



**Lithuania's 6<sup>th</sup> National Communication  
and 1<sup>st</sup> Biennial report  
under the United Nations Framework  
Convention on Climate Change**



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Photos

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## **Abbreviations**

ARR	Annual Review Report
AAU	Assigned amount unit
Art	Article
QC	Quality control
QA	Quality assurance
CDM	Clean development mechanism
CHP	Combined heat and power
CH <sub>4</sub>	Methane
CO <sub>2</sub> eq	CO <sub>2</sub> equivalent
CER	Certified emission reduction unit
CRF	Common reporting format
CTF	Common tabular format
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
ETS	Emissions Trading System
ERT	Expert Review Team
ERU	Emission Reduction Unit
EU	European Union
EUA	European Union emission allowance
GCOS	Global Climate Observing Systems
GDP	Gross domestic product
GHG	Greenhouse gases (CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub> )
GNI	Gross national income
HFCs	Hydrofluorocarbons
IDR	In-depth review report
ITL	International Transaction Log
JI	Joint Implementation
LULUCF	Land Use, Land-Use Change and Forestry
NIR	National Inventory Report
NMVO	Non-methane volatile organic compounds
NPP	Nuclear Power Plant
NO <sub>x</sub>	Nitrogen oxides
N <sub>2</sub> O	Nitrous oxide
R&D	Research and development

RES	Renewable energy sources
SO <sub>2</sub>	Sulphur dioxide
toe	tones of oil equivalent
UCTE	The Union for the Co-ordination of Transmission of Electricity
UNFCCC	United Nations Framework Convention on Climate Change

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## Foreword

The Ministry of Environment is delighted to present Lithuania's 6<sup>th</sup> National Communication and the 1<sup>st</sup> Biennial report under the United Nations Framework Convention on Climate Change.

The National communication is prepared in accordance with the UNFCCC reporting guidelines on national communications (FCCC/CP/1999/7) following incorporation of supplementary information under Article 7, paragraph 2 of the Kyoto Protocol required by the decision 15/CMP.1 and taking into account remarks by the UNFCCC expert team, provided in the Report of the in-depth review of the 5<sup>th</sup> National Communication of Lithuania (FCCC/IDR.5/LTU). Biennial report is compiled in accordance with the UNFCCC biennial reporting guidelines for developed country Parties (decision 2/CP.17), methodology set in the Common tabular format for "UNFCCC biennial reporting guidelines for developed country Parties" (decision 19/CP.18) and views of the UNFCCC secretariat on reporting of Annex I Parties' 6<sup>th</sup> National Communication and 1<sup>st</sup> Biennial Report published on 18 March 2013. The 1<sup>st</sup> Biennial report is presented as an Annex to Lithuania's 6<sup>th</sup> National communication.

The 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> National communications were submitted in 1996, 2003 and 2005, respectively. The 5<sup>th</sup> National Communication on Climate Change was submitted in 2010 and since then the Government of the Republic of Lithuania has enforced ensured actions towards addressing the climate change.

In November 2012 the Parliament of the Republic of Lithuania approved the Strategy for the National Climate Change Management Policy until 2050 (Official Gazette, 2012, No 133-6762), which contains climate change mitigation and adaptation targets and objectives. The Strategy identifies a need for future efforts on the contribution of stabilization of the GHG concentration at a level that enable the 2°C target to be reached. A vision set by the Strategy for the National Climate Change Management Policy is:

*by 2050, the adaptation of national economy sectors to the environmental changes induced by climate change and the climate change mitigation (reduction of GHG emissions) in Lithuania will be ensured, competitive low carbon economy will be developed, eco-innovative technologies will be installed, efficiency of the energy production and consumption will be increased, and renewable energy sources will be used in all national economy sectors (energy, industry, transport, agriculture and etc.).*

Lithuania's targets for climate change and energy policy by 2020 are:

- annual emissions in the European Union emission trading system (EU ETS) not exceeding 8.53 million t CO<sub>2</sub>eq;
- annual emissions in the non-EU ETS not exceeding 18.338 million t CO<sub>2</sub>eq (in case of 20 % target) or 16.584 million t CO<sub>2</sub>eq (in case of 30 % target);
- at least 23 % of renewable energy in final energy consumption;
- 1.5 % less energy consumption annually (17% less energy consumption in 2020 compared to 2009 level);
- no less than 0.38 % of GDP for funding for implementation of measures of climate change mitigation.

Lithuania has committed to contribute to the targets of the EU to reduce GHG emissions by 20 % by 2020 and to move to a 30 % reduction provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities below 1990 level by 2020. Looking on the long term, Lithuania has committed to contribute to the EU milestones to reduce GHG emissions by 2030 – 40 %, by 2040 – 60 % and by 2050 – 80 % compared to 1990 level.

Other significant improvement is 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, approved by the Government in April 2013 (Official Gazette, 2013, No 45-2218). This plan foresees climate change mitigation and adaptation measures and assignments for the implementation of these measures. Also it sets competent authorities and ensures an inter-institutional cooperation, aiming at the implementation of the goals and objectives stated in the Strategy for National Climate Change Management Policy.

Lithuania has already taken significant steps to identify and address climate change mitigation and adaptation and the actions taken are presented in this National communication.

# **1 Executive Summary**

## **1.1 Introduction**

The Republic of Lithuania signed the UNFCCC together with the rest of 154 states at the United Nations Conference on Environment and Development held in Rio de Janeiro in June 1992. The Convention was ratified by the Seimas (the Parliament) of the Republic of Lithuania on 23 February 1995. The Kyoto Protocol was signed in 1998 and ratified in 2002. Under the Protocol, Lithuania is obliged to reduce GHG emissions by 8 % as compared with the 1990 level during the period 2008-2012. Due to the re-organization of the economic sectors, this target has been achieved and already by 2011 the GHG emissions decreased by 56 % compared to the 1990 level (excluding LULUCF).

Lithuania, together with the other EU Member States, contributes to the development of policies in order to ensure that the EU will meet its emission reduction target to reduce GHG emissions by at least 20 % compared to 1990 by 2020, with an offer to step up this target to 30 % if other major economies agree to do their fair share of a global reduction effort.

This report covers the 6<sup>th</sup> National Communication and 1<sup>st</sup> Biennial Report of the Republic of Lithuania under Article 12 of the UNFCCC and under Article 7 of the Kyoto Protocol and under decision 2/CP.17 of the Conference of the Parties under the UNFCCC. This report focuses primarily on activities during the three-year period 2010-2012, including data for 2011 of National GHG Emission Inventory Report (submission 15 April 2013) and CRF (submission 28 October 2013).

## **1.2 National circumstances**

The Republic of Lithuania restored its Independence on 11 March 1990 after many years of the Soviet Union's annexation. Since that date Lithuania began the foundation of the current management and administrative structure. 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<sup>2</sup>. Lithuania borders with Latvia, Belarus, Poland, Russia and the Baltic Sea. The coastal length of Lithuania makes 90.7 km.

In the beginning of 2012 the number of population in Lithuania was reported to be 3003.6 thousand people. Since 1996 Lithuania's population decreased by 643.3 thousand or 17.8 %. About 66.8 % of people reside in towns and about 33.2 % in rural areas.

Lithuania is the country of lowlands with the highest hills not reaching 300 meters height. Agricultural land covers about 53.1 % of the total land area of the country. The Lithuanian woodland occupies about 33.3 % of the country's territory and protected areas – 15.6 %. In recent years the increased woodenness is reported mostly in swamps and the land unfit for agricultural activities.

The climate in Lithuania varies from marine to continental. The average annual climatic standard of weather temperature is 6.2°C. In 2012 the average weather temperature was 6.7°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.

During the period since 2000, the most rapid development of economy was witnessed in 2003. In subsequent years the GDP growth was slightly slower; however it exceeded 7 % per annum. In 2007 the growth of GDP rocketed and reached 8.9 % if compared with the previous year. Global crisis of finance affected Lithuania in 2008, when GDP growth barely reached 3.0 % and dropped towards the negative rate in 2009. The annual estimates of macroeconomic indicators for 2010 show an economic revival – GDP grew by 1.6 %. The provisional annual estimates of macroeconomic indicators for 2011 show an even faster growth in the Lithuanian economy than in 2010: GDP grew by 6.0 %. In 2012 the nominal value of GDP equaled 113 734.70 million LTL, the GDP growth rate stood at 3.7 %.

The most rapid growth of added value in 2011 was in construction, accommodation and food services, wholesale and retail trade, manufacturing, and mining and quarrying activities. The most rapid decrease was observed in the value added generated by electricity, gas, steam and air conditioning supply. In 2012 the growth of gross value added slowed down. In 2012 the largest growth in the value added was observed in agriculture, forestry and fishery (11.8 %), administrative and service (9.8 %), wholesale and retail trade (7.6 %), transportation and storage (6.7 %) activities [12].

Exports and imports of goods and services, on the increase since 2010, continued growing in 2012. In 2012, compared to 2011, exports and imports increased by 14.4 and 9 %, respectively. The most important export partners in 2012 were Russia (18.9 %), Latvia (10.9 %), Germany (7.8 %) and Estonia (7.7 %); in imports - Russia (31.3 %), Germany (9.9 %), Poland (9.8 %) and Latvia (6.1 %). [12]

### ***Energy sector***

In 2011, compared with 1990, GHG emissions in energy sector have decreased by 63.9 %.

In comparison with the year 2000, the gross inland consumption of fuel and energy has increased by 2.4 % in 2012. Lithuania has limited energy resources and for this reason the country is dependent on their import. Lithuanian energy dependency on import increased from 46.9 % in 2001 to 79.1 % in 2012. This was caused by the decommissioning of the 1<sup>st</sup> unit of the Ignalina Nuclear Power Plant (NPP) on 31 December 2004, 2<sup>nd</sup> unit on 31 December 2009 and the increase of energy consumption.

After the closure of Ignalina NPP, one of the most important steps to mitigate an impact of it was an installation of combined cycle gas turbine in the Lithuanian Power Plant. 455 MW combined cycle gas turbine unit was constructed which replaced operation of 3<sup>rd</sup> and 4<sup>th</sup> units of the Lithuanian Power Plant in 2012.

Key measures for the reduction of GHG emissions in the energy sector include promotion of renewable energy use, increase of energy efficiency and development of nuclear power.

The National Energy Independence Strategy of the Republic of Lithuania, approved by Resolution No XI-2133 of the Seimas of the Republic of Lithuania (Official Gazette, 2012, No 80-4149), is the main instrument employed for the development of Lithuania's energy policies. Priority strategic goal defined in the National Energy Independence Strategy is a building of the new NPP until 2020. The new NPP would be built next to the existing units of the Ignalina NPP. Electric capacity of the new plant should not exceed 3400 MW and will depend on the investor and the investor chosen technology. However, after the referendum in 2012, where people voted against new NPP, the future development of nuclear power in Lithuania remains unclear.

The main goal set in the National Strategy for the Development of Renewable Energy Sources approved by Resolution No 789 of the Seimas (Official Gazette, 2010, No 73-3725) is to increase a share of RES in the final energy consumption from 15.3 % in 2008 to 23 % in 2020. In 2012 Lithuania has reached 21.72 % of RES in final energy consumption. Development of RES is recognized as one of the most important priorities in the National energy policy. Also this document sets intermediate goals in order to ensure a regular evaluation of achieved progress. This strategy is implemented via the measures foreseen in the Action Plan for the Development of Renewable energy sources (Official Gazette, 2010, No 78-403).

Energy efficiency measures are provided in the second Energy Efficiency Action Plan, prepared in 2011. It is prepared in pursuance of provisions set in Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC (OJ L 114, 27.4.2006, p. 64) (hereinafter as Directive 2006/32/EC). It defines the results of achievement of national intermediate (2010) index on energy saving. National index on energy saving for period of 9 years (2008-2016) is estimated in accordance of provisions of Directive 2006/32/EC and is equal to 9 % of average (2001-2005) of the final energy consumption.

One of the key measures to improve energy efficiency is the Program for Modernization of Multi-apartment Buildings, approved in 2004, with latest amendments in 2013. In 2009 fundamental changes to the funding arrangements were introduced. Until 2020 modernization of at least 70 % of apartment buildings having received building permits before 1993 with saving 1 000 GWh of estimated heating energy in renovated buildings is intended. This program is funded from the State's aid, municipalities, the EU structural funds, inhabitants and other financial sources.

### ***Transport sector***

In 2011, compared with 1990, GHG emissions in transport sector have decreased by 40.7 %.

It is foreseen in the Law on Energy from Renewable Sources (Official Gazette, 2011, No 62-2936) 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. It is set that the Ministry of Energy foresees measures in order to achieve a task in the transport sector and the Government or an institution authorized by the Government shall approve it. Also the Government or an institution authorized by the Government shall determine the allowable or mandatory share of biofuel for transport blended in fuels for transport produced from mineral fuels for transport.

Also there are measures foreseen for transport sector 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 by the Government Resolution No XI-366. The following measures are applied for the reduction of GHG emissions: increased efficiency of energy consumption, improvement of communication infrastructure and increased use of alternative energy sources in the energy balance of transport sector. In December 2013 the National Communication Development Program for 2014-2022 was approved by the Government Resolution No 1253 (Official Gazette, 2013, No 136-6918).

### ***Industrial processes***

In 2011, compared with 1990, GHG emissions in industrial processes have decreased by 15 %.

The greater share of the total added value belongs to Lithuanian industry sector. The economy has increased by 60 % in 2000-2011, whereas gross value added of manufacturing has increased almost twice, i.e. annually on an average of 6.4 % in comparative prices. Manufacturing is identified as one of the sectors which is seemed as the most urgently recovered after the financial crisis. In 2012, compared with 2010, the production volume has increased by 35 % (compared with 2011 – 7.8 %). General parameters of processing industry are strongly influenced by the activity of the largest Lithuanian companies – Public Company „ORLEN Lietuva“, SC „Akmenės cementas“ and Achema group. The main sources of GHG in the industrial sector include nitric acid, ammonia, cement and lime production.

Key measures for reduction of GHG emissions in the industrial sector include: Integrated Pollution Prevention and Control (IPPC) and Pollution permits, the best available techniques, increased energy efficiency in technological processes, environmental management systems in industry, emission limitations of volatile organic compounds and limitations of emissions of fluorinated gases.

### ***Waste and waste water management***

In 2011, compared with 1990, GHG emissions in waste sector have decreased by 11.8 %.

In 2011 the amount of municipal waste reached 448 kg per capita and, in comparison with 2010, its amount increased by 67 kg per capita. According to the data provided by EUROSTAT for the year 2010, an average amount of municipal waste in the European Union made 502 kg per capita. In Lithuania the amount of municipal waste per capita is one of the lowest in the EU. The sorting of waste has improved, however, it remains unsatisfactory so far. [4]

According to the data of year 2012, 2 925.6 million m<sup>3</sup> of water was used in Lithuania for different needs, of this amount the groundwater made 132.3 million m<sup>3</sup> and surface water – 2 793.3 million m<sup>3</sup>. Compared to 2011, abstraction of surface water from the environment reduced by 3 % and the main reason for the reduction was the economic downfall of that time. As usual, the biggest share of the surface water used accounted for energy needs (97 %). Groundwater use for household/domestic and economic needs is reported to be 67 %. [23]

Treated household and production/technological wastewater discharged into the surface water bodies in 2012 amounted to 179.5 million m<sup>3</sup> which was 1.8 million m<sup>3</sup> less than an amount of the year 2011. Accordingly, the decrease in the amount of the lower treatment degree wastewater was witnessed – in 2012 it barely made 2.75 % while in 2002 it accounted for 78 % of the total amount of the wastewater intended for treatment. Discharge of untreated household and production/technological wastewater has decreased significantly (in 2012 it made 0.02 %). [4]

Lithuanian wastewater sewage sludge management infrastructure has been developed during the period of 2007-2013.

### ***Agriculture and forestry***

In 2011, compared with 1990, GHG emissions in agriculture have decreased by 51.6 %.

Overall the area of land under agricultural use covers more than a half of the total territory of the country, thus it is one of the most historically and economically important sector of the national economy. This sector has a great influence on the development of Lithuanian rural area where one third of Lithuanian residents live [24].

Year 2012 was successful to agricultural sector, as well as to the Lithuanian economy. The gross value added, produced by agriculture, forestry and fishery, to the Lithuanian national economy in 2012 was about 4 073 million LTL<sup>1</sup> and it was caused mostly by a significant increase in crop production.

Agriculture is one of the sectors that is mostly depended on weather and its changes. The temperature and precipitation amounts as well as their regimes are of particular importance to crops of agricultural cultures. In general climate conditions in Lithuania are favorable for agriculture sector development, however, droughts or increased precipitation and other extreme events, as a consequence of climate change, might cause shrinking of harvest. An increase of crop production in recent years has been rapid not only due to climate conditions, but mainly due to economic reasons, such as financial support from structural funds. A growth of agricultural production is also related to food industry which has only a growing tendency during the last decade (at current prices<sup>2</sup>).

On 1 January of 2012, according to state forest stock inventory, forest land area covers 33.3 % of the country's territory in Lithuania. The National Forestry Sector Development Programme for 2012–2020 was approved by the Government Resolution No 569 on 23 May 2012 (Official Gazette, 2012, No 61-3058). Thereby the Programme sought to increase forest coverage of the country up to 34.2 % by the year 2020 by afforesting vacant lands and lands that are not suitable to be used for agricultural activities.

## **1.3 Climate change management policy**

On 7 July 2009 the Seimas of the Republic of Lithuania adopted a Law on Financial Instruments for Climate Change Management (Official Gazette, 2009, No 87-3662, with later amendments). This Law shall stipulate the rights, duties and liabilities of the persons engaged in the economic activities resulting in GHG emissions as well as the sphere of competence of state institutions/authorities and bodies.

On 16 September 2009 the Government of the Republic of Lithuania by its Resolution No 1247 approved the updated National Strategy for Sustainable Development (Official Gazette, 2003, No 89-4029; 2009, No 121-5215; 2011, No 41-1949). In order to reach the objectives set forth in the strategy, implementation plan is prepared. Environment protection and climate change topics are under consideration in the Strategy.

On 15 May 2012 the Parliament of the Republic of Lithuania with its Resolution No XI-2015 adopted Lithuania's Progress Strategy "Lithuania 2030" (Official Gazette, 2012, No 61-3050). This Strategy underlines the need for incentives for business to invest in green technologies, products and services. The main challenges and tasks in the coming period 2014-2020 may appear the increase of energy efficiency and use of RES in final energy consumption by creating and introducing low carbon technologies in industry, agriculture, and transport sectors. Stronger cross-sectorial cooperation between research and industry is needed as well as international cooperation on joint climate change adaptation and risk prevention and management. The National Progress Programme for 2014-2020 was approved by the Government Resolution No 1482 of 28 November 2012 for the implementation of the Strategy (Official Gazette, 2012, No 144-7430)

The main national strategy for climate change management, elaborated and approved in November 2012, is the Strategy for the National Climate Change Management Policy until 2050, which covers adaptation and mitigation policies, targets and objectives in the following Lithuania's economy sectors: energy, industry, transport, agriculture, households, environmental protection and rational use of national resources, spatial planning, health care, science, education and provision of information to the public, international co-operation.

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<sup>1</sup> M2010254 of [20]

<sup>2</sup> M2010254 of [20]

It also defines policies and measures necessary for Lithuania to meet its Kyoto second commitment period target. 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 was approved by the Government Resolution No 366. It contains provisions related to moving to a competitive low carbon economy and foresees measures for climate change adaptation and mitigation in Lithuania.

In order to ensure a consistent, transparent and complete reporting of GHG emissions, structural changes in the national system for GHG Inventory preparation was initiated. The Lithuanian Environmental Protection Agency (EPA) under the Ministry of Environment was nominated as an entity responsible for GHG inventory preparation by the Order of the Minister of Environment No D1-1017. Climate Change Division for preparation of GHG inventory, consisting of 5 officials, was established in the EPA.

In 2011 permanent GHG inventory preparation experts working group was established by the Government Resolution No 683 (Official Gazette, 2011, No 73-3508; 2012, No 39-1939).

In March 2012 the Climate Change and Hydrometeorology Division was restructured to the Climate Change Policy Division and the new Climate Finance and Project Management Division were established in the Pollution Prevention Department of the Ministry of Environment.

In January 2013 the composition of the National Committee on Climate Change was renewed.

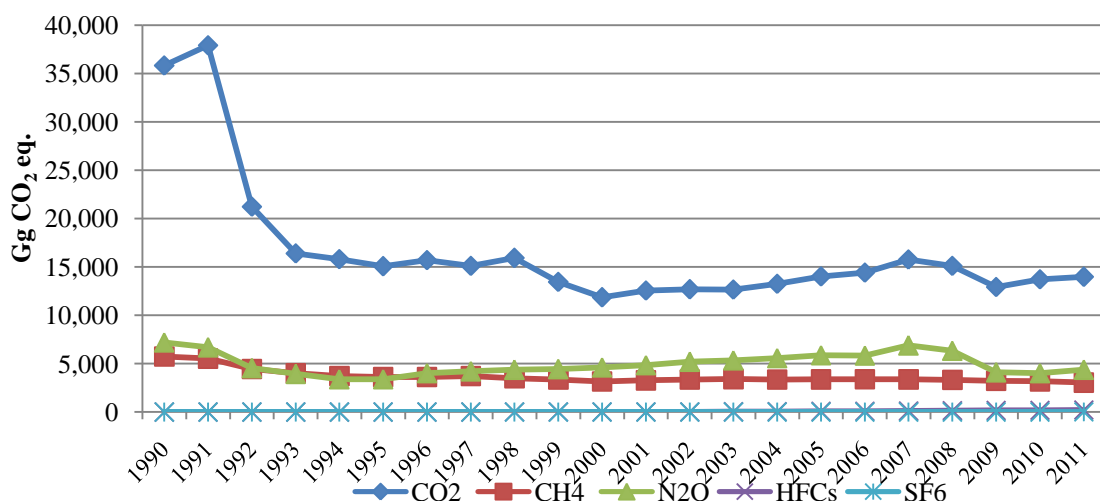
Since 2010 A Special Program for Climate Change has been developed as determined in the Law on Financial Instruments for Climate Change Management. The Program aims to develop an additional funding for climate change management measures. The Program funds are kept in a separate account of the State Treasury. Income and expenses of the Program are planned in the State budget according to the special principles of the funding program. The Program funds are used for increase of energy efficiency, use of RES, 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, reforestation and afforestation, awareness raising and other projects related to climate change. Projects implemented via this Program are presented in Chapter 4.2.1.3.

## **1.4 National Greenhouse gas Inventory**

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 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.

National Inventory Report (NIR) covering the inventory of GHG emissions of Lithuania is being submitted to the secretariat of the UNFCCC, in compliance with the decisions of the Conference of the Parties 3/CP.5 and 11/CP.4. GHG inventory is compiled in accordance with the methodology recommended by the Intergovernmental Panel on Climate Change (IPCC). The data used in Lithuania's 6<sup>th</sup> National Communication is in accordance with its NIR that was submitted in 2013 to the Secretariat of the UNFCCC. This submission covers the inventory of greenhouse gas emissions of Lithuania for the period 1990-2011.

GHG emission trends, excluding LULUCF, are presented in a graph below.



**Fig. 1** GHG emissions in 1990-2011, CO<sub>2</sub>eq, by gases [14]

More detailed description of the national GHG emissions, removals and trends is presented in Chapter 3.

### **Union GHG 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.

The national GHG registry is described more detailed in Chapter 3.

### **Joint Implementation projects**

In accordance with public information provided by Lithuanian Environmental Investment Fund, there were 25 JI projects registered in Lithuania, 5 of them are suspended. Most of the JI projects in Lithuania are related to the use of RES.

In 2008-2012 14 JI projects have generated emission reduction units which were officially verified and transferred to the national registry. In total 8 531 314 emission reduction units were generated during the period of 2008-2012; 888 297 of them originated from the projects related to the use of RES. More detailed information about JI projects is presented in Chapter 5.3.

## **1.5 Policy and measures**

Lithuania's Progress Strategy 2030 was approved by the Parliament of the Republic of Lithuania in 2012. It defines the State's vision and priorities for the economy development and implementation activities until 2030. The National Progress Programme for 2014-2020 was approved by the Government Resolution No 1482 of 28 November 2012 for the implementation of the Strategy and the main priorities for the use of the EU funds from the 2014-2020 Multiannual Financial Framework were determined. Aiming to implement the Europe 2020 Strategy (A strategy for smart, sustainable and inclusive growth) the National Reform Programme 2020 (Official Gazette, 2011, No 54– 2596) was approved. The Programme sets medium term targets of the state and is a summary of the main structural reforms that Lithuania projects in its effort to eliminate obstacles to



economic growth and achieve nationally transposed headline targets under the Europe 2020 Strategy. The measures foreseen for implementation of the National Reform Programme 2020 are set in the sectorial strategies.

On 6 November 2012 the Seimas (Parliament) of the Republic of Lithuania approved the Strategy for the National Climate Change Management Policy until 2050. This is the main strategic document which defines climate change management policy in Lithuania and 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 (see more under Chapter 4.1.2).

The main measures, foreseen in the different strategies, and having impact on climate change mitigation, are enhancement of the use of renewable energy sources, increase of energy efficiency, reduction of use of nitrates, minimization of quantities of the landfilled biodegradable and municipal waste, increasing area of forests and others. For implementation of those targets different fiscal incentives are set, such as the EU structural assistance for 2007-2013, the EU emissions trading system, Special Programme for Climate Change, the Programme of Modernization of Multi-apartment Buildings, feed-in tariffs, or voluntary initiatives, such as the Covenant of Mayors, Environmental management systems. Measures by sectors are presented in Chapter 4.2.

## 1.6 Projections of greenhouse gas emissions

In the figure below, historic emissions, projections of GHG emissions with existing measures (WEM), without measures (WOM) and with additional measures (WAM) are presented. More detailed projections of GHG emissions are presented in Chapter 5.

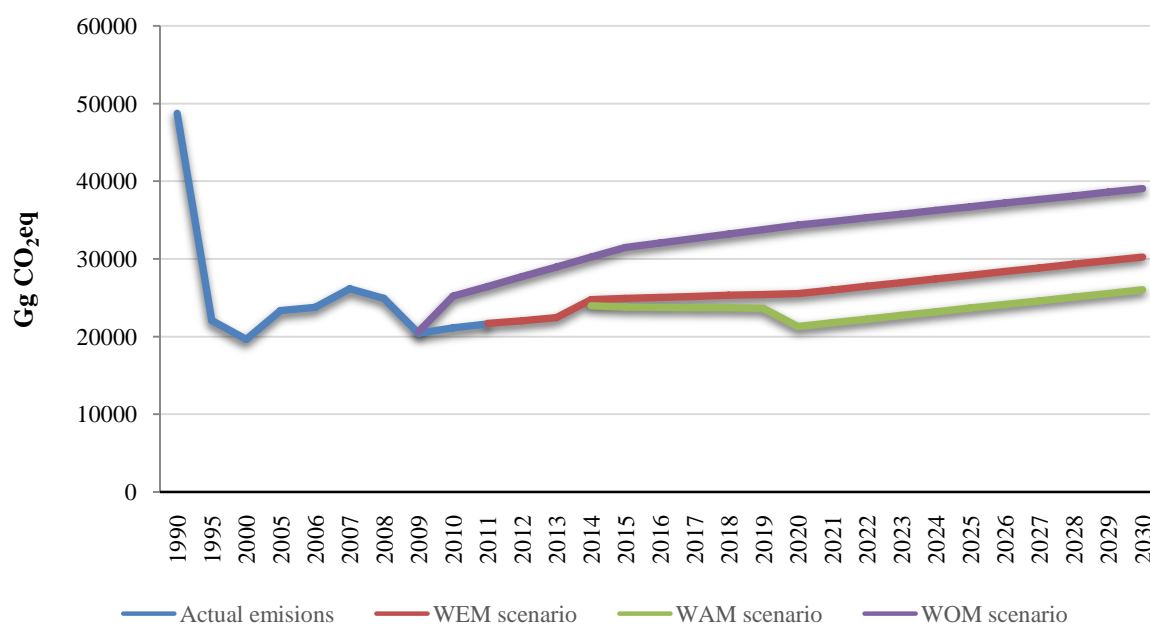


Fig. 2 GHG projections, Gg CO<sub>2</sub>eq

## 1.7 Climate change impacts and adaptation measures

The Baltic Sea Region is an environmentally specific region and Lithuania's beaches, protective sand-hill and coastal dunes as well as the lowest parts of Klaipėda and the port, ecosystems and the quality of the Curonian Lagoon and the Nemunas delta are identified as the areas that are the most vulnerable to the impacts of climate change.

The Coastal Zone Management Programme 2008-2013 was prepared and approved by the Order No D1-88 of the Minister of Environment of the Republic of Lithuania on 31 December 2008 (Official Gazette, 2008, No 17-612). This Programme has set recreational areas of Palanga, Klaipėda and Curonian Lagoon and foreshore

of Šventoji port – Latvia's border as priority sectors and foresees measures for coastal protection and management. This Programme is supported by the European Union funds and national funding.

In addition, a Special plan for management of continental part of coastal zone was approved on 28 July 2011 by the Order No D1-601 of the Minister of Environment of the Republic of Lithuania (Official Gazette, 2011, No 98-4628). This plan is relevant to continental part of coastal zone – 70 – 850 m wide continental coastal land from northern breakwater of the Klaipeda port to the state border with the Republic of Latvia and regulates the use and maintenance of continental part of coastal zone, tendencies for landscape formation, measures and informs the public about the state decisions on coastal zone protection, management and use.

In order to ensure relevant adaptation to climate change and to minimize the adverse impact on human health and the environment, respective measures, deadlines and responsibilities spread among particular institutions are set in the Strategy for the National Climate Change Management Policy until 2050 and 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 approved by Government Resolution No 366.

More detailed climate change impacts and adaptation measures are discussed in Chapter 6.

## **2 National Circumstances**

### **2.1 Government structure**

On 11 March 1990 the Republic of Lithuania restored its independence after long-lasting annexation of the country by the Soviet Union. Since then the creation of government and administration structure of the Republic of Lithuania has started. 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).

Seimas of the Republic of Lithuania is elected for four years term of office and consists of 141 members. Work of this institution includes: consideration and adoption of the Constitution amendments, passage of laws, adoption of resolutions on referendums, call to elections for the President of the Republic of Lithuania, establishment of the State institutions, appointment and dismissal of their managers, assenting to the candidature of the Prime Minister submitted by the President of the Republic Upon proposal/motion of the Government, the Seimas also establishes and abolishes ministries of the Republic of Lithuania and pursues other functions. The right of legislative initiative at the Seimas shall belong to the Members of the Seimas, the President of the Republic, and the Government. Citizens of the Republic of Lithuania shall also have the right of legislative initiative. 50 000 citizens of the Republic of Lithuania who have the electoral right may submit and consider a draft law to the Seimas. Laws shall be adopted at the Seimas according to the procedure established by law and it is provided the possibility to adopt the provisions of laws of the Republic of Lithuania by referendum. [1]

The XI Seimas elected on 16 November 2012 is working at present.

The Government of the Republic of Lithuania consists of the Prime Minister and Ministers, assented by the President of the Republic of Lithuania. The Government of the Republic of Lithuania administers the affairs of the country, executes laws and resolutions of the Seimas on the enforcement of laws, co-ordinates the activities of the ministries and other establishments of the Government, prepares draft State Budget and submits it to the Seimas; executes the State Budget and submits to the Seimas a report on the execution of the budget, prepares draft laws, establishes diplomatic relations and maintains relations with foreign states and international organizations, discharges other duties prescribed to the Government by the Constitution and other laws. [1]

There were 14 ministries in the Republic of Lithuania in 2012:

- Ministry of Agriculture,
- Ministry of Culture,
- Ministry of Economy,
- Ministry of Education and Science,
- Ministry of Energy,
- Ministry of Environment,
- Ministry of Finance,
- Ministry of Foreign Affairs,
- Ministry of Health,
- Ministry of Justice,
- Ministry of National Defense,
- Ministry of Social Security and Labour,
- Ministry of the Interior,
- Ministry of Transport and Communications. [2]

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, within its competence coordinating plans and legislation projects with the Ministry of Economy. The Ministry of Economy is responsible for preparation of the National Long-term Development Strategy, the National Progress Programme for 2014-2020, the National Reform Programme 2020 and the Lithuanian innovation strategy for the year 2010-2020 that set out the measures to accelerate economic growth, economic competitiveness, eco-innovation and employment, and promote investment in human capital.

It should be noted that on 1 January 2009 the Ministry of Energy was established. This ministry took over the functions of the Ministry of Economy in the field of energy – an area mostly affecting GHG emissions in the country.

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. The Law on Financial Instruments for Climate Change Management was adopted on 7 July 2009. Preparation of the law was determined by situation that public relations in the climate change management policy were regulated by the lower level legal acts. According to the Civil Code of the Republic of Lithuania essential conditions for economic activities, prohibitions and restrictions that have a substantial impact on economic activity should be established by law. [5] Therefore, the law seeks to regulate social relations of climate change management, defines powers of public authorities and institutions, and provides measures to manage climate change in Lithuania in order to implement obligations of the Republic of Lithuania under the UNFCCC and the Kyoto Protocol. This law has determined the provisions of Special Programme for Climate Change in order to develop and collect additional funding for climate change management measures. For more details on policies and measures see Chapter 4 and Chapter 4.2.1.3 for information on the Special Programme for Climate Change.

Following the provisions of the law, the Strategy for the National Climate Change Management Policy was adopted on 6 November 2012. The Strategy is composed of two parts: climate change mitigation and adaptation to climate change. With the Strategy, short-term (until 2020) targets, mid-term (until 2030 and 2040) and long-term (until 2050) milestones were incorporated in the national regulation. Sectors identified as particularly coherent to climate change mitigation are energy, industry, transport, agriculture, waste management and forestry. These sectors have the highest contribution to the GHG emissions into the atmosphere through their activities performed. Additionally to the mentioned sectors, the following sectors as related to adaptation to climate change are identified: water resources, landscape, ecosystems, biodiversity, air quality, public health. In addition, based on the results of the studies prepared in Lithuania, the Baltic Sea region is the most vulnerable to the climate change consequences and for this reason implementation of the adaptation measures in this region is of particular importance. The other sectors important to formation of the climate change management policy are education and public awareness, science, international cooperation, spatial planning and regional policy. The Strategy for the National Climate Change Management Policy envisages the assurance of the adaptation of national economy sectors to the environmental changes induced by climate change and climate change mitigation, development of competitive low carbon economy, promotion of eco-innovative technologies, increased use of RES and energy efficiency by 2050.

Following the adoption of the Strategy for the National Climate Change Management Policy, 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 was adopted on 23 April 2013. Action Plan covers climate change mitigation and adaptation measures for the year 2013-2016. In addition, the Action Plan justifies the Ministry of Environment as the main institution for the coordination of the implementing measures and indicates other institutions to contribute and support the implementation of the plan. According to the principles of financial planning on a state level, appropriation for implementation of anticipated measures will be allocated according to the inter-institutional plan which foresees the finances for four years (including running year) and is updated every year in order to reflect the relevant level of financing. For more details on policies and measures see Chapter 4.

The entire territory of the Republic of Lithuania is divided into counties (10) and municipalities (60) (see Fig. 3). Such administrative division of the territory is regulated by the Law on the Territorial Administrative Units of the Republic of Lithuania and their Boundaries (Official Gazette, 1994, No 60-1183; 1999, No 43-1362;

2005, No 88-3284; 2009; No 38-1445; 2010, No 41-1934). Municipality is defined as an administrative territorial unit in which the community has a right to self-government guaranteed by the Constitution, to be implemented within the national territory of the administrative unit residents elected municipal council and its conclusion, and it is accountable to the executive and other municipal authorities and bodies. Municipalities are governed by the Law on the Local Self-Government (Official Gazette, 1994, current version from 2 July 2013). The county is defined as the Republic of Lithuania higher territorial unit, but no longer administrative since the Law on the Vitiation of Law on the County Management and further amendments of the laws was adopted on 7 July 2009 (Official Gazette, 2009, No 87-3661). Part of the counties' functions is transferred to the municipalities. The State shall maintain those functions, which are necessary for implementation of the national policy in specific sectors and ensure supervision of the state.

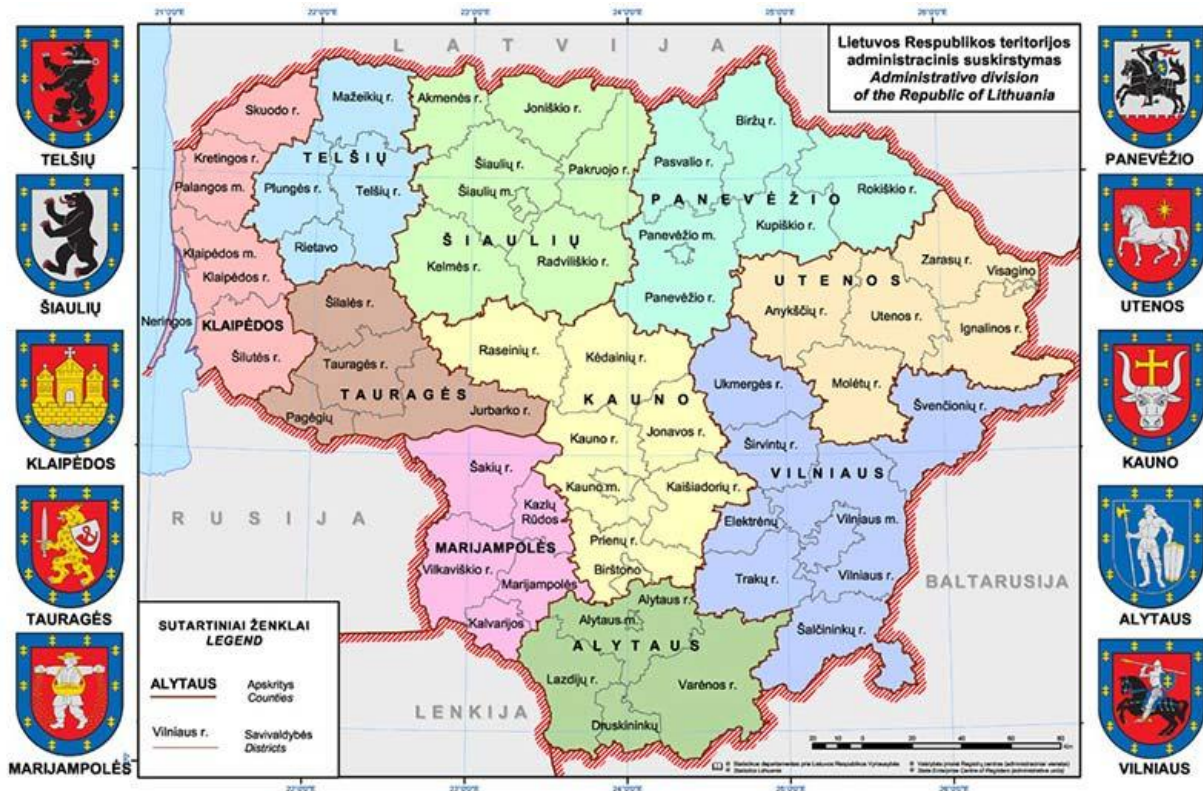


Fig. 3 Lithuanian territorial administrative division [3]

## 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.

In 2011 the Population and Housing Census in Lithuania following the EU legislation requirements, UNECE and Eurostat Recommendations for the 2010 Censuses of Population and Housing, was performed.

Based on the census results, there were 3 043.4 thousand people living in Lithuania in 2011. This statistics number of people differed from the current number at that time by 191.5 thousand people (totally by 5.9%). It was noticed that over the recent decade (2001-2011), the population decreased by 12.6 % (440.6 thousand). The largest decrease was due to migration (338.7 thousand or 77 %): 402.9 thousand persons left, 64.2 thousand – arrived in the country during that period. Due to natural decrease, the population dropped by 101.9 thousand (324.1 thousand persons were born, 426.0 thousand – died). Only during eight months period in 2012 the population decreased by 19.3 thousand, and there were 2.99 million people living in Lithuania in early September. As it was mentioned, the decrease in the population was mainly due to emigration; 15.1 thousand more people emigrated from Lithuania than arrived in the country in January-August in 2012 (Fig. 6). [35]

At the beginning of 2012, the estimated population of Lithuania totalled 3 003.6 thousand persons. Net international migration was the predominant cause and accounted for 85.1 % of the population decline. In the period of 1996-2012 Lithuania's population decreased by 643.3 thousand people or 17.8 %<sup>3</sup>.

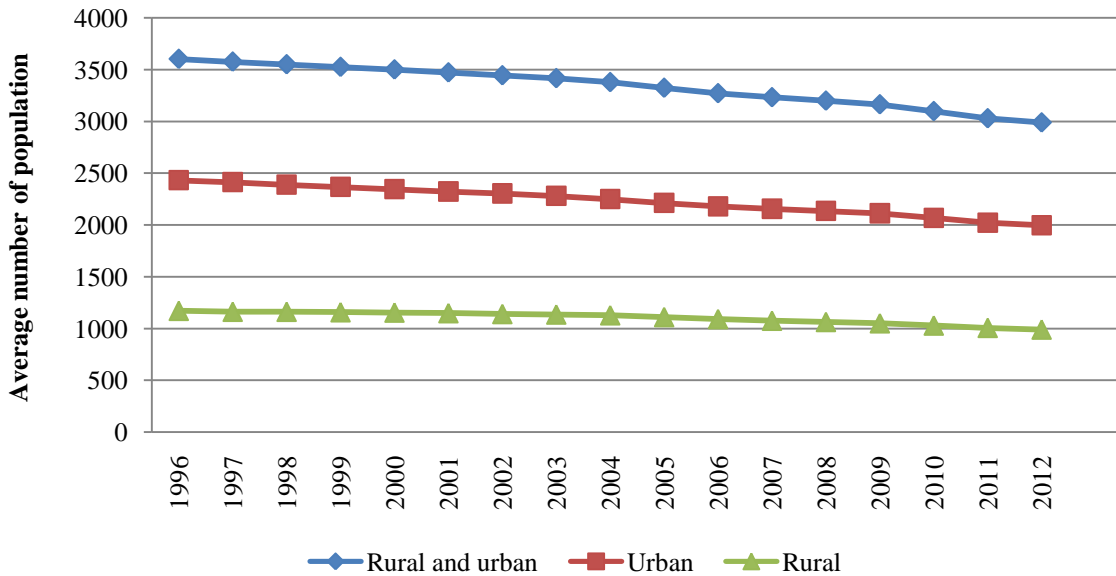


Fig. 4 Average annual number of population in Lithuania in a period from 1996 to 2012, thousand people<sup>4</sup>

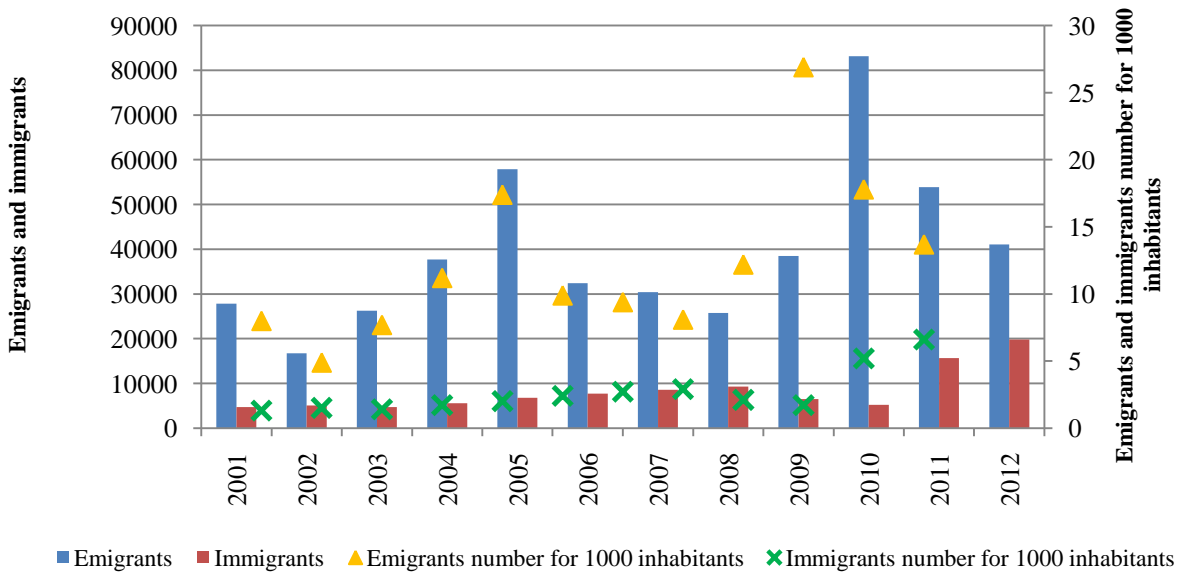


Fig. 5 International migration in Lithuania in 2001-2012<sup>5</sup>

At the beginning of 2012, 2 005.6 thousand (66.8 %) people were living in urban areas, 998 thousand (33.2 %) – in the rural. In the period of 1996-2012 rural and urban population ratio remained almost unchanged<sup>6</sup>. [9, 10]

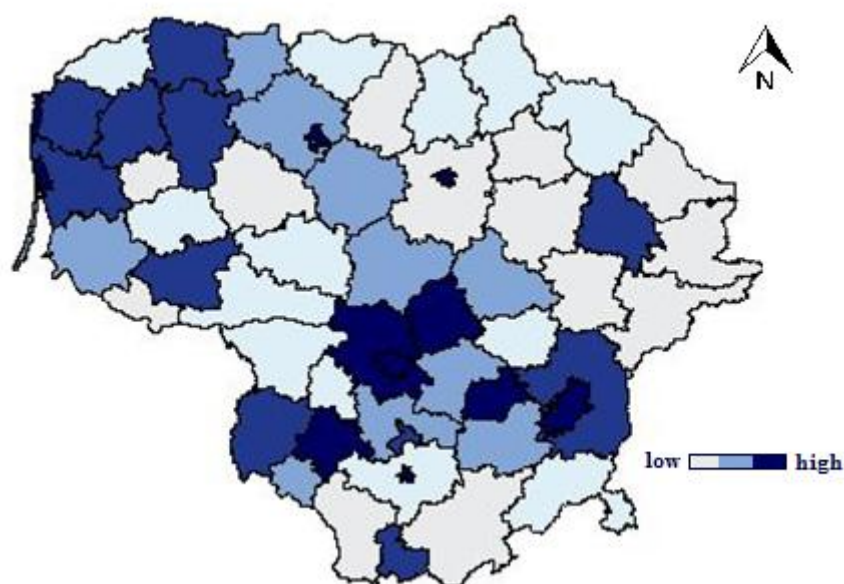
Population density tends to decrease. The national average of population density in 2012 was 46.0 inhabitants per square kilometer (46.1 inh./km<sup>2</sup>), in 1996 - 55.4 inh./km<sup>2</sup>. The most densely populated towns and districts are those of Kaunas, Panevėžys, Klaipėda, Alytus, Vilnius and Šiauliai<sup>7</sup>.

<sup>3</sup> M3010201 of [20]

<sup>4</sup> M3010214 of [20]

<sup>5</sup> M3020102 of [20]

<sup>6</sup> M3010201 of [20]



**Fig. 6** Map of population density in Lithuania in 2012, inh./km<sup>2</sup> [20]

In terms of gender distribution at the start of 2012 the number of population in Lithuania was as follows: 1 383.5 thousand (46.1 %) men and 1 620.1 thousand (53.9%) women<sup>8</sup>. During the period of 2000-2012 the ratio between men and women has changed: in the beginning of 2000 was 1 000 men vs. 1 136 women; in the beginning of 2008 – 1 000 vs. 1 148 and 1 000 vs. 1 171 in the beginning of 2012 [11].

Declining number of population changes the age structure of inhabitants. Low birth rate declines the number of children (0-15 years old). In the beginning of 2012 children composed 15 % of the country's population (2000 - 21.8 %). [9]

In 2012, 41.1 thousand residents emigrated from Lithuania, 19.84 thousand – immigrated. The number of emigrants from Lithuania exceeded that of immigrants by 21.26 thousand<sup>9</sup>.

### 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 km<sup>2</sup>.

The current coordinates of borders of Lithuania's territory are: North - 56°27' north latitude, South - 53°54' north latitude, West – 20°56' east longitude, East – 26°51' east longitude. From East to West the territory of Lithuania goes up to 373 km, from North to South – 276 km. The distance from Lithuanian geographical centre to the Earth equator equals to 6129 km and to the North Pole – 3 873 km. Our country has borders with five neighboring countries. In the North, Lithuania has 588 km long border with Latvia, in the East and South - 660 km long border with Belarus. The neighboring countries in the south-west are Poland (the length of border is 103 km) and Russian Federation (273 km). More than ¾ of the Lithuanian borders stretch along rivers and lakes. Lithuanian economic zone in the Baltic Sea (6 400 km<sup>3</sup>) meets the Swedish waters. The length of Lithuanian coast is 90.6 km.

Lithuania is the region of plains. The highest hill is 293.6 m above the sea level. According to the data reported by the Institute of Geology and Geography, the highest hill in Lithuania is Aukštojas (293.8 m), Kruopynė (293.7 m) and Juozapinė (292.7 m). Padvarionys, Nevaisiai, Barsukynė and other elevations are of similar height (from 292 to 228 m). [9]

<sup>7</sup> M3010211 of [20]

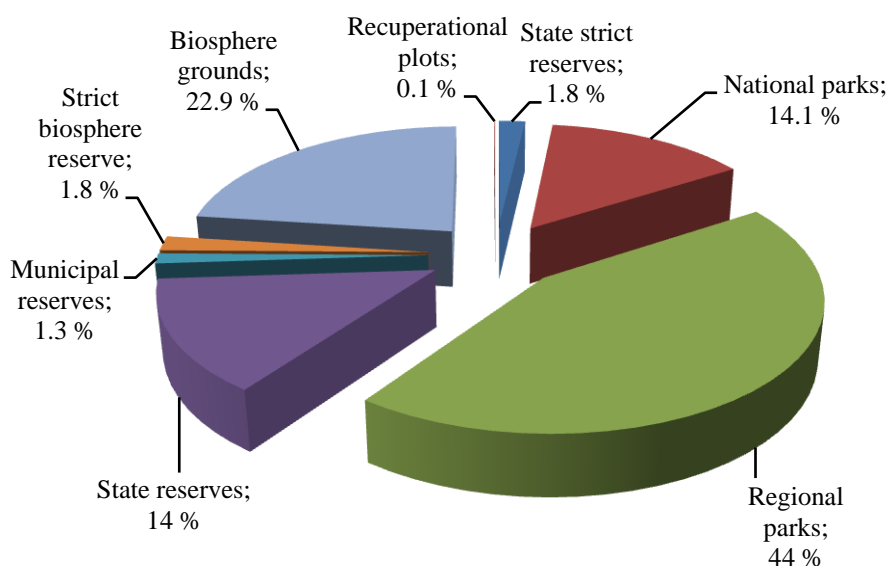
<sup>8</sup> M3010201 of [20]

<sup>9</sup> M3020102 of [20]

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).

According to the data Statistics Lithuania as of 1 January 2012 the Lithuanian land fund consisted of 6 530 thousand ha, more than half of the land reported suitable for agriculture, i.e. the land area used for agricultural production. Agricultural lands occupy 53.1 % (3 465.3 thousand ha) of the entire territory of the country. Forests occupy 32.6 % (2 126.2 thousand ha), roads – 2 % (131.8 thousand ha), built-up area – 2.8 % (181.5 thousand ha), water – 4 % (262.4 thousand ha), other land – 5.5 % (362.8 thousand ha). [13]

Protected areas in Lithuania cover 15.6 % of the country's territory (1 021.4 thousand ha). Protected areas consist of the following categories: the State reservation, reserves, natural heritage objects protected by the State, reconstructive parcels, national parks, biosphere reservations and polygons. [13]



**Fig. 7** Protected area distribution by type [13]

According to the State Forest records, the forested areas increased by 0.8 % from 2006 (as of 1 January 2012 the forest area amounted to 33.3 %). The major increase in the area of forest land is reported for wetlands and the land used for agriculture. Forested land (stands) area has been growing at a slower rate. During the same period (from 1 January 2006) it increased by 41.4 thousand ha. On 1 January 2012 the stands amounted to 2 055.4 thousand ha. [13]

Rivers in Lithuania occupies an area of 332 km<sup>2</sup>, 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), Mūša (133 km) and Merkys (190 km). Rivers flowing only in Lithuania are Nevėžis (209 km), Minija (202 km) and Šventoji (146 km). Lithuania has 2 830 lakes with an area more than 0.5 hectares. The total area of lakes amounts to 880 km<sup>2</sup>. The deepest lake Tauragnas is 62.5 meters deep. [9]

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 the beginning of 2012 the following valuable mineral resources were registered in Lithuania: oil (2.3 million tons), therapeutic peat (1.6 million m<sup>3</sup>), peat (218.1 million tons), limestone (391.2 million tons), dolomite (112.5 million cubic meters), opoca (33.7 million tons), sapropel (4.6 million m<sup>3</sup>), anhydrite (234.8 million tons), plaster (38.3 million tons), chalk marl (14.7 million tons), travertin (0.6 million cubic meters), clay (145 million cubic meters), sand and gravel (888.5 million cubic meters). In the beginning of 2012 the following resources were extracted: oil, therapeutic peat, peat, limestone, dolomite, clay, sand and gravel. Of particular importance is abundant building materials and their raw material resources. [13]



## 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.

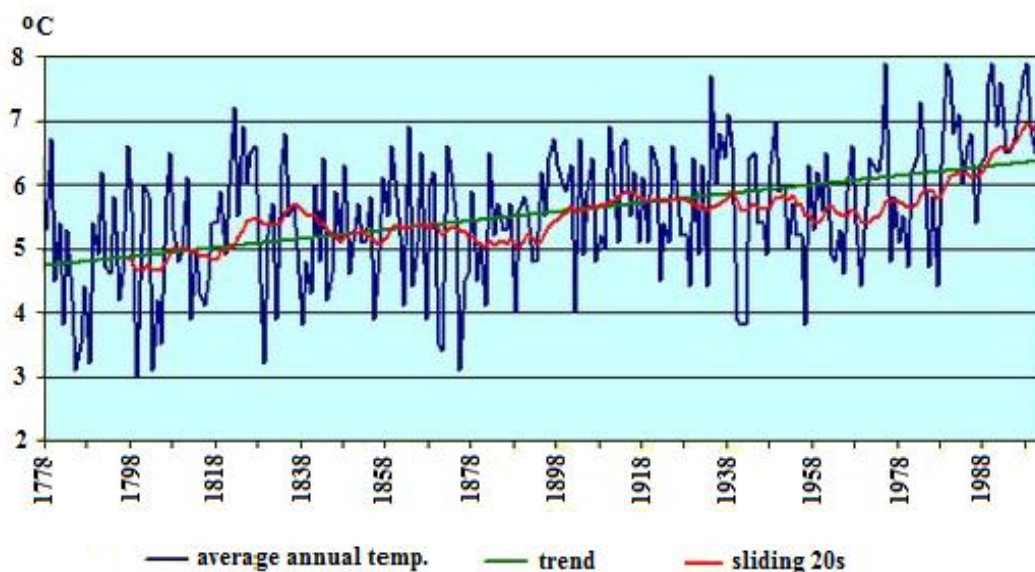
In accordance to Boris Pavlovich Alisov climate classification, the most of Lithuania territory is assigned to the south-western sub-region of the continental forest region of the middle latitudes of the Atlantic Ocean. Only the Baltic Sea coastal region is closer to the climate of Western Europe and the climate can be attributed to individual Southern Baltic climate region. [5]

### Temperature

The average annual temperature in Lithuania is 6.2°C. In 1991-2006 compared to 1961-1990 it increased by 0.7-0.9°C, and in 2008-2012 – about 1.04°C which shows climate warming. The most striking trends of warming are in the Northern and Western Lithuania. From 1961, the year 2008 was the warmest with the average annual air temperature in Lithuania of 8.3°C. In Fig. 8 absolute minimum and maximum values of air temperature and average annual air temperature are presented.



Fig. 8 The average annual air temperature, °C [25]



**Fig. 9** The average annual air temperature in Vilnius 1778-2012, °C [15]

The average annual air temperature in Vilnius in 1778-2012 is presented in Fig. 9.

The hottest month in Lithuania is July, the coldest is January. In the period from 1961 to 1990, the average temperature in July was about 16.7°C and in January – about -5.1°C. In the period from 2006 to 2011 the average temperature in July was about 18.7°C and in January – about -3.6°C. [13]

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. Their probability in 1991-2006 compared to 1961-1990 increased by 2-2.5 times and now amounts to 2-6 days a 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 1961-1990 an average of 12-15 days during winter in the East of Lithuania occurred, in the recent years they occurred for only 8-9 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. [5]

### **Precipitation**

The 1961-1990 climatic normal precipitated rainfall is 675 mm [9]. Year 2010 was particularly rainy – 849 mm which is 126 % of climatic normal. The most humid was warm period of the year. In 2011 summer rainfall significantly exceeded the average multi-annual rainfall: fell 347 mm – 155 % of climatic normal (climatic normal – 223 mm).

In Fig. 10 is presented the average annual rainfall in Vilnius, 1887-2012. 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. [15]

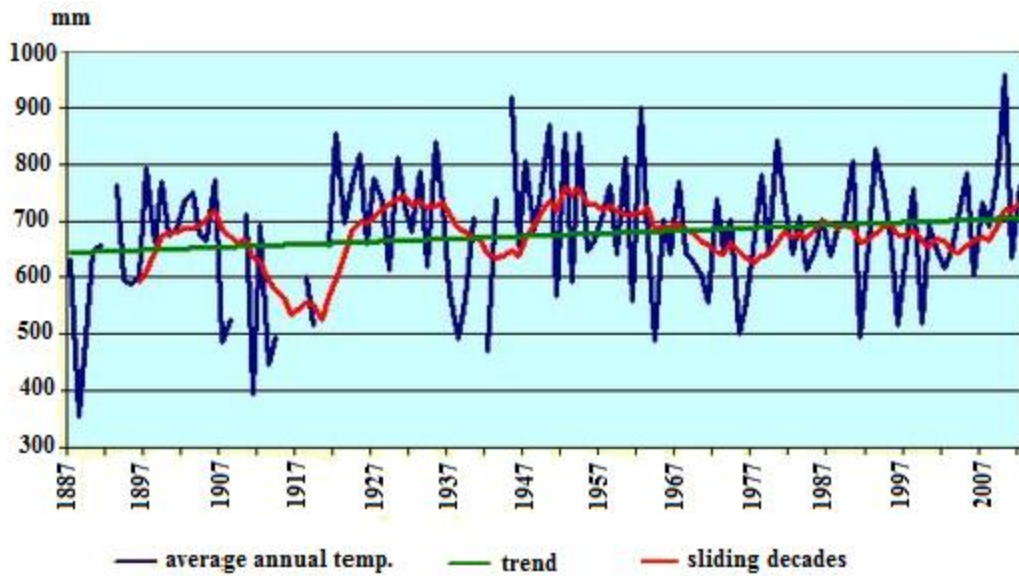


Fig. 10 The average annual rainfall in Vilnius, 1887-2012, mm [15]

### Solar radiation

The longest sunshine duration per year occurs in the Curonian Spit and at the seaside (about 1860 hrs.). Towards the east it decreases up to 1690 hours. The most sunny months are from May to August (an average of 230-270 hours), the least sunny – from November to January (an average of 30-45 hours).

