES technologies in private houses	368	0.49
	Modernization of private houses in order to reduce energy efficiency	148	0.23
2016	Installation of RES technologies in private houses	445	0.1
	Modernization of private houses in order to reduce energy efficiency	181	-
2013-2016	Modernization of multi-apartment buildings in order to reduce energy efficiency	1000	71
Total:		**3078**	**101.24**

*Some projects are being evaluated (2014-2016 call).

**as of 31 of December, 2016.

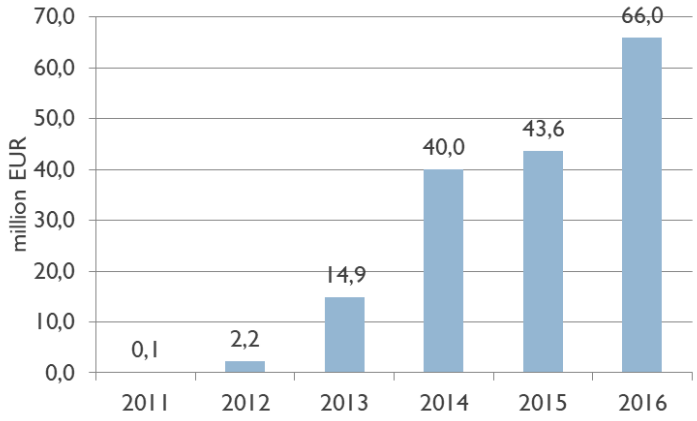


Figure 4-2. The summary of disbursement of Proceeds under Special Programme for Climate Change in 2011-2016, EUR million

Figure 4-3. Modernization of multi-apartment buildings

Other financial programs for implementation of climate mitigation measures

Lithuania's Rural Development Programme 2014-2020 replaced National Strategic Plan for 2007-2013 Rural Development. Lithuania's Rural Development Programme for 2014-2020 period was approved by European Commission on 13 February 2015. Programme for the new period further enhances the existing policy framework for sustainable management of natural resources, contributing to both climate change mitigation and enhancing the resilience of farming to the threats posed by climate change and variability.

The continuation of support for planting of short rotation coppices is foreseen under the sub-measure "Investment to agricultural holdings" of the measure "Investments in physical assets" and biogas production from livestock holdings waste is foreseen under the sub-measure "Support for production of biogas from agricultural and other waste" of the measure "Farm and business development" of the Rural Development Programme for Lithuania 2014-2020. To implement sub-measure "Support for production of biogas from agricultural and other waste" EUR 45.2 million have been allocated.

In the National Rural Development Program for 2007-2013, which aimed at the improvement of life quality in rural areas by increasing employment, supporting transition from agricultural activities to non-agricultural activities, stimulating the development of main services and crafts of the rural population, financial support for rural development from the European Agricultural Foundation (EAF) was foreseen based on the following trends: increased competitiveness of agricultural and forestry sector, improvement of environment and landscape, improvement of life quality and other measures.

In order to reduce water pollution, especially focussing on nitrates and other chemical elements that may have an adverse effect on public health, biodiversity, alter the traditional landscape, as well as protection of the waters of the Republic of Lithuania from eutrophication, support under the measure "Modernisation of agricultural holdings" of the Rural Development Programme for Lithuania 2007-2013 has been provided for the implementation of the Nitrates Directive in farm holdings. Also, with an aim to produce biomass as a source of energy which partially replaces imported raw materials (oil, gas, coal) and contributes to the reduction of CO_2 emissions which causes the greenhouse effect, support under this measure was granted to the planting of short rotation coppices and production of biogas from the waste of holdings. A total sum of EUR 12.4 million was allocated to the beneficiaries satisfying the requirements of the Nitrates Directive and EUR 0.6 million is paid out for short rotation coppices. There were no biogas production projects applying for support during 2007-2013.

The continuation of support for planting of short rotation coppices and biogas production from livestock holdings waste is foreseen under the sub-measure "Investment to agricultural holdings" of the measure "Investments in physical assets" of the Rural Development Programme for Lithuania 2014-2020. To implement this sub-measure EUR 429 million have been allocated.

To fulfil EFA requirements farmers will be allowed to grow protein crops which are crucial in sustaining the nitrogen in the soil. Farmers will also be encouraged to grow protein crops by additional financial incentives available under the voluntary coupled support scheme. Under this scheme farmers will receive additional payments for the areas where selected protein crops are grown. The total coupled support for protein crops in Lithuania amounts from about EUR 14 million (about 213 EUR/ha) in 2015 to about EUR 17 million (about 254 EUR/ha) in 2019 due to external convergence of direct payments across the EU Member States.

Lithuanian Government established the **JESSICA Holding Fund** to offer an attractive financing scheme to support the improvement of energy efficiency in multi-apartment buildings, which were built prior 1993. At a later stage the scheme was extended to cover student dormitories and other buildings under the jurisdiction of the Ministry of Education and Science.

JESSICA loan (maturity up to 20 years at fixed annual interest rate of 3%) is offered to the owners of apartments or other premises in a multi-apartment buildings, provided they commit themselves to implement energy efficiency measures which would result in (i) achieving at least 20% of energy savings as compared to the baseline and (ii) meeting at least the energy efficiency Class D requirements. If these targets are met, the beneficiaries qualify for a "bonus" – an interest subsidy which equals to 15% of loan principal. At the end of 2011 the Lithuanian Parliament introduced an additional incentive to compensate additional 15% of investment cost, provided the overall calculated energy savings reach at least 30% as compared to the baseline (the Law on the State Support for the Modernization of multifamily buildings of the Republic of Lithuania amended on the 11th of October, 2011). Currently the additional improvement of this program is introduced.

By the amendments of the Law adopted on 17 January 2013, the municipalities are more involved in the renovation process of the multi-apartment buildings. The municipality appoints one responsible entity which may take the loan for renovation on preferential conditions. With these changes the additional incentives to compensate investment cost to citizens were introduced, the 15% of loan is compensated from State‘s budged and 25% from the Special Programme for Climate Change if the 40% of energy saving was reached compared with baseline.

From 2005 till 2016 2 354 multi-apartments have already been renovated (in 2016 – were renovated 769), It is foreseen to incentivize comprehensive modernization of multi-apartment and public buildings (priority giving for the quartered renovation) and to renovate 25% of buildings stock till 2020 (2.6-3 TWh saving of energy) and 50% of buildings stock till 2030 (5-6 TWh saving of energy).

On 18 February of 2015 the Ministry of Finance and the Ministry of Energy together with the Public Investment Development Agency established the **Energy Efficiency Fund**. The Fund provide investments in energy efficiency projects using the following financing tools: loans for the modernization of central government buildings and guarantees for loans from commercial banks for the modernization of street lighting projects. The Fund manages EUR 79.65 million. Up to EUR 65.16 million provided for the modernization of central government buildings and up to EUR 14.48 million for street lighting modernization projects.

The Public Investment and Development Agency was appointed as the Fund manager. The first loans and guarantees from the Fund provided in summer of 2015. It is planned that the Energy Efficiency Fund will operate until at least 2030.

The **EU Cohesion policy** provides for important investment possibilities to implement energy policy objectives in Lithuania which will be complemented by national public and private co-financing, aiming at optimal leverage. It also ensures integrated territorial solutions to challenges by supporting capacity building and territorial cooperation, including the Baltic Sea Region macro-regional strategy in which Lithuania takes part.

Internal Energy Market: Over 2014-2020, EU Cohesion Policy will invest some EUR 154 million in smart transmission systems, as well as some EUR 21 million in smart electricity distribution grids in Lithuania. These investments are expected to contribute to around 10 000 additional users connected to smart grids.

Energy efficiency: Over 2014-2020, EU Cohesion Policy will invest some EUR 540 million in energy efficiency improvements in public and residential buildings and in enterprises, as well as in high-efficiency cogeneration and district heating in Lithuania. A further estimated EUR 626 million will be invested in supporting the move towards an energy-efficient, decarbonised transport sector. These investments are expected to contribute to around 3000 households with improved energy consumption classification and a decrease of around 60 GWh per year of decreased primary energy consumption of public buildings, as well as to around 74 km of reconstructed or upgraded railway lines, and 20 km of new or improved inland waterways.

Decarbonisation: Overall, the EU Cohesion Policy investments in Lithuania over 2014-2020 are expected to contribute to an estimated annual decrease of GHG of around 680 kt of CO_2 eq. Over 2014-2020, EU Cohesion Policy will invest some EUR 330 million in renewable energy in Lithuania. These investments are expected to contribute to around 760 MW of additional capacity of renewable energy production.

Research, Innovation and Competitiveness: Over 2014-2020, EU Cohesion Policy will invest significantly in R&I and in SME competitiveness in Lithuania. This will be based on the national strategy for smart specialisation. For Lithuania, the Strategy includes a focus on energy and a sustainable environment priorities, namely (1) smart systems for energy efficiency, diagnostic, monitoring, metering and management of generators, grids and customers, (2) energy and fuel production using biomass/waste and waste treatment, storage and disposal, (3) technology for the development and use of smart low-energy buildings – digital construction and (4) solar energy equipment and technologies for its use for the production of electricity, heat and cooling. At this stage, at least EUR 103 million is foreseen for investments in R&I and adoption of low-carbon technologies in Lithuania, but this might increase further in line with the evolving content of the smart specialisation strategy.

Financing measures, including EU support and the use of EU funds, in the area at national level

With the view to contribute to the achievement of the indicative national energy efficiency target for 2030 Lithuania is being implemented following measures financed from 2014-2020 EU structural funds:

- "Renovation of public buildings belonged to central government" – ~EUR 29 million;
- „Replacement of old depreciated boilers in households with more efficient technologies using RES for heat energy" – EUR 32 million;
- „Modernization and development of heat distribution network" – EUR 69.5 million;
- „Modernization and development of electricity distribution network" – EUR 20.3 million.

Additionally, in 2015 Lithuania established Energy Efficiency Fund, which will seek to encourage investment in energy efficiency projects using the following financing tools: loans for the modernization of central government buildings and guarantees for loans from commercial banks for the modernization of street lighting projects. The Fund manages EUR 79.65 million.

It is also planned to invest about EUR 40 million EU structural funds to smart metering projects being implemented at the level of final consumers.

In 2015 the Study for the evaluation of the effects, benefits and costs for Lithuania by implementing the EU climate and energy policy targets till 2030 were conducted. The total investments to be financed in cost-efficient scenario for the implementation GHG emissions reduction, energy efficiency and RES targets in the period of 2021-2030 would amount to EUR 7 569 million, and the total quantity of the reduced GHG emissions would be 1 382.7 kt CO_2 eq.

Eco-Innovation

The Eco-Innovation Scoreboard 2017, published by the European Commission in 2017, ranks Lithuania in 17nd place among the 28 EU Member States. The performance of Lithuania in every component is below the EU average.

Lithuania's leading eco-innovation areas are assessment and management of contaminants in soil, cleaner production, resource and energy efficiency, promotion of renewable energy, water protection and research and development (R&D) in the biotechnologies sector.

An analysis of the barriers and drivers reveals that the key barriers are still a lack of common understanding of the eco-innovation definition and an even greater lack of understanding of circular economy. Cooperation between business and academia has improved due to the introduction of integrated science, studies and business centers (valleys). The main drivers are favorable financial support,

especially from EU structural funds, a positive relationship in the form of collaborative grants for eco-innovation with Norway, and sufficient and well-qualified human resources and infrastructure, which remains a stable part of the Eco-IS rating.

During the period of 2014-2016 Lithuania has continued its eco-innovation development, building on the effective waste management, renewable energy resources, and electric vehicles. The process of 'clusterisation' also continues, with more than redoubled the number of new clusters working with eco-innovation comparing with 2013.

The trend of utilization of renewable energy resources and the process of establishing clusters are still ongoing. In addition to Vesk cluster (promoting use of wind energy), Biokogen (developing modern, innovative biofuel equipment and technologies, in order to effectively use biomass), several new clusters have emerged. Among these are the Smart & Green City cluster (promoting the use of new technologies to achieve environmentally friendly solutions), the Photovoltaic Technology cluster (the development of environmental energy technologies), the Energy Efficient Housing cluster (development of energy efficient housing and the use of environmental building materials).

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 fertile ground for the future of Lithuanian circular economy as they already base their operations on energy efficiency and effective use of their resources.

It is very important for Lithuania to encourage cross-sector cooperation for the development of Eco-innovation.

For that purpose, the Ministry of Economy is organising and has developed a financial measure **(Eco-Innovation LT, Eco-Innovation LT+)**. The main purpose of Eco-Innovation LT is to develop finance for projects that are intended to improve the environmental impact of products in all of their life-cycle stages (raw material selection and use, manufacturing, packaging, transportation, use), systematically integrating environmental aspects at the earliest stage of product design. The measure aims to encourage micro-, small- and medium-sized enterprises to install non-technological eco-innovative approaches, e.g. to introduce environmental management (management) systems, to carry out the production technology audit, environmental audit or both and design products to apply the principles of ecological design.

The main purpose of Eco-Innovation LT+ is to encourage micro-, small- and medium-sized enterprises to install eco-innovative technology to reduce the adverse effects of climate change and the greenhouse effect. Financed activities of Eco-Innovation LT+: 1) investment into tangible assets that reduce negative environmental effects of economic activity, promote industrial symbiosis and ensure continuous environmental effect; 2) modification of existing production equipment to improve process efficiency and reduce pollution; 3) modification of technology and treatment processes to reduce pollution and consumption of natural resources during the production process; 4) replacement of existing raw materials or auxiliary materials with low toxicity or renewable materials or using such auxiliary materials that would have a longer effect on the process; 5) modification of qualities of a product to reduce the environmental effects of the product during its consumption or after its landfilling, or to reduce the environmental effects of producing the product; 6) reuse of production waste in the same process that generated it or for other purposes within the company; 7) recycling the waste into new products in the company that generated the waste.

4.7 Sectoral policies and measures

In this chapter the main policies and measures related to climate change mitigation in different Lithuania's economy sectors as well as having the most influence on GHG emissions reduction at national level are overviewed.

4.7.1 Energy

The general objective of Lithuania's energy policy is to ensure energy security at competitive prices and with the lowest possible environmental impacts. Energy sector are key sector for the overall functioning of the economy as it provide an important input and service to the other sectors of the economy.

The Law on Energy (2002, with later amendments) is the main law, setting the functions and obligations in the energy sector. Different energy sub-sectors are regulated by the following sectorial laws: the Law on Electricity (2000, with later amendments), the Law on Heat Sector (2003, with later amendments), the Law on Natural Gas (2000, with later amendments), the Law on Nuclear Energy (1996, with later amendments), the Law on the Nuclear Power Plant (regulates implementation of the new NPP) (2007, with later amendments), the Law on Construction (1996, with later amendments), the Law on Energy from Renewable Sources (2011, with later amendments) and the Law on energy efficiency improvement (2016).

In energy sector, the focus will be on implementation of the strategic projects aimed to achieve energy independence including ensuring sufficient local power generation capacities to cover domestic demand (estimated at 12-14 TWh in 2020). Lithuania is obligated to progressively increase the use of renewable energy resources in the production of electricity and heating. According to the current legal documents state aims to reach the target of 23% of renewable energy in final energy consumption in 2020, including no less than 20% of renewable energy in the electricity sector, 60% in the district heating sector and 10% in the transport sector and 80% in the households. Energy consumption is reduced by 1.5% every year to compare with an average of final energy consumption in 2010-2012, achieving 17% till 2020.

The National Energy Strategy**,** approved of by the Parliament (Seimas) of the Republic of Lithuania in 2007 was repealed with new **National Energy Independence Strategy**, adopted on 26 June 2012 by the Decree No XI-2133 of the Parliament of the Republic of Lithuania (*currently under revision*). The main goal of the Strategy is to ensure Lithuania's energy independence before the year 2020 by strengthening Lithuanian's energy security and competitiveness.

The following main programmes and plans are prepared, setting the particular measures for the implementation of energy sector targets: District Heating Development Program, the Energy Efficiency Action Plan, and the National Renewable Energy Resources Development Strategy.

Improvement of energy efficiency through increase of cogeneration is among the targets set in the National Energy Independence Strategy.

Besides the main objectives set until 2020, in the currently valid Energy independence strategy the energy sector development guidelines for 2030 and 2050 are set. However, there is no quantitative targets for RES, energy efficiency but the guidelines for 2030 are the following:

- in 2020-2030 in the country energy efficiency will increase by 1.3% per year;

- RES share will continue to increase in the final energy balance.

Indicative targets outlined for 2050: 40-100% renewables in the energy mix; 0-30% nuclear energy, and 0-30% fossil fuel with carbon capture storage.

Ministry of Energy in June 2017 presented the draft of **renewed National Energy Independence Strategy** (NEIS), which was endorsed by Government on 29 November 2017. The Strategy sets the energy goals of Lithuania and the directions of their implementation until 2030, and sets the energy development guidelines until 2050. The main strategic directions of the Lithuanian energy policy development are energy security, competitiveness, green energy development and innovations. The long term-vision of the Lithuanian energy sector is to achieve complete independence from fossil fuels in both electricity generation and heating.

Reduced dependence on electricity import and more energy independence will strengthen the local production of electricity. This will be done by promoting investment in a reliable and competitive local generation. It is expected that by 2020 Lithuania will produce 35% of its electricity demand.

The breakthrough – more electricity produced in Lithuania than imported – should take place in 2030, when electricity import will decrease twice and Lithuania will produce 70% of the necessary electricity. By 2050, all consumed electricity should be generated in Lithuania.

To reduce environmental pollution, combat climate change, and increase competitiveness, renewable energy will be further developed. The goal is to reach a 30% share of renewable energy sources (RES) in the final energy consumption by 2020. In the next three years, the installed power of wind energy will increase by 50%, and that of solar twice. It is planned that by 2030 RES installed power will be 2.5 times what it is now, and almost half (45%) of the consumed energy should be manufactured from renewable sources; by 2050 energy from renewable and other non-polluting sources will comprise the majority of energy used in the electricity, heating, and transport sectors (80%). By 2050, all electricity – and all heating in the district heating sector – should be produced from RES, while in the transportation sector RES energy will amount to 50%.

National Renewable Energy Resources Development Strategy adopted on 21 June 2010 by the Government Resolution No 789 of the Republic of Lithuania. The main objective of this Strategy is to meet the demand of electricity in the best way in the sector of electricity, heating and transport by increase of the share of RES in the final energy balance and to reduce the import of fossil fuel and in this way to increase the energy security, energy independence and to contribute to the international efforts to reduce the emissions of GHG. This strategy foresees the minimum RES trajectory ensuring that Lithuania meets the objective of 23% of RES in the final energy consumption in 2020.

According to the targets set in the Strategy the part of RES in the final energy consumption must reach not less than 18.6% in 2015-2016, not less than 20.2% in 2017-2018, and by 2020 not less than 23%.

Lithuania in the last decade has rather successfully deployed renewable energy sources. According to the Lithuanian Statistics, in 2016 Lithuania has already generated 25.46% of its gross final energy from RES and nowadays it's over reached this target set for 2020.

The update of the National Renewable Energy Resources Development Strategy until 2020 is being performed. Lithuania further plans to increase the share of RES in gross final energy consumption by 2020 (update of the strategy): in heating and cooling sector from 37.72% to 45% (district heating sector

from 33% to 70%), in electricity from 13.14% to 20%; in transport sector currently the government is looking into possible measures how to reach 10% with the lowest cost.

It is planned to implement two major national importance higher-efficiency cogeneration power plant projects (in Vilnius planned cogeneration plant (biomass/waste) of 150 MW_e power and in Kaunas – 50 MW_e) that will contribute to the national sectorial targets in electricity, heating and cooling sectors and also to the share of RES in gross final energy consumption by 2020. Concerning latter, it is expected to reach 29-30% in 2020. In 2020 renewable energy sources will cover no less than 60% of heat from district heating sector.

It should be noted that in Lithuania the potential of use of biomass, especially of felling residues, is still poorly exploited. Wood fuel potential accumulated in Lithuania's forests is not fully used in the country's energy sector. The biggest part of this not used potential is in softwood broad leave stands as they are used not intensively enough, also in felling residues in private forests, pre-commercial thinnings. There is possibility to use additionally about 1 billion m^3 of such wood each year. However, using part of this potential is not economically beneficial and requires financial support. Additionally, approximately 95% straw pellets are exported and not used in domestic market.

Agriculture and forestry contribution to the climate change mitigation is linked to the production of renewable energy as these sectors are the largest contributors to renewable energy (93.4% 2010). The biggest contributor of the production of renewable energy is forestry – 84.6% (on average in the EU-27 to 48.3%) and agriculture – 8.8% (on average in the EU – 27 to 10.6%). In Lithuania the share of energy crops growing on agricultural land increased from 3.5% in 2007 to 4.5% in 2014 of total agricultural lands and this number is much higher than the average in the EU-27 (1.6%).

Strategy on dwellings of the Republic of Lithuania approved in 21 January 2004 by the Resolution No 60 of Government of the Republic of Lithuania. The main target set in the Strategy is to reduce relative consumption of thermal energy per unit of the used dwelling area by up to 30% by 2020 (compared with the year 2004) by modernization of heating system of the residential houses, renovation of roof constructions and other constructions.

The Law on Energy from Renewable Sources adopted on 12 May 2011 by the Parliament of the Republic of Lithuania, updated in 2015. The Law was adopted to ensure the balanced development of the RES. This Law establishes the tasks for separate energy sectors in order to reach the common goal of 23% of RES in the final consumption of energy by 2020. The Law also establishes the common promotion system on the enhancement of the use of RES and the following tasks by 2020 in separate energy sectors:

- to increase the share of electricity energy, produced from RES, not less than by 20% in comparison to the total country electricity energy consumption;
- to increase the share of centralized provided heating energy, produced from RES, not less than by 60% in the balance of heating energy;
- 10% RES energy consumption in transport sector;
- and, to increase the share of RES used for heating in the households not less than by 80% in the balance of heating energy.

The key support instruments for RES production are feed-in tariffs, also support scheme consisting of several support measures:

- reservation of the capacity and transfer of energy grids or systems for connection of renewable energy installations;
- discount of the costs of connection of renewable energy installations to energy grids or systems;
- priority of transmission of energy from renewable sources;
- support for production and processing of agricultural commodities, namely, raw materials for the production of biofuels, biofuels for transport, bio lubricants and bio oils;
- support of investments in renewable energy technologies;
- purchase of energy from renewable sources.

After adoption of this Law, a mixed support measures model was chosen, where producers of small power plants has the fixed rate of the price and larger producers had to participate in an auction where they compete for quotas and for lowest desired fixed tariff price.

Electricity produced from wind, solar hydropower, biogas and biomass power plants with the installed capacity not exceeding 30 kW was purchased at the fixed price (feed-in tariff) which is determined by the national regulatory authority.

However, in order to avoid a significant distortion of the market and reduce financial burden on consumers in 2013 the important amendments of the Law on Energy from Renewable Sources have been made, for example:

- The power of RES plant, for which the simplified requirements are applied, has been reduced from 30 kW to 10 kW.
- The frequency of feed in tariff review for all types of renewable sources has been changed from one time per year up to four times per year.
- The rules for promotion have been changed. Feed in tariff has been applied from the production permit date, not development permit.

In comparison from 2012 to 2014, feed in tariffs depending on the installed capacity have decreased:

- wind power – 21-24%
- solar – 56-62%
- biomass – 38-40%.

In December 2014, the Parliament of the Republic of Lithuania approved the amendments on Law on Energy from Renewable sources allowing net-metering system application for small solar power plants (residential <10kW budget and public institutions <50 kW). This law promoting solar energy use in households (by entering net-metering system) came into force on 2 March 2015.

Energy Efficiency Action Plan for 2017-2019 approved by Order No 1-181 of 7 July 2017 of the Minister of Energy of the Republic of Lithuania. The Action Plan describes energy efficiency improvement policies:

- taxes on fuel;
- renovation of apartment buildings;
- increasing the energy efficiency of public buildings;
- energy audits in industry;
- agreements with energy suppliers on consumer education and counseling;
- agreements with energy companies on energy saving;

– replacement of boilers in households.

Lithuania has set a target of increasing energy efficiency by 1.5% each year by 2020 and reach 740 thousand. final energy savings by 2020. The total amount of energy savings by 2020 will be 3932.5 GWh, which is 33.7% from 11.67 TWh required to save energy. The Plan sets energy efficiency targets for public buildings and multi-apartment buildings. For multi-apartment buildings the main goal is to reduce the cost of thermal energy (fuel) in multi-apartment buildings constructed in 1993 by at least 20% by the end of 2020, that is, the estimated annual cost of thermal energy in these houses up to 2020 to reduce at least 1 000 GWh/year, carbon dioxide emissions to the atmosphere - at least 230 thousand. tons per year compared to 2005. The 2020 target set in this Plan is to renovate area of 700 000 m^2 of the public buildings by saving 60 GWh of the annual primary energy. In the plan the ongoing measures covering household, services, industry, energy and transport sectors as well as horizontal measures to enhance energy efficiency are prescribed.

On the 3rd of November of 2016 the **Law on Energy Efficiency** with amendments of related energy laws were adopted in 2016. This law establishes the energy efficiency of state management, regulation and supervision of the legal framework. The purpose of this law – to ensure all Lithuanian economic sectors of energy consumption savings in line with Lithuania's European Union legislation enshrined in energy efficiency obligations, and efficient production, distribution and use of energy. In the law the system of energy efficiency improvement is determined to ensure that energy consumption is reduced by 1.5% every year till 2020 to compare with an average of final energy consumption in 2010-2012.

Meanwhile, **renewed National Energy Independence Strategy** (NEIS), which was endorsed by Government on 29 November 2017 and will be approved by Parliament (Seimas), sets more ambitious gross of the final RES energy consumption targets 45% until 2030 and 80% until 2050.

The European Commission adopted in November 2016 Regulation Proposal for the **Governance of the Energy Union**. Lithuania has started preparing a draft integrated national energy and climate plan (NECP) covering a 10-year period, starting from 2021 to 2030. The plan will set out national energy and climate targets and objectives and will represent contribution to the Energy Union's objectives, including the EU at least 40% GHG emission reduction target to compare with 1990 level till 2030 and the EU's joint energy efficiency and renewable energy targets.

Multi-apartment Building Renovation (Modernization) Programme approved by the Government of the Republic of Lithuania Resolution No 1213 of 23 September 2004, later amendments in 2015. In 2009 essential adjustments of the Programme were adopted which have changed the financing rules. Due to this the modernization process was slowed down in 2009 while the owners of multi-apartment buildings were waiting for the determination of the new explicit rules for financing. However, in 2012 Programme of Modernization of Multi-apartment Buildings was changed again, this time enhancing implementation of actual modernisation projects. More detailed information is available in the National Reform Programme 2014.

The main aim of the Programme is to reduce thermal energy use in multi-apartment buildings, built before 1993, at least by 20% by the end of 2020, i.e. estimated annual energy consumption in these buildings by the end of 2020 should be reduced at least by 1 000 GWh/year, and reduce GHG emissions by 230 kt CO_2 eq./year, comparing with 2005.

Programme of Public building renovation approved by the Government of the Republic of Lithuania Resolution No 1328 of 26 of November 2014. The 2020 target set in this Progamme is to renovate area of 700 000 m^2 of the public buildings by saving 60 GWh of the annual primary energy and to reduce GHG emissions by 14 kt CO_2.

It is planned to renovate public buildings by reaching C class of building energy performance. In this Programme it is defined that the total area of public houses which are owned by the state and municipalities is 14.8 million m^2 (approximately 35% of all are non-residential buildings), for the heating all these building approximately 2 300 GWh of heat energy is used.

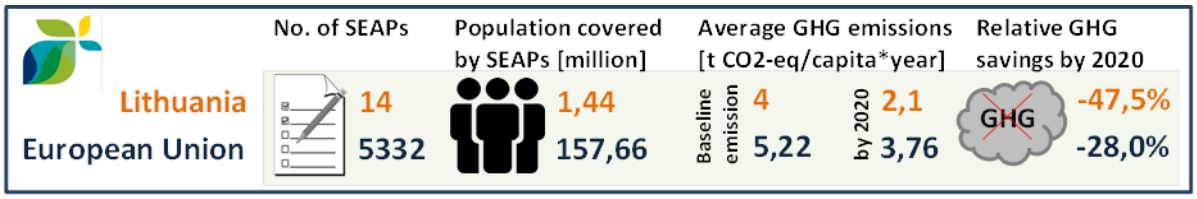
The **Lithuanian Law on Heat Economy** adopted on 2003 by the Parliament (Seimas) of the Republic of Lithuania and later amendments. The objective of this legal act is to reduce the unfavourable effect of heat energy on the environment by promoting combined heat and power generation, the heat generation from biofuels and renewable energy resources.

The **Programme on Heat industry development in 2015-2021** adopted in 2015. The Programme determines trends of heat industry development and modernisation, technical solutions and energy mix for the production of the heat, demand and potential for higher efficiency cogeneration, investments and time frames. In Lithuanian cities, approximately 72% of residential space is heated via centralized heating systems. It is forecasted that 5% will be reduced consumption of centralized heat by 2021 to compare with 2014 due to energy efficiency improvement in public and multi-apartment buildings.

Aiming to shift investments towards a low carbon economy Lithuania promotes cooperation between public, private sector and financial institutions. This cooperation has proved as a valid alternative source of finance for investments in low carbon solutions. As an example of greening finance for sustainable business is project implemented by Lietuvos Energija. This summer Lithuanian's national energy company, which is one of the largest state-owned energy groups in the Baltics, in cooperation with the European Bank for Reconstruction and Development, has successfully issued 300 million euros **green bonds**. This was the biggest ever issued green bond emission (for a duration of 10 years) in all Central and Eastern EU states, and yet the issue was oversubscribed 5 times, resulting in 1.4 billion euros offered from investors. Not only has Lithuania's company managed to get finances at a record low rates for investments in renewable energy, energy efficiency, clean transportation and pollution prevention and control including waste-to-energy. Also, Lithuania has learned a valuable lesson that there many possibilities for green investment projects based on public private and finance institutions partnership in Central and Eastern Europe.

The Covenant of Mayors

By 2016, in the context of the Covenant of Mayors, the sustainable energy action plans delivered by 14 Lithuanian municipalities had been assessed. Overall, these municipalities cover more than 1.4 million inhabitants. All together, these municipalities committed to reduce by 2020 the GHG emissions by 47.5% (as compared to 1990 baseline).



(source: JRC 2016. Notes: SEAP=sustainable energy action plan, GHG=greenhouse gas emissions)

In Lithuania, by September 2016, no cities have yet committed to conduct vulnerability and risk assessment and develop and implement adaptation plans in the framework of the Covenant of Mayors for Climate and Energy. In 2016, the Covenant of Mayors for Climate and Energy and the Compact of Mayors announced the Global Covenant of Mayors for Climate & Energy, a newly merged initiative to bring these two efforts together.

Stimulation of liquefied natural gas (LNG) consumption

On the upstream gas market, until the opening of the Klaipėda LNG terminal and the signing of an LNG supply contract with Statoil, Gazprom was the only gas supplier to Lithuania and the whole Eastern-Baltic region. The Klaipėda LNG terminal significantly enhanced security of natural gas supply for all consumers in the Baltic States by providing an alternative gas supply source on the basis of full Third Party Access, thus ending Lithuania's single dependency on Russian gas. Klaipėda LNG terminal regasification capacities of 3.8 bcm/y (10.3 mcm/d) are sufficient to cover around 90% of all current demand of the Baltic States. The related gas pipeline (Klaipėda-Kuršėnai) was commissioned in November 2015. Furthermore, an agreement on a gas interconnector with Poland (GIPL) was reached in September 2015. The diversification of import sources via the new LNG terminal has had a positive impact on prices. The gas market is 100% liberalised and customers are free to choose among gas suppliers, while the concentration on the wholesale market remains very high. Moreover, LNG is important promoting infrastructure for alternative fuels in order to decarbonize not only energy, but transport sector as well.

Impact assessment of planned policies and measures in energy sector

The **National Energy Independence Strategy** (2012) was revised by Government and there are set quantitative targets for RES, energy efficiency till 2050, which is envisaged to be adopted by Parliament (Seimas) by the end of 2017. The primary and final energy intensity will be 1.5 times lower in 2030 compared with 2017, and in 2050 – 2.4 times. In 2020, in renovated multi-apartment buildings and public buildings will be saved about 2.6-3 TWh of energy, and 5-6 TWh of energy in 2030. In industry will be saved. 1 TWh of electricity by 2030.

Intended energy efficiency measures would allow to save 35 TWh energy and would lead to reduction GHG emission by 1 144 kt CO_2 eq. in 10 years period. It is estimated that 35% use of RES would increase from 1 102 ktoe in 2012 to 1 860 ktoe in 2030. This would decrease the use of natural gas by 960.6 ktoe in energy sector and 37.1 ktoe of gasoline and diesel oil in transport sector. It is assumed that by changing this amount of natural gas, gasoline and diesel oil by RES would influence a decrease reduce in GHG emissions by 2 320 kt CO_2 eq.

Regional cooperation in energy sector

Lithuania is part of **the Baltic Energy Market Interconnection Plan (BEMIP).** BEMIP's main objectives are to develop an internal and regional energy market between the EU Member States in the Baltic Sea region and integrating it fully into the EU's energy markets thus increasing security of supplies. BEMIP projects have been part of the European Economic Recovery Plan (EERP) and the Trans-European Energy Networks Programme. BEMIP projects have also been funded through the EU's structural funds, including the European Regional Development Fund (ERDF) and the Cohesion Fund (CF). Many infrastructure projects are supported through CEF co-funding amounting to EUR 534.3

million. In the framework of the societal challenge for secure, clean and efficient energy of the Horizon 2020 programme, EUR 16.9 million is allocated to participants from the Baltics to stimulate research and innovation in this field.

The implementation of the Paris Agreement and the EU climate and energy targets till 2030 are being periodically discussed in different comities of the Baltic Assembly, which is represented by members of Parliament of Estonia, Latvia and Lithuania, Summits of Prime Ministers, the Baltic Environmental Councils and senior officials group meetings as well as the forums for the implementation **of the European Union Strategy for the Baltic Sea Region (EUSBSR)**.

Also, Baltic States cooperate actively on the energy issues, in particular related to common projects of electricity generation, synchronization and operation of electricity market in the framework **of the Baltic Council of Ministers of Senior Officials on Energy.**

Table 4-4. Summary of policies and measures by energy sector

Name of policy/measure	Objective and activity affected	GHG affected	Type of instrument	Status	Implementing entities	Estimate of mitigation impact by gas CO_2 eq. 2015	2020	2030
Promote energy efficiency	Increase energy efficiency in 2020-2030 by 1.3% per year	CO_2	Regulatory, Economic	Implemented (2013-2020)	Ministry of Energy	-	-	-
Increase the share of RES in the final energy balance and to refuse the importation of polluting fuel	In 2016 Lithuania has already generated 25.46% of its gross final energy from RES and nowadays it's over reached this target set for 2020.	CO_2	Regulatory	Implemented (2016-2020)	Ministry of Energy	-	-	-
Vilnius CHP	In Vilnius power plant - energy savings per unit shall be 43.6% for the waste-to-energy unit (around 440 GWh per year) and 38.9% for the biomass unit (around 640 GWh per year).	CH_4 CO_2	Regulatory, Economic	Implemented (2017-2020)	Ministry of Energy, Ministry of Finance, Ministry of Environment, Vilnius Municipality	-	343	-
Kaunas CHP	High performance CHP plant with electrical capacity of 24 MW and heat production capacity of 70 MW is planned in Kaunas. Such capacity will enable rational use of 200 thous. tons of municipal waste after sorting and production of approx. 500 GWh of heat and 170 GWh of electrical power.	CH_4 CO_2	Regulatory, Economic	Implemented (2017-2020)	Ministry of Energy, Ministry of Finance, Ministry of Environment, Kaunas Municipality	-	310	-
Increasing share of electricity generated from RES	To increase the share of energy produced from RES no less than by 20% in comparison to the total country's electricity energy consumption. In 2015, gross final energy consumption, was 25.8% (above the target).	CO_2	Regulatory, Economic	Implemented (2013-2020)	Ministry of Energy; Ministry of Environment	479	747	-
To increase share of district heating from RES	To increase the share of centralized provided heating energy produced from RES, no less than by 60% by 2020 in the balance of heating energy.	CO_2	Regulatory, Economic, Fiscal	Implemented (2013-2020)	Ministry of Energy; Ministry of Energy; Ministry of Environment; Ministry of Agriculture Ministry of Energy	-	-	-

To increase share of renewable energy sources in the households	To increase the share of RES used for heating in the households not less than by 80% in the balance of heating energy.	CO_2	Regulatory	Implemented (2013-2020)	Ministry of Environment Ministry of Agriculture; Ministry of Economy; Government	-	800	-
Voluntary agreements with energy companies	To implement energy efficiency	CO_2	Voluntary/ negotiated agreements	Implemented (2014-2020)	Ministry of Energy; Municipalities	-	-	-
Promotion of energy efficiency in industry	To implement energy efficiency measures and to reduce energy	CO_2	Economic, Information	Implemented (2014-2020)	Ministry of Environment; Ministry of Energy; Municipalities	815	1 496	-
Renovation (modernization) of multi-apartment	To reduce heating consumption in multi-apartment and public buildings by 30-40% by 2020 and compared to 2011 to save heat from 2 to 3 TWh.	CO_2	Regulatory, Economic	Implemented (2014-2020)	Ministry of Environment, Ministry of Energy, Ministry of Finance Municipalities	230	355	-
Public buildings renovation	The 2020 target set in this Progamme is to renovate area of 700 000 m^2 of the public buildings by saving 60 GWh of the annual primary energy.	CO_2	Regulatory, Economic	Implemented (2014-2020)	Ministry of Environment, Ministry of Energy, Municipalities, Ministry of Finance	-	14	-
Recommendations on the main Lithuania's Republic energy strategic directions for industry subsectors	To promote energy intensive in industry subsectors, applicate eco-innovative technologies	CO_2	Regulatory; Economy	Adopted 2016	Ministry of Economy	-	-	-

4.7.2 Transport

The National Renewable Energy Resources Development Strategy sets the target to increase use of renewable energy resources in transport sector from 4.3% in 2008 to 10% in 2020. A part of raw materials (mainly rape seeds and triticale) for biofuels production is compensated under the Lithuanian state aid scheme.

Lithuania started production of biofuel in 2004 and made about 4 thous. tonnes of biodiesel that year and has made a considerable progress in developing biofuel production. In 2013 the volumes of biofuel production increased to 141 thous. tonnes. About 117 thous. tonnes of biodiesel and 24 thous. tonnes of bioethanol were produced that year. Respectively, about 365 thous. tonnes of rape seeds and about 83 thous. tonnes of triticale were used in the production of biofuel in 2014, Lithuanian producers produced 105.9 thous. tonnes of biodiesel and 9.7 thous. tonnes of bioethanol.

Gross final consumption of electricity produced from renewable energy sources in the transport sector in 2013 the consumption – 60.1 ktoe, in 2014 – 61 ktoe and in 2015 – 69 ktoe. The main legal documents related to promotion of biofuels and climate change mitigation actions in transport sector are listed below.

The National Programme on the Development of Transport and Communications for 2014-2022 was adopted on 15 December 2014 by the Resolution No 1443 of Government of the Republic of Lithuania (latest amendment in 2017) and replaced Long-term (until 2025) Strategy of Lithuanian Transport System Development, adopted on 5 June 2005 by the Government Resolution No 692 of the Republic of Lithuania. The Programme is medium-term strategic planning document setting out the strategic goal, the objectives and tasks aimed at reaching the goal, their evaluation criteria and the institutions implementing the Programme. The Programme contains an analysis of the development prospects of the transport and communications sector, namely, transport (road, railway, maritime, inland waterways and air), logistics and post. The areas of information society development and electronic communications, including their objectives and tasks, are analysed in 'Lithuania's Digital Agenda' – the Programme on the Information Society Development in 2014-2020 approved by Resolution of the Government of the Republic of Lithuania No 244 of 12 March 2014 'On approval of the Programme on the Information Society Development in 2014-2020 'Lithuania's Digital Agenda'. The Programme emphasises the horizontal priorities in the area of transport and communications including the multimodality of transport, integrated urban transport, application of intelligent transport systems to all modes of transport, traffic safety and security, increase in energy efficiency in the transport sector, and development of environmentally-friendly transport. In the Programme it is foreseen 15-16 thousand electric cars (around 6 thousand in 2020) by 2025 in Lithuania.

The strategic goal of the Programme is to create a sustainable, environmentally-friendly and competitive national transport and communications system with a high value-added creation potential. Upon attainment of the strategic goal, the transport and communications system would ensure a high-quality, efficient, uninterrupted and sustainable mobility of members of the public and goods' transportation as well as high-quality logistic and postal services. There are 5 objectives of the Programme:

- Increase mobility of goods and passengers, improve the corridors of the core network of the EU Trans-European Transport Networks as well as their connections with national and local transport networks, and increase the efficiency of multimodal transport.

- By means of the active transport policy measures, increase competitiveness of the transport sector and improve the transport and logistic service quality.
- Promote sustainability of the local (urban and suburban) transport system.
- Increase energy efficiency in transport and reduce the adverse impact of transport on the environment.
- Improve traffic safety and security.

In 2017 the Program was updated transposing the requirements of the Directive 2014/94/EU on the deployment of alternative fuels infrastructure.

The Program identifies the main goals for the development of alternative fuel infrastructure:

- it is planned to install 28 public electric charging access points (high power near the road network of the "Trans-European Transport Network" (hereinafter – TEN-T) and 100 public electric vehicle charging access points (urban and suburban agglomerations with more than 25 thousand inhabitants) until 2020;
- it is planned to install 1 refueling point for liquefied natural gas in inland waters and in port of Klaipėda;
- 1 LNG refuelling point accessible to the public for heavy-duty vehicles shall be put in place in Kaunas along the TEN-T Core Network by 2025;
- it is planned to install 1 liquefied natural gas distribution system for supplying LNG fuel refueling points until 2025;
- it is planned to install 9 publicly available refueling points for compressed natural gas in Vilnius, Kaunas, Klaipėda, Šiauliai, Panevėžys, Telšiai, Ukmergė, Marijampolė, Elektrėnai;
- it is planned to install 10 publicly available compressed natural gas refueling points on the automobile roads of the "TEN-T core network" near the E85 and E67 roads until 2025.

The Law on Energy from Renewable Sources adopted on 12 May 2011 by the Parliament of the Republic of Lithuania, updated in 2015. The Law was adopted to ensure the balanced development of the RES. This Law establishes the tasks for separate energy sectors in order to reach the common goal of 23% of RES in the final consumption of energy by 2020. The Law also establishes the common promotion system on the enhancement of the use of RES and the following tasks by 2020 in separate energy sectors:

- to increase the share of energy from renewable sources in all modes of transport at least up to 10% as compared with the final energy consumption in the transport sector;
- to increase the share of electricity energy, produced from RES, not less than by 20% in comparison to the total country electricity energy consumption;
- to increase the share of centralized provided heating energy, produced from RES, not less than by 60% in the balance of heating energy;
- and, to increase the share of RES used for heating in the households not less than by 80% in the balance of heating energy.

