Lithuania's Fifth National Communication under the United Nations Framework Convention on Climate Change

2010 January

LIETUVOS RESPUBLIKOS APLINKOS MINISTERIJA

Authors

Darius Biekša, UAB „Cowi Lietuva“ - Education, training and public awareness raising, Financial Resources and Transfer of Technology, GHG prognosis

Eglė Jaraminienė, UAB „Cowi Lietuva“ - Policy and Measures, GHG Emissions Projection: energy and buildings

Giedrė Latvėnaitė - Staškevičienė, UAB „Cowi Lietuva“ - Policy and Measures, GHG Emissions Projection: industry

Inga Valuntienė, UAB „Cowi Lietuva“ - Project Manager, Executive summary, Policy and Measures, GHG Emissions Projection, final report

Julija Naujėkaitė, - requirements for report preparation, National Circumstances, GHG inventory information

Marius Bružas, UAB „Cowi Lietuva“ - Policy and Measures, GHG Emissions Projection: Agriculture, LULUCF

Martynas Nagevičius, UAB „Cowi Lietuva“ – quality control

Natalija Siniak, UAB „Cowi Lietuva“ – report formatting

Rita Tijūnaite, UAB „Cowi Lietuva“ - Climate Change Impact, Vulnerability Assessment, Adaptation and Mitigation Measures, Research and Systematic Observation

Sigitas Rinkevičius, UAB „Cowi Lietuva“ - Policy and Measures, GHG Emissions Projection: waste

Tadas Tauginas, UAB „Cowi Lietuva“ - Policy and Measures, GHG Emissions Projection: transport

Živilė Paškauskaitė, UAB „Cowi Lietuva“ - Policy and Measures, GHG Emissions Projection: waste

Photos
Cover Photo Vaida Brukštutė, Ginučiai, 2009 January
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86 page, Mindaugas Janulis, Varniai, 2008 June
88 page, Tadas Tauginas, Kaunas, 2009 April

Abbreviations

QC	Quality control
QA	Quality assurance
CDM	Clean development mechanism
CO_2e	CO_2 equivalent
CRF	Common reporting format
ETS	Emission Trading System
EU	European Union
EUA	European Union emission Allowance
GDP	Gross domestic product
GHG	Greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6)
IDR	In depth review report
JI	Joint implementation
LULUCUF	Land Use, Land-Use Change and Forestry
NIR	National Inventory Report
NPP	Nuclear Power Plant
R&D	Research and development
RES	Renewable energy sources
toe	tones of oil equivalent
UNFCCC	United Nations Framework Convention on Climate Change

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1 Executive Summary

1.1 General information

Lithuania restored its Independence on 11 March 1990 after many years of the Soviet Union's annexation. Since that date the foundation of the current management and administrative structure of the Republic of Lithuania began. 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 square kilometers. Lithuania borders with Latvia, Belarus, Poland, Russia and the Baltic Sea. The coastal length of Lithuania makes 90.6 km.

In the beginning of 2009 the number of population in Lithuania was reported to be 3349.9 thousand people. Over the past nine years Lithuania's population decreased by 162.2 thousand or 4.6%. About 67% of people reside in towns and about 33.1% in rural areas.

Lithuania is the country of lowlands with the highest hills not reaching 300 meters in height. Agricultural land covers about 53.1% of the total land area of the country. The Lithuanian woodland occupies about 32.5% of the country's territory and protected areas make 15.6%. In recent years the increased woodenness is reported mostly in swamps and the land unfit for agricultural activities.

The climate in Lithuania is changeable from marine to continental. The average annual climatic standard of weather temperature is 6.2^0C. In 2008 the average weather temperature was 8.3 ^{0}C and the year was reported to be the warmest year since 1961 in Lithuania

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 9.8% if compared with the previous year. Global crisis of finance affected Lithuania in 2008, when GDP growth barely reached 2.8% and dropped towards the negative rate in 2009. The Ministry of Finance forecasts the country's economic growth since 2011.