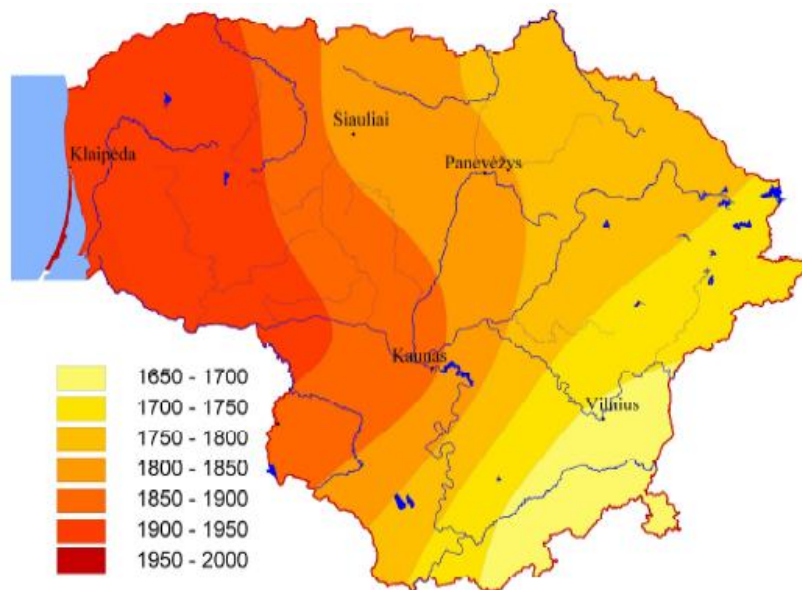


Fig. 11 Duration of sunny hours [25]

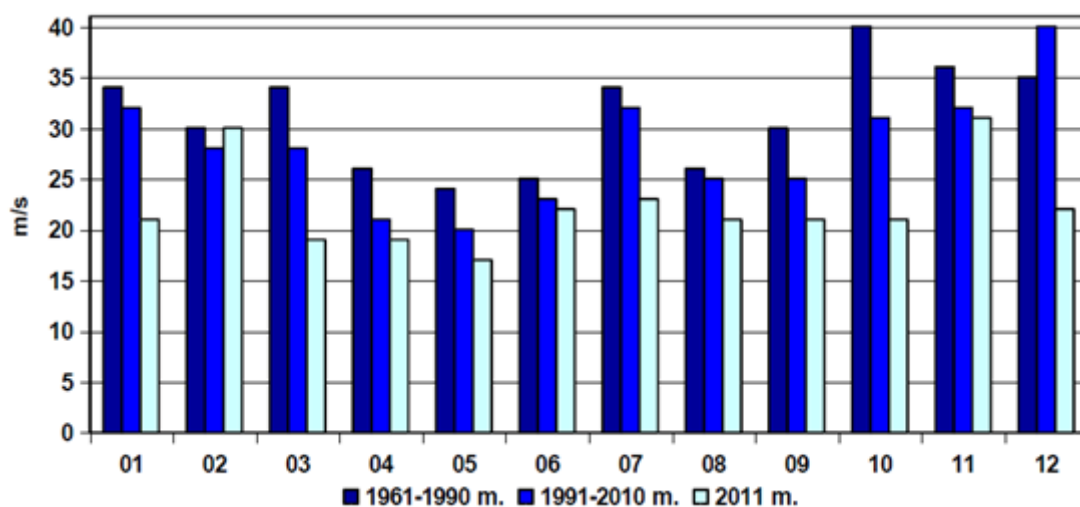
The number of sunny hours in 2011 increased by 12 % compared to 2010. This year duration of sunshine was 1 809.5 hours – 27.4 hours longer than climate normal, which is 1 782 hours. [13]

In Lithuania the average general solar radiation to the horizontal surface during the year is 3 600 MJ/m<sup>2</sup> (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<sup>2</sup>), while the lowest – to cloudy western part of the Žemaičiai highland (about 3 520 MJ/m<sup>2</sup>). [5]

General solar radiation in 2011 as in 2010 was close to permanent values.

## 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 Klaipeda in the late summer and autumn. [5]



**Fig. 12** The annual maximum wind gusts speed at the seaside in the period of 1961–1990, 1991–2010 and in 2011, 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 40 days per year at the seaside. Compared to the multi-annual data, the year 2010 was calm – 15 m/s and stronger wind blew 31 day at the seaside. In 2011 maximum wind speed at the seaside was lower in all months.

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 1971-2012 no significant changes have been identified in their long-term trends. However, it should be noted that during the period of 1999-2012 at the seaside five 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. [5, 15]

In autumn and winter the most often south, southwest and west winds are blowing; while in summer west and north-west winds dominate. [5]

## 2.5 Economic profile

The country's economy and macro-economic indicators increased steadily over the last decade. This growth has been caused by the anchored market economy in the country. Lithuania's accession to the European Union from 2004 also had influence.

During the period from 2000 the most rapid economy development was witnessed in 2003 (GDP growth, compared with the previous year, amounted to 10.28 %), after recovery from the Russian crisis (in 1999 GDP decreased by 1.02 %). In the later years, GDP growth was slightly slower, but exceeded 7 % annually. In 2007 the growth of GDP rocketed and reached 9.8 % 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 2.9 % and its decrease to negative factor in 2009 (-14.8 %). Due to a decrease in return on foreign investment in Lithuania, GNI in 2009 for the first time over the decade exceeded GDP. The annual estimates of macroeconomic indicators for 2010 show an economic revival: GDP grew by 1.6 % and the nominal value of GDP reached 95 675.98 million LTL<sup>10</sup>.

The provisional annual estimates of macroeconomic indicators for 2011 show an even faster growth in the Lithuanian economy than in 2010: GDP grew by 5.9 %, and the nominal value of GDP totaled 106 369.9

<sup>10</sup> M2010201 of [20]

million LTL. In 2012 the nominal value of GDP equaled 113 735 million LTL, the GDP growth rate stood at 3.66 %<sup>11</sup>.

In the table below GDP alteration is shown since 1990 to 2012.

**Table 1.** Gross domestic product (GDP) of Lithuania in 1990 - 2012

	GDP at current prices, mln. LTL <sup>12</sup>	GDP at current prices, mln. EUR	GDP at current prices, mln. USD	Index, comparing with previous period, %	GDP at market price, Chain linked volumes, reference year 2005, mln. LTL <sup>13</sup>
1990	134.1	..	..	..	..
1991	414.7	..	..	94.32	..
1992	3405.8	..	..	78.74	..
1993	11 589.6	..	2 834	83.77	..
1994	16 904.2	..	4 249	90.23	..
1995	26 924.46	5 206.114	6 731.114	..	39 662.78
1996	33 706.35	6 725.398	8 426.588	105.239	41 653.17
1997	40 514.87	8 949.211	10 128.72	108.14	45 070.43
1998	45 016.22	10 020.53	11 254.06	107.623	48 548.17
1999	43 885.44	10274.73	10 971.36	98.979	48 013.60
2000	46 002.52	12 436.48	11 500.63	103.621	49 737.61
2001	48 879.5	13 634.83	12 219.87	106.7	53 150.90
2002	52 351.05	15 128.17	14 251.78	106.838	56 771.73
2003	57 232.43	16 575.66	18 704.02	110.276	62 545.98
2004	62 997.37	18 245.3	22 654.41	107.369	66 987.30
2005	72 401.94	20 969.05	26 094.55	107.791	72 438.66
2006	83 227.15	24 104.25	30 250.12	107.809	78 145.63
2007	99 229.29	28 738.79	39 329.88	109.796	85 769.30
2008	111 920.1	32 414.31	47 486.17	102.912	88 016.33
2009	92 032.4	26 654.43	37 067.99	85.153	75 146.14
2010	95 675.98	27 709.68	36 703.87	101.597	76 293.07
2011	106 893.4	30 958.47	43 072.66	106.049	80 970.86
2012	113 734.7	32 939.85	42 332.49	103.659	83 783.25

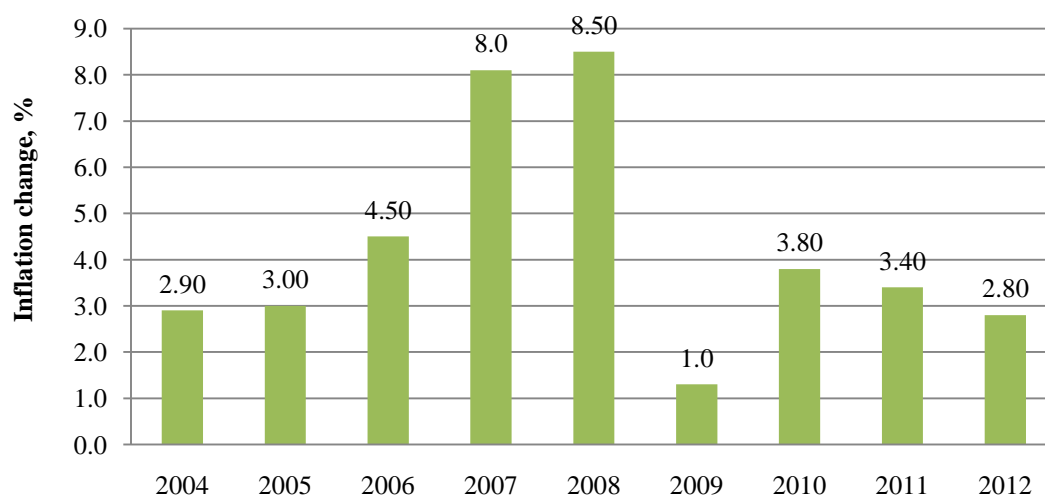
A large number of loans in 2006-2007 led to a leap in domestic consumption and activated development of economy sectors related to internal market, created good conditions for price growth and growth of companies' profitability. In 2009-2011 borrowed funds were also important for economic development, but the only difference – public sector (state) was the main borrower. It's debt in 2009-2011 increased by 23 % (from 15.5 % to 38.5 % GDP). At the same time private sector debt fell from above 64.6 % to 48.6 %. While the majority of public borrowed funds were directed not for economic stimulus, but it went for social payments, and most of them were spent in Lithuania. [6]

In the figure below the annual inflation in December compared with December of the previous year in % is presented.

<sup>11</sup> M2010201 of [20]

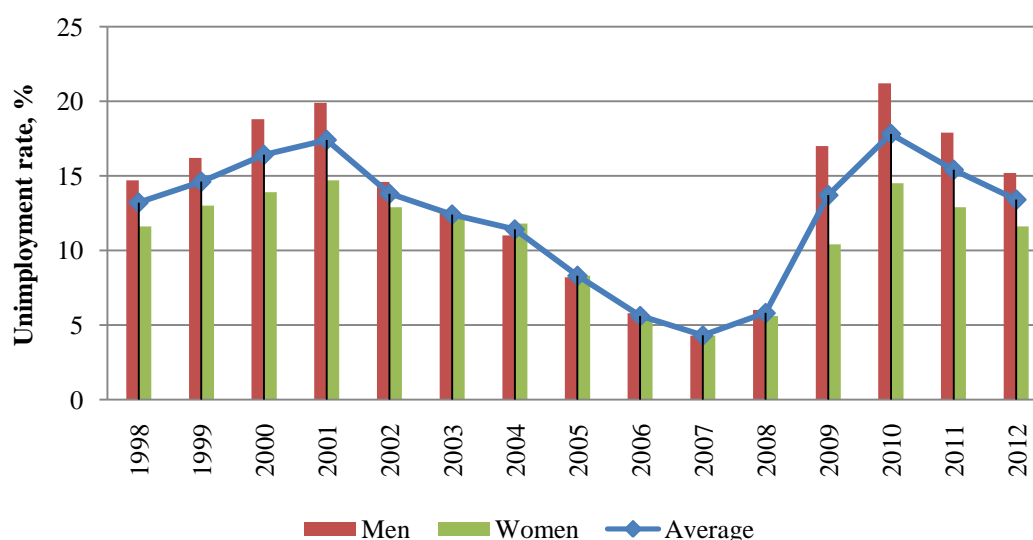
<sup>12</sup> M2010201 of [20]

<sup>13</sup> Source: European Commission (Eurostat) and European Central Bank calculations based on Eurostat data. Available <  
[http://sdw.ecb.europa.eu/quickview.do?jsessionid=1F694D639D8414201E590DBC50C507B5?node=bbn3110&SERIES\\_KEY=119.ES.A.Q.LT.Y.0000.B1QG00.1000.TTTT.L.N.A](http://sdw.ecb.europa.eu/quickview.do?jsessionid=1F694D639D8414201E590DBC50C507B5?node=bbn3110&SERIES_KEY=119.ES.A.Q.LT.Y.0000.B1QG00.1000.TTTT.L.N.A)>



**Fig. 13** Annual change in inflation, % [11]

From 2002 demand for labor force took a respective increase and the salaries increased, however, the inflation factors also increased (Fig. 14).



**Fig. 14** Unemployment level<sup>14</sup> [11]

The situation in the labour market worsened in the second quarter of 2008, when the first signs of the crisis have appeared. The unemployment rate in 2009 jumped to 13.7 %. The highest unemployment level was in 2010 – 17.8 %, which is by 4.1 % more than in 2009 [10]. In 2009 and 2010, an increase in the male unemployment rate was more rapid than that in the female one. This is related to suspension of construction sector. In 2012 the unemployment rate in the country stood at 13.4 %, which is by 2 % points less than in 2011. In 2012, the long-term unemployment rate stood at 6.6 % and was by 1.4 % points lower than in 2011. [12]

A noticeable value added growth in 2011, compared to 2010 was observed in construction (19.1 %), accommodation and food service (12.6 %), wholesale and retail trade (11.2 %), manufacturing (10.7 %), and mining and quarrying (10.1 %) activities. [12] Compared to 2010, a further decrease was observed in the value added generated by electricity, gas, steam and air conditioning supply (-13.7 %), information and communication (-3.0 %), real estate (-0.5 %) and education (-0.4 %) enterprises. [12]

<sup>14</sup> M303922 of [20]

In 2012 the largest growth in the value added was observed in agriculture, forestry and fishery (11.8 %), administrative and service (9.8 %), wholesale and retail trade (7.6 %), transportation and storage (6.7 %) activities [12].

Gross value added (GVA) by the type of economic activity and Gross domestic product are presented in the table 2. Industry contains mining and quarrying, manufacturing, electricity, gas and water supply.

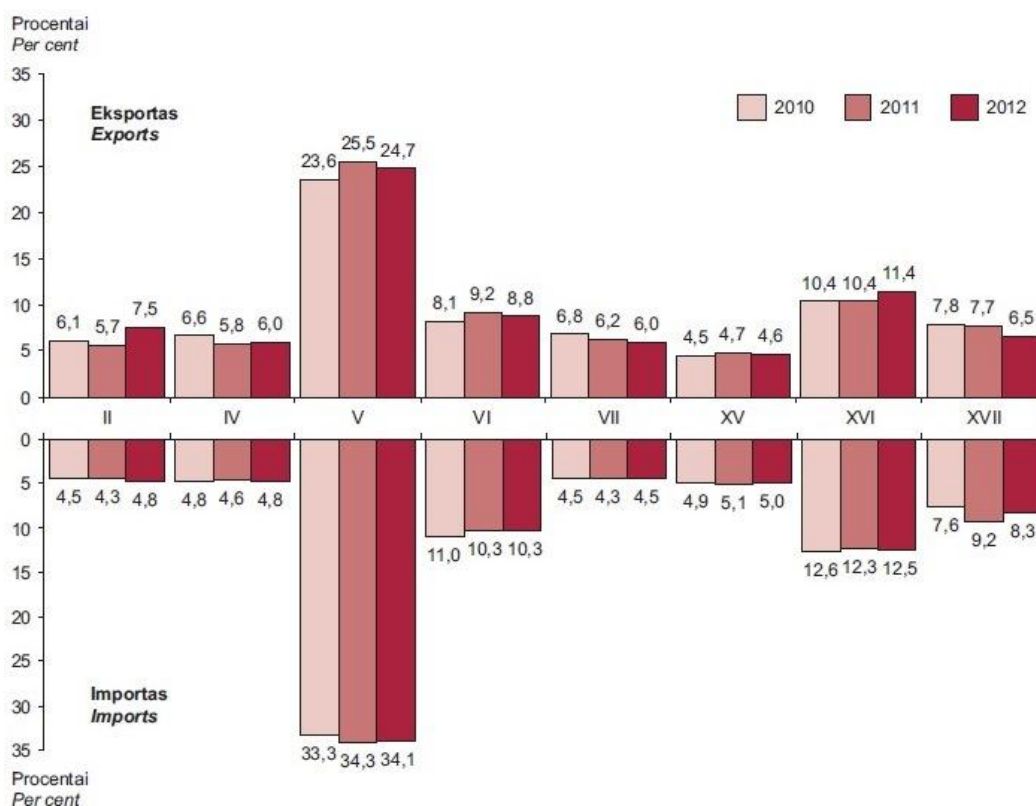
**Table 2.** GVA by the type of economic activity and GDP<sup>15</sup>

		2010	2011	2012
<b>Agriculture, hunting, forestry and fishery</b>	At current prices, mln. LTL	2 815.35	3 658.23	4 073.62
	Index, to compare with previous period, %	93.2	108.2	111.8
<b>Industry</b>	At current prices, mln. LTL	20 144.48	23 751.29	25 748.98
	Index, to compare with previous period, %	106.6	107.1	103.7
<b>Manufacturing</b>	At current prices, mln. LTL	16 215.59	19 686.78	21 384.00
	Index, to compare with previous period, %	108.9	110.1	105.1
<b>Construction</b>	At current prices, mln. LTL	5 047.02	6 244.32	6 131.44
	Index, to compare with previous period, %	93.8	119.1	94.6
<b>Wholesale and retail trade; transportation; accommodation and food service activities</b>	At current prices, mln. LTL	26 844.28	30 125.21	33 738.32
	Index, to compare with previous period, %	104.3	108.0	107.1
<b>Information and communication</b>	At current prices, mln. LTL	3 133.84	2 973.22	3 201.82
	Index, to compare with previous period, %	101.9	95.7	103.9
<b>Financial and insurance activities</b>	At current prices, mln. LTL	2 225.48	2 597.97	2 286.51
	Index, to compare with previous period, %	109.9	109.7	97.6
<b>Real estate activities</b>	At current prices, mln. LTL	5 649.30	5 724.59	5 864.00
	Index, to compare with previous period, %	98.8	101.4	101.6
<b>Professional, scientific and technical activities; administrative and support service activities</b>	At current prices, mln. LTL	4 991.02	5 402.31	5 690.58
	Index, to compare with previous period, %	97.5	103.6	102.2
<b>Public administration and defense; education; human health and social work activities</b>	At current prices, mln. LTL	13 439.18	13 849.06	14 091.21
	Index, to compare with previous period, %	97.6	100.2	100.6
<b>Arts, entertainment and recreation, repair of household goods and other services</b>	At current prices, mln. LTL	1 624.50	1 739.92	1 851.39
	Index, to compare with previous period, %	93.9	104.2	104.0
<b>Gross value added</b>	At current prices, mln. LTL	85 914.44	96 066.12	102 677.87
	Index, to compare with previous period, %	101.6	106.0	103.7
<b>Taxes on products</b>	At current prices, mln. LTL	11 054.85	12 163.11	12 472.55
	Index, to compare with previous period, %	101.6	106.0	103.7
<b>Subsidies on products (minus)</b>	At current prices, mln. LTL	1 293.31	1 335.83	1 415.71
	Index, to compare with previous period, %	101.6	106.0	103.7
<b>GDP gross domestic product</b>	At current prices, mln. LTL	95 675.98	106 893.41	113 734.70
	Index, to compare with previous period, %	101.6	106.0	103.7

<sup>15</sup> M2010252 of [20]

In 2010, compared to 2009, the export and import of goods and services increased by 32.7 and 34.5 %, respectively. [10] In 2011 the growth continued, export and import increased by 28.8 and 29.3 %, respectively. This was the second year of export growth after 2009's drop by 36 %.

In 2012 export and import grew not so intensively – increased by 14.4 and 9.0 %<sup>16</sup>.



By CN section	
II	Vegetable products
IV	Prepared Foods; beverages; spirits and vinegar; tobacco
V	Mineral products
VI	Chemical and allied industries products
XI	Textiles and textile articles
XV	Base metals and articles of base metal
XVI	Machinery and mechanical appliances; electrical appliances; television image and sound recorders and reproducers
XVII	The vehicles and their auxiliary equipment

**Fig. 15** Lithuanian exports and imports [12]

In 2012, the bulk of Lithuania's exports fell within mineral products (24.7 %), machinery and mechanical appliances, electrical equipment (11.4 %), products of the chemical or allied industries (8.8 %). The most significant proportion in imports fell within mineral products (34.1 %), machinery and mechanical appliances, electrical equipment (12.5 %), products of the chemical or allied industries (10.3 %). [12]

The most important export partners in 2012 were Russia (18.9 %), Latvia (10.9 %), Germany (7.8 %) and Estonia (7.7 %). The most important import partners were Russia (31.3 %), Germany (9.9 %), Poland (9.8 %) and Latvia (6.1 %). [12]

<sup>16</sup> M2010252 of [20]



## 2.6 Energy

General GHG emission trends in the energy sector depend on changes in energy market and are provided below.

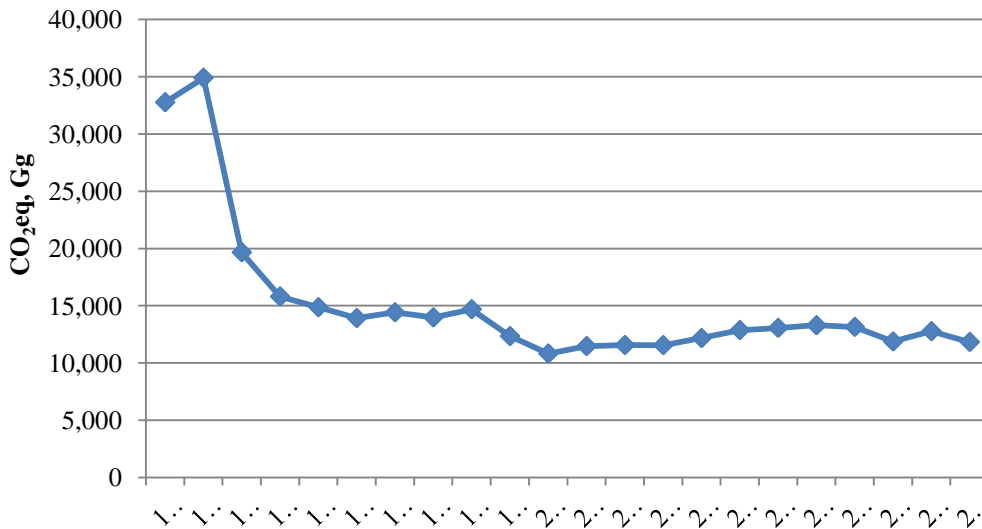


Fig. 16 GHG emission trends in the energy sector (including transport) [14]

### 2.6.1 Primary energy production and consumption

Local and imported primary energy resources are used to meet the overall needs of the country's fuel and energy consumption. Since limited energy resources are available in Lithuania, it is dependent on import of the said resources. Energy dependence of Lithuania on import has significantly increased since 2001. Nevertheless, energy dependence on import in the period of 2010–2012 fell down due to increased use of local and renewable energy resources. In implementing the policy of stimulation of renewable energy resources use, the consumption of the mentioned resources in the country tends to grow.

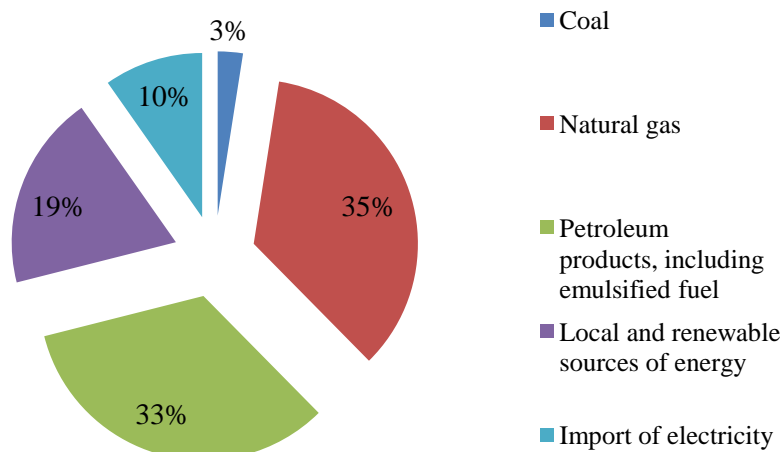


Fig. 17 Structure of Lithuanian primary energy in 2012 [20]

The country's primary energy balance consists of natural gas, oil and oil products, local and renewable energy sources and coal. A share of natural gas in 2012 composed 35.9 % of primary energy sources, in 2001 – 26.0 %. All natural gas consumed in the country is extracted in Russia and is transported to Lithuania by means of pipelines. In 2012 the imported and consumed amount of natural gas made 3.3 billion m<sup>3</sup>. Petroleum products,

including emulsified fuel in 2012 made 34.2 % of primary energy while in 2011 – 33.7 %. Domestic oil resources are not abundant, thus the indicators of oil and petroleum products sector are dependent on imports. Lithuania is the only country in the Baltic region with its oil refineries and possibility to import and export through the Baltic Sea terminal in Klaipeda. [20]

It was foreseen that due to closure of second unit of the Ignalina NPP starting 1 January 2010, nuclear energy in primary energy balance will be replaced by natural gas and local and RES, thus having an impact on national GHG emissions. It should be noted that GHG from sector 1.A.1.a. Public electricity and heat production in 2010 was 22 % higher compared to 2009 but in 2011 it was 6.2 % lower if compared to 2009. The reduction of GHG in the sector was caused by rise of fossil fuel prices and increased electricity imports.

After the closure of Ignalina NPP, Lithuanian Thermal Power Plant (Lithuanian TPP) is the major electricity generation source. 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 neighbouring countries (mostly from Russia).

**Table 3.** Primary energy production and consumption in thousands toe 2005 – 2012 [26]

	2005	2006	2007	2008	2009	2010	2011	2012
<b>Primary energy production</b>	3 879.8	3 443.9	3 758.7	3 811.1	4 346.3	1 522.6	1 537.5	1 558.5
Crude oil	220.2	184.4	157.5	130.6	117.5	117.3	116.9	104.6
Solid fuel	742.2	774.4	747.0	784.6	1017.9	1011.6	995.7	1 009.6
Nuclear, hydro, wind, geothermal and chemical processes energy	2 903.1	2 465.2	2 820.2	2 824.7	3 097.9	279.6	329.7	322.7
Nuclear energy	2 694.0	2 254.5	2 562.4	2 578.3	2 828.2	-	-	-
Hydro energy	38.8	34.2	36.2	34.6	36.5	46.4	41.3	36.3
Wind energy	0.2	1.2	9.1	11.3	13.5	19.3	40.9	46.5
Solar energy	-	-	-	-	-	-	-	0.2
Geothermal energy	2.9	1.7	1.5	0.6	5.1	4.5	3.2	3.8
Chemical processes energy	167.2	173.7	211.0	199.9	214.6	209.4	244.3	235.9
Liquid biofuel and biogas	14.3	19.9	34.0	71.2	113.0	114.1	95.2	121.6
<b>Final consumption</b>	4, 91.3	4 766.2	5 015.8	4 903.3	4 588.4	4 767.8	4 715.3	4 837.1
Industry	942.5	1 002.7	1 009.4	896.9	783.8	857.9	901.0	960.8
Construction	49.9	53.1	56.4	58.3	37.9	42.1	39.7	39.8
Transport	1 438.1	1 550.8	1 842.8	1 847.9	1 506.4	1 557.9	1 544.1	1 574.5
Agriculture	103.0	110.0	117.3	114.2	102.2	109.1	109.2	108.7
Fishery	2.3	4.4	3.1	2.9	2.4	1.9	2.0	2.1
Service sector	569.3	615.9	635.2	604.5	591.2	605.3	584.0	614.1
Households	1 386.2	1 429.3	1 351.6	1 378.6	1 564.5	1 593.6	1 535.3	1 537.1

## 2.6.2 Final energy production and consumption

Heat energy balance is presented below. The largest heat energy consumers are households and services sectors. About 50 % of heat consumed in households is supplied through district heating systems.

**Table 4.** Heat energy balance 2005 – 2012, GWh [20]

	2005	2006	2007	2008	2009	2010	2011	2012
<b>Total gross production</b>	<b>13 861.2</b>	<b>14 521.7</b>	<b>13 655.1</b>	<b>12 863.3</b>	<b>13 147.8</b>	<b>13 557.3</b>	<b>12 746.1</b>	<b>12 904.2</b>
Gross production in nuclear power plant	536.1	553.7	535.4	521.5	540.3	-	-	-
Gross production in public CHP plants	6 337.4	6 869.2	5 583	5 569.9	5 684	6 226.3	5 445.8	5 390
Gross production in autoproducer CHP plants	92.1	52.8	41.6	6.1	47.2	47.3	8.1	43.5
Gross production in public heat plants	4 301.9	4 515.5	4 612.1	4 030.3	3 896.7	4 374.5	4 036.6	4 280.3
Gross production in autoproducer heat plants	415.9	389.3	397.3	399.8	317.7	353.7	324	352.8
Gross production in geothermal plants	234.1	121.5	32.4	10.8	166.9	120.5	91.6	93.9
Gross production in other plants, which use energy from chemical processes	1 943.7	2 019.7	2 453.3	2 324.9	2 495	2 435	2 840.2	2 743.7
<b>Gross consumption</b>	<b>13 861.2</b>	<b>14 521.7</b>	<b>13 655.1</b>	<b>12 863.3</b>	<b>13 147.8</b>	<b>13 557.3</b>	<b>12 746.1</b>	<b>12 904.2</b>
Heat from chemical processes used for electricity production	532	540.1	719.5	733.8	859.3	770.3	794.6	703.9
Consumption in energy sector, total	729.9	1 020.7	397.8	416.8	386.5	351.3	231.5	91.3
Consumption in extraction of peat	0.5	0.8	0.8	0.8	1	1.1	1.1	1.2
Consumption in manufacture of refined petroleum products	375.9	650.8	-	-	-	-	0.3	0.5
Consumption in electricity, gas, steam and air conditioning supply	353.5	369.1	397	416	385.5	350.2	230.1	89.6
<b>Distribution and transmission losses</b>	<b>2 071.4</b>	<b>1 981.8</b>	<b>1 837.5</b>	<b>1 680.7</b>	<b>1 606.2</b>	<b>1 718.3</b>	<b>1 612.6</b>	<b>1 585</b>
<b>Final consumption</b>	<b>10 527.9</b>	<b>10 979.1</b>	<b>10 700.3</b>	<b>10 032</b>	<b>10 295.8</b>	<b>10 717.4</b>	<b>10 107.4</b>	<b>10 524</b>
Final consumption in industry	1 983	2 086.5	2 277.1	1 898.4	1 914.8	2 080.3	2 381.3	2 449.6
Final consumption in construction	22.7	24.9	32.7	32.2	23.4	22	19.1	20.5
Final consumption in agriculture	120.2	110.6	104.9	115	106.1	93.7	75.5	62.8
Final consumption in commercial and public services	2 219.9	2 376.4	2 452.8	2 080.8	2 236.1	2 388	1 984.3	2 321.2
Final consumption in households	6 182.1	6 380.7	5 832.8	5 905.6	6 015.4	6 133.4	5 647.2	5 669.9

In order to enhance energy production, distribution and consumption efficiency and promote use of RES, voluminous financing is allocated for district heating companies, municipal and public organizations. For the period of 2007-2013 an allocation of 399 million EUR (of which 359 million EUR form EU funds) was planned for the projects under the Environment and sustainable development program. As of October 2013 an allocation of 390 million EUR has been approved for the projects under the program and the rest 9 million EUR

should be allocated to projects by the end of 2013, when the evaluation of the applications submitted in August–October 2013 is finished. [21]

The electricity balance in 2005-2012 is presented below.

**Table 5.** Electricity balance 2005-2012, GWh [20]

	2005	2006	2007	2008	2009	2010	2011	2012
<b>Total gross production</b>	<b>14 784.3</b>	<b>12 481.9</b>	<b>14 007.6</b>	<b>13 911.7</b>	<b>15 357.6</b>	<b>5 748.6</b>	<b>4 821.6</b>	<b>5 042.4</b>
Gross production in nuclear power plant	10 337.6	8 651.2	9 832.9	9 893.7	10 852.6	-	-	-
Gross production in public CHP plants	3 251.7	2 649.7	2 496.2	2 449.2	2 586.9	3 677.9	2 690.9	2 776.9
Gross production in autoproducer CHP plants	173.3	168	383.3	211.6	350.6	301.7	343	559.7
Consumption in energy sector, total	2 599.6	2 522.6	2 652.3	2 889.3	3 080.2	2 413.7	2 106.2	1 854.5
Consumption in extraction of peat	5.5	6.2	6.6	5.2	4.8	5.7	5.7	5.6
Consumption in extraction of crude petroleum	18.8	24.6	21.9	18.1	16.1	18.1	18.4	21.1
Consumption in manufacture of refined petroleum products	664.5	609.8	507	695.3	657.6	625.5	629	588.9
Consumption in electricity, gas, steam and air conditioning supply	1 910.8	1 882	2 116.8	2 170.7	2 401.7	1 764.4	1 453.1	1 238.9
<b>Distribution and transmission losses</b>	<b>1 229.3</b>	<b>1 089.5</b>	<b>1 118.1</b>	<b>1 015.3</b>	<b>969.2</b>	<b>989.5</b>	<b>871.8</b>	<b>882.9</b>
Used for electric-powered steam boilers	11.8	10.1	6.5	6.3	5.3	3.7	3.2	2.9
<b>Final consumption, total</b>	<b>7 977.4</b>	<b>8 431.4</b>	<b>8 858.7</b>	<b>9 043.4</b>	<b>8 371</b>	<b>8 331.5</b>	<b>8 579.1</b>	<b>8 921</b>
Final consumption in industry	2 715.7	2 809.7	2 949.7	2 665.1	2 327.1	2 547.5	2 665.5	2 808.3
Final consumption in construction	117	123.4	130.9	129.6	103.2	106	101.5	85.2
Final consumption in transport	103.5	90.8	70	82.6	77	76	74.3	75
Final consumption in agriculture	188.7	192.6	201.8	192.4	178.9	171.2	163.9	178.9
Final consumption in fishing	3.9	4.8	4.8	4.2	4.5	1.8	3	2.9
Final consumption in commercial and public services	2 686	2 835.9	3 012.4	3 239.6	2 954.6	2 838.8	2 952.8	3 128.7
Final consumption in households	2 162.6	2 374.2	2 489.1	2 729.9	2 725.7	2 590.2	2 618.1	2 642

Since 2010 and onwards a potential deficit balance of power/capacity may be present in Lithuania during maximum loads/demands. To overcome deficits it is planned that the missing capacity would be purchased from the neighboring power/energy systems. The Lithuanian Power Plant undertook modernization: a 455 MW combined cycle gas turbine unit was constructed, which should replace an operation of 3<sup>rd</sup> and 4<sup>th</sup> units of the Lithuanian Power Plant.

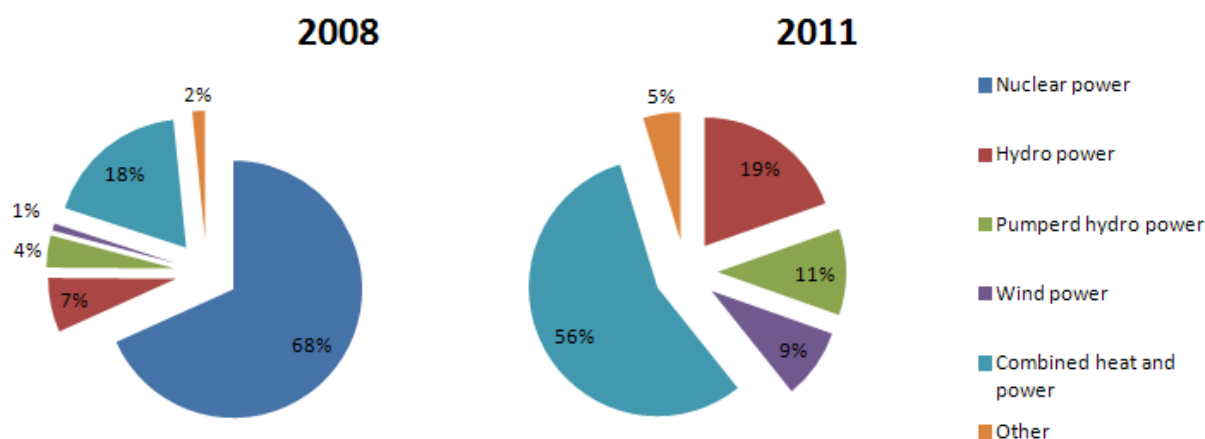


Fig. 18 Electricity production structure in 2008 and 2011 [22]<sup>17</sup>

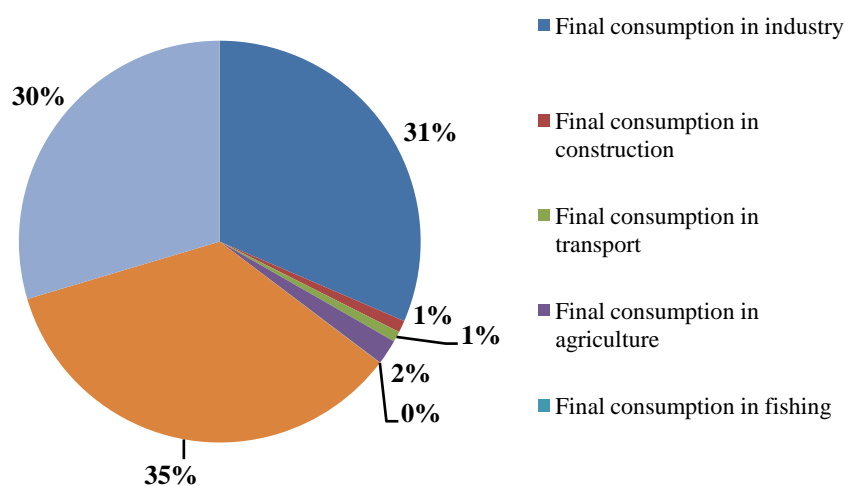


Fig. 19 Final electricity consumption by sector in 2012 [20]

Electricity market has commenced its operation in Lithuania in 2002. During the first years of electricity market existence, a free purchase of electricity was possible only for large industrial users/consumers. However, before the end of 2009, the supplier of cheap electricity, the Ignalina nuclear power plant, was predominant on the market while other plants had only a negligible market share, as their production costs used to be higher. The Ignalina nuclear power generation market share ranged from 70 % to 80 % [16].

Interest in the electricity market opportunities increased in 2009 in relation to the closure of the Ignalina nuclear power plant since 31 December 2009. From 2009 licenses of an independent supplier were issued to 51 companies and the entire number of registered independent electricity suppliers makes 71 entities [27].

In 2011 a reform of electricity sector was continued: from former electricity companies 4 new units were formed - transmission (Litgrid AB), production (Lietuvos energija AB), distribution (LESTO AB) and service [16]. In 2012 this reform was finished.

The first power transmission link between the Baltic and Nordic countries was opened in the end of 2006. Submarine cable "Estlink" is 350 MW power and +/- 150 kV direct current (DC) voltage. It links 330 kV converter substation "Harku" next to Tallinn, and the 440 kV converter substation "Espoo" in the vicinity of Helsinki. [16]

<sup>17</sup> Supply, transformation, consumption - electricity - annual data (nrg\_105a) of [39]

It is planned to connect the Lithuanian and Polish energy systems through 1000 MW DC line Alytus-Elk in order to integrate into the European electricity market. With the combination of the Lithuanian power grids with Poland, the grid would connect the electricity networks of the Baltic countries with the EU electricity networks, thereby expanding the small Baltic electricity market, creating new opportunities for competition in electricity generation in order the functioning of the market efficiency is ensured. Until 2012 special plan, environmental assessment was prepared, designing services of 330 kV overhead transmission line Alytus - Kruonis are being purchased.

Power connection with Sweden - NordBalt - is an opportunity to connect to the electricity system of Nordic countries, aiming at improved energy security in the region and reliability of electricity transmission. It is planned to build 300 kV of direct current cable from 330/110/10kV Klaipeda substation in Lithuania to 400 kV Nybro substation in Sweden. Length of link is 450 km. Until 2012, technical projects were being prepared and a special plan was approved.

On 30 April 2012 three transmission operators in Baltic countries have agreed on feasibility study "Integration of Baltic states into the EU internal energy market". In this study benefit of connecting the Baltic States electricity systems with continental European grids will be identified and technically and economically rational connection means will be presented.

Construction of the new NPP is planned in order to ensure the reliability of electricity supply. For more details about the planned nuclear plant see Chapter 4.2.2.1.

### 2.6.3 Renewable energy sources

A total of 1 156 GWh<sup>18</sup> of electricity was produced from renewable energy sources in Lithuania at the end of 2012. The bulk of green electricity in Lithuania comes from the Kaunas Hydroelectric Power Plant with an installed capacity of 100.8 MW. The main task of 900 MW Kruonis Pumped Storage Plant using the same Nemunas basin is to maintain system balance.

At the end of 2012, the installed capacity of wind turbines in Lithuania totalled 291 MW<sup>19</sup>. In late 2012, the total installed capacity of these renewable energy sources, along with solar, biomass and biogas power plants, made up 477 MW.

Under Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources, Lithuania must ensure that the share of energy from renewable sources in gross final consumption of energy in 2020 makes up at least 23%.

#### *Electricity production*

A share of electricity produced in 2011 using RES accounted for 9.5 % and in 2012 – almost 10 % (4.6 % in 2008). It is obvious that measures for the development of RES use have been effectual. Of these, in 2012, 36.4% RES electricity was produced by hydropower plants, 46.5 % by wind power and 10.55 % generated by bio-mass plants and the rest – in biogas and photovoltaic power plants.

In January 2013 one hydroelectric power station of 100.8 MW installed power, and 95 small hydroelectric power stations with the total installed capacity of 26 MW are in operation in Lithuania. Under the current arrangements governing the construction and operation of hydroelectric power, only small hydropower construction is possible in Lithuania. The current electricity generation of small hydropower plants in 2020 could double due to refurbishment of old equipment for small hydro-electric power and accomplishment of construction plans.

Wind power plants are among the most rapidly expanding technologies based on RES in Lithuania. Currently, the total installed capacity of wind power plants amounts for 278.57 MW.

Solar power plants was also rapidly expanding; however, small-scale installations were attractive to private investors due to legal basis in Lithuania: after National Control Commission for Prices and Energy has set high

<sup>18</sup> Reports on generation of electricity from renewable energy sources, 2012. <http://www.litgrid.eu/index.php/services/certification-of-origin/reports/583>

<sup>19</sup> Reports on generation of electricity from renewable energy sources, 2012. <http://www.litgrid.eu/index.php/services/certification-of-origin/reports/583>

tariffs for purchase of solar energy in 2011 and 2012, increase in small solar power plants (whose capacity does not exceed 30 kW) has been massive. However, since 2013 the tariffs have been lowered. Accordingly, an interest of private investors lowered too.

### *Heat production*

For heat production from RES in Lithuania biomass, geothermal and solar energy are used. Biomass makes a large proportion of the resources consumption. The main fuel for heat generated from biomass resources is wood and wood residues, agricultural products and biogas.

RES in district heating amounts to 27.2 % in Lithuania [28]. In order to reduce negative impact of natural gas to state heat economy, lower pollution and improve economic indicators, assuring energy independence, and to achieve 23 % of RES in total final energy consumption by 2020, Lithuania shall increase the use of biomass for energy production. It is estimated that RES use in district heating shall reach 60 % in order to stay on track of achievements of 2020 target.

## **2.7 Transport**

Transport is a very important part of the Lithuanian economic and social infrastructure that is seen as already recovered from the economic crisis. This sector is based on the export of transport services and such conditions allowed achieving an impressive growth already in 2010.

Last decade transport sector developed much faster than other sectors of national economy, the comparative weight in the structure of gross value added increased from 8.5 % in 2000 to 12 % in 2010. In 2011 freight volumes of all types of transport in ton kilometers have increased by 11 % and exceeded a level of 2007-2008. [6]

In 2011 companies that are working in transport had great results. Turnover from sold services increase by one-fifth to 16 billion LTL and reached a level of 2008. Even 36 % of newly created work places in 2011 were in transport sector (19 % in industry). Also transport sector was one of the sectors where salaries were growing the most rapidly.

In 2012 freight transportation decreased by 0.7 %, passenger transportation increased by 0.2 %, load in Klaipėda seaport decreased by 3.7 % and a number of incoming and outgoing passengers in airports increased by 17.6 %.

One of the main economic indicators in transport - a balance of transport services - was positive in 2012 and saldo amounted to 2.98 billion LTL (an export – 9.54 billion LTL and import – 6.48 billion LTL). 60.2 % of export of Lithuanian services comes for transport sector.

Transport and storage significantly contributes to the state gross value added and its part increased from 8.1 billion LTL in September 2011 (or 11.4 %) to 9.3 billion LTL (or 12.4 %) in September 2012 (+14.6 %). [7]

In 2012 49.4 million t of freight was transported by rail, i.e. 5.6 % less than in 2011. Freight turnover, in comparison with 2011, has decreased by 6.1 % and amounted to 14.2 billion tariff t km. In 2012 economic development of Lithuanian trade foreign partners has been slower than expected. It is also directly reflected by activity of transport sector. Railway freight volumes decreased in both domestic and international markets.

In 2012 international freight compounded 34.5 million t (or 69.8 %), domestic – 14.9 million t (or 30.2 %) in general freight structure. The largest freight flows are formed cooperating with Russia and Belorussia freights turnover constituted accordingly 45.9 % and 39.4 % of international freight. Freight on domestic routes is almost stable. Almost 95.7 % of domestic freight is structured from transport of oil, fertilizers, vegetative origin and mineral products.

Passenger transportation volumes by rail are increasing in the past years. 3.78 million passengers were transported on domestic routes and this number has increased by 0.9 %, in comparison with 2011. Purchase of new vehicles has a positive impact on passenger transportation. Accordingly, 1.02 million passengers were transported on international routes and this number increased by 12.5 %, in comparison with 2011. This number is significantly affected by implementation of tasks and measures increasing efficiency of passenger transportation activity and foreseen in strategic action plans of transport companies [7]

**Table 6.** The main indicators in transport sector [7]

	Units	2010	2011	2012	Compare to 2011, proc. (+,-)
<b>Freight</b>	Thousands t	100 539.7	106 574.1	105 861.7	-0.7%
<b>Railways</b>	Thousands t	48 060.7	52 329.8	49 377.2	-5.6%
<b>of them: transit flows</b>	Thousands t	26 398.5	28 762.3	26 165.4	-9.0
<b>through Klaipėda port</b>	Thousands t	12 155.7	15 669.5	14 058.5	-10.3
<b>Direction of Kaliningrad</b>	Thousands t	13 743.5	12 432.4	11 107.3	-10.7
<b>Roads</b>	Thousands t	44 716.3	46 019.1	48 427.3	5.2
<b>Inland water transport</b>	Thousands t	996.3	1 037.7	1 049.5	1.1
<b>Maritime transport</b>	Thousands t	6 763.5	7 184.0	7 006.3	-2.5
<b>Air transport</b>	Thousands t	2.9	3.48	1.10	-68.4
<b>Passenger transportation</b>	Thousands passengers	387 755.4	394 231.7	394 998.1	0.2
<b>Railways</b>	Thousands passengers	4 363.0	4 655.2	4 802.1	3.2
<b>Roads</b>	Thousands passengers	380 440.4	387 124.8	387 533.2	0.1
<b>of them: by bus</b>	Thousands passengers	268 686.8	274 822.3	275 130.7	0.1
<b>Inland water transport</b>	Thousands passengers	1 870.8	1 715.5	1 764.2	2.8
<b>Maritime transport</b>	Thousands passengers	253.0	291.6	322.6	10.6
<b>Air transport</b>	Thousands passengers	828.2	444.6	576.0	29.6
<b>Incoming and outgoing passengers number in airports</b>	Thousands passengers	2 283.6	2 692.9	3 166.6	17.6
<b>Cargo handling in and from sea-going ships in Klaipėda port and Butinge terminal</b>	Thousand t	40 295.2	45 526.6	43 761.9	-3.9
<b>of them: oil products</b>	Thousand t	17 784.5	18 071.1	16 778.6	-7.2
<b>other cargo</b>	Thousand t	22 510.7	27 455.5	26 983.3	-1.7
<b>Klaipėda seaport</b>	Thousand t	31 277.7	36 594.0	35 242.7	-3.7
<b>of them: road vehicle wagonloads</b>	units	223 910	256 036	261 605	2.2
<b>containers</b>	TEU	295 225	382 185	38 1278	-0.2
<b>Incoming and outgoing passengers number in port</b>	Thousands passengers	250.6	280.9	286.5	2.0

In 2012 maritime transport volumes has decreased by 2.5 %, in comparison with 2011. In 2012 there was 43.76 million t of sea freight in Klaipėda port and Būtingė terminal and this number is by 3.9 % higher than in 2011. The main freight in Klaipėda port is fertilizers (27.6 %), oil products (23.4 %), Ro-Ro freight (13.7 %) and freight in containers (12.4 %).

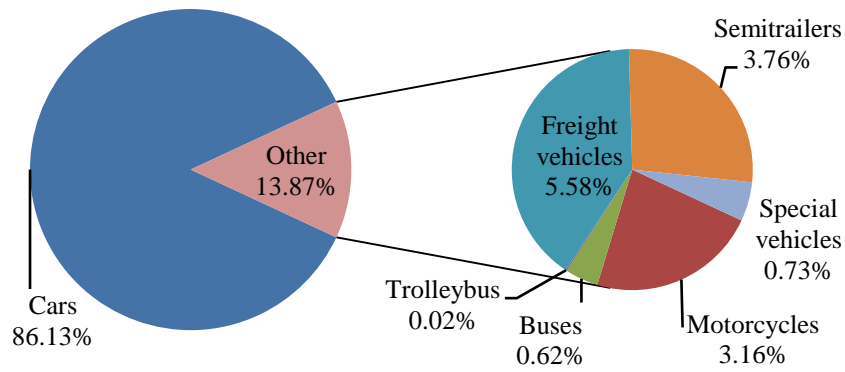
In comparison with 2011, the main decrease was in transport of fertilizers (16.2 %) and oil products (9.6 %). Decline in transport of fertilizers prevailed in the Baltic Sea region due to decrease of demand in foreign markets. In 2012 an average turnover of fertilizers loading was 811.8 thousand t, however rate remains stable and Klaipėda port remains one of the most important fertilizer exporters in the eastern coast of the Baltic Sea region. The main reason that caused a decrease of freight of oil products is major repairs of oil refinery plant.

In 2012, Lithuanian cargo constituted 58.6 % of all cargo in Klaipėda port. Lithuanian cargo amounted to 20.6 million t, i.e. 1.3 % more than in 2011. A share of transit constituted 41.4 % (14.6 million t) and, in comparison with 2011, decreased by 10 %. The largest part of transit freight is from Belorussia (10.76 million t or 30.5 %) and Russia (2.77 million t or 7.9 %). [7]

In 2012, a number of incoming and outgoing passengers in airports has increased by 17.6 %, in comparison with 2011. In the same year, Vilnius airport was the one of three national airports where a number of served passengers has increased the most rapidly: in 2012 services have been provided to 2.2 million passengers, it is 29.2 % more than in 2011. Additionally, freight and post volumes in airports have increased by 8.3% (14.3 thousands t).

According to the data of the Department of Statistics the largest part of road vehicles account for cars (86.1 %). Other vehicles are freight vehicles, special vehicles, semitrailers, motorcycles, buses and trolleybuses (13.9 %).

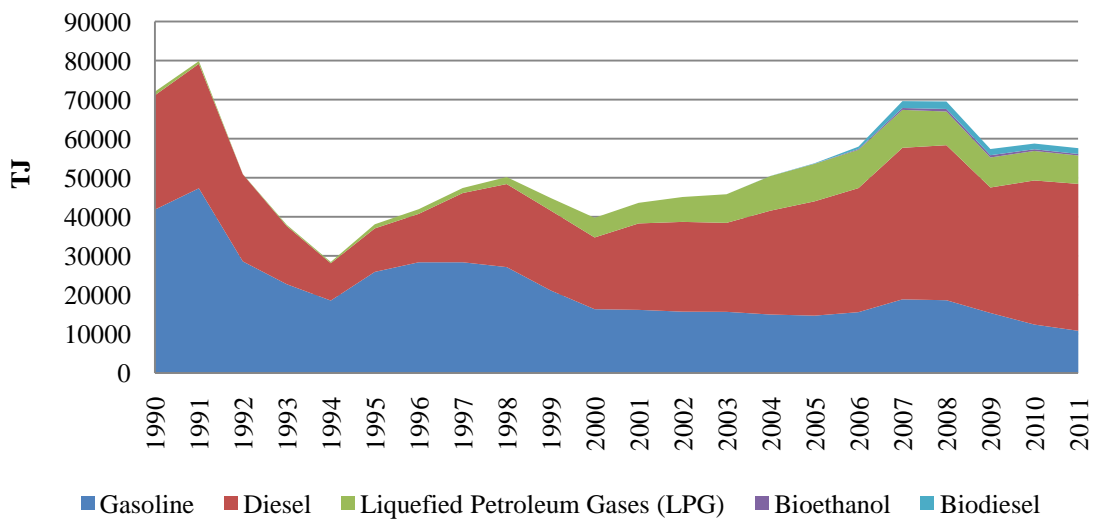




**Fig. 20** Road vehicles<sup>20</sup>

Road transport is one of the main branches of transport sector. More than a half of added value is created by road transport, 45 % of turnover is generated. [6] In 2012 freight transported by road transport has increased by 5.2 %, in comparison with 2011, and constituted 48.4 million t. Passenger transportation almost remained stable, only 0.1 % increase was registered. [7]

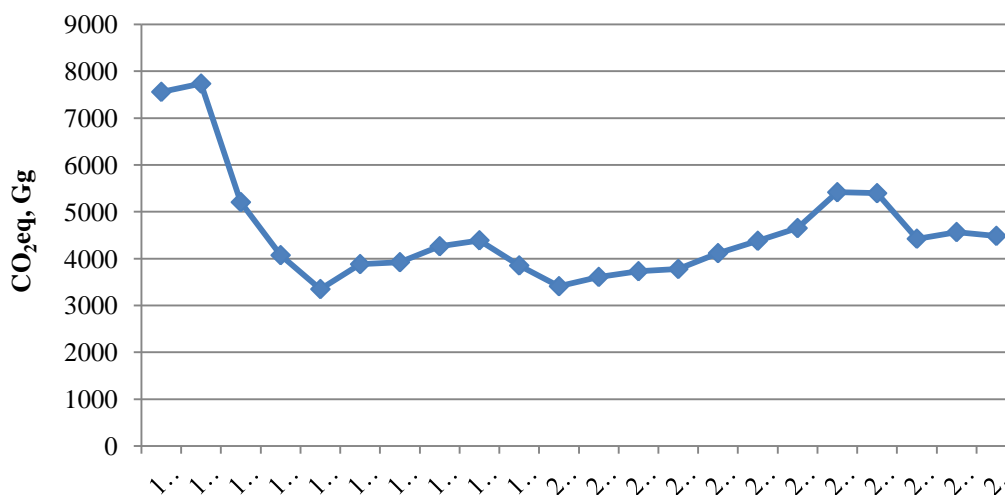
Transport sector is among the main polluters; therefore a lot of attention is paid for implementation of respective measures to reduce pollution from mobile pollution sources. These measures are described in Chapter 4.



**Fig. 21** Consumption of fuel by type in transport sector, TJ [14]

65 % of fuel used in transport sector is diesel oil. Lower consumption of petrol and LPG is reported, accordingly 19 % and 13 %.

<sup>20</sup> Table M7030303 of [20]



**Fig. 22** GHG emission trend in the transport sector [14]

## 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 4 activities: extracting industry (mining and quarrying), manufacturing and supply of electricity, gas and steam and supply of water, sewerage, waste management and remediation activities that together made 24.9 % of the value added in Lithuania in 2012 (accordingly, 0.8 %, 86.9 % and 12.4 % of industry gross value added). [8]

Economic growth in Lithuania as in the EU remarkably slowed down in 2008 and declined in 2009 due to the global financial and economic crisis. Since 2010, the growth rate has slowly increased and the GDP is recovering.

In 2011, compared to 2005, the value of the industrial production manufactured in Lithuania grew by 12.5 %, compared to 2010 – by 7.4 %. This was conditioned by the growth in the manufacture of fabricated metal products, except machinery and equipment – compared to 2005 and 2010, it increased by 11.0 and 38.4 % respectively, manufacture of furniture – by 91.6 and 33.8 %, manufacture of base metals – by 182.2 and 28 %, manufacture of textiles – by 4.7 and 25 %, manufacture of machinery and equipment including other machinery that are not included elsewhere – by 125.8 and 23.4 %, other manufacturing – by 101.9 and 18.7 %, manufacture of electrical equipment – by 8 and 15.5 %, manufacture of rubber and plastic products – by 18.9 and 13.3 %, manufacture of paper and paper products – by 105.6 and 12.1, manufacture of food products – 19.1 and 6.9 %, manufacture of refined petroleum products – 1.4 and 5.4 %, manufacture of chemicals and chemical products – by 106.1 and 3.3 %. [11]

In 2011, changes occurred in the structure of the industrial production sold. The share of the manufacture of chemicals and chemical products in the total mining and quarrying and manufacturing production increased from 5.4 % in 2005 to 11.7 % in 2011, refined petroleum products – from 31.1 to 34.9 %, furniture – from 4.1 to 5.1 %, food products – from 15.1 to 15.6 %, manufacture of machinery and equipment including other machinery that are not included elsewhere – from 1.1 to 1.6 %, paper and paper products – from 1.0 to 1.5 % respectively. [9]

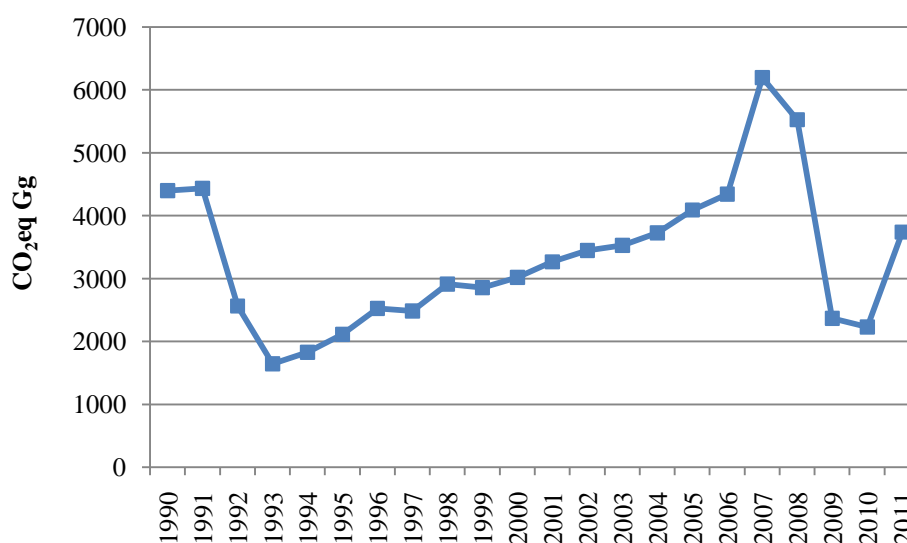
Wood industry and light industry, together with food industry are also considered as large contributors to the development of the manufacturing. Production volumes of wood industry have increased by 10 %, pulp and paper – by 12 %, furniture – by 34 %. It should be noted that structural dynamics of production is positive because the production of higher level of gross value added increases more rapidly. Even though food and drinks production was developing reasonably, gross value added in the period of 2000-2010 has increased by 28 % [6]. This sector is one of the largest branches in manufacturing as its comparative weight in the gross value added compounded 24 % in 2010 and remained stable in the last decade. In addition, textile production has experienced difficulties in 2000-2010 due to increased competitiveness of Asian producers, but in 2010

production volume has increased by 20 % due to increased level of investments. In 2011, compared with 2010, textile production increased by 25 %, garment sewing – by 20 %, tannery – by 14 %.