In 2017 an **amendment of the Law on Energy from renewable sources** is adopted transposing the requirements of the ILUC directive (EU) 2015/1513 setting the requirements that the share of energy from biofuels produced from cereal and other starch-rich crops, sugars and oil crops and from crops grown as main crops primarily for energy purposes on agricultural land shall be no more than 7% of the

final consumption of energy in transport and a reference value for advanced biofuels target at least 0.5% in energy content of the share of energy from renewable sources in all forms of transport in 2020.

The Order No 3-100 of the Minister of Transport and Communications of the Republic of Lithuania on the adoption **of the energy efficiency and environmental protection requirements for the purchasing of road vehicles and setting the cases when the ones are mandatory** adopted on 21 of February in 2011 with latest amendments in 2017.

This legal act implements and transposes to national legislation the Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles, and Directive 2006/32/EC on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.

The Order of the Ministers of Environment, Social Security and Labour, and Transport and Communications **on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations** was adopted on 2000 and revised in 2016 by Order No D1-350/A1-250/3-171(1.5 E) implementing European Parliament and Council Directive 94/63/EC of 20 December 1994 on the control of VOC emissions resulting from the storage of petrol and its distribution from terminals to service stations. This act determining limitations for emissions of VOC from modern equipment of petrol storage, distribution and transportation.

Recommendations on the main Lithuania's Republic energy strategic directions, approved by Order No 1-1314 of Minister of Energy of the Republic of Lithuania on 24 November 2016. In the recommendations energy efficiency improvement measures such as modernising vehicles stock, promotion of efficient public transportation and infrastructure by their electrification are foreseen in transport sector. Energy intensity shall be reduced 2.4 times to compare with current level in transport sector by 2050.

The **Connecting Europe Facility (CEF)** contributes to the goals of the Energy Union. Regarding Lithuanian participation to the CEF – Transport programme 2014-2016, the current Lithuanian action portfolio comprises 12 signed grant agreements, allocating EUR 368.8 million of actual CEF Transport Funding to Lithuanian beneficiaries. The transport mode which receives the highest share of funding is rail (84% of actual funding). Lithuania has a considerable rail portfolio under the CEF programme. Apart from the involvement in a multinational study for the Rail Freight Corridor "North Sea – Baltic", the focus is definitely on the Rail Baltic line, the most significant and strategic Global Project of the North Sea-Baltic Corridor.

First municipalities has prepared and confirmed **City sustainable mobility plans (SSMP)**, in which stated necessity to develop public, engineless and ecologic transport, also infrastructure applied for people with special needs. The objectives of cleantech in transport sector of Lithuania are implementing basic objectives of White book – to reduce twice number of cars which uses fuel by 2030, to avoid them totally by 2050 and to achieve zero pollution from transport in biggest urban centres by 2030.

The Order No 3-108(1.5E) of the Minister of Transport and Communications of the Republic of Lithuania on the approval of **Guidance for the development of sustainable mobility plans in cities,** adopted on 13 March 2015, which provide guidance for the municipalities exceeding 25 thousand inhabitants to develop sustainable mobility plans in cities. 18 municipalities have developed sustainable urban mobility plans containing GHG emission reduction measures in transport.

Stimulation of bio-fuel production and consumption

In Lithuania annual fuel consumption amounts to 200-250 thousand tonnes of gasoline and 1.0 to 1.2 million tonnes of diesel per year. Lithuania produces two types of biofuel: biodiesel and bioethanol. The main feed stocks for biodiesel and bioethanol production are rape seed and rye. In Lithuania there are two biodiesel plants with capacity of 110 thousand tonnes and 30 thousand tonnes. It is estimated that in 2016 production of biodiesel amounted over 103 thousand tonnes. Annual consumption of biodiesel in 2016 is estimated at 56.7 thousand tonnes. The remaining amount of biodiesel is exported. In 2016 annual production of bioethanol is estimated at 14.1 thousand tonnes. In 2014 one of two plants producing bioethanol in Lithuania went bankrupt. In 2016 total bioethanol consumption is estimated at 9 thousand tonnes.

Table 4-5. Bio-fuel production and consumption

Year		**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Production (thous. tonnes)	Biodiesel	7	89.2	79.9	106.7	117.3	119.7	117.6	103.1
	Bioethanol	6.6	39.3	20.9	24.3	27.1	15.1	17.4	14.1
	Total	**13.6**	**128.5**	**101.8**	**131.0**	**144.4**	**134.8**	**135.0**	**117.2**
Consumption (thous. tonnes)	Biodiesel	3.2	39.3	40.0	58.6	58.6	65.1	65.4	56.7
	Bioethanol	0.9	16.2	14.7	13.5	10.4	10.5	15.0	9.9
	Total	**4.1**	**55.5**	**54.7**	**72.1**	**69.0**	**75.6**	**80.4**	**66.6**
Bio-fuel share in total fuel consumption (%)		1.1	4.0	3.5	4.8	4.6	4.2	3.2	2.2

Biofuel production in Lithuania started in 2002 and has expanded continuously since then. A reduction of prices for regular fuels in 2014 made biofuels less competitive. In addition there is still only a small number of bio-fuel using vehicles in the country. The harsh winter conditions and very low temperatures in Lithuania make use of high ethanol blends dangerous to car engines. A third reason is market limitations. Lithuanian blending companies can purchase bio-components from other EU producers who offer more competitive prices. Therefore, local producers are finding it a challenge to sell their higher cost bio-fuels.

Lithuania, as a member of the European Union, has implemented EU law on biofuels with a number of regulations. The basic requirements are two EU directives: Renewable Energy Directive (RED) (2009/28/EC) and Fuel Quality Directive (2009/30/EC).

The efficient implementation of GHG emissions reduction targets in maritime (shipping) sector can be achieved only with international instrument developed under IMO.

The efficient implementation of GHG emissions reduction targets in civil aviation sector can be achieved only with a proper functioning of global market-based measure getting agreement in ICAO. Information about steps taken to promote or implement any decisions by ICAO and IMO to limit or reduce associated emissions is provided in Chapter 4.8.

Regional cooperation

Rail Baltica is a project to link Finland, Estonia, Latvia, Lithuania and Poland with a standard gauge rail line, providing passenger and freight service between the countries and improving rail connections between Central and Northern Europe. It envisages a continuous rail link from Tallinn (Estonia), to Warsaw (Poland), via Riga (Latvia) and Kaunas (Lithuania). It will bypass the Kaliningrad Oblast (Russia) and Hrodna (Belarus), which have historically hosted two Poland-Lithuania rail routes. Rail

Baltica is one of the priority projects of the European Union: Trans-European Transport Networks (TEN-T). The constructions are planned to be finished by 2030.

Impact assessment of planned policies and measures in transport sector

Renewed National Energy Independence Strategy (NEIS), which was endorsed by Government on 29 November 2017 and will be approved by Parliament (Seimas), sets ambitious gross of the final RES energy consumption targets 45% until 2030 and 80% until 2050 and targets to reduce the use of fossil fuel vehicles in cities by half till 2030 and to reach zero use in 2050. It is estimated that 45% use RES in 2035 would reduce the use of gasoline and diesel oil by 33 ktoe in transport sector.

Based on data provided in the study on the "Development of the criteria for determining the rates of vehicle circulation tax and formulation of recommendations for the taxation of vehicles in Lithuania" the estimated impact of the introduced environmental car circulation tax (with the calculation of the tariffs based on CO_2 emissions and type of fuel) could bring up to EUR 76.6 million a year and would reduce 1.2 million tonnes CO_2 emissions in a period of 15 years.

Table 4-6. Summary of policies and measures in transport sector

Name of policy/measure	Objective and activity affected	GHG affected	Type of instrument	Status	Implementing entities	Estimate of mitigation impact by gas CO_2 eq. 2015	2020	2030	General comments
Promotion of the RES use in transport sector	Increase the share of RES (biofuels and electricity) by 10% in all modes of transport in comparison with the final consumption of the energy in the transport sector.	CO_2	Regulatory, Economic, Information	Implemented (2014-2021)	Ministry of Energy; Ministry of Transport and Communication; Ministry of Environment; Ministry of Interior; Ministry of Agriculture	-	423	-	Renewable energy share in transport is 4.6% in 2015.
Reduction of the final energy consumption in transport sector	To reduce energy consumption	CO_2	Regulatory	Implemented (2014-2020)	Ministry of Transport and Communication; Ministry of Environment	-	-	2 320	-
Electrification of railways	By 2030 it is planned to have 459.3 km (26% of railways network) of electrified railways in Lithuania and more than 3/4 of all freight and passengers will be transported using electric traction.	CO_2	Regulatory, Economic	Implemented (2014-2030)	Ministry of Transport and Communication	-	-	-	Electrified railway route (km) {2016 : 122, 2030 : 459.3}
Promotion the use of bicycles and development of bicycle track's infrastructure	To develop 564.3 km of bicycle tracks till 2022 in urban and suburban areas in Lithuania.	CO_2	Regulatory; Economic; Information; Education	Implemented (2014-2020)	Ministry of Transport and Communication; Ministry of Environment; Ministry of Interior; Municipalities	-	-	-	The length of bicycle track paved at national level per year (km) {2015 : 30, 2016 : 40, 2017 : 50, 2022 : 564.3}
Promotion of the use of public transport and improvement of its infrastructure	To increase number of passengers traveling by public transport	CO_2	Information; Education; Planning	Implemented (2014-2022)	Ministry of Transport and Communication; Ministry of Interior; Municipalities	-	-	-	Number of passengers traveling by public transport (Millions) {2012 : 234.9, 2022 : 244}
Improvement of road infrastructure	To improve national roads infrastructure	CO_2	Regulatory	Implemented (2014-2022)	Ministry of Transport and Communication	-	-	-	The length of national gravel roads that have been asphalted (km) {2015 : 42, 2016 : 50, 2017 : 50}
Taxation for vehicles in Lithuania	To introduce taxation for vehicles	CO_2	Economic; Fiscal	Planned (2018-2020)	Ministry of Environment; Ministry of Finance	-	160	960	-
Limitation of fuel use in transport sector	The increase of biofuel consumption part in the transport sector to 10% by	CO_2	Regulatory	Implemented (2014-2020)	Ministry of Transport and Communication Ministry of	278	423	-	-

	2020				Environment				
Promote energy efficiency consumption in transport sector	Annual consumption of diesel would be >5%.	CO_2	Regulatory	Implemented (2014-2020)	Ministry of Energy Ministry of Transport and Communication Ministry of Transport and Communication Municipalities Ministry of Environment Ministry of Interior	-	-	-	-
Sustainable mobility plans	To reduce twice number of cars which uses fuel by 2030, to avoid them totally by 2050 and to achieve 0 pollution from transport in biggest urban centres by 2030	CO_2	Regulatory; Economic; Information	Implemented (2016-2020)	Ministry of Transport and Communication Municipalities	-	-	-	http://sumin.lrv.lt/lt/veiklos-sritys/darnaus-judumo-mieste-planai

4.7.3 Industrial Processes

The policies and measures in industry sector are based on few main principles which are required in order to reach environmental targets. Firstly, the amount of its waste should be reduced, the production should be more sustainable, natural and energy resources should be used efficiently. Secondary, raw materials should be processed, the multi-use packaging and materials should be produced and utilized, waste (especially hazardous) should be securely managed, and equipment needed for environmental protection should be manufactured.

The legal documents and measures covering these issues in industrial sector are provided below.

The Programme for investment incentives and industry development for 2014-2020 was approved on 17 of September 2014 by the Resolution No 986 of the Government of the Republic of Lithuania. In this programme an objective to encourage enterprises to use recourses and energy more efficiently as well as use of RES is set. It is planned to implement energy efficiency measures and to reduce energy use in manufacturing industry from 222.9 (in 2012) to 182.9 (in 2020) kg of oil equivalent (for creation of EUR 1000 value added). Additionally, Ministry of Economy of the Republic of Lithuania prepared a study on "The potential of energy use efficiency increase in industry enterprises and determination of measures which encourage the use of different types of energy" in 2015. The aim of this study is to identify measures and main drives which encourage increasing energy efficiency in industry and to use different types of energy as well as help to identify the main implementation mechanisms and provide recommendations how to implement the proposed measures. Implementation of the Programme is financed from the EU structural funds.

The Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) and the Directive 2008/1/EC of the European Parliament and of the Council of the 15th January 2008 concerning **integrated pollution prevention and control (IPPC)** are transposed into the national legislation.

Industrial enterprises, exceeding 50 MW must apply for the IPPC permit and enterprises below 50 MW must apply for the Pollution Permit in order to ensure pollution prevention and to incentivise transfer to cleaner technologies protecting the quality of environment. Natural resources must be used rationally and sparingly, energy use must be efficient, monitoring and control must be performed for the substances and raw materials, fuel and energy consumption in the processes of production. Less hazardous materials are promoted to use in the process of industrial activities.

The term "best available techniques" includes both the technology used and the way in which the installation is designed and maintained. The presented techniques are developed in the scale that allows implementation under economically and technically viable conditions and the techniques are most effective in achieving a high general level of protection of the environment as whole.

The ISO 14000 family of standards provides practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities. ISO 14001:2015 and its supporting standards such as ISO 14006:2011 focus on environmental systems to achieve this. The other ISO 14000 standards focus on specific approaches such as audits, communications, labelling and life cycle analysis, as well as environmental challenges such as climate change. GHG emissions permits issued for the installations participating in the EU ETS are consistent part of the IPCC permits or Pollution permits.

On 1st of January 2015 **Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases** and repealing Regulation (EC) No 842/2006 was adopted. The main goals of the new Regulation is to ensure a more cost-efficient contribution to achieving the EU's climate objectives by discouraging the use of F-gases with a high impact on the climate in favour of energy-efficient and safe alternatives, and further improving the containment and end-of-life treatment of products and equipment that contain F-gases; help to bring about a consensus on an international agreement to phase down hydrofluorocarbons (HFCs), the most relevant group of F-gases, under the Montreal Protocol.

It is aimed at cutting total EU emissions from F-gases by two thirds by 2030 compared to 2014 levels. It prohibits the placing of F-gases on the market in certain circumstances where alternatives are available. During 2018-2020, quotas for legally placing HFCs on the EU market were reduced to 63% of 2015 levels.

The Ministry of Environment of the Republic of Lithuania has updated the existing national legislation in the area of fluorinated greenhouse gases ensuring the implementation of the requirements of the Regulation (EU) No 517/2014 :

- The Order No D1-897 of the Minister of Environment the Republic of Lithuania ensuring the implementation of the requirements of the containment, use, recovery and destruction of the fluorinated greenhouse gases was adopted on 12 December 2016. This order defines the functions of the national authorities ensuring the implementation of the requirements of the new Regulation (EU) No 517/2014;
- The Order No D1-372 of the Minister of Environment of the Republic of Lithuania establishing the Rules on the issuance of Certificates for the companies handling fluorinated greenhouse gases was updated on 19 December 2014;
- The Order No D1-668 of the Minister of Environment of the Republic of Lithuania establishing the training and attestation system for the employees engaged in the activities with the fluorinated greenhouse gases was prepared with the view to amend and updated the existing national legislation in this area in order to comply with the requirements on the new Regulation (EU) No 517/2014, adopted on 20 October 2016.
- The Order No D1-12 of the Minister of Environment establishing the procedures for reporting on fluorinated greenhouse gases and ozone depleting substances, data collection and management, accounting of equipment and systems which contain these gases or materials was adopted on 10 January 2010 and was amended in 2016.

The amendment to the Administrative Infringement Code establishing more stringent responsibilities for the breach of the requirements of handling fluorinated greenhouse gases was adopted in 2016.

In July 2017, the EU and its Member States committed to ratifying the **Kigali Amendment to the Montreal Protocol** quickly, so that it comes into force on 1 January 2019. This amendment, adopted in October 2016, is a significant step forward in implementing the Paris Agreement by limiting the global production and use of hydrofluorocarbons (HFCs). Science suggests that an ambitious phase-down of HFCs alone could prevent up to 0.5°C of global warming by the end of the century.

The Order No D1-973 of the Minister of Environment on the **green procurement implementation measures for 2012-2015** adopted on 14 December 2011 and later amendments promoting the environmental management system in the manufacturing sectors as well as the strengthening ability of enterprises to organise green procurements.

The Order No 620 of the Minister of Environment of 5 December 2002 (with later amendments in 2014) on **limitation of emissions of volatile organic compounds** (hereinafter – VOC) was adopted. The aim of this order is to reduce the direct and indirect impact of VOC emissions (released by paints, solvents, adhesives and other products) on environment, usually on the ambient air, and the potential risk on human health, by providing measures and procedures to be implemented in the activities referred to by this document, in case the activity exceeds the solvent consumption level prescribed in this normative document.

The pollution reduction scheme is a part of the procedure of the limitation of emissions of VOC due to the use of organic solvents in certain activities and installations. The aim of this scheme is to give a possibility to an operator by using various implements to reduce VOC emission levels at the same degree as it would be reduced if the VOC emissions satisfied the limit levels. In this case, the operator may use any reduction scheme, prepared specially to his equipment to achieve an ultimate equivalent effect of VOC emission reduction.

The Order No 520/104/360 of 11 December 2000 of the Minister of Environment and Minister of Social Security and Labor, Minister of Transport and Communications (with later amendments in 2016) on **Stage II petrol vapour recovery during refuelling of motor vehicles at service stations.** The order lays down measures aimed at reducing the amount of petrol vapour emitted to the atmosphere during the refuelling of motor vehicles at service stations.

Recommendations on the main Lithuania's Republic energy strategic directions, approved by Order No 1-1314 of Minister of Energy on 24 November 2016. In the recommendations promotion of law energy intensive industry subsectors, application of eco-innovative technologies are foreseen in order savings of electricity will amount 620 GWh by 2025. Energy intensity shall be reduced 2.4 times to compare with current level in industry sector by 2050.

Table 4-7. Summary of policies and measures by industrial processes

Name of policy/measure	Objective and activity affected	GHG affected	Type of instrument	Status	Implementing entities	Estimate of mitigation impact by gas CO_2 eq. 2015	2020	2030	General comments
Investment incentives and industry development for 2014-2020	Programme's objective to encourage enterprises to use recourses and energy more efficiently as well as use of RES is set.	CO_2	Regulatory	Implemented (2014-2020)	Ministry of Economy, Ministry of Education and Science Municipalities	-	-	-	-
IPPC permits and Pollution permits	Directive apply to combustion plants with a rated thermal input equal to or greater than 1 MW and less than 50 MW	CO_2	Regulatory	Implemented 2015	Ministry of Environment	-	-	-	-
Best available technology	Reduce the GHG emissions released during the cement production process by changing manufacturing technologies.	CO_2	Economic	Implemented (2013)	Cement producing company	500	500	-	-
Regulation of Fluorinated Greenhouse Gases	To ensure a more cost-efficient contribution to achieving the EU's climate objectives by discouraging the use of F-gases with a high impact on the climate in favour of energy-efficient and safe alternatives, and further improving the containment and end-of-life treatment of products and equipment that contain F-gases; help to bring about a consensus on an international agreement to phase down hydrofluorocarbons (HFCs), the most relevant group of F-gases, under the Montreal Protocol.	HFC, PFC, SF_6	Regulatory	Implemented (2015-2030)	Ministry of Environment	-	-	-	The Ministry of Environment of the Republic of Lithuania has updated the existing national legislation in the area of fluorinated greenhouse gases ensuring the implementation of the requirements of the EU Regulation.
Limitation of emissions of volatile organic compounds VOC	To reduce the direct and indirect impact of VOC emissions (released by paints, solvents, adhesives and other products)	CO_2	Regulatory	Implemented	Ministry of Environment	-	-	-	-
On Stage II petrol	Reducing the amount of	CO_2	Regulatory	Implemented	Ministry of	-	-	-	-

vapour recovery during refuelling of motor vehicles at service stations	petrol vapour emitted to the atmosphere during the refuelling of motor vehicles at service stations.			2016	Environment				
To implement innovative technologies in industry	To promote eco-innovative technologies in industry sector.	CO_2	Regulatory, Economic	Implemented	Ministry of Energy	-	-	-	Electricity savings will amount 620 GWh by 2025. Energy intensity shall be reduced 2.4 times to compare with current level in industry sector by 2050.
Ratification of the Kigali Amendment	The goal is to achieve over 80% reduction in HFC consumption by 2047	HFC	Regulatory	Adopted (2019-2032)	Ministry of Environment	-	-	-	-

4.7.4 Agriculture

More than a half of Lithuania's land is suitable for agriculture. About 33.5% of our land area is occupied by forests, 5.8% by wetlands, 4.8% is attributed to settlements.

In 2014 **Lithuania's Rural Development Programme 2014-2020** was prepared by the Ministry of Agriculture of the Republic of Lithuania (MoA) in cooperation with the Ministry of Environment in fulfilment mission and objectives laid down in the Articles 3 and 4 of the European Parliament and the Council Regulation (EC) Nr. 1305/2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005. In order to achieve the objectives of rural development, which contribute to the Europe 2020 strategy for smart, sustainable and inclusive growth, the main target of the National Rural Development Programme is promoting growth of agriculture sector based on innovative technologies, that is more territorially and environmentally balanced, climate-friendly and resilient and competitive as well as innovative. Therefore, all three objectives of the EAFRD will be implemented: (a) fostering the competitiveness of agriculture; (b) ensuring the sustainable management of natural resources, and climate action; (c) achieving a balanced territorial development of rural economies and communities including the creation and maintenance of employment. On the basis of the analysis of the Lithuanian rural conditions and problems identified, measures will be implemented in all six Union priorities for rural development of the EAFRD and in 16 out of 18 thematic areas. Also, in order to implement properly the EU strategy on Forestry the thematic area related to the improvement of forestry economic value and forest areas expansion has been chosen in addition. The total program budget is EUR 1.978 billion. 36% of all funds be allocated for climate change mitigation (this amount includes previous programming period). The main targets of the program are switching to organic farming (25 000 hectares), keeping organic farming areas (110 000 hectares). The Lithuanian Rural Development Programme has been formally adopted by the European Commission on 13 February, 2015. It outlines Lithuania's priorities for using EUR 1.9 billion of public money that is available for the period 2014-2020 (EUR 1.6 billion from the EU budget and EUR 0.3 billion of national funding). The main objectives are the modernization and improvement of the economic performance of small and medium-sized farms (nearly 8 000 farms will be supported), the preservation of biodiversity (11% of farmland), better management of soil (8% of farmland), the promotion of organic farming, the creation of new jobs (nearly 2 000) and the development of rural areas and businesses. Almost 150 000 people will be trained. They include farmers, land managers, food industry actors, forest holders and the staff of rural SMEs. Their professional skills will be upgraded. They will also be encouraged to diversify their activities. More than EUR 120 million have been allocated for the forestry sector. Trend two, which includes ecological farming (in 2012 a total of 2 594 certified ecological farms accounted for 163.3 thousand ha and covered 5.7% of agricultural land and in 2015 it increased up to 209.6 thousand ha), land afforestation, and improvement of the condition of risky water bodies was assigned nearly EUR 0.3 billion. Manure utilization and utilization for the production of biogas enables to solve problems related to the negative environmental impact of production activities. Livestock and poultry manure can produce about 50 million m^3 of biogas. Total financial assistance of EUR 45 million from Rural Development Programm is planned for the period for 2014-2020. Using this support could be built about 30 biogas plants with a total electric power of about 20 MW. In 2017, there are already operating 8 biogas plants and planned to build 14 biogas plants until 2020, using financial support from Lithuania's Rural Development Programme 2014-2020.

The National Forest Area Development Program 2012-2020 approved on 23 May 2012 by Resolution No 569 of the Government of the Republic of Lithuania. The goal of the Programme is to implement long-term forest economy policy that would be coherent with other sectorial policies, would be based on country specific traditions, the EU regulations, international conventions, resolutions, treaties, programmes, and to set goals and tasks for forestry sector development up to 2020. The Programme sets a strategic goal on forestry development, other forestry goals, and tasks to achieve the set goals, evaluation criteria. In the Annex the implementation evaluation criteria for the years 2011, 2015 and 2020 are set. The Programme is sought to increase forest coverage of the country up to 34.2% by 2020 by afforestation of abandoned lands and lands that are not suitable to be used for agricultural activities, and to encourage people financially to plant forests in private and state-owned lands, to develop forest regeneration on a genetic-ecological basis with selectively valuable and qualitative forest increasing matter. In 2011 the Forest Law was amended by tightening the procedure of forest land transformation. Forest land may be transformed into farming land or other type of land only in exceptional cases. In addition to that new compensation system was created, which ensures obligation to plant new forest on non-forest land as a compensation for the forest land plot transformed into the other land use. This regulation serves not only as additional guarantee to prevent decrease of forest land area, but also creates conditions for increase of forest coverage. In the period 2007-2013 with a financial support from Rural Development Program 2007-2013 the area of 17.2 thousand ha was afforested and additional 3.6 thousand ha were afforested in 2014.

National **Water Area Development Programme 2017-2023** approved on 1 February 2017 by Resolution No 88 of the Government of the Republic of Lithuania. The main goals of the Programme are: to improve status of ground and surface water bodies, to achieve and maintain good environmental status of the Baltic Sea, to reduce the risk of the floods, to provide quality public drinking water supply and sanitation services and to reduce pollution by waste water.

Action plan for the implementation of the Program was approved on 5 May 2017 by the Order No D1-375/3D-312 of Minister of Environment and the Minister of Agriculture of the Republic of Lithuania.

Implementation of the Council Directive of 12 December 1991 concerning **the protection of waters against pollution caused by nitrates from agricultural sources** (91/676/EEC) with the latest amendment by the Regulation (EC) No 1137/2008 of the European Parliament and the Council of 22 October 2008 (further – Nitrates Directive) is primarily directed towards the minimization of the water pollution with nitrates. Activities are supported for the establishment of modern manure silos and other measures which enable the control against manure penetration into the surroundings. Replacement of manure handling systems from thick or dry silos to liquid silos may lead to a reduction in emission of nitrogen compounds to atmosphere by up to 20 times. The country took an obligation that the Nitrates Directive would be implemented in two phases. The implementing Nitrates Directive legal documents are:

- The Order No D1-367/3D-342 of Ministers of Environment and Agriculture on **Environmental Requirements for Manure Management** adopted on 14 July 2005 with later amendments sets requirements pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agriculture activities, particularly the environmental requirements on the use of manure for croplands fertilization. Additionally, the farm, keeping animals are required to store manure and slurry in storage vessels which comply with environmental requirements. In order to reduce GHG emissions, also there are established

requirements for slurry storage covering and slurry speeding technology by the Order No D1-367/3D-342.

- By the Order No D1-490/3D-39 of Ministers of Environment and Agriculture the **Program for Minimization of Water Pollution Caused by Agriculture activities** was adopted on 8 June 2012. The Oder sets requirements pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.

Table 4-8. Summary of policies and measures by agriculture sector

Name of policy/measure	Objective and activity affected	GHG affected	Type of instrument	Status	Implementing entities	Estimate of mitigation impact by gas CO_2 eq			General comments
						2015	2020	2030	
Implementation of Nitrates directive	Reduced water pollution and the emissions of N_2O	N_2O, CH_4	Regulatory, control and monitoring	Implementing (2014-2020)	Ministry of Environment, Ministry of Agriculture	100	100	-	-
Nitrogen compounds into the Baltic Sea the central part of the change, compared with the inflow of reference (1997-2003) for the period 42 kt	Reduced water pollution and the emissions of N_2O	N_2O	Regulatory, control and monitoring	Implementing (2014-2020)	Ministry of Environment, Ministry of Agriculture	9.9	8	-	-
Lithuania's Rural Development Programme 2014-2020	Promote growth of agriculture sector based on innovative technologies, that is more territorially and environmentally balanced, climate-friendly and resilient and competitive as well as innovative	CH_4, N_2O	Regulatory	Implementing (2014-2020)	Ministry of Agriculture, Ministry of Environment	-	-	-	-
Sustainable farming	Promote sustainable farming, crop rotation, rational and regulated use of synthetic fertilisers and replacement of synthetic fertilisers by organic fertilizers, expansion of perennial meadows in order to improve soil fertility, manure handling, review of subsidies and tax concessions (Rural Development Programme 2014-2020).	CH_4, N_2O	Regulatory, Information	Implementing (2014-2020)	Ministry of Agriculture, Ministry of Environment	-	-	-	-
Promotion of the production of biogas from livestock holdings	The planned biogas capacities from livestock holdings are: in 2014 – 1.6 MW, in 2015 – 1 MW, in 2016-2017 – 3 MW, and in 2018-2020 – 4 MW	CH_4	Economic, Regulatory	Implementing (2014-2020)	Ministry of Agriculture, Ministry of Environment	4.34	4.45	-	-
Promotion growth of protein crops	To grow protein crops	N_2O	Economic	Implementing (2014-2020)	Ministry of Agriculture	-	-	-	-

4.7.5 Land use, Land use Change and Forestry

In the land use, land use change and forestry (hereinafter – LULUCF) sector one of the main factor influencing the CO_2 absorption is the forest expansion. **National Forest Area Development Program 2012-2020** approved by Resolution No 569 of the Government of the Republic of Lithuania on 23 May 2012, sets a strategic goal on forestry development, other forestry goals, and tasks to achieve the set goals, evaluation criteria. In the Annex the implementation evaluation criteria for the years 2011, 2015 and 2020 are set. The Programme is sought to increase forest coverage of the country up to 34.2% by 2020 by afforestation of abandoned lands and lands that are not suitable to be used for agricultural activities, and to encourage people financially to plant forests in private and state-owned lands, to develop forest regeneration on a genetic-ecological basis with selectively valuable and qualitative forest increasing matter.

In 2011 the Forest Law was amended by tightening the procedure of forest land transformation. Forest land may be transformed into farming land or other type of land only in exceptional cases. In addition to that new compensation system was created, which ensures obligation to plant new forest on non-forest land as a compensation for the forest land plot transformed into the other land use. This regulation serves not only as additional guarantee to prevent decrease of forest land area, but also creates conditions for increase of forest coverage.

In the period 2007-2013 with a financial support from Rural Development Program 2007-2013 the area of 17.2 thousand ha was afforested and additional 8.4 thousand ha were afforested in the period of 2014-2016.

The main legal act regulating forest management is the Law No XI-1830 on Forests adopted by the Parliament (Seimas) of Republic of Lithuania on 2011. By the amendments of this legal act the new measures were introduced, that creates legal conditions for better preserving of forests and forest land in cases of land use change from the forestry to other use, in particular: the number of cases when it is allowed to change forest land in to any other land is narrowed and prescribed precisely.

The compensatory afforestation in all cases of changing forest land in to any other land was established under the National Forest Area Development Program 2012-2020, adopted on 23 May 2012 by the Government Resolution No 569 of the Republic of Lithuania.

The estimation of policy and measures effect on GHG emissions mitigation in LULUCF sector effect is basically related to the National Forest Area Development Program 2012-2020 where the target to increase the forest area by 3% by 2020 is set. (Table 4-9).

Table 4-9. The mitigation measures in LULUCF sector to minimize GHG emissions in forestry sector

Name of measure	Description	Year of implementation	Implementing entity
Restoration of forestry potential and introduction of prevention actions	Fires and natural disasters pose a significant threat to forest ecosystems. Each year in Lithuania between 100 and 750 hectares of forest is burned. Lithuania's Rural Development Programme 2014-2020 provides investment support for restoration of forest damaged by fires and other natural disasters including pests and diseases, as well as support for implementation of forest fire prevention measures.	2014-2020	Ministry of Environment

Afforestation and restoration of damaged forest	In order to reduce atmospheric pollution originated from agricultural activities and contribute to climate change mitigation as well as to reduce the area of the abandoned land, the afforestation of these lands and the restoration of damaged forests is supported. In the inter-institutional Action Plan on the implementation of the Goals and Objectives for 2013-2020 of the Strategy for the National Climate Change Management Policy the measure is set to plant new economically valuable and productive as well as biological resistant forests in abandoned lands in the state's possession.	2014-2020	Ministry of Environment
Afforestation	Afforestation actions are supported by Lithuania's Rural Development Programme 2014-2020. EUR 53 million allocated for new commitments under the sub-measure „Afforestation" for the programming period 2014-2020. Planned that forest land in 2020 reach 34.2%.	2014-2020	Ministry of Agriculture

EU proposal on LULUCF Regulation for the period 2021-2030

The proposal on LULUCF regulation sets out Member States' commitments on LULUCF that contribute to meeting the GHG emission reduction target at least 40% to compare with 1990 of the Union for the period from 2021 to 2030, as well as the rules for the accounting of emissions and removals from LULUCF and checking the compliance of Member States with these commitments. The Regulation sets a binding commitment for each Member State to ensure that accounted emissions from land use are entirely compensated by an equivalent removal of CO_2 from the atmosphere through action in the sector, what is known as the 'no debit rule'. Although Member States undertook this commitment under the Kyoto Protocol up to 2020, the proposal enshrines the commitment in EU law for the period 2021-2030. Member States would be required to balance GHG emissions and removals from land use, land use change and forestry under the 'no debits rule'. It is proposed that GHG emissions from land use would have to be entirely compensated by equivalent removal of CO_2 from the atmosphere through action in that sector or in the effort-sharing sectors. The new rules will provide Member States with a framework to incentivise more climate-friendly land use, without imposing new restrictions or red tape on individual actors. This will help farmers to develop climate-smart agriculture practices and support foresters through greater visibility for the climate benefits of wood products which can store carbon sequestered from the atmosphere.

Impact assessment of planned policies and measures in LULUCF sector

It is expected to increase forest land area up to 35% of total country area according to the suggestions (not exactly determined in any of the strategic planning documents). National Forestry Development Programme for 2021-2020 sets the goal to increase forest coverage by 3% until 2020. It was estimated that afforestation of the poorly fertile soils in order to increase forest coverage could increase LULUCF sector GHG removals by 1 680 kt CO_2 eq. in 2020. However, successful increase in forest land area mostly depends on support from national programs for afforestation of abandoned lands and Rural Development Program, therefore the aim to increase forest coverage to 35% is unsecured. Additional measure to increase forest land coverage could be specific measures adopted to protect natural

afforestation and reforestation areas in abandoned land or land not suitable for agricultural purposes. The need to identify measures reducing GHG emissions and increasing absorption potential of LULUCF sector included in the Action Plan for the implementation of the Government Work Programme in the period of 2017-2020. Implementation of additional measures could result in increase of GHG removals in LULUCF sector approx. up to 1 050 kt CO_2 eq. in 2035.

Table 4-10. Summary of policies and measures by LULUCF sector

Name of policy/measure	Objective and activity affected	GHG affected	Type of instrument	Status	Implementing entities	Estimate of mitigation impact by gas CO_2 eq			General comments
						2015	2020	2030	
Increase forest area	To increase forest area by 3% until 2020. Planned that forest land in 2020 reach 34.2%.	CO_2	Economic; Regulatory	Implementing (2014-2020)	Ministry of Agriculture; Ministry of Environment	-	1 680	-	-
Restoration of forestry potential and introduction of prevention actions	Support restoration of forest damaged by fires and other natural disasters	CO_2	Economic; Regulatory	Implementing (2007-2020)	Ministry of Environment; Ministry of Agriculture	-	500	-	-
Afforestation and restoration of damaged forest	To reduce atmospheric pollution	CO_2	Regulatory; Economic; Information; Education; Research	Implementing (2007-2020)	Ministry of Environment; Ministry of Agriculture	-	-	-	-
Promotion of planting of short rotation coppices	The support for planting of short rotation coppices with an aim to produce biomass as a source of energy which partially replaces imported raw materials (oil, gas, coal) and contributes to the reduction of CO_2 emissions.	CO_2	Economic; Regulatory	Implementing (2014-2020)	Ministry of Agriculture; Ministry of Energy	-	-	-	Newly afforested area (from 2011) Ha (ha) {2015: 15 000, 2016: 17 500, 2017: 20 000}
Afforestation and damaged forest restoration	To reduce atmospheric pollution	CO_2	Regulatory; Economic; Information; Education; Research	Implementing (2013-2020)	Ministry of Environment; Ministry of Agriculture		840	1 680	-	Increasing the national forest area The National Forest Area Development Program 2012-2020 approved by Resolution No 569 of the Government of the Republic of Lithuania of 23 May 2012 is sought to increase forest coverage of the country up to 34.2% by 2020. To increase forest area by 3% until 2020. LULUCF sector is not included into the implementation of the EU GHG emission reduction target until 2020.

Sustainable forestry: Promoting the use of biomass for energy production	It's planned to use 300 thou. m^3 per year of wood from state forests for biomass production by 2020.	CO_2	Regulatory; Economic	Implementing (2012-2020)	Ministry of Environment; Ministry of Energy; Ministry of Agriculture	-	700	-	The amount of the use of forest cutting waste and residual wood for biomass production (thousand cubic metres) {2015: 300, 2016: 300, 2017: 300}

4.7.6 Waste management

The National Strategic Waste Management Plan 2007-2013 was repealed in April 2014 with the National Waste Management Plan for 2014-2020 by Resolution No 519 of the Government Republic of Lithuania (the latest amendment in June 2016). The targets, directly related to minimisation of GHG emissions in waste sector remains the same, however, stricter measures are set in order to reach those targets. For example, introduction of the Landfill tax since 2016, more requirements for kitchen and food waste treatment, reduced disposal of biodegradable waste and waste containing energy/calorific value in landfills till 2020. By 2020, the preparing for re-use and the recycling of waste materials at least paper, metal, plastic and glass from households, and possibly from other origins as far as these waste streams are similar to waste from households, shall be increased to a minimum of overall 50% by weight. By 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste, excluding naturally occurring material defined in category 17 05 04 in the list of waste, shall be increased to a minimum of 70% by weight. Currently, in Lithuania are 54 biodegradable waste collection areas. It's categorized by regions: Alytus, Kaunas, Klaipėda, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena and Vilnius.

In the light of the on-going review of the recycling targets and landfill restrictions for municipal waste – 65% recycling target for 2030 and possible upwards review of the targets by 2025 and a landfill restriction to 10% for 2030 – the Commission services consider that the optimal incineration capacity in a country is 20-25% of municipal waste generated. Incineration capacity in excess of this is likely to further hinder Lithuania from meeting the 50% recycling target in 2020 and future increase of that target level.

According to the EU Environmental Implementation Review Country Report full implementation of the existing legislation could create more than 5 200 jobs in Lithuania and increase the annual turnover of the waste sector by EUR 550 million.

EU structural and investment funds are an important source of funding for improved waste management system in Lithuania. In 2007-2013 EUR 190 million were invested into waste management projects, including construction of 1 regional mechanical and 9 mechanical sorting and biological waste treatment facilities, remediation of 341 old landfills/dumpsites, construction of numerous bulky waste collection and green waste composting sites, extension of separate waste collection system (210 000 containers for recyclable and biodegradable waste).

In the 2014-2020 period EUR 87.2 million investment from the Cohesion Fund is planned to support further development of the separate collection of waste, modernization of capacities to prepare waste for recycling, reuse or other recovery (sorting lines, other equipment), and modernization of the waste management information system and monitoring.

Several new biogas plants have been constructed in wastewater treatment plants. In 2013 first waste incineration plant in Lithuania has started operation with energy recovery.

The main legal acts and programs of the Republic of Lithuania regulating waste management activities include the Law on Waste Management, Law on Management of Packaging and Packaging Waste, the Law on Taxes for Environment Pollution, the Rules on Waste Management, the National Waste Prevention Programme and the National Waste Management Plan for 2014-2020. Management of

wastewater and sludge is regulated by the Law on Potable Water Supply and Wastewater Handling and the Development strategy of Potable Water supply and wastewater handling.

Implementation of the **Circular Economy Action Package** has been a step in progressing the EU's efforts to reduce emissions from waste. The Package provides a clear, systematic approach that focusses on a number of priority issues, including plastics, food waste, critical raw materials and construction and demolition and clearly delineates actions, commitments and timetables. Implementation of the EU's circular economy action package has been key in progressing efforts to reduce emissions from waste. It provides a clear, systematic and holistic approach that focuses on a number of priority issues, including plastics, food waste, critical raw materials, and construction and demolition, and sets out clear actions, commitments and timetables. The Commission has adopted a raft of legislative proposals on areas such as waste, packaging, landfill, end-of-life vehicles, batteries and accumulators, and waste electrical and electronic equipment. They include stricter targets, such as recycling 65% of municipal waste and 75% of packaging waste by 2030, and reducing landfill to 10% of municipal waste by 2030

The Ministry of Environment of the Republic of Lithuania supports the EU Circular Economy Package and is demonstrating interest in adopting the package on the national level. Government of the Republic of Lithuania approved plan for implementation of measures in 2017. According to this plan amount of recycled, reclaimed or otherwise used municipal waste in 2020 will consider 65% and target for waste suitable for recycling will be 65%.

National waste prevention and management 2021-2027 plan will be prepared after the analysis of the Lithuania's waste prevention and management system, waste trends, taking into account the EU circular economy and other directions of the waste sector. The Ministry of Environment will announced a competition for such analysis. Public procurement procedures will started in 2018.

Impact assessment of planned policies and measures in waste sector

Lithuania is taking steps towards realising the concepts of "recycle, repair and re-use" and avoiding waste at all stages of the value chain with its **EU circular economy package**. The 2015 Circular Economy Package emphasizes the need to move towards a lifecycle-driven 'circular' economy, with a cascading use of resources and residual waste that is close to zero. Implementation of the Circular Economy Action Package has been a key in progressing efforts to reduce emissions from waste. With continuation of existing measures and planned policies GHG emissions from waste sector will decrease by 57% in 2025 and by 62% in 2035, compared with 2014 GHG emissions.

Table 4-11. Summary of policies and measures by waste sector

Name of policy/measure	Objective and activity affected	GHG affected	Type of instrument	Status	Implementing entities	Estimate of mitigation impact by gas CO_2 eq.			General comments
						2015	2020	2030	
Promotion of high efficiency cogeneration in Vilnius	The waste-to-energy unit is expected to reduce CO2 emissions by 93 166 tons per year and biomass unit is expected to reduce CO_2 emissions by 343 328 tons per year.	CH_4; CO_2	Regulatory, Economic	Implemented (2017-2020)	Ministry of Energy, Ministry of Environment, Vilnius Municipality	-	343	-	-
Promotion of high efficiency cogeneration in Kaunas	High performance CHP plant with electrical capacity of 24 MW and heat production capacity of 70 MW is planned in Kaunas. Such capacity will enable rational use of 200 thous. tons of municipal waste after sorting and production of approx. 500 GWh of heat and 170 GWh of electrical power.	CH_4; CO_2	Regulatory, Economic	Implemented (2017-2020)	Ministry of Energy, Ministry of Environment, Kaunas Municipality	-	310	-	-
Promotion of municipal and other waste recycling or using otherwise	To incinerate 180 000 t of waste in 2015 and in 2020 it is planned to incinerate 360 000 - 530 000 t; Potential reaches 150-210 ktoe in 2020.	CO_2; CH_4	Regulatory; Planning	Implemented (2007-2020)	Ministry of Environment; Ministry of Energy; Private sector	-	-	-	-
Biodegradable municipal waste handling	Lowered amounts of landfilled of biodegradable municipal waste ensuring that biodegradable municipal waste would make not more than 50% until 2013 and not more than 35% until 2020, if compared with the year 2000 quantities of the biodegradable municipal waste.	CH_4	Regulatory	Implemented (2013-2020)	Ministry of Energy; Ministry of Environment	359	538	-	-
Biodegradable municipal waste handling	Collection and use of methane from all existing and new landfills	CH_4	Regulatory	Implemented (2013-2020)	Ministries of Energy and Environment	1 440	1 940	-	-
Decreasing the amount of biodegradable waste in landfills	National Waste Management Plan for 2014-2020 sets the goal by the 2030 that	CH_4	Regulatory	Implemented (2014-2020)	Ministry of Environment; Regional Waste	-	538	-	-

		approximately 100 000 t of green waste will be composted.				Management Centres				
Circular economy package		To reduce GHG intensity of production of goods (sustainable waste management)	CH_4; CO_2	Regulatory	Implemented (2016-2030)	Ministry of Environmenr; Municipalities	-	74	260	-

4.8 Steps taken to promote and/or implement any decisions by ICAO and IMO to limit or reduce associated emissions

Maritime transport is a large and growing source of GHG emissions. By its nature, maritime transport is international. The EU and its Member States have a strong preference for shipping emission reduction global approach led by the **International Maritime Organization (IMO)** as this will be most effective. Considerable efforts to agree such an approach have been made over recent years within both the IMO and the UNFCCC also with a view to ensure a fair contribution of the sector to the objective of the Paris agreement to limit the average increase of the temperatures to +1,5°C.