The most rapid growth of added value was in construction, real estate, lease and other businesses, transport, warehousing and communication, wholesale and retail trade companies. The added value of the said businesses composed 50 % of the gross value added. In 2007, if compared with 2000, the Lithuanian industry production increased by 83.9 %. This was influenced by the chemical production growth.

Export of goods and services increased in 2008, compared with previous years. In comparison with 2006, export and import in 2007 increased by 11.1 and 15.4% respectively. The most important export partners in 2007 were Russia (15%), Latvia (12.9%), Germany (10.5%), and Poland (6.3%). The most important import partners were Russia (18%), Germany (15%), Poland (10.6%) and Latvia (5.5%).

1.2 Energy sector

In comparison with the year 2000, the general fuel and energy related expenses of the country increased by 29.6% in 2008. Lithuania has limited energy resources and for this reason the country is dependent on their import. Lithuanian energy dependency on import increased from 46.6% in 2001 to 58% in 2008. This was caused by the decommissioning of the 1st unit of the Ignalina NPP on 31 December 2004 and the increased rate of energy consumption

In Lithuania the major share of electricity was produced from nuclear energy. In 2008, the Ignalina NPP generated 71.1% of the total amount of electricity produced in the country (cf. 73.7% in 2000). Therefore, Lithuania`s energy sector faces major challenges in fulfilling the commitment given to the European Union to close the Ignalina NPP since 1 January 2010. One of the most important steps to mitigate the impact of closure of the Ignalina NPP is installation of combined cycle gas turbine in the Lithuanian Power Plant. Its operation shall start in 2012.

Priority strategic goal is clearly expressed in the Lithuanian Energy Strategy - to build a new NPP by 2015. At the Atomic/Nuclear Energy Commission meeting held on 30 September 2009 a new NPP business model and financing plan developed by an international consortium was presented where the plausibility of construction of a new NPP in 2018-2019 is stated. 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.

The National Energy Strategy (Official Gazette 2007, No. 11-430), approved by the Seimas of Lithuania in 2007 is the main instrument employed for the development of Lithuania's energy policies.

In the same year, the Lithuanian Government approved of the National Energy Strategy implementation plan for 2008-2012 (Official Gazette 2008, No. 4-131). Energy efficiency measures are provided in the Energy Efficiency Action Plan (Official Gazette 2007, No. 76-3024) and the National Energy Efficiency Program for 2006-2010 (Official Gazette 2006, No. 54-1956) (the update of this program for 2011 - 2015 is under preparation). Law on Renewable Energy Sources and Renewable Energy Action Plan are under preparation.

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

One of the key measures to improve energy efficiency is the Program for Modernization of Multi-apartment Buildings, approved in 2004, with later amendments. 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 is intended. This program is funded from the state aid, local governments, the EU structural funds, inhabitants and other financial sources.

In 2009 the Ministry of Energy was established.

1.3 Transport sector

It is foreseen in the Law on Biomass, Bio-fuel and Bio-oils (Official Gazette, 2004, No. 28-870) that the Government or the Government-appointed authority prepares the measures to ensure that by 31 December 2010 bio-fuels make not less than 5.75% of the energy amount, calculating from the total quantity of petrol and diesel vehicle fuel available on the national market. For the Law enforcement a Program on Bio-fuel production and consumption for the period of 2004–2010 has been developed (Official Gazette, 2004, No. 133-4786). Along with this main measure, the following measures are applied for the reduction of GHG emissions: enhancement of liquefied natural gas consumption, improvement of communication infrastructure and increased efficiency of fuel consumption.

1.4 Industrial processes

The main sources of GHG in the industrial sector include nitric acid, ammonia, cement and lime production.