The major share of manufacturing companies' production is sold abroad. From 2005, the market structure of the industrial production sold has also changed significantly. The share of exports increased from 60.5 % in 2005 to 67.4 % in 2011. The major portion of sales and services on the non-Lithuanian market was made up of the sales of the enterprises engaged in the manufacture of refined petroleum products (39.6 %), chemicals and chemical products (14.2 %), food products (11.3 %), furniture (5 %), wood and wood products (except furniture) (3.9 %). [9] According to the Statistics Lithuania, in 2012 the companies that reported to have sold most of their products abroad were manufacturing chemistry and chemical products – 82.5 %, radio, television, communication equipment and apparatus – 81.9 % of the total production, production of vehicles – 85.2 %, textile – 79.5 %, refined petroleum products – 79.7 %. It should be noted that a share of refined oil products production has increased from 20 % in 2010 to 34.5 % in 2012 of the manufacturing and a share of export has also increased from 65.8 % in 2010 to 79.7 % in 2012.

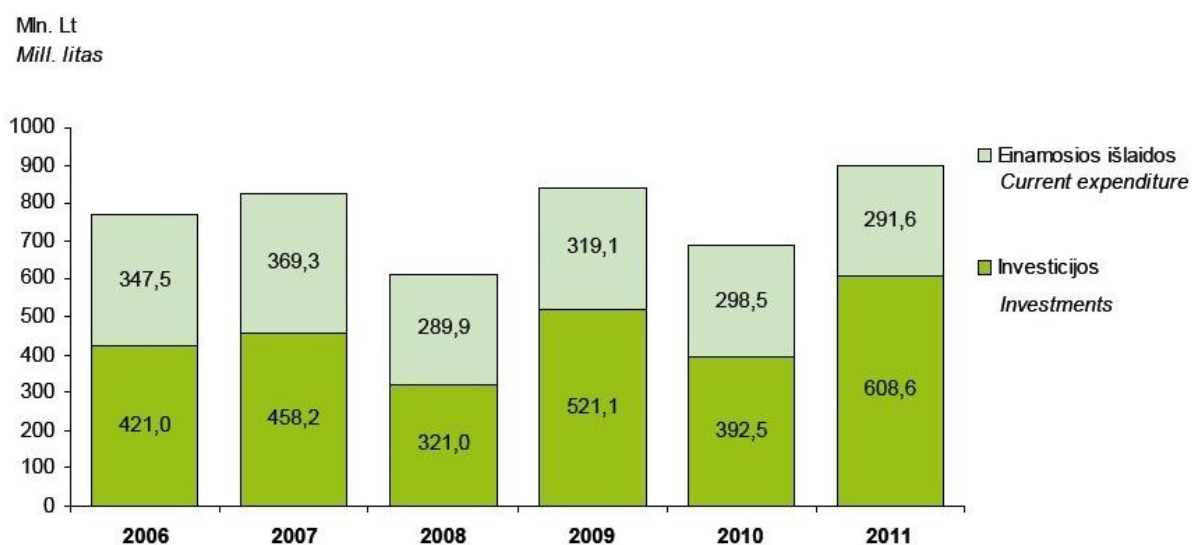
In 2012, compared with 2010, the volume of Lithuanian industrial production increased by 10.3 % and if compared to 2011 – by 3.7 %. It was caused by the growth of processing of refined oil products – 42.8 % and 6.5 %, respectively, pulp and paper production – 20.4 % and 1.1 %, machinery and equipment manufacture – 34.2 % and 7.7 %, other transport equipment – 1 % and 64.5 %, furniture and other production – 60.9 % and 18.7 %. According to the Statistics Lithuania, in 2012, compared with 2011, the production volume increased by 8.4 % in food and drinks production, 4.8 % in textile production, garment sewing and tannery, 6.5 % in chemical production, 9 % in rubber and plastics production.

The main sources of GHG emissions in the industrial sector (manufacturing processes) account for nitric acid, ammonia, cement, lime, mineral wool, bricks and tiles, and glass production.



**Fig. 23** GHG emission trends in industrial processes [14]

Introduction of environmental standards, programs and cleaner technology processes in companies in 2011 revealed an increase in the industries' expenditure for environmental protection if compared with 2006: from 768 million LTL in 2006 to 900 million LTL in 2011. [13]



**Fig. 24** Total environmental protection expenditure of industrial enterprises 2006-2011 [13]

In 2012 environmental protection expenditures of industrial enterprises decreased by 9.3 % and constituted 816.7 million LTL. [12]

## 2.9 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 nonhazardous 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.

In order to implement the requirements of the Council Directive on the landfill of waste, waste managements system was reorganized. 666 landfills and dumpsites not in line with environmental protection and public health safety requirements have been closed. In addition, closure of another 143 landfills and dumpsites is projected. Since July 2009, municipal waste is disposed in 11 regional non-hazardous waste landfills. [4]

The generation of waste used to be influenced by the economic situation of the recent years. However, waste generation took a lower phase than the growth rate of economy, i.e. the ratio between the amount of waste generated and GDP in 2011 reduced by 8 % in comparison with 2010. [4]

According to the national waste statistics, approximately 5.5 million tons of waste was generated in Lithuania in 2011. More than half (including phosphogypsum) of the waste generated in the country is still disposed of at landfills. In 2011 the major share of the managed waste, i.e. 62 % or around 3.3 million tons (2.1 million tons of phosphogypsum) went to disposal and 22 % or 1.2 million tons was recycled or otherwise recovered while 14 % or 0.8 million tons hauled to other countries and the remaining 2 % or 80.8 thousand tons was treated. In 2011 the disposal of waste at regional non-hazardous waste landfills amounted to 505 thousand tons (approx. 66 %) of municipal biodegradable waste, i.e. around 116 thousand tons less than in 2010. The national waste statistics reads, that amount of generated biodegradable waste in industries in 2011 is stated to be over 450 thousand tons, of which around 93.2 thousand tons accounting for agricultural and animal waste. It is further stated by the national waste statistics that 99 % of this waste was recycled or otherwise recovered. [4]

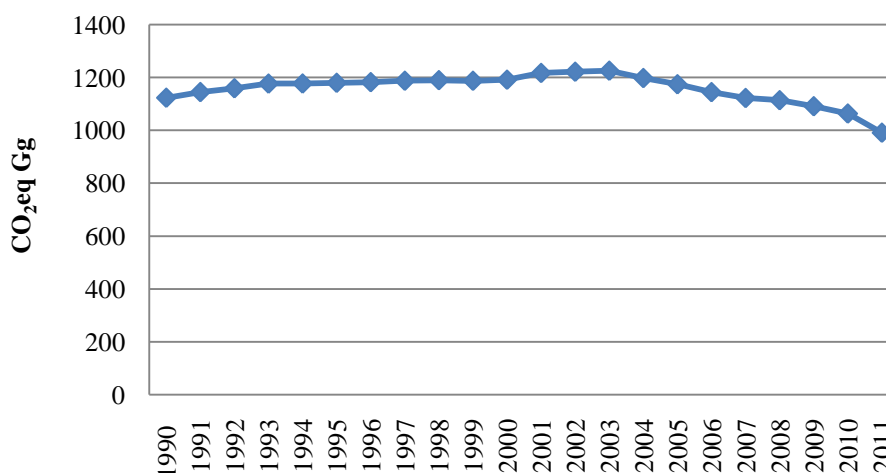
Municipal waste makes nearly 25 % of the entire amount of waste generated in Lithuania. Based on the data of the national waste statistics, in 2011 the collection of municipal waste in Lithuania amounted to around 1.37 million tons (packaging waste inclusive), or 448 kg/capita accordingly. According to EUROSTAT, in 2010 yearly average for the EU per capita was 502 kg of municipal waste. [4]

In 2009 over 90 % of the generated municipal waste was disposed while the year 2011 figures point to approximately 75 % or 337 kg/capita. The data of EUROSTAT indicate that the EU average of the landfilled municipal waste in 2010 made 186 kg/capita. [4]

The following hazardous waste incineration plants are in Lithuania: used tires (the plant capacity of 21 thousand t/year), hospital waste (the plant capacity of 2 thousand t/year, operated until 2011) and hazardous waste (the plant capacity of 8 thousand t/year, it has not entered into operation, the pilot burnings were carried out). The launch of operation of the first bio-mass and municipal waste fired CHP plant (private capital funded) is reported in Klaipeda in 2013. The designed demand of fuel by the plant is 245 thousand t/year, of which the permissible annual amount of waste for incineration is 180 thousand t. Construction of incinerator for mixed municipal waste, sorting residue and waste unfit for recycling but having heat value, including solid recovered fuel is intended for Kaunas and Vilnius regions with the total annual incineration of waste amounting to 360-530 thousand t. 2 925.6 million m<sup>3</sup> of water was used in Lithuania in 2012 for different needs: ground water – 132.3 million m<sup>3</sup>, surface water – 2 793.3 million m<sup>3</sup>. Compared to 2011, the abstraction of ground water and surface water from the environment reduced by 3 %. As usual, the biggest share of the surface water used accounted for energy needs (97 %). Groundwater used for household/domestic and economic needs is reported to be 67 %. [23] Annual fluctuation of the total amount of extracted water accounts for shifting scale of energy production. Wastewater in Lithuania is treated by three types of treatment – mechanical, biological and biological with additional nitrogen and phosphorus separation.

Treated household and production/technological wastewater discharged into the surface water bodies in 2012 amounted to 179.5 million m<sup>3</sup> which was 1.8 million m<sup>3</sup> less than in the year 2011. Major improvements in wastewater treatment quality took place over the entire decade and in 2012 the amount of wastewater treated according to requirement reached a very high level of 97.23 %, though in 2002 level was barely 21 %. Discharge of untreated wastewater reduced accordingly: in 2012 it made 2.75 % and in 2002 – 78 % of the total amount of wastewater to be treated. Discharge of untreated household and production/technological wastewater in 2012 made 0.02 %. [4] Over the decade the trends were determined by construction of the new wastewater treatment facilities and reconstruction of the existing ones. [4]

According to the national waste statistics, generation of municipal wastewater treatment sewage sludge for different years was the following: around 54.21 thousand tons in 2008, around 50.16 thousand tons in 2009, around 51.31 thousand tons in 2010 and around 51.83 thousand tons in 2011. Only 21.60 thousand tons of municipal wastewater treatment sewage sludge was treated in 2011 (of which approximately 0.47 thousand tons went to disposal, approximately 0.54 thousand tons was exported, nearly 10.19 thousand tons was recycled and 10.40 thousand tons recovered in some other way), thus the amount of the accumulated sewage sludge tended to increase and by the end of 2011 it was 172.69 thousand tons. 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. Construction of 21 sewage sludge treatment plants is ongoing along with the development of municipal wastewater sewage sludge treatment capacities making 115 527.47 t per annum, i.e. almost 2.5 times more than annual production of municipal wastewater sewage sludge. [4]



**Fig. 25** GHG emission trend in the waste sector [14]

GHG emission trend line from waste sector covers emissions occurring in the whole territory of Lithuania during the period 1990 to 2011 from solid waste disposal on land (including sewage sludge), wastewater handling and waste incineration. The amount of generated waste during the 1990-2011 period did not change significantly. The decrease of emissions during last decade is due to declining amounts of generated waste, development of waste and wastewater management systems.

## 2.10 Housing and construction

Before the crisis, construction and real estate sector has developed amazingly rapidly. However, in 2009 after the bursting of the housing bubble and shrinkage of material investments accordingly; this sector experienced the biggest fall among all sectors of national economy.

But year 2011 was significantly more positive for housing and construction as gross value added has increased by 19 %. Moreover, the results of the beginning of 2012 are even more positive. In 2012 Lithuanian construction companies have executed works by 16 % more than in comparison with 2011 at the same time (first quarter of 2012). In the beginning of 2012, sales volume in Lithuanian market has increased by 17 %, in non-Lithuanian market – by 2 % [6]. However, the results of 2012 were by 4 % lower than in 2011 (Table 8).

Separate analyses of every category of construction works (residential, non-residential buildings and civil engineering structures) revealed that the major fluctuation could be observed in the dynamics of construction works of residential buildings in the period of 2009-2012, which accounted for 8.4 % of all construction works in 2012 (non-residential buildings – 34.3 %). In 2010, the construction works of residential buildings has decreased by half in comparison with 2005, but in 2012 it increased by 38 % in comparison with 2010 (non-residential buildings – 32.6 % in 2010 and 24.3 % in 2012 accordingly). [8]

In past years a construction of civil engineering structures were generating more than half of all turnovers in construction works. A construction of civil engineering structures are closely related to public sector and large share of public orders is allocated for road network maintenance and development. Public financing for civil engineering structures is gradually decreasing: in 2011 financing was lower by 15 % and it was caused by decreased use of financing from EU funds. However, volume of construction of civil engineering structures increased and this was strongly influenced by the cooperation with private sector. In 2012 the largest share of construction works in the country accounted for a new construction – 40.4 %, reconstruction – 30.2 %, repairs and restoration – 26.2 % and other works – 3.2 % (in 2011, 41.9 %, 31.9 % and repairs and restoration and other works 26.2 % accordingly). [8] In 2010, the construction works of residential buildings has decreased by half in comparison with 2005, but in 2012 it increased by 38 % in comparison with 2010 (non-residential buildings – 32.6 % in 2010 and 24.3 % in 2012 accordingly).

The production of the cement is highly dependent on construction market. In accordance with the data of Statistics Lithuania, the cement production in Lithuania increased by 160 thousand tons and in 2011 reached almost 1 million tons. The bigger part of the production was used in Lithuania (Table 7).

**Table 7.** Cement production in Lithuania 2000-2012, in million t [9]

	2000	2005	2009	2010	2011	2012
Cement, million t	0.57	0.83	0.58	0.83	0.99	1.0

Construction of non-residential buildings in 2011 is divided as follows: industrial buildings and warehouses – 9.1 %, commercial, catering facilities and hotels – 3.9 %, agricultural – 0.7 %, educational and research, healthcare, cultural and sport – 13 %, other purpose – 6.4 %. [9]

Works performed in 2005-2012, by their type and by the type of a building are presented in Table 8.

**Table 8.** Performed works by type [8, 9]

	2005		2009		2010		2011		2012	
	mln. LTL	%	mln. LTL	%	mln. LTL	%	mln. LTL	%	mln. LTL	%
<b>Works carried out in the country</b>	<b>5 925.6</b>	<b>100.0</b>	<b>5 775.8</b>	<b>100.0</b>	<b>5 142.8</b>	<b>100</b>	<b>6 553.2</b>	<b>100.0</b>	<b>6 287.8</b>	<b>100.0</b>
New construction	2 723.3	46.0	2 569.1	44.5	2 114.6	41.1	2 747.0	41.9	2 540.3	40.4
Reconstruction	1 465.8	24.7	1 778.1	30.8	1 862.3	36.2	2 090.6	31.9	1 898.9	30.2
Repairs and restoration	1 574.2	26.6	1 231.8	12.3	988.7	19.2	1 491.4	22.8	1 647.4	26.2
Other works	162.3	2.7	196.8	3.4	177.2	3.5	224.2	3.4	201.2	3.2

**Table 9.** Performed works by buildings type [8, 9]

	2005		2009		2010		2011		2012	
	mln. LTL	%	mln. LTL	%	mln. LTL	%	mln. LTL	%	mln. LTL	%
Engineering constructions	2 323.3	39.2	2 688.0	46.5	2 879.3	56.0	3 571.6	54.5	3 418.8	54.4
Buildings	3 602.3	60.8	3 087.8	53.5	2 263.5	44.0	2 981.5	45.5	2 869.1	45.6
Total	5 925.6	100.0	5 775.8	100.0	5 142.8	100.0	6 553.2	100.0	6 287.8	100.0

Efficient reduction of GHG in the construction sector is foreseen in the continuation of multi-apartment buildings' modernization program. Around 35 thousands multi-apartment buildings which have received building permits or are built until 1993 may receive funding via modernization program. This program is funded by the state aid, municipalities, the EU structural funds, population and other resources. As a result of modernization, reduction of heat and fuel consumption is foreseen including complex/overall modernization of residential neighbourhoods/blocks.

Data on the distribution of housing in the country are listed below.

**Table 10.** Housing in 2000-2012 [9]

	2000	2005	2009	2010	2011	2012 <sup>21</sup>
Total, mln. m <sup>2</sup>	79.5	80.8	82.9	83.7	84.8	85.8
Urban dwelling fund, mln. m <sup>2</sup>	50.6	51.3	52.9	53.4	53.9	54.5
Rural dwelling fund, mln. m <sup>2</sup>	28.9	29.5	30.0	30.3	30.9	31.3
Average living space per capita, m <sup>2</sup>	22.8	23.8	24.9	25.8	26.5	28.6

<sup>21</sup> [20]

## 2.11 Agriculture and forestry

Agriculture is a source of economic wealth which supply food and energy resources [24]. This sector has a great influence on the development of Lithuanian rural area as 33 %<sup>22</sup> of residents live in countryside. 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. [24].

According to the data of Statistics Lithuania as of 1 January 2012 the total area of land intended for agricultural purposes made 3 949.1 thousand ha, of which agricultural land – 3 465.3 thousand ha; arable land – 2 928.9 thousand ha; orchards and berry gardens – 59.2 thousand ha; meadows and natural pastures – 477.2 thousand ha; forests occupy 2 126.2 thousand ha, roads – 131.8 thousand ha, built-up area – 181.5 thousand ha, water – 262.4 thousand ha, other land – 362.8 thousand ha in 2012. [13]

Since 2005, a number of agricultural holdings have decreased by 38 %, from 321 754 in 2005 to 199 242 in 2012, while the average size of farms has increased by more than 43 % in the same period, from 9.9 ha to 14.19 ha. Even though the dominant holdings in Lithuania are with the land size of less than 10 ha and they compound 77.48 %, however the trend shows an increase in size of agricultural holdings. In addition, the number of cattle is decreasing, as a result, an average size of herd increases [32]. Agricultural holdings become bigger and it allows a more efficient management of farms.

Year 2012 was one of the most successful for Lithuanian agriculture and food industry [24]. The gross value added, produced by agriculture, forestry and fishery to Lithuanian national economy in 2012 was about 4 073 million LTL [20] and it is the largest since 1995. In 2012 it constituted almost 4 % of the total gross value added by all sectors. However, this is only one third of gross value added produced by agriculture, forestry and fishery in 1996, when it constituted 12.1 %. Moreover, at the moment the share of gross value added produced by agriculture, forestry and fishery, remains significantly greater than the EU average [24].

During the recovery of export of the other sectors after economic crisis, contribution of Lithuanian agriculture and food industry to the state export remained solid: 18 % in 2010, 16.6 % in 2011 and 18.4 % in 2012. Already since 2004, when Lithuania became a Member State of the EU, trade balance is constantly positive. Lithuanian agriculture and food industry has increased its export by 26.9 % in 2012, compared with 2011 [24].

In general climate conditions are favorable to agricultural production, especially on crop production. In 2011, agricultural production at current prices reached 8.1 billion LTL and, compared to 2010, its volume increased by 8 % (crop production grew by 15.5 %, while animal production had a slight decrease by 1 %). The increase in crop production was influenced by an increase in the harvest of various agricultural crops: vegetables (by 57.2 %), potatoes (23.2 %), sugar beet (21.5 %), rapeseed (16.2 %), and cereals (15.5 %). Animal production fell due to a 13.4 % decrease in pig breeding, 6.7 % – (decrease in) egg production [25].

In 2012, agricultural production at current prices reached 9.3 billion LTL<sup>23</sup> and, compared to 2011, increased by 15 %. In 2012, the biggest portion of agricultural production resulted from milk yield – 17 %, while animal breeding accounted for 14.4 % (of which pig breeding – 6.2 %), cereals – 34.8 %<sup>24</sup>.

In 2012 increase of livestock breeding amounted 36 % of the general agricultural production<sup>25</sup>. Comparing with 2011, production of livestock breeding was almost stable. However, there were changes in the structure of livestock breeding production. In 2012 the breeding an interest of sheep and goat has significantly increased (by 27.7 %), also pig breeding has grown by 24.2 %.

Greenhouse gas emissions from agriculture sector in Lithuania include: CH<sub>4</sub> emissions from enteric fermentation of domestic livestock; CH<sub>4</sub> and N<sub>2</sub>O emissions from manure management; direct and indirect N<sub>2</sub>O emissions from agricultural soils. Direct N<sub>2</sub>O emissions from agricultural soils include emissions from synthetic fertilizers, manure applied to soils, biological nitrogen fixation of N-fixing crops, crop residues, cultivation of organic soils and sewage sludge application. Indirect N<sub>2</sub>O emission sources include emissions from atmospheric deposition and from nitrogen leaching and run off.

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<sup>22</sup> M3010205 of [20] (during th period of 2001-2012)

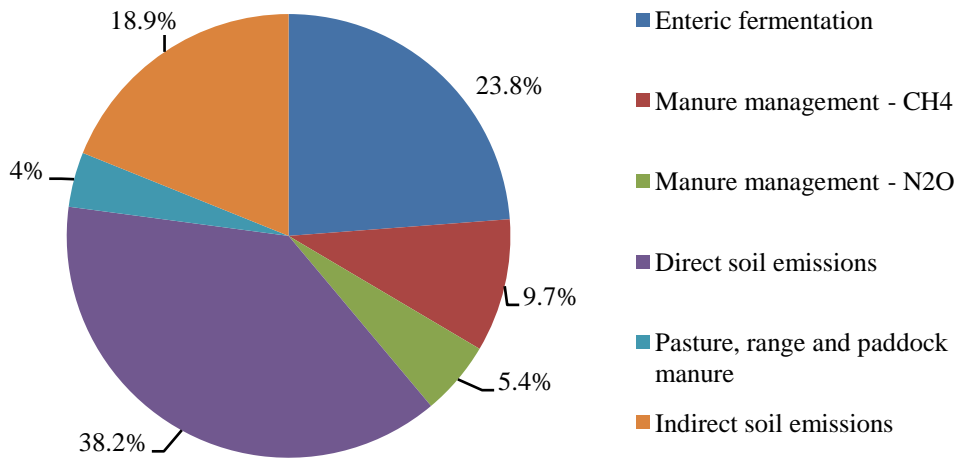
<sup>23</sup> M5010202 of [20]

<sup>24</sup> M5010202 of [2020]

<sup>25</sup> M5010202 of [20]

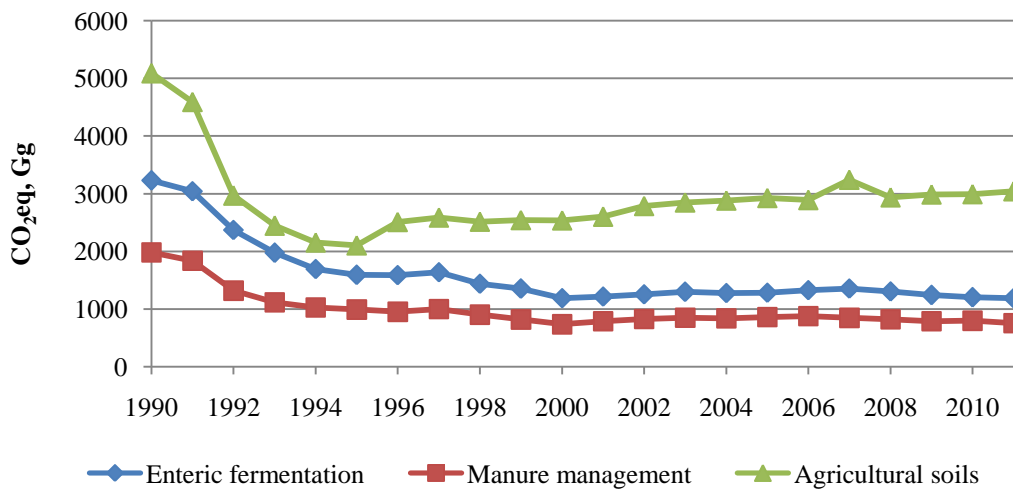


4 979.97 Gg CO<sub>2</sub> eq of GHG emissions in Lithuania originated from agriculture sector in 2011. The major part of GHG emissions is related to the agricultural soils (Fig. 26). [14]



**Fig. 26** The share of aggregated emissions by categories from key sources within the sector in 2011 (%) [14]

In 2011 N<sub>2</sub>O emissions contributed 66.4 % of the total GHG emission from the agriculture sector. The major part of CH<sub>4</sub> emissions from agriculture sector originates from digestive processes. From 1990 to 2011 emissions from agriculture have decreased by 51.6 % (Fig. 27).



**Fig. 27** GHG emissions in the agricultural sector in 1990-2011 [14]

In the second half of the 20<sup>th</sup> century, Lithuania's forest coverage increased by as much as 10 %. This increase was determined not only by the forest afforested artificially but also by the forest that regenerated naturally. This process has especially speeded up in recent years when 4-5 thousand hectares of unused land naturally regenerate annually. Mostly it is unused long-fallow lands, pastures, wetlands and peat-bogs that regenerate naturally. [29] At the present time (1 January of 2013) forest land area, according to the National Forestry Inventory covers 2 184.8 thousand ha, or 33.5 % of the country's territory in Lithuania.

In accordance with the data, provided in the Lithuanian National Inventory Report (afforested and reforested areas) reconstituted forest areas were not stable since 2000. Forests tend to replace neglected areas of unproductive land, inappropriate for intensive farming. In statistics this land is attributed to the category of "other land".

**Table 11.** Afforestation and reforestation[11, 33, 34]

	2000	2005	2009	2010	2011	2012
Natural and artificial afforestation and reforestation areas, ha	5 674.1	7 533.1	3 494.3	8 521.1	7 456.6	10 946.5
Area where forest-plant cultivation work was carried out, ha	14 019	21 062	32 069	44 184	47 007	47 146
Soil preparation for artificial regeneration, reforestation and support for natural regeneration in state forests, ha	6 549	7 830	6 142	6 748	7 902	7 213
Seedlings growing in tree nurseries of State Forest Enterprises, thous.	132 500	219 264	159 963	147153	131 896	138 582
Seeds of trees and bushes collected, kg	20 593	41 248	17 331	29 335	93 700	5 435

Occupying 1 153 200 ha, coniferous stands prevail in Lithuania, covering 56.1% of the forest area. They are followed by softwood deciduous forests (818 500 ha, 39.8%). Hardwood deciduous forests occupy 83 800 ha (4.1%). The total area of softwood deciduous forest land has increased by 120 100 ha over the last nine years. The area of hardwood deciduous has decreased by 8 800 ha and coniferous forest by 6 800 ha. Scots pine occupies the biggest share in Lithuanian forests – 722 200 ha. Compared to 2003, the area of pine forests increased by 10 700 ha. Norway spruce covers 428 400 ha, with a reduction of 16 900 ha. Birch covers the largest area among deciduous trees. Since 2003, it increased by 66 600 ha and reached 458 800 ha by the 1<sup>st</sup> January 2012. [31]

Increasing quantity of CO<sub>2</sub> may have a positive impact on wood production. The bigger concentration of CO<sub>2</sub> in the ground level of atmosphere layer creates the more favorable conditions for photosynthesis [30]. Since 2004, wood production has been steadily increasing and by 2012 an increase was about 12 %, in comparison with 2004.

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### **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 6<sup>th</sup> National Communication is in accordance with its National Inventory Report (NIR) that was submitted in 2013 to the Secretariat of the UNFCCC in compliance with the decisions of the Conference of the Parties 3/CP.5 and 11/CP.4. This submission covers the inventory of GHG emissions of Lithuania for the period 1990-2011. It has been also submitted to the European Commission in compliance with the Decision No 280/2004/EC of the European Parliament and of the Council concerning the mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol. It shall be noted that from 2013 on the reporting will be performed in accordance 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 Summary tables of the National Inventory Report**

As a Party to the UNFCCC and in accordance with Article 7, paragraph 1 of the Kyoto Protocol, Lithuania is required to develop and annually update national inventories of anthropogenic emissions by sources and removals by sinks of all GHGs.

Summary of GHG inventory tables (Table A-1) is presented in the Appendix of the 6<sup>th</sup> National Communication. The data cover the period of 1990-2011.

#### **3.2 Greenhouse Gas emissions trends**

##### **3.2.1 General greenhouse gas emissions trends**

GHG emission level drastically fell down in 1992 and remained steady at approx. 22 thousand Gg CO<sub>2</sub> eq. during the last 19 years. Slight GHG level fluctuations in the range of 11 % can be observed in the period of 1992-2011.

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 [14]. In accordance with comments provided by the ERT in the Report of the in-depth review of the 5<sup>th</sup> National Communication of Lithuania, a more detailed analysis of circumstances which have affected a dynamics of GHG emissions was executed.

In the beginning of 90s, mostly fossil fuel was combusted in manufacturing industries, energy industries and agriculture. A comparison of annual general fuel balances in the period of 1990-2011 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<sup>26</sup>), 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

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<sup>26</sup> M8020305 of [11]

environmental requirements: since 1 January 2004 consumption of sulphureous 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.

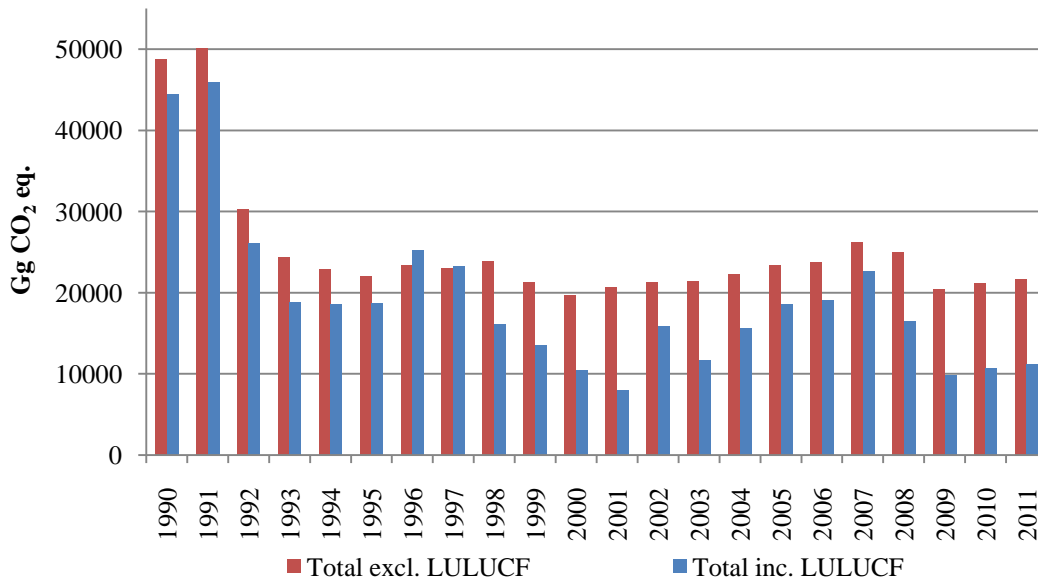


Fig. 28 GHG emissions 1990-2011

Last decrease in 2009 was related with the economic crisis in Europe, while 2011 shows the tendency of return to the previous GHG levels. These fluctuations were reflected in the country's GHG emissions provided in the annual inventory report. [1]

### 3.2.2 Greenhouse gas emissions trends by gas

GHG emissions trends by gas in CO<sub>2</sub> eq are presented in the figure below and reflect the main tendencies of GHG level in general.

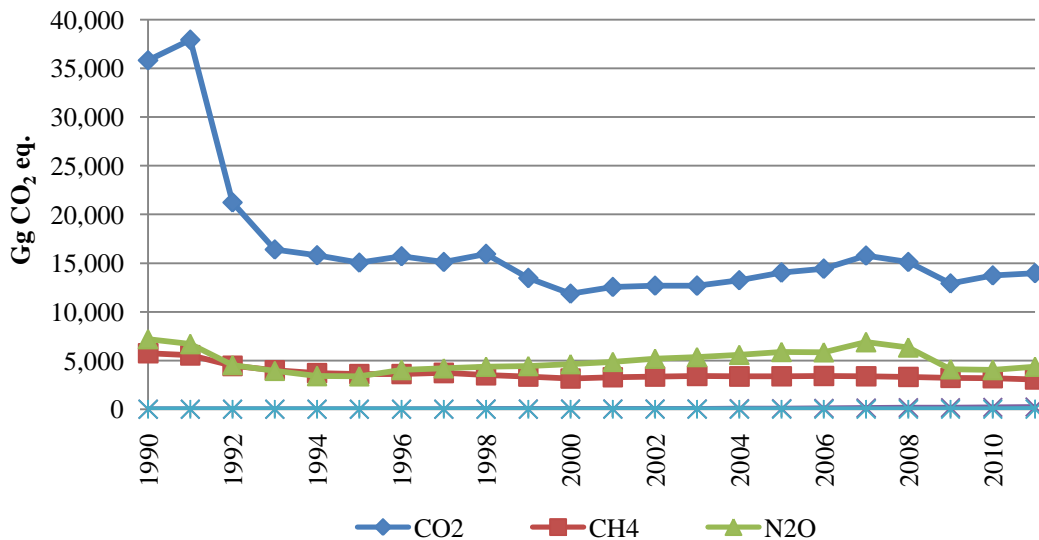
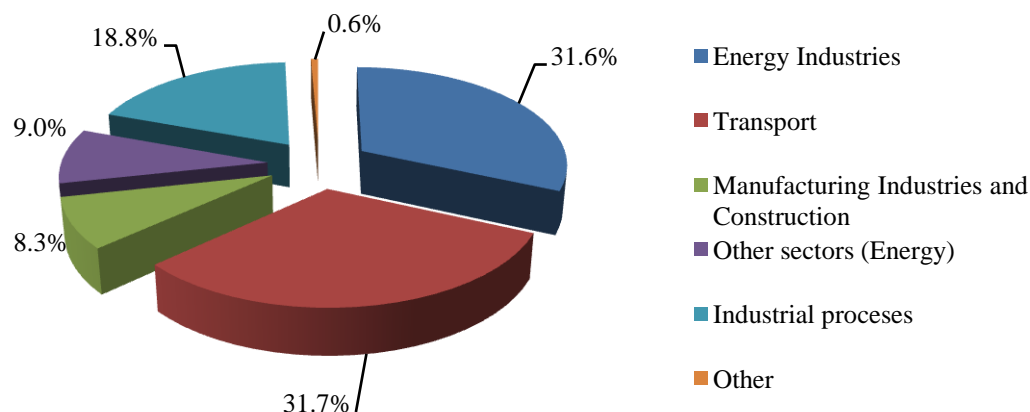


Fig. 29 GHG emissions trends by gas 1990-2011

The most important GHG in Lithuania is carbon dioxide. In 2011, the actual CO<sub>2</sub> emission (excl. LULUCF) was 61 % lower than the emission in 1990. Comparing with 2010 CO<sub>2</sub> emissions increased by 4.7 % including LULUCF and 1.8 % excluding LULUCF. The largest source of CO<sub>2</sub> emissions is energy sector which

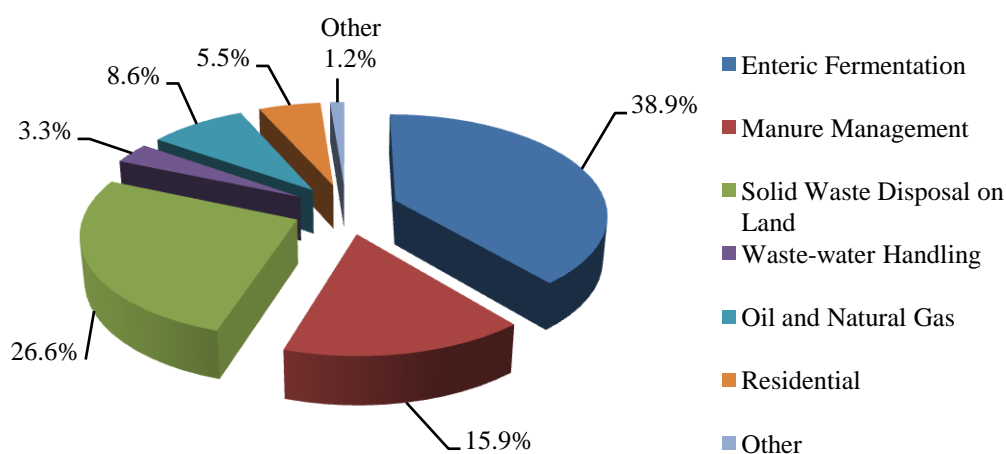
contributes around 80.6 % of all CO<sub>2</sub> emissions. CO<sub>2</sub> emissions from energy sector decreased by 7.3 % compared to 2010.

Distribution of CO<sub>2</sub> emissions in 2011 by the main sectors and subsectors is shown in Fig. 30.



**Fig. 30** Distribution of CO<sub>2</sub> emissions by sectors in 2011

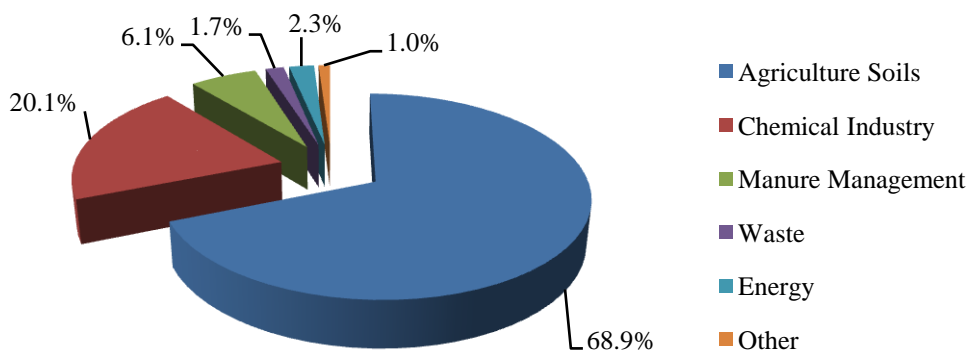
The largest sources of methane emissions are: agriculture sector, contributing with 54.9 % in 2011, waste sector – 26.5 % and fugitive emissions from operations with oil and natural gas – 8.6 % (Fig. 31). The emissions from agriculture derive from enteric fermentation and manure management contributing with 38.9 % and 15.9 % of the total national CH<sub>4</sub> emission (excl. LULUCF).



**Fig. 31** Distribution of CH<sub>4</sub> emissions by sectors in 2011

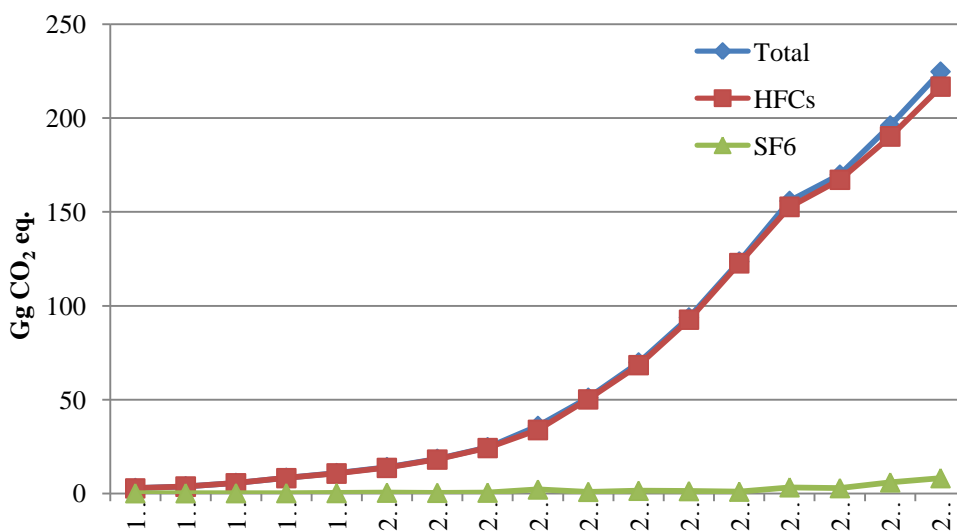
Nitrous oxide is the second most important GHG accounting for 20.2 % in the total national GHG emissions (excl. LULUCF). Agriculture is the main source of N<sub>2</sub>O emissions which contributed 75.7 % to the total N<sub>2</sub>O emissions in 2011. N<sub>2</sub>O emissions from agriculture sector have increased by 1.4 % comparing with 2010. The increase was observed in agricultural soils subsector because emissions from application of sewage sludge were identified.

The second significant source of N<sub>2</sub>O emissions is nitric acid production. It contributes 20 % to the total N<sub>2</sub>O emissions. Fig. 32 shows the distribution of N<sub>2</sub>O emissions in 2011 by the main sectors and subsectors.



**Fig. 32** Distribution of N<sub>2</sub>O emissions by sectors in 2011

The F-gases contribute 1 % to the total national GHG emissions. The emissions of F-gases have increased during 1995-2011. A key driver behind the trend has been the substitution of ozone depleting substances (ODS) by F-gases in many applications. Fig. 33 shows the trend of F-gases emissions during the period 1995-2011.



**Fig. 33** Emission trends for F-gases for the period 1995-2011 (Gg CO<sub>2</sub>eq)

### 3.3 National system

#### 3.3.1 Institutional arrangement for greenhouse gas inventory preparation

Detailed institutional set up for GHG inventory preparation is presented in the National Inventory Report 2013 chapter 1.2.1. Basic elements are presented further in this chapter. At the time of the preparation of this report, the question of implementation on the national system of Lithuania that was identified in the 2010 ARR has been fully resolved.

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.

**Ministry of Environment of the Republic of Lithuania** 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 of the Pollution Prevention Department 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. Among its responsibilities are the following:

- Overall coordination of GHG inventory process;
- Preparation of legal basis necessary for National System functioning;
- An official consideration and approval of GHG inventory;
- Approval of QA/QC plan and procedures;
- Timely submission of GHG inventory to UNFCCC Secretariat and European Commission;
- Coordination of the UNFCCC inventory reviews in Lithuania;
- Keeping of archive of official submissions to UNFCCC and European Commission;
- Informing the inventory compilers about relevant requirements for the national system.

In accordance with the Order of Minister of Environment of 22<sup>nd</sup> of December, 2010, the **Lithuanian Environmental Protection Agency (EPA)** under the Ministry of Environment was assigned as an institution responsible for the GHG inventory preparation, QA and QC starting from 2011. EPA responsibilities inter alia include monitoring of environmental quality, collection and storage of environmental data and information as well as assessment and forecasting of environmental quality.

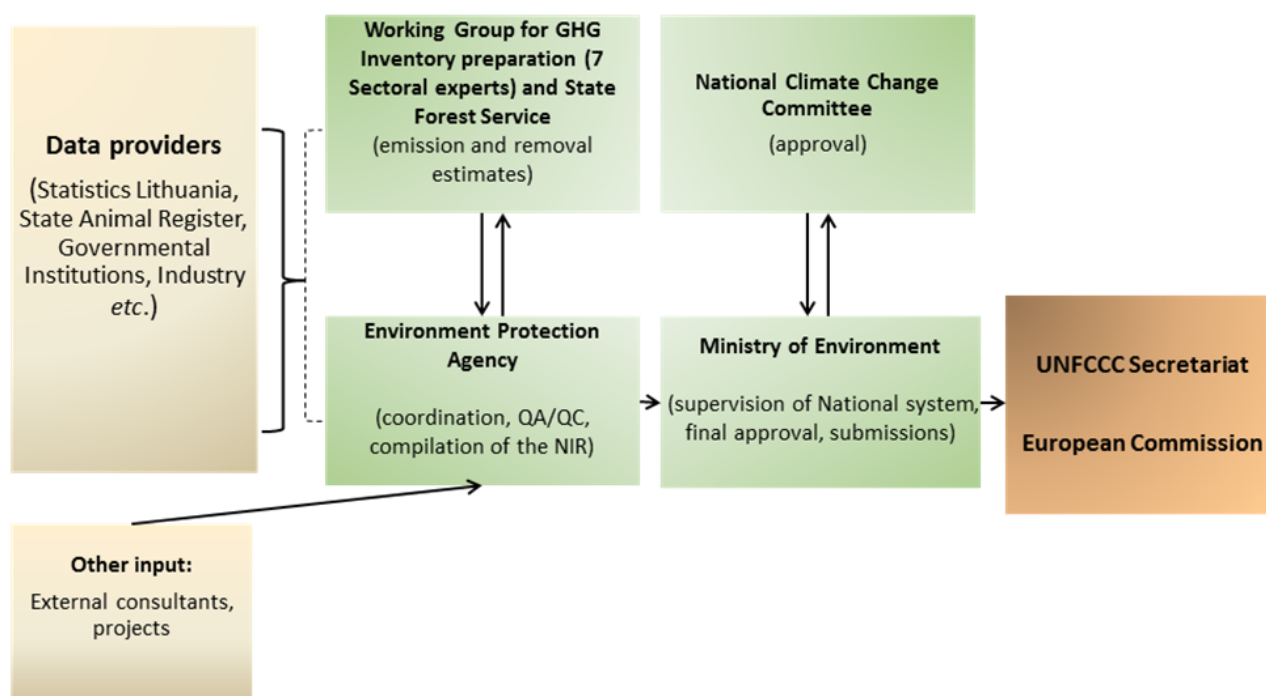
The EPA, as the compiler of the GHG inventory, has the following functions and responsibilities:

- Development and implementation of QA/QC plan and specific QA/QC procedures;
- Identification of data providers for specific information and collection of activity data and emission factors used to calculate emissions;
- Cooperate with sectorial experts on the selection of methods complying with IPCC Good Practice Guidance for calculation of emissions giving the priority to key categories and categories with high uncertainty;
- Checking and archiving of supplied input data, prepared inventory and used materials;
- Key categories analysis;
- Overall uncertainty assessment;
- Preparation of Common Reporting Format (CRF) tables and compilation of National Inventory Report (NIR);
- Maintaining the GHG inventory database;
- Providing the final inventory (CRF tables and NIR) for Ministry of Environment;
- Evaluating requirements for new data, based on internal and external reviews;
- Other activities.

The EPA is responsible for compilation of the final report based on the sectorial information provided by the experts/consultants. Initial data for the sectorial information is provided by the data providers and processed by the experts/consultants. Unprocessed data provided by the data providers are stored in the database before being handed over to experts/consultants for processing. Processed data are also stored in the archive managed by EPA. Composition of the permanent expert working group for the preparation of Inventory is shown in Fig. 35.

The EPA establishes and operates GHG inventory database and archive, where archives of GHG inventory submissions and all supporting reference material is stored and maintained. Backups are prepared on regular basis following the EPA's information management procedures. The archive is managed according to the EPA Director's Order No AV-152 concerning the approval of the National GHG inventory data archiving procedures, adopted on 26 June, 2012. The main QA/QC procedures under responsibilities of EPA are performed according to the EPA Director's Order of 23 July 2012 No AV-191 concerning the approval of the National GHG inventory data quality assurance and quality control procedures.

The institutional GHG inventory report preparation and submission set-up is given in Fig. 34.

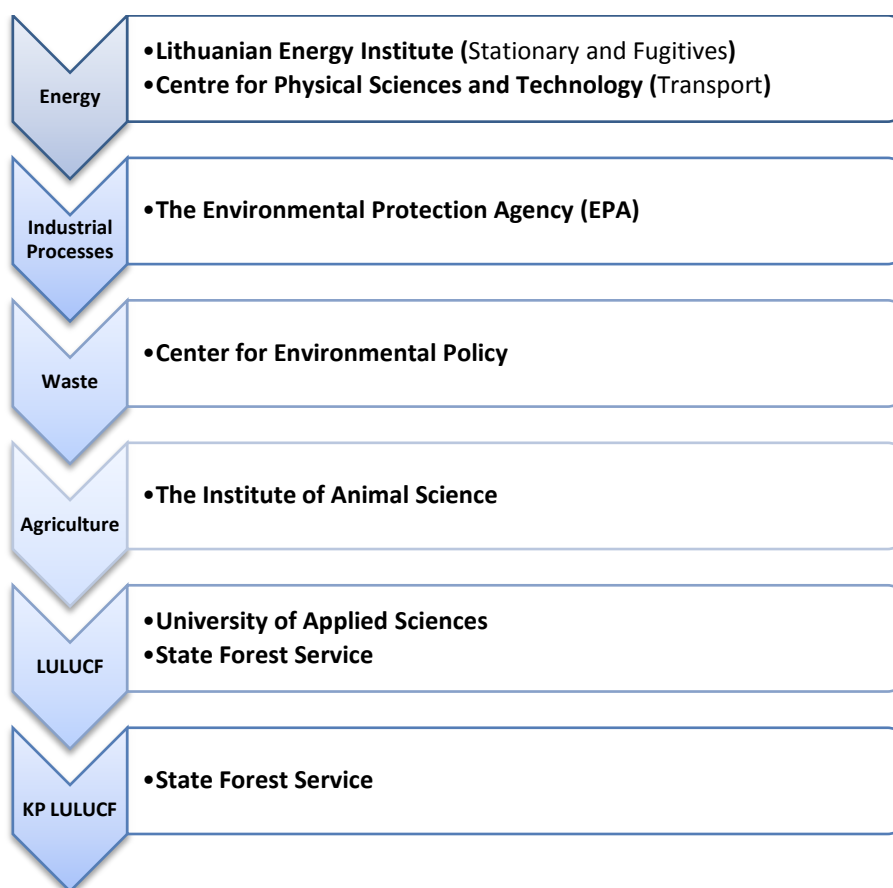


**Fig. 34** Institutional set-up for GHG inventory preparation [1]

**Permanent expert working group** for GHG inventory preparation was established in 2012. 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 University of Applied Sciences. External experts, independent specialists providing data for the GHG inventory, may also be involved during the inventory preparation process.

Functions and responsibilities of the working group for GHG inventory preparation as a whole are defined as follows:

- Evaluation of requirements for new data based on internal and external reviews;
- Search and identification of specific data providers;
- Preparation of requests for new data;
- Identification, on the basis of the IPCC good practice guidelines, of methodologies for calculation of GHG emissions setting priority to key categories and categories with high uncertainty level;
- Determination of activity data;
- Determination of appropriate emission factors;
- Calculation of emissions;
- Data quality control;
- Filling CRF tables for corresponding sectors, drafting relevant NIR sectorial chapters;
- Preparation of comments and answers to the questions and comments received during the EC and UNFCCC reviews;
- Other activities.



**Fig. 35** The composition of permanent expert working group by institutions for preparation of the National GHG inventory in Lithuania

**The State Forest Service** (SFS) 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. The Service functions under the Ministry of Environment.

Since 2010 State Forest Service in the GHG inventory preparation process is responsible for calculations of emissions and removals of LULUCF (forestry part) sector and Kyoto Protocol activities under Art. 3 para. 3 and 4 following the order of the Minister of Environment 29 of July, 2010 No D1-666. SFS representative is also a member of permanent working group for GHG inventory preparation under the Government Resolution No 683. In this framework, the State Forest Service has the following responsibilities:

- Collection of activity data and emission factors used to calculate emissions and removals for LULUCF and KP-LULUCF sectors;
- Selection of methods (complying with IPCC Good Practice Guidance for LULUCF) for calculation of emissions and removals giving the priority to key categories and categories with a high uncertainty;
- Emission and removals estimates for LULUCF and KP-LULUCF sectors;
- Uncertainty assessment for LULUCF and KP-LULUCF sector;
- Checking and archiving of input data, prepared estimates and used materials;
- Preparation of Common Reporting Format (CRF) tables and NIR parts for LULUCF and KP-LULUCF;
- Implementation of QA/QC plan and specific QA/QC procedures related to LULUCF and KP-LULUCF;
- Providing the final estimates (CRF tables and NIR part) for the Environmental Protection Agency;
- Evaluating requirements for new data, based on internal and external reviews.

Before submission, reports are forwarded to the **National Climate Change Committee** for final approval. National Climate Change Committee was established in 2001 in the first instance and periodically renewed (the latest in January 2013). 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. The Committee also has a role on promotion of the implementation of the provisions of the UNFCCC and coordinates compliance with the requirements of the Kyoto Protocol and the EU legal acts related to the UNFCCC.

### **3.3.2 Greenhouse gas inventory preparation process and data collection**

Until 2011 GHG inventory preparation process was performed by contracting compilers on the annual basis. Aiming to increase institutional capacity for inventory preparation and ensure continuity of the inventory preparation process in compliance with Guidelines for National systems under Article 5 paragraph 1 of the Kyoto Protocol (decision 19/CMP.1) the Government of Lithuania and the Minister of Environment have issued a number of key regulatory legal acts and assigned responsible institutions for GHG inventory preparation. Detailed information about institutions involved in the GHG inventory preparation process and their functions is presented in the Chapter 3.3.1.

The annual GHG inventories preparation follows the Work schedule for reporting. Work schedule for preparation and submission of National GHG inventory 2013 is presented in Table 1-2 of NIR. Lithuania has to submit GHG inventory to the European Commission by 15 January and update estimates by 15 March annually. GHG inventory shall be submitted to the UNFCCC Secretariat by 15 April annually.

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. More detailed information of the main data providers are provided in NIR 2013 (Chapter 1.2.1, p. 27).

External experts, independent specialists providing data for the GHG inventory (data providers) may also be involved during the inventory process in preparation and upgrading of methodologies, data review and evaluation; they can also perform expertise of the whole inventory or of its separate parts. External experts can be contracted annually in the areas where specific expertise is needed and the experience and knowledge of the working group member's is not enough.

### **3.3.3 Methodology and data sources**

GHG inventory contains information on anthropogenic GHG emissions by sources and removals by sinks for the direct (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs and SF<sub>6</sub>) and indirect (CO, NO<sub>x</sub>, NMVOCs, SO<sub>2</sub>) GHGs. The latest 2013 GHG inventory covers the years 1990-2011.

NIR is compiled in accordance with the methodology developed by the Intergovernmental Panel on Climate Change (IPCC) in its Revised 1996 Guidelines for National Greenhouse Gas Inventories (IPCC 1996 Guidelines), Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC 2000 GPG) and Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003 GPG). Emission factors used are either country specific (e.g. used for Energy sector, except fugitive emissions) or internationally recommended default factors, mainly those provided in IPCC methodology and in EMEP/CORINAIR Emission Inventory Guidebook.

Lithuania's GHG emission inventory includes all major emission sources identified by the IPCC Good Practice Guidance with some exceptions, which have a minor effect on the total GHG emissions. All Lithuania's territory is covered by GHG inventory.

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, waste water and waste data).

Statistics Lithuania under the established procedure annually publishes the main sustainable development indices in the main annual yearbooks of the Statistics of Lithuania, with specific indices to be issued in other publications.

The State Forest Service is responsible for establishment of national forest inventory and forestry information system, implementation of Lithuania's forests state monitoring, collection and management of statistical data etc. The State Forest Service is established under the Ministry of Environment.

Information about the functions of the Environmental Protection Agency is provided in the Chapter 3.1 above.

Table 12 summarizes the most important data sources used to compile the GHG inventory of Lithuania for each sector.

**Table 12.** 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	Individual production plants EU ETS emission data Industrial statistics database (Statistics Lithuania) F-gases database (EPA)
3. Solvents and Other Product Use	Statistics Lithuania database Published literature
4. Agriculture	The Register of Agricultural Information and Rural Business Centre of Ministry of Agriculture Agricultural Statistics database (Statistics Lithuania) Published literature
5. LULUCF	NFI (National Forest Inventory) Standwise Forest Inventory Lithuanian Statistical Yearbook of Forestry Published literature
6. Waste	Waste database (EPA) Regional Waste Management Centers

### 3.3.4 Key source categories

Key sources for the the period 1990-2011 were analyzed according to IPCC 2000 GPG. Tier 1 and Tier 2 level and trend assessment of the key source categories with uncertainties (including and excluding LULUCF) were conducted for all years for which inventory estimates were available. Tier 2 analysis was performed for the first time in NIR 2013. The contribution of each source category to the national total was calculated. The base year for the analysis is 1990 for the GHG (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) and 1995 for the F-gases (HFC, SF<sub>6</sub>). Any source category that met the 95 % threshold was identified as a key source category.

Comparing Tier 1 and Tier 2 assessment few new key categories were identified in 2013 submission:

- 1.AA.3 Transport, N<sub>2</sub>O
- 1.AA.4 Other sectors, N<sub>2</sub>O

- 3. Solvent and Other Product Use, CO<sub>2</sub>
- 3. Solvent and Other Product Use, N<sub>2</sub>O
- 4.D.1.3. Direct Soil Emissions N-fixing crops, N<sub>2</sub>O
- 5.A.1. Forest Land remaining Forest Land, N<sub>2</sub>O
- 5.D. Wetlands, CO<sub>2</sub>
- 6.B. Waste-water Handling, CH<sub>4</sub>
- 6.B. Waste-water Handling, N<sub>2</sub>O
- 6.B. Waste-water Handling, N<sub>2</sub>O

Results of the Tier 1 and Tier 2 Level and Trend key categories analysis are provided in Table A-2 in the Appendix of the 6<sup>th</sup> National Communication.

### 3.3.5 Recalculations and improvements

Inventory estimates are periodically recalculated. This occurs for a number of reasons, including end-of-series averaging effects, revisions in key external data sources, and revisions of data due to improvements in the estimation methodology or the inclusion of additional sources. 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. Detailed description of recalculations performed for the period 1990-2011 is provided in NIR 2013 (Chapter 10.1).

Planning of improvements is usually initiated because of occurring lack of activity data, need to improve existing activity data or develop country specific emission factors or other parameters used in estimation of GHG emissions. For this purpose various projects, studies and workshops are performed when available. Some of the recent studies that were conducted in order to increase accuracy of activity data and emission factors: Study for development of national emission factors for energy sector; Study to determine the quantity of fluorinated gases (HFCs, PFCs and SF<sub>6</sub>) use in Lithuania, development of the methods for emissions calculations and recommendations to improve F-gases data collection system; Study on research and evaluation of CH<sub>4</sub> producing capacity and N<sub>2</sub>O in Lithuanian manure management systems; Study on research and analyses of methane emissions from waste-water and sludge.

In order to improve the overall preparation process of NIR and some specific areas of GHG estimation the Norway Grants partnership project "The partnership project on greenhouse gas inventory" in the framework of the programme No. 25 „Capacity-building and institutional cooperation between beneficiary state and Norwegian public institutions, local and regional authorities“ financed by the European Economic Area financial mechanism 2009-2014 is planned to be implemented in 2014. The partner of this programme will be Norwegian Climate and Pollution Agency (Klif), which is the national entity responsible for GHG inventory preparation in Norway. This project should undertake these areas: training of experts, development and improvement of QA/QC procedures, implementation of several studies that would fill in the reporting gaps in particular GHG inventory areas.