In July 2011, the IMO approved binding energy efficiency targets for new ships. An Energy Efficiency Design Index (EEDI) will be calculated for each ship during the planning phase. The regulations have been in force since the beginning of 2013. In addition, all ships, the gross tonnage of which is 400 tonnes or more, are required to compile a Ship Energy Efficiency Management Plan (SEEMP) following a guidance format prepared by IMO.

In 2016 the IMO in its MEPC 70 meeting reached an agreement on a global data collection system as the next step in their action to tackle CO_2 emissions. Draft guidelines for administration, data verification procedures, and draft guidelines are still yet to be developed, that work will continue through a correspondence group set to meet mid-2017. Also MEPC 70 agreed to develop a Road Map for addressing CO_2 emissions from international shipping, with initial CO_2 reduction commitments to be agreed to by 2018.

As a first step, large ships over 5000 gross tonnes loading /unloading cargo/ passengers from 1 January 2018 at EU maritime ports are to monitor and later report their related CO_2 emissions and other relevant information in accordance with their monitoring plan. Monitoring, reporting and verification of information shall be done in conformity with the EU Regulation 2015/757 (as amended by Delegated Regulation 2016/2071). National implementation measures are outlined in the Order No D1-56 of the Minister of Environment of the Republic of Lithuania on the approval of the content and procedures of the monitoring, reporting and verification of the carbon dioxide emissions from maritime transport, adopted on 16 January 2017.

Aviation is one of the fastest-growing sources of greenhouse gas emissions. CO_2 emissions from aviation have been included in the EU emissions trading system (EU ETS) since 2012. However, since 2013 under the EU ETS all airlines operating only in European Economic Area, are required to monitor, report and verify their emissions, and to surrender allowances against those emissions. They receive tradeable allowances covering a certain level of emissions from their flights per year. The system has so far contributed to reducing the carbon footprint of the aviation sector by more than 17 million tonnes per year, with compliance covering over 99.5% of emissions.

In October 2016, the agreement reached in Montreal by the **International Civil Aviation Organization (ICAO)** Assembly foresees the establishment of a Global Market-Based Measure (GMBM), which will oblige airlines to offset the growth of their CO_2 emissions post-2020. To do so, airlines will buy "emission units" generated by projects reducing CO_2 emissions in other sectors of the economy (e.g. renewable energies). In its first phase (2021-2026), 65 countries will participate on a voluntary basis. All EU Member States will join from the start. Participating countries include 18 out of the top 20 states with the largest international civil aviation activity. In its second phase (2027-2035) participation is mandatory;

except for those exempted (countries with small aviation activities). This means around 80% of the emissions above 2020 levels will be offset by the scheme between 2021 and 2035.

The agreement foresees a review every three years, which will guarantee that the scheme can be continuously improved, and that its climate objective is achieved and improved over time, consistent with the objective of limiting global temperature increase to well below 2°C, as agreed under the Paris Agreement.

ICAO needs to develop all the remaining elements and implementation tools to allow the GMBM to become operational in 2021. Participating states are expected to take all necessary steps to develop relevant implementing measures at domestic level. The Commission will now report back to the European Parliament and the Council of the EU on the outcome of the ICAO Assembly. In that light, and if appropriate, the Commission should also make a proposal to review the scope of the EU ETS, with due consideration to be given to the necessary consistency to the EU 2030 climate objectives and policy.

4.9 Effect of policies and measures on longer term trends

Lithuania believes that policies and measures described in Chapter 4 are modifying long-term trends in anthropogenic GHG emissions and removals, consistent with the objective of the EU commitments and agreements.

Lithuania is aware of the importance of setting long-term goals and actively trying to achieve them. A large proportion of current climate and energy policies also contribute to the reduction of GHG emissions in the longer term. For example, buildings have long lifetimes, and therefore, the regulations for the energy efficiency of new and existing renovated buildings have long-lasting impacts. Also the improving possibilities for cycling and using public transportation increase CO_2 emissions from transport sector. Lithuania's renewable energy share, expressed in percentage of gross final energy consumption, was 25.46% in 2016, above its 2020 target of 23%. This good performance was driven mostly by the heating sector, where the share of renewables reached 46%, as opposed to a 39% renewables share anticipated for 2020 by Lithuania's National Renewable Energy Action Plan. This reflects a strong growth during the last five years in the deployment of biomass via new investment in district heating and cogeneration, also helping raise the renewables shares in electricity production.

Renewed National Energy Independence Strategy (NEIS), which was endorsed by Government on 29 November 2017 and will be approved by Parliament (Seimas), sets ambitious gross of the final RES energy consumption targets 45% until 2030 and 80% until 2050 and energy efficiency targets: to reduce primary and final energy intensity by 1.5 times till 2030 and 2.4 times till 2050, compare with 2017 level; to save 2,6-3 TWh energy in modernized multi-apartment and public buildings by 2020 and 5-6 TWh energy by 2030; in industry sector to reduce electricity consumption by 1 TWh till 2030.

Measures that promote investments in renewable energy and energy efficiency are the mostly contributed towards transition to low carbon development in all economy sectors in the longer term.

Furthermore waste recycling, the disposal of biodegradable waste on landfills can be expected to lead to permanent changes in current practices, and therefore to yield permanent emission reductions.

F-gases Regulation EU No 517/2014 implementation creates controls of fluorinated GHG and sets the opportunity to reduce emission reductions.

Macroeconomic, environmental, social impacts (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures

Based on data, provided in the Commission impact assessment accompanying "A policy framework for climate and energy in the period from 2020 up to 2030", implementation of Lithuania's GHG emissions reduction target will cost annually from 0.39% to 0.91% of GDP depending on the range of percentage of RES in final energy demand and energy efficiency improvement, at the same time it will allow to save from EUR 2.9 till 4.7 billion for the purchasing fossil fuels, in comparison with oil prices in 2014, in the period 2021-2030.

In 2015 Study for the evaluation of the effects, benefits and costs for Lithuania by implementing the EU climate and energy policy targets till 2030 under the identified the most cost efficient GHG emissions reduction scenario including the measures for both ETS and non-ETS sectors in Lithuania has led to the total costs to EUR 7 569 million, and would amount the reduction of GHG emissions by 1 382.7 kt CO_2 eq. in the period of 2021-2030. The following estimation are provided for the different economy sectors:

- **For electricity production sector** the total installed capacity of wind power plants in 2030 would make 1 000 MW with another 350 MW to be derived from biomass cogeneration plants. Total investments are planned for EUR 890 million. Total GHG emissions in electricity production sector in 2030 would be **116 644 t CO_2 eq**.
- **For heat production (DH) sector** 80% of heat energy would be generated from RES and municipal waste incineration. An overall need for bio-fuel boilers to be installed after 2020 would make 106 MW. Total investment sum is anticipated for EUR 37 million. Total GHG emissions in heat production (DH) sector in 2030 would be **526 084 t CO_2 eq**.
- **In transport sector** the main measures projected include the development of ecological driving skills and habits, and renewal of the available vehicle fleet. Introduction of both measures in the transport sector would result in more efficient fuel consumption. Total investments are planned for EUR 760 million. Total GHG emissions in transport sector in 2030 would be **4 865 029 t CO_2 eq.**
- **In industrial sector** it is foreseen that the final energy consumption in 2030 would make 910 ktoe (in 2005 it was 942.5 ktoe or was by 4% higher than expected in 2030), and an overall use of RES would amount to 15%. Total investments are planned for EUR 750 million. Total GHG emissions in industrial sector (excluding GHG emissions by industrial processes) in 2030 would be **1 056 252 t CO_2 eq.**
- **In services sector** it is projected that the final energy consumption in 2030 would be 630 ktoe (in 2005 it was 569.3 ktoe or was by 10% lower than planned for 2030), and a share of RES would make 10%. Total investments are planned for EUR 630 million. Total GHG emissions in services sector in 2030 would be **394 283 t CO_2 eq.**
- **In household** sector the final energy consumption for 2030 is anticipated to amount to 910 ktoe (in 2005 it was 1 386.3 ktoe or was by 52% higher than expected in 2030), and a share of RES would make 39%. Total investments are planned for EUR 4 180 million. Total GHG emissions in household sector in 2030 would be **268 373 t CO_2 eq**.
- **In agricultural** sector the implementation of numerous GHG emissions reduction measures is foreseen (in agronomy, cattle rearing, and biogas collection, and agrarian environment protection). Total investments are planned for EUR 132 million. Total GHG emissions in agricultural sector in 2030 would be **4 395 300 t CO_2 eq.**

– **For other sectors** no additional measures to reduce GHG emissions are planned.

All non-ETS sectors will have to duly contribute for the purpose of achieving the GHG emissions targets. Moreover, the most GHG emissions reduction-efficient sectors have been identified: transport and agricultural sectors. Eco driving is considered the most effective measure for GHG emissions reduction in transport sector with the effectiveness of the reduced GHG emissions totalling in 9.2 EUR/tCO_2/year. The most effective measure for GHG emissions reduction in agriculture would be the construction of biogas plants with the effectiveness of the reduced GHG emissions totalling in nearly 59.6 EUR/tCO_2/year.

Implementation of this scenario would also lead to reaching an advantageous effect from the social standpoint, which would be reflected in the creation of new 550 jobs due to use of RES and 1 000 jobs due to implementation additional measures in transport sector. In the period of 2021-2030 EUR 40.5 million might be received from labour taxes and reduced amount of fossil fuel by 190 ktoe in transport, which would allow to save EUR 752 million for the oil import. Reduced amount of GHG emissions at the same time would lower air pollutants influencing health benefits. Reduction of a share of fossil fuel in the import balance would enable extra savings thus making the investments into the proposed scenario more attractive and also achieving an optimal level of GHG emissions reduction.

4.10 Policies and measures no longer in place

During the reporting period most of the policies and measures from the previous were continued without major changes. On the other hand some documents, legal acts expired due to the target dates. As a rule, some policy documents, strategies, legal acts were replaced with the new versions, which generally apply similar measures. Overview of some major documents expired and replaced during the reporting period is given below in table.

Table 4-12. Changes in policies reported in Sixth National Communication report

Policy document reported in Sixth National Communication report	Status
Long-term Economic Development Strategy of Lithuania until 2015	Expired.
The EU structural assistance for 2007-2013	The structural assistance for 2014-2020 is different from the previous ones as the support under business instruments are exclusively granted to small and medium-sized business. In 2014-2020, more of the EU structural support is granted through financial instruments rather than subsidies. In 2014-2020, the support for small and medium-sized business focused on the promotion of entrepreneurship, the enhancement of productivity and export (including also private tourism support initiatives) as well as the introduction of eco-innovation.
ENERGY	
Joint implementation projects in the period of 2008-2012.	There were implemented 11 Joint implementation projects related to GHG emissions reduction in electricity sector (10 wind power parks, 1 landfill biogas use for heat and electricity production) and the estimated GHG emissions reduction during whole period is 864 kt CO_2. http://ji.unfccc.int/JI_Parties/DB/U1TUO9IG05C2669GVJJECR9DQM8MZB/viewDFP
The National Energy Independence Strategy, adopted on 26 June 2012 by the Parliament of the Republic of	Renewed National Energy Independence Strategy endorsed by the Government on 29 November 2017. It's planned that strategy will be adopted by Parliament in the end of 2017.

Lithuania	
Modernization of apartment buildings and municipal buildings until 2013	"Promotion of modernization of apartment buildings and municipal buildings" financed by the European Regional Development Fund in the framework of the Priority Implementation Measure of the European Union Funds Investment Action Program for the period 2014-2020.
The Law on Use of Renewable Energy Source 2011	The Law on Use of Renewable Energy Source updated in 1 of November, 2017.
INDUSTRIAL PROCESSES	
Regulation of Fluorinated Greenhouse Gases (Regulation (EC) No 842/2006)	On 1st of January 2015 Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 was adopted. The Ministry of Environment of the Republic of Lithuania has updated the existing national legislation in the area of fluorinated greenhouse gases ensuring the implementation of the requirements of the Regulation (EU) No 517/2014.
AGRICULTURE	
Rural Development Program for 2007-2013	The Lithuanian Rural Development Programme (RDP) has been formally adopted by the European Commission on 13 February, 2015 and last modified on 28 August, 2017. It outlines Lithuania's priorities for using EUR 1.9 billion of public money that is available for the period 2014-2020 (EUR 1.6 billion from the EU budget and EUR 0.3 billion of national funding). The programme will give priority to projects featuring innovation and environmental benefits. Renewed Rural Development Program 2014-2020.
WASTE	
The National Strategic Waste Management Plan for 2007-2013	The National Strategic Waste Management Plan 2007-2013 was replaced in April 2014 with the National Waste Management Plan for 2014-2020 by Resolution No 519 of the Government Republic of Lithuania (the latest amendment in June 2016). The targets, directly related to minimisation of GHG emissions in waste sector remains the same, however, stricter measures are set in order to reach those targets.

4.11 Improvement of the national system of PaMs and projections

The improvement and further development of the national system on reporting of PaMs and projections were implemented within the framework of the Norway Grants partnership project **"Cooperation on GHG inventory and projections development**" between Lithuania and Norway under the programme No 25 „Capacity-building and institutional cooperation between beneficiary state and Norwegian public institutions, local and regional authorities". The partner of this programme was Norwegian Environment Agency, which is the national entity responsible for development of climate and environmental policy in Norway.

The objective of this partnership project was capacity building and improvement of Lithuania's national system for the preparation of the GHG inventory and projections to comply with the relevant the EU, the UNFCCC and the Kyoto Protocol reporting requirements.

Project participants exchanged experience in the preparation of the GHG emission projections with the Norwegian colleagues and the study on assessment of Lithuania's national GHG projections reporting system and Methodological guidance for the preparation of national greenhouse gas emission projections in different economy sectors has been developed. During the project the assistance from the Norwegian

experts in improving of the national system for the reporting on GHG emission projections as well as proposals on fulfilment of the relevant the EU and the UNFCCC reporting requirements on GHG emission projections were received. Evaluation and implementation of the recommendations on the national system improvement ensure the quality of GHG emission projections report and its compliance with the relevant requirements. Project activities were implemented during the period 2015-2016 and were finalized by 1st of January 2017.

The exchange of experience in the preparation of the GHG emission projections with Latvian and Estonian colleagues and increase the quality of GHG inventory reports and projections through knowledge and experience sharing was initiated through the project **„Baltic Expert Network for Greenhouse Gas Inventory, Projections and PaMs Reporting (BENGGI)“,** which was implemented during the years 2016-2017. Baltic countries share similar natural, economic, social and political conditions that influence GHG projections calculations and reporting procedures. The goal of the Project is to establish a network between Baltic state GHG inventory and projections experts in order to improve the national system for preparing, analysing and reporting high quality information to the GHG inventory, policies, measures and projections and to comply with the relevant UNFCCC and Kyoto protocol reporting requirements. Networking allows acquiring necessary knowledge and sharing experience between experts.

The European Commission has launched a voluntary **project to assist Member States in developing and improving national GHG projections.** The project was led by the contractor ICF, with the support of Aether, E4SMA, and IIASA. The project aimed at providing technical assistance and capacity building support to selected 10 Member States with identified potential for improving their projections as required under the MMR. Initial analysis has indicated that Lithuania may benefit from technical support for agriculture, LULUCF, waste sectors from the project team. This technical support was implemented through workshop, technical exchange between MS experts and experts of the project team. MS receiving support include Bulgaria, Croatia, Cyprus, Hungary, Lithuania, Malta and Romania. Project activities were implemented during the period 2016-2017 and were finalized by September 2017.

4.12 Information on minimization of adverse effects

Under Article 3.14 of the Kyoto Protocol and UNFCCC Decision 31/CMP.1, Annex I Parties shall provide information on how they are striving to implement their commitment while minimizing adverse social, environmental and economic impacts on developing country parties.

Since 2004 Lithuania is a Member State of the EU and, as such, designs and implements most of its policies in the framework of EC directives, regulations, decisions, and recommendations. In this context, the minimization of adverse impacts on developing countries is also largely dictated by the European Union's policy on climate change and by its policies and programmes affecting developing countries. Regulation at the European level also controls or influences market conditions, fiscal incentives, tax and duty exemptions and subsidies in all economic sectors in EU Member States. Lithuania strives to design climate change policies and measures in a way as to ensure a balanced distribution of mitigation efforts by implementing climate change response measures in all sectors and for different gases.

The impact assessment of new policy initiatives has been established in the European Union, which allows their potential adverse social, environmental and economic impacts on various stakeholders, including developing country Parties, to be identified and limited at an early stage within the legislative process. Impact Assessment Guidelines specifically address impacts on third countries and also issues related to international relations. This provides a framework in which Member States like Lithuania can also ensure a high level of protection of the environment and contribute to the integration of environmental considerations into the preparation and adoption of specified plans and programmes with a view to promoting sustainable development.

The European Union actively undertakes a large number of activities bringing positive impacts on third countries and their ability to tackle climate change, specifically through capacity building and technology transfer activities. Chapter 7 provides information on Lithuania's participation and support of programmes which aim to minimize adverse effects of climate change on developing countries.

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PROJECTIONS

5 PROJECTIONS

5.1 Greenhouse gas emissions projections

This chapter provides information of future trends in GHG emissions and removals in Lithuania, given current national circumstances and adopted and implemented policies and measures described in Chapter 4.

Projections of GHG emissions have been calculated according to Methodological guidance for the preparation of national GHG emission projections, prepared in 2016 by Lithuanian energy institute. The Methodological guidance for the preparation of GHG emission projections is based on an integrated approach to the long-term development of the economic sectors, with account of the EU climate change and energy objectives by 2030 and targets by 2050, and also on the existing situation and possibilities.

Only activate existing measures allowed the modelling of scenarios 'with existing measures' (WEM) related to climate change mitigation. Activating the planned measures also allowed modelling scenarios 'with additional measures' (WAM) (along with existing measures) related to climate change mitigation.

Projections as well as policies and measures in Chapter 4 are divided into the following reporting categories: energy, industrial processes, agriculture, land use, land use change and forestry (LULUCF) and waste.

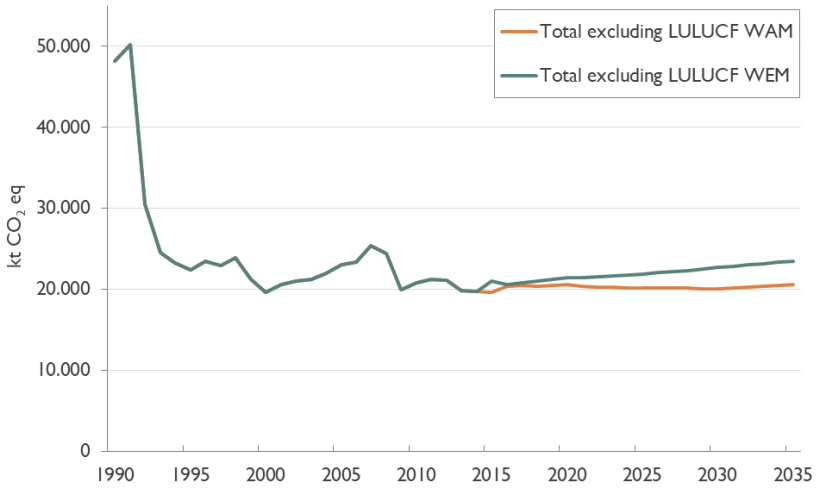

Figure 5-1. Aggregated projected GHG emissions by 2035, kt CO_2 eq.

Table 5-1. Projected GHG emissions in case of WEM scenario, kt CO_2 eq.

Sector	2015	2020	2025	2030	2035
Energy	11 050	11 758	12 109	12 872	13 582
IPPU	3 455	3 945	3 781	3 743	3 738
Agriculture	4 664	4 989	5 044	5 093	5 160
LULUCF	-7 937	-7 954	-7 972	-7 990	-8 006
Waste	1 009	638	491	427	430
Total excl. LULUCF	20 178	21 330	21 425	22 136	22 910
Total incl. LULUCF	12 241	13 376	13 453	14 147	14 904

Table 5-2. Projected GHG emissions in case of WAM scenario, kt CO_2 eq.

Sector	2015	2020	2025	2030	2035
Energy	10 636	9 306	8 928	8 734	8 934
IPPU	3 455	3 945	3 781	3 743	3 738
Agriculture	4 664	4 989	5 044	5 093	5 160
LULUCF	-8 485	-8 653	-8 821	-8 989	-9 157
Waste	1 009	634	470	374	336
Total excl. LULUCF	19 764	18 875	18 223	17 945	18 167
Total incl. LULUCF	11 279	10 222	9 402	8 956	9 011

Implementation of the additional measures would lead to reaching an advantageous effect from the social standpoint, which would be reflected in the creation of new jobs, improvement of life quality, competitiveness, saving financial resources for the purchasing of imported fossil fuel. GHG emissions projection suggests that an increasing demand in energy will result in increasing GHG emissions. Although, existing measures will lessen this increase, the implementation of additional measures could result in lower GHG emissions in 2035 if compared between WAM and WEM scenarios.

5.1.1 Energy

Lithuanian energy institute performed Lithuanian energy sector development analysis in 2014. The main assumptions of this scenario is that the implementation of main energy efficiency initiatives, use of RES, increase in use of co-generation of heat and electricity.

The main scenario assumes successful implementation of mentioned measures would result that final energy consumption in industry would increase by 0.9% up to 2030 and by 0.7% after the year 2030. Same tendencies were applied for construction sector. Energy consumption in residential sector would increase by 0.7% yearly up to 2035. In Commercial/Institutional sector the increase would result in a yearly 0.9% up to 2030 and 0.7% up to 2035. Agricultural, forestry and fisheries sectors final energy consumption would remain the same as in 2015. Fuel demand for house heating will decline due to the increased fuel efficiency, renovation of residential and public buildings and modernization of heating systems and combustion equipment.

According to the Lithuanian energy sector development analysis in average electricity demand will increase 2.0% up to 2030 and thereafter 1.5% up to 2035 and would reach a total of 13 545 GWh by 2035, which may influence slight increase of GHG emissions in energy sector.

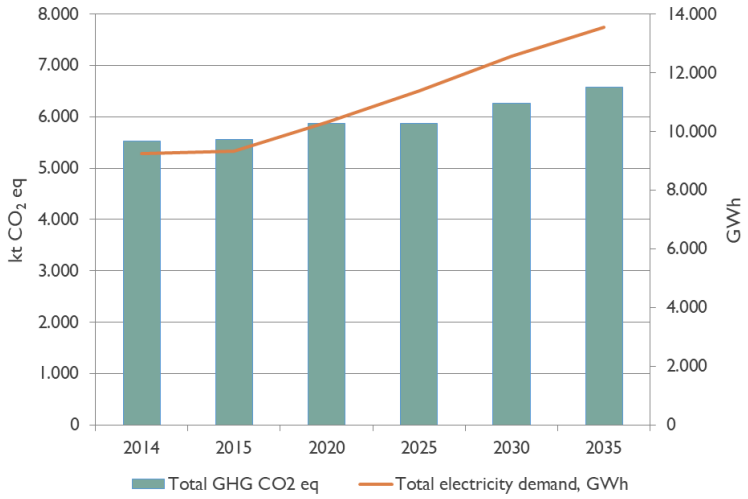

Figure 5-2. Projected total electricity demand and GHG emissions in Energy sector (without transport sector)

It is estimated that the Public electricity and heat production, Manufacture of solid fuels and Residential sectors will remain the main sources of GHG emissions in energy sector.

Historical and projected GHG emissions 1990-2035 from energy subsectors, kt CO_2 eq. (excluding transport sector)

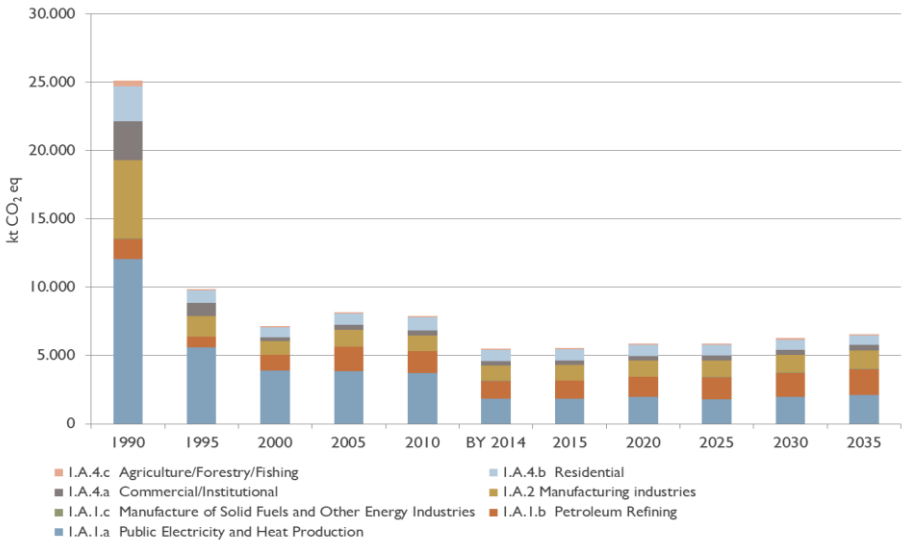

Figure 5-3. Historical and projected GHG emissions, kt CO_2 eq. (excluding transport sector)

Compared to 2014 the GHG emissions will overall increase in all sectors except in Residential sector were buildings renovation program is currently taking place. It was estimated that increased energy consumption efficiency and use of biomass will decrease the use of fossil fuel and final energy consumption by 13.7% in 2035 which will lead to decrease in GHG emissions in this sector.

In energy sector GHG emissions are estimated to reach a total of 6 574.3 kt CO_2 eq. in 2035. Most of the GHG will originate from Public electricity (31.9%), Petroleum refining (29.2%) and Manufacturing

industries (20.2%). Manufacture of solid fuels and other energy industries and Agriculture/Forestry/Fishing sectors are still expected to remain the smallest GHG emissions of energy subsectors.

The biggest potential for reducing GHG emissions is expected in the EU ETS sectors and mainly the public electricity and heat production sector. These sectors are currently undergoing a trend of switching fossil fuel to use of biomass. Same trends are seen in other energy and industry sectors. This change is mainly caused by the increase of the EU ETS carbon price which according to the Commission recommended parameters will increase up to 42 EUR/tonne CO_2 eq. in 2035. For scenario with existing national and EU policies and measures of GHG emissions projections it was assumed that the EU ETS carbon price will remain at the same level as in 2014 (6.37 EUR/tonne CO_2 eq.).

Methodologies and key assumptions

Energy sector constitute of six main subsectors (*Energy Industries, Manufacturing Industries, Transport, Other sectors, Fugitive emissions from fuels and other*) from which GHG emissions are projected. GHG emissions projections from transport sector will be reported separately in the chapter.

5.1.2 Transport

Road transport sector is the main source of GHG emissions (approximately 92% of total transport sector emissions) and fuel consumer in transport sector. It was assumed that GHG emissions in road transport sector are directly linked with fuel consumption which is influenced by the numbers of cars registered in Lithuania. The total number of cars registered in Lithuania was linearly interpolated according to historic data from 2005 to 2014 available from the State Enterprise "Regitra". It was projected that the total number of cars (including passenger cars, light and heavy duty vehicles and motorcycles) will reach 1 917 113 units in 2035. Projected number of vehicles registered and GHG emissions in road transport sector provided in figure 5-4 below.

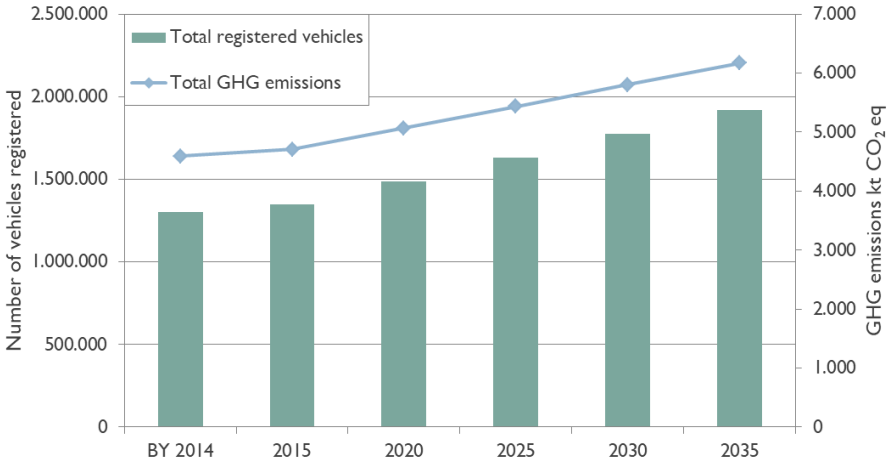

Figure 5-4. Projected number of vehicles registered and GHG emissions in road transport sector

Road transport sector is projected to remain the main gasoline and diesel oil consumption source in transport sector. According to the projected data the gasoline and diesel oil consumption in this sector will increase accordingly by 71% and 14% by 2035.

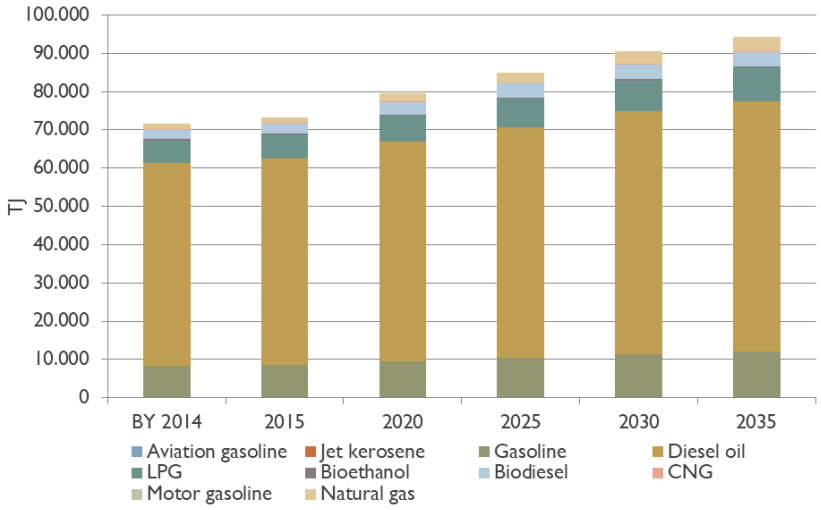

Figure 5-5. Projected fuel consumption and GHG emissions in road transport sector

According to the projected data on number of the registered vehicles in Lithuania the fuel consumption in road transport would increase from 65 721 TJ in 2014 to 88 848 TJ in 2035.

With existing national and the EU policies and measures GHG emissions from transport sector are projected to increase up to 6 710.1 kt CO_2 eq. in 2035. Compared to 2014 the GHG emissions from this sector will increase 1.38 times. The increase of GHG is mostly stipulated because of the increased use of fossil fuel in road transport and transportation in pipelines due to increased need of natural gas.

Figure 5-6. Projected total GHG emissions in transport sector

The main GHG emissions source in transport sector will remain road transport sector followed by transportation in pipelines sector. In civil aviation subsector it is estimated that the GHG emissions would increase 2.24 times, but this sector will remain a minor source of GHG emissions as there are only 10 aircraft operators that have valid licence issued to perform air communication in Lithuania. Most of the flights performed by the Lithuanian aircraft operators are international.

Railways sector is projected to emit less amounts of GHG in 2035 (141.7 kt CO_2 eq. and decreased 27% compared to 2014). This is due to the fact that the fuel consumption in railways would decrease 25.69% and an increase in use of biodiesel in this sector.

Transport sector is less affected by the EU ETS carbon price as in current situation only aviation sector is involved in the EU ETS market. In Lithuania there are several aircraft operators that fall under the scope of the EU ETS and according to the latest data from EUROCONTROL only one aircraft operator was not considered as small emitter in 2015 (emitted more than 55 493 t CO_2 per year).

Methodologies and key assumptions

The projections were carried out by firstly determining the consumption of each fuel type in every subsector (Civil aviation, Road transportation, Railways, Water-borne navigation, other transportation) up to the year 2035. As the GHG emissions are directly linked to the fuel consumption through specific fuel emission factors, knowing the fuel consumption during the specific time period would enable simplified calculation of the GHG emissions.

5.1.3 Industrial processes and product use

The GHG emissions projections from industrial processes and product use with existing policies and measures were estimated using projected production levels data (activity data) by 2035 provided by the main emitters in this sector: clinker, lime, glass, ammonia and nitric acid producing companies. Emissions from these industries covered up about 83% of total industrial processes and product use sector emissions in 2014.

The GHG emissions in industry sector are determined by technology processes and notable emission reduction per production output is hardly possible. Therefore, it is expected that GHG emissions will grow together with increasing industrial production. The projected emissions from industrial processes and product use are presented in figure below:

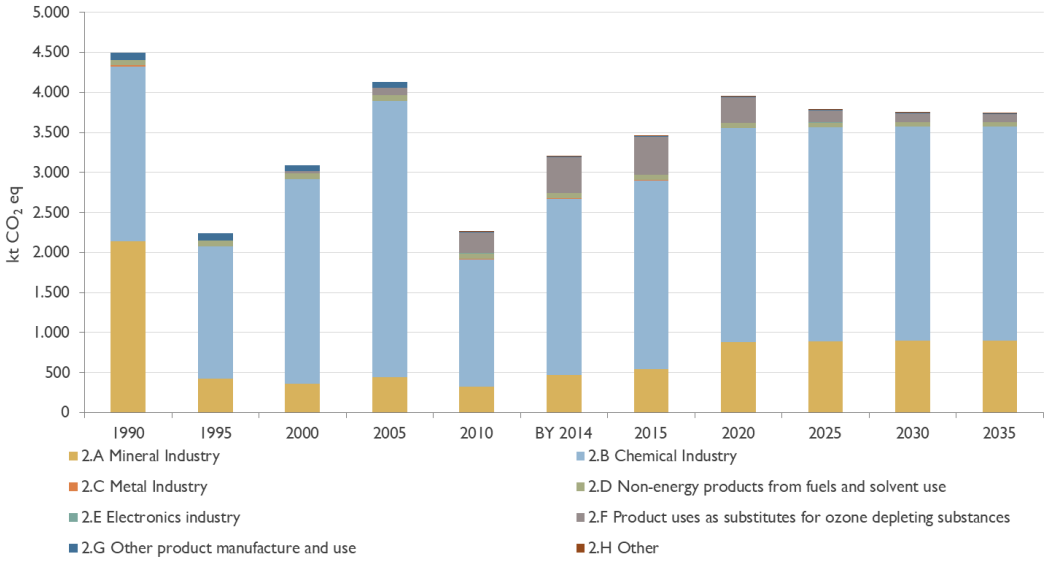

Figure 5-7. Historical and projected GHG emissions in industrial processes and product use sector

The main GHG emissions source in industrial processes and product use sector remains nitric acid and ammonia production. Based on data from chemicals company the GHG emissions trends will remain stable in a period of 2020-2035 due to constant production capacity.

The projections on of F-gases emissions for most sub-categories were based on 1990-2014 emissions trend taking into account growth rates for the different sectors and by including relevant technological improvements and taking into account the impacts of the F-gases Regulation (EU) No 517/2014 implementation (introduced restrictions/controls of the use and introduction of quotas for placing on the market hydrofluorocarbons).

Emissions from domestic refrigeration equipment are expected to decline in 2020-2035 due to EU wide measures and technical changes resulting in decreased leakage. Due to the ban on HFCs with GWP of 2 500 and more to service or maintain refrigeration equipment in domestic refrigerators and freezers the use of (and thus emissions from) HFCs in domestic refrigeration will be phased out gradually and that mainly emissions from disposal will occur. Implementation of F-gases quota system will reduce amount of HFCs placed on the market by 79% between 2015 and 2030. Taking into account these assumptions, it is predicted that in 2035 emissions from commercial and industrial refrigeration sectors will account only 11% compared to F-gases emissions in these sectors in 2015. The emissions from mobile air-conditioning will decrease also taking into account implementation of EU MAC Directive, which prohibits the use of F-gases with GWP of more than 150 in new types of cars and vans introduced from 2011, and in all new cars and vans produced from 2017. Emissions from foam blowing are expected to decrease due to reduced use and emissions from metered dose inhalers will decline due to decrease of population.

Methodology and key assumptions

The GHG emissions projections from industrial processes and product use with existing measures were estimated using projected production levels data (activity data) by 2035 provided by the main emitters in this sector: clinker, lime, glass, ammonia and nitric acid producing companies. The projections of GHG emissions were estimated by applying emission factors taken from Methodological guidance for the preparation of national GHG emission projections prepared by Lithuanian Energy Institute in 2016.

5.1.4 Agriculture

Projections of GHG emissions from agriculture sector with existing policies and measures (WEM) are based on forecasted livestock population, main harvested crops and area harvested, the amount of sold limestone materials, consumption of inorganic N fertilizers and application of urea.

Livestock populations

It is projected that dairy cattle population will decrease by 22% from 315 thousand heads in 2014 to 236 thousand heads in 2030. This decrease is mainly associated with increasing productivity (increase in milk yield).

Population of non-dairy cattle will be constantly increasing: from 2014 to 2015 by 4%; during the period 2015-2020 by 20%, and from 2020 to 2030 – 16%. For the period 2031-2035 average annual growth of 1.5% was applied (1.5% increase represents average non-dairy cattle population increase during the period 2025-2030 each year).

Population of swine will be decreasing during the whole period. Swine population from the base year (2014) until 2020 will decrease by 14%. From 2020 to 2030 swine population will decrease by 1%. It is projected that poultry population will increase about 5% from 2020 to 2030.

Taking into account livestock population developments, it is projected that CH_4 emissions from enteric fermentation during the 2015-2035 period will increase about 5%. Slight decrease of CH_4 emissions from enteric fermentation can be seen from the base year (2014) to 2020. It is projected that emissions from enteric fermentation could decrease 1.2% in 2020 compared to the base year. The share of CH_4 emissions from livestock enteric fermentation generated by different livestock categories is presented below.

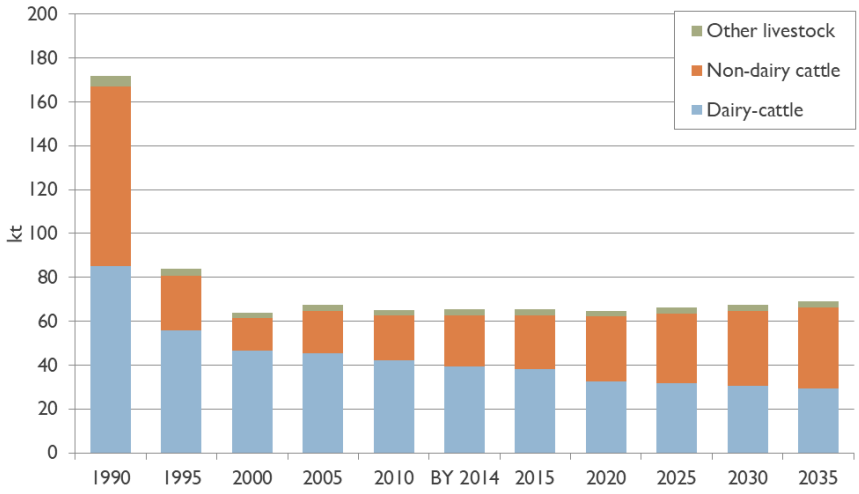

Figure 5-8. Historical and projected CH_4 emissions from enteric fermentation

In the base year (2014) the majority of these emissions comprised from dairy cattle enteric fermentation – 60%. It is projected that the share of non-dairy cattle CH_4 emissions from enteric fermentation will be increasing from 36% in 2015 to 53% in 2035.

It is projected that CH_4 emissions from manure management during the 2015-2035 period will vary slightly. Decrease of CH_4 emissions from manure management can be by 7% in 2020 compared to 2014. From 2020 to 2030 it is projected that CH_4 emissions will increase by 4% and by 2% in 2035. Historical and projected CH_4 emissions from manure management are presented below.