The production of cement is highly dependant on the construction market. The construction and real estate sector development in 2008 was strongly adjusted by the slowed down growth of economy and real estate market. Impressive increase of annual added value in construction sector was observed in 2006 and 2007 - 21.0% and 21.2% accordingly. In 2008 this factor decreased to 1.2%. In 2008 the main part of construction activities undertaken in the country composed new construction - 52.5%, reconstruction - 24.6%, maintenance - 20.8% and other works - 2.1%. By the type of buildings the largest share of works was performed for non-residential buildings - 42.5%, engineering buildings - 39.6%, residential buildings - 17.9%. In 2006 cement production in Lithuania increased by 300 thousand tons and in 2007-2008 it reached 1.1 million tons. The major share of produced cement was consumed in Lithuania.

Key measures for reduction of GHG emissions in the industrial sector include: IPPC 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.

In 2007 by the Order of Ministers of Economy and Environment liabilities on emissions of fluorinated gases were distributed among Lithuanian institutions.

1.5 Waste

Reorganization of waste management system to meet the requirements of the EU, closure of formerly operated small landfills and management of all municipal waste at the regional landfills.

In 2008 the amount of municipal waste reached 400 kg per capita and in comparison with 2007 it remained practically unchanged. This factor is related to the level of consumption and tends to grow constantly since 2004. 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.

According to the year 2008 data 4665.8 million m^3 of water was consumed in Lithuania for different needs, of this amount the groundwater made 119.3, million m^3 and surface water – 4546.5 million m^3. Annual fluctuations in the total amount of water consumption account for the varying energy production scale.

Three types of wastewater treatment are practiced in Lithuania - mechanical, biological and biological with additional nitrogen and phosphorus release. Some wastewater is discharged without treatment however the major quantity of wastewater which needs treatment is produced by households and industrial sector. 126.7 million m^3 of treated wastewater, 47.8 million m^3 of pre-treated wastewater and 0.5 million m^3 of untreated wastewater was released to the surface waters in 2008.

The main measures for reduction of GHG emissions correspond with the main waste sector targets:

- Landfilling of biodegradable municipal waste would make the following amounts: until 2010 – not more than 75 %, until 2013– not more than 50 %, until 2020 – not more than 35 %, if compared with the year 2000 quantities of biodegradable municipal waste.
- By the year 2010 - taking into account the possibilities of inter-regional cooperation to ensure that each waste management region has adequate conditions for treatment (composting and/or anaerobic digestion) of municipal biodegradable waste.
- Until 2013 the quantity of landfilled municipal waste must not exceed 50 % of 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.
- By 2013 the required municipal wastewater sludge handling capacities shall be established in Lithuania.

1.6 Agriculture and forestry

The main measures are set in the National Rural Development Strategy for 2007-2013 and the 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.

The following measures for GHG emissions reduction may be listed: ecological farming, enforcement of environment protection requirements, direct payments for farming, implementation of the Council Directive of 12 December 1991concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC), afforestation of low fertility soils. The main objective of the last measure - to achieve the goal set forth in the Lithuanian Forest Policy and its implementation strategy –by the year 2020 increase forest area of the state by 3%.

In the forestry sector the following measures are used: limitations of felling and the abovementioned afforestation of low fertility soils.

Limitations of felling are warranted by setting annual norm of the main forest felling in the state owned forests approved by the Government. The general annual norm of all types forest felling in the country must not exceed the annual tree growth.

1.7 Climate change management policy

The Seimas of the Republic of Lithuania ratified the UNFCCC in 1995 and the Kyoto protocol in 2002.

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

On 23 January 2008 the Government of the Republic of Lithuania by the Resolution No. 94 approved the Strategy for the Implementation of the UNFCCC until 2012 (Official Gazette, 2008, No. 19-685). 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.

On 16 September 2009 the Government of the Republic of Lithuania by its Resolution No. 1247 approved of the updated National Strategy for Sustainable Development (Official Gazette, 2003, No. 89-4029; 2009, No. 121-5215). 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.