Apart of the projects and studies number of improvements is planned for the next inventory report. Majority of these improvements require analysis of existing data by sectorial experts, improvements in methodology applied or investigation of possibility to use higher Tier method.

Detailed description of improvements planned for the NIR 2014 is provided in NIR 2013 (Chapter 10.2).

### 3.3.6 Quality assurance and quality control

In order to improve data integrity, correctness, and completeness, QA/AC plan is developed every two years. The plan includes Tier 1 General Inventory Level QC Procedures outlined in Table 8.1 of IPCC Good Practice Guidance, and a peer review of the inventory estimates.

The QA/QC plan establishes good practice consistent with the IPCC Good Practice Guidance aimed at improving transparency, consistency, comparability, completeness, and confidence in the national inventory of emissions estimates. QA/QC plan was updated in 2012. The Ministry of Environment and the Environment Protection Agency is responsible for the development of the updated QA/QC Plan. The EPA is responsible for the coordination and implementation of the Plan with a supervision performed by the Ministry of Environment.

The QA/QC Plan describes the quality objectives of the GHG inventory, the national system for inventory preparation, tasks and responsibilities. A description is provided of various formal procedures already implemented in the development of the GHG inventory and of planned improvements.

### **3.3.6.1 Quality assurance**

Quality Assurance (QA) activities include planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process to verify that data quality objectives were met, ensure that the inventory represents the best possible estimate of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the quality control (QC) program.

Quality assurance includes an objective review to assess the quality of the inventory, and also to identify areas where improvements could be made. The objective in QA implementation is to involve reviewers that can conduct an unbiased review of the inventory. In Lithuania reviewers that have not been involved in preparing the inventory are invited to perform the quality assurance procedures. These reviewers are independent experts from other agencies or a national or international expert or group not closely connected with national inventory compilation.

Every year the European Commission performs quality checks of the EU member states GHG inventories. In 2012 technical review of the GHG emission inventory of Lithuania took place to support the determination of annual emission allocations under the EU Decision 406/2009/EC. The technical review of the 2012 GHG inventory estimates of Lithuania was performed by Technical Expert Review Team (TERT) of European Environmental Agency under service contract to the Directorate General for Climate Action of the European Commission. Lithuania performed the corrective actions in order to take the EU checks and comments into consideration.

Actually objective and independent assessment of GHG inventories is made annually by the ERT. Bearing in mind existing constraints it is considered that in-country reviews performed by the ERT fulfill requirements of the QA.

The last in-country review of Lithuanian GHG inventory took place in 2012 and centralised review was performed in 2013. Comments provided by the expert team are summarized in the Report of the individual review of the annual submission of Lithuania submitted in 2012. Number of ERT recommendations were taken into account and resulting recalculations were performed in 2012 GHG inventory submission. For 2014 inventory submission Lithuania will also take into account 2013 ERT comments, when Report of the centralised review of the annual submission of Lithuania submitted in 2013 will be available.

### **3.3.6.2 Quality control**

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardised procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting.

QC involves the following:

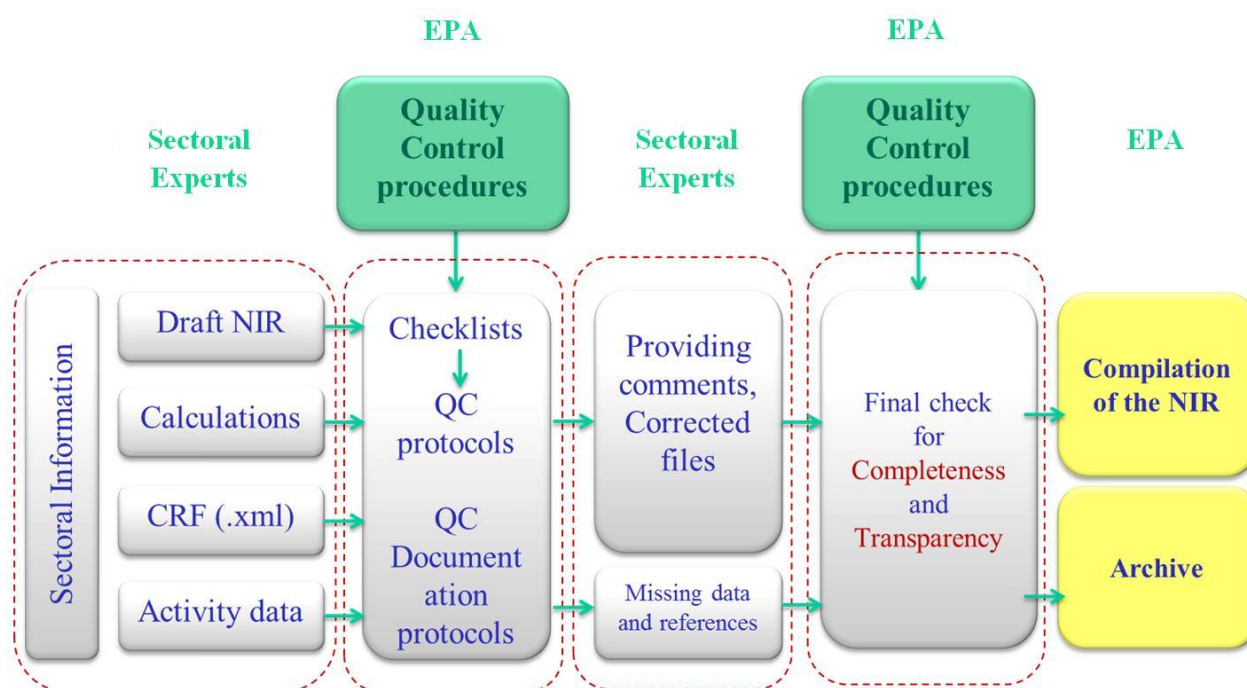
- Evaluation of the data collection procedure, to establish whether:
  - The necessary methods, activity data and emission factors (i.e. those in conformity with the IPCC Good Practice Guidance) have been used;
  - The calculations have been made correctly;
  - All-time series data has been provided and calculated;

- The data and results for the current year have been compared with the data and results of the previous years;
- The notes and comments contain all necessary information on the data sources, calculation methods, etc.
- Evaluation of the emission calculation to establish:
  - Consistency of the emission factors used;
  - Correctness of the emission parameters, units, conversion factors used;
  - Correctness of the data transferred from spread sheets to CRF tables;
  - Correctness of repeat calculations.
- Evaluation of the preparation of respective chapters of the NIR, to establish:
  - Integrity of the structures of the inventory data;
  - Completeness of the inventory;
  - Consistency of time series;
  - Whether the emission estimates have been compared with previous estimates;
  - Whether the data tables of the NIR correspond to the text;
  - Whether all necessary information on the data sources, assumptions and calculation methodology has been provided.
- As the coordinator and compiler of GHG inventory, EPA is responsible for QA/QC procedures and applies the following procedures for quality control:
  - Checking and archiving all information and activity data related to inventory preparation;
  - Checking data inputs and references in CRF and calculation files;
  - Checking consistency of data between source categories;
  - Checking assumptions and ensuring adequate documentation;
  - Checking data aggregation and transcription;
  - Coordinating QC activities by providing quality control protocols, documentation quality control protocols, recalculation protocols and checklists;
  - Providing the final inventory (CRF tables and NIR) to the Ministry of Environment.

The results of the check are recorded in a check list for initial check of the information provided by sectoral experts. More detailed information on errors found is recorded in quality control protocols. After the check, the protocol is given back to the sector experts who respond to the comments of the QC Manager and, if necessary, correct the data, calculation methodology or the report (NIR) accordingly. The main CQ procedures applied are presented in the figure below.

In addition to routine quality checks (Tier 1), source specific quality control procedures are applied, focusing on key categories and on categories with higher uncertainty. Source-specific QA/QC details are discussed in the relevant sections (Energy, Industrial processes, Agriculture and Waste) of the NIR. [1]





**Fig. 36** Quality control procedures applied by the EPA during inventory preparation process

All QA/QC procedures under responsibilities of EPA are performed according to the EPA Director's Order of 23 July 2012 No. AV-191 concerning the approval of the National GHG inventory data quality assurance and quality control procedures. This order also contains templates for checklists, QC protocols and CQ documentation protocols.

### 3.4 National registry

General description and background information on the National GHG Registry was 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 6<sup>th</sup> National Communication). On 21 December 2011, the Compliance Committee of the Kyoto Protocol imposed a restriction of the partial functions of Lithuania's National GHG Registry due to non-compliance raised in the review report of Lithuania 2010 GHG inventory submission. However, the question of implementation has been resolved and on 24 October 2012 the Registry restored its normal operation.

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.

In April 2011, 4-eye transaction verification mechanism was implemented as a counter measure against phishing and session hijacking. 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 representative 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 informatic environment of the Commission.

### **3.4.1 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 (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 (Official Gazette, 2013, No 54-2691). 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 (Official Gazette, 2013, No 116-5823). 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.

### **3.4.2 The registry website address and information available in the website**

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

<https://ets-registry.webgate.ec.europa.eu/euregistry/LT/index.xhtmll>

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.

## **Literature**

1. 1990-2011 GHG Inventory report (submission 15 April 2013) and CRF version 2.1 (submission 28 October 2013).
2. Report of the individual review of the annual submission of Lithuania submitted in 2012, UNFCCC/ARR/2012/LTU, 8 March 2013.
3. Report of the in-depth review of the fifth national communication of Lithuania, CC/ERT/2011/18, 22 September 2011.
4. 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 Directive 2009/29/EC.
5. 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.
6. Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.
8. 7. Law on Financial Instruments for Climate Change Management (Official Gazette, 2009, No 87-3662; with later amendments). Order of the Minister of Environment No D1-817 "On the adoption of Rules on the Use of the Union Registry and repeal particular Orders of the Minister of Environment" (Official Gazette, 2013, No 116-5823).
9. Lithuanian Environment Investment Fund: <http://www.laaif.lt> (accession date: 2013-11-15).
10. GHG registry web-site: <https://etsregistry.webgate.ec.europa.eu/euregistry/LT/index.xhtml> (accession date: 2013-11-15).
11. Statistics Lithuania: <http://db1.stat.gov.lt/statbank/default.asp?w=1366> (accession date: 2013-11-20).

## **4 Policy and Measures**

### **4.1 General policy**

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. This chapter mainly covers cross-sectorial policies and measures. Strategies and plans for individual sectors are presented in Chapter 4.2.

In accordance to the recommendations raised by the 5<sup>th</sup> National Communication review team, an explanation on the relationships and linkages between the strategies and programmes is given in this chapter as well.

On 6 November 2012 the Seimas (Parliament) of the Republic of Lithuania approved the Strategy for the National Climate Change Management Policy until 2050. The aim of the Strategy is to develop and implement climate change management policy in Lithuania. The Strategy sets short-term (until 2020), indicative mid-term (till 2030 and till 2040) and long-term (until 2050) goals and objectives in the field of climate change mitigation and adaptation (see more under chapter 4.1.2). The Ministry of Environment organizes and coordinates implementation of the Strategy. The Ministries of Environment, Energy, Finance, Transport and Communications, Health, Education and Science, Economy, Agriculture and other institutions are involved depending on their competence.

For implementation of goals and objectives of the Strategy the Government of the Republic of Lithuania approved 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.

Institutional capacity in climate change sphere has been significantly expanded recently. In 2011 the Lithuanian Environmental Protection Agency (EPA) under the Ministry of Environment was nominated as an entity responsible for GHG inventory preparation by the Order of the Minister of Environment No D1-1017. The same year a permanent GHG Inventory preparation expert working group consisting of 5 specialists was established by the Governmental Resolution No 683. In 2012 the Climate Change Division for GHG inventory preparation was established within the EPA. The Climate Change and Hydrometeorology Division of the Ministry of Environment was reorganised into the Climate Change Policy Division, and the new Climate Finance and Project Management Division was established in 2012. In January 2013 the composition of the National Climate Change Committee was renewed.

#### **4.1.1 Transposition of international legal acts**

The national legal acts, related to the implementation of the Kyoto Protocol, are elaborated in accordance with the provisions of the UNFCCC, the Kyoto Protocol and the EU legal acts related to climate change. According to Article 138 of the Constitution of the Republic of Lithuania, international treaties ratified by the Seimas (Parliament) of the Republic of Lithuania are the constituent part of the Lithuanian legal system. According to the Law on Treaties (Official Gazette, 1999, No 60-1948, 2005, No. 88-3295) Article 11 part 2, if ratified treaty of the Republic of Lithuania having entered into force establishes norms other than those established by the laws, other legal acts of the Republic of Lithuania in force at the moment of conclusion of the treaty or having entered into force after enforcement of the treaty, the provisions of the treaty shall prevail.

Provisions of the national laws shall be in accordance with the provisions of the EU legal acts.

Together with the other 154 countries Lithuania has signed the **United Nations Framework Convention on Climate Change** (UNFCCC) in the Rio de Janeiro conference on July 1992. The Seimas of the Republic of Lithuania ratified the UNFCCC on 23 February 1995, and the Kyoto Protocol – on 19 November 2002. Ratifying the Kyoto Protocol, Lithuania as Annex I country, undertook the obligation to reduce GHG emissions by 8 % until 2012, compared to the level of 1990.

The Law on Financial Instruments for Climate Change Management was adopted on 7 July 2009. The detailed description of the Law is presented in the 5<sup>th</sup> National Communication, Chapter No 4.1.4. The Law was

amended in 2011 and 2012 in relation to the changes in the National registry (National GHG registry became an integral part of the Union registry, see more under Chapter 3.4) and to other issues.

#### 4.1.2 Cross-sectorial strategies

Fig. 37 illustrates the relationship between the different strategies and programmes. **Lithuania's Progress Strategy 2030** was approved by the Parliament of the Republic of Lithuania in 2012. It defines the State's vision and priorities for the development and implementation activities until 2030. This is the main planning document which should be used while preparing and developing the other plans or programs.

**National Reform Programme (Agenda) 2020** is a document which sets medium term targets of the state. 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 Europe 2020 strategy. 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 strategies (see Fig. 37). Strategies are harmonized, e.g., targets related to energy efficiency in one strategy are the same as in another, and however, the level of elaboration differs depending on the theme of the particular strategy. 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 strategy. For monitoring and evaluation of progress, institutions shall yearly report about actions in the previous year.

The National Progress Programme for 2014-2020 was approved by the Government Resolution No 1482 of 28 November 2012 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.

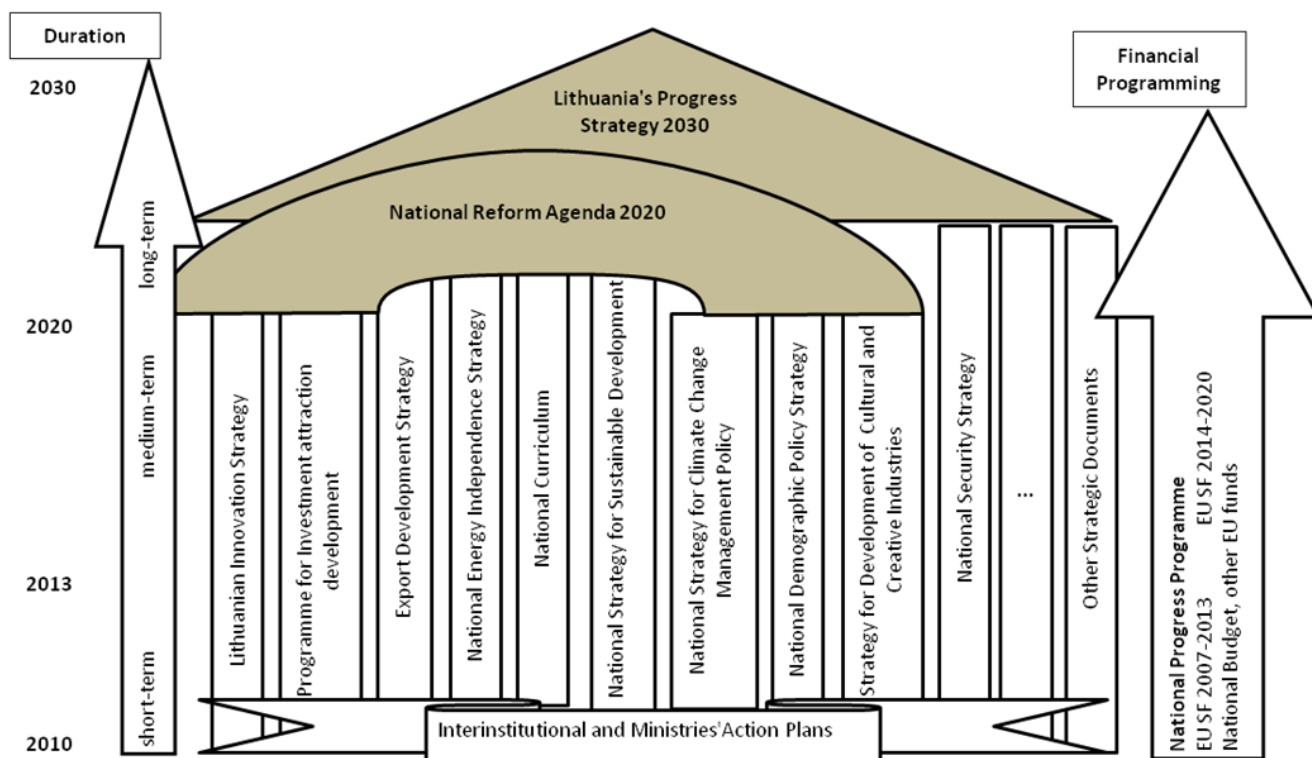


Fig. 37 The relationship between the different strategies and programmes

**The Strategy for the National Climate Change Management Policy** is drawn for the period of 2013–2050. The Strategy implements the EU legal acts on climate change and Third energy package, replaces the National Strategy for the Implementation of the UNFCCC until 2012 (Official Gazette, 2008, No 19-685).

The goal of the 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.

Chapter I of the Strategy is dedicated to general provisions, Chapter II – for presentation of findings of sectorial analysis: analysis of the sectors that are related to the GHG emissions reduction, analysis of sectors that are related to adaptation to climate change and analysis of the sectors that are crucial for development of climate change management policy; Chapter III presents the climate change management vision; Chapter IV is dedicated to climate change mitigation goals and objectives distinguishing climate change mitigation goals and objectives for sectors that participate in the EU Emission Trading System (EU ETS) and those not participating; Chapter V – adaptation to climate change goals and objectives; Chapter VI presents the general adaptation to climate change and climate change mitigation goals and objectives; Chapter VII defines the implementation of the Strategy and reporting. Annex 1 presents the structure of the Strategy; Annex 2 presents a list of the national and EU strategic documents used to formulate special and general goals and objectives for adaptation to climate change and climate change mitigation.

In 2012 Lithuania, together with the other EU Member States, Croatia and Iceland undertook 20/30 % GHG emissions reduction below 1990 level commitment for the second Kyoto Protocol commitment period from 2013 to 2020. This commitment was transferred in the Strategy, which specifies the quantitative annual GHG emissions reduction targets for the EU ETS and non-EU ETS sectors for the period 2013-2020. In non-EU ETS sectors the set targets allow an increase of the GHG emissions by 15 % in the scenario of 20 % GHG emissions reduction and by 4 % – in the scenario of 30 % GHG emissions reduction compared with emission level in 2005. In addition, an annual carbon budget has been determined for non-EU ETS specific sectors (agriculture, transport, industry, waste management and the other sectors) according to 20 % and 30 % GHG emission reduction scenario by 2020.

Sectorial targets and goals set in the Strategy conform with these of the sectorial strategies (e.g. the share of RES in gross fuel balance is set in the Strategy and in the National Energy Independence Strategy), thus the goals for each sector are presented in further chapters dedicated to the sectorial analysis.

For implementation of goals and objectives for 2013-2020 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. 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 collaboration.

On 16 September 2009 the Government of the Republic of Lithuania approved the updated **National Strategy for Sustainable Development** by Resolution No 1247. The detailed description of this Strategy is presented in the 5<sup>th</sup> National Communication, Chapter No 4.1.6.

In 2002 the Seimas (Parliament) of the Republic of Lithuanian approved the **Long-Term Development Strategy of the State** (Official Gazette, 2002, No 113-5029), in which environment protection is set as one of the main objectives, securing safe growth of the Lithuanian society. Environmental policy objectives cover water, air, soil, waste and other sectors.

In the same year the Government approved the **Long-term Economic Development Strategy of Lithuania until 2015** (Official Gazette, 2002, No 60-2424), which is an integral part of the Long-term Development Strategy of the State and sets long-term economic policy development trends.

**Lithuania's National Progress Programme for 2014-2020**, adopted on 28 November 2012, by the Resolution No 1482 of the Republic of Lithuania was developed in order to implement the Lithuania's Progress Strategy 2030.

The Programme covers not only provisions of national policy that are stated in the main national long-term strategic document „Lithuania's Progress Strategy 2030“, but also contains the main European Union policy provisions set in the EU strategy for smart, sustainable and inclusive growth „Europe 2020“. Development of the Programme has been matched with the EU financial support for the 2014-2020 programming period, thus

the Strategy is set for the same period. The provisions of the main national (the National Reform Programme), regional and the EU strategic documents (e.g. the EU Strategy for the Baltic Sea Region, the EU strategy on adaptation to climate change and etc.) are also reflected in the Programme. Priorities for the use of the EU funds under the 2014-2020 EU Multiannual Financial Framework, among others, include the mainstreaming of environment and climate objectives in all the EU funding instruments in order to provide opportunities for Member States to achieve related objectives and to raise climate-related expenditure to at least 20 % of the whole budget.

After the European Parliament and Council adopt European Union's legislative documents that regulate the use of the EU Structural Funds, the Programme will be revised in order to ensure its compliance to the thematic requirements.

#### **4.1.3 National and regional programs or treaties, warranty of implementation and administration procedures**

This Section contains information on legislative arrangements, enforcement and administrative procedures in relation to the Kyoto protocol flexible mechanisms.

The **Law on Financial Instruments for Climate Change Management** sets forth the main provisions on administrative structure for the administration and implementation of Joint Implementation (JI) and Clean Development Mechanism (CDM) projects.

The functions of different institutions, participating in the administration of the Kyoto Protocol flexible mechanisms, are presented below.

##### **Ministry of Environment:**

1. Administers JI and CDM projects in conjunction with other institutions authorized by the Government;
2. Lays down the procedure for implementation of JI and CDM projects;
4. Accepts, examines and evaluates applications and other documents related to implementation of projects;
5. Approves or rejects the implementation of projects (issues Letter of Approval, Letter of Endorsement);
6. Exercises control over implementation of projects;
7. Submits to the UNFCCC Secretariat information on institutions and actions, related to the implementation of the Kyoto Protocol flexible mechanisms;

##### **Ministries of Energy, Transport and Communications, Economy and Agriculture:**

1. Based on their competence administer JI and CDM projects in conjunction with the Ministry of Environment;
2. Based on their competence, submit recommendations on JI project ideas and expediency of their further performance to the Ministry of Environment;
3. Participate in the preparation of procedures for implementing and administering JI and CDM projects.

##### **Lithuanian Environmental Investment Fund**

1. Performs evaluation of JI project ideas;
2. Performs functions, related to the Kyoto units registration in the GHG registry.

##### **Regional Environmental Protection Departments**

Regional Environmental Protection Departments perform environmental control functions, participate in performing the environmental impact assessment procedures according to the Environmental Impact Assessment Law (Official Gazette, 2005, No 84-3105, with later amendments), and issue IPPC permit to the JI project operator according to the provisions of the IPPC Issuance, Renewal and Cancellation rules (Official Gazette, 2002, No 85-3684; 2005, No 103-3829, with later amendments) by July 2014.

## 4.2 Policy and measures by sectors, impact on greenhouse gas emissions

### 4.2.1 Existing measures

The existing measures (the ones under implementation or just approved), are presented in this section. Cross-sectorial measures are described first and the measures of separate sectors are reviewed further.

Following financing instruments are applied in order to implement targets set in the sectorial strategies: the EU structural assistance for 2007-2013, the EU emissions trading system (ETS), the Special Programme for Climate Change, the European Agricultural Fund for Rural Development via Rural Development Programme for Lithuania 2007–2013, the JESSICA Holding Fund.

#### 4.2.1.1 The EU structural assistance for 2007-2013

Total allocation of the EU structural assistance for Lithuania for the period 2007-2013 amounts to more than 23 billion LTL and is used for financing of the projects covered by the programmes and priorities listed below.

1. Human Resources Development Operational Programme (approved by the EC on 18 May 2009, last amendment on 21 November 2012) was dedicated to mobilization of all employable Lithuanian citizens, since investments on knowledge, competence, activity and business skills of people of Lithuania ensure long term economic growth. 13.8 % of EU structural funds (or 3.2 billion LTL) was allocated to this program. Investment directions:

- 1.1. Attraction and retention of people in the labour market;
- 1.2. Learning and professional development, development of the system of lifelong learning;
- 1.3. Strengthening of capacities of researchers and scientists;
- 1.4. Enhancing the capacities of public administration;
- 1.5. Technical assistance.

2. To the Economic Growth Operational Programme (approved by the European Commission on 14 May 2009, last amendment on 8 July 2012) was allocated the largest part of funds – 45.72 % of total funds from the EU structural assistance, or 10.7 billion LTL for the period 2007-2013. It was extremely important that 10 % of funding had to be allocated to the scientific researches and technological development of competitiveness and growth of economy. Investment directions:

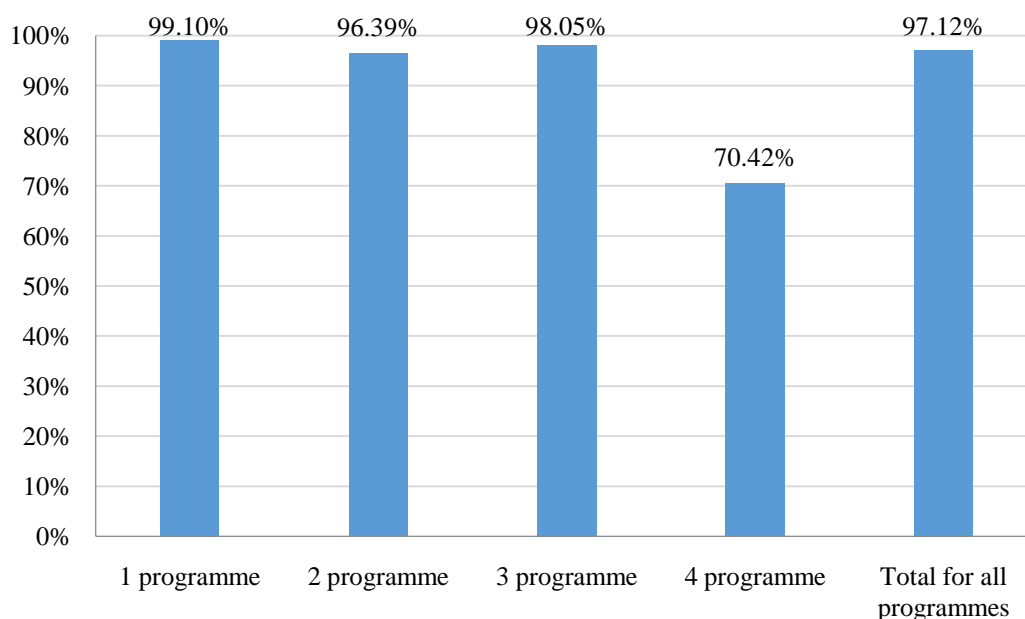
- 2.1. Direct and indirect assistance to R&D and innovations and investment promotion;
- 2.2. Favourable conditions for business and innovations;
- 2.3. Information society for all;
- 2.4. Essential economy infrastructure;
- 2.5. Transportation network;
- 2.6. Technical assistance.

3. The Cohesion Promotion Operational Programme (approved by the EC on 14 May 2009, last amendment on 8 July 2011) aim to embody a vision of more harmonious society. For the improvement of environment and quality of residency by minimizing differences between separate regions, it was allocated 39.08 % of the total funds from the EU structural assistance, or 9.2 billion LTL, for the period 2007-2013. Investment directions:

- 3.1. Urban infrastructure of municipalities; diversifying of activities in rural areas; heritage/tourism;
- 3.2. Quality and accessibility of public services;
- 3.3. Environment and sustainable development;
- 3.4. Technical assistance.

4. The Technical Assistance Operational Programme (approved by the European Commission on 18 December 2007; last amendment on 21 October 2012) – is a special program for administration of thematic programs of actions. 1.4 % of the EU structural funds, or 0.3 billion LTL, was allocated to this programme.





**Fig. 38** Amount of already allocated structural assistance within the programmes as of 30 October 2013

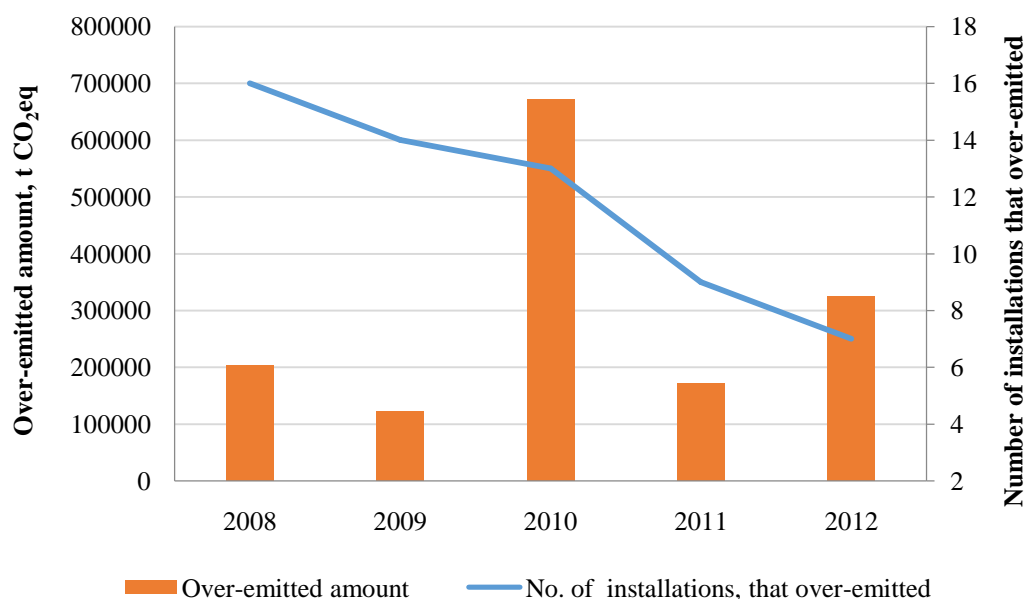
The total amount of structural assistance allocated within the programmes is more than 97 % and the allocation in individual programmes is shown in Fig. 38.

In relation to climate change mitigation the EU Structural assistance funds are designated for switch to biomass in district heat production (allocated 306 427 982 LTL, 77.07 % out of which is already distributed, applications currently under consideration amount to 26.21 %), refurbishment of public buildings (allocated 906 709 358 LTL), and increase of energy efficiency, mainly modernisation of district heat supply networks (allocated 200 978 902 LTL, 79.63 % out of which is already distributed, applications currently under consideration amount to 39.15 %).

#### 4.2.1.2 The EU emissions trading system for 2008-2012 and 2013-2020

The National allocation plan for the second emission trading period (2008-2012) under the EU ETS was approved by the Order of the Ministers of Economy and Environment in 2007. Total amount of the EU allowances for the second period was 44 179 066 where JI project reserve amounted to 1 292 186 and new entrants' reserve – 7 216 955. Over second emission trading period from 2008 – 2012 in total 39 715 628 free allowances were allocated, from which 35 669 925 allowances were allocated for incumbent installations and 4 045 703 allowances from new entrants' reserve - for new or increased capacity installations. Unused amount of 3 299 413 allowances from new entrants' reserve and 31 112 allowances from JI project reserve (in total 3 330 500 allowances) were sold in auctions.

During the second emission trading period every year there was a number of installations that had their verified emissions higher than the allocated amount of allowances (Fig. 39). A rather considerable rise of verified emissions in energy sector compared to allocation to some installations was experienced in 2010 due to closure of the second unit of Ignalina Nuclear Power Plant and intensive in-country power generation from fossil fuel (natural gas and residual oil) in the Lithuanian Power Plant (Lietuvos elektrinė). Second significant rise was experienced in 2012 with the Lithuanian Power Plant being the major emitter. One of the main reasons for the second significant rise was intergovernmental electricity transmission grid's disturbances when the Lithuanian power grid experienced lack of imported electricity due to electricity grid maintenance works in Russia (the main electricity exporter to Lithuania) and it was economically more feasible to generate power in the in-country power generators (namely the Lithuanian Power Plant) as the market prices were comparatively high.



**Fig. 39** Amount of GHG that was over-emitted by certain installations compared to their allocation

During the period of 2008-2012 a total surplus of approximately 10 million EU allowances was experienced. The overall amount of verified emissions each year during the period of 2008-2012 did not exceed the amount of allocated allowances.

The number of installations that participated in the EU ETS during the second trading period (2008-2012) was 101. The 90 installations are participating in the EU ETS as of 1 of January 2013. The installations that withdrew from the EU ETS either had ceased their operation or had reduced their capacity below the threshold of the EU ETS.

The third emissions trading period has started from the 1 of January 2013 and will last until the end of 2020. The allocation of the EU allowances to the Member States and installations was not completed at the time of preparation of the Communication although the preliminary amount of the EU allowances for Lithuania was set to about 45 million for the whole period.

One of the main differences of the third period is that no free EU allowances are allocated to electricity production. Although this is one of the main provisions for the third period, there has been an exception for some countries, including Lithuania, when transitional free allowances have been allocated for electricity generators. The allowances that may be allocated free of charge under the derogation (Article 10c of the Directive 2003/87/EC) shall be withdrawn from the Member State's EU auctioning share, thus the total amount of the EU allowances that is allocated to the industry will not change. The transitional allowances may be allocated to electricity producers during the period of 2013-2019. If a certain amount of allowances that were supposed to be allocated are not allocated, this amount is returned to the Member State's auctioning share. The total amount of allowances that may be issued to the electricity producers in 2013-2019 is 2 853 628 EUAs.

According to the balancing mechanism, electricity producers shall receive their allocation only after they have made certain investments fixed in the National Investment Plan of Lithuania. The amount of the investments should be equivalent to the market value of the free allocation. The value of allowances was set by the European Commission to 14.5 EUR/EUA in 2010-2014 and 20.0 EUR/EUA in 2015-2019. The investments included in the National Investment Plan are in compliance with the following principles:

1. 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. The only exclusion to the rule – investments into the connection of the national electricity network to the Union for the Coordination of the Transmission of Electricity (UCTE) system where calculation of the reduction of GHG emissions is not required.

2. Investments should be related only with the modernization of electricity production, transmission, distribution and consumption.
3. Investments should be additional to investments Member States must undertake in order to comply with other objectives or legal requirements accruing from Union law.

The value of investments foreseen in the National Investment Plan is 934 million EUR and the market value of the allocation is 51 million EUR.

#### **4.2.1.3 Special Programme for Climate Change**

As it is stated in the Law on Financial Instruments for Climate Change Management a Special Programme for Climate Change was developed in order to collect additional funding for climate change management measures. The Funds for the Programme are accumulated in a separate account of the State Treasury.

The Law states that the sources of financing of the Programme shall be as follows:

- 1) The funds obtained from the transfer of assigned amount units;
- 2) The funds obtained from the EU allowances sold at auction;
- 3) The funds obtained in accordance with the procedure laid down in Chapter VI of this Law;
- 4) The funds donated by natural and legal persons for implementation of the measures aimed at mitigation of climate change;
- 5) Other funds received in legal ways.

The funds of the Programme shall be 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 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.
- 8) For administration of the Programme and the Union GHG registry.

The general provisions of the management of funds of the Programme shall be as follows:

- 1) 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;

- 2) 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;
- 3) 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 (Official Gazette, 2010, No 42-2040; with later amendments).

**Table 13.** Financing under the Special Programme for Climate Change in 2011-2012

Name of the call for applications	Year of the call	No of projects that received subsidies	Subsidies, EUR
Change to low emitting public busses and renewal of public buses fleet	2011	93 buses (of which 10 are hybrid)	25 978 575
Refurbishing of educational purpose buildings in order to reduce energy consumption	2011	14 projects	7 131 796
Installation of biomass boilers with capacity ranging from 500 kW to 5 MW in district heating systems of municipalities that have a total number of population not exceeding 100.000 inhabitants	2011	31 project	11 584 111
Installation of biomass boilers up to 500 kW capacity in public buildings	2011	80 projects	7 418 399
<b>Total for year 2011</b>			<b>52 112 881</b>
Introduction of ferries for public transport purposes pursuing reduction of polluting city transport flow	2012	1 project	1 737 720
Refurbishing of educational purpose buildings in order to reduce energy consumption	2012	16 projects	6 762 627
Application of renewable energy sources in individual single family buildings that were built by the building codes that were active before year 1993	2012	39 projects	78 228
Modernisation of single or two family buildings built by the building codes that were active before year 1993 in order to achieve energy efficiency class C and reduce energy consumption not less than 20 %.	2012	62 projects	293 359
<b>Total for year 2012</b>			<b>8 871 934</b>

#### 4.2.1.4 The Covenant of Mayors

The Covenant of Mayors is the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and use of renewable energy sources on their territories. By their commitment, Covenant signatories aim to meet and exceed the European Union 20 % CO<sub>2</sub> reduction objective by 2020. As of 1 November 2013, 14 municipalities (out of a total of 60 municipalities in Lithuania) have signed the Covenant.

Each Signatory evaluates the direct and indirect (due to electricity consumption) GHG emissions that occurred on the territory that falls under the authority of the Signatory (the municipalities, in case of Lithuania) to establish a baseline. Generally most of the activities that fall under the energy sector are covered and only CO<sub>2</sub> emissions are reported. In some Lithuanian municipalities waste sector is covered by the baseline, thus CH<sub>4</sub> emissions are reported for this sector. The reporting does not cover any fuel combustion in the industry and for power generation in installations that participates in the EU ETS.

The Signatories are advised to evaluate the baseline for the year 1990, although this is not a mandatory requirement, so many Signatories report a base year to be as far in the past as the data is available (there may be no data available on the regional level). As for Lithuania data on regional level would be only available starting from year 2000-2003.

When the baseline is established, the Signatories develop an action plan for sustainable development where the measures aimed at GHG reduction and climate change awareness rising are set. In general, the Signatories develop such an action plan that the implementation of the measures results in reported GHG emissions levels in 2020 to be at least 20 % below the established baseline. As of 1 November 2013, 8 of 14 Signatories in Lithuania have submitted their action plans for sustainable development (available online on the Covenant of Mayors webpage <http://www.covenantofmayors.eu> in national language).

The Signatories report the progress (the GHG inventory for the reported activities and GHG) once every two years and review the action plans for sustainable development to be in line with the commitments.

#### **4.2.1.5 Monitoring of energy efficiency**

In order to establish harmonized method for calculation of impact of energy efficiency measures the Government of the Republic of Lithuania approved the Rules on the Monitoring of Efficient Use of Energy Resources and Energy (Official Gazette, 2008, No 83-3296; 2010, No 7-296) in 2008. Rules on the Monitoring of Efficient Use of Energy Resources and Energy stipulate the requirements of monitoring of energy efficiency measures implemented in buildings, technological processes, plants or transport facilities via the financial support of energy efficient programs undertaken by the national authorities. Assessment of the object indices, generalization and forecasting of monitoring carried out in the process of the object monitoring are used for determination of the saved quantities of energy consumed by the object, safeguarding of efficient use of energy resources and energy at the national scope, development of energy efficient programs and creation of increased energy efficiency mechanisms/tools. The measure itself does not influence the quantities of GHG emissions; however, it enables the assessment of impact of individual measures on the use of initial energy resources and at the same time – on the quantity of GHG emissions.

#### **4.2.1.6 Energy**

The Law on Energy (Official Gazette, 2002, No 56-2224, with later amendments) is the main law, setting the functions and obligations in the energy sector. Different energy sectors are regulated by the following sectoral laws: the Law on Electricity (Official Gazette, 2000, No 66-1984, with later amendments), the Law on Heat Sector (Official Gazette, 2003, No 51-2254, with later amendments), the Law on Natural Gas (Official Gazette, 2000, No 89-2743, with later amendments), the Law on Nuclear Energy (Official Gazette, 1996, No 119-2771, with later amendments), the Law on the Nuclear Power Plant (regulates implementation of the new NPP) (Official Gazette, 2007, No 76-3004, with later amendments), the Law on Construction (Official Gazette, 1996, No 32-788, with later amendments), the Law on Use of Renewable Energy Sources (Official Gazette, 2011, No 62-2936, with later amendments).

The National Energy Strategy, approved of by the Seimas of the Republic of Lithuania in 2007 (Official Gazette, 2007, No 11-430) is replaced 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 (Official Gazette, 2012, No 80-4149).

The following main programmes and plans are prepared, setting the particular measures for the implementation of energy sector targets: District Heating Development Guidelines (Official Gazette, 2008, No 82-3244), the Energy Efficiency Action Plan (Official Gazette, 2009, No 2-38), the National Renewable Energy Resources Development Strategy, adopted on 21 June 2010 by the Government Resolution No 789 of the Republic of Lithuania (Official Gazette, 2010, No 73 – 3725).

Cogeneration Development Plan (Official Gazette, 2008, No 130-5002) is not valid since 17 November 2010; however, improvement of energy efficiency through increase of cogeneration is among the targets set in the National Energy Independence Strategy.

Programme of Modernization of Multi-apartment Buildings was approved in 2004, with later amendments. In 2009 essential adjustments 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 formulation 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 (see more under Chapter 4.2.1.6.2).

Further particular objectives and measures listed in the above mentioned programmes are presented.

#### **4.2.1.6.1 Enhancement of the use of RES**

Previously listed strategies contain following targets for renewable energy:

- By 2010 7 % of all the electricity consumed in Lithuania shall be produced from RES (achieved).
- By 2020 energy from RES shall amount to 23 % in the total final energy balance.
- By 2020 not less than 20 % of electricity to be generated from renewable energy sources.
- In 2020 renewable energy sources will cover no less than 60 % of heat from district heating sector.
- RES (including biofuel) will make 20 % in the total primary energy supply by 2025.

Following measures are designated for achievement of the targets: subsidies from the EU Structural Funds, the Special Programme for Climate Change, feed-in tariffs, discount for the connection to the grid, excise duty exemption for electricity produced from RES and excise duty exemption for energy products with substances of biological origin. For biofuel the obligation for mixing conventional fuel with biofuel is set by the Law.

Evaluation of impact of RES policy on the GHG emissions included the evaluation of general impact of the overall targeted use of RES, thus no more detailed analysis by separate measures has been performed.

In general target No 2 in the list above (by 2020 energy from RES shall amount to 23 % in the total final energy balance) incorporates other renewable energy targets, for transport as well.

#### **4.2.1.6.2 Modernization of multi-apartment buildings**

Modernization of multi-apartment buildings is planned in all energy efficiency related programmes. It is expected to modernize at least 70 % of all multi-apartment buildings (24 000 units). It is supposed to reduce relative consumption of thermal energy per unit of the used dwelling area by up to 30%, compared with the year 2004. Savings targets for 2010 were planned 150 GWh (delayed), and 1700 GWh for 2016. Programme started in 2005 and its completion date is 2020.

Modernisation of multi-apartment buildings is subsidized via JESSICA Holding Fund. 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 had been built before 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 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, beneficiaries qualify for a "bonus" – an interest subsidy which equals to 15 % of loan principal. At the end of 2011 the Lithuanian Parliament introduced one more 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 Acquisition or Rent of housing and for the Modernization of multifamily buildings of the Republic of Lithuania amended on the 11th of October, 2011).

Recently an additional improvement of this program has been introduced. According to the amendments of the law on support for buying or renting dwellings given by the Government of the Republic of Lithuania adopted

on 17 January 2013, municipalities are more involved in the renovation process of multi-apartment buildings. The municipality will be able to appoint one responsible person who may take the loan for renovation on preferential conditions.

In 2012 JESSICA controlled funding loans were given to 44 multi-apartment buildings to implement their renovation projects. The cost of these renovations amounts totally 6.3 million EUR. Totally 78 credit agreements were signed for granting loan for 9.6 million EUR.

Additional financing for modernisation of multi-apartment buildings is provided via the Special Programme for Climate Change.

#### **4.2.1.6.3 Modernization of public buildings**

Modernization of public buildings is subsidized via different programs, which are listed below.

- 2007–2013 EU Structural Funds (for reduction of energy consumption in public buildings), Savings targets for 2010 – 30 GWh, and for 2016 – 100 GWh, the programme started in 2007 and its completion year is 2015;
- Programme of renovation and upgrading of libraries for 2003–2013; Saving targets for 2010 – 3 GWh, and for 2016 – 5 GWh, Programme started in 2003 and its completion year is 2013;
- Programme of modernization of cultural centres for 2007–2020; Saving targets for 2010 – 2 GWh, and for 2016 – 8 GWh, Programme started in 2007 and its completion year is 2020;
- Programme of modernization of museums for 2007–2015; Saving targets for 2010 – 4 GWh, and for 2016 – 14 GWh., Programme started in 2007 and its completion year is 2015;
- Special Programme for Climate Change.

#### **4.2.1.6.4 Increase of energy efficiency**

Modernization of multi-apartment and public buildings is the most voluminous measure aiming to increase the overall energy efficiency in Lithuania. Besides, there are other programmes also aimed at the increase of energy efficiency.

Implementation of Energy Efficiency Action plan (Official Gazette, 2007, No 76-3024, 2009, No 2-38) provides for final energy savings to amount to 1092 GWh/year in 2010 (726 GWh/year if early actions are excluded) and 4725 GWh/year in 2016. This target corresponds to the National Energy Independence Strategy – starting from 1 January 2008 to achieve 9 % of the final energy savings during the period of 9 years, compared with the final energy consumption level of 2005. This target also involves modernization of buildings.

The following measures are applied to increase energy efficiency:

- Voluntary agreements with energy companies. Planned energy savings in 2010 – 110 GWh, 2016 – 740 GWh. Starts in 2009 and ends in 2016;
- Lithuanian Environmental Investment Fund subsidies for measures reducing negative impact on the environment;
- Requirement to purchase energy-efficient goods and National Green Procurement Implementation Programme;
- Design requirements, Energy Star labelling for office equipment, Energy efficiency labelling for household appliances;
- Modernization and development of the existing district heating systems subsidized via EU Structural Funds.

On 25 October 2012, the the European Parliament and the Council adopted the Directive 2012/27/EU on energy efficiency amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. The most of its provisions will have to be implemented by the Member States by 5 June 2014.

This Directive establishes a common framework of measures for the promotion of energy efficiency within the Union in order to ensure the achievement of the Union's 2020 20 % headline target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date. It lays down rules designed to remove barriers in the energy market and overcome market failures that impede efficiency in the supply and use of energy, and provides for the establishment of indicative national energy efficiency targets for 2020. In line with this Directive the Lithuanian legal acts related to energy efficiency shall be revised and attention to energy efficiency measures shall increase.

New measures under the Directive 2012/27/EU that directly are related to the reduction of GHG emissions include:

- The **legal definition and quantification** of the **EU energy efficiency target** as the "Union's 2020 energy consumption of no more than 1 474 Mtoe primary energy or no more than 1 078 Mtoe of final energy". With the accession of Croatia the target was revised to "1 483 Mtoe primary energy or no more than 1 086 Mtoe of final energy".
- The obligation of each Member State to set an **indicative national energy efficiency target** in the form they prefer (e.g. primary/final savings, intensity, consumption) and, by 30 April 2013, to notify it together with its 'translation' in terms of an absolute level of primary energy consumption and final energy consumption in 2020. For Lithuania this target corresponds the earlier set national indicative targets set in the National Energy Independence Strategy (see Table 4.2.1.6.7)
- The obligation of Member States to **achieve certain amount of final energy savings over the obligation period** (1 January 2014 – 31 December 2020) by using energy efficiency obligations schemes or other targeted policy measures to drive energy efficiency improvement in households, industries and transport sectors. Lithuania has not yet set clear way for structuring the energy efficiency obligation scheme. However, this saved amount is a part of the above mentioned target; therefore the savings will not have additional impact on GHG.
- Public sector to lead the example by renovating 3% of buildings owned and occupied by the central governments starting from 1 January 2014 and to include energy efficiency requirements in public procurement, if certain conditions are met (e.g. cost-effectiveness, economic feasibility). However, this saved amount is a part of the above mentioned national target; therefore the savings will not have additional impact on GHG.
- Efficiency in energy generation: monitoring of efficiency levels of new energy generation capacities, national assessments for co-generation and district heating potential and measures for its uptake to be developed by 31 December 2015, including recovery of waste heat, demand side resources to be encouraged. However, Lithuania has not decided on actual measures to promote energy efficiency cogeneration (see Chapter 4.2.1.6.5). Accordingly, it is not possible to define, if the measures will be additional to the above mentioned national indicative target.

#### **4.2.1.6.5 Promotion of cogeneration**

Several targets were set to increase of CHP and energy efficiency, however after introduction of the National Energy Independence Strategy targets for increase the share of electricity from CHP is very unclear.

Natural gas based CHP has been constructed at the Lithuanian Power Plant as one of the measures to achieve the goals listed in the 5<sup>th</sup> National Communication. Lithuanian Power Plant was expected to be the main plant, replacing electricity production at the Ignalina NPP after its closure in 2009.

Previously Planned energy savings in the Energy Efficiency Action plan could amount to 0 GWh in 2010 and to 370 GWh in 2016. Those numbers were indicated in the 5<sup>th</sup> National Communication as well. However currently (in 2013) there are no fiscal incentives for promotion of CHP; therefore it is not clear if the targets will be reached. Accordingly this measure is not presented in the table 4.2.1.6.7 "Energy sector policy impact on GHG emissions" anymore.



#### 4.2.1.6.6 JI projects in energy sector

Most of the JI projects in Lithuania are related to the use of RES. As of October 2013, from 24 projects with Letters of Endorsement 16 are wind energy projects. Planned reduction of GHG emissions for 2008-2012 is 1 247 576 tCO<sub>2</sub>eq. According to the data retrieved from the Lithuanian Environmental Investment fund, there are 3 JI projects in industry, 1 LULUCF project and 2 suspended biofuel and wind energy projects.

All JI projects performed in the country are presented in Chapter 5.3.

#### 4.2.1.6.7 Energy sector policy impact on GHG emissions

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas in CO <sub>2</sub> eq Gg		
						2010	2015	2020
Enhancement of the use of RES*	<ul style="list-style-type: none"> <li>By 2010 7 % of all electricity consumed in Lithuania shall be produced from RES (achieved);</li> <li>By 2020 energy from RES shall amount to 23 % in total final energy balance;</li> <li>RES (including biofuels) will make 20% in total primary energy supply by 2025.</li> </ul>	Mainly CO <sub>2</sub>	Variety of measures	Under implementation	Ministries of Energy, Environment and Transport and Communications	310	479	747
Increase of Energy Efficiency	Starting from 1 January 2008 to achieve 9% final energy savings during the period of 9 years, compared with final energy consumption level of 2005 and Increasing energy efficiency 1,5 % compared to 2009 annually until 2020	Mainly CO <sub>2</sub>	Variety of measures	Under implementation	Ministries of Energy, Environment and Transport and Communications	145**	815***	1 496***
						455	1 294	2 243

\* Impact of biofuels usage not included; it is presented in Transport sector.

\*\* Actual energy savings of 780 GWh were reached in 2010.

\*\*\* Based on goals set in the National Energy Independence Strategy the energy savings for years 2015 and 2020 are projected to be 4 661 GWh and 8 548 GWh, respectively.

The main assumptions for emission reduction due to energy efficiency are that the emissions intensity of final energy consumption (including transportation and distribution losses and consumption in energy industries) according to the GHG NIR 2013 for 2010 data 0.0515 GgCO<sub>2</sub>eq/TJ, and for 2011 and later years 0.0486 GgCO<sub>2</sub>eq/TJ is applied (drawn from the GHG Inventory for 2011 data).

When evaluating GHG reduction due to increased share of renewables in the final energy consumption, the data on projected renewable energy consumption from the report "Policies & Measures and Projections of Greenhouse Gas Emissions in Lithuania" is used. The projected amounts of renewables are multiplied by the GHG intensity that was calculated as GHG emissions from Energy industries (1.A.1) ratio to aggregated activity data. Since the aggregated activity data is primary energy and projected consumption of renewables in final energy, the final energy consumption was recalculated to primary energy consumption applying conversion factors (a default 2.5 ratio is applied for electricity and 1.0 for other energy consumption [33]). The applied GHG intensity is 191.34 GgCO<sub>2</sub>eq/TWh (0.00532 GgCO<sub>2</sub>eq/TJ).

As the projections were made considering energy efficiency increasing measures, the reduction due to increment of share of renewables does not overlap.

#### **4.2.1.7 Transport**

The main legal acts and programs of the Republic of Lithuania regulating measures associated with climate change in the sector of transport include the National Communication Development Program for 2014-2022 (Official Gazette, 2013, No 136-6918) was approved in 18 December 2013 by the Resolution No 1253 of Government of the Republic of Lithuania and replaced Long-term (until 2025) Strategy of Lithuanian Transport System Development Long-term (until 2025) (in the 5<sup>th</sup> National Communication translated as Lithuanian Transport System Development Strategy), the Law on Environment Pollution Tax (Official Gazette, 1999, No 47-1469; 2002; No 13-474; with latter amendments), the Rules on Trading of Oil Products, Bio-fuel, Bio-oil and other Flammable Liquid Products in the Republic of Lithuania, Rules on Financing of Development of Bio-fuel Production (Official Gazette, 2009, No 153-6938; 2011, No 78-3848).

The Law on Biomass, Bio-fuel and Bio-oils (Official Gazette, 2004, No 28-870), is replaced by the Law on Use of Renewable Energy Sources (Official Gazette, 2011, No 62-2936, with later amendments).

##### **4.2.1.7.1 Stimulation of bio-fuel production and consumption**

It was stated in the 5<sup>th</sup> National Communication, that one of the planned objectives is the increased share of bio-fuel consumption in the transport sector to 5.75 % until 2010 and 15 % (450 toe) until 2025 as foreseen in the Long-term (until 2025) Strategy of Lithuanian Transport System Development. The goal for 2010 is implemented. The goal is implemented via mandatory requirement for fuel mix sold in the country.

Under the Law of Excise duty (Official gazette, 2010, No. 45-2174, with later amendments), zero tariff is set for the ethyl alcohol that is intended for the production of bio-ethyl-tret-butyl-ether.

Due to the preparation of the Rules on Financing of Development of Bio-fuel Production (Official Gazette, 2009, No 153-6938; 2011, No 78-3848), compensation of a part of price payable for the raw material, purchased to produce rape methyl (ethyl) ester (RME), takes place.

It is enforced by the Law on Environment Pollution Tax (Official Gazette, 1999, No 47-1469 and 2002, No 13-474) that physical and legal persons polluting through the use of transportation means/vehicles driven by bio-fuel of defined standard shall be subject to exemption from tax of environment pollution from mobile pollution sources upon submission of documentary proof on bio-fuel consumption.

##### **4.2.1.7.2 Stimulation of liquefied natural gas (LNG) consumption**

Subsidies from Special Programme for Climate Change for acquisition of LNG driven public busses were set. As a result 93 busses were acquired in 2011, in major Lithuanian cities.

Additionally, if the liquefied natural gas is used as a fuel in local public buses engines it is exempt from the excise tax (The amendment of Law on Excise duty, Art. 58<sup>1</sup> art. 1 part (Official gazette, 2010, Nr. 148-7560)).

##### **4.2.1.7.3 Improvement of communication infrastructure**

A variety of measures provided in the main legal acts regulating the development of transport sector and national and municipal master plans is projected for improvement of communication infrastructure. The following measures, such as how to improve the street network frames in the cities, modernize traffic control and management systems, develop modern tram networks in Vilnius and Klaipėda, extend contact networks in the larger cities with the developed trolleybus infrastructure, improve railway network infrastructure by reducing street/motorway loading with heavy vehicles thus minimization of pollution, are foreseen.

##### **4.2.1.7.4 Increased efficiency of fuel consumption**

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 (Official Gazette, 2011, No 23 -1110) implements and transposes to national legislation the European Parliament and Council 23 April 2009 Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (OJ 2009 L 120, p. 5).

It is foreseen in the National Green Procurement Implementation Program approved by the Government of the Republic of Lithuania (Official Gazette, 2007, No 90-3573) that passenger transportation companies acquiring passenger vehicles (cars, busses) and the related maintenance services shall apply environmental protection criteria based on the approved list.

The legal act 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 2011 (Official Gazette, 2000, No 108-3470, with later amendments) determine limitations for emissions of VOC from modern equipment of petrol storage, distribution and transportation.

#### 4.2.1.7.5 Transport sector policy impact on GHG emissions

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas in CO <sub>2</sub> eq. Gg		
						2010	2015	2020
Stimulation of bio-fuel production and consumption	Increase of the biofuel part in the total quantity of petrol and diesel fuel intended for the transport sector and available on the national market by 5,75 % till 2010 and by 15 % till 2025	Mainly CO <sub>2</sub>	Variety of measures	Under implementation	Ministries of Energy and Transport and Communications	215	278	423

The main assumptions: emissions ratio according to the latest GHG Inventory data 0.0705 GgCO<sub>2</sub>/TJ, amount of energy, replaced by biofuel, makes 3.048, 3.948 and 6.006 TJ (based on historical emissions data and projection in the report "Policies & Measures and Projections of Greenhouse Gas Emissions in Lithuania"), respectively in the years 2010, 2015 and 2025, the primary energy conversion factor 1.0.

### 4.2.1.8 Industry

#### 4.2.1.8.1 IPPC permits and Pollution permits

After adoption of 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) 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) will be expired on 7 January 2014. The Directive 2010/75/EU lays down rules on integrated prevention and control of pollution arising from industrial activities. It also lays down rules designed to prevent or, where that is not practicable, to reduce emissions into air, water and land and to prevent the generation of waste, in order to achieve a high level of protection of the environment taken as a whole.

The Directive 2010/75/EU is transposed into the national legislation by the following legal acts: The Law on Environmental Protection (Official Gazette, 1992, No 5 -75; 2013, No 55-2727) and the Order No D1-528 of 15 July 2013 of the Minister of Environment on the Approval of the Rules on the Issue, Replace and Repeal of Validity of the Integrated Pollution Prevention and Control Permit (Official Gazette, 2013, No 77-3901). The Law on Environmental Protection sets provisions on the issue, replace and repeal of IPPC permits and Pollution permits. In transitional period the Rules on the issuance, renewal and cancellation of IPPC permits (Official Gazette, 2002, No 85-3684, with later amendments) will be valid for the issue of permits for the activities not covered by the Directive 2010/75/EU before rules on issue Pollution permits come into force from 1 July 2014.

Industrial enterprises must apply for the IPPC permit for pollution prevention and cleaner technologies to ensure the quality of environment. Natural resources must be used rationally and sparingly, energy use must be efficient and 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.

Additionally, encourage the implementation of environmental management system in industrial enterprises. The companies having ISO 14001:2005 are not obliged to prepare the natural resources protection and waste reduction plan.