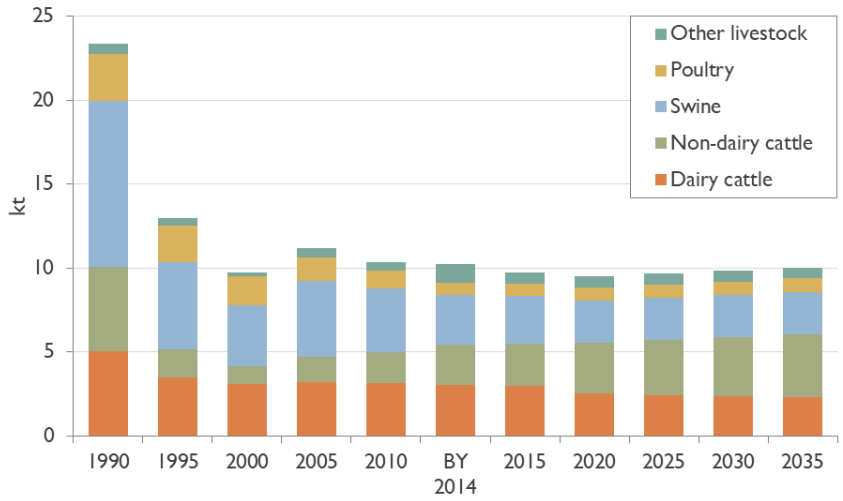

Figure 5-9. Historical and projected CH_4 emissions from manure management

It is projected that total direct and indirect N_2O emissions from manure management will increase by 2% in 2020 compared with the base year (2014). From 2020 to 2035 emissions will increase by 3.2%. Historical and projected direct and indirect N_2O emissions from manure management generated by different livestock categories is presented below:

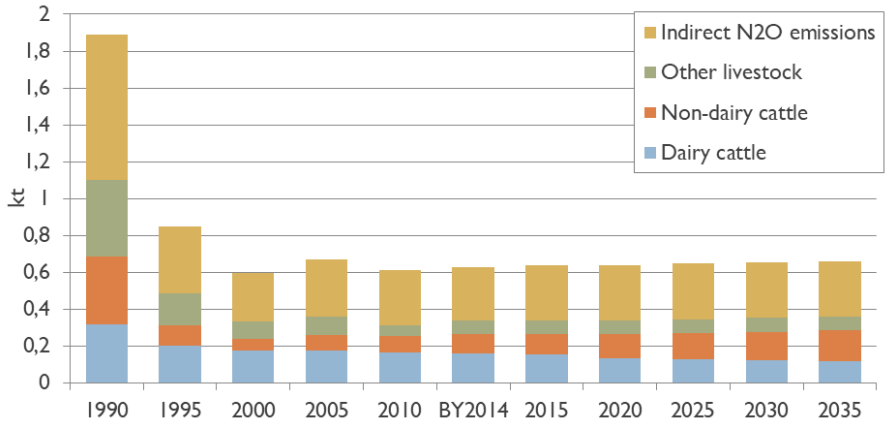

Figure 5-10. Historical and projected direct and indirect N_2O emissions from manure management

Crop residues projections

It is projected that crop yield will be increasing by reducing crops cultivation in less fertile areas and implementing intensive growth technologies in specialized more efficient (fertile) soil farms. Crop yield will be also increasing due to concentration of farms in the lands of middle Lithuania, the rise of farming culture, implementation of new technologies and best practice of the EU. The projected activity data of harvested crops and area of crops harvested for the year 2020 and 2030 presented below in the table:

Table 5-3. Projected amount of crops harvested and area harvested

Activity data	2014	2015	2020	2025	2030	2035
Harvested crops (thous. tonnes)						

Wheat	1 708	2 890	4 542	4 576	4 611	4 646
Triticale	395	434	528	532	536	541
Barley	1 019	912	897	904	911	918
Rye	85	118	168	169	171	172
Oats	184	256	365	368	371	373
Rape	286	362	460	465	470	475
Peas	101	213	357	375	393	412
Beans	63	137	233	245	256	268
Sugar beet	1 014	897	850	855	860	860
Potatoes	469	434	255	258	260	262
Vegetables	275	267	275	280	285	290
Area harvested (thous. ha)						
Wheat	355	615	884	893	902	911
Triticale	120	111	103	104	105	106
Barley	267	220	175	176	178	180
Rye	38	35	33	33	33	34
Oats	76	73	71	72	73	73
Rape	104	129	155	156	158	160
Peas	41	98	156	158	159	161
Beans	22	45	70	71	71	72
Sugar beet	17	17	17	17	18	18
Potatoes	27	25	18	18	18	18
Vegetables	12	12	12	13	13	13

Increase of direct and indirect N_2O emissions from agricultural soils by 5.7% from 2014 to 2015 and by 13% from 2015 to 2020. From 2020 to 2035 the expected increase in N_2O emissions from agricultural soils is about 0.7% every 5 years.

The share of the total N_2O emissions from agricultural soils categories is presented below:

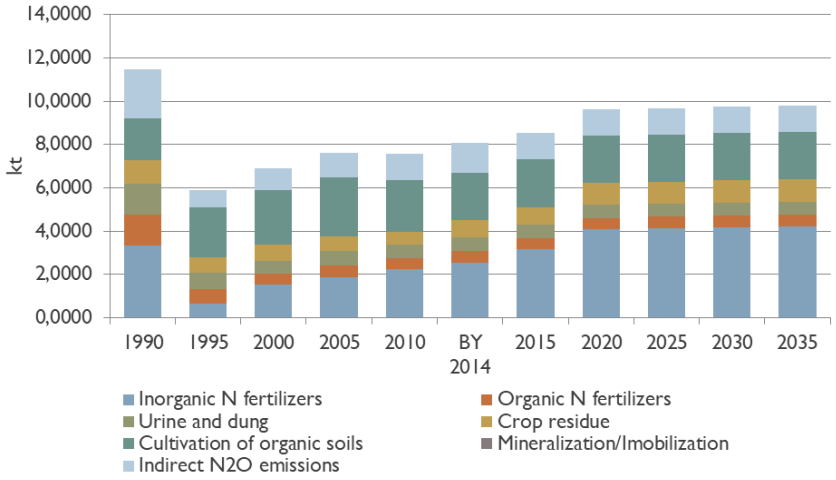

Figure 5-11. Historical and projected emissions from agricultural soils categories

Inorganic N fertilizers projections

Projections of inorganic N fertilizers consumption was based on the projected harvest of the crops.

Consumption of inorganic N fertilizers will be increasing during the projected period. The biggest increase is expected in 2014-2020 period where inorganic N fertilizers consumption will increase 60%. Afterwards slight increase in inorganic N fertilizers consumption is projected. The increase of inorganic

N fertilizers consumption is strongly related with increase in crop yield. Urea application projection is related to the projection of inorganic N fertilizers (estimated as average (2010-2014) percentage of urea in total amount of inorganic N fertilizers).

Table 5-4. Projected amount of inorganic N fertilizers consumption, kt N

Activity data	2015	2020	2025	2030	2035
Inorganic N fertilizers	201	260	262	265	267
Urea application	28	36	36	37	37

It is projected that emissions from urea application will increase 1.7 times in 2020. From 2020 CO_2 emissions from urea application will increase slightly by 1% in every 5 years.

Liming materials projections

Consumption of limestone and dolomite will be increasing during 2014-2035 period. Due to currently about 66.5% of soils are acidic, consumption of limestone and dolomite will increase by 28% and 48%, respectively in 2035 compared to the base year (2014).

Table 5-5. Projected amount of limestone and dolomite consumption, tonnes

Activity data	2015	2020	2025	2030	2035
Limestone	73 798	99 738	88 547	66 022	66 283
Dolomite	4 991	5 859	5 964	6 084	6 223

It is projected that CO_2 emissions from liming will increase 1.7 times by 2020 compared to the base year (2014) as more than half of soils in Lithuania are acidic. After 2020 CO_2 emissions from liming will decrease by 10% and by 24% in 2030, a slight increase (0.6%) of CO_2 emissions in 2035 could be observed.

Aggregated emissions

Total GHG emissions from agriculture sector will increase by 3.1% from 2014 to 2015 and will increase afterwards – by 7% from 2015 to 2020, by 1% in 2025 and 2030, and by 1.3% in 2035. The largest source of GHG emissions is agricultural soils, particularly direct soils emissions. The figure below represents GHG emissions trend during the historical and projected period, covering 35 years.

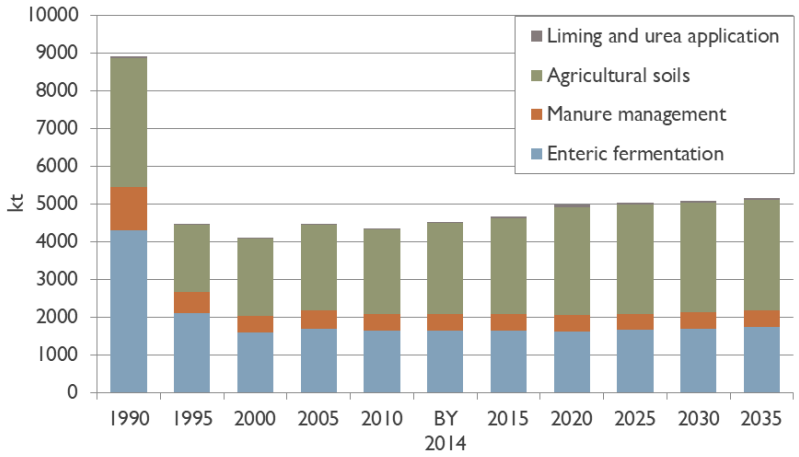

Figure 5-12. Historical and projected GHG emissions from agriculture sector by categories

No additional measures were identified for agriculture sector.

Methodology and key assumptions

Projections of GHG emissions from agriculture sector with existing measures (WEM) are based on forecasted livestock population, main harvested crops and area harvested, the amount of sold limestone materials, consumption of inorganic N fertilizers and application of urea. Forecast of the main data are provided by the Ministry of Agriculture (MoA), Environmental Protection Agency (EPA) and main companies that sell liming products.

5.1.5 LULUCF

About 33.8% (33.5% according to State Forest Cadaster) of Lithuania's land area is covered by forests, 32.8% cropland, 22.6% grassland, 5.2% by wetlands, 5.4% is attributed to settlements. Forest land area should reach 34.2% of the total country area in 2020 as determined in the National Forestry Development Programme for 2012-2020. Due to the implementation of measures for afforestation/reforestation activities, listed in National Forestry Development Programme for 2012-2020 and Interinstitutional action plan on the implementation of the Goals and Objectives of the Strategy for the National Climate Change Management Policy, which contains LULUCF action plan measures under the LULUCF decision No 529/2013/EU, land conversion to forest land will remain as determined in the most recent years of inventory, therefore total forest land area should not increase more than approximately 0.8 thousand ha annually. Felling rates will remain constant and similar as in current situation – 7.3 million m^3 (2010-2014 year data). The full potential of harvesting is not exploited in Lithuania. There could be approximately 9.5 million m^3 harvested each year, however at the moment full harvest potential is not promoted by any specific measures in Lithuania, therefore removals in harvested wood product pool should remain constant as reported in 2014. Current cropland and grassland trend shows that with support from the Rural Development Program (RDP) in agriculture, both crop production and livestock farming are equally important, what means that cropland and grassland will remain constant, as well as share between conversions among these two land use categories. LULUCF sector is expected to act as a net sink until 2035 according to the projections, the main sink remaining forest land (GHG removals in biomass) with projected stable carbon sink in harvested wood products and grassland mineral soils (in the event of conversions from cropland to grassland). The main sources of GHG emissions in LULUCF sector is cropland category, especially emissions from mineral soils after conversion to arable land, and wetlands category, emissions mainly from peat extraction sites. GHG emissions from cropland and wetlands are projected to remain similar as in 2014: 4 385 kt CO_2 eq. and 892 kt CO_2 eq. respectively. It is expected that approximately 8 000 kt CO_2 eq. could be removed in LULUCF sector annually, sector's GHG removals are not projected to increase with the existing measures comparing to the GHG removals in 2014. The impact of implementation of 2013 Wetlands Supplement on emissions and removals from all key categories under WEM scenario was also calculated, assuming that area of drained organic soils in forest land, cropland and grassland will remain stable for the entire projection period. The implementation of 2013 Wetlands Supplement results in significant decrease of total projected GHG emissions under WEM scenario, average annual GHG removals in LULUCF sector key categories will comprise only half of the removals without implementation of Wetlands Supplement – 4 669 kt CO_2 eq.

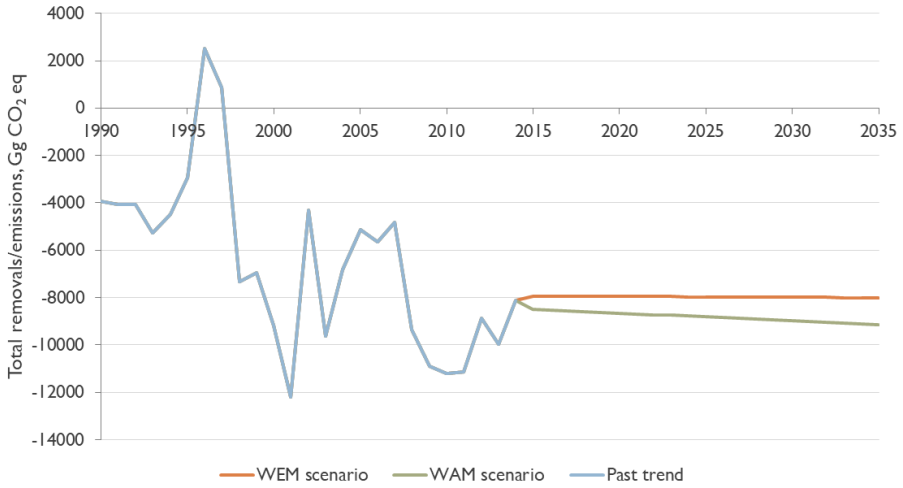

Figure 5-13. Overall historical (1990-2015) and projected (2016-2035) GHG emissions and removals from LULUCF sector

5.1.6 Waste management

Projected amount of generated municipal solid and biodegradable waste (MSW) for period 2015-2020 is provided in the National Waste Management Plan for 2014-2020. The projections on industrial biodegradable and sewage sludge generation are provided for the period 2015-2035 by the Ministry of the Environment. Municipal solid waste and biodegradable MSW generation during the period 2021-2035 was calculated following the increase during the period 2015-2020. Results are shown in the figure 5-14 below.

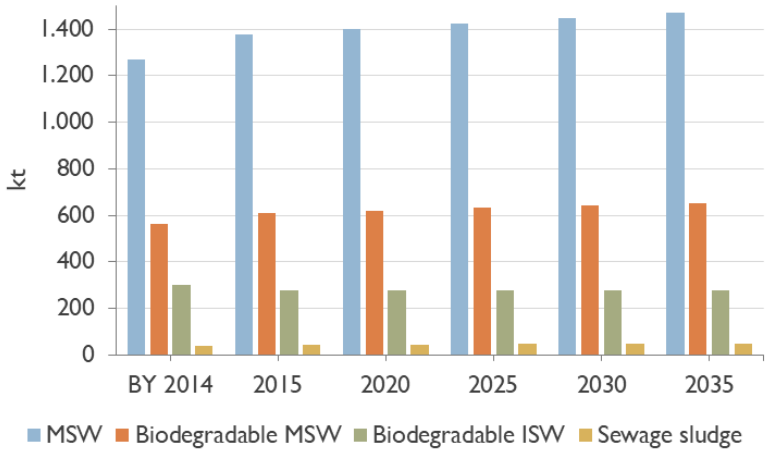

Figure 5-14. Projected amount of generated waste

GHG emissions projections are provided in four subsectors: disposal in landfills, composting, incineration of waste and wastewater treatment and discharge. Compared with 2014 emissions from waste sector will decrease by 57% in 2025 and by 62% in 2035. Historical and projected GHG emissions from waste sector are presented in figure 5-15 below.

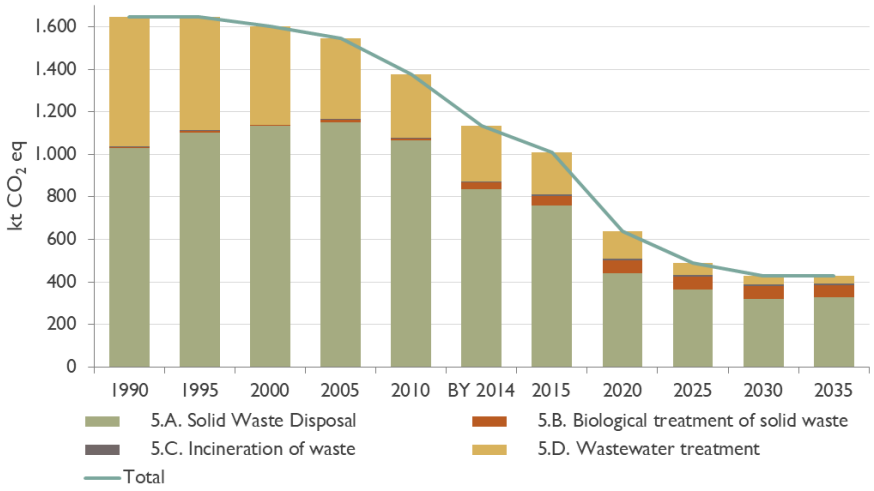

Figure 5-15. Historical and projected GHG emissions from waste sector

Methodologies and key assumptions

Projections of GHG emissions from waste sector with existing measures are based on the National Waste Management Plan for 2014-2020, data provided by the Ministry of Environment, the Environmental Protection Agency and the Regional Waste Management Centres. Projections with additional measures are based on the 2015 Circular Economy Package.

5.2 Assessment of aggregate effects of policies and measures

As an European Union Member State, Lithuania is subject to EU climate policy and thus it applies EU Common and Coordinated Policies and Measures relevant to climate change. Lithuania believes that country's policies and measures modifying long term trends in anthropogenic GHG emissions and removals consist with the objective of the Convention.

Moreover, GHG emissions are inseparable from the long-term development analysis of the economic sectors that meet human needs. GHG emissions projection suggests that an increasing demand in energy will result increasing of GHG emissions. Existing measures will lessen this increase. Total historic and projected GHG emissions in Lithuania are presented in table:

Table 5-6. Actual and projected GHG emissions in case of WEM scenario, kt CO_2 eq.

	2015	**2020**	**2025**	**2030**	**2035**
CO_2 emissions excl. net CO_2 from LULUCF	13 142	14 429	14 790	15 553	16 264
CO_2 emissions incl. net CO_2 from LULUCF	5 974	6 094	6 437	7 183	7 878
CH_4 emissions excl. net CH_4 from LULUCF	3 376	2 908	2 800	2 774	2821
CH_4 emissions incl. net CH_4 from LULUCF	3 377	2 911	2 803	2 777	2 824
N_2O emissions excl. net N_2O from LULUCF	3 094	3 670	3 681	3 697	3 717

N_2O emissions incl. net N_2O from LULUCF	3 555	4 047	4 059	4 074	4 094
HFCs	478	316	148	105	102
PFCs	NO	NO	NO	NO	NO
SF_6	5.54	5.98	5.98	5.98	5.98
NF_3	0.26	0.50	0.50	0.50	0.50
Total incl. LULUCF	13 391	13 376	13 453	14 146	14 904
Total excl. LULUCF	20 096	21 330	21 425	22 136	22 910

Since Sixth National Communication report Lithuania has improved its estimations for GHG projections calculations. National system on reporting projections were improved within the framework of several experience exchange projects (Chapter 4.11). In the following table difference between projections in Sixth and Seventh National Communication reports is shown:

Table 5-7. Changes in projections since Sixth National Communication report (WEM scenario), kt CO_2 eq.

Projections in Sixth National Communication report (using WEM scenario)					
Sector	**2015**	**2020**	**2025**	**2030**	**2035**
Energy	15 592	17 397	19 714	21 964	-
IPPU	6 452	6 936	6 396	6 396	-
Agriculture	6 753	7 369	7 500	7 638	-
Waste	2 667	3 179	3 100	3 058	-
LULUCF	-11 650	-12 000	-12 350	-12 500	-
Total excl. LULUCF	31 464	34 881	36 710	39 056	-
Total incl. LULUCF	19 814	22 881	24 360	26 556	-
Projections in Seventh National Communication report (using WEM scenario)					
Sector	**2015**	**2020**	**2025**	**2030**	**2035**
Energy	11 050	11 758	12 109	12 872	13 582
IPPU	3 396	3 945	3 781	3 743	3 738
Agriculture	4 600	4 989	5 044	5 093	5 160
Waste	1 042	638	491	427	430
LULUCF	-6 705	-7 954	-7 972	-7 990	-8 006
Total excl. LULUCF	20 096	21 330	21 425	22 136	22 910
Total incl. LULUCF	13 391	13 376	13 453	14 146	14 904

Human economic activities are among the key sources of GHG emissions. This is primarily linked with fuel combustion for energy production, but also other processes of human economic activities have a fairly great significance as well. Total projected emissions for year 2030 have decrease by 53% comparing projections in Sixth and Seventh National Communication reports. Noticeable changes are visible in all sectors – in Agriculture, LULUCF, Energy, Industry and Waste management. GHG projected emissions have decreased.

Based on data, provided in the Commission impact assessment accompanying a policy framework for climate and energy in the period from 2020 up to 2030, implementation of Lithuania' s GHG emissions reduction target will cost annually from 0.39% to 0.91% of GDP depending on the range of percentage of RES in final energy demand and EE improvement, at the same time it will allow to save from 2.9 till 4.7 billion EUR for the purchasing fossil fuels, in comparison with oil prices in 2014, in the period 2021-2030.

5.3 Sensitivity analysis

5.3.1 Energy sector

One of the main parameters used to project GHG emissions in Lithuania is annual growth of gross domestic product. It is well known that the growth and expansion of economic activities are directly linked to the consumption of fuel and therefore is influencing GHG emission trends. For the projections of the GHG emission, the annual GDP growth rate was assumed to be 3.5% up to year 2030 and 2.6% thereafter. These assumptions were based on the data provided in the Lithuanian energy sector development outlook analysis in relation to the EU's strategic energy initiatives performed by the Lithuanian Energy Institute in 2015[3] and data available from the Ministry of Finance of the Republic of Lithuania. Sensitivity analysis focused on GDP growth rate provided from parameters recommended by the European Commission in 2016. The GDP growth rate recommended for Lithuania is presented in Table 5-8.

Table 5-8. European Commission recommended annual real GDP growth rate in Lithuania

	Annual real GDP growth rate (in market prices)			
	2015-2020	**2020-2025**	**2025-2030**	**2030-2035**
EC recommended	2.8%	1.2%	0.2%	0.3%
Used for GHG projections	3.5%	3.5%	3.5%	2.6%

For the purpose of sensitivity analysis it was assumed that changes in GDP will most likely affect energy and industry sectors. Results of GDP sensitivity analysis are presented in Figure 4-50.

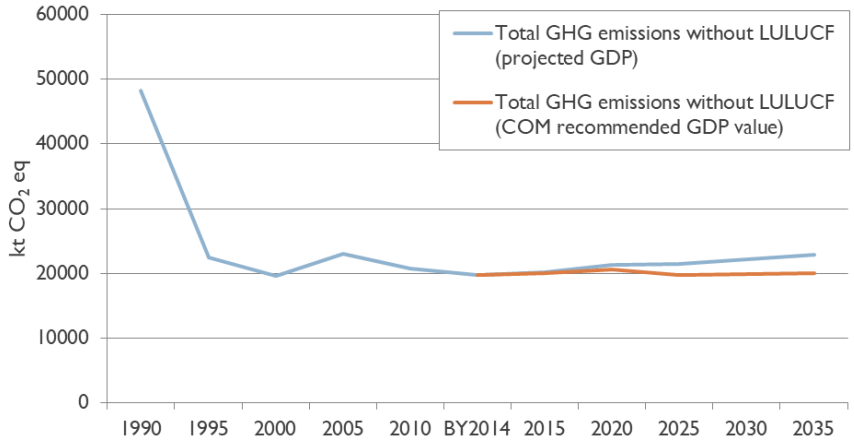

Figure 5-16. GDP sensitivity analysis for GHG emissions

Results of sensitivity analysis show that lower GDP values would result lower GHG emissions in Lithuania. According to performed sensitivity analysis GHG emissions would be lower by 12.37% in 2035 if annual GDP growth rate would be lower than expected (Table 5-9).

Table 5-9. Comparison of GDP sensitivity analysis, kt CO_2 eq.

	2014	**2015**	**2020**	**2025**	**2030**	**2035**

[3] http://www.lrv.lt/bylos/LESSED%20projektas/Dokumentai/4.%20Tyrimo%20ataskaita.pdf

Total GHG emissions excl. LULUCF (Projected GDP)	19 777.7	20 178.0	21 330.3	21 424.8	22 135.6	22 910.2
Total GHG emissions excl. LULUCF (Commission recommend GDP value)	19 777.7	19 988.8	20 559.3	19 751.7	19 924.3	20 075.8
Difference,%	-	0.94	3.61	7.81	9.99	12.37

Another important parameter in preparing GHG emissions projections can be considered the EU ETS carbon price. Most of installations under the EU ETS are local districts heat providers. Over the last few years and from the start of the 3rd EU ETS trading period many smaller installations producing heat energy started to switch from fossil fuel to biomass. This can be explained by the fact that recently the European Commission proposed the EU ETS market back-loading[4] solution to decrease the surplus of EUAs in the market and therefore increase carbon price. Therefore, the switch to biomass may greatly reduce the amount of EUAs needed for installations to cover the GHG emissions or even opt-out from the EU ETS. The EU ETS carbon prices used in sensitivity analysis for the EU ETS sectors are presented in Table 5-10.

Table 5-10. Carbon price used for GHG sensitivity analysis

	Carbon price (in constant €2010/t CO_2)				
	2015	**2020**	**2025**	**2030**	**2035**
Used in GHG projections	6.37	6.37	6.37	6.37	6.37
EC recommended	7	15	22.5	33.5	42

Results of the EU ETS GHG emissions sensitivity analysis are presented in Figure 5-17.

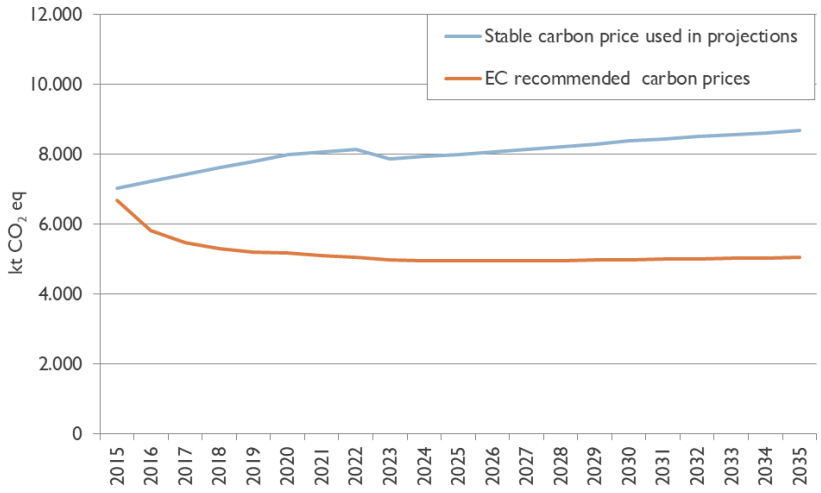

Figure 5-17. Results of carbon price impact on GHG emissions in Lithuania's EU ETS sectors

Sensitivity analysis results showed considerable margin between GHG emissions projected using stable carbon price and increasingly high carbon price in 2035. Huge distinction can be explained due to increase of expenditures for GHG emissions from installations. The operators will most likely consider switching to use biomass instead of fossil fuels. Also it is more likely that those operators will start

[4] EU Climate Change Committee agrees back-loading

investing in energy efficiency due to not only increasing fossil fuel prices, but also due to increasing EUAs price.

Results show that because of increase of EUAs price up to 42 EUR/t CO_2 the biggest reduction of GHG will be seen in Public electricity and heat production sectors and in Manufacturing industries and construction sectors. This is due to the fact that at a current state fossil fuel fired combustion units are still vastly used in these sectors and there is a potential to replace them with biomass using units.

5.3.2 Agriculture sector

For the estimation of GHG emissions projections from agriculture sector livestock population's projections were provided by the Ministry of Agriculture (MoA). However, EPA also received projections on livestock populations from Institute of Animal Science (IAS). Projections on livestock populations from both institutions differ. ISA provided approximate livestock population's projections only for 2030 and noted that more precise projections on livestock populations should be prepared by MoA as it is responsible for the agriculture policy and measures. MoA livestock population's projections calculates according to National livestock sector development program (2014-2020).

Sensitivity analysis has been made on how changes in the projected livestock populations would affect total GHG emissions. Results of sensitivity analysis on the total GHG emissions are provided in the table and figure below.

Table 5-12. Comparison of livestock population's sensitivity analysis, kt CO_2 eq.

	2014	2015	2020	2025	2030	2035
Total GHG emissions excl. LULUCF (data of MoA)	19 777.7	20 177.1	21 329.3	21 423.9	22 134.7	22 909.3
Total GHG emissions excl. LULUCF (data of IAS)	19 777.7	20 177.4	21 330.9	21 351.6	21 988.6	22 738.0
Difference, %	-	-0.001	-0.007	0.338	0.664	0.753

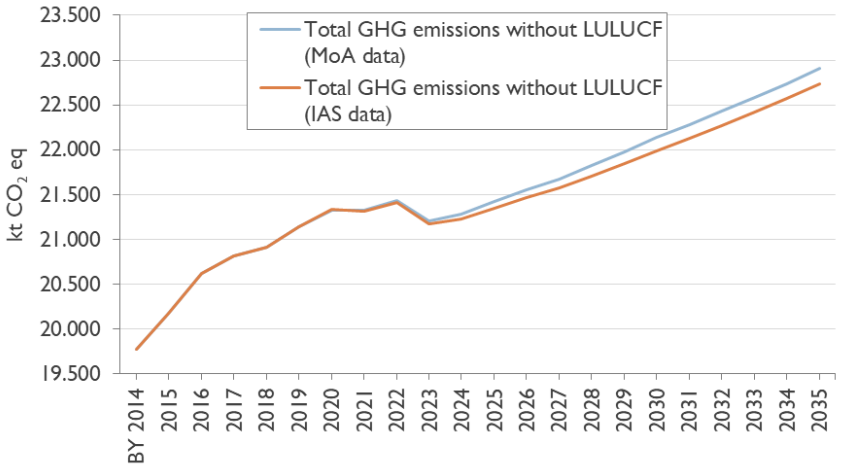

Figure 5-18. Results of livestock populations impact on GHG emissions

5.3.3 LULUCF sector

Sensitivity analysis was performed with the same projection tool for LULUCF sector GHG projections – *LULUCFeat*. Sensitivity analysis results are provided in the table below and include all the parameters defined as having the most important share for the overall LULUCF sector GHG removals/emissions in the past and projected for WEM and WAM scenarios in the future.

Table 5-13. Sensitivity analysis for the parameters projected for 1990 and 2035

Parameter	WEM scenario		WAM scenario	
	1990	2035	1990	2035
Forest land remaining forest land, area	-71.54	-91.38	-71.54	-68.27
Forest land carbon stock change in living biomass	-66.80	-85.32	-66.80	-62.21
Forest land carbon stock change in dead wood	-4.74	-6.06	-4.74	-6.06
Grassland converted to forest land, area	-6.78	-7.18	-6.78	-8.55
Grassland converted to forest land, carbon stock change in living biomass	-3.86	-4.06	-3.86	-4.84
Grassland converted to forest land, carbon stock change in litter	-2.92	-3.11	-2.92	-3.71
Grassland converted to cropland, area	47.13	35.75	47.13	12.90
Grassland converted to cropland, carbon stock change in mineral soil	46.15	32.56	46.15	11.75
Cropland converted to grassland, area	-20.82	-26.81	-20.82	-49.14
Copland converted to grassland, carbon stock change in mineral soil	-20.82	-26.81	-20.82	-49.14

5.4 Supplementarity relating to the Kyoto protocol mechanisms

Kyoto mechanisms allowed for Lithuania to meet its national emission reduction commitments of the Kyoto Protocol. The Kyoto Protocol introduced three market-based mechanisms: clean development mechanism (CDM); joint implementation (JI) and emissions trading. Use of Kyoto mechanisms must be supplemental to domestic action to achieve KP targets. These mechanisms are referred to as flexible mechanisms.

Certified emission reduction (CERs) units from the clean development mechanism and emission reduction (ERUs) units from JI projects, can be used to achieve the targets under the EU ETS and EU Effort Sharing Decision (with limitations).

In 2008-2012 there were implemented 11 Joint implementation projects related to GHG emissions reduction in electricity sector (10 wind power parks, 1 landfill biogas use for heat and electricity production) and the estimated GHG emissions reduction during whole period is 864 kt CO_2.

Together with the implemented JI projects during 2008-2012 period in Lithuania 64 wind power plants (total capacity 183.8 MW) had been installed (in 2002-2012 period there were 78 operating wind power plants in Lithuania with an installed capacity of 234.8 MW). And during the period 2003-2012 totally 20 biogas plants had been installed in Lithuania with the capacity of 20.32 MW.

GHG emissions reduction due to the 2 JI projects of N_2O emissions reduction in chemical industry amounts to 7 643 017 t CO_2 eq. Thus, without the implementation of these projects in 2013 the ETS sector‘s verified emission could be 1.2 million t CO_2 eq. higher (8.7 million instead current 7.5 million t CO_2 eq.).

Lithuania’s total greenhouse gas emissions in the 2008-2012 commitment period were 109 786 321 t CO_2 eq., approximately 52 per cent lower than the assigned amount, which was 227 306 177 tonnes CO_2 eq. The total amount of Kyoto Protocol units retired in the first commitment period is 109 786 321. Lithuania has requested 71 822 887 AAUs, 246 966 CERs and 2 327 000 ERUs to be carried over to the second commitment period of the Kyoto Protocol.

According to projections “with existing measures” (WEM scenario) for 2020, Lithuania’s Kyoto target for the second commitment period will be met entirely by domestic actions.

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CLIMATE CHANGE IMPACTS, VULNERABILITY ASSESSMENT, ADAPTATION MEASURES

6 CLIMATE CHANGE IMPACTS, VULNERABILITY ASSESSMENT, ADAPTATION MEASURES

6.1 Climate projections for Lithuania

This section presents the results of the climate projections research carried out at the Hydrology and Climatology Department of Vilnius University during 2013-2015. Projections were derived from the (World Climate Research Program's Coupled Model Intercomparison Project Phase 5 (CMIP5). Four Representative Concentration Pathways (RCPs) scenarios were chosen (RCP2.6, RCP4.5, RCP6.0, RCP8.5), which are defined and named after a possible range of radiative forcing in the year 2100 relative to pre-industrial values (+2.6, +4.5, +6.0, and +8.5 W/m^2, respectively). These RCP scenarios were used in climatological models with output data of CMIP5. Projections of air temperature and precipitation amount for the territory of Lithuania for 1861-2100 years were obtained from the KNOW (Royal Netherlands Meteorological Institute) Climate Explorer database. According to the 5th IPCC report, 2006-2100 period includes prognostic values, and data until 2006 are considered as historical (used the same for all RCP). Territory of Lithuania was divided into 5 grid cells, the size of each cell was 2.5°x2.5°. Depending on the RCP scenario, the number of models used to compute the values for each cell indicator CMIP5 is different: the maximum number of models is used to estimate the monthly average values of air temperature and precipitation according to RCP4.5 scenario (42 models), the lowest – according to RCP6.0 (25 models). The values of the RCP2.6 scenario are calculated using the results of 32, and RCP8.5 – 39 models. Only models that perform calculations according to all four RCP scenarios were selected for the study (24 models in total). The study evaluated the estimated changes in the air temperature and precipitation content in each cell covering the territory of Lithuania. Projections for the indicators were made for two periods – the nearest future projections cover the period from 2016 to 2035, and the long-term forecasts are for period 2081-2100. In addition, the projected mean annual air temperature dynamics for Lithuania in 2006-2100 was estimated.

In each cell differences in weather temperature and precipitation (in January to December) until 2035 and by 2100 compared to 1986-2005 average values for the base period were evaluated. Air temperature changes were set within ± 0,1°C. Precipitation changes were expressed as a percentage.

At the beginning of the projected period in 2005 the global air temperature was approximately 0.85°C (in Lithuania at approximately 1.0°C) higher than in the pre-industrial period. Based on CMIP5 data, only according to RCP8.5 scenario global air temperature is expected to increase by more than 4 degrees compared to pre-industrial level. In Lithuania the air temperature should increase faster: based on RCP8.5 scenario, which represents highest changes, the average annual temperature can increase by almost 6°C. According to RCP2.6 scenario the 2°C threshold in Lithuania will be exceeded in the first half of the 21st century and after it the air temperature will not change considerably. According to scenarios RCP4.5 and RCP6.0 the average annual air temperature in Lithuania will increase by 3.2 and 3.7°C, respectively at the end of this century. To summarize, it is expected that global temperature increase by 2°C compared to the pre-industrial levels in the middle of the 21st century, and in Lithuania about 15-20 years earlier.

All RCP scenarios for Lithuania lead to a quite similar evolution of temperatures until about the 2040s (Figure 6-1). For later period, projected indicators vary. Long-term projections predict that greenhouse

gas impacts will be much stronger than internal fluctuations in the climate system and therefore climate change will directly depend on the expected magnitude of exposure. In Lithuania the highest increase in air temperature is projected according to RCP8.5 scenario and the lowest increase according to RCP2.6 scenario. According to RCP4.5 and RCP6.0 scenarios the average annual air temperature will increase at a similar pace as until the end of the 1980s, and only later, according to RCP4.5 the air temperature will stabilize and based on RCP6.0 will continue to rise (Figure 6-1).

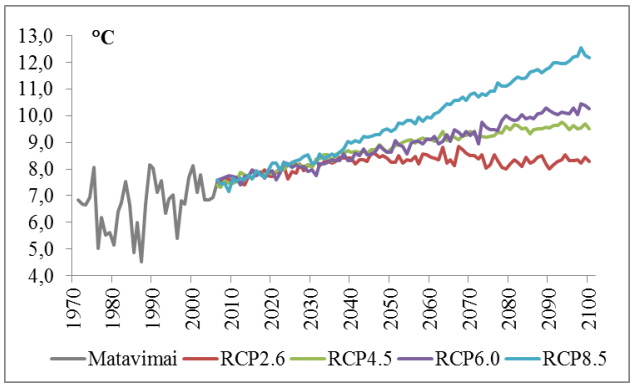

Figure 6-1. Projections of the average annual air temperature change for Lithuania by 2100 according to different RCP scenarios

Based on the study results it is projected that by 2035 the air temperature will grow throughout all Lithuania. The average annual temperature will increase by 1.1-1.4°C (compared to the period 1986-2005). Major changes in air temperature during 2016-2035 are projected according to RCP4.5 and RCP8.5 scenarios. By 2035 the temperatures of the cold season in Lithuania will likely to rise mostly. Major changes of air temperature are expected in February and March.

It is forecasted that in the late-21st century the air temperature in Lithuania will continue to rise (Figure 6-2). The average annual temperature can increase by 1.5-5.1°C. The major changes in the late-21st century for Lithuania are projected according to RCP8.5 scenario, the lowest – according to RCP2.6 scenario.

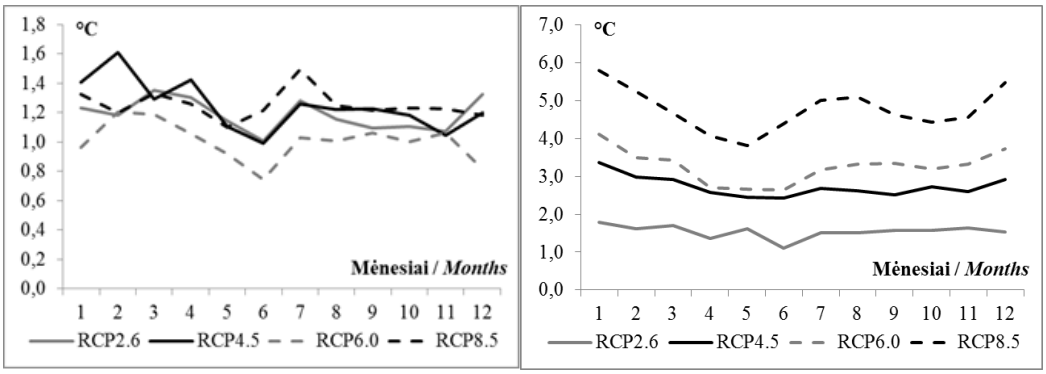

Figure 6-2. Projected air temperature changes in Lithuania by 2035 (left) and by 2100 (right) based on different RCP scenarios

In the late-21st century the air temperature in Lithuania will be fastest growing in the cold season. Based on RCP8.5 scenario the average temperature in January (Figure 6-3) will rise mostly. In the north-eastern part of Lithuania the temperature is expected to rise by 6.3°C. Projected growth of temperature is also

expected in August. According to RCP8.5 scenario air temperature variations in this month vary from 4.7 to 5.4°C in different parts of the country.

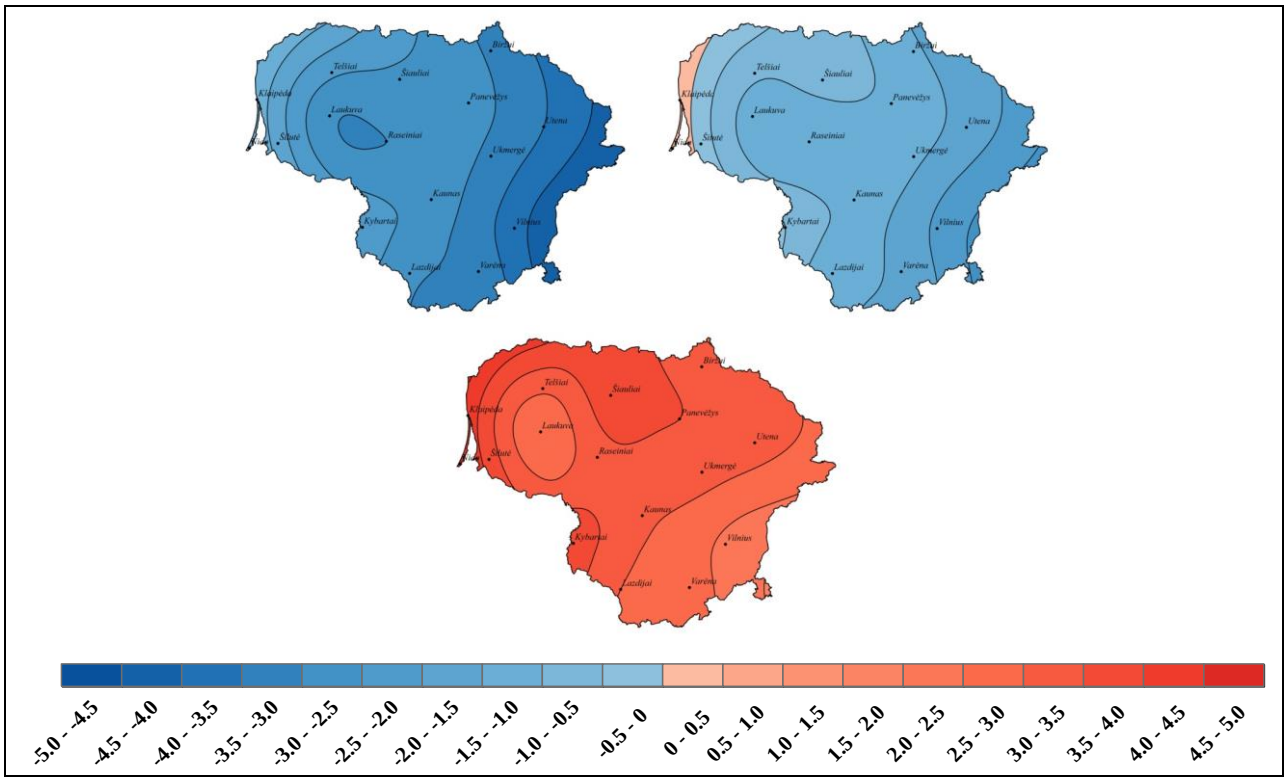

Figure 6-3. The average air temperature in Lithuania in January during 1986-2005 (left) and projected for 2081-2100 period according to RCP2.6 (center) and RCP8.5 (right) scenarios, ºC

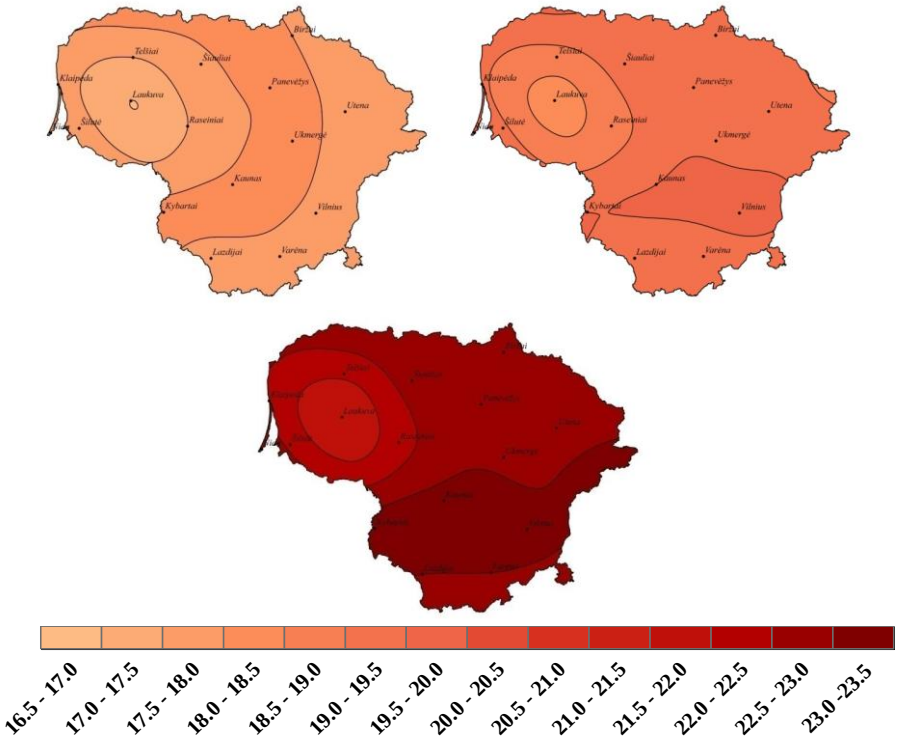

Figure 6-4. The average air temperature in Lithuania in July during 1986-2005 (left) and projected for 2081-2100 period according to RCP2.6 (center) and RCP8.5 (right) scenarios, ºC

Precipitation projections

Likewise for air temperatures, the projections of annual precipitation rates up to mid-21st century under various RCP scenarios for Lithuania almost not differ (Figure 6-5). Only later higher projected changes appear according to RCP8.5 scenario and average yearly precipitation rate stabilization is observed according to RCP2.6 scenario. Estimated changes in precipitation rates according to RCP4.5 and RCP6.0 almost not differ.

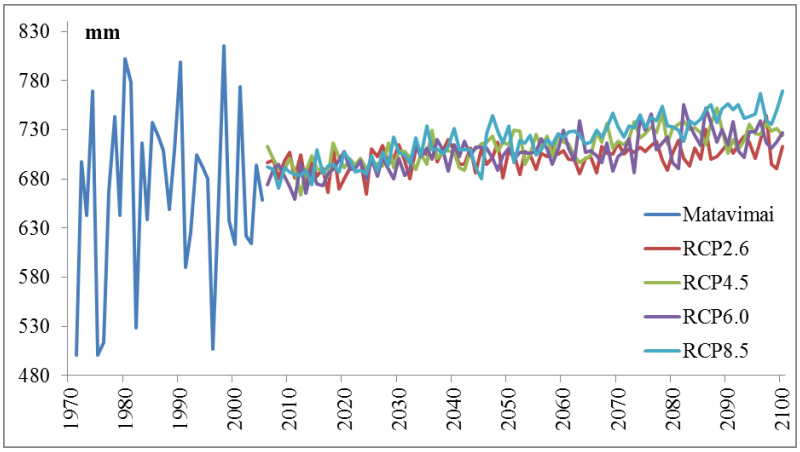

Figure 6-5. Projected annual precipitation in Lithuania up to 2100 according to different RCP scenarios

By 2035 the average annual precipitation should increase by 1.6-4.0%. Major changes are projected according to RCP4.5 scenario and the lowest in RCP6.0 scenario. Model output results for all four RCP

scenarios for the beginning of 21st century anticipate increase of the total amount of precipitation from October to April and in June. In September the decrease of precipitation is projected according to all RCP scenarios, with the exception of Lithuania's western part (RCP4.5).

Even more significant changes in precipitation are projected in the late-21st century. The average annual precipitation may increase by 3.7-13.5%. More changes are expected in the northern part of the country than in the southern. According to RCP2.6 scenario annual average precipitation rate will unlikely to change significantly, most changes are projected according to RCP8.5 scenario.

Other climate indicators and sea level projections

During 21st century in Lithuania daily air temperature fluctuations will increase and the number of hot days (>30°C) and warm nights (>15 and >18°C) will increase. Thus, possibly heat waves will increase in frequency and intensity (they will last longer and will reach higher air temperatures). Number of extremely cold days will decrease more slowly. Relative air humidity during the cold season will unlikely to change much, but during the summer season will decrease significantly, especially in the second half of summer and at the beginning of autumn.

The average wind speed will vary slightly, but wind speed fluctuations due to more frequent storm recurrence may increase. The snow cover depth and the number of days with snow cover will decrease (especially in the western part of Lithuania). The number of thunderstorms will grow. The increase in the number of dangerous meteorological phenomena (such as freezing rain, hail, hurricane winds, etc.) is possible.

Based on the results of previous studies in Lithuania the Baltic Sea coast region is mostly vulnerable to climate change. Coast, coastal ecosystems, as well as local population are mostly affected by sea level rise, storm and hurricane winds, sea and Curonian Lagoon water warming and salinity changes.

In 2081-2100 compared to 1986-2005 the global ocean level is likely to rise to 26-98 cm. Thermal water expansion contribution to the level rise will constitute 30-55%, glaciers 15-35%. It is estimated that the water level in the Baltic Sea in the 21st century will rise as well. However, changes in wind patterns and vertical tectonic movements will lead to a significant variation in water levels in different parts of the Baltic Sea. The water level will rise highest on the south-eastern coast, where Klaipeda city is situated.

The summary of other climate indicators and sea level projections is provided in the Table 6-1 below.

Table 6-1. Projected climate elements changes in Lithuania in the 21st century

Climate elements	Description of forecasted changes
Air temperature	Average annual temperature in the 21st century may increase by 1.5-5.1°C. Increase in temperature will be larger in wintertime.
Extreme air temperatures	The number of extremely hot days and warm nights will increase. Heat waves will become more frequent and its temperatures will be higher. Extreme cold events recurrence will slightly decrease.
Precipitation	The average annual precipitation rate in the 21st century should increase by 3.7-13.5%. The highest precipitation growth is expected in October-April.
Extensive rainfall	Increases in number of heavy rainfall (≥ 10 mm) and annual daily amount of maximum precipitation.
Droughts	The number of droughts in the summer (especially during the second half of vegetation period) is expected to increase.
Air humidity	During the cold season relative humidity is unlikely to change much and during warm season will decrease (mostly in July to September).

Wind speed	The average wind speed is unlikely to change much, but wind gusts may increase, especially during the summer period. It is likely that the recurrence of storms and hurricane winds will increase, especially during the cold season.
Solar radiation	Sunshine duration will shorten in the cold season and significant changes during the warm season are not expected.
Hazardous weather phenomena	Expected increase in the number, duration and intensity of dangerous weather phenomena (such as thunderstorms, freezing rain, hail, squall etc.)
Sea level	Sea level over the 21st century will rise by 20-90 cm
Snow indicators	The average number of days with snow cover will decrease, but the maximum snow cover thickness will not likely to change much.

6.2 Vulnerability assessment

Lithuania is investing in efforts to understand climate change impacts and is taking action to reduce vulnerability and adapt to a changing climate. Lithuania is already facing increased incidence of extreme weather (heat waves, storms, extreme cold and floods), leading to reduced crop yields, loss of biodiversity, impact of economy and human health. Since the 6th National Communication (2014), Lithuania has continued to strengthen the evidence base that supports climate change adaptation decision-making and has enhanced efforts to increase climate resilience.

Climate change will affect agriculture and food, forestry, water resources, fisheries, energy, transport infrastructure, construction and building sector, biodiversity, health, social impacts, economy and private sectors. In the Table 6-2 provided summarized information about vulnerability and adaptation.

Table 6-2. Vulnerabilities and adaptation instruments by sectors

Sector	Vulnerability	Adaptation
AGRICULTURE	**Adverse** - Storm and floods damage or destroy crops; - Decrease of soil fertility; - Soil erosion impacts on agriculture; - Heat waves effects on agriculture and livestock; - Increased number of insects; - Increased number of fires; - Changes in crop productivity and quality of production; - Increased spread of diseases. **Beneficial** - More favourable conditions for warm-season crops, longer vegetation period	- Farms consolidation; - Organic farming; - Environmentally friendly farming practices; - To plant ”protective green belts” around agricultural land; - To bread more resistant livestock and crops; - System for warning of fires and information about extreme weathers development; - To develop research for agriculture sector; - Insure against potential damages; - Increase the capacities of observation networks; - The Strategy of National Climate Change Management Policy.

BIODIVERSITY AND NATURAL ECOSYSTEMS	**Adverse** - The emergence of invasive alien species; - Landscape degradation; - Eutrophication; - Different ecosystems and different species will be differently affected; - Change of species habitat; - Rising sea level and warming lakes, rivers; - Increasing frequency of extreme events, such as floods and heatwaves, and weather that has a high risk of bushfires.	- Species that have survived previous climatic changes have done so changing their behaviour, moving to areas where the climate is more suitable; - To protect threatened species and ecological communities, by implementing protective or recovery actions; - To plant local native species; - To controll pest animals; - Environmental management plans for territories that are important for the protection of birds and their habitat; and a biological diversity protection programme; - The Strategy of National Climate Change Management Policy.
COASTAL ZONES	**Adverse** - Increase of storms frequency can lead coastal erosion; - rising sea level cause more frequent floods in the coastal region; - winter storms will cause more frequent floods in the coastal region; - Growing water mineralization of the Curonian Lagoon will have an impact on fish resources in this basin; - the average height of waves will increase due to the destruction of Baltic sea shores and the degradation of dunes; **Beneficial** - Benefits to tourism industry related to the relatively favourable climatic conditions during the tourist season.	- The coastal foredune ridge accumulates sand and prevents degradation of the coastal line; - Adaptation to the Impacts of Climate Change at the Lithuanian Seaside; - Coastal protection measures implementation program 2017-2021 (coastal dune ridge condition monitoring); - The Curionian Lagoon prevention; - Public information and education; - Nature Management Plan of the Coastal Dunes.
ENERGY	**Adverse** - Extreme weather events causes supply disruptions and affect infrastructure that depends on the energy supply; - Higher summer temperatures increase electricity demands for cooling; - Flooding, wildfires and icy conditions affect roads and other fuel transportation networks; - Cold winters damaged electric power lines. **Beneficial** - Warmer winters will reduce heating energy demand.	- To ensure energy reserves; - Management and technical measures; - Technological and structural measures; - Training and education; - Innovation and research.
FISHERIES	**Adverse** - Decreasing fish stocks in the Baltic Sea; - Water quality degradation; - Rising water temperature; - Baltic sea level rise; - Increasing water salinity in the Baltic	- Public education and information; - To develop scientific research; - To reduce water eutrophication; - To ensure the migration of diadromous fish; - Fight against invasive species; - Programme of the Lithuanian fisheries

	sea; - Changes in fish distribution; - Deterioration of diadromous fish migration; - Lack of water resources in fish farms; - Harm caused to fish stocks by the increasing number of invasive species; - The disappearance of local species.	sector 2014-2020
FORESTS	**Adverse** - Increased forest fires; - Increased amount of storms and windfalls; - Increasing frequency of extreme events, such as floods and heatwaves, and weather that has a high risk to destroy young forests; - Floods damages young forest plantations; - Increasing number of insects; - Defoliation of trees increases and productivity of forests changes; - Soil erosion.	- To plant forests in unused or not suitable for agriculture land; - To implement a sustainable forestry policy; - Forest fire management; - Reforestation avoid homogeneous stands (especially spruce); - Research development; - Insure against potential damages.
HUMAN HEALTH	**Adverse** - Higher frequency of extreme weather events: heat waves (23 periods of heat waves were recorded Lithuania's capital during 1993-2007); - Higher frequency of extreme colds during the winter season (sudden frost kills more than 300 people every year in Lithuania); - Increased ultraviolet (UV) radiation exposure increases the risk of skin cancers and cataracts (every year in Lithuania skin cancer is detected for 1 800 people. Skin cancer is killing more than a 140 people every year); - Health problems caused by the new invasive insects species; - Health problems caused by *Ixodes ricinus* (In 2006-2012, in Lithuania Lyme disease ill 15 604 persons. *Ixodes ricinus*, which caused Lyme disease is widely spread in Lithuanian territory: in the forests, in the city parks. In 2015 recorded 336 tick-borne encephalitis diseases and 2252 Lyme disease); - Stress caused by the extreme events: floods, storms, droughts.	- Study identifying the climate change threats to human health including the recommendations (2014) Direct link (Lithuanian only): - http://www.am.lt/VI/files/File/Klimato%20kaita/Galutine%20ataskaita-2014-09-17.pdf - To increase the consumer demand for regional organic products of high environmental and nutritional quality as well as seek out more balanced diets. This can help to support a range of human health benefits. - National Public Health and Heat Prevention Action Plan for 2016-2020; - Improve cooperation at the international level; - Improve awareness about risks of climate change and adaptation measures; - Public warning system.
INFRASTUCTURE AND ECONOMY (INCLUDING TOURISM)	**Adverse** - Increasing the insect spread diseases, which will have major impacts on tourism; - Roads may be flooded during autumn and spring seasons;	- Preparation of technical regulations for the building of bridges or roads through territories prone to flooding; - Tourism sector consumers analysis; - Sensitivity, risk and potential adaptation measures research.

	- Deterioration of air quality; - Impact for winter sport tourism; - Changes in tourism destinations and seasonal tourism caused by increasing temperature; - Losses to tourism industry due to the worsening of bathing water quality caused by eutrophication.	
TRANSPORT	**Adverse** - Rising temperatures and extended heat-wave periods increasing the problems of rail buckling; - Thermal comfort for passengers in vehicles; - Weather extremes generating floods to delays, interruptions and detouring needs; - Air transport challenged by changing wind patterns;	- National Programme for the Development of Transport for 2014-2022; - To ensure a stable transport system under extreme weather events; - Strategies, action plans; - To make transport infrastructure climate-resilient; - Accept interruptions, repair the affected infrastructure after a disaster; - Insure against potential damages.
SOCIAL IMPACTS	**Adverse** - European Commission predicts that Lithuania experience negative effects on climate change on agriculture and tourism sectors with high number of employed per unit of output.	- Insure against potential damages.
WATER RESOURCES	**Adverse** - Eutrophication; - Increasing number of floods; - The risk to the quantity and quality of water resources; - Deterioration status of ground and surface water bodies; - Worsen environmental status of the Baltic Sea; - Deterioration in quality public drinking water supply; - Increasing pollution by wastewater; - Increasing number of wet lands areas; - Water shortage.	- To build an overpass in Rusnė (preventing from floods) by the end of 2018 with a cost of nearly EUR 10 million; - Flood risk management; - A flood map; - The Strategy of National Climate Change Management Policy. - "The study of climate change impact to the land ecosystems, biodiversity, water resources, agriculture and forestry and human health and the strategic plan for the mitigation of consequences" (2007); - National Water Area Development Programme 2017-2023; - Drainage system optimization; - Climate change mitigation and adaptation guidelines for municipalities, 2017; - Adaptation to the Impacts of Climate Change at the Lithuanian Seaside. - In Vilnius for instance, it is planned to fix rain drainage system - "Methodology for Flood Risk Appraisal in Lithuania", 2015.
WASTE	**Adverse** - Decline in air quality; - Impacts on biological processes (composting anaerobic digestion); - Increased risk of flooding from groundwater, surface water; - Disruption to infrastructure (roads);	- National Waste Management Plan for 2014-2020; - The 2015 Circular Economy Package; - Recycling, reuse and waste minimization; - Public awareness-raising and operators training; - Improvement of fire protection systems;

	- Impacts on outdoor biological processes; - Inundation of waste management facilities.	- More frequent collection of waste; - Good on-site management can minimise the chances of non-compliances or pollution incidents; - Wastewater control and treatment.

6.3 Adaptation measures

Climate change impacts provide risks and new opportunities. In order to minimize the risks and to benefit from the opportunities caused by the climate change, adaptation measures need to be planned and implemented.

In the table 6-2 summarized information on various adaptation policy instruments is provided.

Adaptation to climate change is integrated in the legal basis for major projects, through the processes of vulnerability and risk assessments which are:

- Vulnerability – evaluating the sensitivity and exposure of infrastructure to climate change;
- Risk – estimating the likelihood and impact of relevant climate hazards;
- Adaptation – consideration of adaptation options and integration into the project planning.

The Ministry of Environment (MoE) is the main coordinating institution responsible for development of climate change mitigation and adaptation policy and its implementation, transposing the EU climate policy legislation and advising for other institutions on integrating climate policy objectives and concerns into sectors which are not under MoE's responsibilities. Other Ministries (Energy, Finance, Transport and Communications, Health, Education and Science, Foreign Affairs, Economy, Interior, Agriculture), municipal and other institutions within their remit are responsible for mainstreaming climate goals and objectives into sectoral strategies and programmes and implementing related activities in Lithuania.

Creation of a central climate adaptation portal for Lithuania is underway (expected completion in 2018), with the purpose of simplifying the exchange of information on climate change adaptation and aid cooperation.

National Risk Assessment, performed in 2013 and coordinated by The Fire and Rescue Department under the Ministry of Interior comprises the evaluation of all threats in Lithuania, including also the threats caused by climate change. An updated Risk Assessment was carried out in 2015.

Baltadapt "Climate Info" bulletins describe the impact of climate change on the Baltic Sea and each issue reviews the expected impacts on one selected indicator, namely: precipitation, wind climate, sea level rise, oxygen content, salinity, water temperature, biodiversity and habitats, biological production, wind waves, river discharge, nutrient loads to the Baltic sea, eutrophication and sea ice.

Lithuania provided updated information on adaptation activities, information about national adaptation planning and strategies in the National adaptation actions deliveries database on EIONET, and on the Climate-ADAPT website.

Moreover, in 2016 "Climate change impacts and vulnerability in Europe" report provided detailed information of climate change impacts, vulnerabilities and risks in Europe.

The **Strategy for National Climate Change Management Policy for 2013-2050** is an integrated Strategy, which covers both adaptation to climate change and climate change mitigation policies. The Strategy consists of sections accordingly dedicated to climate change mitigation and adaptation.The strategic goal of Lithuania's climate change adaptation policy as determined by the Strategy is to reduce vulnerability of natural ecosystems and domestic economic sectors by implementing measures for maintaining and increasing their resilience to climate change and ensuring favourable conditions for social life and economic activities. The implementation of the strategic goal of adaptation to climate change follows directions:

- *The integrated approach on the climate change impact on the particular territories at the regional level.* Such approach encourages compromise solutions taking into account different needs, involves other processes of regional changes (for example, demographical changes) and may optimise the sectoral and inter-sectoral interaction of adaptation measures, applicable for that region.
- *The synergy of climate change mitigation and adaptation to climate change measures and the avoidance of their conflict*. The chosen climate change adaptation measures should not oppose the climate change mitigation efforts but should contribute to them.
- *The contribution of country-specific scientific research to adaptation to climate change*. Mutually beneficial cooperation between governmental, municipal and financial institutions, funds, universities, with other countries and the EU projects should be encouraged in the area of climate research. Adaptation to climate change should become a separate component of the climate scientific research.
- *A strong knowledge basis about the climate change impact and consequences,* which is composed of the constant and systematic scientific research methods and results, data, projections, experience and to the information collection, transmission and exchange between the parties.

The specific short-term by 2020 climate change adaptation goals and objectives are set in the following sectors: agriculture, soil; forestry, ecosystems, biodiversity, landscape; water resources; energy, transport, industry; public health. Indicative medium-term (by 2030 and 2040) and long-term (by 2050) adaptation to climate change goals and objectives are the following:

The first goal is related to continuous monitoring and survey of the most vulnerable economic sectors and ensuring resilience of such sectors, especially agriculture, to climate change. This goal will be reached implementing the following objectives:

- ensuring continuous monitoring of climate change sensitive sectors and effective implementation of measures reducing climate change effects;
- ensuring the resilience of the engineering infrastructure to climate change;
- monitoring, investigating and assessing the impact of climate change on the agricultural sector and, in the context of changes, adapting agricultural production to climate change;
- organising proper selection and implementation of measures increasing resilience of agricultural and other sensitive sectors to climate change;
- ensuring sparing use of such natural resources as water, biodiversity and soil.

The second goal is related to promotion of cooperation with other countries in relation to climate change adaptation. In order to attain the goal these objectives are set:

- ensuring long-term effective management of financial and technical resources and implementation of measures in third countries;
- continuous support for preparation and implementation of pilot climate change adaptation projects in developing countries in order to increase their resilience to climate change.

Update of the Strategy aiming to set legally biding adaptation to climate change goals and objetives for the period 2021-2030 is planned by the end of 2019.

In 2014 risk assessment and vulnerability to climate change was evaluated in the sector of public health, cost-efficient measures and indicators were proposed. The study identifying the climate change threats to human health including the recommendations was conducted in Lithuania.

In 2015, the Ministry of Environment published a "Study Identifying Vulnerability to Climate Change of Individual Sectors, Risk Assessment and Opportunities to Adapt to Climate Change", which identified individual sectors/fields (energy, transportation, industry, agriculture, landscape, territorial planning, ecosystems and biodiversity, fishery and aquaculture, forestry, tourism, groundwater resources, waste management), assessed risks and proposed measures that could be implemented. The results were based on a qualitative assessment.

Lithuania's climate change adaptation practice also includes various studies and individual projects that are not purely Lithuanian, but involve the whole Baltic region. They are members of the EU Strategy for the Baltic Sea Region and the Strategy for the Baltic Sea Region Action Plan, which targets implementation strategies. The Action Plan identifies to "*promote and support the implementation of the BSR (Baltic Sea Region) Climate Change Adaptation strategy".* The Strategy and Plan are both complete, with the Plan's web page providing a comprehensive list of projects undertaken.

In 2016-2017 Lithuania's municipalities participate in the project: "Climate change mitigation and adaptation at the local level". The project is funded under the Norwegian Financial Mechanism Program LT10 "Capacity-building and institutional cooperation between beneficiary state and Norwegian public institutions, local and regional authorities". The main goal of the project is to strengthen the capacity of Lithuanian municipalities in the climate change management and adaptation. During the project methodological guidance for municipalities "Climate change mitigation and adaptation guidelines for municipalities" was prepared.

Also, Kaunas University of Technology is involved in various environmental programmes and research projects. They are active members of EU Water 2020 (Wastewater treatment) and the Multidisciplinary journal, Environmental Research, Engineering and Management (EREM), publishing articles such as "Optimisation of waste stabilisation pond performance for piggery waste treatment using response surface methodology". More universities in Lithuania are conducting research projects into areas of climate change adaptation, including:

- Vilnius University; researching Ecosystems of Lithuania (Climate Change and impact on persons) and air temperature observations;
- Vilnius Gediminas Technical University is actively involved in Construction21 – a Green Building Exchange supported by the Department of Urban Design;
- The Research Institute of Environmental Protection (Vilnius Gediminas Technical University) focuses on waste management, technologies and impacts; and
- Vytautas Magnus University funds research into various environmental infrastructure projects.

Lithuania has taken part in several transboundary projects, including Astra, Baltadapt, BaltCICA, BalticClimate, Baltclim, RADOST. Baltadapt (2010-2013) was a flagship project under the EU Strategy for the Baltic Sea Region, developing a Baltic Sea Region-wide climate change adaptation strategy. The overriding goal of the Baltadapt Action Plan was to promote the implementation of the Baltic Sea Region Strategy for Adaptation to Climate Change, and to specify priority activities for the macro-region in the field of adaptation to climate change impacts.

Lithuania has been active within the Baltic Sea Region Climate Change Adaptation Strategy and Action Plan. In these projects the adaptation options to be applied at local level are analysed and elaborated. In addition, Lithuania takes part in the implementation of the EU Strategy for the Baltic Sea Region (EUSBSR).

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The study in 2015 on "Laying down specific sectors vulnerability to climate change impacts, risk assessment and adaptation to climate change, effective adaptation and evaluation criteria" http://www.am.lt/VI/index.php#a/12840

The Radost project http://www.klimzug-radost.de/en

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FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

7 FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

Article 4(1) of the UNFCCC states that all parties shall fulfil their obligations taking into account their common, but differentiated responsibilities. By doing so, the countries should evaluate their specific national and regional development priorities, objectives and circumstances. Lithuania is among the countries listed in Annex I with the specific added condition that the country is undergoing the process of transition to market economy.

Article 4(3) of the UNFCCC (to provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1), article 4(4) (to assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects) and article 4(5) (to take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties) are applicable to developed countries and countries listed in Annex II of the UNFCCC. Lithuania is not referred to as a developed country listed in Annex II of the UNFCCC.

In December 2009, all Parties of the Convention met in Copenhagen (COP15) and agreed to provide developing countries with new and supplementary, larger-scale, foreseeable and adequate funding to enable them to take more active measures to combat climate change. Developed countries pledged 30 million dollars for 2010-2012, which was called *Fast Start Financing* (FSF). They also set a long-term target for 2020 to jointly mobilize USD 100 billion annually from a variety of sources: public, private and alternative. Despite the difficult economic situation and tight budgetary constraints, the EU and its member states have fulfilled their FSF commitment: in 2010-2012 they jointly awarded EUR 7.34 billion in support.

In 2013 climate finance provided by EU to developing countries reached EUR 9.5 billion, in 2014 – EUR 14.5 billion, in 2015 – EUR 17.6 billion, in 2016 – EUR 20.2 billion.

Although Lithuania is among the countries listed in Annex I with the specific added condition that the country is undergoing the process of transition to market economy and do not have obligations to support developing countries, as part of the EU, Lithuania voluntary has been providing technical and financial support in climate change area to developing countries since 2011.

Lithuania's aim to ensure financial and technological support for the implementation of climate change mitigation and adaptation measures in other countries, as well as cooperating with other countries in developing climate change-oriented projects is determined in various legal acts:

- **Law on Development Cooperation and Humanitarian Assistance** (approved by the Parliament on 16th May 2013). This law determines the goals of the Lithuanian development cooperation policy, formation, implementation, coordination and financing of the Lithuanian development cooperation, and ways of providing humanitarian aid. One of the priority areas of cooperation development is climate change mitigation and adaptation measures.
- **Law on financial instruments for climate change management** (approved by the Parliament in 2009) states that the funds of the Climate Change Special Programme may be used for climate

change mitigation and adaption measures in third countries in accordance with the EU legislation, the UNFCCC, the Kyoto Protocol and other international agreements.

- **Inter-institutional action plan of implementation of objectives and tasks of the National climate change management policy strategy for 2013-2020** (approved by the Government in 2013 and annually updated). In the inter-institutional Action Plan the identification of potential finance sources in public and private sectors and contribution to financing and implementation of measures of climate change mitigation and adaptation in developing countries are foreseen in 2013 and onwards (up to the year 2020) by the Ministry of Environment.
- **National Interinstitutional Development Cooperation Action Plan for the period 2017-2019** (approved by the Government in 2016 with the latest amendment in 2017, setting measures for 2018-2020). This Plan lays down development cooperation policy guidelines and sets out concrete measures in order to contribute to the achievement of the sustainable development goals set by the UN 2030 Agenda within the aid recipient countries. The Plan is based on the Lithuanian Law on Development Cooperation and Humanitarian Aid, Lithuania's foreign policy priorities, taking into account relevant strategic documents of the UN and EU, and international commitments. The Plan will help to ensure continuous and efficient implementation and coordination of the development cooperation activities and to enhance Lithuania's role as a reliable and responsible donor country in the international community. For the 2013-2016 period *Directions for the Politics of Development Cooperation in 2014-2016* and *Inter-institutional action plan for development cooperation* was in place.

Lithuanian institutions responsible for financial support to developing countries in the field of climate change mitigation and adaptation through are:

- Ministry of Environment through the funding from the Climate Change Special Programme (the main financial fund);
- Ministry of Foreign Affairs which administrates development cooperation projects, some of the projects are climate related and
- Ministry of Finance that makes contribution to international funds and programs, including EPTATF.

Through 2011-2013 period the Ministry of Environment provided climate finance through various multilateral and regional funds. In 2015 Ministry of Environment made a contribution to the Green Climate Fund (more information can be found in the table 7-1 below).

From 2014 onwards the Ministry of Environment supports bilateral development cooperation projects related to climate change. The decision to focus on bilateral support was due to new legislation and policy adopted by the Government of Lithuania (mentioned above). The Ministry of Environment believes that bilateral support is more efficient and beneficial for both parties, not only helps to share Lithuanian experience and gain valuable relationships through cooperation, but creates enabling environment to using public finances to mobilize private sector investments into low carbon solutions under bilateral cooperation projects transferring technologies to developing countries.

Eligible for this bilateral support are a variety of Lithuanian entities (private and public) which intend to implement climate change mitigation and adaptation projects in developing countries. Each year Ministry's *Commission on development cooperation and humanitarian aid* announces calls for project

concepts/applications and selects the most distinguished projects. Requirements for projects and all procedural issues are laid down in the *Manual on the implementation of development cooperation activities by state and municipal institutions and agencies*, approved on 26 March 2014 by Resolution No 278 of the Government of the Republic of Lithuania).

Generally applicants are required to contribute financially at least 10% of total eligible costs of the project. In this way Lithuania is seeking to mobilise private finance. The Commission approves the list of eligible countries, usually Lithuania gives priority (additional evaluation points) to the Eastern European partnership countries.

Calls for submission of bilateral development cooperation projects are announced each year – usually in the second quarter – on www.am.lt, www.orangeprojects.lt and in the national press.

2017 call for bilateral development cooperation projects

Last update: 31.07.2017

The Ministry of Environment of the Republic of Lithuania invites local companies, institutions and organisations to submit projects of bilateral development cooperation in the field of climate change according to conditions confirmed 27.07.2017 by the ministry's Commission on development cooperation and humanitarian aid (see the table below).

Grants are being provided from the funds of the Climate Change Special Programme, administered by the Ministry of Environment of the Republic of Lithuania.

Requirements for bilateral development cooperation projects:

Recipient country(-ies)	Low or lower-middle income (GNP per capita up to 3955 USD) developing country(-ies) according to World bank's classification, included in OECD DAC list of ODA recipients: * **Europe & Central Asia**: Afghanistan, Armenia, Georgia, Kyrgyzstan, Kosovo, Moldova, Tajikistan, Uzbekistan; * **Near East & North Africa**: Egypt, Jordan, Morocco, Syria, Tunesia, West Bank and Gaza Strip, Yemen; * **Latin America & Caribbean**: Bolivia, Guatemala, Haiti, Honduras, Nicaragua, El Salvador; * **East & South Asia, the Pacific Ocean**: Bangladesh, Bhutan, Cambodia, India, Indonesia, , Kiribati, Korea DPR, Lao PDR, Micronesia, Myanmar, Mongolia, Nepal, Pakistan, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Timor-Leste, Vanuatu, Viet Nam; * **Sub-Saharan Africa**: Angola, Benin, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Congo DR, Cote d'Ivoire, Djibouti, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenia, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Figure 7-1. Calls announcements

In 2014 finance was given to the Lithuanian solar cell producer "BOD Group" which implemented project in Malaysia. During the project two solar power plants were installed on the roof-top of the University and in the harbor in the Perak state of Malaysia (total capacity of the solar plants is 60 kW). The total costs of the project were EUR 222 300, from which EUR 144 000 were subsidy from the Ministry of Environment.

Figure 7-2. Project in Malaysia (photo credits: BOD group)

In 2015 two projects in Moldova were approved: solar power plant on the Ministry of Environment of Moldova building (55 kW capacity) and the installation of 4 biomass boilers in kindergartens, schools and

health center in the nearby area of Kishinev. These projects still ongoing, solar power plant projects is planned to be finished at the end of 2017. The biomass boilers project is planned to be finished in the middle of 2018.

In 2016 the Ministry of Environment approved one project in Georgia. Lithuanian company "Saulės grąža" has installed 6 solar power plants in the schools and kindergartens in the remote areas of Georgia. The total capacity of solar power plants is 131 kW. The total budget of the project is EUR 286 500, from which EUR 191 160 is the subsidy. The project planned to be finished in May of 2018.

Table 7-1. The data on international climate finance provided by Lithuania

Year	Thousands, EUR	Type of support	Recipient of support	Provider of support
2011	25.7	multilateral	ESMAP - Energy Sector Management Assistance Program, administered by the World Bank	MoE
	29.0	regional	E5P - Eastern Europe Energy Efficiency and Environment Partnership Fund, administered by the European Bank for Reconstruction and Development	MoFA
	34.8	bilateral	Development cooperation projects (Moldova, Georgia)	MoFA
2012	29.0	multilateral	ESMAP	MoE
2013	105.4	regional	E5P (Moldova, Georgia, Armenia)	MoE
	9.2	bilateral	Development cooperation project (Ukraine)	MoFA
2014	222.3	bilateral	Development cooperation project (Malaysia, solar power plants)	MoE
	6.8	regional	Development cooperation project (Armenia, Moldova, Ukraine)	MoFA
	50.0	multilateral	EPTATF - Eastern Partnership Technical Assistance Trust Fund, administered by the European Investment Bank	MoFin
2015	100	multilateral	Green Climate Fund	MoE
	397.4*****	bilateral	Development cooperation projects (Moldova, solar power plant and biomass boilers)	MoE
	50	multilateral	EPTATF	MoFin
2016	286.5*****	bilateral	Development cooperation project (Georgia, solar power plants)	MoE
	50	multilateral	EPTATF	MoFin
2017	618******	bilateral	Development cooperation projects (selection of projects ongoing)	MoE

* planned total project value, including beneficiary's own contribution

** preliminary figures

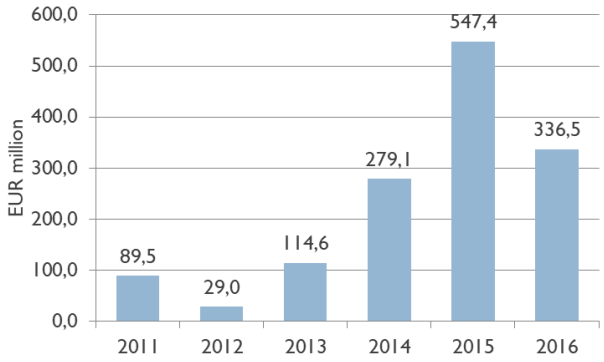

Figure 7-1. International climate finance provided by Lithuania (in EUR million)

Starting from 2018 Lithuania is voluntarily doubling its climate finance to developing countries and has intentions to mobilize 1 million euros for climate financing from public and private sources annually till 2020.

International cooperation on training and capacity building

The EU-funded EU Twinning Program supports cross-border co-operation between institutions, strengthens the administrative capacity of the beneficiary countries and helps them implement the necessary reforms. Lithuania has provided expert support in this EU program since 2004.

Lithuania has participated in international cooperation measures listed in Table 9-3 below.

Table 9-3. International cooperation measures

Recipient country/region	Programme or project title	Description of programme or project
Serbia	Serbia's waste management system improvement	Specialists of the Ministry of Environment and the Environmental Project Management Agency will help Serbia to develop and improve its waste management system under the EU Twinning programme project intended to support the waste management policy. The European Commission has assigned EUR 1.5 million to this project. The Lithuanian experts will participate in the project together with their colleagues from Austria and Sweden. For two years they will help the Serbian Ministry of Agriculture and Environment to drawn up national and strategic waste management plans, upgrade legislation of this sector and determine economic instruments for ensuring its operation. The EU Twinning programme funded by the European Commission supports cooperation of sister institutions in different countries, enhances the administrative capacity of beneficiaries and helps to implement the necessary reforms.
Macedonia	Strengthening the capacities for effective implementation of the acquis in the field of	Recognizing the need to improve the water quality management issues in the country, the European Union, through the Instrument for Pre-Accession Assistance, is funding the Twinning Project *"Strengthening the capacities for effective implementation of the acquis in the field of water quality".* The project duration is 21 months (May 2017 – January 2019) with a budget of EUR 1.2 million. The main beneficiary institutions are the Ministry of Environment and Physical

	water quality	Planning and the Hydrometeorological Service. The main EU member state partners are Environment Agency Austria (Umweltbundesamt), Ministry of Environment of the Republic of Lithuania and the National Institute for Public Health from The Netherlands. The project purpose is to strengthen the administrative capacities in the area of water management by implementing the appropriate EU acquis. In particular the project will assist the national authorities in drafting the Vardar River Basin Management Plan and in harmonising and implementing secondary legislation in the area of water monitoring and water permitting.
Georgia	Strengthening Sustainable Management of Forests in Georgia	The European Union delegation in the Republic of Georgia notified that European Union Twinning project *"Strengthening Sustainable Management of Forests in Georgia"* will be implemented by Lithuanian and Hungarian consortium. The proposal of Lithuanian-Hungarian consortium was selected against the proposals of Austrian-German consortium and Greece. This is the first Twinning project in Georgia, which will be implemented by Lithuania as a leading partner. Ministry of Environment of the Republic of Lithuania, State Forest Service of Lithuania and Ministry of Agriculture of the Republic of Hungary in cooperation with National Food Chain Safety Office of Hungary will enhance the capacity of the state forest institutions in order to prevent and combat illegal activities in the sector, ensuring the sustainable management of Georgian forests and harmonizing the Georgian forest regulatory framework to the EU standards and practices. Environmental Projects Management Agency will be responsible for the project administration management, while Central Project Management Agency will be responsible for the financial management of the project. This Twinning project will be implemented during 18 months period. The European Commission provides the budget of EUR 840 000. As a Junior Leader, Lithuania has been participating in two other European Union Twinning projects in Georgia. Lithuanian Standards Board with partner institutions from Germany were strengthening the Meteorology and Standards Infrastructure in Georgia in 2010-2012. Moreover, Lithuanian National Commission for Energy Control and Prices in cooperation with partners from Austria have been helping to develop Energy Market Regulatory System in Georgia since 2015. EU Twinning project is an EU instrument for representatives from the public administrations of the EU Member States and Beneficiary Countries working together in order to transfer the know-how and good practices developed within the EU to beneficiary public administrations during implementation of the Twinning Project. Lithuania is participating in this programme since 2004. Lithuania has been awarded 76 European Union Twinning projects with the budget of EUR 65.5 million. According to the European Commission, Lithuania is one of the five most successful countries implementing the European Union twinning projects in 2013-2015. The other four countries are France, Germany, Spain and Austria.
Moldova	Support to the Civil Service Modernization in the Republic of Moldova in line with EU	The Steering Committee of the EU-funded Twinning project *"Support to the Civil Service Modernization in the Republic of Moldova in line with EU best practices"* has gathered for the7th quarterly meeting. The activities jointly carried out, reform agenda on public administration, building institutional capacity of the State Chancellery as a result of its reorganization process, as well as perspectives on the partnership framework were among the tackled subjects of the meeting.

	best practices	The Twinning projectwere analysed, such as: providing expertise in drafting legislative and normative acts, organizing training programs for civil servants from the Republic of Moldova and others. In this regard, the execution of the planned budget was discussed, concluding the saved financial resources would enable the project to organize additional activities.
Macedonia	Strengthening capacities to effectively implement EU requirements in the area of nature protection in Macedonia.	State service for protected areas under the ministry of Environment , together with the Finnish state-owned enterprise "Metsähallitus" implement the project *"Strengthening capacities to effectively implement EU requirements in the area of nature protection"* in Macedonia. The project consists of four activities: preparation of management plans for natural protected areas, strengthening of capacities for the preparation of assessment studies, strengthening of capacities for the preparation of biodiversity monitoring methodologies and development of the National Biodiversity Monitoring Programme. Project started in the autumn of 2017, with a duration of 24 months. The Lead Project Leader is Finland, while Lithuania is the Junior Project Leader.

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EU Twinning Program projects http://www.am.lt/VI/article.php3?article_id=18640

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Lithuanian Development Cooperation portal https://www.orangeprojects.lt/en/

Ministry of Environment webpage http://www.am.lt/VI/en/VI/index.php#a/534

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Photo credits: Sigita Rudaitytė, www.realisbeautiful.lt

RESEARCH AND SYSTEMATIC OBSERVATION

8 RESEARCH AND SYSTEMATIC OBSERVATION

8.1 General policy on research

At the highest level, Lithuanian science, technology and innovation (STI) policy is set by the Seimas (Parliament) and the Government of the Republic of Lithuania.

The main law devoted to the regulation of STI system is the Law on Higher Education and Science. In 2016, Seimas adopted the Guidelines of Lithuanian research and innovation policy where main directions of state STI policy were defined.

The Research Council of Lithuania (hereinafter – the Research Council) serves as an advisory body to the Seimas and the Government. In 2016, the Higher Education Monitoring and Analysis Center (MOSTA) became the institution under Lithuanian Government and it is now responsible for monitoring and analysis of all system of higher education, research, technology and innovation.

The Lithuanian STI policy governance structure is based on a dual ministry model, with the Ministry of Economy responsible for innovation and industrial research policy, and the Ministry of Education and Science responsible for higher education and public sector research policy. The Ministry of Economy is the principal institution involved in shaping policy for the promotion of innovation and development of small and medium enterprise. The Ministry of Education and Science deals with research excellence in the public science sector and is responsible for the development of highly-skilled human resources for research and innovation. Furthermore, the Ministry of Finance also plays a major role in allocating funding for national research programmes.

The 14 universities form the framework of the Lithuanian research system. In 2017 there were 14 public universities and 8 non-public universities, 13 public and 12 non-public colleges and 11 public and 10 non-public research institutes. The University Research Institute stands for a research institution where the University carries out its goals and mission towards a certain direction and fulfils research and experimental development, providing scientific basis for the university students and researchers to develop and improve the qualification of teachers of scientific society.

In Lithuania, there are 8 Science and Technology Parks (STP), which offer good infrastructure and variety of services for the establishment of new innovative businesses in Lithuania. STP is one of the most important integrated elements to promote business and innovation.

In 2008 five Integrated Science, Studies and Business Centres ("Valleys") were established. The valleys enable successful use of scientific knowledge for the development new products or technologies, bring business and academia cooperation up to the front. In this way the state would achieve greater business participation in all innovation cycles from basic research to the introduction of new products into the market, as well as increase of private sector's investment in research, development and innovation will be encouraged.

A background of funding research and experimental development in Lithuania is constituted from basic and non-basic financing. While research funding was started to bond with the results of science activity, new challenges related with the evaluation of the quality and reliability of these results occur to funding institutions.

In 2015, research and development expenditure amounted to EUR 387 million. Compared to 2014, it increased by EUR 10.2 million, or 2.7%. In 2015, based on provisional GDP figures, total research and development expenditure accounted for 1.04% of GDP (in 2014, 1.03%). In terms of source of funding, the biggest proportion of research and development expenditure – 35.6% – was made up of government funds; foreign funds accounted for 34.6, business enterprise funds – for 28, the funds of higher education and non-profit institutions – for 1.8% (Figure 8-1).

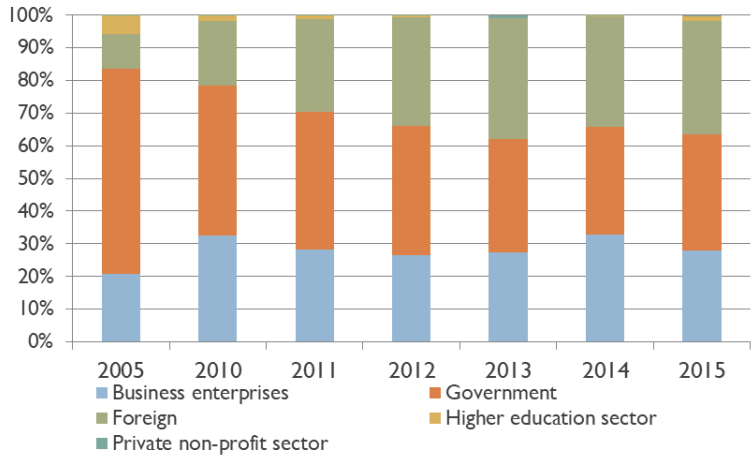

Figure 8-1. Research and development financing in 2005-2015 by source of funds, %.