GHG emissions permits issued for the installations participating in the EU ETS are consistent part of the IPPC permits or upcoming Pollution permits.

#### **4.2.1.8.2 Practice of Best Available Techniques**

Until 7 January 2013, (Directive 2010/75/EU adopted on 6 January 2011 and had to be transposed into national legislation by Member States by 7 January 2013<sup>27</sup>) emission levels in the IPPC permit are set by the European Best Available Techniques (further – BAT) reference document (EU BREF) prepared for certain industrial activities. There is no requirement for the specific production methods or technology, but, regarding the operator's technical and economic feasibility, geographical location and local environmental conditions, the established emission levels must be compared and, to the extent possible, satisfy the emission levels stated in the EU BAT reference documents.

Operators must comply with the specific IPPC permit issuance requirements – the comparative estimation of operation methods and technology characteristics of a particular industrial device shall be made to find out whether it is compatible with the BAT. According to the EU BREF their summaries, annotations and the comparative parameters are set (e.g. air emissions, energy consumption per unit of output, etc.). Where the industrial device activity rates do not satisfy the BAT level, the operator must prepare environmental action plan, anticipating the changes to ensure a higher level of environmental protection.

After the 7 January 2013, when Directive 2010/75/EU came to force, IPPC conditions for certain installation shall be set using BAT conclusions as a reference document.

After the 7 January 2014, when Directive 2010/75/EU comes to force, IPPC conditions for certain installation shall be set using BAT conclusions as a reference document.

As it is set in the Directive 2010/75/EU emission limits shall be based on BAT without prescribing the use of any technique or specific technology. 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 a whole.

The BAT shall be presented in BAT reference documents that are drawn up for defined activities and describing, in particular, applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques. BAT conclusions is a document containing the parts of BAT reference document laying down the conclusions on best available techniques, their description, information to assess their applicability, the emission levels associated with the best available techniques, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures.

The competent authority may set stricter permit conditions than those achieved by the techniques set in the BAT conclusions. The rules for applying such strict conclusions shall be established by EU Member states. In case when an activity or a type of production process carried out within the installation is not covered by any of the BAT conclusions or where those conclusions do not address all the potential environmental effects of the activity or process the competent authority after prior consultations with the operator shall set the permit conditions on the basis of the BAT by giving special consideration to the criteria (criteria for determining BAT):

1. The use of low-waste technology;
2. The use of less hazardous substances;
3. The furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate;
4. Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale;
5. Technological advances and changes in scientific knowledge and understanding;
6. The nature, effects and volume of the emissions concerned;
7. The commissioning dates for new or existing installations;

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<sup>27</sup> <http://ec.europa.eu/environment/air/pollutants/stationary/>

8. The length of time needed to introduce the BAT;
9. The consumption and nature of raw materials (including water) used in the process and energy efficiency;
10. The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it;
11. The need to prevent accidents and to minimise the consequences for the environment;
12. Information published by public international organisations.

To assist the licensing authorities and companies to determine BAT, the European Commission organises an exchange of information between experts from the EU Member States, industry and environmental organisations. This work is co-ordinated by the European IPPC Bureau of the Institute for Prospective Technology Studies at the EU Joint Research Centre in Seville (Spain). This results in the adoption and publication by the Commission of the BAT conclusions and BAT Reference Documents (BREFs).

In industry, a significant share of the GHG emissions belongs to the CO<sub>2</sub> emissions from cement production. In Lithuania the only cement manufacturing company is SC "Akmenės Cementas" produces cement by using the so-called wet method. For this reason the GHG emissions are even 30 % higher than using the dry method in production processes. Therefore, the emissions could be significantly reduced by changing the technology. This would allow SC "Akmenės Cementas" to reduce GHG levels by 500 GgCO<sub>2</sub>eq/year [3]. The BAT implementing project in this company was finished on 16 October 2013 [35]. It was planned that the technology will be installed earlier, and emissions reduction in 2010 was indicated in the 5<sup>th</sup> National Communication, table "Industry sector policy impact on GHG emissions".

#### **4.2.1.8.3 Environmental management systems in industry**

Currently there are two types of accredited environmental management systems in the European Union: a certified environmental management system under the conditions provided in ISO 14001 "Environmental Management System. Requirements and guidelines for use" (hereinafter – ISO 14001) by the International Organization for Standardization and the system on the voluntary participation in the Community Eco-Management and Audit Scheme (EMAS) approved on 19 March 2001 by the European Parliament and Council Regulation 761/2001.

The National Program for the Implementation of Green Procurements (Official Gazette, 2007, No 90 -3573) approved in 2007 by the Lithuanian Government emphasizes the implementation of environmental management system as one of the main criteria for the green procurement.

Rules of IPPC permits issuance (Official Gazette, 2002, No 85-3684; 2005, No 103-3829) encourage the implementation of environmental management system in industrial enterprises as well. The companies having ISO 14001:2005 are not obliged to prepare the natural resources protection and waste reduction plan. However, as a new wording of the Rules of IPCC permits issuance, correcting and termination (Official Gazette, 2013, No 77-3901) entered into force on 19 July 2013 no exceptions on preparation of the natural resources protection and waste reduction plan are applied.

#### **4.2.1.8.4 JI projects in industry**

Three JI projects in chemical industry were implemented: SC „Achema“ N<sub>2</sub>O emissions reduction in UKL-7 units, SC „Achema“ N<sub>2</sub>O reduction in the GP unit and SC „Achema“ N<sub>2</sub>O reduction in the ninth UKL-7 unit. Planned reduction of GHG emissions in 2008-2012 from the first project amounted to 4 732 541 t CO<sub>2</sub>eq, from the second project – up to 2 603 560 t CO<sub>2</sub>eq and from the third – up to 89 900 t CO<sub>2</sub>eq. Actual reduction from these projects in the period of 2008-2012 was 7 643 017 t CO<sub>2</sub>eq.

All JI projects performed in the country are presented in Chapter 5.3.

#### **4.2.1.8.5 Limitation of emissions of volatile organic compounds**

Since 1st January 2004 limitation of emissions of VOC was established and proceeds due to the use of organic solvents in certain activities and installations (Official Gazette, 2003, No 15 – 634, with later amendments). 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 especially to his equipment to achieve an ultimate equivalent effect of VOC emission reduction.

#### 4.2.1.8.6 Fluorinated greenhouse gas emissions limitation

On 17 May 2006 the European Parliament and the Council approved Regulation (EC) No 842/2006 on certain fluorinated GHGs. The purpose of this regulation is to prevent emissions of fluorinated GHG included in the Kyoto Protocol and thereby reduce these emissions. Regulation No 842/2006 requires that the producers, importers and exporters of the fluorinated GHG have to report to the Commission, on an annual basis, the data of preceding calendar year. The same information should be sent to a relevant competent authority of the Member State. All fluorinated gas users, suppliers (individuals and firms importing fluorinated gas to Lithuania, exporting from Lithuania, buying or selling fluorinated gases in Lithuania market) and operators (individuals and firms, collecting, regenerating and decontaminating the fluorinated gas) must register as per order directed by the Ministry of Environment [3].

On 29 June 2007 the Ministers of Economy and Environment approved the order No D1-369/4-263 „On the enforcement of abatement of certain fluorinated greenhouse gas“, which allocates responsibilities to Lithuanian authorities according to the Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated GHGs. Rules on the issue of licences for the enterprises managing equipments containing F-gases are determined by the Order No D1-420 of 20 July 2009 of the Minister of Environment of the Republic of Lithuania (Official Gazette, 2009, No 88-3778.).

In December 2013 an agreement of the Council and the European Parliament was reached on the review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases based on the European Commission Proposal for a Regulation of the European Parliament and of the Council on fluorinated greenhouse gases.<sup>28</sup> The main aims of the new Regulation 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.

#### 4.2.1.8.7 Industry sector policy impact on GHG emissions

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas in CO <sub>2</sub> eq Gg		
						2010	2015	2020
BAT	Decrease GHG emissions due to change of cement production technology	CO <sub>2</sub>	Regulatory	Under implementation	Cement production company		500	500
JI projects	Decrease N <sub>2</sub> O emissions from production of nitrogen fertilizers and chemical products	N <sub>2</sub> O	Economical	Under implementation	Fertilizer production company	1 513*	1 467**	1 467**
						1 513	1 967	1 967

\* Actual reduction in 2010, according to information on <http://www.laaif.lt/index.php?437052674>

\*\* 1/5 of the planned GHG emissions reduction for 2008-2012, according to the data included in the PIN and published on the website [www.laaif.lt](http://www.laaif.lt)

<sup>28</sup> Source: European Commission < [http://ec.europa.eu/clima/policies/f-gas/index\\_en.htm](http://ec.europa.eu/clima/policies/f-gas/index_en.htm) >

#### **4.2.1.9 Agriculture**

The main legislation enforcing agricultural activities in the Republic of Lithuania is the Law on Agriculture and Rural Development (Official Gazette, 2008, No 81-3174), the Law on Land (Official Gazette, 2004, No 28-868), the Law on Fishery (Official Gazette, 2004, No 73-2527), the Law on Cattle Breeding (Official Gazette, 1998, No 110-3023), the Law on Plant Raising (Official Gazette, 2004, No 156-5687).

Substantial attention in the developed National Rural Development Strategy for 2007-2013 is paid to the protection of environment, minimization of impact of climate change, maintaining of biodiversity, development of rural businesses and the like. Based on the developed Rural Development Strategy, a Rural Development Program for 2007-2013 (in other documents translated as National Strategic Plan for 2007 – 2013 Rural Development) has been prepared and is currently under implementation.

A Rural Development Programme for 2014-2020 period is under development and the draft will be submitted to European Commission in January 2014. Programme for the new period will further enhance 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.

In the Lithuanian Rural Development Program for 2007-2013, which aims 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 (RDEAF) is 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. 7.8 billion LTL have been allocated for trend one, which covers the 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). Another 3.2 billion LTL have been allocated for the increase of economic value of forests. Trend two, which includes ecological farming (in 2012 a total of 2594 certified ecological farms accounted for 163.3 thousand ha and covered 5.7 % of agricultural land), land afforestation, and improvement of the condition of risky water bodies was assigned 2.8 billion LTL.

Number of biogas plants have received subsidies from the EU and currently are under construction [36].

Information on ecological farming, enforcement of environment protection requirements, direct payments for farming, termination of agricultural activities, strengthening of the carbon concentration function by the soil in agriculture, afforestation of low fertility soils and implementation of Directives 92/43/EEC and 79/409/EEC (Natura 2000) was submitted in the Lithuania's 5<sup>th</sup> National Communication under the UNFCCC, no essential changes occurred during reporting period.

##### **4.2.1.9.1 Implementation of the Strategy for the National Climate Change Management Policy**

The Governmental Resolution No 366 „On approving 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“ of 23 April 2013 put into force an Action Plan where measures for implementation of climate change policy are set. Measures that address agriculture sector are:

1. Promote implementation of investment projects on biogas collection and application for energy production in rural areas in order to reduce the methane release in livestock complexes.
2. Perform a research on sustainable use of nitrogen fertilizers and prepare recommendations.
3. Implement agri-environment programmes.
4. Develop selection and scientific research programme for new species and breeds of agricultural plant and livestock that are adaptive to climate change and are resistant to diseases.
5. Develop a system to forecast agricultural plant deceases and pests.

##### **4.2.1.9.2 Implementation of Nitrates Directive (91/676/EEC)**

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 groundwater 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. Sole 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.

By the Order No D1-490/3D-39 of Ministers of Environment and Agriculture (Official Gazette, 2012, No 66-3374) the Program for Minimization of Water Pollution Caused by Agriculture activities was adopted on 8 June 2012. The Order sets requirements pursuant to Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources:

1. The nitrogen input to soils per calendar year must not exceed 170 kg per hectare (fertilization with the application of manure or slurry of grazing animals).
2. Farms keeping less than 10 livestock units must store manure and slurry in the manner which would ensure the prevention of surface and groundwater.
3. Spreading manure and slurry from 15 November to 1 April (in the cold season), as well as on frozen, water-saturated, flooded or snow-covered ground, is forbidden.
4. Spreading manure and slurry from 15 June to 1 August is forbidden with the exception when it is done with the purpose of fertilizing the fallow, pastures or areas which are designated for growing winter crops.

The Order No D1-367/3D-342 of Ministers of Environment and Agriculture on environmental requirements for manure management adopted on 14 July 2005 (Official Gazette, 2005, No 92-3434, 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 over 10 livestock units are required to store manure and slurry in storage vessels which comply with environmental requirements.

Fulfillment of the advanced farming rules and recommendations may also be attributed to the implementation of nitrates directive since these describe the sustainable farming and optimization of the amounts of the substance penetrating into the soil (nitrogen compounds in particular).

#### 4.2.1.9.3 Agriculture sector policy impact on GHG emissions

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas in CO <sub>2</sub> eq. Gg		
						2010	2015	2020
Implementation of Nitrates Directive	Minimization of the groundwater pollution with nitrates and emission reduction	N <sub>2</sub> O	Regulatory	Under implementation	Ministry of Agriculture	700	1 200	1 700

#### 4.2.1.10 Forestry

The Law on Forests is the main legal act of the Republic of Lithuania regulating the activities associated with forest economy (Official Gazette, 2001, No 35-1161).

Policy of the Lithuanian forest economy and its implementation strategy (Official Gazette, 2002, No 93-4029) provide a long-term policy of the forest economy and its trends and strategic goals for its development until year 2020. One of the trends of the forest economy policy is the ecological trend, which foresees the safeguarding of sustainability of forest ecosystems, maintaining of biodiversity and improvement of healthiness of forests. Program on the increased afforestation of Lithuania and policy of the Lithuanian forest economy as well as strategy of its implementation includes a goal to increase the forest area by 3 % by the year 2020. In 2006 the forests in Lithuania covered 2 121 thousand ha of land; in other words they made 32.5 % of the area, which means that by 2020 the total area of forests in Lithuania should make approximately 2 317 thousand ha



or 196 thousand ha more. As of 1 January 2012 forest land area was 2 173 thousand ha, covering 33.3 % of the country's territory.

Following the data of national forest registration performed by the State Forest Management, annual self-growing (regeneration) of forest is reported on approximately 4–5 thousand ha of a non-forest land (mostly it is unused long-fallow lands, pastures, wetlands and peat-bogs that regenerate naturally), thus it is expected that by 2021 self-growing of forest may be found on approximately 70–90 thousand ha of an agricultural land. For this purpose artificial afforestation should take place on the area of approximately 100–120 thousand ha, or 6–7 thousand ha per year on average. Forests should contain 45 % of deciduous and 55 % of coniferous trees.

Until late 2012 the Strategy was supported with the Program on the increased afforestation of Lithuania (Official Gazette, 2003, No 1-10; 2004, No 188-7039; repealed since 14 October 2012). At present the supporting role for the Strategy is taken by the National Forest Area Expansion Program 2012-2020 approved by Resolution No 569 of the Government of the Republic of Lithuania of 23 May 2012 (Official Gazette, 2012, No 61-3058). 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, 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 vacant 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. The compensatory afforestation in all cases of changing forest land into any other land was established under this Program.

Information on restitution of forestry potential and implementation of preventive measures, payments for forest environment protection, payments due to limitations of economic activities in "Natura 2000" territories, the first afforestation of agricultural land and the first afforestation of non-agricultural and neglected land was submitted in the Lithuania's 5<sup>th</sup> National Communication under the UNFCCC, no essential changes occurred during the reporting period.

#### **4.2.1.10.1 Limitations of felling**

Forests shall be managed on the basis of the uninterrupted use principle so that lumber and other forest resources are continuously supplied, and the annual or periodic balance between the lumber growth and the scope of its use is maintained. Annual norm of the main forest felling in the state owned forests is approved by the Government. The defined annual norm of main forest felling must not be exceeded except for the cases of natural disasters when the volume of dry, wind-fallen, burnt out or otherwise damaged trees makes more than one fourth of the annual norm of forest felling. The general annual norm of all types' forest felling in the country must not exceed the annual tree growth.

Forest managers having over 500 hectares of forest must not exceed the annual norm of main forest felling. Other forest managers and owners without violations to forest felling rules may deviate from the annual forest felling norm but they must adhere to the decade forest felling norm. Under the Government Resolution No 1178 of 7 October 2007 on the approval of annual norm of main felling of state forests in 2009-2013, the approved annual norm of a state forest felling for 2009-2013 made 10 500 ha of equivalent clear cut area intended for felling up to 2 800 thousand hard meters of lumber. The amendment of the Government Resolution No 1178 was adopted on 17 October 2010 (the Government Resolution No 1621) stating that an additional norm for over-mature softwood forest stands shall be 1500 ha of equivalent clear cut area for felling up to 420 thousand hard meters of lumber for 2011-2013. Under the Government Resolution No 304 "On the approval of annual norm of main felling of state forests in 2014-2018" of 10 April 2013, the approved annual norm of the state forest felling for 2014-2018 shall be the area of 11 168 hectares of equivalent clear cut area for felling up to 3 145 thousand hard meters of lumber. In the following a description of measures foreseen in the Lithuanian Rural Development Program for 2007-2013 for the increase of forest value and quantity is given.

#### **4.2.1.10.2 Implementation of National Strategy for Climate Change Management Policy**

The Governmental Resolution No 366 "On approval of Inter-institutional Action Plan for implementation of Goals and Objectives for 2013-2020 of the Strategy for the National Climate Change Management Policy" of

23 April 2013 put into force an Action Plan where measures for implementation of climate change policy are set. Measures that address forestry sector are:

1. Afforestation of state-owned unused land passed to state forest enterprises in order to create economically valuable, biologically resistant forest applying the financial support for rural development.
2. Manage the state-owned forests passed to state forest enterprises and manage land plots formed by land-use documents for state afforestation.
3. Development and implementation of a system for wood biomass mobilisation from forest that is promoted by financial mechanisms.
4. Implementation of investment projects for forest felling waste removal for biomass production.
5. Promote non clear-cut felling in private-owned forests by implementation of promotional measures.
6. Ensure that the area of state-owned forest, where chemicals for forest health protection from deceases, pests and unwanted vegetation are used, does not exceed 3 500 ha per annum, with exception to necessary extermination of seedbeds of forest pests under the integrated forest health protection.
7. Prepare an inventory and recommendations for management and restoration of endangered or degraded forest ecosystems.

In the action plan it is set that the minimum annual removals by sink in LULUCF should be 3.7 million tCO<sub>2</sub>eq. The new forest area (from 2011 inclusive) should be 11 thousand ha for 2013 (forest coverage of 33.5 % of the country area); 13 thousand ha in 2014 (forest coverage of 33.6 % of the country area); 15 thousand ha in 2015 (forest coverage of 33.7 % of the country area); and 18 thousand in 2016 (forest coverage of 33.8 % of the country area).

#### 4.2.1.10.3 Forestry sector policy impact on GHG emissions

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas in CO <sub>2</sub> eq. Gg		
						2010	2015	2020
Afforestation of low fertility soils	By the year 2020 increase forest area of the state by 3 %	Mainly CO <sub>2</sub>	Variety of measures	Under implementation	Ministries of Environment and Agriculture	-	840	1 680

#### 4.2.1.11 Waste management

The main legal acts and programs of the Republic of Lithuania regulating waste management activities include the Law on Waste Management (Official Gazette, 1998, No 61-1726; 2002, No 72-3016), Law on Management of Packaging and Packaging Waste (Official Gazette, 2002, No 81-3503, with later amendments), the Law on Taxes for Environment Pollution (Official Gazette, 2002, No 13-474, with later amendments), the Rules on Waste Management (Official Gazette, 1999, No 63-2065, with later amendments) and the National Strategic Waste Management Plan (Official Gazette, 2007, No 122-5003, with later amendments). Management of wastewater and sludge is regulated by the Law on Potable Water Supply and Wastewater Handling (Official Gazette 2006, No 82-3261, with later amendments) and the Development strategy of Potable Water supply and wastewater handling 2008-2015 (Official Gazette, 2008, No 104-3975, with later amendments).

The National Strategic Waste Management Plan for 2007-2013 defines strategic waste management tasks taking into account Lithuanian environmental protection policy, planned development of economy and international obligations. It includes administrative and economic measures for implementation of waste treatment and safe disposal requirements. National Strategic Waste Management Plan for 2007-2013 includes minimization of quantities of the landfilled biodegradable and municipal waste. For implementation of this measure, waste sorting, recycling and recovery takes place.

The National Strategic Waste Management Plan includes the following targets, directly related with minimisation of GHG emissions in waste sector:

Landfilling of 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.

Until 2013 the quantity of landfilled municipal waste must not exceed 50 % of the annual amount of municipal waste produced inside the territory of municipality. The remaining quantity of municipal waste must be recycled or recovered in some other way. Waste containing energy/calorific value shall be used for energy generation.

In 2013 a draft of National Waste Management Plan for 2014-2020 was developed. Draft of National Waste Management Plan for 2014-2020 defines strategic goals of waste management, targets and tools for 2014-2020 period, administrative and economic measures etc.

The targets, directly related with minimisation of GHG emissions in waste sector remains the same as presented above, however more strict measures are set in order to reach those targets. For example, introduction of the Landfill tax since 2016, requirements for kitchen and food waste treatment, stop disposal of biodegradable waste and waste containing energy/calorific value in landfills till 2030. By 2020, the preparing for re-use and the recycling of waste materials such as 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. It is planned to construct 1 mechanical sorting plant in Klaipėda region and 8 mechanical sorting and biological treatment plants (4 biological treatment plants with biogas production in Alytus, Panevėžys, Telšiai and Utena regions, 1 biodegradable waste biodrying plant with preparation for incineration in Vilnius region, 4 composting plants in Kaunas, Marijampolė, Šiauliai and Tauragė regions) till the end of 2015. 9 projects are already signed.

Several new biogas plants have been constructed [36] in waste water treatment plants.

In 2013 first waste incineration plant in Lithuania has started operation.

#### 4.2.1.11.1 Waste sector policy impact on GHG emissions

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas in CO <sub>2</sub> eq Gg		
						2010	2015	2020
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 <sub>4</sub>	Regulatory	Under implementation	Ministries of Energy and Environment	251*	359*	538*
Biodegradable municipal waste handling	Collection and use of methane from all existing and new landfills	CH <sub>4</sub>	Regulatory	Under implementation	Ministries of Energy and Environment	940 <sup>[41]</sup>	1 440 <sup>[41]</sup>	1 940 <sup>[41]</sup>
						1 191	1 799	2 478

\*Only reduction of methane emissions due to the lowered amounts of landfilled biodegradable municipal waste was evaluated. Increase of CO<sub>2</sub> emissions due to increased waste incineration was not calculated.

## 4.2.2 Additional measures

### 4.2.2.1 Energy

In the National Energy Independence Strategy strategic goal to build a new regional nuclear power plant in Visaginas is set. However, an advisory referendum on the construction of a new nuclear power plant was held in Lithuania on 14 October 2012 and the proposal was rejected by 65% of voters. Therefore, currently it is unclear if the new nuclear plant will be constructed. More detailed information about the new NPP is available on [www.vae.lt](http://www.vae.lt).

In evaluating impact of additional measures to GHG emissions it is assumed that new NPP might start operation in 2020 and will decrease GHG emissions in Lithuania by 2 300 Gg CO<sub>2</sub>eq starting from 2020.

In 2013 waste incineration plant started to operate in Klaipėda. This is first such type plant in Lithuania. The plant capacity is 50 MW heat and 20 MW of electricity. It supplies heat to Klaipeda district heating system and electricity to national electricity grid. New waste incineration plant is planned in Vilnius. However, the procedures for construction and the legitimacy of permit for construction were under discussions in November 2013. It is estimated that waste incineration with energy recovery will have a capacity 330 kt/year and save up to 183.9 Gg CO<sub>2</sub>eq of GHG emissions annually starting from 2015.

### 4.2.2.2 Transport and other sectors

The railway electrification will have positive influence on GHG emissions reduction in the transport sector. Lithuania is going to invest approximately 300 million EUR for electrification of railway corridors by 2020. For a moment there is only 122 km electrified railway route Naujoji Vilnia-Kaunas (7 % of railways network). During 2012-2014 railway line on route Naujoji Vilnia – Kena – border with the Republic of Belarus will be electrified. Electrification of Vilnius bypass is planned to be completed during 2014-2018. The electrification of two more railway routes is planned to be carried out during 2016-2020. After successfully completing these projects, it is planned to have 459.3 km (26 % of railways network) of electrified railways in the Republic of Lithuania by 2020.

Lithuania is implementing Trans-European Transport Network (TEN-T) infrastructure project: Rail Baltica. Rail Baltica is a strategic and sustainable rail project linking five Member States of the EU - Poland, Lithuania, Latvia and Estonia - as well as Finland. In addition, it is the only rail connection between the three Baltic States themselves to Poland and the rest of the EU. The Rail Baltica project will create the possibility to shift the major freight transport in the regions from road to rail, which for the time being is transported towards Russia and then north by heavy trucks. The project is financed by the member states and by the European Union TEN-T budget. Lithuanian part of the project should be finished until 2015.

As indicated previously, emissions annual cap is determined for non-EU ETS sectors (agriculture, transport, industry and other sectors) according to 20 % and 30 % GHG emission reduction scenario by 2020. The difference of the emission limits for the separate sectors is considered to be as additional measures (Table 14).

**Table 14.** The difference of the emission caps under 20 and 30 % emission reduction scenarios, thous. tCO<sub>2</sub>eq

Sector	2014	2015	2016	2017	2018	2019	2020
Transport	243	291	339	388	437	486	534
Agriculture	255	305	356	407	458	508	560
Industry	122	146	171	195	219	245	269
Waste	79	94	110	126	141	157	173
Other sectors	100	119	139	159	179	199	219
<b>Total</b>	<b>797</b>	<b>956</b>	<b>1 116</b>	<b>1 275</b>	<b>1 435</b>	<b>1 594</b>	<b>1 754</b>

### 4.2.3 Implemented policy and measures

#### Energy

**Programme for the Promotion of the Production and Use of Biofuel in 2004-2010** (Official Gazette, 2004, No 133-4786, available in English on [http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc\\_l?p\\_id=265232](http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=265232))

**National Energy Efficiency Programme for 2006–2010.**

**EU emissions trading system for first 2005-2007 and second 2008-2012 trading periods**

In 2005-2007 103 installations were included in the EU ETS, and their GHG emissions amounted to 19 119 524 t CO<sub>2</sub>.

In 2008-2012 101 installations were included in the EU ETS, and their GHG emissions amounted to 29 608 875 t CO<sub>2</sub> (source: [http://ec.europa.eu/environment/climat/emission/pdf/fin\\_lt.xls](http://ec.europa.eu/environment/climat/emission/pdf/fin_lt.xls)).

From the year 2013 the third period for 2013-2020 has started.

**Modernization of multi-apartment buildings**

In order to demonstrate efficiency of modernization of multi-apartment buildings demonstration project in the field of energy saving (housing) was implemented in 1998 – 2003. 626 projects of building modernization were implemented, with an average of 20–30% of heat savings.

**Modernization of public buildings**

**EU structural assistance for 2004–2006** (energy efficiency in public buildings) targeted savings for 2010 of 40 GWh and for 2016 – 40 GWh. The programme is implemented; it was started in 2005 and ended in 2007.

**Programme for improvement of schools**, targeted savings for 2010 – 12 GWh, and for 2016 – 12 GWh. The programme has been implemented; it was started in 2002 and ended in 2005.

**Special programme „Implementation of energy savings projects“**, targeted savings for 2010 – 6 GWh, and for 2016 – 6 GWh. The programme has been implemented; it was started in 2004 and ended in 2008.

**Energy-savings programme for buildings of public bodies**, targeted savings for 2010 – 4 GWh, 2016 – 4 GWh. The programme has been implemented; it was started in 2003 and ended in 2005.

**2003, 2004, 2005, 2006, 2007, 2008 m. programmes of construction, reconstruction, repairs and material provision of municipal buildings** used for educational, cultural, health care, social and other purposes; targeted savings for 2010 – 5 GWh, and for 2016 – 5 GWh. 2003–2008 programmes have been implemented.

**Programme of renovation of university student halls**; Savings targets for 2010 – 6 GWh, and for 2016 – 6 GWh; Programme started in 2006 and ended in 2009;

**Programme of renovation and provision with teaching aids of general education schools and vocational education and training establishments** for 2006–2008; Savings targets for 2010 – 7 GWh, and for 2016 – 7 GWh, Programme started in 2006 and finished in 2008;

**Programme of renovation of imprisonment institutions and humanization of imprisonment conditions** for 2004–2009, Savings targets for 2010 – 5 GWh, and for 2016 – 5 GWh. Programme started in 2004 and finished in 2009;

**Programme of renovation and reconstruction of science and studies institutions for 2007–2009**; Savings targets for 2010 – 17 GWh, 2016 m. – 17 GWh, Programme started in 2007 and finished in 2009;

#### Transport

**The Program on Bio-fuel production and consumption for the period of 2004–2010** ensured that by 31 December 2010 bio-fuel makes no less than 5.75 % of the energy amount, calculating from the total quantity of petrol and diesel fuel intended for transport available on the national market.

**The Long-term (by 2025) Strategy of Lithuanian Transport System Development**, adopted on 5 June 2005 by the Resolution No 692 of the Government of the Republic of Lithuania (Official Gazette, 2005, No 79-2860)

### **4.3 Information on minimization of adverse effects**

Lithuania continues to finance the projects to minimize the adverse social, environmental and economic impacts of the developing countries. It continued to provide financing under the Fast Start Financing. During the period of 2010-2012, Lithuania contributed to the financing of developing countries both providing finance to mitigation and adaptation projects. Overall contribution from Lithuania to Fast Start Financing was around 64 000 USD. In addition to the contribution of 26 711.44 USD to the Energy Sector Management Assistance Programme (ESMAP) through the World Bank in 2010, Lithuania continued to provide financing to this fund, additionally contributing the amount of 30 000 USD and further amount of 31 173 USD, in the year 2011. 37 461.6 USD were transferred to the E5P fund financed through EBRD in 2011. In addition, 44 953.92 USD were allocated for the implementation of bilateral projects in the Eastern European Countries in the frame of Official Development Assistance in 2011. In 2012 amount of 37 965.07 USD was allocated to the ESMAP (for more information see Chapter 7).

In 2012 Lithuania has adopted the Strategy for the National Climate Change Management Policy by 2050 and an 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 these policy documents contributions are outlined for the assistance to the developing countries by the year 2020.

Lithuania is currently planning to increase its bilateral project assistance through ODA and additional contributions from its Special Programme for Climate Change. Climate change is set as one of the priorities areas for areas in the Development cooperation and democracy promotion guidelines for 2014 and will be approved by the Minister of Foreign affairs. The guidelines set the priorities for projects financed in developing countries.

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## 5 Projections of Greenhouse gas Emissions

### 5.1 Greenhouse gas emissions projections

Further in the tables projections with existing measures (WEM), without measures (WOM) and with additional measures (WAM) are presented. Methodology for projections is explained in Chapter 5.4.

**Table 15.** Projections without measures by sectors, Gg CO<sub>2</sub>eq

Sector / Year	1990	2010	2011	2015	2020	2025	2030
Energy (excluding transport)	25 185.15	8 648.89	7 338.74	10 040.75	11 453.27	13 310.62	15 167.97
Transport	7 559.80	4 778.90	4 481.71	5 552.60	5 944.98	6 404.69	6 797.18
Industrial Processes, including Solvent and Other Product Use	4 594.32	3 830.41	3 823.50	6 452.07	6 396.48	6 396.48	6 396.48
Agriculture	10 292.09	5 684.65	4 979.97	6 753.33	7 369.14	7 500.42	7 638.17
Waste	1 122.51	2 253.74	990.31	2 667.23	3 179.74	3 100.65	3 058.92
LULUCF	-4 286.58	-10 397.49	-10 483.49	-11 650.00	-12 000.00	-12 350.00	-12 500.00
Total, excluding LULUCF	48 753.87	25 196.60	21 614.23	31 465.98	34 343.62	36 712.87	39 058.72
Total	44 467.29	14 799.11	11 130.74	19 815.98	22 343.62	24 362.87	26 558.72

**Table 16.** Projections with existing measures by sectors, Gg CO<sub>2</sub>eq

Sector / Year	1990	2010	2011	2015	2020	2025	2030
Energy (excluding transport)	25 185.15	8 193.89	7 338.74	8 746.75	9 210.27	11 067.62	12 924.97
Transport	7 559.80	4 563.90	4 481.71	5 274.60	5 521.98	5 981.69	6 374.18
Industrial Processes, including Solvent and Other Product Use	4 594.32	2 317.41	3 823.50	4 485.07	4 429.48	4 429.48	4 429.48
Agriculture	10 292.09	4 984.65	4 979.97	5 553.33	5 669.14	5 800.42	5 938.17
Waste	1 122.51	1 062.74	990.31	868.23	701.74	622.65	580.92
LULUCF	-4 286.58	-10 397.49	-10 483.49	-11 650.00	-12 000.00	-12 350.00	-12 500.00
Total, excluding LULUCF	48 753.87	21 122.60	21 614.23	24 927.98	25 532.62	27 901.87	30 247.72
Total	44 467.29	10 725.11	11 130.74	13 277.98	13 532.62	15 551.87	17 747.72
International bunker fuels	706.06	593.34	622.55	662.93	733.82	804.71	875.60

**Table 17.** Projections with existing measures by gas, Gg CO<sub>2</sub>eq

Gas / Year	1990	2010	2011	2015	2020	2025	2030
CO <sub>2</sub> emissions	35 815.45	13 725.06	13 970.47	16 609.73	17 246.48	18 858.39	20 454.37
CH <sub>4</sub> emissions	5 749.67	3 177.09	3 045.57	3 135.94	3 031.50	3 314.83	3 595.36
N <sub>2</sub> O emissions	7 188.74	4 022.40	4 370.88	4 999.33	5 071.66	5 545.67	6 015.00
HFCs emissions	NA,NO	192.20	219.19	172.28	172.28	172.28	172.28
PFCs emissions	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF <sub>6</sub> emissions	NA,NO	5.85	8.12	10.70	10.70	10.70	10.70
Total, excluding LULUCF	48 753.87	21 122.60	21 614.23	24 927.98	25 532.62	27 901.87	30 247.72

**Table 18.** Projections with additional measures by sectors, Gg CO<sub>2</sub>eq

Sector / Year	1990	2010	2011	2015	2020	2025	2030
Energy (excluding transport)	25 185.15	8 193.89	7 338.74	8 627.75	6 691.27	5 997.74	6 390.23
Transport	7 559.80	4 563.90	4 481.71	4 983.60	4 987.98	5 981.69	6 374.18
Industrial Processes, including Solvent and Other Product Use	4 594.32	2 317.41	3 823.50	4 339.07	4 160.48	4 160.48	4 160.48
Agriculture	10 292.09	4 984.65	4 979.97	5 248.33	5 109.14	5 240.42	5 378.17
Waste	1 122.51	1 062.74	990.31	590.33	344.84	265.75	224.02
LULUCF	-4 286.58	-10 397.49	-10 483.49	-11 650.00	-12 000.00	-12 350.00	-12 500.00
Total, excluding LULUCF	48 753.87	21 122.60	21 614.23	23 789.08	21 293.72	21 646.09	22 527.08
Total	44 467.29	10 725.11	11 130.74	12 139.08	9 293.72	9 296.09	10 027.08

## 5.2 Summary of policy and measures impact on greenhouse gas emissions projections

Impact on GHG emissions by separate existing policies and measures is presented in Chapter 5.2. Existing measures are those measures that are already included in approved national legal acts or programmes.

In 2011, the European Commission launched three roadmaps to promote the discussion on the long-term framework of climate and energy policies in Europe: a) the "Roadmap for Moving to a Competitive Low Carbon Economy in 2050" (COM (2011) 112 final) b) the "Roadmap to a Single European Transport Area - Towards a Competitive and Resource Efficient Transport System" (COM (2011) 144 final) and c) the "Energy Roadmap 2050" (COM(2011) 885/2). The Roadmap for moving to a competitive low-carbon economy in 2050 is based on economic modelling and scenario analysis, which considers how the EU can move towards a low carbon economy. The cost-efficient pathway for achieving the 2050 target calls for domestic GHG reductions below 1990 levels of 25 % in 2020, 40 % in 2030 and 60 % in 2040.

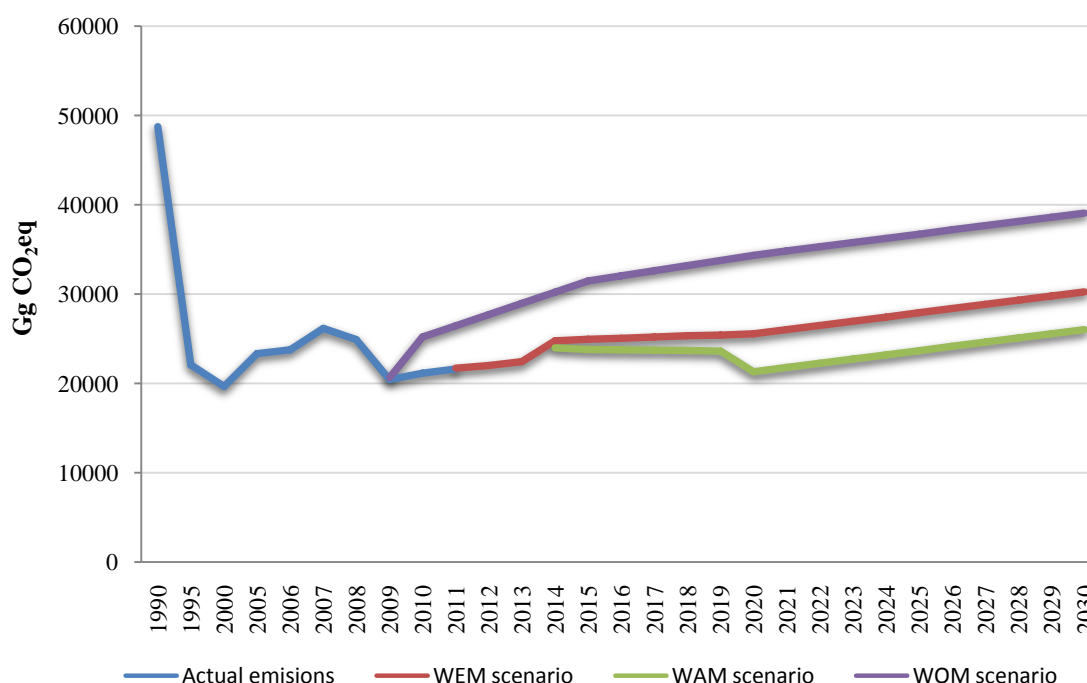
Though the EU level pathway is set, it is not transposed yet into national levels. Therefore it is not included in the summary of impact of particular measures, presented below.

**Table 19.** Summary of existing policy and measures impact on GHG, Gg CO<sub>2</sub>eq

Sector / Year	2010	2015	2020	2030
Energy (excluding transport)	666	1 294	2 243	2 243
Transport	215	278	423	423
Industrial Processes, including Solvent and Other Product Use	1 513	1 967	1 967	1 967
Agriculture	700	1 200	1 700	1 700
Waste	1 191	1 799	2 478	2 478
LULUCF	0	840	1 680	1 680
Total, excluding LULUCF	4 285	6 538	8 811	8 811
Total, including LULUCF	4 285	7 378	10 491	10 491

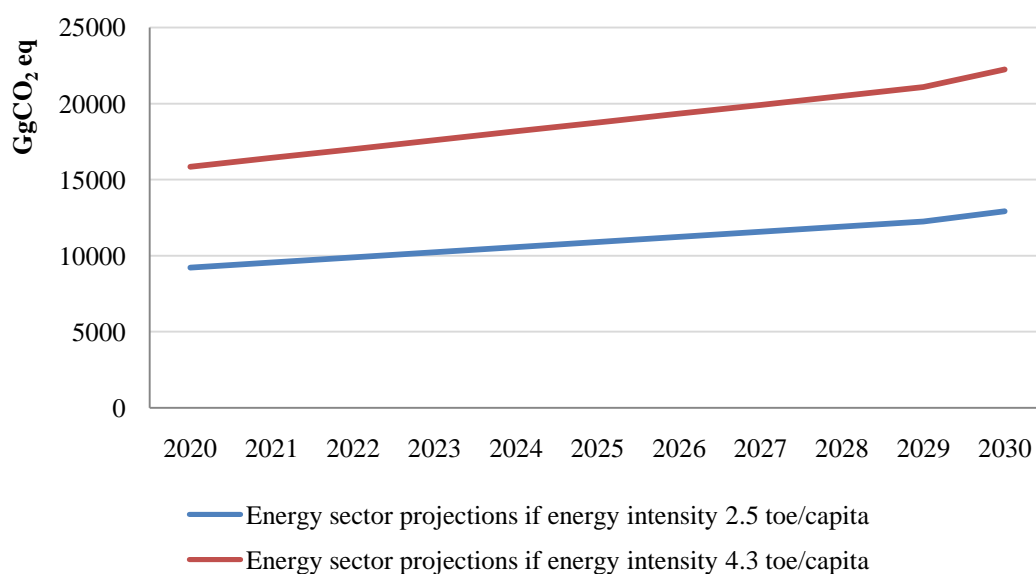
**Table 20.** Summary of additional policy and measures impact on GHG, Gg CO<sub>2</sub>eq

Sector / Year	2014	2015	2020	2030
Energy (excluding transport)	100	119	2 519	2 519
Transport	243	291	534	534
Industrial Processes, including Solvent and Other Product Use	122	146	269	269
Agriculture	255	305	560	560
Waste	79	278	357	357
Total, excluding LULUCF	799	1 139	4 239	4 239

**Fig. 40** GHG emissions projections 1990-2030, GgCO<sub>2</sub>eq

As presented above the Roadmap for moving to a competitive low-carbon economy in 2050 sets the cost-efficient pathway for achieving the 2050 target. The Energy Roadmap 2050 clearly indicates that increase of energy efficiency will be between the main measures for GHG emission reduction. Though Lithuania is seen as

a country with potential for increase of energy efficiency, it also has particularly low per capita energy consumption – less than 2.5 toe/capita – compared with the EU-28 average of 4.3 toe/capita. While making projections until 2030 it was assumed, that energy efficiency measures will compensate increase of energy consumption due to changing habits or growing economy. However, it might occur, that energy efficiency measures will be introduced slower than the growth of energy consumption. Therefore, energy sector GHG emissions sensitivity analysis on energy consumption intensity was performed, taking the EU-28 average energy intensity of 4.3 toe/capita as a maximum point and 2.5 toe/capita as a minimum point.



**Fig. 41** GHG emissions projections of energy sector sensitivity to energy consumption intensity changes for 2020-2030, GgCO<sub>2</sub> eq

### 5.3 In addition to Articles 6, 12 and 17 of the Kyoto Protocol

Law on Financial Instruments for Climate Change Management adopted on 7 July 2009 provided legal conditions for the Lithuanian institutions/authorities for sale of the Assigned Amount Units. It is also set by the law, that all income from the sale of Assigned Amount Units shall be addressed to financing of GHG emissions reduction projects.

On 25 June of the 2013 there were 147 142 903 AAUs and 3 497 359 ERUs and 785 732 CER in the Lithuania's national holding accounts. In the retirement account were 19519 889 AAUs, 1 810 374 ERUs and 2 562 399 CERs.

There were no AAUs issued on the basis of the assigned amount pursuant to Article 3, paragraphs 7 and 8. During the year 2012 there were 2 346 649 ERUs converted from AAUs.

3 263 364 AAUs, 1 667 611 ERUs and 785 732 CERs were surrendered by Lithuania's operators and retired to Lithuania's national retirement account for the GHG emissions in 2012.

#### 5.3.1 Joint Implementation projects

Lithuania participates as a host country in JI projects. From 2008 until 2012 25 JI projects were implemented in Lithuania [6].

Most of the JI projects were projects of wind power plant parks, 3 were related to biofuels production, 1 was related to waste gas from oil extraction used for motor gas production and electricity production, 1 is Lapes landfill biogas use for heat and electricity production, 3 projects were related to N<sub>2</sub>O emissions reduction at AB "Achema" plant and 1 project was related to afforestation. Elaborations of the JI projects related to biofuels

production, waste gas from oil extracton, and one project on wind energy were suspended. One project on afforestation hasn't received a Letter of Endorsement.

All JI projects were implemented reduced by 8 531 314 tCO<sub>2</sub>eq for 2008-2012. GHG emission reduction due to the 3 projects of N<sub>2</sub>O emissions reduction in chemical industry amounts to 7 643 017 tCO<sub>2</sub>eq.

The Law on Energy from Renewable Energy Sources adopted in May 2011 addressed existing barriers for the use of renewable energy sources, connection to electricity grid and other, as a result in October 2013 a total of 94 wind power plants (or wind parks) were connected to the electricity grid. 73 wind power plants are of capacity equal or less than 250 kW (having a sum installed capacity of 16.69 MW), 5 wind power plants (or wind parks) have their capacity ranging from 250 kW to 2 MW (having a sum capacity of 21.52 MW), and 16 wind power plants (or wind parks) have their capacity above 2 MW (having a sum capacity of 256.33 MW).

Aiming to avoid doublecounting for JI projects, which influence the reduction of GHG emissions in installations participating in the EU ETS (for example, wind power parks), the reserve was set – 1 292 186 ERU, from which 646 835 ERUs were allocated to the implemented JI projects, 31 120 ERUs were auctioned and the rest were cancelled. ERU's from the JI projects reserve were reserved for the JI projects having received Letter of Approval from the Ministry of Environment.

### **5.3.2 Clean Development Mechanism**

The Lithuanian governmental institutions or private companies do not participate in the Clean Development Mechanism projects at present.

## **5.4 Methodology for greenhouse gas emissions projections**

In order to strengthen GHG projections process and especially cooperation among different ministries, in the Strategy for the National Climate Change Management Policy until 2050 approved in 2012 and 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 approved in 2013, particular objectives and measures were set and resources foreseen:

1. Objective – ensure the monitoring and reporting of GHG emissions.

Measure – create a national information system that comprises GHG inventory, GHG projections, implementation of strategic documents, database on financing of climate change measures, report generation and informational system that is in line with the provisions for the EU GHG inventory reporting under the 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, (OJ L 165, 18.6.2013, p. 13).

2. Objective – ensure consistent projection of GHG emissions.

Measure – to compile databases that are necessary for projections of GHG emissions and removals, considering the requirements of the Regulation (EU) No 525/2013.

Measure – prepare projections of GHG emissions and removals.

GHG emissions projections were developed in the following steps:

1. First activity data projections were developed according to the information provided from the different ministries, responsible for the particular sectors. Activity data projections are performed including existing measures (e.g., energy consumption in 2020 was predicted already incalculating energy efficiency measures). Activity data was developed and divided into subsectors as close to the same activity data which was used for historical emissions calculations in the NIR and CRF, as possible. Then using the same emissions factors as in the NIR, emissions projections were calculated. Activity data, calculations and assumptions for emissions projections with existing measures are presented further in this chapter and in the report "Policies & Measures and Projections of Greenhouse Gas Emissions in Lithuania" [7].

2. Secondly, impact of the separate measures to GHG reduction was calculated. Methodology for calculation per particular measure and on interaction between the measures is presented in particular paragraphs of Chapter 4.2.1. Then sum of the GHG emissions projections with existing measures and result of emissions reduction by separate measures formed a scenario without measures. By the same principles emissions scenario with additional measures is evaluated. Methodology for calculation of the impact of additional measures is presented in Chapter 4.2.2.

Some weaknesses of projections are discussed further, following by introduction of planned improvements.

No specific models have been used for the projections of the GHG emissions or activity data. The calculations were performed in Microsoft Office Excel and based on IPCC guidelines.

Projections of activity data were made by different ministries, for example, projections of transport fuel was prepared by the Ministry of Transport and Communications, Ministry of Energy provided projections for energy demand, Ministry of Agriculture provided projections on number of farms. This way of GHG projections is the most accurate, as ministries, responsible for particular sector, are making projections in order to prepare their strategic plans and evaluate their sectors. However, fuel prices, the number of population, GDP rate and other national indicators the institutions use for their long term projections are not unified. Short term macroeconomic indexes (until 2016) are prepared by the Ministry of Finance ([http://www.finmin.lt/web/finmin/aktualus\\_duomenys/makroekonomika](http://www.finmin.lt/web/finmin/aktualus_duomenys/makroekonomika)).

#### 5.4.1 Main assumptions in Energy sector

Following main assumptions were used for projections of GHG emissions with existing measures.

- Energy efficiency targets will be achieved (see Chapter 4.2.1.6);
- Renewable energy will make a percentage in the final energy balance as set in the national legal acts (see Chapter 4.2.1.6);
- Emissions from energy subsector "1.B Fugitive emissions from fuels" would remain at the same level as in 2010;
- Emission factors, used to calculate GHG emissions from fuels projections are used the same as in the NIR 2013, and are described in the particular chapter of the NIR (see Chapter 3.2.);
- Lithuania has particularly low per capita energy consumption – less than 2.5 toe/capita – compared with the EU-28 average of 4.3 toe/capita. It is assumed, that implementation of energy efficiency measures will compensate the increase of energy consumption per capita, and in year 2030 energy consumption intensity will be 2.5 toe/capita.
- Population projection for 2030 is 3.079 mln.

Net calorific values (NCVs) used to convert fuel consumption in natural units into energy units are provided in the tables below.

**Table 21.** Conversion factors (Statistics Lithuania)

Conversion factors (Statistics Lithuania) Factor	TOE	GJ	Gcal	MWh
TOE	1.000	41.861	10.000	11.628
GJ	0.024	1.000	0.239	0.278
Gcal	0.100	4.186	1.000	1.163
MWh	0.086	3.600	0.860	1.000

**Table 22.** Specific net calorific values for different types of fuel (Statistics Lithuania)

Type of fuel	Ton	Ton of oil equivalent (TOE)	TJ/ton
Hard coal	1.0	0.600	0.02512
Coke	1.0	0.700	0.02930
Peat	1.0	0.280	0.01172

Type of fuel	Ton	Ton of oil equivalent (TOE)	TJ/ton
Peat briquettes	1.0	0.360	0.01500
Firewood (m3)	1.0	0.196	0.00820
Biogas (1000 m3)	1.0	0.480	0.02000
Natural gas (1000 m3)	1.0	0.800	0.03349
Liquefied petroleum gases	1.0	1.109	0.04642
Motor gasoline	1.0	1.070	0.04479
Gasoline type jet fuel	1.0	1.070	0.04479
Kerosene type jet fuel	1.0	1.031	0.04316
Transport diesel	1.0	1.029	0.04307
Heating and other gasoil	1.0	1.029	0.04307
Fuel oil	1.0	0.957	0.04006
Crude oil	1.0	1.022	0.04278
Bioethanol	1.0	0.645	0.02700
Biodiesel (methyl ester)	1.0	0.884	0.03700

**Table 23.** Summary of activity data for energy sector GHG emissions projection, PJ

Activity	Units	Historic values			Scenario 'with existing measures'	
		2000	2005	2010	2015	2020
<b>Energy sector</b>						
Total gross inland consumption		275.52	234.11	226.62	246.98	259.51
- Liquid Fuels (fossil)	Petajoule (PJ)	88.14	100.26	94.47	102.95	108.00
- Solid Fuels (fossil)	Petajoule (PJ)	4.08	8.42	8.58	9.35	10.00
- Gaseous Fuels	Petajoule (PJ)	63.20	78.45	82.01	89.38	94.00
- Biomass	Petajoule (PJ)	27.01	35.63	41.56	45.30	48.00
- Nuclear (IEA definition for energy calc.)	Petajoule (PJ)	93.09	11.36	0.00	0.00	0.00

### 5.4.2 Main assumptions in Transport sector

For the GHG accounting purposes, GHG emissions and fuel consumption in transport sector are distributed into the main 5 subsectors:

1. Civil aviation. This subsector includes jet and turboprop powered aircraft (turbine engine fleet) and piston engine aircraft from national aviation.
2. Road transportation. This subsector includes transportation on roads by vehicles with combustion engines: passenger cars, light duty vehicles, heavy duty vehicles and buses, mopeds and motorcycles.
3. Railways. This subsector includes railway transport operated by diesel locomotives.
4. Water-borne navigation. This subsector includes merchant ships, passenger ships, container ships, cargo ships, technical ships, tourism ships and other inland vessels only from inland navigation.
5. Other. This subsector includes transport of gases via pipelines, military activity and off-road transport.

Fuel consumption projections were prepared according to the same sectors. CO<sub>2</sub> emissions from road transportation are dominant in transport sector source category.

Following the main assumptions were used for projections of GHG emissions with existing measures.

- The Ministry of Transport and Communications of the Republic of Lithuania provided the required activity data for the estimation of projections in the road transport sector in 5 year intervals. The data

for specific year in these intervals was linearly interpolated according to the anticipated fuel consumption increase and the statistical data on fuel consumption in 2010

- Renewable energy will make a percentage in the final energy balance as set in the national legal acts (see Chapter 4.2.1.7)
- International bunker fuels (GHG emissions projections related to fuel sold to ships and aircraft engaged in international transport) are projected as linear trend of historical emissions. International bunker fuel emissions are not included in the national total emissions from the energy sector.
- Emission factors are the same as in the NIR2013, and are described in the chapter 3.4. of the NIR2013.
- According to the Strategy for the National Climate Change Management Policy for 2013 – 2050 it is stated that by 2050 all GHG emissions from water borne navigation subsector should be reduced by 40 % according to GHG emissions in 2005. Therefore, the GHG emission projections were based on the assumption that this will be achieved and the emissions from water borne navigation will reduce by 40 % by the year 2050 (from 16.9 Gg CO<sub>2</sub> eq. in 2005 to 10.1 Gg CO<sub>2</sub> eq. in 2050). The emissions from this subsector mainly follow the trend of gasoil consumption as it is the main fuel used in this subsector. Therefore the data between 2010 and 2050 was linearly interpolated according to the GHG emissions reduction aim mentioned above;

**Table 24.** Specific net calorific values (conversion factors)

Type of fuel	Tonne	Tonne of oil equivalent (TOE)	TJ/tonne
Gasoline type jet fuel	1.0	1.070	0.04479
Kerosene type jet fuel	1.0	1.031	0.04316

**Table 25.** Summary of activity data for transport sector GHG emissions projection

Activity	Units	Historic values			Scenario 'with existing measures'	
		2000	2005	2010	2015	2020
Transport sector						
Transport		47	60	63	72	76
Gasoline	Petajoule (PJ)	16.337	14.686	12.396	14	15
of which biofuels	Petajoule (PJ)	0.000	0.035	0.436	0.976	1.515
Diesel	Petajoule (PJ)	24.245	35.032	41.342	47.246	49.438
of which biofuels	Petajoule (PJ)	0.000	0.119	1.454	2.973	4.491
Jet Kerosene	Petajoule (PJ)	0.062	0.012	0.005	0.007	0.095
Other liquid fuels	Petajoule (PJ)	5.426	10.008	7.900	9.223	9.609
Gas (fossil)	Petajoule (PJ)	0.694	0.647	1.028	1.211	1.393

- It is assumed, that in order to secure safe primary need Lithuania would require stable supply of 0.9–1.5 billion m<sup>3</sup> of natural gas in 2020. Therefore the projections of GHG emissions in natural gas transportation sector were prepared as liner interpolation between actual GHG emissions in 2010 and assumed need in 2020.



Net calorific values (NCVs) used to convert fuel consumption in natural units into energy units are provided in Table 24.

### 5.4.3 Main assumptions in Industry sector

The main sources responsible for the highest GHG emissions in industrial processes sector are: nitric acid production (N<sub>2</sub>O); ammonia production (CO<sub>2</sub>) as well as cement and lime production (CO<sub>2</sub>).

Following main assumptions were used for projections of GHG emissions with existing measures:

- The projections of CO<sub>2</sub> emissions from cement and lime production were based on activity data provided by the SC "Akmenės cementas" company's authorities (see Table Table 26). The projections of CO<sub>2</sub> emissions from cement and lime production were performed by applying emission factor from the National GHG Inventory report of Lithuania submitted in 2012 – 0.5 t CO<sub>2</sub>/t for cement and 0.8 t CO<sub>2</sub>/t for lime production.
- The projection of N<sub>2</sub>O which is emitted during the nitric acid and ammonia production process was based on data provided by SC „Achema“- the single manufacturer in Lithuania (see Table 27). Emission factors are the same as in the NIR 2013, and are described in the particular chapters of the NIR (see NIR Chapter 3.4.).
- Activity data projections were developed only for the main emitters of the sector nitric acid production (N<sub>2</sub>O); ammonia production (CO<sub>2</sub>) as well as cement and lime production (CO<sub>2</sub>). Other sectors emissions as well emissions from Halocarbons and SF<sub>6</sub> is projected to be equal to 2010 (NIR2012).

**Table 26.** Projections of cement and lime production, kt

No	Production volume	2015	2020
1	Cement production, kt	1 650	1 650
2	Lime production, kt	80	80
1	Limestone, kt	2 001	2 001
2	Clay, kt	313	313
3	Sand, kt	77.2	77.2
4	Dross, kt	2.52	2.52
5	Plaster, kt	80	80

**Table 27.** Projections of nitric acid and ammonium production

No	Planned production	2015	2020
1	Ammonia production, kt	1 130	1 130
2	Natural gas, mln. m <sup>3</sup>	1 190	1 160
3	Nitrogen acid production, kt	1 400	1 400

### 5.4.4 Main assumptions in Agriculture sector

The main source of GHG emissions in agriculture sector in Lithuania includes these subsectors: enteric fermentation, manure management and agricultural soils. These subsectors results emissions of methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). Major sources of CH<sub>4</sub> are enteric fermentation and manure management; sources of N<sub>2</sub>O emissions include manure management and agricultural soils. N<sub>2</sub>O emissions from agricultural soils subsector includes direct N<sub>2</sub>O emissions (application of synthetic N fertilizers, animal manure applied to soils, biological nitrogen fixation of N-fixing crops, crop residues and cultivation of organic soils) and indirect N<sub>2</sub>O emissions (atmospheric deposition and nitrogen leaching and run-off). Indirect N<sub>2</sub>O emissions are closely related to circumstances that influences direct N<sub>2</sub>O emissions.

72% of agriculture sector CH<sub>4</sub> emissions resulted from enteric fermentation and 28% from manure management. N<sub>2</sub>O emissions contributed almost 82% of the total N<sub>2</sub>O emissions in 2010 (excl. LULUCF). The major portion of N<sub>2</sub>O emissions resulted from agricultural soils subsector – almost 92% of the total N<sub>2</sub>O emissions from agriculture sector. The rest of N<sub>2</sub>O emissions resulted from manure management (8%).

Following the main assumptions were used for projections of GHG emissions with existing measures:

- According to the Ministry of Agriculture there will be a small decrease in dairy cattle population: by 1.6% from 2010 to 2015 and by 2% from 2015 to 2020. Following these projections it is assumed that dairy cattle population will continue with a small decrease in population until 2030 by 0.4% annually.

**Table 28.** Summary of activity data for agriculture sector GHG emissions projection

Activity	Units	Historic values			Scenario 'with existing measures'	
		2000	2005	2010	2015	2020
<b>Agriculture sector</b>						
Total Cattle	1000 heads	748.3	800.3	707.678	859.2	892.6
Dairy cattle	1000 heads	438.4	416.5	354.7	349.0	342.0
Non-dairy cattle	1000 heads	309.9	383.8	353.0	510.2	550.6
sheep	1000 heads	11.5	29.21	55.75	NE	NE
swine	1000 heads	867.6	1 114.7	929.4	1 067.0	1 127.0
poultry	1000 heads	5 576.5	9 397	9 466	NE	NE
Fertilizer used (synthetic & manure)	kt Nitrogen	125.4	151.5	175.3	179.5	183.3
enteric fermentation - dairy cattle	t CO <sub>2</sub> eq/1000 heads	1 894.3	2 027.2	2 155.2	2 140.7	2 140.7
enteric fermentation - non-dairy cattle	t CO <sub>2</sub> eq/1000 heads	998.3	995.3	1 069.7	1 061.2	1 061.2
enteric fermentation - sheep	t CO <sub>2</sub> eq/1000 heads					
manure management - dairy cattle	t CO <sub>2</sub> eq/1000 heads	336.6	393.6	439.8	436.8	436.8
manure management - non-dairy cattle	t CO <sub>2</sub> eq/1000 heads	151.7	162.6	185.2	183.2	183.2
manure management - swine	t CO <sub>2</sub> eq/1000 heads	258.2	246.8	242.8	242.8	242.8

- It is projected that there will be a sharp increase in non-dairy cattle population by 44.5% during the period 2010-2015 and a relatively slight increase of 8% during the period 2015-2020. It is forecasted that price of beef and veal will be increasing until 2020. This kind of convergence is foreseen due to beef cattle increase in the structure of cattle population that improves quality of meat.
- The period 2010-2015 showed increase in swine population by 15% that is in average 3% annually. For the period 2015-2020 the projected increase in swine population was assumed to be 5.5% what is about 1% increase every year. Based on this assumption we followed 1% increase in swine population every year for the period 2020-2030.
- For calculation of projected CH<sub>4</sub> emissions from enteric fermentation of cattle and swine the average emission factor (kg/head/year) for the period 2007-2010 was used. This period was used because in 2007 the Agricultural Information and Rural Business Centre (AIRBC) register started to provide the activity data on cattle population, and emission factor for cattle and swine was recalculated using country specific values for gross energy (animal nutrition and other country specific parameters).
- To calculate CH<sub>4</sub> emissions from manure management the same share of AWMS as in 2010 was used, taking an average gross energy value for the period 2007-2010 and calculating emission factor. Projections of CH<sub>4</sub> emissions were calculated for cattle and swine as they represent almost 97% of all CH<sub>4</sub> emissions comprising from manure management subsector. CH<sub>4</sub> emissions from other livestock population were assumed to be the same as in 2010.
- To calculate N<sub>2</sub>O emissions from manure management only projected values of cattle and swine were used. Parameters and emissions from other livestock population is considered to be the same as in 2010 (NIR2012) as they represent only minority of emissions from AWMS systems (around 6%)

- Emission factors are the same as in the NIR2013, and are described in the particular chapters of the NIR (see NIR Chapter 6).

#### **5.4.5 Main assumptions in LULUCF sector**

Following sectors are the key categories within LULUCF sector: Forest Land remaining Forest Land, Land Converted to Forest Land, Cropland, Grassland and Wetland.

Following main assumptions were used for projections of GHG emissions with existing measures:

- Increase forest coverage by nearly 3 %, i.e. increase forest land area to 15 thou ha till 2015 and to 30 thou ha till 2020 and after 2020 forest land area will remain stable;
- Area of afforested land will increase in the period of 2013-2020 by nearly 3 thou ha annually, by afforesting abandoned and unsuitable for agricultural purposes land;
- Croplands, grasslands and wetlands area will remain stable and equal to the 2012 level.

#### **5.4.6 Main assumptions in Waste sector**

In Lithuania GHG from Waste Sector originate from the following sources: solid waste disposal on land including sewage sludge, wastewater handling (industrial and domestic/commercial wastewater), human sewage and waste incineration.

The following assumptions were used for projections of GHG emissions with existing measures:

- National targets set in the Strategic Waste Management Plan will be achieved (see Chapter 4.2.1.11);
- Municipal solid waste (MSW) generation in 2010 was 387 kg/capita/year, by 2020 it will reach 464 kg/capita/year and 600 kg/capita by 2050. Waste generation in a period 2011-2030 was interpolated using Monte Carlo simulation model;
- It is assumed that up to 35% (544 kt) of biodegradable waste will be composted by 2020;
- In the Lithuanian National GHG inventory Report 2012 emissions of sludge disposal are reported together with solid waste disposal on land category. Information on sludge management projections were provided by the Water Department of the Ministry of Environment. It is planned that 50% of sludge will be treated by 2015 and 90% by 2020, 2030. Projected annual sludge generation was evaluated using population projections and average sludge generation per person;
- Amount of CH<sub>4</sub> recovery from landfills and sewage sludge for the period 2012-2030 will be equal to year 2011 (4.9 Gg);
- Emissions from MSW and sewage sludge were calculated using First Order Decay (FOD) model provided in the 2006 IPCC Guidelines (see explanation of the model in Chapter 8.2.3 of the NIR 2013);
- According to the Water Department of the Ministry of Environment the percentage of Lithuanian population connected to centralised sewer networks will increase to 100 % in 2030. For earlier years percentage of population connected to centralised sewer networks was interpolated using Monte Carlo simulation model;
- Emissions from waste water were calculated using projected discharges of degradable organic matter provided by the Water Department of the Ministry of Environment. It is assumed that it will reach 75 Gg biochemical oxygen demand (BOD) by 2020 (see explanation of the methodology in Chapter 8.3.2. of the NIR 2013).

**Table 29.** Projected discharge of degradable organic matter

Year	2011	2015	2020
Gg BOD	71.7	73.0	75.0

**Table 30.** Summary of activity data for MSW GHG emissions projection

Activity	Suggested units	Historic values			Scenario 'with existing measures'	
		2000	2005	2010	2015	2020
<b>Waste sector</b>						
Municipal solid waste generation	kt	1197.35	1088.29	1287.14	1379.55	1475.52
The organic fraction (DOC) of municipal solid waste	%	0.22	0.22	0.18	0.22	0.22
Municipal solid waste disposed to landfills	%	1.00	1.00	1.00	0.41	0.37
Municipal solid waste disposed incinerated	%	0.001	0.003	0.001	0.24	0.22
Municipal solid waste disposed composted	%				0.26	0.32
Municipal solid waste disposed to landfills	kt	1197.35	1088.29	1287.14	561.41	539.95

#### 5.4.7 Analysis of the reasons for differences for greenhouse gas emissions projections in the 5<sup>th</sup> and 6<sup>th</sup> National Communications

Essential differences are seen in the projections for GHG emissions, especially in energy and LULUCF sectors. The main reason for the differences was the performed recalculation of the National GHG inventory due to improvements of activity data and emissions factors moving to the higher Tier methods, as a result of further described studies.

Recalculations resulted that actual total emissions for 2008 in 5<sup>th</sup> national communication were 24 390.72 Gg excluding LULUCF and 10 700.54 Gg including LULUCF, in the newest NIR actual total emissions for 2008 are 24 919.27 Gg and 16 483.76 Gg. Recalculations affected most of the sectors. Source-specific recalculations are presented in Chapter 10 RECALCULATIONS AND IMPROVEMENTS and in detail in relevant Chapters of the NIR (see Chapters 3.2.6.5 ; 3.2.7.5; 3.2.8.5; 3.3.3.5; 3.3.4.5; 3.3.5.5; 3.3.6.5; 3.4.1.5 and others) [4].

At the beginning forcalculation of GHG emissions from the fuel combustion were used the emission factors (EF) based on the study conducted in 1997, based on research data from the Lithuanian oil refinery and as a default IPCC values. In order to improve GHG calculation in energy sector in 2012 the study on national emission factors for energy sector was developed. Based on the study results the carbon content and other physical properties of fossil fuel consumed in the country was more accurately reflected. The new emission factors as study results were applied for GHG calculations in 2013 national inventory submission.

The other factor that resulted in difference of projections was the share of import of electricity and production in Lithuanian power plants. The GHG projections for 5<sup>th</sup> National Communication were performed in 2009. At that time the share of nuclear energy in the primary energy balance (year of final closure of Ignalina NPP) was 31.6 %.

In 2011, share of electricity generated by all Lithuanian power plants was about 42% in the balance of gross consumption and 58 % of electricity necessary to meet internal needs was covered by electricity import, mostly from Russia. While preparing projections for the 5<sup>th</sup> National Communication, it was expected what the natural gas power plant in Elektrenai will cover electricity demand.

Additionally, the country specific CO<sub>2</sub> EF for road transportation was developed in 2010 based on research data from the Lithuanian oil refinery.

Other important factor that resulted in differences in GHG emissions projections is projection of industry production. Emissions from industrial processes amount to 17.3 % of the total GHG emissions (excl. LULUCF) in 2011. The main categories are: ammonia production, nitric acid production and cement production. Ammonia production is the largest source of GHG emissions in industrial processes sector contributing 10.3 % to the total national CO<sub>2</sub> emissions (excl. LULUCF) in 2011. Nitric acid production is the single source of N<sub>2</sub>O emissions in industrial processes sector and accounts for 20 % in the total national N<sub>2</sub>O emissions (excl. LULUCF) in 2011. The GHG emissions in 2011 from industrial processes have increased by 67.6 % comparing with 2010. The increase of GHG emission from industrial processes in 2011 was mainly due to increased ammonia and nitric acid production.

Study on research and evaluation of methane producing capacity and nitrous oxide in Lithuanian manure management systems. The study was developed and results are presented in 2013 submission.

Study on research and analyses of methane emissions from wastewater and sludge. The study was required as data is not sufficient for the proper calculation of GHG emissions from waste sector. The study was completed in 2012 and results are applied in 2013 submission.

## **Literature**

1. The Law on Financial Instruments for Climate Change Management (Official Gazette, 2009, No 87-3662), [http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc\\_1?p\\_id=353938](http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_1?p_id=353938) (accession date: 2013-10-31).
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5. The standard electronic format (SEF) tables, submission 2013.
6. Lithuanian Environmental Investment Fund public information available on [www.laaif.lt](http://www.laaif.lt).
7. Ministry of Environment of the Republic of Lithuania. Policies & Measures and Projections of Greenhouse Gas Emissions in Lithuania, 2013.

## 6 Climate Change Impacts, Vulnerability Assessment, Adaptation Measures

### 6.1 Key developments

Since the 5<sup>th</sup> National Communication, more attention has been drawn to climate change adaptation at a national level. On 6 November 2012 the Parliament of the Republic of Lithuania adopted the Strategy for the National Climate Change Management Policy until 2050 by the Resolution No XI-2375 which has set a strategic goal of the Lithuanian adaptation to climate change policy - to reduce vulnerability of the natural ecosystems and national economy sectors by implementing measures that preserve and increase the resistance to climate change, and maintain beneficial conditions of social life and economic activity. The implementation of this goal will be assessed according to the achievement of the special adaptation objectives in the most vulnerable national economic sectors (agriculture, forestry and biodiversity conservation, water resource management, energy, transport, industry, public health, etc.).

The strategic goal shall be implemented according to these main directions:

1. *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 optimize the sectorial and inter-sectorial interaction of adaptation measures applicable for that region.
2. *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.
3. *The contribution of country-specific research to adaptation to climate change.* Mutually beneficial cooperation between governmental, municipal and financial institutions, funds, universities, with other countries and via 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.
4. *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 of the information collection, transmission and exchange between the parties.

In addition to this, on 23 April 2013 the Government of the Republic of Lithuania adopted 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 by the Resolution No 366. This plan foresees various measures in order to minimize an impact of climate change and assignments for the implementation of these measures. Also it sets competent authorities and ensures an inter-institutional cooperation, aiming at the implementation of the goals and objectives stated in the Strategy for the National Climate Change Management Policy.

An impact of the climate change, vulnerability assessment and adaptation measures in Lithuania are presented further in this chapter. Actions taken to cooperate with the developing countries on adaptation are presented in Chapter 7.

### 6.2 Impacts of climate change

Climate change has brought challenging and possibly continual alterations that have an impact on the geological, biological and ecological systems. The first consequences of climate change can already be seen worldwide and it is predicted that the intensity of these impacts will strengthen. These consequences will demand joint efforts on the management of various risks rising from the impact of climate change, including environmental, socio-economic and technological etc.

Global processes of climate change will have an effect on the Lithuanian climate as well. In accordance to the report prepared and presented by the European Environment Agency (EEA) [34], Lithuania lies in the Central and Eastern European part where increase in warm temperature extremes, water temperature, risk of forest fire and decrease in summer precipitation and economic value of forests are predicted.

In order to ensure a timely and effective reaction to climate change impacts depending on the location, a level of vulnerability and consequences, permanent observations and continuous researches are of great importance. Lithuanian systematic observations (monitoring) systems is described in the Chapter 8.3. The main research centres are the Centre of the Marine Research of the Ministry of Environment of the Republic of Lithuania, the Institute of Ecology of Nature Research Centre, the Lithuanian Geological Survey, Vilnius and Klaipėda Universities. The executed researches are described in the Chapter 8.2.

The researches related to the UNFCCC implementation issues are concentrated mostly on the Lithuanian climate analysis and prognosis. Climate change impact scenarios for different economy branches are prepared. However, there is not sufficient number of researches on climate change impact to ecosystems, biological diversity, agriculture and forestry or public health in Lithuania.

By the agreement with the Ministry of Environment, the Institute of Ecology of Vilnius University carried out the study "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). The study is still one of the most important studies, which complexly investigates the impact of climate change on ecosystems, biodiversity, water resources, agriculture and forestry and human health in Lithuania.

On a regional level one of the most significant projects in the scope of evaluation of climate change impacts is the BaltCICA project (called "BaltCICA: climate change impacts, costs and adaptation in the Baltic Sea Region"), which is designed to identify and focus on the most imminent problems that climate change is likely to cause in the Baltic Sea Region and prepare the most appropriate and cost-efficient strategies focusing on the spatial planning. The BaltCICA project was based on the results of two projects, the BSR Interreg IIIB projects ASTRA (Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region), and SEAREG (Sea Level Change Affecting the Spatial Development in the Baltic Sea Region) [36]. The BaltCICA project uses IPCC climate change scenarios (A1B, scenario of a more integrated world with balanced energy sources, and B1, scenario of an ecologically friendly integrated world) to discuss and develop adaptation measures with relevant planning authorities and stakeholders [1]. The results of this project are reviewed in Chapter 6.3. The BaltCICA Project is part-financed by the EU Baltic Sea Region Programme 2007 - 2013. The project duration is from February 2009 to January 2012 (the final version of the report is released in May 2012).

Lithuania actively takes part in the development and implementation of the Baltadapt Strategy and Action Plan for adaptation to climate change in the Baltic Sea Region under the Baltadapt project.

Climate change impact within separate subsectors is presented further. As no essential changes or improvements in already estimated impact was elaborated, the text similar to 5<sup>th</sup> National Communication is presented with some detalisation and amendments.

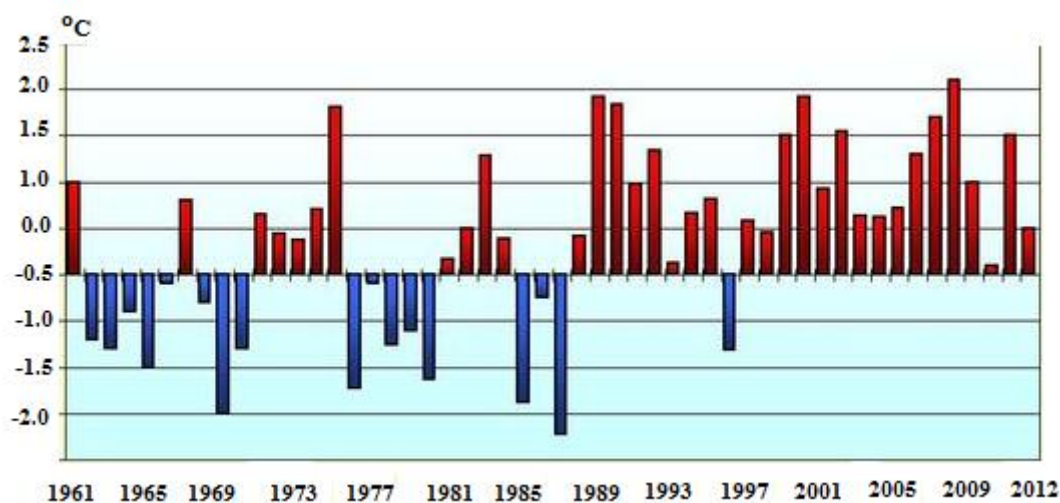
### **6.2.1 Climate**

Climate in Lithuania is considered as mid-cold, with snowy winter. There is precipitation in all seasons, especially during warm seasons. An average temperature of the coolest month is lower than -4 °C and does not exceed 20 °C in the warmest month. Not less than 4 months an average temperature exceeds 10 °C. Such climate is specific to the eastern part of Europe.

During the last five decades, an average air temperature in Lithuania has increased by 0.7-1.0 °C: in the period of 1991-2006 has grown by 0.7-0.9 °C, comparing with the period of 1961-1990. These facts show climate warming. Distinct tendencies of climate warming are in the western and northern parts of Lithuania. In the recent 20 years (1991-2011) the average annual temperature exceeded the limit of 6 °C in the entire territory of Lithuania, and reached 6.3–8.3 °C. The year 2008 was the warmest since 1961 and the average annual temperature was 8.3 °C, hence the deviation from the norm made 2.1 °C. Recently the warmest year registered was 2011 - the average annual temperature was 7.7 °C.



The most significant increase in temperature is registered in January, February, April, July and August (1.3-2.8 °C). There is an increasing number of extremely hot (30 °C and more) temperature cases and decreasing number of cold (-20 °C and less) temperature cases.



**Fig. 42** Deflection from standard of annual average air temperature [26]

The following changes of the main climate indicators are foreseen in Lithuania in the 21<sup>st</sup> century [2]:

- The air temperature will rise significantly. The changes will be more significant in the cold period (increase depending on the scenario can be 4-8 °C). Diurnal temperature variations will also grow.
- Most of the climate models project a small increase of precipitation amount per year. That is because of the intense precipitation amount in the cold period of a year; whereas the reduced precipitation is foreseen during the warm period, in the second half of summer in particular.
- Average speed of the wind will change very little. However, high fluctuations in the wind speed are related to more frequent recurrence of storms.
- The wind (storms) will get stronger in the territory, recurrence of big heavy rain-showers, a number of thunderstorm and hail events will rise in particular. The aridity will grow significantly, especially from July till September. Frequent invasions of short-term fierce winter cold into the territories not covered with snow are possible.
- Air humidity and precipitation amount will increase in the cold period of year; however, it will strongly decrease in the warm period. Significant negative changes are foreseen in the second half of summer and in the beginning of autumn.
- The snow cover and a number of days with snow cover will decrease (especially in the western part of Lithuania).

The change of other climate indicators is described in Chapter 2.4.

### 6.2.2 Impact on agriculture

The temperature and precipitation amounts as well as their regimes are of particular importance to crops of agricultural cultures. Data of the research pursued in Lithuania shows the dependency of phytomass resources, CO<sub>2</sub> removal, productivity of agricultural cultures, abundance of pests and spread of diseases upon climatic characteristics and changes in climate. Change of regime of temperature and precipitation amounts will continue to have an impact on crops of agricultural cultures, quality of production, will cause more funding being required for agriculture and its certain areas. A demand will exist to co-ordinate cultured species, to change and modify technologies for the growing of crops, to adapt crops, or to lay them out in the country territory according to its changeable climate [2].

- Due to climate getting warmer and the active temperature amounts of the vegetation period in the air and soil maintaining to grow, a period of vegetation will be longer. That fact will effect on plants' growing conditions and humidity stocks in soil.
- Due to warmer climate and weather extremes, GHG emissions from soil increase, a threat of decrease of organic matters appears. Accordingly, soil degradation may continue and be more rapid.
- As a result of winters getting warmer, losses due to shift of plants wintering conditions can appear. Current species are not adapted to climate change.
- The probability of elemental drought can grow, especially in the south and the southeast sandy ground of the country. To mitigate the negative impact of this nature, not only effective draining, but also effective irrigation systems are needed.
- Climate change and frequent extreme phenomenon (waves of heat, prolonged droughts and etc.) will have a direct impact on animal health, slow down their growth, decrease productivity and affect reproduction. There is a risk of bout of known and new diseases that can have serious consequences to stock-raising branch of agriculture. Also there may appear indirect impacts: change in feeding resources due to changed fertility in pasture and feeding crop and increased demand of food, biofuel, land, resistance of ecosystems, drought, lack of water, and decrease of grain production.
- Because of climatic extremes becoming stronger, losses experienced by the farmers will grow, which can decrease an interest in traditional agriculture among country people.

### **6.2.3 Impact on forest ecosystems**

Forest state is permanently observed in Lithuania since 1987 by Lithuanian University of Agriculture and Institute of Forest Management. Following main impacts are observed or could be predicted:

- Droughts of different intensity occur more frequently [4] leading to decreased soil humidity and consequently causing more intensive defoliation of trees. Frequent droughts negatively influence chemical composition of the soil and the amount of microorganisms resulting in poorer growth of living cover of soil, especially moss and increased amount of fallen trees accordingly. Due to geographical location, meteorological factors, structure of wood, forests in Lithuania are more combustible than an average level, so every year there is an increasing number of fires that are managed by organized fire protection system.
- During last two decades fir groves get weaker and drier, defoliation of trees gets bigger, productivity of forests changes, etc. This might be attributed to a climate warming impact.
- Increased the amount of storms and squalls, especially in the western part of Lithuania, is causing a greater amount of slash (trees fallen because of strong wind).
- The climate impact on genetic diversity stays very problematic. It is likely that the impact of climate warming on forest ecosystems is differenced, meaning that different species of trees will have different reactions to the same climate factor [2]. Some species may migrate via seed dispersal to cooler climates. Also the reaction may be opposite: species may remain in their territories, but warmer climate may speed-up a lifecycle of forests.
- Climate change, especially warmer climate, warmer winters, may predetermine a raise an activity of pests and massive diseases, which can cause a great harm to the 126 tree species currently found in the forests of Lithuania. Also new species may anchor in the territory of Lithuania, interacting with the present species. These problems will increase the forest protection costs.

### **6.2.4 Impact on biological diversity, ecosystems and their components**

As a result of the global warming, degradation of ecosystems and habitats, extinction or withdrawal of species from the territory of Lithuania, and the appearance of species from other environments will take place. Not all the new coming species will be desirable - new diseases and new pests, new changed connections in ecosystems, consequences of which can be difficult to forecast [2]. During last decades, seasonal dynamics of

abundance, migration time and direction of particular type of animal populations are noticeable and may be related to climate change.

The impact on ecosystems will come out through eutrofication, dryness, change of habitat, acceleration of natural succession of changes, loss of balance of the ecosystem inside communications (i.e. the ecosystem itself). The researches show that the global warming can influence some of the species of the northern part of Lithuania more than the direct anthropogenic effect.

Global climate change has impact to bird's species hatching in Lithuania. Dr. habil. M. Žalakevičius, Head of the Laboratory of Avian Ecology in the Institute of Ecology of Nature presents material in his articles, providing the impact of global climate change on various bird species: change of habitat, population state, and change of migration characteristics. One of the last articles presented together with the other scientists and published in 2012 is "The importance of potential impact of climate change on bird species composition in designing effective ways of bird protection and management: a case study from the eastern Baltic region" [37]. A list is presented, stating the species that are caused to north-east-east in the Baltic region. Climate is determined to be more important for the land and wet complex birds, and less - for the waterfowl and bog birds [2].

### **6.2.5 Impacts on groundwater regime and chemical composition, on hydrological and hydro physical indices of the Baltic Sea, the Curonian Lagoon, lakes and rivers**

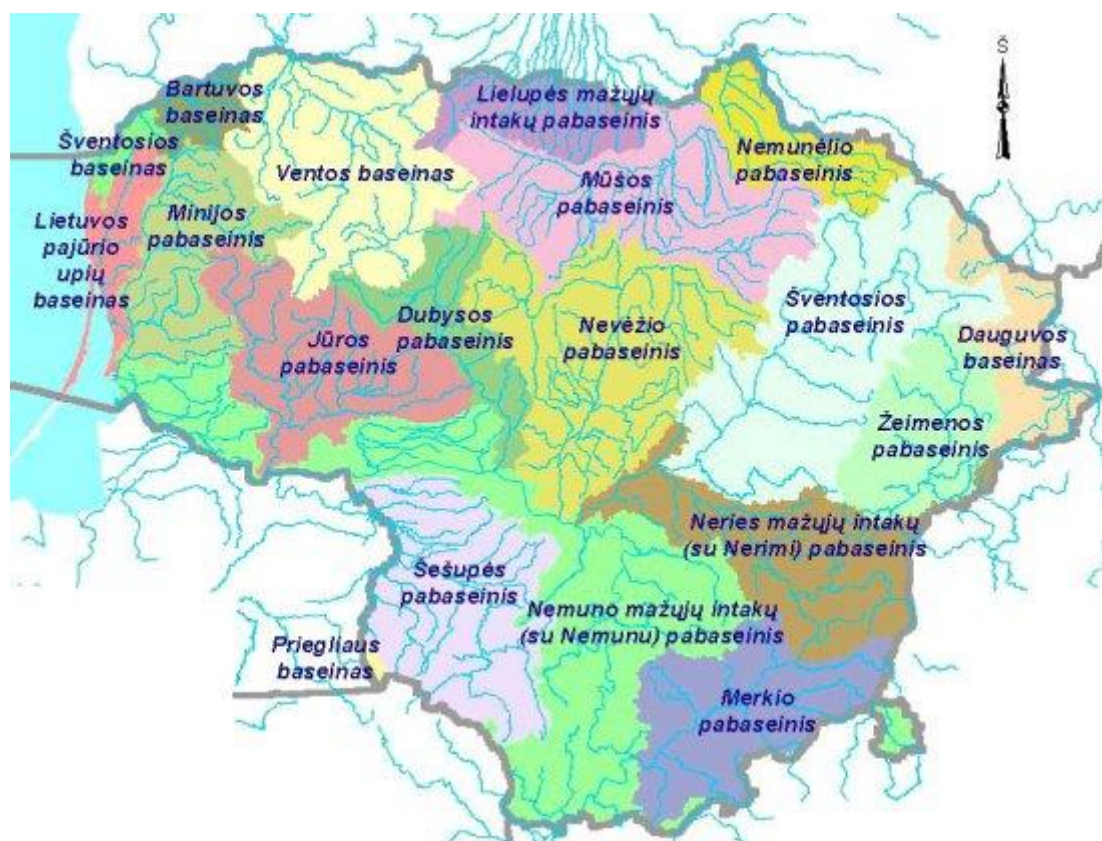
Growth of climate extreme points is forecasted. It will reveal itself by heavy showers, sudden thaws and frosts, long-lasting droughts and intense heats. It will have an impact on the water mass circulation between the Baltic Sea and the Curonian Lagoon, fluctuation in the quality of water stocks (especially surface) [3, 9].

Currently the biggest negative impact of the changing climate on the Lithuanian coast is due to the increase in the recurrence of strong winds, the rising temperature of air and water in winter, and also the decrease in the number of days with ice formation on shore and snow cover on coast, resulting from the previous two factors [7, 11, 12]. In addition, the negative impact on the coastline is also caused by waves and resulting water lift, water flows, fluctuation of sea level and human activity. Changing of the water level in the Baltic Sea would mostly affect the Lithuanian coast sections by Nida, Pervalka-Juodkrantė, Palanga-Butingė [2].

Because of the continual change of the coastline, Lithuania even suffers a loss of its territory. It is more and more frequently observed that a littoral plane on the mainland shore is being overflowed by the sea during the storms. Significant shore destruction has been taking place in the last 30 years [3, 4].

Rising sea level and more frequent winter storms will determine the more frequent floods on the sea-coast region; destruction of the Baltic sea shores and the degradation of dunes will grow stronger, average height of waves will keep growing bigger. Frequency and intensity of the invasions of sea water masses in to the Curonian Lagoon will change. Growing water mineralization of the Curonian Lagoon will have a straight impact on the fish resources in this basin [9, 16].

During a period of 2008-2010, plans for management of river basin areas were prepared by the Environmental Protection Agency (EPA). These plans have overviewed a climate change impact on surface and ground water.



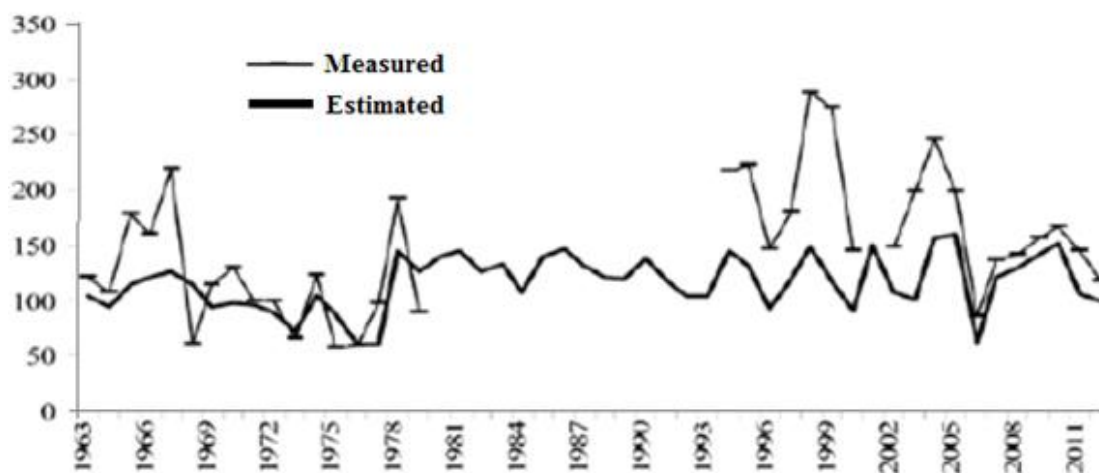
**Fig. 43** River basin areas in Lithuania

Nourishment of Nemunas, Venta, Lielupe and Dauguva rivers basins is significantly affected by the regime of precipitation, thus impact of changing hydrometeorological conditions is inevitable. During the last 50-80 years, significantly negative river outflows are identified in spring, summer and autumn, and inflows are identified in winter. It is estimated that maximum sums of daily precipitation increase, moreover, results of modeling show an increasing recurrence of heavy precipitation in future. Due to increased precipitation it is projected that general volume of river outflows will increase, also due to increased air temperature, shortened winter season, thinner blanket of snow and shorter duration of its persistence, decrease of spring flood and slip of dates of start and end are projected. In addition, increased inflows in winter are also affected by sudden and intense snow melting. It also has an impact on the duration of floods. As a result, river outflows and a probability of flood may increase in winter and decrease in spring and it will have a tendency of decrease after 2025. The results of the project "Management of the Niemen River basin with account of adaptation to climate change", where Vilnius University has participated in 2010, proved statistically significant increase in annual, winter and summer temperature and winter precipitation, decreased maximum spring flood discharge and the increased minimum winter flow in large part of territory and earlier peak of spring flood and the dates of minimum winter flow. Results of the future water balance modeling show that significant changes of the runoff regime in the Neman basin are likely to happen. The projected annual runoff will be lower in 2021-2050 than in 1961-2009 in the Belorussian part of the Neman basin, but the annual runoff in the Lithuanian part of the Neman basin is likely to increase. It was determined that the impact of climate change will be more important on runoff in the Neman River Basin on the territory of Belarus in comparison with forecasted impact of water use changes. [43] Research on the dependence of underground water resources upon climate change was done 1999-2003 by the Lithuanian Geology service during the project "Climate change impact upon underground water resources formation".

### 6.2.6 Impact on geological structures

The Lithuanian Geology service together with the Climate and water systems department of the Institute of Geology and Geography carries out monitoring of melted gypsum in the coffin area (chemical denudation) [3,

15]. The chemical denudation of gypsum has intensified in the eight decade of the last century, and his intensity stays big in the XXI century too.



**Fig. 44** Fluctuation of gypsum chemical denudation intensity ( $\text{m}^3/\text{km}^2$  per year) in Tatula river basin in 1963-2012 [32]<sup>29</sup>

In 2006 due to an especially little leakage, the chemical denudation of gypsum significantly fell down to  $85 \text{ m}^3/\text{km}^2$  and resembled the chemical denudation of the 7-8 decade. But in 2007 it was close to average again and reached  $136 \text{ m}^3/\text{km}^2$ . In 2008 it increased slightly and to  $142 \text{ m}^3/\text{km}^2$  [21]. In comparison with 2009, in 2010 gypsum denudation has increased from  $156$  to  $167 \text{ m}^3/\text{km}^2$ . This intensity is by 9 % lower than an average of 1994-2010, however by 44 % exceeds intensity during the period of 1963-1979. In 2012 measured gypsum denudation is the lowest since 2007 and is  $118 \text{ m}^3/\text{km}^2$  [32].

Gypsum melting is mostly predetermined by the water balance, which changes depending on the meteorological conditions, mostly on the amount of precipitation and the intensity of water evaporation. During last decades, due to climate change regime of groundwater has changed. Earlier on, reserves of groundwater had been filled only in spring and autumn. Recently, due to warmer winters and increased precipitation causing decreased water evaporation, water reserves are stored all year. This change evidently has its influence on the increased denudation of gypsum [21]. Therefore, a subsequent intensity of the gypsum denudation will depend on the results of climate change process.

### 6.2.7 Impact on public health

Human health is undoubtedly affected by environment, weather and climate, and changing climate brings a range of new challenges to public health. Interaction of climate change and human health is complex and profound and depends on the other factors that are present in the local territory and that are demography, condition of population health and health services available. Elderly, children, people with health issues, also socially isolated people are the most sensitive to these changes. Even though the impact of climate change is felt globally, a level of impacts caused by climate change varies in accordance with the region.

Climate change will have an impact on human health and well-being of the society and will cause costs related to direct and indirect impacts. Increased amount of illness cases and death numbers as a result of extreme air phenomena due to a greater impact of heat and cold waves and a strengthened ultraviolet radiation level, increased number of deaths, injuries and mental disorders due to the greater frequency and intensity of natural phenomena are recognized as direct impacts caused by climate change. In addition to this, spread of infectious diseases due to a reproduction of disease carriers, expansion of their activity; spread of infectious diseases due to the agents of diseases spreading by water and food; more illness cases and deaths due to the air pollution with chemical and biological materials, including a risk of spread of allergens, and due to inferiority of drinking water influenced by floods and changes of groundwater level; changes in the periods of pollen spread, changes in diseases spread by bloodsucking insects and ticks (tick-borne encephalitis and Lyme disease) in all the

<sup>29</sup> Translation: išmatuota - measured; apskaičiuota - estimated

territory of Lithuania; extreme phenomena (floods, wind storms, droughts, heat waves) - these are identified as indirect impacts of climate change. [23]

In Lithuania the most relevant phenomena of climate change consequences are a dynamics of dust seasonality, more frequent heat waves and increased number of diseases transferred by harvest-bugs. It is projected that, as a result of climate change, a quantity of natural aerial-allergens will increase: duration of plant vegetation will prolong, plant productivity will increase, procreation of fungus and its allergic impact will strengthen, aerial-allergens due to distant transfer will be active all year long. Heat waves may cause serious health problems, such as dehydration (loss of water) and hyponatremia (loss of sodium), also may canker breathing and blood circulation systems. However, it is not possible to unambiguously estimate what temperature menace to human organism. [23]

A problem of diseases spread by harvest-bugs is becoming more and more important, because they become active all year. Lithuania is in the territory which is attributed to zone of increased danger to sicken encephalitis, thus research and observations of this and the other risks remain of utmost importance in order to ensure preparedness and an appropriate and operative reaction to certain consequences.

### **6.2.8 Impact on individual sectors of economy**

**Tourism.** Tourism as a sector of economy is very important to Lithuania with its countryside tourism in particular. Climate change has caused a spread of blood sucking insects thus the increasing occurrence of the insects carried diseases (encephalitis and Lyme disease). Consequently, the situation may have an adverse impact on the countryside tourism business and change the focus of attraction. Shorter lasting and irregular snow cover in winter has a negative effect on winter sport, tourism and recreation in Lithuania. However summer season gets longer at the Baltic Sea summer resorts.

**Energy.** The warming climate brings lower demand for heating, but may increase a demand for cooling. Duration of the heating season gets shorter in towns and settlements, therefore fuel is saved and GHG emissions to the atmosphere decrease. Nevertheless, an increasing frequency of extreme phenomena (the increasing water level, more frequent hurricanes and storms) may have a negative impact on the infrastructure, especially on overhead electricity lines in coastal zone.

**Transport.** Rising water level caused by warming climate may have serious consequences on transport sector. Routes may be flooded during cold periods of year and it may cause inaccessibility of some locations. In addition, increased frequency of extreme phenomena may also have a negative impact on the communication services.

**Fishery.** Fish resources of the Curonian Lagoon undergo changes. The factors of water temperature and salinity in water ecosystems are critical to the fish stocks and are stimulated by climate change. Changes in spawning conditions may cause the inevitable loss of individual populations and fish stocks. In addition to this, due to migration of various sea organisms, disappearance of local species and spread of new comers is more likely to happen.

Climate change impacts have not been thoroughly investigated for these and other sectors.

## **6.3 Vulnerability assessment**

Climate change will affect all components of environment; ones are more vulnerable in comparison with others though. The Baltic Sea and its drainage basin constitute a specific eco-region with limited water exchange and a projected warming that is higher than the global mean [33]. The Strategy for the National Climate Change Management Policy has stressed the Baltic Sea Region as being one of the regions that is the most vulnerable to the impacts of climate change. No additional components vulnerable to the climate change or additional impact to already identified in the 5<sup>th</sup> National Communication.

Lithuania's **beaches, protective sand-hill and coastal dunes** as well as the lowest parts of Klaipeda and the port, ecosystems and the quality of the Curonian Lagoon and the Nemunas Delta are the areas the most vulnerable to climate change.

The most problematic foreshores of the Lithuanian coast were distinguished considering the trends of dynamics of the foreshores and upon discussing the factors and their possible changes influencing Lithuania's coastal development within the Baltic sea [2, 11, 12]. **Recreational area of Palanga.** It is one of the most problematic sections in the coastal zone of Lithuania. Increasing load on recreational area and intensified development of urbanized areas is observed on an annual basis. Rapid destruction of beaches and sand-dunes in the southern part of Palanga, the most liked spot by holidaymakers, is witnessed. Due to low drift at the coast and in the littoral zone, the foreshore is also sensitive to alterations of the climate change. It should be noted that the current condition of the coast in the northern part of Palanga between the rescue station and Kunigiškiai is good enough. However the coastal condition tends to worsen steadily in the southern part and it is also important to preserve the coastal condition in the northern part as much as possible. The decreased recreational space in the southern part should be substituted by its increase in the northern part. [38]

**Recreational area of Klaipeda.** The growing urbanization increases a number of visitors and holidaymakers in the recreational area of Klaipeda every year. A deep-sea port is foreseen to be built and it is assumed to reduce the attractiveness of the recreational area of Klaipeda. Furthermore, the deep-sea port may also worsen the morphologic state of the area. Besides, the condition of foreshore II Melnrage – Giruliai is strongly influenced by the consequences of climate change [38]. This influence may become even stronger in the future.

**Foreshore of Šventoji port – Latvia's border.** The increased recreational load and growing urbanization is observed in the southern part of the foreshore. However geodynamic trends are not satisfactory along the entire strip. The rebuilt port of Šventoji (start of construction is expected in 2015) will have a particularly negative impact on the strip. Moreover, the condition of the foreshore is also influenced by the consequences of climate change. This influence will become even stronger in the future.

Within the framework of the international project "Climate Change; Impact, Costs and Adaptation in the Baltic Sea Region (BaltCICA)" the Lithuanian coastline of the Baltic Sea in Karkle village has been stressed as vulnerable. It is only 1.4 km long, but complex geological processes are present. Besides the climate change driven factors the shoreline area of the Karkle is constantly exposed to increasing human impact (e.g. dredging in Klaipeda harbour) and the latter factor became an independent factor affecting shore-formation processes. Results of analysis indicate that coastline at the Karkle was developing in cyclic manner – erosion period is followed by accretion period. Different coastal sectors or individual profiles may vary considerably due to local geological conditions, morpho-lithological diversity and anthropogenic loads. It is most likely that due to climate change coastline at Karkle will retreat from 3.9 to 4.9 meters. [1]

Within the entire **coastline of the Curonian Lagoon** the Kopgalis foreshore is the most problematic. Although the recreational load is small here (mostly the visitors of the sea museum visit it), the present geodynamic state of the strip is poor and the increase of depletion process is possible. Due to significant extension of the piers of the port (as a result of the deep-sea port construction), a considerable increase in the threat to the foreshore is witnessed. It is intensified even more by a more frequent and stronger southwest wind, influenced by the climate change. The induced affluent gives occasion for intensive depletion of this foreshore. The worst is that the intensive leaching process of this strip makes an adverse influence on the condition of an intensive recreational area of the nearby Smiltynė I. The accumulative trends formerly and lastingly dominating in Smiltynė I have already been replaced by the coastal depletion.

Perennial dynamics trends of the foreshore show that the foreshore has depleted (annual decrease of reserves of drifts at Lithuania's coast, especially at the continental coastal zone is observed). The degradation processes in such strips are most likely to expand and the total length of the degraded foreshores may increase from 25 km (2008) to 32 km (2023) in fifteen years.

An **increase of climatic extremes** is being forecasted, which will reveal itself by heavy rain-showers, sudden thaw, long lasting draughts and extreme heat and will influence quality variations of water resources (especially of surface water). Such variations are considerably harder to be forecasted and controlled. **Rivers** of Lithuania will become particularly vulnerable in summer (quantity and quality will change). Rivers and streams in the Western Lithuania will respond with particular sensitivity (indicators of spring and autumn floods will change greatly if climate change scenarios come true). With climate becoming warmer the maximum summer temperature of **lakes** will rise and therefore the processes of eutrophication will accelerate. Naturally the perennial and often recurring short lasting extreme variations of **water-table**, which are stated by hydro geologists, especially in vegetation period, may cause certain changes of landscapes, flora and biodiversity, may influence forests, the yield of crops, etc. [2]

The impact of climate change on biodiversity was started to be investigated some years ago. With reference to the results of State environmental monitoring, state of biological diversity of natural eco-systems is changing, however, particular types of landscape and natural habitation experience great changes due to processes of renaturalization and elemental urbanization [39].

Eventually biological diversity will become a condition for health, high standard of living and employment. Biodiversity in Lithuania as well as in the entire Europe is supposed to decrease in the future. Qualitative and quantitative composition will change. A number of adventic species will inevitably increase and it will change the structure of residences. It is associated with climate change and subsequences of global anthropogenic activities. [2]

Biological diversity is the main factor, stimulating the productivity of natural systems, functional variety of environment, upholds its resistance, adaptability and ability to renew. On the other hand, biodiversity forms and maintains the landscape. The basis of this is a natural frame which consists of hydrological network and peculiarity of geomorphological surface with entire flora cover. It is natural and semi natural - forests, wetlands, grassland; seas – the Curonian Lagoon, the Baltic Sea and antropogenically influenced agricultural and urban ecosystems. Biodiversity as well as the landscape is sensitive to human activity. River valleys, the Lower Nemunas and the karst region of the Northern Lithuania are the most easily affected territories. Although biodiversity and changing landscape is an integral part of peculiarity of some regions, but life and human health quality, leisure activities and tourism, regional production and service supply depend on it. Aukštaitija National Park, for instance, overcomes with its flora variety any reserve of Lithuania.

A specific problem of the Northern Lithuania region remains topical. Due to anthropogenic activities and impact of climate change (see Chapter 6.2.6), karst processes got intensified. The conditions of territory use and natural protection of ground hydrosphere get worse. [15].

The change of regime of temperature and precipitation amounts will continue to impact crops of agricultural cultures, quality of production, will require more funding for agriculture and its certain areas. There will be a demand to co-ordinate the cultured species, to change and modify technologies for crops growing, to adapt crops or to lay out them in the country's territory according to its changeable climate. Climate change will influence forest productivity, especially in protected area forests will increase.

Sanitary state of Lithuanian forestry is sufficiently good at the moment. Since 2000, an area of cankered wood had a decreasing tendency; however, in future new sicknesses and pests may significantly and negatively affect forest eco-systems. Spread of new sicknesses and pests will demand more finance as an application of extraneous tools may be necessary in order to manage a pervasion and dominance of new species. The National Forestry Sector Development Programme for 2012–2020 approved on 23 May 2012 by the Resolution No 569 of the Government of the Republic of Lithuania provides for increasing the many-sided benefit brought by the forests taking into consideration a long duration of the growth of a forest and differences in the forms of property and their interaction, as well as ensuring the implementation of the principles of sustainable forest sector in all forests of the country. Thereby the Programme it is sought to increase forest coverage of the country up to 34.2 % by the year 2020 [39]. If the current speed of forestry expansion remains, it may be expected that a goal in 2020 will be exceeded [40]. Also with this Programme, it is foreseen to afforest 25.7 thousand ha of new forests, to increase oak trees occupation from 2 to 2.4 %, to increase a quantity of waste volumes of forest cuttings used for biofuel from 155 to 500 thousand m<sup>3</sup>. In addition, this Programme aims at ensuring rational use of Lithuanian forestry resources and increasing wood production. Until 2020, a proportion of forest cuttings and wood increment shall be not less than 50 % [42].

Tree defoliation is observed 25 years in Lithuania [40]. Since 2007 an average tree defoliation of all species has been increasing, however, since 2010 it has a decreasing tendency. Tree defoliation is strongly affected by reoccurring droughts as well as droughts influence combustibility, thus warming climate will have a significant influence on this process. If such conditions occur more frequently in Lithuania, a level of vulnerability of Lithuanian forestry may increase.

Climate warming has a direct and indirect impact on human health. The biggest expected threats for public health are posed by the risks associated with more frequent heat waves, elderly people and children. Risk and increased danger is also associated with diseases, caused by ticks and bloodsucking insects, the spread of new diseases and a growing number of sudden deaths. Unfortunately, more precise prognosis cannot be provided



due to the lack of research. Experience of other countries cannot always be applicable to a particular region and country. [2].

Water quality will be badly influenced by the change of ground water level and floods. It can cause the increase of diseases influenced by drinking water quality and epidemic risk.

Further spread of ticks that carry encephalitis and the Lyme disease and of bloodsucking insects is projected in Lithuania. Further number increase of bloodsucking insects, spread of diseases, transmitted by ticks in the territory, pests and disease outbreaks will influence human and public health and welfare. Time change of pollen spread will cause problems for prevention and treatment of allergies. Increase of extreme weather phenomena will cause new problems for the society. Reduced snow cover and its timing will influence winter sport and tourism in the country.

## **6.4 Adaptation measures**

Over the past years some work on coastal management has been implemented: Melnragė – Giruliai littoral zone and Palanga beaches were replenished with sand, the foreshore at Palanga Bridge was rebuilt and the sand-hill was strengthened. The work gave positive results however it should be continued. Considering this, the Coastal Zone Management Programme 2008-2013 was adopted on 31 December 2008 by the Order No D1-88 of the Minister of Environment of the Republic of Lithuania. Under this Programme, the goals are a reduction of coastal erosion, strengthening Lithuanian beaches, preservation of dune ridge. Supplement of dune with sand is of great importance in terms of dune security. As a result of this Programme, beaches were replenished with 300 thousand m<sup>3</sup> of sand and it is considered to be an obstruction for waves, even for storms.

On 28 July 2011, the Special Plan for Management of Continental Part of Coastal Zone was approved by the Order No D1-601 of the Minister of Environment of the Republic of Lithuania (Official Gazette, 2011, No 98-4628). It is one of the most important documents for the establishment of land use regime in the continental part of coastal zone. This Special plan is relevant to the land are of continental part of coastal zone - 70-850 m wide continental coastal zone from northern breakwater of the Klaipeda port to the State border with the Republic of Latvia - which includes dune ridge, cliff, beach and coastal area. The Special plan covers zones and measures for landscape and biological diversity, sets directions for engineering and recreational infrastructure and installation of ports and docks, sets land use and construction regulations. This is the main planning document which regulates the use and maintenance of continental part of coastal zone, tendencies for landscape formation, measures and informs the public about the State decisions on coastal zone protection, management and use [22]. Moreover, this plan stresses that coasts and beaches and rafting of ground will be monitored. In addition, a Programme Implementation of Solutions of Special Plan for Management of Continental Part of Coastal Zone was adopted on 2 September 2013 (Official Gazette, 2013, No 95-4730). It foresees a responsibility of institutions in the implementation of particular measures related to coastal management, protection of biological diversity, building of infrastructure and etc.

In the frame of the BaltCICA project, researchers made an assessment of consequences of climate change in the area - Klaipėda city - and presented several scenarios to the local stakeholders. First scenario workshop with local stakeholders took place in Klaipeda on 16 April 2010. The main goal of this workshop was to discuss main reasons of the floods in the southern part of Klaipeda and possible adaptation options. As a main output the list of adaptation measures selected for appraisal procedure was developed. At later stage the feasibility study of selected adaptation measures was prepared, presented and discussed with local stakeholders during the second workshop that took place in Klaipeda on 13 December 2010. The option that was finally chosen proposes to install flood protection embankments along the river. This selection was later approved by the City Council. [1]

Policies and measures of different sectors for climate change mitigation are presented in Chapter 4. In this chapter specific measures for adaptation to the climate change impact are presented. These measures are foreseen 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.

**Table 31.** Measures foreseen to ensure observation of climate change and adequate adaptation to changes

Measures	Period of implementation	Implementing authority
To increase capacities of observation network of Lithuanian Hydrometeorological Service - to equip meteorological radio locator in the eastern part of Lithuania for the prognosis of extreme phenomena	2013-2014	Ministry of Environment
To renew the measurement equipment of automatic agro meteorological stations network (43 stations)	2013-2016	Ministry of Environment
To renew the measurement equipment of solar ultraviolet radiation (3 stations)	2013-2016	Ministry of Environment
To analyse and systemize the material provided by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), to improve a climate database	2015	Ministry of Environment
To improve a monitoring of surface and groundwater	2015-2016	Lithuanian Hydrometeorological Service
To develop a satellite climatology	2013	Lithuanian Hydrometeorological Service
To prepare and present a new Review of Lithuanian regional climate description in accordance to standard climate norm in the period of 1961-1990 and 1980-2010	2013-2014	Lithuanian Hydrometeorological Service
To maintain and improve a system for agro meteorological observations	2013-2016	Lithuanian Hydrometeorological Service
To prepare a digital archive of Lithuanian climate monitoring data	2014-2016	Lithuanian Hydrometeorological Service
To create a system for forecasting diseases and pests of agricultural plants	2015	Ministry of Agriculture
To establish a model for flood forecasting, capacitating hydrological prognoses	2013	Lithuanian Hydrometeorological Service

**Table 32.** Measures to ensure the assessment of vulnerability of the landscape, ecosystems and biological diversity, water resources and the planning of adaptation options

Measures	Period of implementation	Implementing authority
To assess the vulnerability of climate change on various Lithuanian regions and identify the main threats from the climate change viewpoint	2016	Ministry of Environment
To evaluate the implementation of Coastal Zone Management Programme 2008-2013 and to present and approve Coastal Zone Management Programme 2014-2020	2013	Ministry of Environment
To coordinate the implementation of measures for coastal zone management that are foreseen in Coastal Zone Management Programme 2008-2013	2013	Ministry of Environment
To continue research on climate change impact on biological diversity and to prepare planning documents for climate change adaptation, especially protection of biological diversity, in different sectors, including protected areas, landscape, forestry, agriculture, fishery and etc.	2014	Ministry of Environment
To apply measures for decimation of massive reproduction focus of pests and diseases that have appeared due to climate change	2013-2015	Ministry of Environment
To prepare environmental management plans for territories that are important for protection of birds and their habitation and where climate change the most sensitive and vulnerable species and habitations of the EU are detected	2016	Ministry of Environment
To prepare a biological diversity protection programme and to foresee a complex integration of biological diversity protection aspects into the other sectors	2013	Ministry of Environment
To organize an implementation of national science programme "Lithuanian ecosystems: climate change and human impact" which was approved by the Minister of Education and Science on 19 June 2010 (Official Gazette, 2010, No 5-3849) and research projects, to approve the final report that includes the main findings	2013-2014	Research Council
To prepare technical regulation for building of bridges or roads through affluent territories	2013	Ministry of Transport
To prepare a special plan for State landscape management and to foresee measures for coping with climate change, to set measures in territories which may be potentially impacted by climate change	2013-2014	Ministry of Environment
To prepare a study on the protection and use of coastline of the Curonian Lagoon	2013-2014	Ministry of Environment
To prepare a recreational plan for beaches in continental part of coastal zone	2013	Ministry of Environment
To update management plans of rivers (Nemunas, Venta, Lielopė, Dauguva) basin area to assess an impact of climate change to water basins and, in accordance with assessment results, to foresee measures for climate change adaptation or mitigation	2015	Ministry of Environment
To prepare a study for financing management of surface wastewater in cities	2013	Ministry of Environment
To implement infrastructure and modernization projects of surface wastewater management	2016	Ministry of Environment
To prepare and present for adoption the maps of flood threats and flood risks, also flood risk management plans	2015	Environmental Protection Agency
To identify territories which may be flooded and to assess a potential negative impact on these territories	2013-2014	Environmental Protection Agency
To organize research to improve efficiency of reclamation systems on the condition of increased outflow	2015	Ministry of Agriculture

**Table 33.** Measures to reduce the impact of climate on energy, industry, transport, agricultural and forestry sectors

Measures	Period of implementation	Implementing authority
To prepare a science program or studies for various sectors (spatial planning, transport, energy, waste, industry, agriculture and etc.) for vulnerability assessment and adaptation options	2014-2016	Ministry of Environment
To implement the agrarian environment programmes	2013	Ministry of Agriculture
To prepare a research programme for investigation and selection of adaptive current and new species of flora and stock-raising	2013	Ministry of Agriculture
To prepare landscape guidelines for roads and railway and foresee measures for determination of spatial parameters	2013	Ministry of Environment
To apply incentivizing measures for non-smooth forest cuttings in private forests	2013-2016	Ministry of Environment
To foresee measures for integration of elements of close-to-nature forestry in forests of II-III types and age of forests which is differentiated in accordance to habitats	2014	Ministry of Environment
To control that chemical use in State forests would not exceed 3500 ha per year, except decimation of massive reproduction focus of pests	2013	Ministry of Environment
To prepare an inventory and recommendations due to management and restoration of endangered or degraded forest ecosystems	2016	Ministry of Environment

**Table 34.** Measures to reduce the impact of climate change on human health, to conduct research and to raise public awareness about adaptation to climate change

Measures	Period of implementation	Implementing authority
To foresee guidelines and measures on adaptation to negative impacts of climate change for public health in the Lithuanian health programme	2013	Ministry of Health
To prepare a study on identification of threats to public health and presentation of recommendations	2013	Ministry of Health
To prepare a national public health and heat prevention plan and implement on a municipality level	2014	Ministry of Health Municipalities
To prepare and approve a list of climate change and health indicators, a methodology for estimation of them and to perform a monitoring of these indicators	2014-2016	Ministry of Health
To improve a cooperation in climate change adaptation between Lithuanian health institutions and international organizations	2013-2016	Ministry of Health
To increase conveyance of residents and health care specialists about climate change threats to public health and to foresee climate change adaptation measures	2013-2016	Ministry of Health
To install a system for registration of people that aggrieved due to climate change	2015-2016	Ministry of Health
To establish a programme for prophylaxis of diseases (allergic and infectious) related to climate change	2014	Ministry of Health

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## **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 1 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.

The countries listed in Annex 1 of the UNFCCC supply information on the Government programs of collaboration in clean technology development, transfer of know-how and experience related to the climate change adaptation and mitigation activities. In October of 2009, at the European Council meeting seeking for the international agreement on GHG reduction targets after 2012, by the end of the first Kyoto commitment period 2008-2012, Lithuania undertook a commitment to provide financial assistance to the developing countries together with other 27 EU Member States. On 23 April 2013 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 in the period of 2013-2016 was adopted by the Government Resolution No 366. In the inter-institutional Action Plan a measure for 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 is foreseen in 2013 and onwards (up to the year 2016) by the Ministry of Environment.

In accordance with Article 10 (3) of Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for GHG emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 2003, p. 32), at least 50 % of the revenues generated from the auctioning of allowances shall be allocated not only for implementation of domestic measures for climate change mitigation and adaptation, but also to funding implementation of measures in developing countries.

In accordance with Article 10 of Law on Financial Instruments for Climate Change Management, a Special Programme for Climate Change is established for disbursement of funding for climate change management measures. The sources of financing of the Programme are the funds obtained from the transfer of assigned amount units, from the auctioning of allowances, the funds donated by natural and legal persons for implementation of the measures aimed at mitigation of climate change and others. The funds of the Programme are used for 1) at least 40 % for energy consumption and production efficiency enhancement processes: modernisation of multistore 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; 2) at least 40 % for promotion of the use of renewable energy resources, introduction of environment-friendly technologies, including efficient energy production by cogeneration; 3) implementation of 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; 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 of measures on climate change mitigation and adaptation effects as stipulated under legal acts of the European Union, the UNFCCC and the Kyoto Protocol in the territory of the Republic of Lithuania and third countries; 7) implementation of other measures of efficient management of climate change policy which, by means of State aid, would allow operators and other economic entities whose activities are not included in the EU ETS to

reduce the financial and economic burden of the commitments of GHG emissions reduction. Therefore, part of the revenues from this programme is dedicated to the implementation of mitigation and adaptation activities in the developing countries.

Pursuant to Article 16 of the European Parliament and the Council Regulation (EU) No 525/2013 on a mechanism for monitoring and reporting GHG emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC (OJ L 165, 18.6.2013, p.13), Lithuania has presented an information on financial support provided by Lithuania to developing countries in 2011-2012 which consisted of official information from the „Fast Start Finance” contributions, which was submitted to the Secretariat of the UNFCCC, for the year 2011 and 2012. No contributions through bilateral or regional channels were provided in 2012.