Currently, the main responsible institutions responsible for research and innovation funding and for regulating the field and/or providing specific services are:

- Agency for Science, Innovation and Technology (MITA). Since 2010 it is the main institution responsible for the implementation of innovation policy in Lithuania. Currently, it administers a number of measures and programmes aimed at innovation and especially research collaboration.
- Lithuanian Business Support Agency administers the business support programmes, including innovation and research in the business sector.
- European Social Fund Agency administers European Union Structural funds aid and implements measures assigned to the Ministry of Education and Science in the development of human resources for science, technology and industry.
- The Research Council of Lithuania. Since 2008, this institution is the central funding agency for fundamental research and researchers' mobility, complementing institutional funding for basic research with project-type funding.
- Central Project Management Agency under the Ministry of Finance administers the high scale investments into the development of research infrastructures.
- The Lithuanian Centre for Quality Assessment in Higher Education deals with quality assurance and higher education standards.
- The agency "Invest Lithuania" is responsible for foreign direct investment attraction, and Enterprise Lithuania is responsible for entrepreneurship as well as export development.

The legal framework for prioritising and budgeting public investments in research, technological development and innovation is embedded in two strategic documents: the Lithuanian Progress Strategy "Lithuania 2030" published in 2012, and the Lithuanian Innovation Strategy for 2010-2020 published in 2010. Lithuanian Progress Strategy 2030 is a long-term strategy to strengthen fundamental public capacities, thus ensuring a harmonious development of the State and helping to respond to global economic and environmental changes and pressure coming from the global competition, as well as to create high standards of living for all. It seeks to promote fundamental changes in society and to facilitate the formation of a creative, responsible and open personality.

Aiming to implement the Lithuanian Progress Strategy "Lithuania 2030" and to conduct projects under the EU Research and Innovation Programme "Horizon 2020", Lithuanian Innovation Development Programme for 2014-2020 was adopted in 2014. The Programme is devoted to consolidate state resources for the promotion innovation and development of competitive economy based on higher level knowledge, innovative technologies, qualified humane resources and smart specialization. The strategic goal of this Programme is to increase a competitiveness of Lithuanian economy, developing an efficient innovation system which would stimulate innovativeness of economy. It was determined by priorities and goals set in the strategy "Europe 2020". Lithuanian Innovation Development Programme for 2014-2020 is implemented via the action plans that are prepared and approved by the Minister of Economy for the periods of 2014-2017 and 2018-2020. The institution responsible for the implementation is the Ministry of Economy.

In 2015, the Lithuanian Government approved the Programme on the implementation of the *research, development and innovation* priority areas and their priorities (Smart Specialization Programme) and Action plans for implementation of the priorities. In August 2015, a general Action plan for the implementation of this programme concerning the measures coordinated by the Ministry of Education and Science was also approved. These documents cover the implementation of six priority areas and their twenty specializations – specific priorities.

Following the principles of coordination and monitoring provided in the Smart Specialization Programme, the coordination group consisting of key stakeholders was established in 2014 to monitor and coordinate the implementation of the priorities. By the end of 2014, the detailed procedures of evaluation and monitoring of Smart Specialization Programme were adopted. The provisions provide that two institutions are responsible for monitoring and evaluation of the implementation of the Programme on the implementation of the research, development and innovation priority areas and their priorities – the Research and Higher Education Monitoring and Analysis Center (MOSTA) and the Ministry of Economy.

The overall aim of this Programme is to develop policy instruments that would include both horizontal and subject measures necessary to achieve a substantial breakthrough in the six priority fields that Lithuania had identified as main areas for research, development and innovation*:*

- energy and environmental sustainability;
- agro innovation and food technologies;
- new processes, materials and production technologies;
- health technology and biotechnology;
- transport, logistics and ICT;
- inclusive and creative society.

One of the priority areas of the Smart Specialization Programme is "Energy and sustainable environment", which has close links to influencing climate change. The main priorities of the "Energy and sustainable environment" priority area are the following:

- Smart systems for energy efficiency, diagnostic, monitoring, metering and management of generators, grids and customers.
- Energy and fuel production using biomass/waste and waste treatment, storage and disposal.
- Technology for the development and use of smart low-energy buildings – digital construction.
- Solar energy installations and technologies for using them for the power generation, heating and cooling.

8.2 Research

8.2.1 National Research Programs

National Research Programs (hereinafter – NRPs) are competitive scientific programs, which enable to solve problems of state and society and increase the international competitiveness of Lithuanian science. The purpose of the NRPs is to bring together Lithuania's scientific potential and financial resources, to initiate new research and to coordinate already existing research in order to solve a given problem. The National Research Programs are approved by the Minister of Education and Science and the implementation of these programs is administered by the Research Council of Lithuania. In order to ensure financing of the highest competency research and to promote the competitiveness of Lithuanian science, the projects of the National Research Programs are selected through a public tender procedure.

The Research Council of Lithuania approved a new list of the National Research Programmes in 2013: Modernity in Lithuania; Welfare society; Towards future technologies; Healthy aging; Sustainability of agro-, forest and aquatic ecosystems. These programmes finance large-scale research and continue the previous NRPs.

One of the five National Research Programmes approved by the Research Council of Lithuania in 2013 provides competitive funding for research in a climate change research field. The NRP "Sustainability of agro-, forest and aquatic ecosystems", approved by the Government of the Republic of Lithuania started in 2015 and is expected to end in 2021. Overall budget is EUR 6.6 million. This Programme replaced the previously existing programme "The Ecosystems in Lithuania: Climate Change and Human Impact". The purpose of the programme is to understand and be able to forecast the general effects of climate change

and the intensive use of ecosystem resources, and to obtain new fundamental and empiric knowledge to enable the avoidance of threats related to these effects.

A characteristic feature of Lithuania is an intensive and market-driven agriculture and forestry sector that contributes to soil degradation and creates a threat to the landscape, biological diversity, and the sustainability of agro-, forest and water ecosystems. The accelerating climate change also affects all the components of ecosystems in addition to their functions and will eventually create new environmental conditions unprecedented in the history of Lithuania. The emerging ecosystem degradation processes are complex and difficult to manage, and need to be examined in a comprehensive manner in order to obtain results which will constitute a basis for taking decisions and proposing the relevant measures.

The objective of the programme is to obtain, analyse and generalise, through integrated scientific research, new scientific knowledge about the impact of climate change and the use of ecosystem resources on the ecosystems of Lithuania, their adaptability to the changing climate and environmental conditions, and, having acquired new fundamental and empiric knowledge about the overall consequences of the use of ecosystem resources, to propose measures to avoid threats related to such consequences and draw up new guidelines for controlling and restoring the sustainability of ecosystems.

Two tasks are designed to meet the objective of the programme:

1. Study the effects of climate change and other environmental stress factors on agro-, forest and water ecosystems, their productivity and biological diversity;
2. Study how the intensive exploitation of resources affects agro-, forest and water ecosystems, identify the long-term consequences and the possible damage caused by such impact, and propose measures for the restoration of sustainability.

The 1st call for proposals for 2015-2018 period launched with about EUR 3.96 million in total for the financing of the programme research projects. During the period 11 projects have already started (Table 8-1).

Table 8-1. List of National Research Programme "Sustainability of agro-, forest and aquatic ecosystems" projects

Institution	Project title
Aleksandras Stulginskis University (partners: Institute of Physics, Munich University)	The complex impact of climate and other environmental stressors on the ability of forests to adapt and mitigate global change threats
Lithuanian Energy Institute (partners: Nature Research Centre, Vilnius University, Aleksandras Stulginskis University)	Impact assessment of climate change and other abiotic environmental factors on aquatic ecosystems
Lithuanian Research Centre for Agriculture and Forestry (partner: Nature Research Centre)	Response and plasticity of different tree species & juvenile-stage forest communities under impact of climate change and other environmental stressors (MIŠKOEKOKAITA)
Lithuanian Research Centre for Agriculture and Forestry (partner: Nature Research Centre)	Establishment and diversity of a newly emerging cereal pathogen in the agroecosystem due to changing climate and farming practices
Lithuanian Research Centre for Agriculture and Forestry (partners: Aleksandras Stulginskis University, Vilnius University)	The influence of long-term contrasting intensity resources management on genesis of different soils and on other agro-ecosystems components (AGROTVARA)
Nature Research Centre	Agroecosystems microbiota under climate change:

(partner: University of Ostrava)	structure and concordance mechanisms
Nature Research Centre (partner: Klaipėda University)	Implication of species and functional diversity for aquatic ecosystem services under increasing eutrophication and chemical pollution (RETRO)
Vilnius University (partners: Vytautas Magnus University, Nature Research Centre)	Anthropogenic impact on the stability of the vegetation component of some Lithuanian rivers' ecosystems
Vytautas Magnus University (partners: Lithuanian Research Centre for Agriculture and Forestry, Aleksandras Stulginskis University)	Climate and environmental change complex impact on agro-ecosystem productivity, biodiversity and sustainability
Vytautas Magnus University (partners: University of Warsaw, Vilnius University, Lithuanian Research Centre for Agriculture and Forestry)	Research on clear-cut felling impact on forest ecosystems biodiversity dynamics
Lithuanian University of Health Sciences (partner: Vilnius University)	The impact of intensive farming on the of antibiotics and biocides resistant bacteria emergence, survival and spread in soil and water

8.2.2 The main institutions related to climate research development in Lithuania

Aleksandras Stulginskis University (ASU) performs various research projects related to agriculture in a field of climate change. Recently the University actively participates in the projects related to:

- Research of plants to adapt to changing climate and development of new plants species which could be resistant to climate change consequences
- Technological and eco- innovations in reducing pollution in livestock farming
- Information and communication technologies and robotics for sustainable agriculture
- Use of precise farming technological processes in reducing impact on environment and costs of agricultural production
- Use of new probiotics to reduce emissions from manure
- Influence of bio-additives on soil water retention
- Humidity regime control in soil
- Sustainable farming, short rotation crops impacts on the environment, crop productivity and bio-economic potential
- Water emissions and their reduction in village communities-villages in Baltic sea region etc.

The Environmental Protection Agency ensures continuous and complex monitoring, evaluation, forecast of and information providing on environmental quality and nature resources use. It also organizes and performs chemical, biological and radiological investigations of environment and pollution sources, coordinates applied and other scientific environmental research, programs and projects.

EPA has participated in these projects:

- "MyOcean2" which is a continuation of "MyOcean" project. It is a 30-month project granted by the European Commission within the Global system for monitoring of environment and safety (GMES) program. The main objective is to end, to develop and to improve services provided by GMES, to prepare a system for an operative phase. MyOcean2 addressed the sustainability of its

service provision beyond 2014. For this purpose, a dedicated European structure, the European Centre for Ocean Monitoring and Forecasting (ECOMF), will be designed and set up.

- "MyOCEAN Follow On" („MyOCEAN FO") which ensures a controlled continuation and extension of the services already implemented in MyOcean and MyOcean2 projects that have advanced the pre-operational marine service capabilities. The main objective of the MyOcean FO project will be to operate a rigorous, robust and sustainable Ocean Monitoring and Forecasting component of the pre-operational Copernicus Marine Service delivering ocean physical state and ecosystem information to intermediate and downstream users in the areas of marine safety, marine resources, marine and coastal environment and weather, climate and seasonal forecasting. The project is implemented in 2014-2015 is funded from HORIZON 2020 EU Research and Innovation programme.
- 3 projects related to river basins management and protection: "Preparation and update of Nemunas, Lielupė, Venta and Dauguva river basins management plans, programs of measures and other necessary documents for water protection purposes" (implemented during 2013-2015), "Preparation of floods risk management plans" (implemented during 2013-2015), "Preparation of flood risk and flood threat maps for the territory of Lithuania" (implemented during 2011-15). The projects aimed to analyse the state of the main river basins, to assess human impact on surface water bodies and underground water resources and to perform economic analysis of water use, to develop and update river basin management plans and programs of measures, to prepare flood risk and flood threat maps for the areas of Nemunas, Venta, Lielupė and Dauguva river basins. The projects implemented with the funding from EU Cohesion Promotion Action Program.
- "Strengthening of marine and inland water management (part II)". Project will be implemented during 2014-2017 period. It is funded from European Economic Area (EEA) Grants programme. The goal of the project is to improve information on the environment (to collect and evaluate information on water quality elements, effects of land cover change, transboundary air pollution, etc.), to develop the tools to assess the status of water bodies, to implement measures to improve the status of water and to evaluate their effectiveness. To achieve this, the status of water bodies at risk and its root-causes will be assessed, the effects biogenic compounds of the bottom sediments of the Curonian Lagoon on its status will be evaluated, impact of agricultural activities on the status of water bodies will be measured, effectiveness of diffuse pollution reduction measures will be evaluated, data on water quality elements will be collected, land cover changes will be evaluated, fluxes of long-range transboundary air pollution will be assessed. This will help ensure effective control of water quality at both national and European Union levels.

The Department of Hydrology and Climatology at Vilnius University actively participates in research activities in relation to climate change. The most recent ones are related to research on climate fluctuations and quantitative and qualitative changes of Lithuanian water resources:

- UNECE project "Management of the Niemen River basin with account of adaptation to climate change" in the programme of pilot projects on adaptation to climate change in transboundary basins under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention)". Project duration – 2011-2013. The overall objective of the project is to improve integrated river basin management and transboundary

cooperation in times of a changing climate in the Neman river basin. Implemented in cooperation with Belarus and Russian Federation.

- Climate change in peatlands: Holocene record, recent trends and related impacts on biodiversity and sequestered carbon (CLIMPEAT) project together with Nature Research Centre and University of Bern, funded by Lithuanian-Swiss Cooperation Programme. Project duration – 2013-2016.
- Climate change and quantitative and qualitative fluctuations of Lithuanian water resources (implemented in 2009-2013). The tasks of the project is identification of the tendencies of the regional climate change and the hydrological processes, assessment of the climate change impact on the Baltic Sea coasts, analysis of the measures to facilitate adequate adaptation strategies, verification of numerical weather prediction outputs under different atmospheric circulation background.
- Regional analysis of climate and water resources. Project duration – 2004-2018. The aim of the project: identification of the tendencies of the regional climate change and the hydrological processes, assessment of the climate change impact on the Baltic Sea coasts, analysis of the measures to facilitate adequate adaptation strategies, verification of numerical weather prediction outputs under different atmospheric circulation background.
- Global Water Partnership and World Meteorological Organization (WMO) initiated Integrated Drought Management Programme (IDMP) for Central and Eastern Europe. Project duration – 2013-2015. The overall objective were: to adapt the integrated water management systems, according to the Water Framework Directive (WFD), that provide guidelines how to integrate drought management into the planning and development of river basin management plans in a changing climate; use a stepwise approach to develop drought management plans in accordance with WMO/GWP Guidelines and EU Guidelines.

The Department also participates in two ESSEM COST action projects:

- ESSEM COST action ES1206 „Advanced Global Navigation Satellite Systems tropospheric products for monitoring severe weather events and climate (GNSS4SWEC)". Project duration – 2013-2017. The Action address new and improved capabilities from concurrent developments in both GNSS and atmospheric communities to improve short-range weather forecasts and climate projections.
- ESSEM COST Action ES1404 „A European network for a harmonized monitoring of snow for the benefit of climate change scenarios, hydrology and numerical weather prediction". Project duration – 2014-2018. The Action co-ordinate efforts for establishing harmonized snow monitoring practices, enhancing the use of observations by promoting new observing strategies, bringing together different communities, facilitating data transfer, upgrading and enlarging knowledge through networking, exchange and training, and linking them to activities in international agencies and global networks.

The projects are funded from EU Framework Programme for Research and Innovation Horizon 2020.

Kaunas University of Technology (KTU) is one the largest technological universities in the Baltics. The Institute of Environmental Engineering of KTU activities and research are based on practical engineering and management, policy decision-making related to environmental quality management. The Institute participates in the project "Novel roles of regional and LOcal authorities in supporting energy consumers'

behaviour change towards a low CARBOn economy (LOCARBO)". Project duration – 2016-2020, funded from INTERREG Europe programme. An overall objective of LOCARBO is improving policy instruments targeting demand-driven initiatives to increase energy efficiency related to the built environment. This is to be achieved by finding innovative ways for regional/local authorities to support energy consumers' behavior change. The KTU Institute of Environmental Engineering in the project will carry out research related to energy efficiency of buildings in reducing environmental impact.

In addition, the Institute participates in EU funded project "Electric Vehicles for City Renewable Energy Supply (EV ENERGY)". EV Energy analyses and develops innovative policies that promote renewable energies, electric mobility and the use of information and communication technologies for their integration. The Institute will analyze the measures and actions of the Kaunas region promoting the use of renewable energy sources and ETP in the region, good practices and the use of information and communication tools to integrate mobility and the use of renewable resources in the city. It will familiarize with the experience of other regions (project partners) and transfer their best practices to interested institutions and contribute to the implementation of the Kaunas region's sustainable urban mobility. Project duration – 2017-2021, funded from INTERREG Europe programme.

Klaipėda University performs projects related to marine research, coastal protection and resource preservation, biological diversity, development of aquacultural technologies. It also plays an important role in the creation of background on environmental research of sustainable development, systematic research on the Baltic architectural, urban environment, marine and cultural landscape, modelling of tendencies and strengthening of identity.

The other important research center in Lithuania is the **Lithuanian Energy Institute** and the main objectives are to perform fundamental and applied research in the fields of thermal physics, hydrodynamics, metrology, safety and reliability of energy objects, materials engineering, hydrology, and processes management, climate change, the preparation of energy sector planning conceptual and methodological basis in the energy sector of the State's policy. The laboratory for Energy systems research is established by the Lithuanian Energy Institute. Experience of Lithuanian Energy Institute related to climate change projects is used on an international level – institute's experts contributed to the Intergovernmental Panel on Climate Change report about climate change mitigation measures, study "Energy and climate change" in accordance with the World Energy Council plan, research supported by the International Energy and Environmental Policy Center and executed in partnership with experts from Central and Eastern European countries. The most recent projects were:

- Modelling of least-cost long-term greenhouse gas emission reduction strategies for Lithuania. Project is devoted to elaboration of methodology and corresponding mathematical models (based on IAEA tools) for evaluation of the least-cost long term greenhouse gas mitigation strategies in Lithuania, as well as for preparation of recommendations for applicability of different measures, including nuclear energy, in order to achieve foreseen emission reduction targets. Project duration – 2016-2018. Project is funded by TATENA.
- Assessment of perspectives for broader use of renewable energy sources in Lithuania taking into account interdependencies among energy, water and climate change. Climate change mitigation strategies involve broader use of renewable energy sources in production of commercial energy. Evaluation of impact of renewable energy sources in prospective development of energy sector requires development and use of new analytical approaches. Report describes modelling

principles of land use, growing of agricultural products, forest growing and water management in mathematical models of energy sector development, operation and environmental analysis. Project duration – 2012-2014. Project was funded by TATENA.

- Lithuanian energy sector development research (2015). The research provides projected trends of the Lithuanian energy sector based on the analysis of the mathematical modelling results, rational scenarios for the development of the energy sector in the long-term perspective and the environmental impact. A draft of updated National Energy Strategy was prepared. Project was funded by Ministry of Energy.

The institute is also actively involved in research activities in support of the national greenhouse gas inventory and projections development. The following researches have been funded from the Norway Grants programme in the scope of partnership project between Lithuania and Norway "Cooperation on GHG inventory and Projections":

- National emission factors for energy sector development and revision study implemented in 2015.
- Preparation of methodological guidelines for the development of national greenhouse gas emission projections (2016). The study provides methodological guidelines for the preparation of GHG emission projections in separate sectors of the economy of Lithuania, linking the forecasted GHG emissions with the perspective development of Lithuanian economy sectors. In addition the training for specialists responsible for GHG emission projections of individual sectors is conducted.

Lithuanian Geological Survey collects, monitors, analyzes and provides scientific understanding about the underground geology, natural resources, carrying out investigations and forecasting the geological processes.

Lithuanian Geological Survey initiated several projects related to geothermal energy development in Lithuania:

- Geothermal data module project (2015). The geological data module of the subsystem Geological Survey of the State Geological Information System GEOLIS was created during the project. Geothermal data from the wells in which the temperature measurements were carried out were systematized. Systematized data will be used for the installation of geothermal heating systems and power plants.
- Project "Preparation of methodology for calculation of geothermal energy resources" was carried out during 2016-2017. The project aims to develop a methodology for calculating geothermal energy resources and to evaluate the resources by defining terminology by choosing the appropriate resource classification scheme and clearly defining the estimated resources. The final result is an evaluation methodology that meets selected needs.
- Project "Assessment of geothermal energy resources and their use potential" to be implemented during 2017-2018. An analysis of the geothermal well data (energy power, heat pump characteristics, well borehole and hydrogeological conditions) is necessary to evaluate the geothermal energy resources of the Earth and their use potential.

The projects are funded from State's budget.

Lithuanian Research Centre for Agriculture and Forestry (hereinafter – LRCAF) in the perspective of it's activity focuses on sustainability of agro and forest ecosystems under changing climate conditions.

The most recent climate change related researches performed and currently executed by LRCAF are:

- Ecology of interaction of pests that desolate trees and microorganisms in the context of climate change. The aim of this research work was the collection of fundamental and applied knowledge about interaction and influencing factors of currently present and new pests and microorganisms. Research duration – 2012-2015. It was funded by the Research Council of Lithuania.
- Biogeography and spread of local and invasive tree pathogens: focus on climate, tree species and intensity of forest management". Project duration – 2017-2020. It is funded by the Research Council of Lithuania.
- Sustainable forestry and global changes. An objective of this research is a collection of knowledge that is necessary to the development of sustainable forestry in the context of natural, economic and social changes. The initial project implemented in 2012-2016 and will continue during 2017-2021. It is funded from the State budget.
- Project of the Ministry of Education and Science of the Republic of Lithuania and Belarus State Science and Technology Committee on scientific and technological cooperation programme "Estimation of Scots pine ecological plasticity using molecular-genetic methods aimed to improve reforestation strategy in the context of climate change, to preserve forest biodiversity and genetic resources in Belarus and Lithuania". Project implemented during 2015-2016.
- Benchmarking sustainability performance of value chains using ToSIA (the Tool for Sustainability Impact Assessment). Project duration – 2017-2019. Funded by FP7 ERA-NET "SUMFOREST" project.
- Research on resistance of perennial plants to drought and cold. The aim of this research to investigate resistance of ryegrass genes to drought and cold. The project duration – 2012-2014. It was funded by the Research Council of Lithuania.
- The aim of "Ecology of interaction of pests that desolate trees and microorganisms in the context of climate change" research work was the collection of fundamental and applied knowledge about interaction and influencing factors of currently present and new pests and microorganisms. Research duration – 2012-2015 and it was funded by the Research Council of Lithuania.
- Research on decarbonization of soil and erosive processes and measures for their stabilization. The aim of this research is to evaluate the intensity of soil acidity and erosive processes in the impact of natural and anthropogenic factors. It is a long-term project (2008-2016) funded from the State budget.

The LRCAF is also involved in research activities in support of the national greenhouse gas inventory. Several researches have been funded from the Norway Grants programme in the scope of partnership project between Lithuania and Norway "Cooperation on GHG inventory". In particular, national parameters to estimate carbon stock changes in soils have been developed and improved: soil and forest litter carbon stocks in forest land, non-forest land and afforested/reforested land; carbon stocks in dead organic matter (dead wood) analyzing various degrees of dead wood decomposition rates. In addition study on development of the harvested wood products (HWP) accounting system and preparation of relevant accounting methodology has been prepared. In 2017 LRCAF started research to support national parameters development in agriculture sector (research "Greenhouse gas inventory of the state's crop production sector"). The project will be finalized in 2020. It is funded by the Ministry of Agriculture.

Lithuanian University of Health Sciences (LUHS) is the biggest institution of higher education for biomedical sciences in Lithuania. Within the University Institute of Animal Science is established, which

research activities includes the studies of animal breeding, biology of reproduction and genetic resources; the studies of animal nutrition and production quality; the studies of animal welfare and environmental issues related with animal production.

The University together with 22 countries implemented the program "Large-scale methane measurements on individual ruminants for genetic evaluations (METHAGENE)" (COST action FA1302). METHAGENE aims to discuss and agree on: protocols to harmonize large-scale methane measurements using different techniques; easy to record and inexpensive proxies for methane emissions to be used for genetic evaluations; and approaches for incorporating methane emissions into national breeding strategies. METHAGENE will co-ordinate and strengthen the EU scientific and technical research through improved cooperation and interactions, which is essential for breeding ruminants with lower environmental footprints resulting in less contribution to global warming. This EU funded project was implemented during 2013-2017.

The University together with Latvia, Germany, Denmark, Poland, Sweden and Estonia participates in the project "Reducing nitrogen loss from livestock production by promoting the use of slurry acidification techniques in the Baltic Sea Region (Baltic Slurry Acidification)". Baltic Slurry Acidification aims to promote the implementation of slurry acidification techniques throughout the Baltic Sea Region. Slurry acidification techniques (SATs) will reduce the ammonia losses from livestock manure and thus reduce airborne eutrophication of the Baltic Sea. The usage of SATs will provide clear environmental benefit for the region. The use of SATs benefits also farmers by increasing the nitrogen use efficiency of their manure fertilizers and thereby decreasing their dependency on mineral nitrogen. The project started in 2016 and will end in 2019, funded by EU (Interreg Baltic Sea Region Programme).

In addition, the University participates in "European research area network on sustainable animal production systems (ERA-NET SusAn)". The project aims to tackle animal production challenges from projected increases in global demand for food, climate change, competition for natural resources and economic volatility. These challenges and complexities can be effectively addressed through joint European research within a framework which supports the three pillars of sustainability – economy, environment and society – and targets opportunities for innovative research spanning all areas of animal production such as health and welfare, feeding and nutrition, reproduction, breeding and genetics, housing, nutrient management and economics. The project receives funding from the EU Horizon 2020 Research and Innovation Programme, duration – 2016-2020.

The Nature Research Centre is significantly contributing to the implementation of State's ecologic monitoring, provides conclusions and proposals on the subjects of improvement of environmental quality, impacts of negative human activity and mitigation of global climate change.

Nature Research Centre participates in these projects:

- Climate change in peatlands: Holocene record, recent trends and related impacts on biodiversity and sequestered carbon (CLIMPEAT). The project explored the interconnections and interdependencies of peatlands ecosystems with climate (change), anthropogenic activity and sequestered carbon. The project duration – 2013-2016. The project is performed together with University of Bern, Vilnius University and is funded by Lithuanian-Swiss Cooperation Programme.

- UV-B radiation: a specific regulator of plant growth and food quality in a changing climate, COST Action FA0906. The research financed from **EU Framework Programme for Research and Innovation Horizon 2020**. Project duration – 2010-2014.
- A global network of nurseries as early warning system against alien tree pests (Global Warning), COST Action FP1401. The research financed from **EU Framework Programme for Research and Innovation Horizon 2020.** Project duration – 2014-2018.
- Research on biological diversity and prognosis on conditions of global change and anthropogenic impact implemented during 2012-2016. The results will be important to the establishment of biota stability mechanisms in the Baltic region. Fundamental knowledge received from the research will deepen a perception about formation and functioning of ecosystems in the Baltic countries; and contributed to the execution of objective environmental protection programmes and forecasting potential changes. The project was funded by the Ministry of Education.

Vilnius Gediminas Technical University (VGTU) participates in projects that are related with the technological development. During 2009-2015 VGTU participated in the EU funded project "Sustainable zero carbon ECO-town developments improving quality of life across EU". The project involves the application of the principles of sustainable development in cities and the application of good practice in the development of urban areas.

VGTU together with 49 partners from 14 countries is also involved in the EU funded project 3Ccar. The project addresses the ever growing complexity in mobility systems, especially in electrified vehicles (EV). Complexity control and reduction, translated into highly innovated semiconductors, enable improved energy efficiency, while enhanced systems integration leads to significant cost reduction, all enabling widespread EV development. 3Ccar will demonstrate semiconductor-based powertrain, battery and fuel–cell systems for higher efficiency, cost effectiveness and reliability, even in harsh environments, that are ideally suited to the plugin hybrid and electric automotive mass market. Project duration – 2015-2019.

Since 2008, science and research clusters were started to establish in **Vytautas Magnus University**, i.e. groups of researchers in order to execute common researches were started to form. One of the clusters executes research related to an effect of anthropogenic environmental changes and climate to alive organisms. The aim of scientific cluster is to investigate and evaluate response of alive organisms to single and integrated impact of anthropogenic and natural factors, changes in productivity, structure and biological diversity of populations and biological communities, and to evaluate possibilities of different economy branches to upgrade their ecological efficiency and sustainability. In order to implement this aim, researchers of cluster investigate and analyze impact of environmental factors, such as environmental acidification and eutrophication, ground level ozone, UV radiation, geo-magnetic storms, sun flashes, and consequences of climate change – increased frequency of droughts, waves of heat and frost to agro- and forest ecosystems and human health. Increased attention is paid to the research and forecast of changes in competitiveness and adaptability of agricultural plants, productivity and seasonal development of main tree species according to different scenarios of climate change. In order to achieve practical value of obtained results, possibilities to reduce environmental impact of different economy branches is analysed.

Recent research projects performed by **Vytautas Magnus University** are provided in Table 8-1.

8.3 Systematic observations

8.3.1 Global Climate Observing System

Lithuanian GCOS related activity is coordinated by the Lithuanian Hydrometeorological Service under the Ministry of Environment (hereinafter – LHMT). It performs climate observations, analyzes climate changes, provides information and actively participates in the activities of Eastern and Central European working groups. In GCOS Surface Network (GSN) the Vilnius meteorological station is included which provides a contribution to the surface-based atmospheric essential climate variables (ECVs) – atmospheric ECVs. Significant planning is undertaken to ensure appropriate correlation between Lithuanian and international needs and data that are collected.

Lithuanian scientists actively perform international collaboration in the research fields of climate change. Lithuania supported capacity-building project in adaptation implemented in developing countries.

In addition, LHMT has bilateral agreements with the institutions in Belarus (i.e. Ministry of Natural Resources and Environmental Protection of Belarus), Russia (i.e. Federal Service of Hydrometeorology and Environmental Monitoring in Russia and others), Poland and etc., which allow an improvement of quality and expedition of information provided by the both sides. In such way a partnership is formed and it stimulates a sustainable development of the other countries and making of decisions related to ecologic economy, climate change and the others.

Lithuanian hydrometeorological observations

LHMT was established in 1921 and its goals are meteorological, hydrological and agrometeorological observations and forecasts. Currently network of meteorological observations covers all territory. It is composed of 18 meteorological stations, 3 aeronautical meteorological stations, 9 automatic meteorological stations, 43 automatic agro-meteorological stations, 3 lightning detectors which are in the network with ECLID, 2 Doppler weather radars. Net of water measurement includes 93 stations. LHMT performs regular hydrometeorological observations in the State territory, forms data bank of these observations, evaluates water resources and climate, makes weather forecasts, releases early warnings of hazardous hydrometeorological conditions, provides hydrometeorological information to Lithuanian institutions and organizations, prepares and issues yearly books, annual reference books and reviews.

LHMT participates in the international projects and programmes:

- Cooperates with EUMETNET – organization of national European hydrometeorological services – and participates in the remote program of meteorological education called EUMETCAL and in early warning multi-hazard programme EMMA.
- Participates in the project of development of HIRLAM (High Resolution Limited Area Modelling) and performs adaptation of digital weather forecast model to Lithuania, participates in the meetings and the other activities of the project. It collaborates in the execution of Joint flood programme of World Meteorological Organization (hereinafter – WMO) for Central and Eastern Europe, participates in the seminars, and prepares information about the strongest floods in Lithuania. It also participates in the WMO program WWIS (World Weather Information Service) of project “Weathers of world cities” and provides daily information to WWIS about forecasted weather during coming 5 days about in 5 Lithuanian cities and climate data.
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- Participates in the WMO World Weather Research Programme (share scientific researches made in Lithuania) and WMO CEE-WMO/GWP Associated Programme on Flood Management (collaborate on realizing floods management program in Central and East Europe)
- Participates in the programme for climate information and prognosis, called CLIPS (Climate Information and Prediction Services) and collaborates in the sharing of climate information, in the development of climate prognosis system and in research on climate change.
- Is actively participating in the program to ensure a safe navigation in seas and oceans, called NAVTEX. It twice per day makes and transfers prognosis and warnings about expected dangerous hydrometeorological phenomena in south-east Baltic Sea. This information is transmitted to ships through NAVTEX system which is a constituent of Global Maritime Distress and Safety System.
- Collaborates with World Ozone and Ultraviolet Radiation Data Centre (WOUDC) of WMO. LHMT constantly provides measurement data of total ozone and ultraviolet radiation, also it has an access to common WOUDC database.
- Collaborates in the establishment of database for world rivers outflow. It provides data of hydrological observations and information about Lithuanian rivers. It has access to the database of Global Runoff Data Centre – GRDC.
- Participates in the international project of trainings (EUMeTrain) funded by EUMETSAT. It is established to maintain and improve the data use of meteorological satellites. LHMT participates in lectures and cycles of lectures of remote meteorological trainings.
- Participates in the working groups of NORDMET (co-operation between the Nordic and the Baltic National Meteorological Services in the field of Infrastructure – to achieve better cost efficiency by sharing resources in such areas as observation, information management, product development, production, training and education).
- Belongs to NORDRAD (North Europe Radars) together with Finland, Norway, Sweden, Denmark, Island, Estonia and Latvia.
- Membership in WMO, EUMETSAT and ECMWF, bilateral and multilateral agreements with hydrometeorological services of other countries and international organizations presume the improvement of quality and expedition of hyrometeorological information provided by the services. Implementing the agreements of international collaboration, LHMT shares data of hydrometeorological observations and warnings about adverse hydrometeorological conditions with other countries, specialists of LHMT participate in the implementation of international programmes and projects.
- Participates in EUCLID (European Cooperation for Lightning Detection) and collaborate on lightning data exchanges.

8.3.2 Systematic observation of other climate parameters

A purpose of **State Environmental Monitoring Programme for 2011-2017** (hereinafter – Programme) is, pursuant to the current international commitments and national needs, to supply responsible state' and international institutions with reliable information about the state of natural environment and changes influenced by anthropogenic impact. Implementation of the Programme enable easier data collection and it contributes to the correct evaluation of natural environment in Lithuania, the management and forecasting on national and international levels, to supply institutions responsible for environmental

quality and public health of all levels with information about the state of environment that is of utmost importance in order to make decisions. Moreover, it will allow a solution of environmental problems, including threats of climate change, consequences to public health and ecosystems, long-range transboundary air pollution, increased intensity of occurrence of sinkholes, deteriorative soil conditions due to land use in karst region in the Northern part of Lithuania.

The implemented tasks of the Programme enable to solve the following environmental problems:

- air pollution, the effects of climate change on human health and ecosystems;
- the negative impact of radionuclides on the radiological quality of the environment;
- the negative impact of anthropogenic activity on the state of groundwater, territorial sea, coastal and intermediate waters, inland rivers, lakes and ponds;
- deterioration of soil quality due to natural processes induced by natural or economic activity, increasing soil anthropogenic physical and chemical pollution;
- the loss of biodiversity and irrational use of wildlife;
- the spread of non-indigenous invasive plants and animals of species threatening biodiversity and human health;
- the threat of long-range transboundary air pollution from other countries to Lithuania and the impact of climate change on semi-natural ecosystems;
- increasing pollution of the Baltic Sea, loss of biodiversity and productivity of agro-ecosystems, pollution of wells with nitrates due to pollution of surface and groundwater with nutrients from diffuse sources;
- the degradation of the most valuable and ecologically sensitive landscape complexes (in the protected areas) , including the shores of the sea, aesthetic decline in their value due to economic activity and recreational load;
- intensification of the karst processes due to climate change, deteriorating territory conditions in the karst region in the Northern part of Lithuania.

There are few types of monitoring performed in Lithuania: air, water, live nature, ecosystems, landscape and radiological.

- *Air monitoring*. Priorities of environmental protection policy in the field of air state observation are concurrent to the priorities of sustainable development in Lithuania: reduction of impact of the main economic sectors on environment and threats on human health, mitigation of global climate change and its consequences.
- *Water monitoring*. The main tasks of the Programme for 2011-2017 are defined for the state of certain water bodies, also for the monitoring of the effect of measures foreseen in the management plans of river basins and the provision of the data and information.
- *Monitoring of live nature*. The most part of measures of the Programme foreseen for the evaluation of the state of live nature is constituted from observations for the state evaluation of species (important to European Community, habitats and concentration locations of bird migration). It shall ensure a collection of information which will allow to identify the most sensitive areas of biological diversity and to stop its decline.
- *Landscape monitoring*. In the Programme the substantial monitoring system of landscape is kept as it was set in 2005-2010: structural changes of landscape are recorded and analysed, a degree of

landscape polarization is set on national, regional and local levels, and specific parameters are foreseen for monitoring of coastal zone, region of sinkholes and protected areas.

- *Radiological monitoring*. Radiological monitoring is performed in Lithuania for more than 50 years by EPA. Pursuant to the Programme which was prepared in accordance to the recommendations of European Commission, International atomic energy agency (IAEA) and Helsinki commissions, a radiological monitoring of Gama dose power, air aerosols, surface water and bottom silt in the rivers, lakes, the Baltic Sea and the Curonian lagoon is performed. Also EPA functions include a control of Ignalina Nuclear Plant.
- *Monitoring of ecosystems*. Recently research on complex impact of air pollutants and climate change on forest ecosystems is prioritized not only due to increased detrimental impact on forestry, but also due to necessity to observe an impact of global pollution on natural ecosystems of various countries and regions.

Environmental goals and tasks are defined and their implementation will require state observations of natural environmental on a national level, therefore, measures, responsible institutions, funding scheme, need of funding and allocation are foreseen in the Programme until 2017. Currently the Programme is under the revision and will be extended for the 2018-2023 period.

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EDUCATION, TRAINING AND PUBLIC AWARENESS

9 EDUCATION, TRANINING AND PUBLIC AWARENESS

Lithuania investing resources into raising awareness among people to the challenges posed by climate change and also the opportunities in particular related to reducing GHG emissions and strengthening resilience to climate change.

This chapter reports on the actions taken in Lithuania to increase public awareness of climate change, education and training relating to climate change mitigation and adaptation. The field of education, public information campaigns, communication activities, training, and awareness raising campaigns, have played an important role.

The National Strategy for Climate change management policy for 2013-2050 is one of the highest national-level long-term planning documents. In the Strategy for the National Climate Change Management Policy for 2013-2050 the education and awareness raising are identified as a field related to formation of both policies – climate change mitigation and adaptation. Information and awareness raising activities are of utmost importance in order to form an understanding of climate change, climate adaptation to support a making of climate change policies and other activities related to the UNFCCC issues, to encourage society to choose sustainable lifestyle and habits of consumption in order to reduce its share in GHG emission. Awareness raising is therefore an important component of the adaptation process to manage the impacts of climate change, enhance adaptive capacity, and reduce overall vulnerability. Public awareness is important to increase enthusiasm and support, stimulate self-mobilisation and action, and mobilise local knowledge and resources. A lack or distinction of perception on subjects related to climate change and its impact on various sectors guides to partition of common policy framework and may have a significantly negative impact in the process of policy making, as well as to the timely implementation of appropriate measures in the locations where a problem of climate change is present. Thus, improvement of public environmental awareness should be continued. Measures foreseen to raise public awareness and education are presented in Chapter 9.2.

Lithuania puts efforts on international cooperation. The Lithuanian institutions participate in the international projects related to capacity-building and in the frame of these projects trainings to the experts of Lithuania and the other countries are performed. Detailed information about such projects is presented in Chapters 4 and 7.

The Government of Lithuania agrees that social education, including environmental education and promotion of lifestyle which is not detrimental to environment, is one of the priorities in shifting to sustainable development foreseen in the updated version of the National Strategy for Sustainable Development, approved by the Government of Lithuania on 16 September 2009, (updated on 8 April 2011). The legislation draws a particular attention to the atmosphere protection and climate change. The undertaken liabilities follow the provisions stated in the EU Sustainable development strategy and form a new national priority, which concentrates on the sparing consumption.

More and more people understand the importance of individually contributing to the protection of the environment, including combating climate change. The “Let’s Do It!” clean-up campaign, “Velomarathon”, “Earth hour”, “European Mobility week”, “European Week for Waste Reduction” and other campaigns can be good examples of civic initiatives in Lithuania. Detailed information about these campaigns described in Chapter 9.4. Non-governmental organisations play an important role in educating people in the field of climate change. The government has turned its attention to more systematic

promotion of environmental education: cities have joined the Covenant of Mayors, Lithuania has also participated in education cooperation projects, financed projects and initiatives which raising awareness of climate change.

The numerous articles on climate issues in different economy sectors are being published in web portals and newspapers, representatives of public and local authorities as well as scientists take part in the broadcasts and programs of TV and radio channels, conferences for stakeholders of different economy sectors are being organized.

9.1 Primary, secondary and higher education

The chapter focuses on key aspects related to education, training, public awareness. The Ministry of Education and Science is the leading state administration institution in the field of education and science. The Ministry of Education and Science implements the national system of formal and non-formal education; implements the state policy of science and studies in accordance with the Law on Science and Studies and other legal acts; coordinates the activity of Lithuanian institutions of science and studies.

The education system in Lithuania is comprised of 8 levels: 0 – pre-school education, 1 – primary education, 2 – lower secondary education, 3 – upper secondary education, 4 – post secondary non-tertiary education, 5 – according to the Lithuanian legislation short-cycle tertiary educational programmes are not provided, 6 – bachelor's or equivalent level, 7 – master's or equivalent level, and 8 – doctoral or equivalent level. Pre-school and pre-primary education is not compulsory; children start primary education in the calendar year when they reach the age of seven. Education is compulsory until 16 years of age.

The Law on Education establishes the main purpose of the education system, which is to provide an individual with a basis for a worthy independent life and to assist the individual in the continuous cultivation of abilities. National strategic documents on education also set an ambitious goal of turning the education system in Lithuania into a sustainable foundation for the furtherance of national welfare, brave and independent human beings able to create, responsibly and jointly with others, their own future as well as that of the nation and the world.

Organisation of the school system

This sub-chapter will provide much of the detail that is needed to understand the process of decision-making and the allocation and use of resources in the school system.

Early childhood education. Pre-school education is provided for children from birth to six years of age. Pre-primary education lasts one year and is typically for six-year-old children, although may be provided to five-year olds in exceptional cases.

Compulsory education. Children start primary education in the calendar year when they reach 7 years of age. Parents have the obligation of enrolling their child in Grade 1, thus ensuring the child's right to education. If a seven-year-old child does not attend school, parents may be subjected to administrative liability. Parents may choose and change a school for their child, be it a public (state, municipal) or private (non-state) school. By the Law on Education of the Republic of Lithuania, the participation in primary and lower secondary education for children until the age of 16 is compulsory and State-

guaranteed. Education content makes reference to the provisions of sustainable development of society, including climate change. Schools are encouraged to implement the ideas of sustainable development as it is a constituent of their community life.

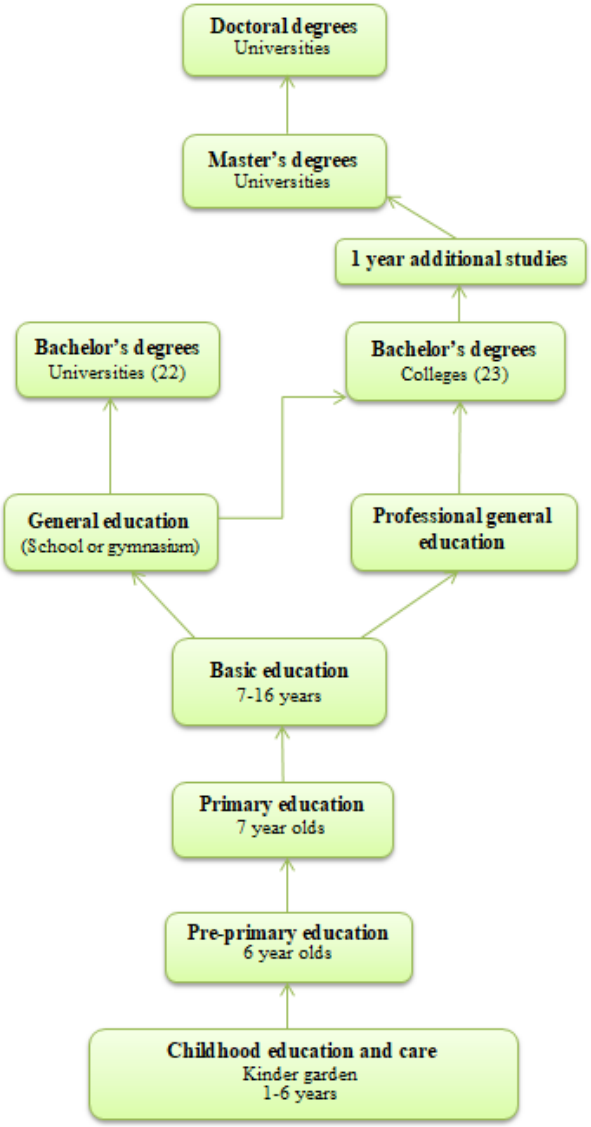

Figure 9-1. Lithuanian education scheme

Climate change education in primary and secondary schools also is possible through public awareness campaigns and projects organized by different organizations. Ministry of Environment in 2017 of September organized 150 nature knowledge lessons. This is two and a half hours lessons, using modern teaching aids and techniques. The main lessons topics: nature, environment, water management, biodiversity, energy saving, climate change issues. Moreover, it is planned to release two educational books: "Environment" and "Living Nature" (100 thousand copies). Value of the project – EUR 388.5 thousand, from EU funds.

The professional teacher is put in focus as the main prerequisite for transforming education and improving schools. Lithuanian teachers actively participate in Scientix program. Scientix promotes and supports a Europe-wide collaboration among STEM (Science, Technology, Engineering and Maths) teachers, education researchers, policymakers and other STEM education professionals. In its first stage (2009-2012), the project built an online portal to collect and present European STEM education projects and their results, and organized several teacher workshops. The main networking event was the Scientix conference, held in May 2011 in Brussels. The goal of the second phase of the Scientix project (2013-2015) was to expand this community to the national level. Through a network of National Contact Points (NCPs), Scientix reached out to national teacher communities, and contributed to the development of national strategies for wider uptake of inquiry-based and other innovative approaches to science and maths education. This activity is continued in the third stage of Scientix (2016-2019), which is funded by the Horizon 2020 programme of the European Union for research and innovation. Scientix was originally born at the initiative of the European Commission and has, since its inception, been coordinated by European Schoolnet, a Brussels-based consortium of thirty ministries of education, which is a driving factor for innovation in teaching and learning and fosters pan-European collaboration of schools and teachers. The lack of specialists in STEM is currently a significant problem throughout Europe. In Lithuania STEM does apparently not attract sufficient number of individuals. There is a lack of practical adaptation and understanding of theory when it comes to teaching of exact and natural subjects theoretical in schools, and how this knowledge can be adapted to everyday life. In order to achieve the best effect it is necessary to take into account the good practices of foreign countries and after assessment of the situation in Lithuania's STEM fields to offer solutions matching labor market demands. To achieve this result during the project a good practice STEM learning guide based on robotics technology, which will prepared using the experience of the Norwegian partners. The main goal of the project increased and strengthened institutional cooperation at all levels of the education sector (school education, higher education, vocational training/education and adult education) between Beneficiary and EEA EFTA States.

Professional general education. Environmental education is provided at several professional education establishments. Study programs that are related to the topics of climate change are offered at Panevėžys College, Utena College and other professional education establishments. In the 2015-2016 academic year, there were 76 vocational education institutions, with 46.5 thousand students in them. In 2015, there were 15.3 thousand graduates from such institutions.

Higher education establishments. Topics of environment protection and global climate change in particular are broadly common in study programmes offered by the higher educational institutions in Lithuania.

In Lithuania research is carried out by research institutes and higher education institutions. In 2017 there were 14 public universities and 8 non-public universities, 13 public and 12 non-public colleges and 11 public and 10 non-public research institutes. The majority of these institutions carry out studies under particular categories of research of climate change, such as climate change, factors, impact of and sensitivity to climate change, climate change adaptation and mitigation. At the beginning of the 2015-2016 academic year, there were 133 thousand students in those schools, of whom 93 thousand – in universities, 40 thousand – in colleges. In 2016, compared to 2015, the number of students in schools of higher education decreased by 5%.

The main higher education institutions related to research development in the area of climate change are Aleksandras Stulginskis University, Vilnius University, Klaipėda University, Lithuanian University of Health Sciences, Lithuanian Research Centre for Agriculture and Forestry (LRCAF), Nature Research Centre, Vytautas Magnus University and others.

Lithuanian University of Health Sciences have integrated various aspects of climate change issues in bachelor study programmes: Public health, Livestock technologies, Animal science, Veterinary medicine and master study programmes: Public health and Public health management.

The study programmes which are offered by **Vilnius University** have successfully integrated various aspects of climate change issues in bachelor, master and doctoral studies in Biology, Ecology, Hydrology and Meteorology, Hydrometeorology, Geography, Geology and etc. Students have possibilities to broaden their knowledge in environmental design, sustainable industry development, analysis of sensitivity of ecosystems, management of resources, eco-design, environmental impact assessment, adapting to climate change, modelling and forecasting of climate change.

Currently, **Klaipėda University** implements over 100 study programmes in all three cycles, providing research and technological innovations-based contemporary knowledge which ensures advanced university education and high professional skills and develops an intelligent, responsible, and creative personality. Over 60 research and training labs, a botanical garden, a research vessel "Mintis", a research and training sailboat "Brabander", the yacht "Odisėja", an Open Access Centre for Marine Research, provide for an important infrastructure that enables the successful development of the international level fundamental and applied scientific research, experimental development activities in the fields of physical, biomedical (including climate change), technological, social sciences, and the humanities. Klaipėda University have integrated different aspects of climate change issues in bachelor, master and doctoral studies in Ecology and Environmental studies, Hydrology, Geography, Social geography, Environmental Engineering, Marine Engineering.

Vilnius Gediminas Technical University is an innovative Lithuanian University, educating highly qualified and creative specialists. Scientific research and experimental development is performed by 14 institutes, 2 research centres and 34 research laboratories. Faculty of Environmental Engineering is the second largest faculty of Vilnius Gediminas Technical University, which provides 3-level specialists: bachelors, masters and doctors. Training courses in this faculty provided on environmental engineering, civil engineering, energetics engineering and measurement engineering. Climate change aspects are included in bachelor, master and doctoral studies in Environmental Protection Engineering (Environment Protection Technology, Management of Environment Protection, Environment Management Technologies specializations), Water Supply and Management, Energetics Engineering, Water Economy Engineering. Also Environmental Engineering faculty annually organizes international conference "Environmental Engineering", related sustainable development and climate change issues.

Vytautas Magnus University offered by 10 faculties (Arts, Catholic Theology, Economics and Management, Humanities, Informatics, Law, Natural Sciences, Political Science and Diplomacy, Social Sciences, Music Academy). Vytautas Magnus University has integrated sustainable development and climate change issues in Biology and Genetics, Molecular Biology and Biotechnology, Environmental Management.

Kaunas University of Technology is one the largest technological universities in the Baltics. Kaunas University of Technology awards bachelor's, master's and doctoral degrees. Climate change issues are

integrated in Renewable Energy, Heat energy and technologies, Sustainable Engineering and Environmental Technology study programs.

Mykolas Romeris University (MRU) is an international university located in Vilnius and Kaunas, Lithuania. MRU offered different study programs in which are integrated climate change aspects: Environmental management, Public Administration, Sustainable environmental policy and management. In bachelors and master degrees programs are integrated these courses Climate change policy, Urban Sustainable Development and Climate Change. The purpose of these courses are make students able to analyze and systematize key policies on climate change and their implementation, understand climate change policy and their impact, learn about climate adaptation.

Aleksandras Stulginskis University is the only state institution of higher education and research in Lithuania awarding the degrees at bachelor's, master's and doctoral levels in the fields of food sciences, agriculture, forestry, water and land resources management, bioenergy and mechanical engineering, climate change and sustainable use of natural resources. Aleksandras Stulginskis University is planning to establish a European demonstration center for mitigating effects of climate change, using the best practices and scientific knowledge. It is planned that the Center will consist of the Interactive Climate Change Information Center, Research and Demonstration Facilities.

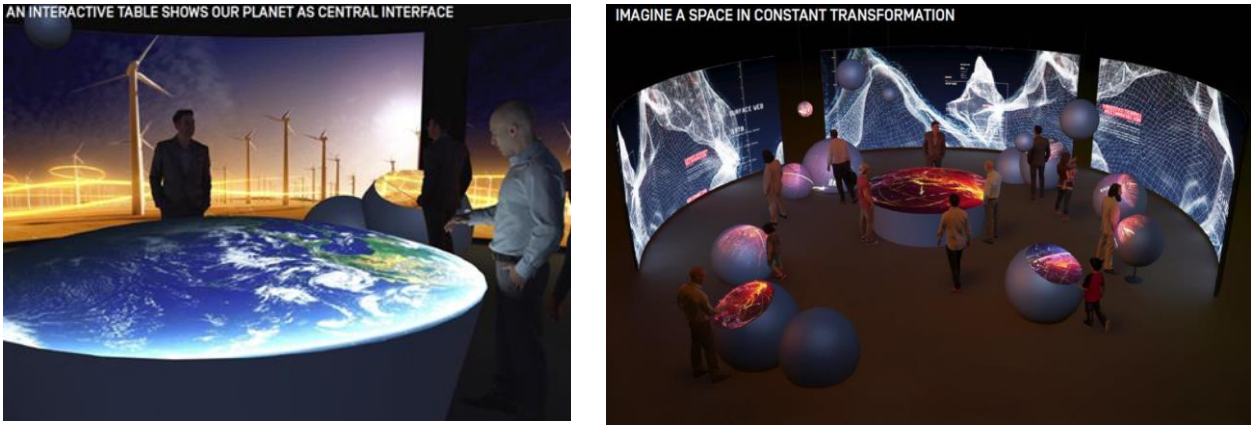

Figure 9-2. Climate demonstration center

Several international projects related to climate change issues are already accomplished or still on-going. Lithuania has participated in several international projects related to climate change issues. They are listed in Chapter 8.2.

Erasmus Education

Erasmus program for higher education aims to modernize and improve higher education across Europe and the rest of the world. It gives students and staff opportunities to develop their skills and boost their employment prospects from 2014 to 2020. Students can study abroad for 3-12 months, with a maximum of 12 months in each study cycle: bachelor, master and doctoral.

Since 2014 the program is called "Erasmus +", as it can benefit more people from the wide variety of options available. The "Erasmus+" programme for Higher Education students, there are plenty of mobility opportunities in Europe and beyond: volunteering, jobs, studies, traineeships, travelling for fun.

Lithuania joined “Erasmus” programme in 1999, and since then over 18 thousands students from abroad came to Lithuanian Universities for a semester or two of their degree studies. During the same time more than 40 thousands students and 10 thousands lecturers took advantage of Erasmus and went to study or have work placements abroad.

9.2 Society involvement and awareness rising

Lithuania has participated in several public information and awareness-raising campaigns that are of direct or indirect relevance to climate change. Many of the campaigns make considerable use of the internet and social media tools, but also include chance for personal citizen interaction. The campaigns employ websites, Facebook page, video clips, TV programs, seminars, workshops or other types of live events. The main initiators of such activities are the Ministry of Environment of the Republic of Lithuania, educational institutions and NGOs.

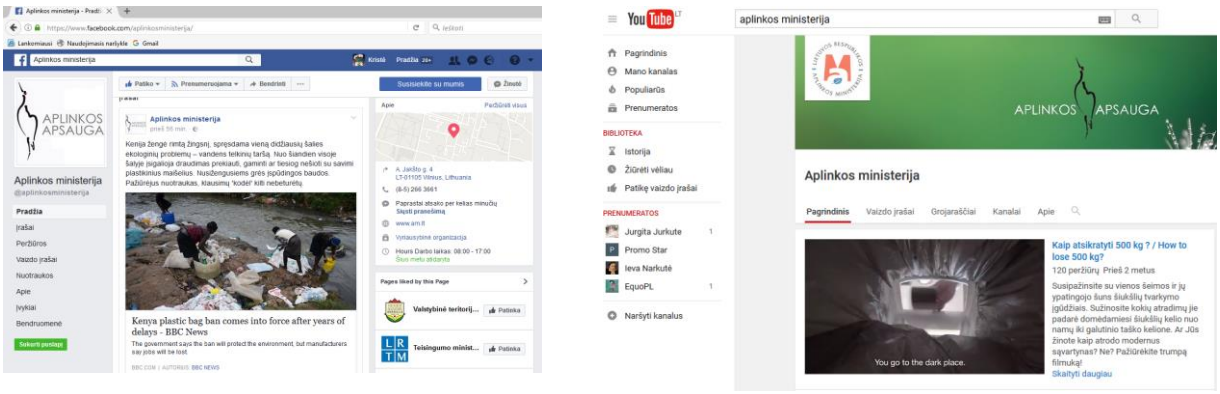

Figure 9-3. Ministry of Environment official social media channels (video clips)

The Ministry of Environment prepared video clips about reduction of air pollution and waste sorting. Climate change legislation, announcements, up-to-date information and organized events are presented to the society on the website of the Ministry of Environment. The Public Relations Division of the Ministry of Environment plays an important role in the information dissemination and public involvement. Climate change related legislation, announcements, up-to-date information and organized events are presented to the society on the website of the Ministry of Environment.

In 2014-2017, specialists of the Climate Change Policy Division together with the representatives of the Lithuanian Hydrometeorological Service actively participated in more than 60 radio and TV programs, related public awareness for climate change issues. Also, the specialists made presentations on the Lithuanian climate change policy and it’s implementation in more than 15 conferences and workshops annually.

During the Norway Grants partnership project, in 2016-2017 Climate Change Policy Division of Ministry of Environment organized 3 conferences related to climate change issues: “Climate change policy in Lithuania”, „Agricultural and forest land greenhouse gas emissions accounting and innovative technologies for agriculture sector“, and final information dissemination event of the Lithuanian-Norwegian partnership project.

The Climate Change Policy Division organized and actively participated in seminar "Climate change projects: new financing opportunities" in 2017 in Kaunas. Specialists of the Division presented LIFE sub-programme for climate action, LIFE financial requirements and close-to-market projects, NGO Lithuanian Fund for Nature experience in LIFE projects. Additionally, national climate policy priorities and national funding programmes for climate related business projects were presented. Two private companies shared their engaging experience in international projects on renewable energy. The event was organized in a cooperation with the Ministry of Environment and Lithuanian Energy Institute.

In November 2017, a seminar „LIFE programme capabilities and practical implementation" took place in Lithuanian Research Centre for Agriculture and Forestry, where EU LIFE programme and its funding of environmental and climate projects were discussed. Expert from Climate change policy division presented LIFE programme and Lithuanian National co-financing, experts from Environmental project management agency introduced the ongoing LIFE project in Germany related to climate change adaptation and agronomy, the services of Lithuanian capacity building project. Lithuanian Fund for Nature representative shared their experience of applying for and implementing LIFE projects, gave valuable practical advice for potential applicants.

Using Special Climate Change Program funds the Ministry of Environment financed publishing of book about climate change: "100 questions about climate change". The books will be given to high schools and public libraries. It's important to mention, that book will be printed, using environmentally friendly paper (recycled or certified). Book was presented on 14th of December 2017, in Martynas Mažvydas National Library of Lithuania.

The Ministry of Environment will organize 120 environmental social events until 2019. The goal of social campaigns is to emphasize the influence of pollution sources on changes in environmental quality, to encourage target groups to change their behavioral habits and thus contribute to the reduction of environmental pollution, climate change and its consequences.

Other conferences and seminars related to climate change issues provided in the table 9-1 below.

Table 9-1. Events related to Climate change

Institution	Event
Aleksandras Stulginskis University	– AgroEco2016 "Long-term Agroecosystem Sustainability. Links between Carbon Sequestration in Soils, Food Security and Climate Change". – "Lithuanian forest Challenges and Perspectives 2016". – The 1st International Scientific Conference "WaterLand-2016". – "The young scientist 2017". – Republican conference "Soil and environment 2017", organized annually. – International scientific conference "Rural development 2017: Bioeconomy Challenges".
Association Green.LT (Susivienijimas Zali.lt**)** Public and non-governmental organization	– "Combating Climate Change After Paris: Challenges and Perspectives", 2016. – "The fight against climate change: Challenges and Perspectives", 2017.
Department of Environmental Protection at Vilnius Gediminas Technical University and Environmental Protection Institute	– 20th Conference „Environment Protection Engineering".This conference is organized annually

at Faculty of Environmental Engineering	
Lithuanian Research Centre for Agriculture and Forestry	– Seminar: "Climate change and Lithuanian ecosystems", 2016.
Vilnius Gediminas Technical University	– Annual international conference "Environmental Engineering"
Vilnius University	– "EcoBalt 2018" – Seminar for municipalities: "Adaptation to climate change and integrated water resources management" – International seminar: "Climate change and health", 2017
Vytautas Magnus University	– International scientific-practical conference "Human and environment protection 2017". This conference organized annually.
Seimas, the Association of Local Authorities of Lithuania and the French Embassy	– "Climate change measures implementation in municipalities", 2017
Kaunas Regional Energy Agency	– Seminar: "Climate change mitigation and adaptation at local level (municipalities)" – Seminar: "Mitigation and adaptation in municipalities" – Final event: "Climate change mitigation and adaptation"
Nordic council of Ministers Office in Lithuania	– Discussion: "Are humans really blame for global warming and climate change?", 2017
The Chamber of Agriculture of the Republic of Lithuania	– "Agriculture and climate change: Facing new challenges" 2016

The international conference **"Baltic Pathway Towards Low Carbon and Climate Resilient Development"** organized by the Ministry of Environmental Protection and Regional Development (MEPRD) of Latvia, took place in main building of the University of Latvia on October 30-31, 2017.

Figure 9-4. International conference

More than 200 people attended the conference, and many also watched on internet. This was the largest climate conference in the Baltics in 2017. The aim of the conference was to encourage changes and to promote vision of low carbon development becoming a reality. The target audience of the conference was decision makers from state institutions and municipalities, non-governmental organizations, largest companies and research institutions. Conference consisted of several events structured into two areas: 1) Conference area (substantial policy relevant presentations and discussions); and 2) Action area (specially organized activities to explain climate change, illustrate benefits and possibilities of low carbon development; accessible also for people not registered for the conference). First day of conference was

dedicated to issues of low carbon development, second – to climate change adaptation. Lithuania's experts from different ministries, scientists actively participated in the conference, prepared presentations about different examples: how GHG emission reduction measures in energy, agriculture, transport, household and good practice examples of adaptation measures in health sector, risk management and landscape can be implemented at national and municipal levels, as well as the positive social-economic effects of these measures..

Lithuanian Hydrometeorological Service published book "Climate of Lithuanian Resorts 2015". This publication is devoted to Lithuanian resorts and describes their climatic conditions. 9 resort areas (Anykščiai, Birštonas, Druskininkai, Ignalina, Likėnai, Neringa, Palanga, Trakai and Zarasai) are described and their climatic tourism potential is evaluated. Book also examines how main meteorological elements influence human body and sensation. Separate chapters explain how the humans are affected by various meteorological variables: temperature, pressure, wind and provides guidance how to protect themselves from dangerous weather and climate phenomena. This publication is intended for those who are interested in climatotherapy, weather and climate impacts on health, Lithuanian resort areas and its recreational potential.

Baltic Environmental Forum and UAB „Hnit-Baltic" created Carbon footprint tool **www.maps.lt/CO2**, which is intended to raise awareness and to promote modification of non-ecological attitudes. This climate calculator can be used by everyone to compare and calculate its CO_2 emissions for car, electric car, bus, trolleybus, train, cycling or walking.

Figure 9-5. Ecological Footprint tool

Regional Parks are also adapted for public access. This includes the creation of visitor infrastructure, educational trails and routes, forest parks, and sightseeing spots to enable visitors to experience the outstanding value of the landscape. Special attention should be devoted to presenting landscapes and objects in a suitable manner. Visitor infrastructure (information panels, benches, bicycle tracks, etc.) and educational trails have been installed in all Regional Parks.

In 2015, National Visitors Centre of Protected Areas has been opened providing visitors with information on protected areas in Lithuania and abroad.

Figure 9-6. National Visitors Centre of Protected Areas

There are 5 national and 30 regional parks, also 3 state natural and 2 cultural reserves, approximately 300 nature reserves, and over 500 natural heritage objects protected by the Lithuanian state. Visitors will be welcomed at the Centre by its exposition "Protected Areas. Journey through the Circle of Life". The exposition catches attention not only by its content, but also amazes by visual solutions. Inside, visitors will feel surrounded by nature in the Centre – with grassland, birds, and grasshoppers around, the clouds above their heads. Every exposition participant becomes an active participant capable to touch, listen, and feel. The exposition will spark the interest not only of nature fans, but also will attract young visitors who can play interactive games. Descriptions of exhibits are provided in Lithuanian and English languages.

Lithuania from 10 June until 10 September 2017, participated in the international specialized exhibition EXPO in Astana, the capital of Kazakhstan. The main theme of the Exhibition was *Future Energy*.

Figure 9-7. Lithuanian pavilion at Exhibition EXPO 2017

A total of 112 countries and 18 international organisations participated in the Exhibition, and it Exhibition will attracted over 2 million of people (5 million of visits). The theme of the Exhibition was a topical issue for Lithuania which seeks to achieve full energy independence and fulfils its international commitments regarding the use of renewable energy sources. The presentation of Lithuania in this Exhibition was entrusted to the Ministry of Environment in cooperation with the Ministry of Energy. In this Exhibition, our country demonstrated the progress achieved to date, the projects which were successfully implemented or are still being implemented (the LNG terminal *Independence*, the LitPol Link and NordBalt power interconnections with Poland and Sweden, the successful solar element production projects of BOD Group and Precizika, etc.).

Lithuania planned to participate in **Expo 2020.** Universal Exposition will be hosted by Dubai in the United Arab Emirates, opening on October 20, 2020. Expo 2020 theme will be "Connecting Minds, Creating the Future", sub-themes being Sustainability, Mobility and Opportunity.

Funds for programmes of public environmental awareness are allocated from the 2014-2018 EU structural assistance. Support is provided in accordance with 05.41-APVA-V-017 priority "Public awareness of the environment and the management of environmental and recreational facilities" measures "The Public information system on the environment and development" and "Public Information and Education about the environment and the implementation of the measures". Until now, from the EU funds in total almost EUR 19.46 million under measures allocated to projects related to public awareness. Measures related to public awareness raising and education are foreseen in the Inter-institutional Action Plan for the Implementation of the Goals and Objectives for 2016-2020 of the Strategy for the National Climate Change Management Policy and presented in the table below.

Table 9-2. Measures in the Inter-institutional Action Plan foreseen to raise public awareness

Measures	Period of implementation	Implementing authority	Cost, thousand EUR	Financing funds
To organize initiatives for public awareness raising and education in energy efficiency and promotion of use energy saving equipment's in household	2017-2019	SC "LESTO"	45	-
To prepare and publish a book: "100 questions about climate change"	2016-2017	Science and Encyclopedia Publishing Center	10	Special Climate Change Program
To organize 150 nature knowledge lessons and prepare two educational books: "Environment" and "Living Nature"	2016-2017	Ministry of Environment	388.5	EU funds
To organize a distribution of information related to adaptation to climate change	2017-2019	Ministry of Agriculture	484.8	-
To expand service providers and institutions that would consult in subjects related to farm management	2017-2019	Ministry of Agriculture	300	-
To implement public awareness of the environment projects, climate change issues	2017-2019	Ministry of Environment	9.8	-
To prepare information portal about climate change in Lithuania www.klimatokaita.lt	since 2018	Ministry of Environment	299.7	EU funds

9.3 Participation in international programs and projects

Several international projects related to climate change issues are already accomplished or still on-going. Since 2016 Kaunas Regional Energy Agency implemented the Norway Grants partnership project "Capacity-Building and Institutional Cooperation between Beneficiary State and Norwegian Public Institutions, Local and Regional Authorities" between Lithuania and Norway. Project partners are Kaunas

Regional Energy Agency, Association of Local Authorities of Lithuania and the Norwegian Association of Local and Regional Authorities.

Figure 9-8. Seminar for municipalities

The objective of this partnership project is capacity building, seminars for municipalities cooperation on climate change adaptation issues. It is very important that municipalities ensure sustainable urban develop and transport and bike path infrastructure, and as soon as possible draw up and implement sustainable movement plans and acquire low polluting public transport vehicles. The quality of ambient air determines human health, especially diseases of the respiratory tract and cancer. Thus the reduction of air pollution and greenhouse gases emissions is primarily aimed at creating a healthy environment for the population. The meeting has agreed on cooperation with municipalities in the future when implementing the national objectives of climate change mitigation and air pollution reduction.

Also a project **"ECO-Life – Sustainable Zero Carbon ECOTown Developments Improving Quality of Life across EU"** supported by the Seventh Framework Programme under the CONCERTO Initiative is performed in Lithuania. The ECO-Life project includes activities for the development of zero CO_2 emission areas in 3 urban communities of the EU – one of them is Birštonas in Lithuania. It significantly contributes to public awareness raising being a demonstration project for building new low energy houses or refurbishing the current into minimum existing building regulations and promotion of renewable energy production. The project started up in January 2010 and ended in January, 2016.

"Let's make our cities greener" project in cooperation with 9 Lithuanian municipalities, aims to restore urban parks and green infrastructure; improve the wellbeing, awareness and engagement of citizens to maintain green areas in their neighborhood; and enable city planners to integrate green infrastructure in urban space.

9.4 Public information campaigns

Many of campaigns make considerable use of the social media tools, but also include chance for personal live interaction. The main campaigns and activities related to climate change issues are carried out in Lithuania:

European Mobility Week which is an annual campaign on sustainable urban mobility organised with the support of the Directorates-General for the Environment and Transport of the European Commission. In Lithuania a week of events "Car-free day!" is coordinated by the Communication Division of the Ministry of Environment. The every year on 22 of September during which the citizens of Lithuania are asked to not use a private cars and use public transport or bicycles.

"Let's Do it World" campaign is a civic-led mass movement that began in Estonia in 2008 when 50 000 people united together to clean up the entire country in just five hours. Since then, "Let's Do It!" has spread this model: one country in one day – around the world. To date, 113 countries and over 16 million people have joined us to clean up illegal waste. "Let's Do It!" has never been only about cleaning up waste. It also aims to unite the global community, raise awareness and implement true change to achieve our final goal – a clean and healthy planet. Lithuania was one of the first countries to join this movement (campaign started in Lithuania in spring 2008 for the first time). Air pollution reduction was set as the priority of "Let's Do It!" in 2016, when about 260 thousand participants took part in the events of the campaign.

Lithuania participates in the **"European Week for Waste Reduction"**. "The European Week for Waste Reduction" is an initiative aiming to promote the implementation of awareness-raising actions about sustainable resource and waste management during a single week. It encourages a wide range of audiences: public authorities, private companies, civil society as well as citizens themselves to get

involved. In Lithuania a week of events "European Week for Waste Reduction" is coordinated by the Waste Prevention and Management Strategy Division of the Ministry of Environment.

Lithuania participates in **"Earth Hour"** worldwide movement. This global initiative calls on all governments, business organizations, communities, municipalities, citizens (wherever they may be) to turn off the lights for one hour, therefore showing your concern for the planet's future. The lights turned off for one hour at the Lithuanian Presidential Palace, Parliament House, the Lithuanian Hotel and Restaurant Association members, bars, cafes and restaurants, and banks… Central city lights and famous attractions are darkened in more than fifty municipalities.

On the 20th of March, as every year on the **World Earth Day**, the Earth Flag waved in Vilnius next to the Seimas building and Ministry of Environment. The United Nations officially declared the World Earth Day in 1971. It is celebrated on the spring equinox to mark the precise moment when day and night become equal in length on all spots of the globe. After Lithuania regained Independence, initiator of the Earth Day John McConnell addressed our nation calling to become Earth guardians and to mark the spring equinox, which falls on the 20th or 21st of March at different locations of the planet, as the World Earth Day.

On the 20th of August – for eight year in Vilnius city was organized the biggest cycling event in Lithuania – **Velomarathon** 2017. The race divided into three groups: childrens, amateurs, and sports. The track of the "Velomarathon" is situated at the very heart of Vilnius, the old town. "Velomarathon" is:

- an initiative of four main values: ecology, family, health and traffic safety to promote cycling culture in Lithuania and to form a new tradition;
- a record braking event that attracted the most competitors in the history of Independent Lithuania
- exclusive track situated in the heart of Vilnius old town adapted to three different heats: children heat, hobby heat and sports heat;
- spectacular sport and entertainment program;
- award ceremony.

9.5 Information availability

Legal acts, reports and information related to the climate change topic are available on the internet portals of the Ministry of Environment of the Republic of Lithuania (www.am.lt), the Environmental Protection Agency (http://klimatas.gamta.lt/cms/index), https://aplinka.lt/klimato-kaita; the Lithuanian Hydrometeorological Service (http://www.meteo.lt/lt/klimato-kaita) and the Lithuanian Environment Investment Fund (www.laaif.lt), Health Education and Disease Prevention Center http://www.smlpc.lt/lt/aplinkos_sveikata/klimatas_ir_sveikata/. All legal acts are placed in the internet portal of the Parliament of the Republic of Lithuania (www.lrs.lt). Also Ministry of Environment published information in social network Facebook.

From the beginning of 2018 information related to climate change topic will be available via the link www.klimatokaita.lt, funding for this portal is EUR 299 750 from EU funds. Lithuania will be the first in the eastern Baltic countries, which will have a modern, informative, easily manageable portal about climate change, adaptation. In this portal will be available public information about climate change issues, news, reports, legal acts, climate studies, information about investment projects related to climate change, press releases and public awareness campaigns.

It's planned to create an electronic books information library www.gamtosknyga.lt. This site will combine all projects: electronic books, video clips, audio records, photos and other information about environment.

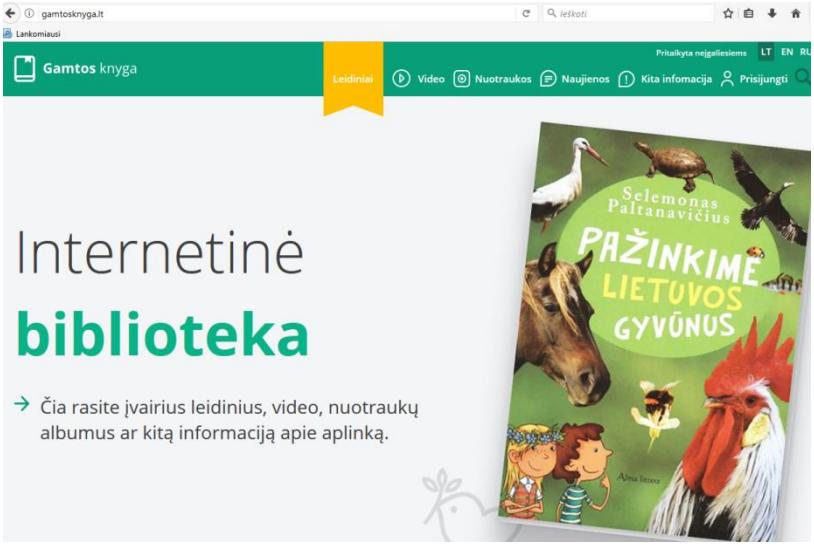

Figure 9-9. Information library

CLIMATE-ADAPT aims to support Europe in adapting to climate change. It is an initiative of the European Commission and helps users to access and share data and information about country. Lithuania's country profile available via link: http://climate-adapt.eea.europa.eu/countries-regions/countries/lithuania.

WEB PAGES	
Environmental Protection Agency	http://klimatas.gamta.lt/cms/index
Ministry of Environment	http://www.am.lt
Expo Lithuania	http://expo2017.lt/
State Forest Service	http://www.amvmt.lt/
Lithuanian Hydrometeorological Service	http://www.meteo.lt
Information about air polution	http://www.orotarsa.lt/

9.6 Involvement of the public and non-governmental organizations

A role and involvement of the public and non-governmental organizations (NGOs) is very important in the development of climate change policy. NGOs are active establishments in Lithuania: they organize the events related to public education, collaboration and sharing of experience related to climate change, participate in the development of national and international legislation, prepare and issue publications about changing climate, its consequences, and measures for prevention and participates in the other projects related to climate change awareness raising.

NGOs have actively participated in the preparation of the Strategy for the National Climate Change Management Policy and its action plan (presented their comments, participated in the meetings), together with the partners prepared and published books, brochures and other publications related to climate change.

The other institution which is involved in awareness rising is the Lithuanian Fund for Nature (LFN) which is a non-governmental organization for the conservation of nature. Its activities are closely related to the preservation of wildlife. One of the latest publications where climate change problem is incorporated were books "Sustainable Forestry" issued in 2014, "Ecological network in South Lithuania creation. Good Practice Guide" issued in 2014.

Following the initiative of the Ministry of Environment, the Lithuanian association of municipalities in cooperation with the Kaunas region energy agency and the Norwegian local and regional authorities association developed Guidance for Lithuania's municipalities on mitigation and adaptation to climate change in 2017.

Websites of main NGO's in Lithuania:

- In the Association Green.LT (Susivienijimas Žali.lt) www.zali.lt available information about events, seminars on climate change issues;
- In the Baltic Environmental Forum (BEF) website www.bef.lt is information on various projects and project seminars, including reports and presentations about climate change topic;
- The website of Sustainable development http://www.darnusvystymasis.gpf.lt/lt/klimato-kaita informs the public on various aspects of the climate change;
- The Lithuanian Fund for Nature (LFN) is a non-governmental organization for the conservation of nature http://www.glis.lt
- The Lithuanian Association of Municipalities http://www.lsa.lt/en/
- Kaunas Region Energy Agency http://www.krea.lt/
- The Lithuanian Confederation of Industrialists http://www.lpk.lt/en/
- Public institution Circular Economy http://www.circulareconomy.lt/

REFERENCES

Aleksandras Stulginskis University http://agroeco.asu.lt/updates

Aleksandras Stulginskis University Faculty of Forest Sciences and Ecology. http://mef.asu.lt/2016/11/16/konferencija-lietuvos-misko-ukio-issukiai-ir-perspektyvos

Aleksandras Stulginskis University Faculty of Water and Land management http://vuzf.asu.lt/2016/06/21/conference-waterland-2016-2

Brochure about climate change http://www.am.lt/VI/files/File/Klimato%20kaita/Lankstinukas_Klimato_kaita_ENG.pdf

Climate of Lithuanian Resorts 2015 http://www.meteo.lt/documents/20181/103901/Kurortu_klimatas_internetui.pdf/085a6384-0340-4a56-a25d-a7b0fdaf7ec9

Earth hour http://zali.lt/category/zemes-valanda

Ecobalt 2018. http://www.ecobalt.chgf.vu.lt/lithuania

European Mobility Week in Lithuania http://www.am.lt/VI/article.php3?article_id=16282

European Union Investment in Lithuania (2014-2020) http://www.esinvesticijos.lt/lt/patvirtintos_priemones/visuomenes-informavimas-apie-aplinka-ir-aplinkosauginiu-rekreaciniu-objektu-tvarkymas

European Week for Waste Reduction https://epilietis.lrv.lt/lt/naujienos/europos-atlieku-mazinimo-savaite-nebe-uz-kalnu

Information about Climate change portal http://jura.diena.lt/lt/naujienos/uostas/dauges-ziniu-apie-klimato-kaitos-anomalijas-508978

International Rural Development 2017 http://www.ruraldevelopment.lt

Let's do it campaign. http://mesdarom.lt

Lithuanian Hydrometeorological Service http://www.meteo.lt/lt/klimato-kaita

Lithuanian University of Health Sciences http://www.lsmuni.lt/

Ministry of Environment of the Republic of Lithuania http://www.am.lt/

Nature Research Centre http://www.gamtostyrimai.lt/

The Chamber of Agriculture of the Republic of Lithuania. Information about Climate change conference https://www.zur.lt/konferencija-zemes-ukis-ir-klimato-kaita-pasitinkant-naujus-issukius

The Environmental Project Management Agency under the Ministry of Environment of the Republic of Lithuanian http://www.apva.lt/kvietimas/informacijos-apie-klimato-kaita-portalo-sukurimas

Vilnius University http://www.vu.lt

Vilnius University Faculty of Natural Sciences http://www.gf.vu.lt/naujienos/bendros-naujienos/524-seminaras-prisitaikymas-prie-klimato-kaitos-ir-integruotas-vandens-istekli-valdymas

Velomarathon http://www.velomaratonas.lt/en/about-velomarathon

World Earth day http://www.am.lt/VI/en/VI/article.php3?article_id=101

20th Conference „Environment Protection Engineering“. http://jmk.aainz.vgtu.lt/index.php/aplinka/2017

ABBREVIATIONS

BY	Base year
CIS	Commonwealth of Independent States
CHP	Combined heat and power
CRF	Common reporting format
CTF	Common tabular format
EPA	Environmental Protection Agency
EPTATF	Eastern Partnership Technical Assistance Trust Fund
ETS	Emissions Trading System
EU	European Union
EUA	European Union emission allowance
GCOS	Global Climate Observing Systems
GDP	Gross domestic product
GHG	Greenhouse gases
IPCC	Intergovernmental Panel on Climate Change
ISPS Code	International Ship and Port Facility Security Code
JI	Joint Implementation
LULUCF	Land Use, Land-Use Change and Forestry
MMR	Monitoring Mechanism Regulation
NIR	National Inventory Report
NGOs	Non-governmental organizations
NMVOC	Non-methane volatile organic compounds
NPP	Nuclear Power Plant
QA/QC	Quality assurance/ Quality control
R&D	Research and development
RES	Renewable energy sources
SFS	State Forest Service
UCTE	The Union for the Co-ordination of Transmission of Electricity
UNFCCC	United Nations Framework Convention on Climate Change
WAM	Scenario with additional measures
WEM	Scenario with existing measures

CHEMICAL FORMULAS

CH_4	Methane
CO_2	Carbon dioxide
HFCs	Hydrofluorocarbons
N_2O	Nitrous oxide
NF_3	Nitrogen trifluoride
PFCs	Perflurocarbons
SF_6	Sulphur hexafluoride
VOC	Volatile organic compounds

UNITS OF MEASUREMENT

CO_2 eq.	CO_2 equivalent
^oC	Degree Celsius
GWh	Gigawatthour
ha	Hectare
kg	Kilograms
km^2	Square kilometres

kt	Kilotonnes
ktoe	Kilotonne of oil equivalent
Mt	Million tonnes
MW	Megawatt
%	Per cent
PJ	Petajoule
thous.	Thousand
toe	Tonnes of oil equivalent
TJ	Terajoule
TWh	Terawatt hours

ANNEX I Summary of reporting of the Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in the NC7

Information reported under Article 7, paragraph 2	Chapter of the 7th National Communication
National systems in accordance with Article 5, paragraph 1	**3.2**
National Registries	**3.3**
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	**5.4**
Policies and measures in accordance with Article 2	**4; 7**
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	**3.2-3.3; 4.1-4.2; 4.11**
Information under Article 10:	
– **Article 10a** (programmes to improve the quality of local emission factors, activity data and/or models which reflect the socio-economic conditions of each Party for the preparation and periodic updating of national inventories)	**3.2-3.3; 8.2.1**
– **Article 10b** (measures to mitigate climate change and measures to facilitate adequate adaptation to climate change)	**4; 6.2-6.3**
– **Article 10c** (transfer of, or access to, environmentally sound technologies, know-how, practices and processes related to climate change, in particular to developing countries)	**7**
– **Article 10d** (maintenance and the development of systematic observation systems and development of data archives to reduce uncertainties related to the climate system etc.)	**8**
– **Article 10e** (the development and implementation of education and training programmes)	**9**
Financial resources	**7**

ANNEX II SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (CRF SUMMARY 1.A)

Inventory 2015
Submission 2017 v4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]	PFCs[1]	Unspecified mix of HFCs and PFCs[1]	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)			(kt)					
Total national emissions and removals	5973,85	135,11	11,93	478,36	NO	NO	0,00	0,00	53,56	125,84	55,44	18,14
1. Energy	10422,95	19,82	0,46						43,28	124,14	29,58	17,35
A. Fuel combustion Reference approach(2)	10429,83											
Sectoral approach(2)	10418,63	8,06	0,46						43,22	123,48	17,56	10,81
1. Energy industries	3100,17	0,85	0,11						5,12	7,79	0,46	5,38
2. Manufacturing industries and construction	1171,68	0,17	0,04						4,38	4,93	1,45	1,41
3. Transport	5048,20	0,54	0,17						29,41	17,91	3,61	0,03
4. Other sectors	1062,57	6,50	0,14						4,21	92,40	11,92	3,98
5. Other	36,01	0,00	0,00						0,10	0,46	0,11	0,01
B. Fugitive emissions from fuels	4,32	11,77	0,00						0,06	0,66	12,02	6,54
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	4,32	11,77	0,00						0,06	0,66	12,02	6,54
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	2649,64	NO	0,88	478,36	NO	NO	0,00	0,00	0,70	0,54	15,30	0,79
A. Mineral industry	578,43								NO	NO	NO	NO,IE
B. Chemical industry	2019,66	NO	0,87	NO	NO	NO	NO	NO	0,70	0,54	NO,NA	0,79
C. Metal industry	2,02	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	NO
D. Non-energy products from fuels and solvent use	49,36	NO	NO						NO	NO	15,30	NO
E. Electronic industry				NO	NO	NO	0,00	0,00				
F. Product uses as substitutes for ODS				478,36	NO	NO	NO	NO				
G. Other product manufacture and use	NO	NO	0,02	NO	NO	NO	0,00	NO	NO	NO	NO	NO

H. Other[3]		0,17	NO	NO						NO	NO	NO	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	HFCs [1]	PFCs[1]	Unspecified mix of HFCs and PFCs[1]	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)			(kt)					
3. Agriculture	63,45	76,16	8,84						9,51	NO	9,42	NO
A. Enteric fermentation		65,50										
B. Manure management		10,66	0,68								9,42	
C. Rice cultivation		NO									NO	
D. Agricultural soils		NA	8,16						9,51	NO	NA	
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		NO	NO						NO	NO	NO	
G. Liming	20,91											
H. Urea application	42,54											
I. Other carbon-contining fertilizers	NO											
J. Other	NO	NO	NO						NO	NO	NO	NO
4. Land use, land-use change and forestry [4]	-7167,92	0,06	1,55						0,07	1,16	NE,NO	NO
A. Forest land [4]	-8898,04	0,02	0,12						NE	NE	NE	
B. Cropland [4]	4084,62	0,00	1,02						0,00	0,01	NE	
C. Grassland [4]	-2460,85	0,04	0,00						0,07	1,15	NE	
D. Wetlands [4]	960,14	NE,NO	0,02						NE	NE	NE	
E. Settlements [4]	382,09	NO	0,10						NE	NE	NE	
F. Other land [4]	53,65	NO,NE	0,03						NE	NE	NE	
G. Harvested wood products	-1289,53											
H. Other [4]	NO	NO	NO						NO	NO	NO	NO
5. Waste	5,73	39,07	0,20						0,01	0,00	1,14	0,00
A. Solid waste disposal [5]	NA,NO	32,09							NA	NA	1,09	
B. Biological treatment of solid waste [5]		1,12	0,05						NE	NE	NE	

C. Incineration and open burning of waste [5]	5,73	0,00	0,00						0,01	0,00	0,04	0,00
D. Wastewater treatment and discharge		5,87	0,15						NA,NO	NA,NO	0,00	
E. Other [5]	NO	NO	NO						NO	NO	NO	NO
6. Other ***(please specify)***[6]	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**Net CO_2 emissions/removals**	**CH_4**	**N_2O**	**HFCs[1]**	**PFCs[1]**	**Unspecified mix of HFCs and PFCs[1]**	**SF_6**	**NF_3**	**NO_x**	**CO**	**NMVOC**	**SO_2**
	(kt)			**(kt CO_2 equivalent)**					**(kt)**			
Memo items:[7]												
International bunkers	485,78	0,02	0,01						1,24	0,29	0,01	0,08
Aviation	245,06	0,00	0,01						1,24	0,29	0,01	0,08
Navigation	240,71	0,02	0,01						NE	NE	NE	NE
Multilateral operations	NO	NO	NO						NO	NO	NO	NO
CO_2 emissions from biomass	5439,58											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	3787,86											
Indirect N_2O			NE,NO									
Indirect CO_2	NO,NE,IE											

[1] The emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), unspecified mix of HFCs and PFCs and other fluorinated gases are to be expressed as carbon dioxide (CO_2) equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in table 2(II) of this common reporting format.