**Table 35.** Contribution through multilateral channels

Institution of programme	Contribution, USD	
	2011	2012
Multilateral institutions:		
1. World Bank	33 173	37 965.07
2. European Bank for Reconstruction and Development	37 461.6	
Total:	70 634.6	37 965.07
Multilateral scientific, technological and training programmes:		
1. Energy Sector Management Assistance Programme (ESMAP) financed through World Bank	33 173	37 965.07
2. The Eastern Europe Energy Efficiency and Environmental Partnership fund, financed through EBRD	37 461.6	
Total:	70 634.6	37 965.07

**Table 36.** Contribution (USD) through bilateral, regional and other channels for the year 2011

2011	Mitigation		Adaptation		
	Energy	Other (public awareness)	Capacity-building	Coastal zone management	Other vulnerability assessments
Moldova	-	-	11 238.48	-	-
Georgia	26 223.12	7 492.32	-	-	-
Total:	26 223.12	7 492.32	11 238.48	-	-

**Table 37.** Fast start finance 2010-2012: projects/funds financed by Lithuania

Beneficiary	Area	Project/fund	Implem. period	Impact/results
Moldova	Adaptation	Certification of organic agriculture (livestock farming)	2011	Strengthening of the administrative capacity and competence
Georgia	Mitigation	Promoting alternative energy sources for heating in rural areas of Ajara	2011	Thanks to the successful implementation of the project by a local NGO, Government of Ajara was persuaded of the benefits of alternative energy sources to the region and intends to provide financing to similar projects
Georgia	Mitigation	„Green capital“	2011	Drawing attention of young people to their everyday consumption habits and how it influences GHG emissions
Ukraine	Mitigation	E5P - Eastern European Energy Efficiency and Environment Partnership - fund	2011	Financing of projects in the strategic sectors of water supply, renovation of water cleaning and heating systems
Global	Adaptation	ESMAP - Energy Sector Management Assistance Program - fund	2010-2012	Assistance to low- and middle-income countries to promote environmentally sustainable energy solutions for poverty reduction and economic growth



All of the funding for 2011 and 2012 was new and additional, because Official Development Assistance (ODA) was specified to be climate related and other official flows (OOF) were provided through designated Climate Change Special Programme fund, all committed as assistance to developing countries under the UNFCCC after the pledges and commitments were announced at COP15 in Copenhagen. Private sector directly participates in the development of clean technologies. A special tariff system for renewable energy generation could be identified as indirect support for the development of clean technologies in Lithuania. Business responds to the demand of clean technology in the market. The constant need to maintain competitiveness requires a steady improvement. It is directly related to the attraction of the country's intellectual potential to this area, know-how and specific skills generation. In the private sector technology development and capacity strengthening take place under the market conditions with indirect support possibilities: the EU emission trading scheme and available EU support. In case of EU support, local authorities contribute to the development of technologies with the partial funding.

## **8 Research and Systematic Observation/Monitoring**

### **8.1 General policy on research and systematic observation/monitoring**

At the highest level, Lithuanian research and innovation policy is set by the Seimas (Parliament) and the Government of the Republic of Lithuania. The Research Council of Lithuania (hereinafter – the Research Council) serves as an advisory body to the Seimas and the Government.

The Lithuanian research and innovation 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 2012 there were 14 public universities and 9 non-public universities, 14 public and 11 non-public colleges and 13 public and 7 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 (social, cultural) development, providing scientific basis for the university students and researchers to develop and improve the qualification of teachers of scientific society.

Since joining the Europe Union, research, technological development and innovation policy has rapidly grown in importance. The breakthrough was achieved after the Government reached an agreement to invest a significant amount of funding (10 % of the total Europe Union structural assistance for 2007-2013) into research. A versatile mix of new policy instruments and competitive research programmes was planned; most of investments started in 2009-2010. Monitoring of the implementation of the EU research and experimental development policy is performed via the activities of ERAWATCH net.

During a period of 2009-2013, institutional framework of Lithuanian research has radically changed. In 2010 the Government put emphasis on the inter-linkages of the knowledge triangle policies by approving the broad-based Lithuanian Innovation Strategy for 2010-2020 and by establishing the Agency for Science, Innovation and Technology and Research, acting as advisory body to the Ministry of Education and Science and the Ministry of Economy. Also Higher Education Monitoring and Analysis Centre, acting as advisory body to the Ministry of Education and Science, were established. In 2009 the Higher Education Council as an advisory body was established. A majority of the State science institutes were integrated to universities or reorganized to independent science centres. Also private research establishments started to develop. [2]

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. [2]

Currently, the main responsible institutions responsible for research and innovation funding and for regulating the field and/or providing specific services are [1]:

1. Agency for Science, Innovation and Technology (MITA). Since 2010 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.
2. Lithuanian Business Support Agency administers the business support programmes, including innovation and research in the business sector.
3. Europe Social Fund Agency administers Europe Union Structural funds aid and implements measures assigned to Ministry of Education and Science in the development of human resources for science, technology and industry.

4. The Research Council. 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.
5. Central Project Management Agency under the Ministry of Finance administers the high scale investments into the development of research infrastructures is the responsibility
6. The Lithuanian Centre for Quality Assessment in Higher Education deals with quality assurance and higher education standards.
7. 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 (Official Gazette, 2010, No 23-1075). 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. Lithuanian Innovation Strategy for the year 2010-2020 is a long-term strategic planning document which sets vision, objectives, goals and results to be achieved in the innovation policy field before 2020. The purpose of this Strategy is to mobilise and manage State resources effectively: to create competitive knowledge economy based on the latest technologies and qualified human resources.

Aiming to implement the Lithuanian Progress Strategy "Lithuania 2030" and to conduct projects under the EU Research and Innovation Programme "Horizon 2020", the draft Lithuanian Innovation Development Programme for 2014-2020 is prepared and discussed in the Government in December 2013. The draft 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 specialisation. 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 will be implemented via the action plans that will be prepared and approved by the Minister of Economy for the periods of 2014-2017 and 2018-2020. The institution responsible for the implementation is going to be the Ministry of Economy.

### **Thematic research priorities**

In 2008, the Government of the Republic of Lithuania adopted a resolution on establishment of Five Integrated Centres ("Valleys") of Science, Studies and Business. The aim is to consolidate and efficiently use the potential of scientific research, studies and knowledge intensive business as defined in the Conception for the Establishment and Development of Integrated Centres (Official Gazette, 2007, No 40-1489; 2012, No 129-6484). The Ministry of Education and Science intended to allocate up to 400 million EUR for implementation of the programmes through the "National Complex Programme" and the "General National Research and Science and Business Cooperation Programme". It has been decided to prepare Joint Research Programmes aimed at co-ordinating implementation of the above projects. The Government of the Republic of Lithuania approved Joint Research Programmes in the following fields: natural resources and agriculture, biomedicine and biotechnology, materials science, physical and chemical technologies and engineering and information technologies.

Dealing with the questions of relevant scientific and technological development, corporate and university research cooperation, public-private partnership, an attention is focused on the establishment of the programmes of research and business collaboration. Such programmes are called as National Complex Programmes (hereinafter – NCP). The NCP is a group of projects that are oriented to the training of high level specialists, execution of research and experimental development, creation of common infrastructure and strengthening of link between science and business in the certain economy sector. The 12 NCPs were approved in: biotechnology and biopharmaceuticals; lasers, new materials, electronics, nanotechnologies and applied physical sciences; sustainable chemistry; information and communications technology; medical sciences; sustainable environment; mechatronics; civil engineering and transport; cultural and creative industries; marine

sector; agriculture, forestry and food industry. 34 research projects under the NCPs will be funded from the end of 2010 with a total budget of 51 million EUR. [15]

The Research Council of Lithuania also approved a list of National Research Programmes (hereinafter - NRP) in 2008: Future Energy; Chronic Non-infection Diseases; Lithuania's Eco-system: Climate change and Human factor; Safe and Healthy Food; State and the Nation: Heritage and identity.

In June 2013 new NRPs were proposed by the Research Council of Lithuania. Proposed NRPs had distinguished with the novelty and relevance of problems in Lithuania, the validity of funding, and were in line with the resources of the country's best scientists and potential to achieve goals and objectives of the NRPs. It is proposed to execute new NRPs 6-7 years. These programmes would finance large-scale research and would continue the current NRPs.

## **8.2 Research**

One of the six national Research and Development programmes approved by the Research Council of Lithuania in 2008 provides competitive funding for research in a climate change research field. The NRP "The Ecosystems in Lithuania: Climate Change and Human Impact", approved by the Government of the Republic of Lithuania (Official Gazette, 2010, No 75-3849 with later amendments) started in 2010 and is expected to end in 2014. Overall budget is 5.7 million EUR. This Programme replaced the previously existing programme "Support to Priority Research and Experimental Development Trends in Lithuania".

The Programme aims to obtain new scientific knowledge of contemporary and historical impact of biologic invasions towards the structure of biologic systems, their functioning and evolution in order to clarify the basic adaptation patterns of ecosystems and their components in the context of global changes. In addition, it aims to implement a complex evaluation of the current state of ecosystems, their biological diversity and resource availability, the impact of global biologic invasions, identify the most common adaptability and impact reduction measures.

Results obtained by the research projects of this NRP during 2010-2012 period, covering investigations on modern and ancient biological invasions and changes in species distribution areas. Scientific achievements of the project principals and their scientific findings are reviewed, their significance is evaluated. During the period 38 projects were started. These projects were executed by Lithuanian State research institutes and universities: Nature Research Centre, Vytautas Magnus University, Vilnius University, Forestry Institute of Lithuanian Research Centre for Agriculture and Forestry, Klaipėda University, Kaunas University of Technology.

Another NCP which is related to climate change is called "Sustainable use of natural environment", and currently under it are developed 4 projects for which implementation almost 5 million EUR are allocated [15].

### **8.2.1 The main institutions and centres related to research development in Lithuania**

**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 [9].

EPA has participated in these projects:

- "My Ocean" which is implemented via the Seventh Framework Programme. The main objective of this project was to establish a unified and consolidated system of monitoring and prognosis of European oceans which would include sea safety, management of sea resources, a monitoring of sea and coastal zone, water quality and pollution, climate and seasonal prognosis. Within the frame of the project, 5 different centres of monitoring and prognosis are consolidated: global "Global GOOS", European "EuroGOOS", Arctic Ocean "ArcticGOOS", Mediterranean "MOON/MedGOOS" and "Black Sea GOOS". The project was developed by 18 working groups: 5 thematic centres, 7 centres for monitoring and prognosis and 6 working groups for management of services. The project started in 1 January 2009 and ended in 31 March 2012.

- "MyOcean2" which is a continuation of "My Ocean". 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 will address 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 [16].
- "Preliminary evaluation of flood risk in the territory of Lithuania" which is implemented with the funding from the measure "Identification of measures for water protection and management" of priority "Local and urban development, cultural heritage and nature conservation and adaptation for tourism development" of 2007-2013 Cohesion Promotion Action Program. The main objective is to evaluate flood risks in the area of rivers basins (Nemunas, Venta, Lielupė, Dauguva). More information about the results is provided in Chapter 6.2.5. In addition to this, EPA executes a project "Preparation of flood risk and flood threat maps for the territory of Lithuania" which aims at the preparation of flood risk and flood threat maps for the areas of Nemunas, Venta, Lielupė and Dauguva river basins.
- Since 2010 Lithuania participates in the pilot project on river basin management and climate change adaptation in the Nemunas river basin. Within the framework of this project the analysis, in order to evaluate climate change impact on Nemunas river basin, is performed.

Since 1 January 2010 by the Resolution of the Government of the Republic of Lithuania, the Lithuanian Institute of Agriculture, the Lithuanian Institute of Horticulture and Olericulture and the Lithuanian Institute of Forests are merged into the **National Lithuanian Research Centre for Agriculture and Forestry** (hereinafter - NLRCAF). [12] NLRCAF in the perspective of its activity pays an attention on monitoring and research of impact of global climate changes on agriculture and environment, because due to warmer climate and more frequent droughts breeding of plants and livestock may have more perspectives in Northern European regions. [13] NLRCAF pays more attention to research of climate change consequences and retention of sufficient genetical diversity of forest trees, to the prevention of forest vermin population development, forest management to increase the value of a short-rotation plantation forests and analysis of efficient forest management models. NLRCAF is intensively involved in the projects related to climate change.

The NLRCAF together with Vilnius University, Aleksandras Stulginskis University, Klaipėda University and Kaunas University of Technology participates in the project of the National Research Program "Lithuanian ecosystems: climate change and human impact". NLRCAF participates in the project called KLIMSEGVA which focuses on changes in flora, management measures in agrarian landscape in the changing climate, biologic invasion in forestry and its adaptation to climate change, vulnerability analysis of local tree species and their populations on the conditions of changing climate. [3]

The most recent researches performed and currently executed by NLRCAF are:

- 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. This project started in 2012 and is expected to end in 2014. It is funded by the Research Council of Lithuania.
- An evaluation of criteria for assessment of drought in agriculture, creation of methodology. It was performed in 2012-2013 together with Aleksandras Stulginskis University and funded by the Ministry of Agriculture.
- An objective of "Sustainable forestry and global changes" is a collection of knowledge that is necessary to the development of sustainable forestry in the context of natural, economic and social changes. This project started in 2012 and is expected to end in 2016 and is funded from the State budget.
- Research on structural analysis of Lithuanian forestry in accordance with climate change scenarios and to identify opportunities for tree immigration and growth, it was funded by the Ministry of Environment in 2012-2013.
- 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 is 2012-2015 and it is funded by the Research Council of Lithuania.

- COST action ES0805 "The terrestrial biosphere in the Earth system (TERRABITES)", started in 2009 and funded by the EU. The aim of activity is to evaluate the stability of world system in the perspective of climatic-biosphere volatility.
- Research on phenologic regularity of plants, aiming at investigation of features of Lithuanian bioclimate, regularities of succession and rhythm of natural phenomena and etc., with an application of the results in agriculture and other natural sciences. It is funded from the State budget. Project duration - 2009-2013.
- Research on sustainability and affecting factors of forestry eco-systems in the context of climate change. The aim of this research is to investigate the climate change impact on sustainability of eco-systems. Current climate conditions capacitate the better conditions to the development of eco-systems of Lithuanian forestry. Climate change changes the areas of natural allocation of species and communities. It is funded from the State budget. Project duration - 2009-2012.
- 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 funded from the State budget: started in 2008, it is expected to end in 2016.
- Research on impact of climatic, biotic and anthropogenic factors to marshy forest phytocenosis and water circulation. It is funded from the State budget. Project duration - 2003-2010.

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 and to prepare first-class specialists for energy and scientific research related to it. [4] The laboratory for Energy complex research is established by the Lithuanian Energy Institute. Experience of laboratory related to climate change projects is used on an international level preparing a report of the Intergovernmental Panel on Climate Change 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. [4] The most recent projects were:

- A preparation of study "Evaluation of GHG national emission indicators in energy sector" in 2012 in order to ensure an accurate and reliable accounting of GHG emissions in the national GHG emissions inventory was performed under the funding of Ministry of Environment.
- "Climate and Energy Systems" in 2007-2010. The scope of this project was an analysis of changes in water resources in rivers in North and the Baltic countries in accordance with the unified methodology. Together with Lithuania in this project participated Sweden, Norway, Denmark, Finland, Iceland, Estonia and Latvia and it was financed by the Nordic Energy Research.
- COST Action ES0901 "European procedures for flood frequency estimation" in 2009-2013. In this project flood forecasting methods are analysed and the best practices are identified. 25 Member States have participated in this project, this action partially financed by the EU.
- "Natural research on changes of hydrological regime of the Curonian lagoon due to natural and anthropogenical factors in 2010-2012". Balance of water of the Curonian lagoon was estimated and forecast of elements of water balance was executed using a scenario analysis.
- In 2013-2015 the Lithuanian Energy Institute is going to participate in the research on extreme hydrological phenomena of Lithuanian rivers. Research will be based on the newest scenarios on climate change. This project will be funded by the State's subsidies.

On 23 December 2009 with Governmental Resolution No 1800 Institute of Ecology of Vilnius University, Institute of Geology and Geography as well as Institute of Botany were consolidated and reorganized to the state institute of science and research called the **Nature Research Centre**.

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:

- "Research on biological diversity and prognosis on conditions of global change and anthropogenic impact" started in 2012. 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 eco-systems in the Baltic countries; and will contribute to the execution of objective environmental protection programmes and forecasting potential changes. The project is expected to end in 2016 and is funded by the Ministry of Education.
- "Research on climate change in peatlands" is called CLIMPEAT. The main objective is a research on interactions among peatland eco-systems, climate change and anthropogenic activity as well as carbon emissions. The project started in 2013 and it is expected to end in 2016. The project is performed together with University of Bern, Vilnius University and is funded by Research Council of Lithuania.
- BIOCOLD – "Biotic response to climate change in cold climates". The objective is to organize academic community in order to identify a reaction of flora and fauna to natural changes. The project is funded by Nordic Council of Ministers (NordForsk) and executed in 2011-2013.
- COST Action ES0907 "INTEgrating Ice core, MARine and TERrestrial records - 60,000 to 8,000 years ago (INTIMATE)". The aim of this action is to prepare common measures and methods in global research net with the reconstruction of sudden and extreme climate changes in various ambients (icebergs, seas and lands) in Europe in the period of 60,000-8,000 years. Also it aims at coordination of scientists in pursuance of better perception of impact of changes and mechanisms and reduction of uncertainties in such ways. Project duration - 2010-2014 - and this project is funded by the EU.
- PALEOAUGALIJA is a project which aim is to assess change of climate conditions and its impact on history of flora. Project duration - 2012-2014 - and this project is funded by the Research Council.

In 2012 the **Lithuanian Geological Survey** developed the International project "Climate Change; Impact, Costs and Adaptation in the Baltic Sea Region (BaltCICA)" (duration 2009–2012). Lithuanian partners of the project were: Vilnius University and Environmental Centre for Administration and Technology, administrations of the Klaipėda city municipality and the Klaipėda district municipality. The BaltCICA project activities in Lithuania were carried out as two case studies of the Klaipėda district areas: the predicted impacts of climate change on groundwater were analysed and the potential effects of climate change on the Karkle beach was evaluated [6]. Detailed information is presented in Chapters 6.2, 6.3 and 6.4.

Since 2010 Vilnius University has published 32 different publications related to climate change. **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 [17]. Also it participated in BaltCICA project "BaltCICA: climate change impacts, costs and adaptation in the Baltic Sea Region" described previously and in Chapter 6.2.

In addition, Vilnius University participates, in besides the CLIMPEAT project together with Nature Research Centre, in a project called "Management of the Niemen River basin with account of adaptation to climate change, aiming at investigation and forecasting of changes of climate and hydrosphere in Nemunas river basin", funded by UNECE. In the scope of this project adaptation measures are chosen for evaluation. Together with Vilnius University, the Central Research Institute for Complex Use of Water Resources (CRICUWR, Minsk, Belarus) participated in this project. The project has resulted in a first joint assessment of water resources and climate change impacts in the Neman Basin, thereby enabling a renewal of cooperation between experts from the riparian countries on the shared river basin. This project also contributes to Lithuanian efforts in training experts from developing countries. Also adaptation measures are chosen for evaluation. A detailed description of the results is presented in Chapter 6.2.5.

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 ecosystems. The main goal

of this cluster is to investigate changes of growth, production, structure, biological diversity and current state of forestry and vegetation of agrarian ecosystems in changing conditions of environment and climate. Additionally, the aim is to evaluate opportunities of various economic branches to reduce anthropogenic impact on environment and climate while ecologic efficiency of production and consumption is increased, and sustainable development is achieved. The other cluster is an application of innovation technologies to the research of health risks raised by climate change and environmental pollution. The cluster strives to evaluate changes of population genetical structure that is occurring due to changing environmental conditions. Also it strives to improve the technology of early stadium recognition of diseases pre-determined by environment. It endeavours to propose a modern tool of environmental quality monitoring to observe changes of eco-systems. [14]

**Vilnius Gediminas Technical University** participates in projects that are related with the technological development. Together with the partners, Vilnius Gediminas Technical University executes research on biogas, its composition, solid fractions, application of new technologies and it allows creating and producing installations with appropriate parameters that significantly contribute to the reduction of GHG emissions.

Since November 2011, **Šiauliai University** participates in the project related with the development of RES base and improvement of environmental state. The main objective is to capacitate a development of forestry culture and to improve an environmental state in the frontier of Lithuania and Latvia. This project is financed via the Latvia–Lithuania Programme.

**Aleksandras Stulginskis University (ASU)** performed various research projects related to research on agriculture in a field of climate change. The University actively participates in a pilot projects related to the research of plants to adapt to changing climate and development of new species of plants which could be resistant to climate change consequences. Within NRP "Lithuanian ecosystems: climate change and human impact", in 2010-2011 ASU performed research on impact of new-come trees to biological diversity of forest community, its structure and sustainability.

In 2010 ASU performed complex research on eco-systems, investigated an impact of long-term farming on environment (water, soil and etc.) and quality of production, estimated GHG quantity that is emitted during a lifecycle of stock for biofuel production and prepared proposals for sustainable production of stock and biofuel. In 2011 it participated in the evaluation of impact of long-range transboundary air pollutants to common pollution level of Lithuanian air basin.

The specialists also participated in the international projects related with the establishment of constant observation net for monitoring of eco-systems, called "EnvEuropa", which would improve the currently operated Shared Environmental Information System (SEIS). The project started implementing period 2010-2013. In addition, in 2011-2012 ASU participated in the implementation of BERAS. The objective of it was to solve a problem of the Baltic Sea pollution by applying ecological farming and increasing public awareness in all Baltic countries.

Since 2012 Aleksandras Stulginskis University participates in a project related to an evaluation of criteria for assessment of drought in agriculture and impact of long-range transboundary air pollutants to water resources and agricultural systems in Lithuania. This project contributes to projects related to identification of water resources for energy production and in the scope of this project presents practical recommendations for the development of hydroenergy. It also plays a role in the research of technological processes of agricultural machines and how it may influence parameters of soil, GHG emissions and energy consumption; investigates varietal and genetical diversity and sustainable use of Scotch pines.

**Kaunas University of Technology (KTU)** is focused on the development of innovative technologies that would contribute to the mitigation of climate change impact. KTU participated in the project "Polygeneration of Energy and Materials from Biomass Residues and Sewage Sludge (ENERCOM)" which aim was to develop the innovative high-efficient technologies. The results have significantly positive impact on efficiency of production of energy, fuel and fertilizers using biofuel residues.

Additionally, KTU participated in the research on climate change impact on air quality in schools and state of health of students (international project "Air Quality in Schools and Childcare Settings Project (SINPHONIE)" funded by Directorate General for Health and Consumers of the European Commission). KTU contributed to a practical implementation of management plan for river basins ("From theory and plans to eco-efficient and sustainable practices to improve the status of the Baltic Sea (WATERPRAXIS)", funded by the Baltic Sea



Region programme 2007-2013), research on seasonality of municipal waste generation and composition and corresponding fluctuations of various environmental indicators for waste management and treatment facilities (SWC-ENV-IND, funded by Swiss National Scientific Foundation), assessment of impact of landfill mining to decrease of GHG emission, funded by Swedish Institute, research on improvement of energy efficiency of housing stock and impacts on indoor environmental quality and public health in Europe (INSULAtE, partly funded by LIFE+).

**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.

### **8.3 Systematic observations**

In accordance with the comments provided by the ERT team in the report of the in-depth review of the 5<sup>th</sup> National communication of Lithuania, the more detailed information about capacity-building in developing countries and summary information on Global Climate Observing System (GCOS) activities are provided hereafter.

#### **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, more detailed information is presented in Chapters 7 and 8.2.

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 it: of 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. 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:

- Belongs to EUMETNET - organization of national European hydrometeorological services - and participates in the remote program of meteorological education called EUMETCAL. It also participates in the 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 3 Lithuanian cities and climate data.

- 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.
- 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 ozone and ultraviolet radiation, also it has an access to common WOUDC database.
- Participates in collaboration program with Czech Meteorological Institute due to installation and maintenance of climate data management system, called CLIDATA (Climatological Database). Climate database is installed and it stores, structures and analyzes observation data received from meteorological stations. For the presentation of data, geographical information system (GIS) is used.
- 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. [7]

LHMT has various agreements on the sharing of information and experience with Belarus, Poland, Russia, Latvia, Estonia and Czech Republic.

Membership in WMO, EUMETSAT and ECMWF, bilateral and multilateral agreement with the hydrometeorological services of the other countries and international organizations presume the improvement of quality and expedition of hydrometeorological information provided by the services. Implementing the agreements of international collaboration, LHMT shares data of hydrometeorological observations and warnings about adverse hydrometeorological conditions with the other countries, specialists of LHMT participates in the implementation of international programmes and projects.

### **Systematic observation of other climate parameters**

The EPA, as mentioned previously, is responsible for the monitoring of air quality, collection and storage of data and information related to environmental protection, evaluation and forecasts of environmental quality. There are few types of climate monitoring performed in Lithuania: atmosphere, water, soil, live nature, ecosystems and landscape.

- *State environmental monitoring programme.* A purpose of State environmental monitoring for 2011-2017 (hereinafter - Programm) is, pursuant to the current international commitments and national needs, to supply the responsible state and international institutions with reliable information about the state of natural environment and changes of natural environment influenced by anthropogenic impact. After the tasks of the Programme are implemented, it will be easier to collect the right data and the other information and it will contribute to the correct evaluation of natural environment in Lithuania, to the management and forecasting it on national and international levels, to supply institution of 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 natural environment problems, including threats of climate change consequences to public health and ecosystems, distant carry of air pollutants, increased intensity of occurrence of sinkholes, deteriorative conditions for territory use in sinkhole region in north Lithuania.

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.

- *Monitoring of eco-systems.* Recently research on complex impact of air pollutants and climate change on forest eco-systems 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 eco-systems of various countries and regions.

Lithuania participates in ICP IM programme which is established due to implementation of Convention on Long-range Transboundary Air Pollution. The main goal of this programme is to identify, evaluate and to forecast a state of conditionally natural eco-systems and long-term changes in accordance with carry of long-range air pollutants (especially combinations of sulphur and nitrogen), impact of ozone and heavy metals, regional peculiarities and climate changes. The results of ICP IM programme contribute to the implementation of the requirements of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, the UNFCCC, the Conventions for Biological Diversity, the Vienna Convention for the Protection of the Ozone Layer and the Kyoto Protocol. Observations of state of conditionally natural eco-systems on a national level provides information about pollutants, which are carried from countries in the Western and Central Europe to Lithuania, and impact of climate changes to the quality of water and soil of anthropogenized territories, biological diversity and state of forestry. [10]

- *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 pools, 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 fields 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 analyzed, a degree of landscape poliarization 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 40 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.

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## 9 Education, Training and Public Awareness Raising

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, to support a making of climate change policies and other activities related to UNFCCC issues, to encourage society to choose sustainable lifestyle and habits in order to reduce its share in GHG emission. 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 collaboration. 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 8.2 and 8.3.

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. 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.

One of the developments in this field is an establishment of a system on public conveyance about climate changes, its threats on public health by the Order of the Minister of Environment and the Minister of Health No V-386/D1-391 (Official Gazette, 2012, No 54-2689) approved on 3 May 2012. It regulates a course for collection of information, analysis, and preparation of reports and organization of information provision. A concept of threats of climate change includes changes of solar radiation, heat, frost, development of blood-sucking pests and etc. Centre for Health Education and Disease Prevention is designated to be the main responsible institution in managing a system on public conveyance about climate changes, its threats on public health.

### 9.1 Education

*General education establishments.* Pursuant to Common Programme of Primary and Secondary Education, approved by the Minister of Education and Science No ISAK-2433 on 26 August 2008 (Official Gazette, 2008, No 99-3848), a principle of sustainable development is one of the most important ones in the process of preparation of Common Programmes. Education content makes reference to the provisions of sustainable development of society. Schools are encouraged to implement the ideas of sustainable development as it is a constituent of their community life.

Environmental education was complemented with the actual and complex problems of global environment by analyzing it at a greater extent, in accordance with renewed common programmes of secondary education, approved by Order of the Minister of Education and Science on 21 February 2011 No V-269 (Official Gazette, 2011, No 26-1283). Causes of climate change, combustion of fossil fuel, acid rains, ozone depletion, and pollution of surface water, soil, air and other problems and their solutions are analyzed in the classes of biology, chemistry, physics, exploratory works and projects related to natural sciences are executed.

In the field of non-formal education events are organized by the Lithuanian Centre for Non-formal Youth Education and Education Development Centre. The Lithuanian schools continue an active participation in the Global Learning and Observations to Benefit the Environment (GLOBE) Programme. Currently the country counts 30 schools which have joined the international scientific – environmental educational programme [6]. Also schools participate in the international projects, such as "Our gold is GREEN" (the main objective is to

increase an interest of schoolchildren in culture of sustainable consumption of natural resources), "Baltijos jūros" (aiming at a unification of efforts of Baltic Sea schools to look for common and specific to Baltic Sea region solutions for environmental problems), "U4energy" (an objective is to invite teachers and students to seek for ambitious climate change objectives), contests, seminars for schoolchildren and teachers.

Tangible input for information dissemination and complete educational means (texts and visual information, presentations, etc.) is provided by the European Commission and the Ministry of Environment of Lithuania through their websites.

*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 Panevezys College, Utena College and other professional education establishments.

*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.

The study programmes which are offered by Vilnius University, Vilnius Gediminas Technical University, Vytautas Magnus University, Kaunas University of Technology, Klaipeda University, Siauliai University and the Lithuanian University of Agriculture have successfully integrated various aspects of climate change issues in Bachelor and Master courses in Biology, Ecology, Environmental Engineering, Hydrology and Meteorology, Environmental Management and Clean Production, 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, ecodesign, environmental impact assessment and etc.

## **9.2 Society involvement and awareness rising**

The society education and awareness rising in the field of environment protection and climate change is secured through periodically organized conferences, TV programs and radio discussions that advocate principles of sustainable development. Awareness and public discussions are directed towards both, rising of environmental self-consciousness among businesses companies and education of population. The main initiators of such activities are the Ministry of Environment of the Republic of Lithuania, educational institutions and NGOs.

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, they 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. For example, the most active independent, non-profit and non-governmental organisations in the field of climate change in Lithuania - the Baltic Environmental Forum Lithuania, "Sustainable Development Initiatives" and others - 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 Government which is managing all decisive tools and financing measures is the main policy making institution, however, a role of NGOs in highlighting a relevancy and extent of a problem is influential in this context.

The Public Information Division of the Ministry of Environment of the Republic of Lithuania plays an important role in the information dissemination and public involvement. Climate change legislation, announcements, up-to-date information and organized events are presented to the society on the website of the Ministry of Environment. Recently the Public Information Division has issued a publication - information book, called "Your law to clean environment", to society about a right to receive an information, participation in decision-making and going to law due to environmental issues in accordance with Orhus Convention.

The other institution which is involved in awareness raising 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 was a book "Principles of Sustainable Forestry" issued in 2011.

Conferences related to public awareness in climate change and held by Aleksandras Stulginskis University in Lithuania were:

- international scientific-practical conference "Human and environment protection", organized annually;
- international scientific conference "Agricultural engineering and environment in 2011";
- international scientific conference "Rural development in 2011: in global changes";
- international scientific conference "A reaction of forestry ecosystems to air pollution and changing climate";
- republican conference "Soil and environment", organized annually.

Funds for programmes of public environmental awareness are allocated from the 2007-2013 EU structural assistance in accordance with the approved funds for 2007-2013 Cohesion Promotion Action Program. Support is provided in accordance with 3.1. Priority "Local and urban development, cultural heritage and nature conservation and adaptation for tourism development" measures "VP3-1.4-AM-08-V the Public Information System on the environment and development" and "VP3-1.4-AM-09-K "Public Information and Education about the environment and the implementation of the measures". Until now, in total almost 5 million EUR under the first measure and 3.95 million EUR under the second measure were allocated to projects related to public awareness from the EU funds [7].

Under the first measure, 7 projects are financed, one of them - Renewal of exposition in Tada Ivanauskas zoo in Kaunas - is finished. In the frame of the project, innovative digital technologies are installed in order to visualize an exposition. Under the second measure, 48 projects are financed, 34 of them are finished - campaigns ("LabasEKO", "PRADĖK NUO SAVĖS", "Atgal į gamtą!", "Keliuokime kitaip!"), seminars ("Taupyk, tausodamas aplinką"), events, TV and radio programs ("EKO office"), internet pages (www.natura2000.lt), articles and etc.

From 8 October 2012 Lithuania together with other EU Member States have been taking part in the European Commission's climate change campaign "A world you like. With a climate you like" (<http://world-you-like.europa.eu/en/> ; <http://www.am.lt/VI/index.php#r/713>). This campaign aims to show solutions and best practices applied by citizens, businesses and authorities across the European Union. It covers five areas: travel and transport; production and innovation; building and living; shopping and eating; and re-use and recycling.

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 2013-2020 of the Strategy for the National Climate Change Management Policy and presented in the table below.

**Table 38.** Measures foreseen to raise public awareness

Measures	Period of implementation	Implementing authority
To organize initiatives for public awareness raising and education in energy efficiency and promotion of use energy saving equipments in household	2013-2016	SC "LESTO"
To prepare and issue the Climate Atlas of Lithuania	2013	Lithuanian Hydrometeorological Service
To prepare information, to lecture about climate change, its impacts and adaptation to climate change of the Lithuanian society, schoolchildren, students, to participate in the meetings with society of the Lithuanian cities and municipalities	2014	Lithuanian Hydrometeorological Service
To organize a distribution of information related to adaptation to climate change	2013	Ministry of Agriculture
To expand service providers and institutions that would consult in subjects related to farm management	2013	Ministry of Agriculture

Measures	Period of implementation	Implementing authority
To prepare and implement a programme for public awareness raising and information related to climate and climate change	2016	Ministry of Environment
To prepare recommendations due to preparation of individual environmental instructions in the field of climate change (e.g. posters, signs in the workplace, recommendations for eco-driving and etc.)	2015	Ministry of Environment

This information is provided in reference to the comment related to reporting on the evaluation of the public awareness campaigns between 2007 and 2013, and on any post-2013 plans and provided by ERT team.

### 9.3 Information availability

Legal acts, reports and other 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](http://www.am.lt)), the Environmental Protection Agency (<http://klimatas.gamta.lt/cms/index>), the the Lithuanian Hydrometeorological Service ([http://www.meteo.lt/klim\\_kaita.php](http://www.meteo.lt/klim_kaita.php)) and the Lithuanian Environment Investment Fund ([www.laaf.lt](http://www.laaf.lt)). All legal acts are placed in the internet of the Parliament of the Republic of Lithuania ([www.lrs.lt](http://www.lrs.lt)). Information on the Lithuanian adaptation to climate change policy and its implementation is placed in the European Commission's CLIMATE-ADAPT portal: <http://climate-adapt.eea.europa.eu/web/guest/countries/lithuania>. Information contained in the other sources usually is sectorial and fragmentary.

### 9.4 Participation in international programs and projects

On 6 April 2010 the Minister of Environment signed legislation establishing the Green Investment Scheme (GIS) in Lithuania. It is based on the framework where money from any carbon trade that is under Government's disposition is spent in the form of subsidies, soft loans and capitals investments in the climate change projects ensuring the sustainability of the programme. GIS is implemented under the Special Programme for Climate Change, described in 4.2.1.3.

Lithuania participates in the 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 [9]. In Lithuania a week of events "The day without a car!" is coordinated by the Public Information Division of the Ministry of Environment.

Lithuania participated in the international project ECOWILL which stands for "ECODriving – Widespread Implementation for Learner Drivers and Licensed Drivers", coordinate by Austrian Energy Agency (partner in Lithuania - JSC "COWI Lietuva"). The ECOWILL project focused on the following main aspects:

- establishment of minimum standards for contents and establishment of ecodriving training courses and train-the-trainer seminars;
- development and roll-out of ecodriving shortduration training for licensed drivers;
- integration of ecodriving into driving lessons and driving tests for learner drivers and quality control and harmonisation of driver education and testing procedures with reference to ecodriving;
- qualification and certification of driving instructors for providing ecodriving lessons to learner drivers as well as short-duration ecodriving courses;
- establishment of an ecodriving infrastructure which will keep the approach alive after the end of the project [8].



The project consortium comprised 15 expert organizations, including 13 national organizations representing the 13 partner countries as well as two multinational partners. The project was supported by the Intelligent Energy Europe Programme of the European Commission. The ECOWILL project was launched in May 2010 and ended in April 2013.

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<sub>2</sub> emission areas in 3 urban communities of the EU - one of them is Birstonas 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 will end in January 2016.

Lithuania participated in the implementation of BERAS. BERAS Implementation is a genuine ecological alternative for a sustainable and prosperous development in the Baltic Sea Region. The focus of the project is look for a solution of Baltic Sea pollution problem establishing ecological recycling agriculture and increasing public awareness in the whole Baltic region. The project started in March 2011 and ended in February 2012. Södertörn University was designated as the main managing partner and Aleksandras Stulginskis University has represented Lithuania.

In 2011-2014 Lithuania also participates in the project "Regional Strategies for Energy Conscious Communities (REENERGY)" which is partly financed by INTERREG IVC. The main objective is to develop a policy for energy efficiency increase and economic modernization in local communities and to look for solutions of problems related to energy consumption with environmentally friendly methods. The project aims at establishing new strategies for innovative energy saving and solutions to local and regional communities with applying effective and innovative methods and RES. The project is based on regional cooperation, sharing of experience, knowledge and best practices. It undoubtedly positively affects public awareness raising. In Lithuania this project is managed by Kaunas University of Technology.

In 2010-2013 Vilnius Gediminas Technical University participated in CO2OL BRICKS - Climate Change, Cultural Heritage and Energy Efficient Monuments. The project has been granted under the "Priority1: Fostering Innovations" of the Baltic Sea Region Programme 2007 – 2013 and it compounds 18 partners from 9 countries with 9 languages [10]. The main objective is to decrease energy consumption in historically valuable buildings without destruction of its value and identity. This project performs 3 programmes: policy making, development of technical solutions and education. Education programme involves an increase of education level of architects, building engineers and masters, to prepare projects that help to save energy in historical buildings and to modernize them, to concert educational programmes with direct market demands of historical buildings.

Projects managed by NLRCAF and related to information sharing was the following. In 2011 a project "Centre of Advanced Research on Environmental Services, CAR-ES", aiming at a collection of data about impact of forestry on biological diversity and carbon and nitrogen collection in soil and water, to establish databases and to adapt modeling systems to forecasting, was started. Such centre will contribute to the filling of the information related with climate change. It is funded by Nordic Development Fund and is expected to end in 2015. In addition, a project "Expected Climate Change and Options for European Silviculture", funded by EU, was performed in 2008-2012. The main objective is a mobilization and integration of knowledge to foresters and policy makers in order to inform about adaptation to climate change and reduction of climate change impact.

Vilnius University has participated in BalticClimate - Baltic Challenges and Chances for local and regional development generated by Climate Change - in 2009-2011. Evaluation of climate change impact on the development of municipalities and regions integrating information related to climate change in the long-term strategies and plans was performed. This project was financed by Baltic Sea Region programme in 2007-2013.

## **Literature**

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10. Project "Co2olBricks": <http://www.co2olbricks.eu/> (accession date: 2013-11-15)

## Appendix

Table A-1. Emission trends summary

Inventory 2011  
Submission  
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LITHUANIA

(Part 1 of 3)

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	31478.45	33651.72	16995.82	10813.11	11388.73	11624.42	17478.76	15261.91	8208.99	5694.82
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	35815.45	37906.77	21218.11	16387.05	15799.12	15053.53	15702.75	15104.27	15923.09	13455.67
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	5751.98	5530.97	4459.26	4011.60	3718.06	3624.27	3618.07	3726.05	3501.61	3356.74
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	5749.67	5528.90	4454.15	4008.55	3715.02	3621.23	3615.03	3723.01	3499.57	3353.74
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	7236.86	6735.41	4589.87	3982.22	3445.96	3433.78	4067.60	4250.74	4424.99	4493.26
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	7188.74	6686.83	4539.65	3934.54	3394.26	3383.40	4023.47	4204.19	4372.14	4435.36
HFCs	NA,NO	NA,NO	NA,NO	0.10	0.27	2.76	3.68	5.44	8.17	10.66
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF <sub>6</sub>	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.05	0.05	0.08	0.10	0.14
<b>Total (including LULUCF)</b>	<b>44467.29</b>	<b>45918.10</b>	<b>26044.95</b>	<b>18807.03</b>	<b>18553.01</b>	<b>18685.27</b>	<b>25168.16</b>	<b>23244.23</b>	<b>16143.86</b>	<b>13555.61</b>
<b>Total (excluding LULUCF)</b>	<b>48753.87</b>	<b>50122.50</b>	<b>30211.91</b>	<b>24330.24</b>	<b>22908.66</b>	<b>22060.97</b>	<b>23344.98</b>	<b>23036.99</b>	<b>23803.07</b>	<b>21255.56</b>

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)
1 Energy	32744.95	34883.84	19646.13	15789.18	14849.86	13903.45	14407.93	13963.72	14676.63	12331.85
2 Industrial Processes	4396.79	4434.17	2561.62	1642.78	1827.47	2111.51	2525.85	2484.37	2910.33	2856.13
3 Solvent and Other Product Use	197.52	195.83	193.87	191.53	188.98	186.36	183.75	181.17	178.61	176.07
4 Agriculture	10292.09	9464.70	6651.94	5530.83	4866.13	4680.76	5046.05	5221.04	4848.59	4704.95
5 Land Use, Land-Use Change and Forestry <sup>(5)</sup>	-4286.58	-4204.40	-4166.96	-5523.22	-4355.65	-3375.69	1823.18	207.24	-7659.21	-7699.94
6 Waste	1122.51	1143.96	1158.36	1175.92	1176.21	1178.88	1181.41	1186.69	1188.91	1186.56
7 Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (including LULUCF)<sup>(5)</sup></b>	<b>44467.29</b>	<b>45918.10</b>	<b>26044.95</b>	<b>18807.03</b>	<b>18553.01</b>	<b>18685.27</b>	<b>25168.16</b>	<b>23244.23</b>	<b>16143.86</b>	<b>13555.61</b>

Table A-1 Emission trends summary

Inventory 2011  
Submission  
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GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	2551.81	-213.39	7276.24	2857.52	6594.97	9228.57	9610.62	12198.03	6595.52	2224.00
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	11853.19	12558.01	12676.10	12661.14	13244.24	14017.63	14408.34	15769.66	15103.94	12920.15
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	3160.98	3284.89	3359.11	3413.83	3364.75	3373.81	3414.29	3379.19	3326.25	3229.45
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	3158.03	3282.66	3354.76	3410.52	3361.68	3372.95	3404.68	3378.51	3324.99	3226.32
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	4681.01	4909.54	5245.10	5388.22	5632.26	5925.60	5916.43	6951.87	6406.13	4169.99
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	4622.59	4854.25	5192.90	5343.63	5584.65	5882.97	5841.24	6885.67	6334.48	4106.78
HFCs	13.66	18.17	24.27	33.93	50.25	68.48	92.66	122.81	152.81	167.27
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF <sub>6</sub>	0.33	0.26	0.35	2.03	0.78	1.35	1.18	0.88	3.21	2.77
<b>Total (including LULUCF)</b>	<b>10407.79</b>	<b>7999.46</b>	<b>15905.07</b>	<b>11695.53</b>	<b>15643.01</b>	<b>18597.80</b>	<b>19035.18</b>	<b>22652.78</b>	<b>16483.93</b>	<b>9793.47</b>
<b>Total (excluding LULUCF)</b>	<b>19647.80</b>	<b>20713.34</b>	<b>21248.38</b>	<b>21451.26</b>	<b>22241.60</b>	<b>23343.38</b>	<b>23748.09</b>	<b>26157.53</b>	<b>24919.43</b>	<b>20423.30</b>

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)
1 Energy	10807.37	11461.38	11551.44	11544.79	12164.11	12858.95	13049.23	13283.25	13132.81	11861.22
2 Industrial Processes	3019.01	3265.70	3445.08	3528.74	3724.18	4089.04	4341.13	6195.31	5525.37	2367.35
3 Solvent and Other Product Use	173.54	170.87	168.22	165.58	162.64	159.22	127.72	117.56	90.95	95.38
4 Agriculture	4457.30	4599.14	4862.90	4987.46	4993.67	5062.77	5086.29	5439.91	5057.12	5008.98
5 Land Use, Land-Use Change and Forestry <sup>(5)</sup>	-9240.01	-12713.88	-5343.31	-9755.72	-6598.59	-4745.58	-4712.91	-3504.75	-8435.51	-10629.82
6 Waste	1190.58	1216.25	1220.74	1224.69	1196.99	1173.40	1143.73	1121.50	1113.19	1090.37
7 Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (including LULUCF)<sup>(5)</sup></b>	<b>10407.79</b>	<b>7999.46</b>	<b>15905.07</b>	<b>11695.53</b>	<b>15643.01</b>	<b>18597.80</b>	<b>19035.18</b>	<b>22652.78</b>	<b>16483.93</b>	<b>9793.47</b>

Table A-1. Emission trends summary

Inventory 2011  
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GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	(%)
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	3287.76	3443.42	-89.06
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	13725.06	13970.47	-60.99
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	3178.14	3047.53	-47.02
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	3177.09	3045.57	-47.03
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	4061.15	4412.49	-39.03
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	4022.40	4370.88	-39.20
HFCs	192.20	219.19	100.00
PFCs	NA,NO	NA,NO	0.00
SF <sub>6</sub>	5.85	8.12	100.00
<b>Total (including LULUCF)</b>	<b>10725.11</b>	<b>11130.74</b>	<b>-74.97</b>
<b>Total (excluding LULUCF)</b>	<b>21122.60</b>	<b>21614.23</b>	<b>-55.67</b>

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	CO <sub>2</sub> equivalent (Gg)	CO <sub>2</sub> equivalent (Gg)	(%)
1 Energy	12757.79	11820.46	-63.90
2 Industrial Processes	2230.00	3737.55	-14.99
3 Solvent and Other Product Use	87.41	85.95	-56.49
4 Agriculture	4984.65	4979.97	-51.61
5 Land Use, Land-Use Change and Forestry <sup>(5)</sup>	-10397.49	-10483.49	144.57
6 Waste	1062.74	990.31	-11.78
7 Other	NA	NA	0.00
<b>Total (including LULUCF)<sup>(5)</sup></b>	<b>10725.11</b>	<b>11130.74</b>	<b>-74.97</b>

- <sup>(1)</sup> 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.
- <sup>(2)</sup> 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 (+).
- <sup>(3)</sup> Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO<sub>2</sub> equivalent emissions.
- <sup>(4)</sup> 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 Gg of CO<sub>2</sub> equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.
- <sup>(5)</sup> Includes net CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from LULUCF.



Table A-2. Key source categories analysis by level and by trend (years 1990, 2011, 1990-2011)

KEY category	GHG	Level without LULUCF 1990	Level with LULUCF 1990	Level without LULUCF 2011	Level with LULUCF 2011	Trend (1990-2011) without LULUCF	Trend (1990-2011) with LULUCF	Approach used
1.AA.1.A Public electricity and heat production, gaseous fuel	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.1.A Public electricity and heat production, liquid fuel	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.1.B Petroleum refining, liquid fuel	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.2 Manufacturing industries and construction, gaseous fuels	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.2 Manufacturing industries and construction, liquid fuels	CO <sub>2</sub>	X	X			X	X	Tier 1 Tier 2
1.AA.2 Manufacturing industries and construction, solid fuels	CO <sub>2</sub>			X	X	X	X	Tier 1 Tier 2
1.AA.3 Transport	N <sub>2</sub> O			X	X			Tier 2
1.AA.3.B Road transportation, diesel	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.3.B Road transportation, gasoline	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.3.B Road transportation, LPG	CO <sub>2</sub>			X	X	X	X	Tier 1

KEY category	GHG	Level without LULUCF 1990	Level with LULUCF 1990	Level without LULUCF 2011	Level with LULUCF 2011	Trend (1990-2011) without LULUCF	Trend (1990-2011) with LULUCF	Approach used
1.AA.3.C Railways	CO <sub>2</sub>	X		X				Tier 1 Tier 2
1.AA.3.E Off-road vehicles and machinery	CO <sub>2</sub>	X	X	X		X	X	Tier 1 Tier 2
1.AA.4 Other sectors, biomass	CH <sub>4</sub>			X	X	X	X	Tier 1 Tier 2
1.AA.4 Other sectors	N <sub>2</sub> O			X				Tier 2
1.AA.4.A Commercial/Institutional	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.4.B Residential	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
1.AA.4.C Agriculture/Forestry/Fisheries	CO <sub>2</sub>	X						Tier 1
1.B Fugitive Emissions from Fuels	CH <sub>4</sub>	X	X	X	X	X	X	Tier 1 Tier 2
2.A.1 Cement Production	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2

KEY category	GHG	Level without LULUCF 1990	Level with LULUCF 1990	Level without LULUCF 2011	Level with LULUCF 2011	Trend (1990-2011) without LULUCF	Trend (1990-2011) with LULUCF	Approach used
2.A.7 Bricks and tiles	CO <sub>2</sub>					X		Tier 1
2.B.1 Ammonia Production	CO <sub>2</sub>	X	X	X	X	X	X	Tier 1 Tier 2
2.B.2 Nitric Acid Production	N <sub>2</sub> O	X	X	X	X	X	X	Tier 1 Tier 2
2.F.1 Refrigeration and Air Conditioning Equipment	HFC			X	X	X	X	Tier 1 Tier 2
3. Solvent and Other Product Use	CO <sub>2</sub>	X		X	X	X		Tier 2
3. Solvent and Other Product Use	N <sub>2</sub> O	X				X	X	Tier 2
4.A Enteric Fermentation, cattle	CH <sub>4</sub>	X	X	X	X	X	X	Tier 1 Tier 2
4.B Manure Management	N <sub>2</sub> O	X	X	X	X	X	X	Tier 1 Tier 2
4.B Manure Management, cattle	CH <sub>4</sub>	X	X	X	X	X		Tier 1 Tier 2
4.B Manure Management, swine	CH <sub>4</sub>	X	X	X	X	X	X	Tier 1 Tier 2

KEY category	GHG	Level without LULUCF 1990	Level with LULUCF 1990	Level without LULUCF 2011	Level with LULUCF 2011	Trend (1990-2011) without LULUCF	Trend (1990-2011) with LULUCF	Approach used
4.D.1.1 Direct Soil Emissions, Synthetic N fertilizers	N <sub>2</sub> O	X	X	X	X	X		Tier 1 Tier 2
4.D.1.2 Direct Soil Emissions, manure fertilizers	N <sub>2</sub> O	X	X	X	X	X	X	Tier 1 Tier 2
4.D.1.3. Direct Soil Emissions N-fixing crops	N <sub>2</sub> O	X	X	X	X	X	X	Tier 2
4.D.1.4 Direct Soil Emissions, Crop residues	N <sub>2</sub> O	X	X	X	X	X	X	Tier 1 Tier 2
4.D.1.5. Direct Soil Emissions Cultivation of histosols	N <sub>2</sub> O	X	X	X	X	X	X	Tier 1 Tier 2
4.D.2 Pasture Range and Paddock Manure	N <sub>2</sub> O	X	X	X	X	X	X	Tier 1 Tier 2
4.D.3 Indirect Emissions	N <sub>2</sub> O	X	X	X	X	X	X	Tier 1 Tier 2
5.A.1 Forest Land remaining Forest Land	CO <sub>2</sub>		X		X		X	Tier 1 Tier 2
5.A.1 Forest Land remaining Forest Land	N <sub>2</sub> O				X			Tier 2
5.A.2 Land converted to Forest Land	CO <sub>2</sub>		X		X		X	Tier 1 Tier 2

KEY category	GHG	Level without LULUCF 1990	Level with LULUCF 1990	Level without LULUCF 2011	Level with LULUCF 2011	Trend (1990-2011) without LULUCF	Trend (1990-2011) with LULUCF	Approach used
5.B Cropland	CO <sub>2</sub>		X		X		X	Tier 1 Tier 2
5.C Grassland	CO <sub>2</sub>		X		X		X	Tier 1 Tier 2
5.D Wetland	CO <sub>2</sub>		X		X			Tier 2
6.A Solid Waste Disposal on Land	CH <sub>4</sub>	X	X	X	X	X	X	Tier 1 Tier 2
6.B Waste-water handling	CH <sub>4</sub>	X	X	X	X	X		Tier 2
6.B Waste-water handling	N <sub>2</sub> O	X	X	X	X	X		Tier 2

**Annex I: Lithuania's 1<sup>st</sup> Biennial report to the United Nations Framework Convention on Climate Change**



**Vilnius  
2014**

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## **Abbreviations**

AR	Annual Review
CO <sub>2</sub> eq	CO <sub>2</sub> equivalent
CRF	Common reporting format
CTF	Common tabular format
EC	European Commission
ETS	Emission Trading System
EU	European Union
EUA	European Union emission Allowance
GDP	Gross domestic product
GHG	Greenhouse gases (CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub> )
GNI	Gross national income
GWP	Global Warming Potential
IDR	In-depth review report
JI	Joint implementation
LULUCF	Land Use, Land-Use Change and Forestry
NIR	National Inventory Report
NPP	Nuclear Power Plant
QC	Quality control
QA	Quality assurance
RES	Renewable energy sources
UNFCCC	United Nations Framework Convention on Climate Change



## Introduction

Lithuania is pleased to submit its First Biennial Report (BR1) as the Annex I to the Lithuania's 6<sup>th</sup> National Communication (NC) under the UNFCCC.

The Biennial report is elaborated in accordance with the UNFCCC biennial reporting guidelines for developed country Parties (Decision 2/CP.17 of the Conference of the Parties under UNFCCC). As defined in the guidelines the report structure is the following:

- Information on GHG emissions and trends.
- Quantified economy-wide emission reduction target.
- Progress in achievement of quantified economy-wide emission reduction targets.
- Greenhouse gas projections.
- Provision of financial, technological and capability-building support to developing country Parties.

The EU and Member States are committed to achieve a joint quantified economy-wide emission reduction target – 20 % by 2020, compared to 1990 levels. The details of the EU joint target under the UNFCCC are clarified in the document *Additional information relating to the quantified economy-wide emission reduction targets contained in document FCCC/SB/2011/INF.1/Rev.1* (FCCC/AWGLCA/2012/MISC.1).

This biennial report contains summary information on GHG inventory information for the time period 1990-2011, provides summary information on Lithuania's progress made in relation to Lithuania's contribution to the joint EU quantified economy-wide emission reduction target. Also summary information on projections until 2030 is also presented. Information provided on GHG and trends is consistent with the information in Lithuania's GHG inventory submission in 2013.

Tabular information to be reported electronically in the Common Tabular Format (CTF) in accordance with "UNFCCC biennial reporting guidelines for developed country Parties" (Decision 19/CP.18 of the Conference of the Parties under UNFCCC) is enclosed to the BR1 submission. It is submitted to the UNFCCC using the CTF software and presented in the particular chapters below.

## 1. Information on GHG emissions and trends

Lithuania's efforts on monitoring of current GHG emission levels and projection reporting enable the tracking of emissions at the national level, across different sectors and on different gases. National system that is established for preparation of national GHG emissions inventory capacitates comprehensive, comparable and transparent information which is of great importance in assurance of progress towards the national emission reduction commitments.

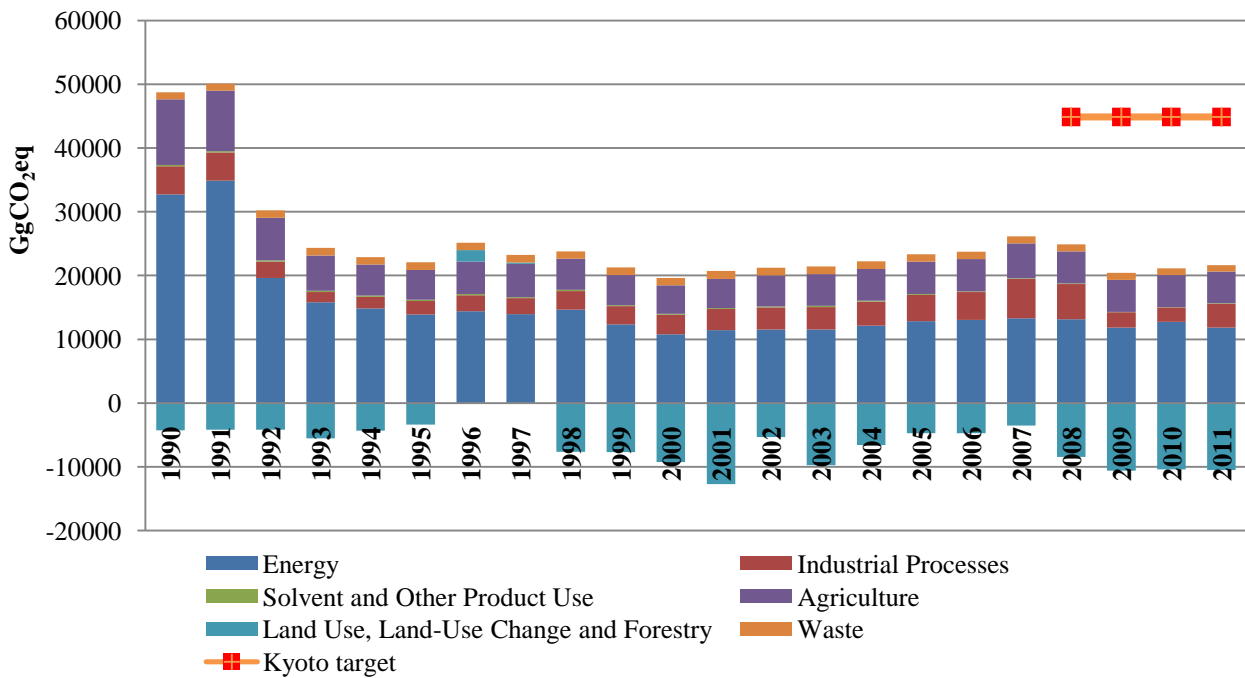
This chapter contains summary information on the Lithuania's GHG emissions and emission trends for the period 1990-2011. The GHG data presented in this chapter is consistent with the information in Lithuania's GHG inventory submission in 2013. Summary tables of GHG emissions are presented in CTF Table 1. Further information is reported in the Chapter 3 of 6<sup>th</sup> National Communication.

The chapter presents data on direct greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>).

### 1.1 Summary information on greenhouse gas emissions and trends

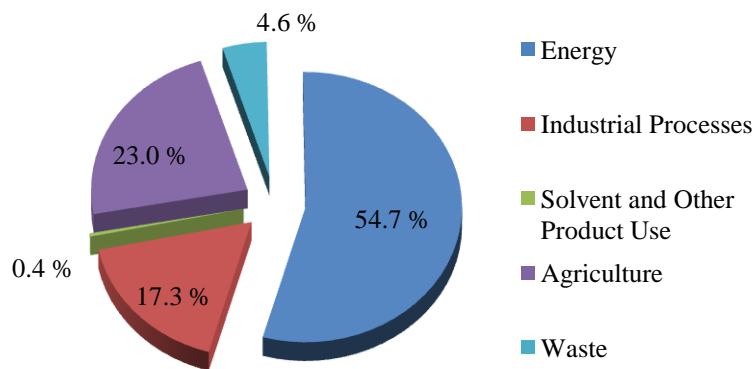
In 2011, Lithuania's total greenhouse gas emissions, excluding the Land-Use, Land-Use Change and Forestry (LULUCF) sector, were 21.6 million GgCO<sub>2</sub>eq. Lithuania's Kyoto Protocol target was to reduce GHG emissions by 8 % during the period of 2008-2012 compared to the 1990 level. The emissions have

decreased by 55.7 % comparing with the base year. The base year is 1990 for the greenhouse gases CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and 1995 for the F-gases HFC, PFC and SF<sub>6</sub>. Emission trends by sector and the Kyoto Protocol target are given in Fig. 1.



**Fig. 1** Lithuania's GHG emissions by different sectors in the period of 1990-2011 and Kyoto target, GgCO<sub>2</sub>eq

The most significant source of greenhouse gas emissions in Lithuania is the energy sector contributing 54.7 % share of total emissions in 2011. Agriculture is the second most significant source, which accounted for 23 % of the total emissions. Emissions from industrial processes contributed 17.3 % of the total GHG emissions, waste sector – 4.6 %.

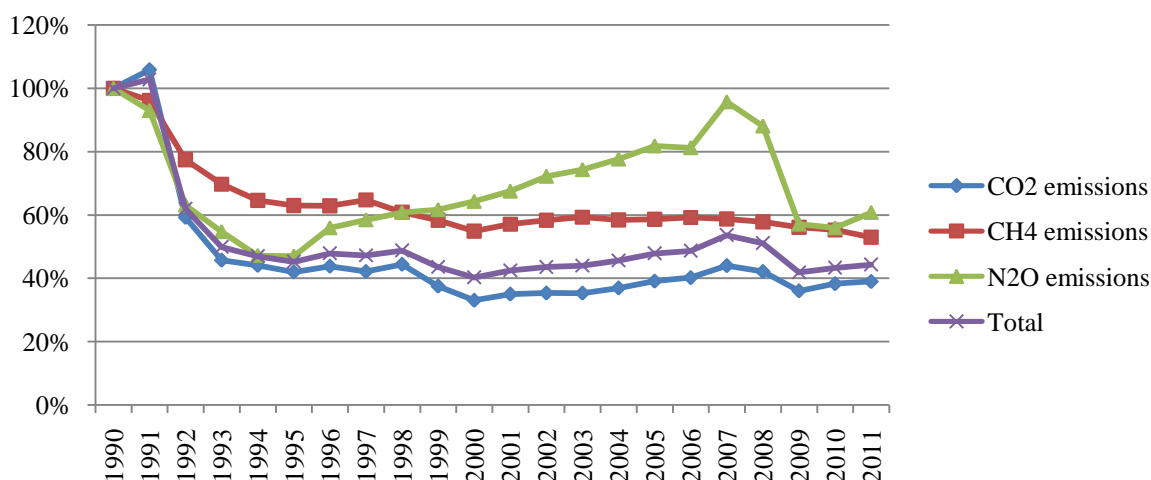


**Fig. 2** GHG emissions by sector in 2011, %

When LULUCF sector emissions and removals (-10 Mt) are included in the total, Lithuania's net greenhouse gas emissions fall to 11.1 Mt CO<sub>2</sub>eq. With the LULUCF sector emissions and removals, Lithuania's net greenhouse gas emissions in 2011 decreased by 75 % compared to 1990 levels.

The most important greenhouse gas in Lithuania is carbon dioxide. In 2011 it contributed 64.6 % to the total national GHG emissions expressed in CO<sub>2</sub>eq, followed by N<sub>2</sub>O (20.2 %) and CH<sub>4</sub> (14.1 %). PFCs, HFCs and SF<sub>6</sub> together amounted to 1 % of the total greenhouse gas emissions (excl. LULUCF) in Lithuania.

The development of emissions of three main GHG – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O – relative to the 1990 level is presented in Fig. 3.



**Fig. 3** Relative development of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O without LULUCF in relation to the 1990 level, %

Emissions of CO<sub>2</sub> have decreased by 61 % during the period of 1990-2011. It was caused mainly by CO<sub>2</sub> emissions from the energy sector which is the major source of CO<sub>2</sub> in Lithuania. CH<sub>4</sub> emissions have decreased by 47 % from the 1990 level, mainly from the enteric fermentation in agricultural sector. N<sub>2</sub>O emissions have decreased by 39.2 %, largely from agricultural soils. Implementation of N<sub>2</sub>O abatement technology in nitric acid production has also contributed to the reduction of N<sub>2</sub>O emissions.

## 1.2 National inventory arrangements

Lithuania prepares National Inventory Report (NIR) and CRF tables annually according to requirements of the UNFCCC, the Kyoto Protocol and the Regulation (EU) No 525/2013 on 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 Ministry of Environment of the Republic of Lithuania (MoE) 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 MoE is the main coordinating institution responsible for the establishment of national level climate change management policies that aim at achieving national GHG reduction and adaptation to climate change goals and objectives. The MoE 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.

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The MoE is responsible for:

- Overall coordination of GHG inventory process;
- Preparation of legal basis necessary for National System functioning;

- An official consideration and approval of GHG inventory;
- Approval of QA/QC plan and procedures;
- Timely submission of GHG inventory to the UNFCCC Secretariat and the European Commission;
- Coordination of the UNFCCC inventory reviews in Lithuania;
- Keeping of archive of official submissions to the UNFCCC and the European Commission;

Informing the inventory compilers about relevant requirements for the national system. Lithuania's GHG inventory submission in 2013 was compiled in cooperation between the MoE, the Environmental Protection Agency, the State Forest Service, National Climate Change Committee, permanent GHG inventory expert working group, data providers, external consultants.

In accordance with the Order of Minister of Environment of 22<sup>nd</sup> of December 2010 No D1-1017, the Lithuanian Environmental Protection Agency (EPA) under the Ministry of Environment was assigned as an institution responsible for the GHG inventory preparation, QA and QC starting from 2011. EPA, according to the competence, ensures continuous and complex monitoring, evaluation, forecast of and information providing on environmental quality and nature resources use. Also EPA compiles the national GHG inventory, ensures QA and QC of the GHG inventory, manages archive, collects data that is necessary for GHG calculation and projections and makes GHG projections.

The Lithuanian Environmental Investment Fund is responsible for the administration of the Union GHG registry and national Kyoto Protocol registry. Also it is responsible for the selection and supervision of the implementation of GHG reduction related projects which are financed from the Special Programme for Climate Change, describe in Chapter 4.2.1.3 of the NC6.

Since its 5<sup>th</sup> National Communication on Climate Change (NC5) Lithuania has:

- more accurate and comprehensive emissions estimates following the adoption of new data, methods and source/sink categories;
- complete and more reliable data collected under the Governmental Resolution No 683, nominating experts with experience in areas related to GHG emissions accounting;
- improved national inventory system through strengthening of the institutional capacities and quality control systems.

Detailed information on Lithuania's national inventory arrangements, including changes since Lithuania's NC5, are detailed in Chapter 3 of NC6. Information on GHG emissions projections are presented in Chapter 5 of NC6. For further details and information on the preparation of the NIR and calculations also please refer to the Lithuania's GHG Inventory Report, submitted to UNFCCC in 2013.

For more information see Chapter 3 of NC6 and Common Tabular Format (CTF) Table 1.

CTF Table 1. Emission trends: summary

	Base year (kt CO <sub>2</sub> eq)	1991 (kt CO <sub>2</sub> eq)	1992 (kt CO <sub>2</sub> eq)	1993 (kt CO <sub>2</sub> eq)	1994 (kt CO <sub>2</sub> eq)	1995 (kt CO <sub>2</sub> eq)	1996 (kt CO <sub>2</sub> eq)	1997 (kt CO <sub>2</sub> eq)	1998 (kt CO <sub>2</sub> eq)	1999 (kt CO <sub>2</sub> eq)
<b>Greenhouse Gas Emissions</b>										
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	31478.45	33651.72	16995.82	10813.11	11388.73	11624.42	17478.76	15261.91	8208.99	5694.82
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	35815.45	37906.77	21218.11	16387.05	15799.12	15053.53	15702.75	15104.27	15923.09	13455.67
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	5751.98	5530.97	4459.26	4011.60	3718.06	3624.27	3618.07	3726.05	3501.61	3356.74
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	5749.67	5528.90	4454.15	4008.55	3715.02	3621.23	3615.03	3723.01	3499.57	3353.74
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	7236.86	6735.41	4589.87	3982.22	3445.96	3433.78	4067.60	4250.74	4424.99	4493.26
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	7188.74	6686.83	4539.65	3934.54	3394.26	3383.40	4023.47	4204.19	4372.14	4435.36
HFCs	NA, NO	NA, NO	NA, NO	0.10	0.27	2.76	3.68	5.44	8.17	10.66
PFCs	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
SF <sub>6</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.05	0.05	0.08	0.10	0.14
<b>Total (including LULUCF)</b>	44467.29	45918.10	26044.95	18807.03	18553.01	18685.27	25168.16	23244.23	16143.86	13555.61
<b>Total (excluding LULUCF)</b>	48753.87	50122.50	30211.91	24330.24	22908.66	22060.97	23344.98	23036.99	23803.07	21255.56
<b>Greenhouse Gas Source and Sink Categories</b>										
1. Energy	32744.95	34883.84	19646.13	15789.18	14849.86	13903.45	14407.93	13963.72	14676.63	12331.85
2. Industrial Processes	4396.79	4434.17	2561.62	1642.78	1827.47	2111.51	2525.85	2484.37	2910.33	2856.13
3. Solvent and Other Product Use	197.52	195.83	193.87	191.53	188.98	186.36	183.75	181.17	178.61	176.07
4. Agriculture	10292.09	9464.70	6651.94	5530.83	4866.13	4680.76	5046.05	5221.04	4848.59	4704.95
5. Land Use, Land-Use Change and Forestry <sup>b</sup>	-4286.58	-4204.40	-4166.96	-5523.22	-4355.65	-3375.69	1823.18	207.24	-7659.21	-7699.94
6. Waste	1122.51	1143.96	1158.36	1175.92	1176.21	1178.88	1181.41	1186.69	1188.91	1186.56
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (including LULUCF)</b>	44467.29	45918.10	26044.95	18807.03	18553.01	18685.27	25168.16	23244.23	16143.86	13555.61

continue CTF Table 1 Emission trends: summary

	2000 (kt CO <sub>2</sub> eq)	2001 (kt CO <sub>2</sub> eq)	2002 (kt CO <sub>2</sub> eq)	2003 (kt CO <sub>2</sub> eq)	2004 (kt CO <sub>2</sub> eq)	2005 (kt CO <sub>2</sub> eq)	2006 (kt CO <sub>2</sub> eq)	2007 (kt CO <sub>2</sub> eq)	2008 (kt CO <sub>2</sub> eq)	2009 (kt CO <sub>2</sub> eq)	2010 (kt CO <sub>2</sub> eq)	2011 (kt CO <sub>2</sub> eq)	Change from base to latest reported year (%)
<b>Greenhouse Gas Emissions</b>													
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	2551.81	-213.39	7276.24	2857.52	6594.97	9228.57	9610.62	12198.03	6595.52	2224.00	3287.76	3443.42	-89.06
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	11853.19	12558.01	12676.10	12661.14	13244.24	14017.63	14408.34	15769.66	15103.94	12920.15	13725.06	13970.47	-60.99
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	3160.98	3284.89	3359.11	3413.83	3364.75	3373.81	3414.29	3379.19	3326.25	3229.45	3178.14	3047.53	-47.02
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	3158.03	3282.66	3354.76	3410.52	3361.68	3372.95	3404.68	3378.51	3324.99	3226.32	3177.09	3045.57	-47.03
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	4681.01	4909.54	5245.10	5388.22	5632.26	5925.60	5916.43	6951.87	6406.13	4169.99	4061.15	4412.49	-39.03
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	4622.59	4854.25	5192.90	5343.63	5584.65	5882.97	5841.24	6885.67	6334.48	4106.78	4022.40	4370.88	-39.20
HFCs	13.66	18.17	24.27	33.93	50.25	68.48	92.66	122.81	152.81	167.27	192.20	219.19	100.00
PFCs	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
SF <sub>6</sub>	0.33	0.26	0.35	2.03	0.78	1.35	1.18	0.88	3.21	2.77	5.85	8.12	100.00
<b>Total (including LULUCF)</b>	10407.79	7999.46	15905.07	11695.53	15643.01	18597.80	19035.18	22652.78	16483.93	9793.47	10725.11	11130.74	-74.97
<b>Total (excluding LULUCF)</b>	19647.80	20713.34	21248.38	21451.26	22241.60	23343.38	23748.09	26157.53	24919.43	20423.30	21122.60	21614.23	-55.67
<b>Greenhouse Gas Source and Sink Categories</b>													
1. Energy	10807.37	11461.38	11551.44	11544.79	12164.11	12858.95	13049.23	13283.25	13132.81	11861.22	12757.79	11820.46	-63.90
2. Industrial Processes	3019.01	3265.70	3445.08	3528.74	3724.18	4089.04	4341.13	6195.31	5525.37	2367.35	2230.00	3737.55	-14.99
3. Solvent and Other Product Use	173.54	170.87	168.22	165.58	162.64	159.22	127.72	117.56	90.95	95.38	87.41	85.95	-56.49
4. Agriculture	4457.30	4599.14	4862.90	4987.46	4993.67	5062.77	5086.29	5439.91	5057.12	5008.98	4984.65	4979.97	-51.61
5. Land Use, Land-Use Change and Forestry <sup>b</sup>	-9240.01	-12713.88	-5343.31	-9755.72	-6598.59	-4745.58	-4712.91	-3504.75	-8435.51	-10629.82	-10397.49	-10483.49	144.57
6. Waste	1190.58	1216.25	1220.74	1224.69	1196.99	1173.40	1143.73	1121.50	1113.19	1090.37	1062.74	990.31	-11.78
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>Total (including LULUCF)</b>	10407.79	7999.46	15905.07	11695.53	15643.01	18597.80	19035.18	22652.78	16483.93	9793.47	10725.11	11130.74	-74.97

CTF Table 1. Emission trends: (CO<sub>2</sub>)

	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
<b>1. Energy</b>	32246.74	34346.77	19268.91	15389.42	14456.96	13494.43	13975.41	13514.11	14198.39	11856.10	10327.61
A. Fuel Combustion (Sectoral Approach)	32245.71	34344.10	19263.88	15383.60	14449.57	13484.29	13963.13	13497.33	14176.48	11837.75	10302.58
1. Energy Industries	13517.78	14583.52	8580.29	7254.95	7210.82	6355.29	7034.93	6477.76	7280.51	5897.29	5038.29
2. Manufacturing Industries and Construction	5739.06	5855.94	2787.62	1783.02	1808.04	1510.48	1391.72	1385.28	1371.28	1055.47	985.39
3. Transport	7475.06	7631.17	5135.54	4020.35	3305.75	3828.83	3869.59	4204.21	4331.16	3796.46	3361.24
4. Other Sectors	5513.82	6273.47	2760.43	2325.28	2124.95	1789.69	1666.89	1430.07	1193.52	1088.52	917.66
5. Other	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, NE, NO
B. Fugitive Emissions from Fuels	1.03	2.67	5.03	5.82	7.40	10.14	12.28	16.78	21.91	18.35	25.03
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	1.03	2.67	5.03	5.82	7.40	10.14	12.28	16.78	21.91	18.35	25.03
<b>2. Industrial Processes</b>	3463.97	3455.09	1847.51	894.04	1241.73	1456.47	1628.16	1491.71	1626.88	1503.25	1428.71
A. Mineral Products	2141.74	2021.37	1082.46	500.62	483.13	424.93	405.01	441.49	508.86	419.80	357.34
B. Chemical Industry	1291.50	1407.23	747.22	377.90	743.50	1017.25	1208.38	1034.94	1102.14	1067.12	1055.46
C. Metal Production	21.41	17.17	8.50	6.21	5.79	4.97	5.45	5.96	6.56	7.00	7.47
D. Other Production	9.32	9.32	9.32	9.32	9.32	9.32	9.32	9.32	9.32	9.32	8.44
E. Production of Halocarbons and SF <sub>6</sub>											
F. Consumption of Halocarbons and SF <sub>6</sub>											
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Solvent and Other Product Use</b>	100.42	100.59	100.48	100.00	99.31	98.55	97.80	97.09	96.38	95.70	95.03
<b>4. Agriculture</b>											
A. Enteric Fermentation											
B. Manure Management											
C. Rice Cultivation											
D. Agricultural Soils											
E. Prescribed Burning of Savannas											
F. Field Burning of Agricultural Residues											
G. Other											

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	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
<b>5. Land Use Land-Use Change and Forestry</b>	-4337.00	-4255.04	-4222.29	-5573.94	-4410.39	-3429.12	1776.01	157.64	-7714.10	-7760.85	-9,301.39
A. Forest Land	-7819.47	-7757.27	-7622.56	-8219.24	-7672.26	-5476.52	372.81	-1063.38	-8437.55	-8239.64	-9,617.52
B. Cropland	5772.10	5211.77	5042.86	4855.18	4682.01	4494.04	4326.35	4211.87	4052.16	3891.01	3619.64
C. Grassland	-2362.36	-2531.35	-2699.37	-2837.69	-3057.70	-3150.97	-2997.85	-3307.42	-3750.98	-4017.87	-4,333.64
D. Wetlands	72.73	72.73	72.73	63.31	75.27	74.85	74.70	67.08	67.96	211.14	71.14
E. Settlements	NE NO	749.08	774.13	354.57	1313.93	524.65	NE NO	249.49	249.49	394.51	958.99
F. Other Land	NE NO	NE NO	209.92	209.92	248.36	104.83	NE NO	NE NO	104.83	NE NO	NE, NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
<b>6. Waste</b>	4.33	4.33	1.21	3.59	1.11	4.08	1.38	1.37	1.44	0.62	1.84
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling											
C. Waste Incineration	4.33	4.33	1.21	3.59	1.11	4.08	1.38	1.37	1.44	0.62	1.84
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in the summary table in CRF)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CO<sub>2</sub> emissions including net CO<sub>2</sub> from LULUCF</b>	31478.45	33651.72	16995.82	10813.11	11388.73	11624.42	17478.76	15261.91	8208.99	5694.82	2551.81
<b>Total CO<sub>2</sub> emissions excluding net CO<sub>2</sub> from LULUCF</b>	35815.45	37906.77	21218.11	16387.05	15799.12	15053.53	15702.75	15104.27	15923.09	13455.67	11853.19
<b>Memo Items:</b>											
<b>International Bunkers</b>	701.44	978.89	1119.76	618.77	597.40	566.57	514.07	283.10	239.94	305.54	366.01
Aviation	399.27	480.54	194.69	107.93	114.57	118.04	96.66	90.81	81.85	76.07	73.40
Marine	302.17	498.35	925.07	510.84	482.83	448.53	417.41	192.29	158.09	229.47	292.62
<b>Multilateral Operations</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>CO<sub>2</sub> Emissions from Biomass</b>	1309.57	1309.57	1310.56	1956.99	2023.26	2122.39	2325.26	2379.88	2623.75	2719.70	2968.07



Continue CTF Table 1. Emission trends: (CO<sub>2</sub>)

	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
<b>1. Energy</b>	10953.69	11041.00	11028.23	11643.97	12318.14	12491.17	12723.67	12556.63	11293.49	12185.18	11255.97	-65.09
A. Fuel Combustion (Sectoral Approach)	10916.42	11006.68	10997.98	11620.08	12300.98	12476.79	12711.44	12546.48	11284.35	12176.06	11246.87	-65.12
1. Energy Industries	5510.08	5324.72	5198.12	5371.04	5627.07	5173.95	4712.82	4809.94	4783.13	5288.21	4419.06	-67.31
2. Manufacturing and Construction	961.52	1047.38	1064.41	1154.93	1250.79	1468.62	1441.80	1276.93	1014.11	1114.95	1155.56	-79.87
3. Transport	3556.94	3678.13	3724.83	4060.01	4320.64	4587.18	5344.20	5322.52	4368.40	4510.12	4430.26	-40.73
4. Other Sectors	887.17	955.37	1007.15	1024.78	1090.06	1234.98	1196.81	1124.81	1107.44	1246.89	1229.21	-77.71
5. Other	0.72	1.08	3.47	9.32	12.42	12.06	15.82	12.28	11.27	15.89	12.79	100.00
B. Fugitive Emissions from Fuels	37.27	34.32	30.25	23.89	17.15	14.38	12.23	10.15	9.15	9.12	9.10	786.23
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Oil and Natural Gas	37.27	34.32	30.25	23.89	17.15	14.38	12.23	10.15	9.15	9.12	9.10	786.23
<b>2. Industrial Processes</b>	1507.66	1539.43	1534.24	1505.61	1603.79	1823.42	2957.79	2460.10	1540.29	1453.91	2625.22	-24.21
A. Mineral Products	359.90	354.06	363.00	425.95	444.71	598.18	599.68	520.73	304.57	326.28	381.60	-82.18
B. Chemical Industry	1131.61	1168.86	1155.48	1063.09	1141.83	1208.06	2339.83	1925.12	1223.12	1115.27	2231.08	72.75
C. Metal Production	7.80	7.51	6.96	7.05	7.19	6.87	6.54	4.78	4.03	4.11	3.72	-82.61
D. Other Production	8.35	9.00	8.81	9.52	10.05	10.31	11.74	9.47	8.58	8.25	8.82	-5.41
E. Production of Halocarbons and SF <sub>6</sub>												
F. Consumption of Halocarbons and SF <sub>6</sub>												
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>3. Solvent and Other Product Use</b>	94.22	93.43	92.65	91.57	90.01	88.52	87.47	86.61	85.72	84.04	82.29	-18.05
<b>4. Agriculture</b>												

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	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
A. Enteric Fermentation												
B. Manure Management												
C. Rice Cultivation												
D. Agricultural Soils												
E. Prescribed Burning of Savannas												
F. Field Burning of Agricultural Residues												
G. Other												
<b>5. Land Use Land-Use Change and Forestry</b>	-12771.40	-5399.86	-9803.62	-6649.27	-4789.06	-4797.72	-3571.63	-8508.42	-10696.16	-10437.29	-10527.05	142.73
A. Forest Land	-11969.98	-4035.96	-8243.52	-4836.21	-3065.58	-4639.47	-3196.54	-9295.30	-11868.19	-10854.54	-11143.80	42.51
B. Cropland	3199.58	3046.18	2661.07	2575.64	2449.87	3147.14	3346.45	3792.27	3953.31	3669.41	3700.05	-35.90
C. Grassland	-4565.78	-4678.15	-4699.25	-4690.89	-4687.94	-4370.44	-4067.69	-3734.50	-3441.59	-3308.62	-3138.86	32.87
D. Wetlands	71.36	58.16	194.31	197.37	55.78	57.60	56.47	56.06	126.70	56.47	55.57	-23.59
E. Settlements	249.49	209.91	144.66	104.82	458.80	723.86	289.69	394.51	394.51	NE NO	NE NO	0.00
F. Other Land	243.93	NE NO	139.10	NE NO	NE NO	283.59	NE NO	278.54	139.10	NE NO	NE NO	0.00
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.00
<b>6. Waste</b>	2.44	2.24	6.02	3.09	5.69	5.23	0.73	0.61	0.64	1.93	6.99	61.54
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
B. Waste-water Handling												
C. Waste Incineration	2.44	2.24	6.02	3.09	5.69	5.23	0.73	0.61	0.64	1.93	6.99	61.54
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>7. Other (as specified in the summary table in CRF)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>Total CO<sub>2</sub> emissions including net CO<sub>2</sub> from LULUCF</b>	-213.39	7276.24	2857.52	6594.97	9228.57	9610.62	12198.03	6595.52	2224.00	3287.76	3443.42	-89.06

	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
<b>Total CO<sub>2</sub> emissions excluding net CO<sub>2</sub> from LULUCF</b>	12558.01	12676.10	12661.14	13244.24	14017.63	14408.34	15769.66	15103.94	12920.15	13725.06	13970.47	-60.99
<b>Memo Items:</b>												
<b>International Bunkers</b>	413.13	432.37	441.65	465.96	595.91	595.98	578.83	515.36	516.80	590.39	619.38	-11.70
Aviation	98.25	83.44	93.48	105.90	139.13	158.13	198.08	229.43	109.95	145.35	166.95	-58.19
Marine	314.88	348.93	348.17	360.05	456.77	437.85	380.75	285.92	406.85	445.04	452.44	49.73
<b>Multilateral Operations</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>CO<sub>2</sub> Emissions from Biomass</b>	3228.97	3487.01	3682.47	3862.30	3905.53	4091.57	4113.09	4354.90	4493.86	4480.39	4372.16	233.86

CTF Table 1. Emission trends: (CH<sub>4</sub>)

	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
<b>1. Energy</b>	18.45	19.42	14.10	15.48	15.48	16.09	17.07	17.77	18.83	18.92	19.32
A. Fuel Combustion (Sectoral Approach)	11.34	11.95	6.72	7.74	7.39	7.44	8.17	8.35	8.53	8.73	8.66
1. Energy Industries	0.42	0.48	0.29	0.27	0.26	0.22	0.24	0.23	0.28	0.20	0.19
2. Manufacturing Industries and Construction	0.31	0.32	0.18	0.11	0.12	0.10	0.10	0.11	0.12	0.10	0.10
3. Transport	1.84	2.14	1.38	1.06	0.88	1.05	1.04	1.15	1.11	0.99	0.77
4. Other Sectors	8.76	9.01	4.87	6.30	6.14	6.08	6.78	6.86	7.03	7.44	7.60
5. Other	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, NE, NO
B. Fugitive Emissions from Fuels	7.11	7.46	7.37	7.74	8.08	8.65	8.91	9.42	10.30	10.19	10.66
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	7.11	7.46	7.37	7.74	8.08	8.65	8.91	9.42	10.30	10.19	10.66
<b>2. Industrial Processes</b>	0.18	0.20	0.11	0.01	0.06	0.08	0.04	0.05	0.02	NA, NE, NO	0.02
A. Mineral Products	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO
B. Chemical Industry	0.18	0.20	0.11	0.01	0.06	0.08	0.04	0.05	0.02	NO	0.02
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production											
E. Production of Halocarbons and SF <sub>6</sub>											

	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
F. Consumption of Halocarbons and SF <sub>6</sub>											
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Solvent and Other Product Use</b>											
<b>4. Agriculture</b>	205.73	193.23	146.62	123.39	109.21	104.11	102.60	106.77	94.97	88.01	78.13
A. Enteric Fermentation	153.65	144.79	112.86	93.89	80.47	75.63	75.61	77.90	68.31	64.25	56.58
B. Manure Management	52.08	48.44	33.76	29.50	28.74	28.48	27.00	28.87	26.66	23.76	21.55
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE
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. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Land Use, Land-Use Change and Forestry</b>	0.11	0.10	0.24	0.14	0.14	0.14	0.14	0.14	0.10	0.14	0.14
A. Forest Land	0.02	0.01	0.15	0.06	0.06	0.06	0.06	0.06	0.01	0.05	0.05
B. Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Grassland	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
D. Wetlands	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
<b>6. Waste</b>	49.43	50.44	51.27	52.00	52.16	52.16	52.43	52.70	52.82	52.77	52.92
A. Solid Waste Disposal on Land	41.15	42.15	43.04	43.82	44.04	44.11	44.44	44.76	44.93	45.04	45.44
B. Waste-water Handling	8.28	8.29	8.23	8.18	8.11	8.05	7.99	7.94	7.90	7.73	7.48
C. Waste Incineration	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in the summary table in CRF)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CH<sub>4</sub> emissions including CH<sub>4</sub> from LULUCF</b>	273.90	263.38	212.35	191.03	177.05	172.58	172.29	177.43	166.74	159.84	150.52
<b>Total CH<sub>4</sub> emissions excluding CH<sub>4</sub> from LULUCF</b>	273.79	263.28	212.10	190.88	176.91	172.44	172.14	177.29	166.65	159.70	150.38
<b>Memo Items:</b>											
<b>International Bunkers</b>	0.02	0.04	0.06	0.03	0.03	0.03	0.03	0.01	0.01	0.02	0.02

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	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	0.02	0.03	0.06	0.03	0.03	0.03	0.03	0.01	0.01	0.02	0.02
<b>Multilateral Operations</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>CO<sub>2</sub> Emissions from Biomass</b>											

Continue CTF Table 1 Emission trends: (CH<sub>4</sub>)

	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
1. Energy	20.35	20.29	20.44	20.37	21.18	21.61	21.25	21.86	22.26	22.39	22.14	19.99
A. Fuel Combustion (Sectoral Approach)	8.92	8.97	9.15	9.21	9.48	9.86	9.55	9.87	9.87	9.97	9.72	-14.25
1. Energy Industries	0.25	0.28	0.30	0.35	0.35	0.37	0.36	0.41	0.46	0.46	0.42	-0.28
2. Manufacturing Industries and Construction	0.12	0.18	0.22	0.23	0.23	0.25	0.25	0.22	0.17	0.20	0.21	-33.28
3. Transport	0.78	0.77	0.79	0.81	0.85	0.81	0.74	0.74	0.65	0.62	0.55	-69.92
4. Other Sectors	7.77	7.73	7.84	7.83	8.05	8.44	8.21	8.50	8.60	8.69	8.54	-2.53
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
B. Fugitive Emissions from Fuels	11.43	11.32	11.29	11.16	11.70	11.75	11.70	11.99	12.38	12.41	12.41	74.59
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Oil and Natural Gas	11.43	11.32	11.29	11.16	11.70	11.75	11.70	11.99	12.38	12.41	12.41	74.59
2. Industrial Processes	0.06	0.06	0.08	0.09	0.08	0.10	0.10	0.11	NA, NO	NE, NO	NA, NO	NE, NE, -100.00
A. Mineral Products	NA, NO	NE, NO	NA, NO	NE, NO	NA, NO	NE, NO	NA, NO	NE, NO	NA, NO	NE, NO	NA, NO	NE, NE, 0.00
B. Chemical Industry	0.06	0.06	0.08	0.09	0.08	0.10	0.10	0.11	NO	NO	NO	-100.00
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Other Production												
E. Production of Halocarbons and SF <sub>6</sub>												
F. Consumption of Halocarbons and SF <sub>6</sub>												
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00

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	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
3. Solvent and Other Product Use												
4. Agriculture	81.77	85.02	87.51	86.42	87.37	89.80	89.74	86.95	83.06	81.92	79.57	-61.33
A. Enteric Fermentation	57.86	59.66	61.66	60.80	61.03	63.02	64.47	62.12	58.96	57.17	56.46	-63.26
B. Manure Management	23.92	25.37	25.85	25.62	26.35	26.78	25.26	24.83	24.10	24.75	23.11	-55.63
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Agricultural Soils	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	0.00
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
5. Land Use, Land-Use Change and Forestry	0.11	0.21	0.16	0.15	0.04	0.46	0.03	0.06	0.15	0.05	0.09	-15.21
A. Forest Land	0.02	0.12	0.07	0.04	0.01	0.19	0.01	0.02	0.05	0.00	0.05	118.51
B. Cropland	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-43.87
C. Grassland	0.08	0.08	0.08	0.10	0.02	0.26	0.02	0.04	0.09	0.04	0.04	-47.70
D. Wetlands	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	0.00
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.00
F. Other Land	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	0.00
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.00
6. Waste	54.13	54.38	54.37	53.21	51.98	50.62	49.79	49.41	48.32	46.98	43.32	-12.36
A. Solid Waste Disposal on Land	46.92	47.38	47.82	46.96	46.07	45.29	44.56	43.78	43.03	42.09	38.46	-6.53
B. Waste-water Handling	7.22	7.00	6.56	6.25	5.91	5.33	5.23	5.62	5.29	4.89	4.86	-41.31
C. Waste Incineration	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
7. Other (as specified in the summary table in CRF)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Total CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	156.42	159.96	162.56	160.23	160.66	162.59	160.91	158.39	153.78	151.34	145.12	-47.02

	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
Total CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	156.32	159.75	162.41	160.08	160.62	162.13	160.88	158.33	153.63	151.29	145.03	-47.03
Memo Items:												
International Bunkers	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.03	37.50
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-58.19
Marine	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.03	51.08
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO <sub>2</sub> Emissions from Biomass												

CTF Table 1. Emission trends: (N<sub>2</sub>O)

	Base year (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
<b>1. Energy</b>	0.36	0.42	0.26	0.24	0.22	0.23	0.24	0.25	0.27	0.25	0.24
A. Fuel Combustion (Sectoral Approach)	0.36	0.42	0.26	0.24	0.22	0.23	0.24	0.25	0.27	0.25	0.24
1. Energy Industries	0.08	0.09	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.04	0.03
2. Manufacturing Industries and Construction	0.04	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
3. Transport	0.15	0.19	0.12	0.09	0.07	0.09	0.09	0.10	0.11	0.10	0.09
4. Other Sectors	0.10	0.10	0.07	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10
5. Other	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, NE, NO
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>2. Industrial Processes</b>	3.00	3.14	2.30	2.41	1.88	2.10	2.88	3.18	4.11	4.33	5.08
A. Mineral Products	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO
B. Chemical Industry	3.00	3.14	2.30	2.41	1.88	2.10	2.88	3.18	4.11	4.33	5.08
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

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	Base year (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
D. Other Production											
E. Production of Halocarbons and SF <sub>6</sub>											
F. Consumption of Halocarbons and SF <sub>6</sub>											
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Solvent and Other Product Use</b>	0.31	0.31	0.30	0.30	0.29	0.28	0.28	0.27	0.27	0.26	0.25
<b>4. Agriculture</b>	19.26	17.44	11.53	9.48	8.30	8.05	9.33	9.61	9.21	9.22	9.09
A. Enteric Fermentation											
B. Manure Management	2.86	2.64	1.96	1.60	1.36	1.26	1.24	1.27	1.10	1.02	0.90
C. Rice Cultivation											
D. Agricultural Soils	16.41	14.80	9.57	7.88	6.94	6.79	8.09	8.34	8.11	8.19	8.18
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. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Land Use, Land-Use Change and Forestry</b>	0.16	0.16	0.16	0.15	0.17	0.16	0.14	0.15	0.17	0.19	0.19
A. Forest Land	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
B. Cropland	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.02	0.04	0.06	0.06
C. Grassland	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
D. Wetlands	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
<b>6. Waste</b>	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25
A. Solid Waste Disposal on Land											
B. Waste-water Handling	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



	Base year (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>7. Other (as specified in the summary table in CRF)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total N<sub>2</sub>O emissions including N<sub>2</sub>O from LULUCF</b>	23.34	21.73	14.81	12.85	11.12	11.08	13.12	13.71	14.27	14.49	15.10
<b>Total N<sub>2</sub>O emissions excluding N<sub>2</sub>O from LULUCF</b>	23.19	21.57	14.64	12.69	10.95	10.91	12.98	13.56	14.10	14.31	14.91
<b>Memo Items:</b>											
<b>International Bunkers</b>	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Aviation	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Multilateral Operations</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>CO<sub>2</sub> Emissions from Biomass</b>											

continue CTF Table 1. Emission trends: (N<sub>2</sub>O)

	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
<b>1. Energy</b>	0.26	0.27	0.28	0.30	0.31	0.34	0.37	0.38	0.32	0.33	0.32	-10.10
A. Fuel Combustion (Sectoral Approach)	0.26	0.27	0.28	0.30	0.31	0.34	0.37	0.38	0.32	0.33	0.32	-10.12
<b>1. Energy Industries</b>	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.06	-20.38
<b>2. Manufacturing Industries and Construction</b>	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	-39.10
<b>3. Transport</b>	0.10	0.10	0.11	0.12	0.12	0.14	0.18	0.18	0.13	0.13	0.13	-13.48
<b>4. Other Sectors</b>	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	13.00
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

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	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
<b>B. Fugitive Emissions from Fuels</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	814.17
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	814.17
<b>2. Industrial Processes</b>	5.61	6.06	6.31	6.99	7.79	7.81	10.04	9.38	2.12	1.86	2.85	-4.73
A. Mineral Products	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	0.00
B. Chemical Industry	5.61	6.06	6.31	6.99	7.79	7.81	10.04	9.38	2.12	1.86	2.85	-4.73
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Other Production												
E. Production of Halocarbons and SF6												
F. Consumption of Halocarbons and SF6												
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>3. Solvent and Other Product Use</b>	0.25	0.24	0.24	0.23	0.22	0.13	0.10	0.01	0.03	0.01	0.01	-96.23
<b>4. Agriculture</b>	9.30	9.93	10.16	10.25	10.41	10.32	11.47	10.42	10.53	10.53	10.67	-44.59
A. Enteric Fermentation												
B. Manure Management	0.92	0.94	0.98	0.97	0.98	1.01	1.01	0.96	0.90	0.89	0.87	-69.72
C. Rice Cultivation												
D. Agricultural Soils	8.38	8.98	9.18	9.29	9.43	9.32	10.46	9.46	9.63	9.64	9.81	-40.21
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>5. Land Use, Land-Use Change and Forestry</b>	0.18	0.17	0.14	0.15	0.14	0.24	0.21	0.23	0.20	0.13	0.13	-13.54
A. Forest Land	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.08	5.89
B. Cropland	0.05	0.05	0.03	0.03	0.02	0.10	0.10	0.11	0.08	0.01	0.02	-37.52
C. Grassland	0.01	0.01	0.01	0.01	0.00	0.02	0.00	0.00	0.01	0.00	0.00	-47.70

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	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
D. Wetlands	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	-23.59
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.00
F. Other Land	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	0.00
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.00
6. Waste	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	-8.19
A. Solid Waste Disposal on Land												
B. Waste-water Handling	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	-8.36
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.67
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
7. Other (as specified in the summary table in CRF)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Total N2O emissions including N2O from LULUCF	15.84	16.92	17.38	18.17	19.11	19.09	22.43	20.66	13.45	13.10	14.23	-39.03
Total N2O emissions excluding N2O from LULUCF	15.66	16.75	17.24	18.02	18.98	18.84	22.21	20.43	13.25	12.98	14.10	-39.20
Memo Items:												
International Bunkers	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-39.12
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	-58.19
Marine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.08
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO2 Emissions from Biomass												

CTF Table 1. Emission trends: HFCs, PFCs and SF6

	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
Emissions of HFCsc - (kt CO <sub>2</sub> eq)	NA, NO	NA, NO	NA, NO	0.10	0.27	2.76	3.68	5.44	8.17	10.66	13.66

	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
HFC-23	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
HFC-32	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
HFC-43-10mee	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
HFC-125	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-134	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
HFC-134a	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-152a	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-143	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
HFC-143a	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ea	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00
HFC-236fa	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
HFC-245ca	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Unspecified mix of listed HFCsd - (kt CO <sub>2</sub> eq)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
<b>Emissions of PFCsc - (kt CO<sub>2</sub> eq)</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
CF <sub>4</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
C <sub>2</sub> F <sub>6</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
C <sub>3</sub> F <sub>8</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
C <sub>4</sub> F <sub>10</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
c-C <sub>4</sub> F <sub>8</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO

	Base year <sup>a</sup> (kt)	1991 (kt)	1992 (kt)	1993 (kt)	1994 (kt)	1995 (kt)	1996 (kt)	1997 (kt)	1998 (kt)	1999 (kt)	2000 (kt)
C <sub>5</sub> F <sub>12</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
C <sub>6</sub> F <sub>14</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Unspecified mix of listed PFCs(4) - (Gg CO <sub>2</sub> equivalent)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
<b>Emissions of SF<sub>6</sub>(3) - (Gg CO<sub>2</sub> equivalent)</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.05	0.05	0.08	0.10	0.14	0.33
SF <sub>6</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00	0.00

continue CTF Table 1 Emission trends: HFCs, PFCs and SF6

	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to latest reported year (%)
<b>Emissions of HFCsc - (kt CO<sub>2</sub> eq)</b>	18.17	24.27	33.93	50.25	68.48	92.66	122.81	152.81	167.27	192.20	219.19	100.00
HFC-23	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
HFC-32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-41	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
HFC-43-10mee	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
HFC-125	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	100.00
HFC-134	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
HFC-134a	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.06	0.07	0.08	100.00
HFC-152a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-143	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00
HFC-143a	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	100.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

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	2001 (kt)	2002 (kt)	2003 (kt)	2004 (kt)	2005 (kt)	2006 (kt)	2007 (kt)	2008 (kt)	2009 (kt)	2010 (kt)	2011 (kt)	Change from base to reported (%)	from latest year
HFC-236fa	NA, NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	
HFC-245ca	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
Unspecified mix of listed HFCsd - (kt CO <sub>2</sub> eq)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
<b>Emissions of PFCsc - (kt CO<sub>2</sub> eq)</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
CF <sub>4</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
C <sub>2</sub> F <sub>6</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
C 3F8	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
C <sub>4</sub> F <sub>10</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
c-C <sub>4</sub> F <sub>8</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
C <sub>5</sub> F <sub>12</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
C <sub>6</sub> F <sub>14</sub>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
Unspecified mix of listed PFCs(4) - (Gg CO <sub>2</sub> equivalent)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.00	
<b>Emissions of SF<sub>6</sub>(3) - (Gg CO<sub>2</sub> equivalent)</b>	0.26	0.35	2.03	0.78	1.35	1.18	0.88	3.21	2.77	5.85	8.12	100.00	
SF <sub>6</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	

## 2. Quantified Economy-wide Emission Reduction Target (QEERT)

Chapter 4 of the NC6 provides information on the policies and measures that contribute to Lithuania's meeting its quantified economy-wide emission reduction targets.

Lithuania – a Party of the Convention and Kyoto Protocol - together with the other EU's Member States has committed to a quantified economy-wide emission reduction target of 20 % by 2020, below 1990 level (and move to a 30% reduction provided that other developed countries commit themselves to a comparable emission reduction and that developing countries contribute adequately according to their responsibilities and respective capabilities) which is unconditional and supported by the EU Climate and Energy Package (2009).

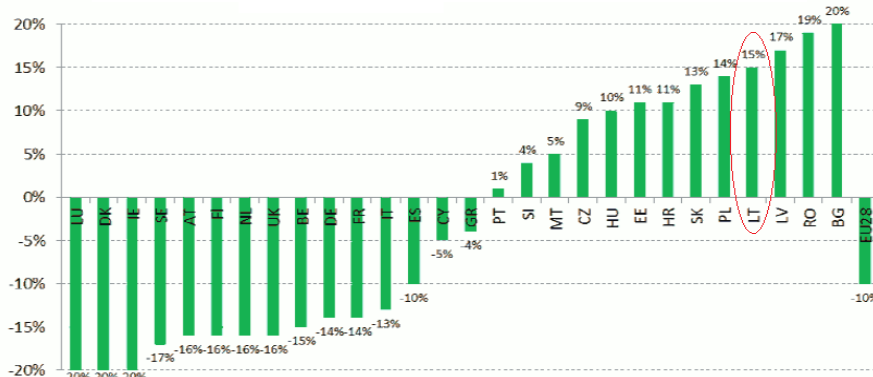
Information on Lithuania's quantified economy-wide emission reduction target has been presented to the UNFCCC and is contained in the document FCCC/SB/2011/INF.1/Rev.1<sup>30</sup> and document FCCC/AWGLCA/2012/MISC.1<sup>31</sup>. No individual target is set for Lithuania in the documents mentioned previously as 20 % target will be reached jointly by the EU.

In addition, the EU Climate and Energy Package also requires Lithuania to increase its use of renewable energy sources to 23 % of final energy consumption by 2020 and the share of biofuels in gasoline and diesel to 10 per cent by 2020.

The EU Directive of the GHG Emissions Trading System (Directive 2003/87/EC and respective amendments) and the Effort Sharing Decision (Decision No 406/2009/EC) are the main EU legal acts that lay down provisions for the implementation of the target. A joint quantified economy-wide emission reduction target of 20 % is calculated providing that in 2020 emissions from sectors covered by the EU ETS will be 21 per cent lower than in 2005.

As the common EU climate policy objectives shall be divided in accordance with the capacities of the Member States and their development. On 28 March 2013 the European Commission has adopted a decision that determined Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (OJ L 90, p. 106). With this decision the national emission targets for 2020 have been set on the basis of Member States' GDP per capita and emission level 2005. They range from a 20 % emissions reduction by 2020 (from 2005 levels) for the richest to a 20% increase for the least wealthy one Member States (Fig. 4). Thus, Lithuania is allowed to increase its GHG in 2020 for not included in the EU ETS sectors to more than 15 % above 2005 level.

Description of quantified economy-wide emission reduction target for Lithuania is provided in the CTF Table 2.



**Fig. 4** Member State GHG emission limits in 2020 compared to 2005 levels<sup>32</sup>

<sup>30</sup> <http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf>

<sup>31</sup> <http://unfccc.int/resource/docs/2012/awglca15/eng/misc01.pdf>

<sup>32</sup> Source <[http://ec.europa.eu/clima/policies/effort/index\\_en.htm](http://ec.europa.eu/clima/policies/effort/index_en.htm) >

### **3. Progress in achievement of QEERT**

#### **3.1 Mitigation action and progress towards Lithuania's QEERT**

Lithuania's fuel combustion installations above 20 MW participate in the EU emission trading scheme (EU ETS) and GHG reduction measures are implemented in the non EU ETS sectors (agriculture, transport, household, etc.), which enable Lithuania to meet national emission reduction targets. Detailed information on the EU emission trading scheme is provided in Chapter 4.2.1.2. and in Chapter 3.4 of the NC6.

Further information on mitigation actions and their effects is provided in the CTF Table 3. The detailed information on these policies and measures can also be found in the Chapter 4 of the NC6.

Further information on progress towards meeting Lithuania's target can be found in the NC6 Chapters 4 and 5.



CTF Table 2 Description of quantified economy-wide emission reduction target

<b>Emission reduction target: base year and target</b>		
Base year/ base period	1990	
Emission reductions target (% of base year/base period)	20.00	The target of 20% will be fulfilled jointly by the EU and LT. Legally binding target trajectories for the period 2013-2020 are enshrined in both the EU-ETS Directive (Directive 2003/87/EC and respective amendments) and the Effort Sharing Decision (Decision No 406/2009/EC). These legally binding trajectories not only result in a 20% GHG reduction in 2020 compared to 1990 but also define the EU's annual target pathway to reduce EU GHG emissions from 2013 to 2020. The Effort Sharing Decision sets annual national emission targets for all Member States for the period 2013-2020 for those sectors not covered by the EU emissions trading system (ETS), expressed as percentage changes from 2005 levels. In March 2013, the Commission formally adopted the national annual limits throughout the period for each Member State. By 2020, the national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered compared with 2005 levels.
Period for reaching target	by 2020	

<b>Gases and sectors covered. GWP values.</b>			
<b>Gases covered</b>	<b>Covered</b>	<b>Base Year</b>	<b>GWP<sup>c</sup> reference source</b>
CO <sub>2</sub>	Yes	by 2020	4nd AR
CH <sub>4</sub>	Yes	by 2020	4nd AR
N <sub>2</sub> O	Yes	by 2020	4nd AR
HFCs	Yes	by 2020	4nd AR
PFCs	Yes	by 2020	4nd AR
SF <sub>6</sub>	Yes	by 2020	4nd AR
NF <sub>3</sub>	Yes	1995/2000-2020	4nd AR

<b>Sectors covered<sup>e</sup></b>	<b>Covered</b>
Energy	Yes
Transport <sup>f</sup>	Yes
Industrial processes <sup>g</sup>	Yes
Agriculture	Yes
LULUCF	Yes
Waste	Yes

<b>Role of LULUCF sector</b>		
LULUCF in base year level and target	Excluded	
Contribution of LULUCF is calculated using	Land-based approach	As all Annex I countries, Lithuania in the National GHG inventory under the UNFCCC report information on emissions and removals from LULUCF sector by using land-based approach. However, Lithuania uses activity-based approach to report supplementary information on LULUCF sector in the National GHG inventory which is required under the Kyoto Protocol.

CTF Table 3. Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action	Included in WEM GHG projection scenario	Sectors affected	GHGs affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief description	Start year of implementation	Implementing entity or entities	Mitigation impact		Comment
										2015, kt CO <sub>2</sub> eq	2020, kt CO <sub>2</sub> eq	
Enhancement of the use of RES	Yes	Energy	CO <sub>2</sub>	Fuel balance	Other (Various instruments)	Implemented	<ul style="list-style-type: none"> <li>By 2010 7 % of all electricity consumed in Lithuania shall be produced from RES (achieved);</li> <li>By 2020 energy from RES shall amount to 23 % in total final energy balance;</li> <li>RES (including biofuels) will make 20% in total primary energy supply by 2025.</li> </ul>	2007	Ministries of Energy and Environment.	479	747	Initially the targets of RES had been set in National Energy Strategy, approved of by the Seimas (Parliament) of the Republic of Lithuania in 2007 (Official Gazette, 2007, No 11-430).
Increase of Energy Efficiency	Yes	Energy	CO <sub>2</sub>	Fuel consumption.	Other (Various instruments)	Implemented	Starting from 1 of January, 2008 in 9 years there was planned to save 9% of final energy, comparing with 2005 final energy consumption level.	2007	Ministries of Energy, Environment.	815	1496	The energy efficiency target had been set in National Energy Strategy, approved of by the Seimas (Parliament) of the Republic of Lithuania in 2007 (Official Gazette, 2007, No 11-430).
Bio-fuel production and consumption	Yes	Transport	CO <sub>2</sub>	Fuel balance.	Other (Various instruments)	Implemented	The increase of the bio-fuel part in the total quantity of petrol and diesel fuel intended for the transport sector and available on the national market by 5.75 % till 2010 and by 15 % till 2025.	2007	Ministries of Energy and Transport and Communications.	278	423	The targets had been set in National Energy Strategy, approved of by the Seimas (Parliament) of the Republic of Lithuania in 2007 (Official Gazette, 2007, No 11-430).
Implementation of the best available technology	Yes	Industry/industrial processes	CO <sub>2</sub>	Best available technology in cement production company	Regulatory	Implemented	Decrease GHG emissions due to change of cement production technology.	2013	Cement production company.	500	500	-
Change in production technology	Yes	Industry/industrial processes	N <sub>2</sub> O	Decrease N <sub>2</sub> O emissions from production of nitrogen fertilizers and chemical products.	Economic	Implemented		2009	Fertilizers' production company.	1467	1467	For the first JI project, fertilizer production company, received the final determination from UNFCCC Secretariat in 2009.

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Name of mitigation action	Included in WEM GHG projection scenario	Sectors affected	GHGs affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief description	Start year of implementation	Implementing entity or entities	Mitigation impact		Comment
										2015, kt CO <sub>2</sub> eq	2020, kt CO <sub>2</sub> eq	
Implementation of Nitrates Directive (91/676/EEC)	Yes	Agriculture	N <sub>2</sub> O	Minimization of the groundwater pollution with nitrates and emission reduction.	Regulatory	Implemented		2004	Ministry of Agriculture.	1200	1700	-
Afforestation of low fertility soils	Yes	Forestry/LU LUCF	CO <sub>2</sub>	Increase the States' forest area.	Other (Various of instruments)	Implemented	By the year 2020 increase forest area of the state by 3 %.	2002	Ministries of Environment and Agriculture.	840	1680	The Program on the increased afforestation of Lithuania (Official Gazette, 2003, No 1-10; 2004, No 188-7039; repealed since 14 October 2012).
Reduction of biodegradable municipal waste amount in landfills	Yes	Waste management/waste	CH <sub>4</sub>	Biodegradable municipal waste handling.	Regulatory	Implemented	Lowered amounts of land-filled of biodegradable municipal waste.	2007	Ministries of Energy and Environment.	359	538	The National Strategy Plan of Waste Management (Official Gazette 2007, No 122-5003, with later amendments)
Collection and use of methane from all existing and new landfills.	Yes	Waste management/waste	CH <sub>4</sub>	Biodegradable municipal waste handling.	Regulatory	Implemented		2007	Ministries of Energy and Environment.	1440	1940	The National Strategy Plan of Waste Management (Official Gazette 2007, No 122-5003, with later amendments)



Greenhouse Gas Source and Sink Activities	Base year	Net emissions/removals					Accounting Parameters	Accounting Quantity
		2008	2009	2010	2011	Total		
period								
A.2. Deforestation		9.00	8.61	26.31	10.48	54.39		54.39403
B. Article 3.4 activities								
B.1. Forest Management (if elected)		-9023.53	-11642.34	-10592.08	-10849.56	-42107.50		-5133.3333
3.3 offset							0	0
FM cap							5133.3333	-5133.3333
B.2. Cropland Management (if elected)	0	NA	NA	NA	NA	NA	0	0
B.3. Grazing Land Management (if elected)	0	NA	NA	NA	NA	NA	0	0
B.4. Revegetation (if elected)	0	NA	NA	NA	NA	NA	0	0

## **4. Greenhouse gas projections**

Projections provided in Chapter 5 of the NC6 show that target would not be achieved without measures. However, Lithuania's package of existing policy measures including the target for renewable energy and energy efficiency measures are consistent with Lithuania's commitments.

Development of activity data projections was performed in accordance with the information from the different ministries, responsible for the particular sectors. Projections are made depending on policies and measures, which are defined in policy documents. Impact of the separate measures to GHG reduction was calculated. The sum of the GHG emissions projections with existing measures and result of emissions reduction by separate measures formed a scenario without measures.

There have been no substantive changes to the modelling framework that Lithuania uses for projections since the NC5. Information on these methodologies can be found in Chapter 5 of the NC6.

CTF Table 5. Summary of key variables and assumptions used in the projections analysis

Key underlying assumptions	Unit	Historical						Projected				Comments
		1990	1995	2000	2005	2010	2011	2015	2020	2025	2030	
Population	thous.	3697.80	3629.10	3499.50	3314.70	3094.80	3030.20	3246.00	3180.00	3115.00	3079.00	<p>The historical data provided here are updated based on 2011 census data, and which was used in the NIR 2013 estimations.</p> <p>However, the GHG emissions projections were calculated in 2012 and were based on population data used in the estimations of the NIR 2012.</p> <p>We would like to highlight that the overall trend of population in Lithuania is declining (see the Chapter 2.2). Thus, the projected population numbers should be recalculated in the future GHG projection estimation process.</p>

CTF Table 6. Information on updated greenhouse gas projections

GHG emissions projections	Unit	GHG emissions and removals							GHG emission projections - Scenarios					
		Base Year	1990	1995	2000	2005	2010	2011	With measures		Without measures		With additional measures	
									2020	2030	2020	2030	2020	2030
<b>Sector</b>														
Energy	kt CO <sub>2</sub> eq	25185.15	25185.15	10024.78	7401.11	8482.07	8193.89	7338.74	9210.27	12924.97	11453.27	15167.97	6691.27	6390.23
Transport	kt CO <sub>2</sub> eq	7559.80	7559.80	3878.67	3406.26	4376.88	4563.90	4481.71	5521.98	6374.18	5944.98	6797.18	4987.98	6374.18
Industry/industrial processes	kt CO <sub>2</sub> eq	4594.32	4594.32	2297.87	3192.55	4248.26	2317.41	3823.50	4429.48	4429.48	6396.48	6396.48	4160.48	4160.48
Agriculture	kt CO <sub>2</sub> eq	10292.09	10292.09	4680.76	4457.30	5062.77	4984.65	4979.97	5669.14	5938.17	7369.14	7638.17	5109.14	5378.17

GHG emissions projections	Unit	GHG emissions and removals							GHG emission projections - Scenarios					
		Base Year	1990	1995	2000	2005	2010	2011	With measures		Without measures		With additional measures	
									2020	2030	2020	2030	2020	2030
Forestry/LULUCF	kt CO <sub>2</sub> eq	-4286.58	-4286.58	-3375.69	-9240.01	-4745.58	-10397.49	-10483.49	-12000	-12500	-12000	-12500	-12000	-12500
Waste management/waste	kt CO <sub>2</sub> eq	1122.51	1122.51	1178.88	1190.58	1173.40	1062.74	990.31	701.74	580.92	3179.74	3058.92	344.84	224.02
Other (specify)	kt CO <sub>2</sub> eq													
<b>Gas</b>														
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	kt CO <sub>2</sub> eq	31478.45	31478.45	11624.42	2551.81	9228.57	3287.76	3443.42	NE	NE	NE	NE	NE	NE
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	kt CO <sub>2</sub> eq	35815.45	35815.45	15053.53	11853.19	14017.63	13725.06	13970.47	17246.48	20454.37	NE	NE	NE	NE-
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	kt CO <sub>2</sub> eq	5751.98	5751.98	3624.27	3160.98	3373.81	3178.14	3047.53	NE	NE	NE	NE	NE	NE
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	kt CO <sub>2</sub> eq	5749.67	5749.67	3621.23	3158.03	3372.95	3177.09	3045.57	3031.50	3595.36	NE	NE	NE	NE
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	kt CO <sub>2</sub> eq	7236.86	7236.86	3433.78	4681.01	5925.60	4061.15	4412.49	NE	NE	NE	NE	NE	NE
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	kt CO <sub>2</sub> eq	7188.74	7188.74	3383.40	4622.59	5882.97	4022.40	4370.88	5071.66	6015.00	NE	NE	NE	NE
HFCs	kt CO <sub>2</sub> eq	NA, NO	NA, NO	2.76	13.66	68.48	192.20	219.19	172.28	172.28	NE	NE	NE	NE
PFCs	kt CO <sub>2</sub> eq	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO



GHG emissions projections	Unit	GHG emissions and removals							GHG emission projections - Scenarios					
		Base Year	1990	1995	2000	2005	2010	2011	With measures		Without measures		With additional measures	
									2020	2030	2020	2030	2020	2030
SF <sub>6</sub>	kt CO <sub>2</sub> eq	NA, NO	NA, NO	0.05	0.33	1.35	5.85	8.12	10.70	10.70	NE	NE	NE	NE
Other (specify)	kt CO <sub>2</sub> eq													
Total with LULUCF <sup>f</sup>	kt CO <sub>2</sub> eq	44467.29	44467.29	18685.28	10407.79	18597.81	10725.10	11130.75	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO
Total without LULUCF	kt CO <sub>2</sub> eq	48753.86	48753.86	22060.97	19647.80	23343.38	21122.60	21614.23	25532.62	30247.71	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO

## **5. Provision of financial, technological and capability-building support to developing country Parties**

Lithuania is not an Annex II Party of UNFCCC therefore the provisions of Decision 2/CP 17, Annex I "UNFCCC biennial reporting guidelines for developed country Parties", section VI (A, B, C) are not applicable.

However, in October 2009 at the European Council Summit seeking for the international agreement on the GHG reduction targets after 2012, by the end of the first Kyoto commitment period 2008-2012, Lithuania undertook a commitment to provide financial assistance to the developing countries together with the other 27 EU Member States.

On 23 April 2013 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 was adopted by the Government Resolution No 366. In the inter-institutional Action Plan a measure for identification of potential finance sources in public and private sectors and contribution to financing and implementation of measures related to climate change mitigation and adaptation in developing countries is foreseen for the period of 2013-2016 by the Ministry of Environment in cooperation with the Ministry of Foreign Affairs.

Lithuania in the CTF table 7 has provided the information on financial support to developing countries in 2011-2012 which consisted of official information from the "Fast Start Finance" contributions, which was already submitted to the Secretariat of the UNFCCC, for the year 2011 and 2012. No contributions through bilateral or regional channels were provided in 2012.

For more information please see the Chapter 7 of the NC6.

CTF Table 7. Provision of public financial support: summary information.

Allocation channels	Lithuanian litas - LTL					USD <sup>b</sup>				
	Core /general	Climate-specific <sup>d</sup>				Core /general	Climate-specific <sup>d</sup>			
		Mitigation	Adaptation	Cross-cutting	Other		Mitigation	Adaptation	Cross-cutting	Other
<b>2011</b>										
Total contributions through multilateral channels		100 000	88 847.25				37 461.60	33 173.00		
Multilateral climate change funds <sup>g</sup>										
Other multilateral climate change funds <sup>h</sup>										
Multilateral financial institutions, including regional development banks		100 000	88 847.25				37 461.60	33 173.00		
Specialized United Nations bodies										
Total contributions through bilateral, regional and other channels		90 000	30 000				33 715.44	11 238.48		
<b>Total</b>		<b>190 000</b>	<b>118 847.25</b>				<b>71 177.04</b>	<b>44 411.48</b>		
<b>2012</b>										
Total contributions through multilateral channels				100 000					37 965.07	
Multilateral climate change funds										
Other multilateral climate change funds										
Multilateral financial institutions, including regional development banks				100 000					37 965.07	
Specialized United Nations bodies										
Total contributions through bilateral, regional and other channels										
<b>Total</b>				<b>100 000</b>					<b>37 965.07</b>	