[2] For verification purposes, Parties are requested to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach in the documentation box to table 1.A(c). For estimating national total emissions, the results from the Sectoral approach should be used.

[3] 2.H. Other includes pulp and paper and food and beverages industry.

[4] For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(5) CO_2 from categories solid waste disposal on land and waste incineration should only be included if it stems from non-biogenic or inorganic waste streams. Only emissions from waste incineration without energy recovery are to be reported in the waste sector, whereas emissions from incineration with energy recovery are to be reported in the energy sector.

(6) If reporting any country-specific category under sector "6. Other", detailed explanations should be provided in Chapter 8: Other (CRF sector 6) of the national inventory report (NIR).

(7) Parties are asked to report emissions from international aviation and international navigation and multilateral operations, as well as CO_2 emissions from biomass and CO_2 captured, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

SUMMARY REPORT FOR CO2 EQUIVALENT EMISSIONS (CRF SUMMARY 2)

Inventory 2015

Submission 2017 v4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [(1)]	CH_4	N_2O	HFCs	PFCs	SF_6	Unspecified mix of HFCs and PFCs	NF_3	Total
	CO_2 equivalent (kt)								
Total (net emissions)[(1)]	5973,85	3377,79	3555,38	478,36	NO	5,54	NO	0,26	13391,18
1. Energy	10422,95	495,57	138,56						11057,09
A. Fuel combustion (sectoral approach)	10418,63	201,43	138,54						10758,61
1. Energy industries	3100,17	21,15	33,78						3155,10
2. Manufacturing industries and construction	1171,68	4,16	11,46						1187,30
3. Transport	5048,20	13,58	51,97						5113,75
4. Other sectors	1062,57	162,54	41,04						1266,15
5. Other	36,01	0,01	0,30						36,32
B. Fugitive emissions from fuels	4,32	294,14	0,02						298,48
1. Solid fuels	NO	NO	NO						NO
2. Oil and natural gas	4,32	294,14	0,02						298,48
C. CO_2 transport and storage	NO								NO
2. Industrial processes and product use	2649,64	NO	262,78	478,36	NO	5,54	NO	0,26	3396,58
A. Mineral industry	578,43								578,43
B. Chemical industry	2019,66	NO	257,89	NO	NO	NO	NO	NO	2277,55
C. Metal industry	2,02	NO	NO	NO	NO	NO	NO	NO	2,02
D. Non-energy products from fuels and solvent use	49,36	NO	NO						49,36
E. Electronic Industry				NO	NO	4,74	NO	0,26	5,00
F. Product uses as ODS substitutes				478,36	NO	NO	NO	NO	478,36
G. Other product manufacture and use	NO	NO	4,89	NO	NO	0,80	NO	NO	5,69
H. Other	0,17	NO	NO						0,17
3. Agriculture	63,45	1903,96	2632,90						4600,30
A. Enteric fermentation		1637,44							1637,44
B. Manure management		266,51	201,18						467,70
C. Rice cultivation		NO							NO
D. Agricultural soils		NA	2431,71						2431,71
E. Prescribed burning of savannas		NO	NO						NO
F. Field burning of agricultural residues		NO	NO						NO
G. Liming	20,91								20,91

H. Urea application	42,54								42,54
I. Other carbon-containing fertilizers	NO								NO
J. Other	NO	NO	NO						NO
4. Land use, land-use change and forestry[1]	-7167,92	1,45	461,44						-6705,03
A. Forest land	-8898,04	0,42	35,81						-8861,81
B. Cropland	4084,62	0,01	304,03						4388,66
C. Grassland	-2460,85	1,02	1,11						-2458,73
D. Wetlands	960,14	NE,NO	4,97						965,10
E. Settlements	382,09	NO	30,71						412,80
F. Other land	53,65	NO,NE	8,54						62,19
G. Harvested wood products	-1289,53								-1289,53
H. Other	NO	NO	NO						NO
5. Waste	5,73	976,82	59,70						1042,25
A. Solid waste disposal	NA,NO	802,20							802,20
B. Biological treatment of solid waste		27,88	14,68						42,56
C. Incineration and open burning of waste	5,73	0,01	0,17						5,91
D. Waste water treatment and discharge		146,73	44,85						191,58
E. Other	NO	NO	NO						NO
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:[2]									
International bunkers	485,78	0,60	3,94						490,32
Aviation	245,06	0,04	2,04						247,14
Navigation	240,71	0,56	1,90						243,18
Multilateral operations	NO	NO	NO						NO
CO_2 emissions from biomass	5439,58								5439,58
CO_2 captured	NO								NO
Long-term storage of C in waste disposal sites	3787,86								3787,86
Indirect N_2O			NE,NO						
Indirect CO_2 [3]	NO,NE,IE								
Total CO_2 equivalent emissions without land use, land-use change and forestry									20096,21
Total CO_2 equivalent emissions with land use, land-use change and forestry									13391,18
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry									NA
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry									NA

[1] For carbon dioxide (CO_2) from land use, land-use change and forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] See footnote 7 to table Summary 1.A.

(3) In accordance with the UNFCCC Annex I inventory reporting guidelines, for Parties that decide to report indirect CO_2, the national totals shall be provided with and without indirect CO_2.

TABLE 10 EMISSION TRENDS (CRF TABLE 10)
GHG CO_2 eq emissions

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(kt CO_2 equivalent)										
Total (net emissions)[2]	44528,69	44528,69	46146,21	26740,89	19575,36	18378,76	18530,84	24859,45	23019,58	16226,24	13880,47
1. Energy	33107,67	33107,67	35175,03	19881,58	16003,48	15044,20	14062,38	14519,37	14052,37	14734,36	12360,98
A. Fuel combustion (sectoral approach)	32841,89	32841,89	34916,81	19632,29	15763,49	14803,74	13826,65	14303,34	13834,63	14522,84	12163,10
1. Energy industries	13552,63	13552,63	14625,40	8605,07	7284,17	7235,41	6373,98	7055,83	6498,19	7308,07	5915,99
2. Manufacturing industries and construction	6164,93	6164,93	6212,65	3051,70	2006,50	2055,30	1759,75	1540,60	1565,97	1535,00	1194,54
3. Transport	5835,06	5835,06	6430,88	4237,19	3241,59	2567,21	3133,43	3447,77	3830,83	4012,76	3580,75
4. Other sectors	7288,90	7288,90	7647,44	3737,82	3230,64	2945,09	2558,61	2258,05	1938,40	1665,49	1470,00
5. Other	0,36	0,36	0,44	0,51	0,58	0,73	0,87	1,09	1,24	1,53	1,82
B. Fugitive emissions from fuels	265,78	265,78	258,22	249,29	239,99	240,46	235,73	216,03	217,75	211,52	197,88
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	265,78	265,78	258,22	249,29	239,99	240,46	235,73	216,03	217,75	211,52	197,88
C. CO_2 transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes	4502,71	4502,71	4535,09	2689,79	1759,31	1955,91	2243,06	2633,15	2596,41	3003,68	2939,16
A. Mineral industry	2141,98	2141,98	2022,52	1083,55	500,73	483,26	425,65	405,42	441,54	509,17	420,10
B. Chemical industry	2176,29	2176,29	2332,62	1433,80	1091,10	1306,93	1646,90	2057,60	1975,19	2315,17	2339,66
C. Metal industry	16,98	16,98	13,68	6,97	5,43	5,35	4,55	5,07	5,33	5,67	6,25
D. Non-energy products from fuels and solvent use	71,39	71,39	71,99	72,97	71,35	71,41	72,64	72,07	80,62	77,64	75,27
E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Product uses as ODS substitutes	NO	NO	NO	NO	0,03	0,09	6,21	7,68	10,22	13,90	17,50
G. Other product manufacture and use	96,05	96,05	94,26	92,47	90,67	88,87	87,10	85,29	83,52	82,14	80,37
H. Other	0,02	0,02	0,02	0,02	0,00	NO	NO	NO	NO	NO	NO
3. Agriculture	8853,48	8853,48	8673,70	6607,15	5362,22	4750,58	4442,38	4613,59	4648,52	4536,24	4272,75
A. Enteric fermentation	4282,35	4282,35	4057,44	3495,41	2838,76	2424,05	2183,95	2114,11	2111,26	2010,36	1830,15
B. Manure management	1216,29	1216,29	1130,01	929,74	731,90	653,03	618,58	593,42	586,52	565,72	507,68
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	3298,55	3298,55	3423,88	2146,59	1781,62	1663,63	1629,08	1879,37	1923,97	1932,36	1909,40
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

G. Liming	20,59	20,59	20,59	20,59	2,70	2,62	4,03	13,38	13,11	13,75	9,69
H. Urea application	35,71	35,71	41,77	14,82	7,24	7,24	6,74	13,31	13,66	14,05	15,83
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry[(2)]	-3511,89	-3511,89	-3839,98	-4009,18	-5143,00	-4921,31	-3795,28	1516,04	142,77	-7613,46	-7232,32
A. Forest land	-7743,23	-7743,23	-7682,04	-7542,12	-8136,33	-7603,71	-5430,44	406,79	-1008,73	-8331,84	-8137,64
B. Cropland	5645,97	5645,97	5446,86	5267,60	5087,87	4905,99	4721,98	4561,79	4454,19	4296,36	4140,93
C. Grassland	-1773,90	-1773,90	-2025,31	-2260,27	-2500,44	-2744,94	-2973,54	-3020,07	-3144,44	-3334,82	-3510,94
D. Wetlands	523,40	523,40	556,37	584,08	340,60	737,13	446,53	463,66	488,81	348,67	791,64
E. Settlements	NO	NO	42,29	76,24	84,12	153,48	164,54	155,75	169,84	182,55	199,40
F. Other land	NO,NE	NO,NE	NO,NE	12,84	22,16	183,44	29,72	27,96	27,96	34,38	32,62
G. Harvested wood products	-252,55	-252,55	-263,83	-230,80	-121,60	-633,13	-830,06	-1154,42	-916,97	-877,01	-815,09
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Waste	1576,72	1576,72	1602,37	1571,55	1593,35	1549,39	1578,29	1577,30	1579,51	1565,41	1539,91
A. Solid waste disposal	1028,83	1028,83	1053,64	1076,08	1095,40	1101,03	1102,71	1111,02	1118,94	1123,13	1125,97
B. Biological treatment of solid waste	6,92	6,92	6,92	2,52	2,35	6,43	9,19	7,93	6,93	6,06	11,27
C. Incineration and open burning of waste	2,74	2,74	2,74	0,78	2,22	0,68	2,59	0,88	0,88	0,97	0,42
D. Waste water treatment and discharge	538,22	538,22	539,06	492,18	493,39	441,25	463,80	457,48	452,77	435,25	402,24
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other ***(as specified in summary 1.A)***	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:											
International bunkers	707,45	707,45	987,45	1130,08	624,17	602,43	571,14	517,94	284,55	240,71	306,69
Aviation	402,27	402,27	484,15	195,82	108,25	114,81	118,16	96,38	90,33	81,01	74,89
Navigation	305,18	305,18	503,30	934,26	515,92	487,62	452,98	421,56	194,22	159,71	231,80
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	1207,57	1207,57	1207,57	1208,48	1804,56	1865,67	1957,08	2144,15	2194,52	2419,39	2507,86
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Long-term storage of C in waste disposal sites	2160,50	2160,50	2242,62	2321,92	2395,63	2466,94	2543,73	2617,71	2690,77	2760,23	2832,04
Indirect N_2O	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
Indirect CO_2 [(3)]	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE
Total CO_2 equivalent emissions without land use, land-use change and forestry	48040,58	48040,58	49986,19	30750,07	24718,36	23300,07	22326,11	23343,41	22876,81	23839,70	21112,79
Total CO_2 equivalent emissions with land use, land-use change and forestry	44528,69	44528,69	46146,21	26740,89	19575,36	18378,76	18530,84	24859,45	23019,58	16226,24	13880,47
Total CO_2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total CO_2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
	(kt CO_2 equivalent)										
Total (net emissions)[2]	9779,82	12433,75	13578,96	13864,82	14879,37	16739,58	17967,80	18462,24	17378,31	12502,46	10881,33
1. Energy	10808,18	11434,49	11525,70	11529,86	12162,86	13042,00	13116,62	13367,71	13186,32	11922,78	12874,68
A. Fuel combustion (sectoral approach)	10596,12	11216,07	11296,88	11300,15	11919,37	12765,57	12857,39	13126,54	12950,93	11702,96	12628,41
1. Energy industries	5055,97	5532,75	5350,47	5223,86	5399,42	5655,86	5202,95	4736,99	4804,58	4782,67	5329,59
2. Manufacturing industries and construction	1091,49	1052,17	1116,84	1142,13	1221,63	1492,30	1634,65	1643,49	1481,65	1192,67	1290,66
3. Transport	3206,20	3439,70	3565,62	3627,38	3963,93	4208,20	4477,84	5236,25	5206,31	4301,45	4418,65
4. Other sectors	1238,95	1190,71	1262,86	1303,29	1324,99	1396,69	1529,78	1493,87	1446,01	1414,80	1573,49
5. Other	3,50	0,73	1,09	3,50	9,40	12,53	12,16	15,95	12,38	11,36	16,03
B. Fugitive emissions from fuels	212,07	218,42	228,82	229,70	243,49	276,43	259,23	241,17	235,39	219,82	246,27
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	212,07	218,42	228,82	229,70	243,49	276,43	259,23	241,17	235,39	219,82	246,27
C. CO_2 transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes	3094,39	3342,60	3515,16	3597,80	3787,19	4108,63	4367,40	6144,87	5475,54	2294,45	2239,19
A. Mineral industry	357,28	360,05	354,59	363,47	426,46	445,04	598,92	600,41	521,30	304,78	327,12
B. Chemical industry	2554,78	2794,02	2964,15	3028,41	3136,38	3440,42	3545,09	5288,90	4693,35	1710,09	1588,81
C. Metal industry	6,78	7,11	7,17	6,78	6,89	7,26	6,95	6,54	4,69	4,19	4,29
D. Non-energy products from fuels and solvent use	74,73	75,96	77,69	76,32	76,43	54,95	54,82	60,60	50,13	43,79	46,60
E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO	2,96	2,37	4,74
F. Product uses as ODS substitutes	22,08	28,59	36,41	47,88	69,10	90,31	120,02	155,89	194,55	216,11	259,52
G. Other product manufacture and use	78,75	76,87	75,15	74,95	71,93	70,65	41,60	32,53	7,01	12,27	6,75
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	1,55	0,84	1,36
3. Agriculture	4156,97	4054,60	4226,85	4339,91	4387,73	4420,46	4396,09	4488,55	4340,16	4381,11	4329,22
A. Enteric fermentation	1715,19	1610,88	1645,08	1691,63	1715,46	1701,12	1732,55	1751,35	1717,15	1679,50	1650,98
B. Manure management	465,27	455,22	476,61	491,13	494,42	500,02	511,93	497,45	474,31	465,05	463,85
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	1952,40	1965,76	2076,77	2129,44	2150,23	2180,84	2125,44	2201,48	2118,64	2193,42	2192,32
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming	7,60	5,56	9,03	8,17	7,92	6,93	7,26	6,73	10,66	6,86	6,30

H. Urea application	16,51	17,18	19,37	19,54	19,71	31,54	18,92	31,54	19,40	36,27	15,77
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry[(2)]	-9820,50	-7981,63	-7262,42	-7164,14	-6991,17	-6328,26	-5372,91	-6974,73	-7045,53	-7472,11	-9901,15
A. Forest land	-9494,91	-7054,34	-6276,81	-5125,40	-4971,90	-4516,13	-4643,53	-5894,96	-7497,35	-8728,82	-9845,85
B. Cropland	3871,69	3461,94	3314,37	2681,33	2589,38	2467,68	3162,99	3359,58	3798,18	3956,84	3672,41
C. Grassland	-3736,52	-3975,31	-4156,63	-4323,11	-4399,08	-4471,21	-4220,80	-3985,37	-3677,15	-3472,99	-3445,09
D. Wetlands	466,29	472,73	845,06	761,20	768,20	879,91	780,31	519,26	858,19	1042,04	548,67
E. Settlements	248,58	248,61	257,26	261,76	266,08	431,95	458,76	318,38	336,98	353,83	348,56
F. Other land	32,62	41,13	39,38	47,88	41,47	41,47	208,36	48,22	65,25	70,24	68,48
G. Harvested wood products	-1268,83	-1232,17	-1336,93	-1518,42	-1334,16	-1209,53	-1174,22	-1396,56	-993,29	-763,96	-1317,45
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Waste	1540,77	1583,69	1573,67	1561,40	1532,76	1496,75	1460,60	1435,85	1421,82	1376,24	1339,40
A. Solid waste disposal	1136,00	1172,91	1184,54	1195,54	1174,27	1152,34	1134,71	1117,01	1096,63	1085,06	1066,53
B. Biological treatment of solid waste	4,47	9,24	11,28	10,30	8,42	13,22	11,16	13,50	14,86	15,24	14,43
C. Incineration and open burning of waste	1,17	1,59	1,43	3,81	1,97	3,71	3,39	0,68	0,66	0,70	1,51
D. Waste water treatment and discharge	399,12	399,96	376,43	351,74	348,10	327,47	311,34	304,66	309,68	275,25	256,93
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:											
International bunkers	366,38	412,39	436,58	445,93	468,94	601,44	601,69	584,31	520,16	521,80	596,07
Aviation	70,81	94,34	84,14	94,27	105,27	140,09	159,47	199,75	231,37	110,88	146,57
Navigation	295,57	318,05	352,44	351,66	363,67	461,35	442,23	384,56	288,79	410,93	449,50
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	2736,85	2977,49	3216,01	3396,38	3558,67	3597,46	3782,88	3821,10	4049,59	4156,31	4144,72
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Long-term storage of C in waste disposal sites	2914,20	2988,26	3062,06	3123,10	3185,77	3252,57	3315,74	3380,93	3456,88	3525,71	3593,46
Indirect N_2O	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
Indirect CO_2 [(3)]	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE
Total CO_2 equivalent emissions without land use, land-use change and forestry	19600,32	20415,39	20841,38	21028,97	21870,54	23067,84	23340,71	25436,97	24423,84	19974,57	20782,48
Total CO_2 equivalent emissions with land use, land-use change and forestry	9779,82	12433,75	13578,96	13864,82	14879,37	16739,58	17967,80	18462,24	17378,31	12502,46	10881,33
Total CO_2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total CO_2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2011	2012	2013	2014	2015	Change from base to latest reported year
	(kt CO_2 equivalent)					(%)
Total (net emissions)[2]	11116,61	12010,84	11443,61	12537,14	13391,18	-69,93
1. Energy	12028,98	12071,29	11419,70	11049,58	11057,09	-66,60
A. Fuel combustion (sectoral approach)	11835,10	11822,55	11173,73	10763,26	10758,61	-67,24
1. Energy industries	4461,86	4410,68	3851,99	3167,59	3155,10	-76,72
2. Manufacturing industries and construction	1387,11	1487,05	1431,83	1309,09	1187,30	-80,74
3. Transport	4380,01	4392,11	4383,24	4857,19	5113,75	-12,36
4. Other sectors	1593,23	1523,68	1489,26	1394,19	1266,15	-82,63
5. Other	12,89	9,03	17,41	35,19	36,32	9871,09
B. Fugitive emissions from fuels	193,88	248,75	245,96	286,32	298,48	12,30
1. Solid fuels	NO	NO	NO	NO	NO	0,00
2. Oil and natural gas and other emissions from energy production	193,88	248,75	245,96	286,32	298,48	12,30
C. CO_2 transport and storage	NO	NO	NO	NO	NO	0,00
2. Industrial Processes	3719,53	3565,42	3000,41	3176,87	3396,58	-24,57
A. Mineral industry	383,09	455,78	516,62	466,91	578,43	-73,00
B. Chemical industry	2965,70	2698,51	2021,05	2199,63	2277,55	4,65
C. Metal industry	3,91	3,22	2,48	2,60	2,02	-88,12
D. Non-energy products from fuels and solvent use	46,81	44,45	42,97	46,73	49,36	-30,86
E. Electronic industry	5,93	3,56	5,98	5,05	5,00	100,00
F. Product uses as ODS substitutes	306,54	351,03	405,15	449,48	478,36	100,00
G. Other product manufacture and use	7,54	5,12	5,15	6,41	5,69	-94,08
H. Other	0,02	3,75	1,01	0,06	0,17	639,36
3. Agriculture	4345,41	4379,52	4357,33	4529,73	4600,30	-48,04
A. Enteric fermentation	1632,04	1617,15	1585,86	1628,90	1637,44	-61,76
B. Manure management	457,67	454,50	456,19	461,75	467,70	-61,55
C. Rice cultivation	NO	NO	NO	NO	NO	0,00
D. Agricultural soils	2232,76	2281,17	2282,79	2373,36	2431,71	-26,28
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	0,00
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	0,00
G. Liming	8,75	10,93	16,71	24,71	20,91	1,53
H. Urea application	14,19	15,77	15,77	41,00	42,54	19,13
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	0,00

J. Other	NO	NO	NO	NO	NO	0,00
4. Land use, land-use change and forestry[2]	-10227,95	-9217,12	-8504,46	-7331,99	-6705,03	90,92
A. Forest land	-10366,56	-10068,86	-9873,84	-9225,28	-8861,81	14,45
B. Cropland	3711,78	3860,68	4075,75	4345,66	4388,66	-22,27
C. Grassland	-3194,93	-2854,88	-2652,02	-2450,66	-2458,73	38,61
D. Wetlands	639,54	641,84	883,06	892,36	965,10	84,39
E. Settlements	316,81	300,67	360,49	402,10	412,80	100,00
F. Other land	68,48	67,65	56,58	58,34	62,19	100,00
G. Harvested wood products	-1471,49	-1233,46	-1426,19	-1429,82	-1289,53	410,60
H. Other	NO	NO	NO	NO	NO	0,00
5. Waste	1250,64	1211,74	1170,64	1112,96	1042,25	-33,90
A. Solid waste disposal	979,83	962,67	920,75	859,96	802,20	-22,03
B. Biological treatment of solid waste	17,76	19,69	24,64	42,31	42,56	514,55
C. Incineration and open burning of waste	4,59	1,06	0,80	2,02	5,91	115,42
D. Waste water treatment and discharge	248,46	228,33	224,45	208,67	191,58	-64,41
E. Other	NO	NO	NO	NO	NO	0,00
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	0,00
Memo items:						
International bunkers	625,33	580,20	494,32	271,85	490,32	-30,69
Aviation	168,35	191,88	212,86	236,10	247,14	-38,56
Navigation	456,97	388,32	281,46	35,75	243,18	-20,32
Multilateral operations	NO	NO	NO	NO	NO	0,00
CO_2 emissions from biomass	4041,26	4460,76	4615,24	4890,66	5439,58	350,46
CO_2 captured	NO	NO	NO	NO	NO	0,00
Long-term storage of C in waste disposal sites	3657,26	3706,71	3740,87	3767,41	3787,86	75,32
Indirect N_2O	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0,00
Indirect CO_2 [3]	NE,NO,IE	NE,NO,IE	NE,NO,IE	NE,NO,IE	NO,NE,IE	0,00
Total CO_2 equivalent emissions without land use, land-use change and forestry	21344,57	21227,96	19948,07	19869,14	20096,21	-58,17
Total CO_2 equivalent emissions with land use, land-use change and forestry	11116,61	12010,84	11443,61	12537,14	13391,18	-69,93
Total CO_2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	0,00
Total CO_2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	0,00

EMISSION TRENDS SUMMARY (CRF TABLE 10)

GREENHOUSE GAS EMISSIONS	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt CO_2 equivalent)													
CO_2 emissions without net CO_2 from LULUCF	35807,13	35807,13	37903,60	21207,61	16352,69	15768,56	15024,18	15678,51	15089,48	15906,85	13426,02	11806,06	12514,55	12620,55
CO_2 emissions with net CO_2 from LULUCF	31768,89	31768,89	33552,69	16691,77	10722,96	10351,23	10765,57	16738,93	14790,64	7874,98	5780,84	1606,06	4180,96	5022,76
CH_4 emissions without CH_4 from LULUCF	6953,76	6953,76	6718,89	5887,57	5161,85	4661,02	4429,55	4345,25	4342,91	4213,70	3970,24	3840,26	3778,21	3830,36
CH_4 emissions with CH_4 from LULUCF	6956,64	6956,64	6721,40	5894,95	5165,93	4665,09	4433,62	4349,32	4346,98	4216,16	3974,25	3844,18	3780,97	3836,53
N_2O emissions without N_2O from LULUCF	5279,69	5279,69	5363,70	3654,90	3203,79	2870,40	2866,13	3311,92	3434,13	3704,74	3698,48	3931,20	4093,38	4353,32
N_2O emissions with N_2O from LULUCF	5803,16	5803,16	5872,12	4154,18	3686,45	3362,35	3325,39	3763,47	3871,66	4120,69	4107,33	4306,77	4442,58	4682,51
HFCs	NO	NO	NO	NO	NO	0,03	0,09	6,21	7,68	10,22	13,90	17,50	22,08	28,59	36,41
PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF_6	NO	NO	NO	NO	NO	NO	0,05	0,05	0,08	0,51	0,54	0,72	0,66	0,75
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (without LULUCF)	48040,58	48040,58	49986,19	30750,07	24718,36	23300,07	22326,11	23343,41	22876,81	23839,70	21112,79	19600,32	20415,39	20841,38
Total (with LULUCF)	44528,69	44528,69	46146,21	26740,89	19575,36	18378,76	18530,84	24859,45	23019,58	16226,24	13880,47	9779,82	12433,75	13578,96
Total (without LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt CO_2 equivalent)													
1. Energy	33107,67	33107,67	35175,03	19881,58	16003,48	15044,20	14062,38	14519,37	14052,37	14734,36	12360,98	10808,18	11434,49	11525,70
2. Industrial processes and product use	4502,71	4502,71	4535,09	2689,79	1759,31	1955,91	2243,06	2633,15	2596,41	3003,68	2939,16	3094,39	3342,60	3515,16
3. Agriculture	8853,48	8853,48	8673,70	6607,15	5362,22	4750,58	4442,38	4613,59	4648,52	4536,24	4272,75	4156,97	4054,60	4226,85
4. Land use, land-use change and forestry[5]	-3511,89	-3511,89	-3839,98	-4009,18	-5143,00	-4921,31	-3795,28	1516,04	142,77	-7613,46	-7232,32	-9820,50	-7981,63	-7262,42
5. Waste	1576,72	1576,72	1602,37	1571,55	1593,35	1549,39	1578,29	1577,30	1579,51	1565,41	1539,91	1540,77	1583,69	1573,67
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)[5]	44528,69	44528,69	46146,21	26740,89	19575,36	18378,76	18530,84	24859,45	23019,58	16226,24	13880,47	9779,82	12433,75	13578,96

GREENHOUSE GAS EMISSIONS	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year (%)
	(kt CO_2 equivalent)													
CO_2 emissions without net CO_2 from LULUCF	12609,90	13185,12	14089,11	14402,61	15762,94	15079,88	12828,06	13712,65	14066,76	14132,97	13107,04	12874,38	13141,77	-63,30
CO_2 emissions with net CO_2 from LULUCF	5120,08	5878,60	7457,80	8652,77	8434,91	7640,68	4918,62	3388,11	3416,76	4492,22	4166,54	5082,42	5973,85	-81,20
CH_4 emissions without CH_4 from LULUCF	3880,02	3898,45	3893,98	3892,06	3856,70	3798,37	3693,84	3660,82	3491,88	3499,73	3425,07	3432,90	3376,34	-51,45
CH_4 emissions with CH_4 from LULUCF	3884,53	3902,42	3894,95	3905,14	3857,56	3800,00	3697,95	3662,07	3494,58	3500,72	3425,87	3435,76	3377,79	-51,45
N_2O emissions without N_2O from LULUCF	4488,81	4716,72	4992,74	4924,48	5660,20	5347,57	3233,50	3143,50	3471,64	3240,24	3004,44	3106,10	3093,94	-41,40
N_2O emissions with N_2O from LULUCF	4809,98	5028,10	5294,83	5288,33	6012,63	5739,60	3666,72	3565,64	3890,99	3662,88	3439,68	3563,22	3555,38	-38,73
HFCs	47,88	69,10	90,31	120,02	155,89	194,55	216,11	259,52	306,54	351,03	405,15	449,48	478,36	100,00
PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
SF_6	2,35	1,15	1,70	1,54	1,25	3,47	3,05	5,99	7,74	3,99	6,32	5,98	5,54	100,00
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,06	0,29	0,26	100,00
Total (without LULUCF)	21028,97	21870,54	23067,84	23340,71	25436,97	24423,84	19974,57	20782,48	21344,57	21227,96	19948,07	19869,14	20096,21	-58,17
Total (with LULUCF)	13864,82	14879,37	16739,58	17967,80	18462,24	17378,31	12502,46	10881,33	11116,61	12010,84	11443,61	12537,14	13391,18	-69,93
Total (without LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total (with LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
	(kt CO_2 equivalent)													(%)
1. Energy	11529,86	12162,86	13042,00	13116,62	13367,71	13186,32	11922,78	12874,68	12028,98	12071,29	11419,70	11049,58	11057,09	-66,60
2. Industrial processes and product use	3597,80	3787,19	4108,63	4367,40	6144,87	5475,54	2294,45	2239,19	3719,53	3565,42	3000,41	3176,87	3396,58	-24,57
3. Agriculture	4339,91	4387,73	4420,46	4396,09	4488,55	4340,16	4381,11	4329,22	4345,41	4379,52	4357,33	4529,73	4600,30	-48,04
4. Land use, land-use change and forestry[5]	-7164,14	-6991,17	-6328,26	-5372,91	-6974,73	-7045,53	-7472,11	-9901,15	-10227,95	-9217,12	-8504,46	-7331,99	-6705,03	90,92
5. Waste	1561,40	1532,76	1496,75	1460,60	1435,85	1421,82	1376,24	1339,40	1250,64	1211,74	1170,64	1112,96	1042,25	-33,90
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Total (including LULUCF)[5]	13864,82	14879,37	16739,58	17967,80	18462,24	17378,31	12502,46	10881,33	11116,61	12010,84	11443,61	12537,14	13391,18	-69,93

[1] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[2] Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[3] In accordance with the UNFCCC reporting guidelines, for Parties that decide to report indirect CO2 the national totals shall be provided with and without indirect CO_2.

[4] In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

[5] Includes net CO_2, CH_4 and N_2O from LULUCF.

ANNEX III List of key categories in Lithuanian greenhouse gas inventory

IPCC Category	GHG	Identification criteria
1.A.1 Energy industries - Other fossil fuels	CO_2	T1
1.A.1 Energy industries - Solid fuels	CO_2	T1
1.A.1 Energy industries - Biomass	N_2O	T2
1.A.1 Energy industries - Biomass	CH_4	T2sub*
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO_2	L1,T1,T2
1.A.1.a Public electricity and heat production - Liquid Fuels	CO_2	L1,T1, T2
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	L1,T1
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO_2	T1sub*
1.A.2 Manufacturing industries and construction - Gaseous fuels	CO_2	L1,T1
1.A.2 Manufacturing industries and construction - Liquid fuels	CO_2	T1,T2
1.A.2 Manufacturing industries and construction - Solid fuels	CO_2	L1,T1
1.A.3.b Road transportation	CO_2	L1,T1,T2
1.A.3.c Railways	CO_2	L1, T1
1.A.4 Other sectors-Biomass	CH_4	L1,L2,T1,T2
1.A.4 Other sectors-Biomass	N_2O	L2sub, T2sub*
1.A.4 Other sectors-Gaseous fuels	CO_2	L1,T1
1.A.4 Other sectors-Liquid fuels	CO_2	L1,T1, T2
1.A.4 Other sectors-Liquid fuels	N_2O	T1
1.A.4 Other sectors-Peat	CO_2	T1sub*
1.A.4 Other sectors-Solid fuels	CO_2	L1,T1,T2
1.A.4 Other sectors-Solid fuels	CH_4	T2sub*
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH_4	L1,T1
2.A.1 Cement Production	CO_2	L1,T1
2.A.2 Lime Production	CO_2	T1
2.A.4 Other process use of carbonates	CO_2	T1
2.B.1 Ammonia Production	CO_2	L1,T1
2.B.2 Nitric Acid Production	N_2O	L1,T1
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	L1,T1, T2
3.A.1 Enteric Fermentation - Cattle	CH_4	L1,L2,T1,T2
3.B.1.1 Manure Management - Cattle	CH_4	L1
3.B.1.3 Manure Management - Swine	CH_4	T1
3.B.2 Manure Management - Cattle	N_2O	L1sub*
3.B.2 Manure Management - Indirect N_2O Emissions	N_2O	L2, T1,T2
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	N_2O	L1,L2,T2
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	N_2O	L1, T2
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung	N_2O	L1,L2,T1,T2
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	N_2O	L1,L2
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	N_2O	L1,L2,T1,T2

3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	N_2O	L2
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	N_2O	L1, L2
4.A Forest land, Emissions and removals from drainage and rewetting	CO_2	L1,L2,T1,T2
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO_2	L1,L2,T1,T2
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO_2	L1
4.A.2 Land converted to forest land - carbon stock change in biomass	CO_2	L1,L2,T1,T2
4.A.2 Land converted to forest land - net carbon stock change in litter	CO_2	L1,L2,T1,T2
4.B Cropland, Emissions and removals from drainage and rewetting	CO_2	L1
4.B Cropland	N_2O	L1, L2, T2
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO_2	L1,L2,T1,T2
4.B.2 Land converted to cropland - carbon stock change in biomass	CO_2	L1,L2,T1,T2
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO_2	L1,L2,T1,T2
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO_2	L1,L2,T1,T2
4.E.2 Land converted to settlements	CO_2	L1,L2,T1,T2
4.G Harvested wood products	CO_2	L1,L2,T1,T2
5.A Solid Waste Disposal	CH_4	L1,L2,T2
5.B Biological treatment of waste	CH_4	T2sub*
5.D Wastewater Treatment and Discharge	CH_4	L1,T1,T2

**Lsub, Tsub denote the categories that were identified by level and trend assessment for a subset without LULUCF when compared to Approach 1*
Abbreviations:
L1, T1 – approach 1 (level and trend) assessment
L2, T2 - approach 2 (level and trend) assessment

ANNEX IV Response to the review recommendations of Lithuania‘s Sixth National Communication

Recommendation	Lithuania’s response
20. The NC6 does not include information required by the annex to decision 15/CMP.1 regarding the name and contact information for the national entity and its designated representative with overall responsibility for the national inventory of Lithuania. During the review, Lithuania provided the information to the ERT, also explaining that it was presented in its biennial report, which is an annex to the NC6. **The ERT recommends that Lithuania include the name and contact information for the Party’s national entity and its designated representative in its next NC.**	Information on name and contact information of GHG inventory national entity and its designated representative is added, see Chapter 3.2.1.
23. **The NC6 does not include information required by the annex to decision 15/CMP.1 on the name and contact information of the registry administrator designated by the Party to maintain the national registry.** During the review, Lithuania provided this information, explaining also that it was presented in the Party’s national inventory report submitted in 2014. **The ERT recommends that Lithuania include such information in its next NC.**	Information on name and contact information of the registry administrator designated to maintain the national registry is added, see Chapter 3.3.
35. The recommendation made in the previous review report with regard to how PaMs are modifying longer-term trends in anthropogenic GHG emissions and removals in accordance with the objective of the Convention has to some extent been considered in the NC6. During the review, Lithuania provided additional information, referring in particular to the Strategy for the National Climate Change Management Policy until 2050. **To improve transparency, the ERT recommends that Lithuania report more explicitly on how it believes its PaMs are modifying longer-term trends in anthropogenic GHG emissions and removals, in its next NC.**	This information can be found in Chapter 4.9. Effect of policies and measures on longer term trends.
64. **The NC6 does not include information required by the annex to decision 15/CMP.1 on steps taken to promote and/or implement any decisions by the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) in order to limit or to reduce GHG emissions not included in the Montreal Protocol from aviation and marine bunker fuels.** During the review, Lithuania informed the ERT that it supports the initiatives by ICAO and IMO and that Lithuanian aircraft operators have been participating in the EU ETS since 1 January 2012. Lithuania also informed the ERT of the proposal by the European Commission for the “Regulation on monitoring, reporting and verification of CO2 from maritime transport” (June 2013). **The ERT reiterates the recommendation made in the previous review report that Lithuania include such information in its next NC.**	This information can be found in Chapter 4.8. Steps taken to promote and/or implement any decisions by ICAO and IMO to limit or reduce associated emissions.
66. The NC6 outlines several of the Party’s actions that take into account the minimization of the adverse effects of PaMs by Lithuania from two perspectives: through the funding of projects abroad as a part of the fast-start financing programme and the channelling of bilateral funding for projects in developing countries; and through the application of policies based on the Strategy for the National Climate Change Management Policy and its action plan. During the review, Lithuania provided the ERT with additional information; however, **the ERT considered that the information provided was not sufficiently elaborated to provide an understanding of how the reported activities contribute to the minimization of adverse effects, including the adverse effects of climate change and effects on international trade and social, environmental and economic impacts on other Parties, especially developing country Parties. The ERT recommends**	This information can be found in Chapter 4.12. Information on minimization of adverse effects. Chapter 7 provides information on programmes which aim to minimize adverse effects of climate change on developing countries.

that Lithuania provide more information on this matter in its next NC.	
80. During the review, Lithuania informed the ERT that the total effect of PaMs was not estimated for years prior to 2010 as the impact of measures implemented before 2005 is estimated to be minor. In the NC6, the total effect of PaMs is not presented by gas (on a CO2 eq basis). **The ERT recommends that Lithuania present the total effect of PaMs by gas in its next NC.**	The total effect of PaMs by gas is provided in Chapter 4.
90. According to its NC6, Lithuania cooperates with other countries in preparation for adaptation by actively taking part in the development and implementation of a strategy and action plan for adaptation to climate change in the Baltic Sea region as part of the Baltadapt project. However, the ERT noted that in its NC6, **Lithuania did not provide an outline of the action taken to implement Article 4, paragraph 1(e), of the Convention, on cooperation for the development of integrated plans for coastal zone management, water resources and agriculture, particularly in countries affected by drought and desertification, as well as floods.** During the review, Lithuania informed the ERT that it is planning to support countries affected by drought, desertification and floods through multilateral institutions such as the World Bank, EBRD and other multilateral scientific, technological and training programmes. The Contribution Agreement with EBRD was signed in the first half of 2014, after which funds were disbursed to different climate change mitigation and adaptation projects. **The ERT recommends that Lithuania provide, in its next NC, complete information on the outline of the action taken to implement Article 4, paragraph 1(e), of the Convention with regard to adaptation in line with the information provided to the ERT during the review.**	Lithuania implemented project *"Strengthening the capacities for effective implementation of the acquis in the field of water quality"* in Macedonia. The project purpose is to strengthen the administrative capacities in the area of water management by implementing the appropriate EU acquis. The project will assist the national authorities in drafting the Vardar River Basin Management Plan and in harmonising and implementing secondary legislation in the area of water monitoring and water permitting. Information about financial and capacity-building support for developing countries is presented in Chapter 7 (see table 9-3).
97. Regarding research and systematic observation related capacity-building in developing countries, Lithuania refers in chapter 8.3 of its NC6 to adaptation projects implemented in and financial support provided to developing countries, such as the Republic of Moldova and Georgia. While acknowledging the reported information, the ERT considered that the capacity-building referred to was not related to research and systematic observation. Lithuania also informed the ERT, during the review, that there are currently no plans to initiate capacity-building activities in developing countries to establish and maintain observing systems and related data and monitoring systems due to limited financial and human resources at the Lithuanian Hydrometeorological Service. **The ERT reiterates the recommendation made in the previous review report that Lithuania provide, in its next NC, information on the action taken to support research and systematic observation related capacity-building in developing countries.**	Lithuania has limited financial and human resources at the Lithuanian Hydrometeorological Service, so currently there are no plans to initiate capacity-building activities in developing countries to establish and maintain observing systems. Information about financial support for developing countries is presented in Chapter 7.
111. The 2013 national inventory report, NC6 and the additional information provided during the review presented the initiatives of Lithuania aimed at minimizing adverse impacts from two perspectives: through the funding of projects abroad as a part of the fast-start financing programme and the channelling of bilateral funding for projects in developing countries; and through the application of policies based on the Strategy for the National Climate Change Management Policy by 2050 and its Inter-institutional Action Plan (see para. 30 above). **The ERT recommends that Lithuania provide more information on how the activities being undertaken contribute to the minimization of adverse social, environmental and economic impacts on developing countries.**	This information can be found in Chapter 4.12. Information on minimization of adverse effects. Chapter 7 provides information on programmes which aim to minimize adverse effects of climate change on developing countries.