In 2008 the Climate Change Division was created at the Ministry of Environment, consisting of 5 officials in 2009. In the end of the year 2009 the Climate Change Division was reformed to the Climate Change and Hydrometeorology Division.

In 2009 the composition of the National Committee on Climate Change was renewed.

It is foreseen in the Law on Financial Instruments for Climate Change Management (Official Gazette, 2009, No. 87-3662) that for the sake of development and raising of additional funding for the measures of climate change management, a Special Program for Climate Change shall be composed. The Program funds are kept in a separate State Treasury account. Income and expenses of the Program shall be planned in the budged of the state according to the special principles of the funding program. The Program funds will be used for implementation of the GHG emission reduction projects.

1.8 National GHG Inventory

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

In 2009 the sixth National Inventory Report (NIR) covering the inventory of GHG of Lithuania was presented. The most important data providers are the Statistics Department of Lithuania, the Environmental Protection Agency and the State Forest Survey Service.

The seventh National Inventory Report, covering the period of 1990-2008 has been developed and ready for submission. The data from this inventory are used for this communication.

Below GHG emission trends are presented in a graph, CO_2e, by gases.

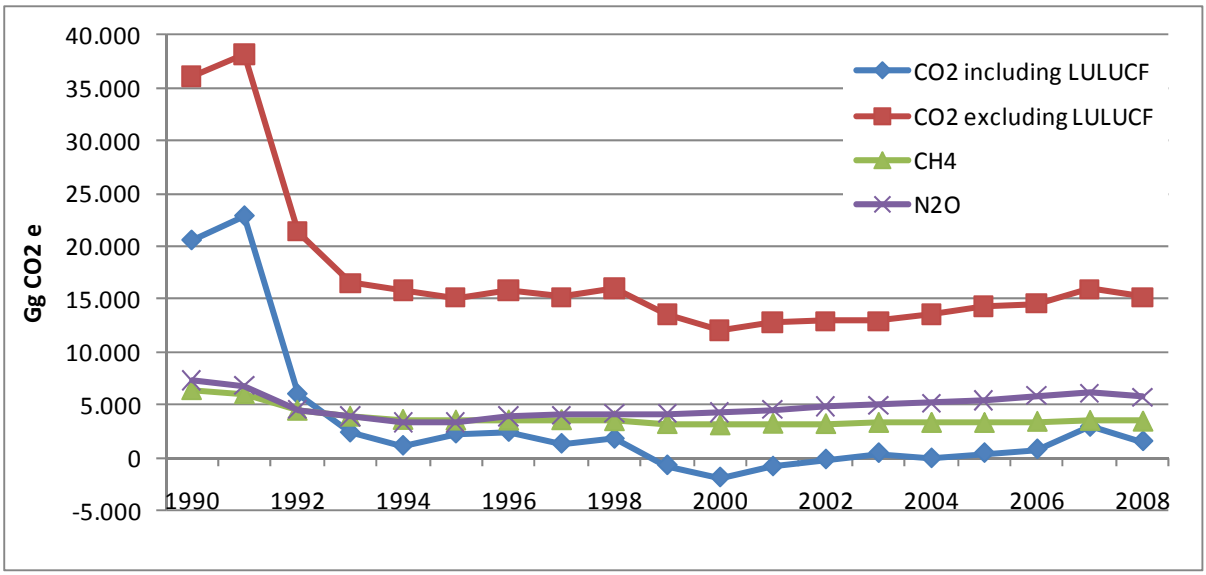


Fig. 1. GHG emissions in 1990-2008

More detailed description of the national GHG inventory is presented in Chapter 3.

1.9 National GHG Registry

The registry works implementing the Commission Regulation (EC) No. 2216/2004 of 21 December 2004 for standardized and secured registries system pursuant to the Directive 2003/87/EC of the European Parliament and of the Council and Decision No. 280/2004/EC of the European Parliament and of the Council and its amendments made by the Commission Regulation (EC) No. 916/2007 of 31 July 2007 amending Regulation (EC) No. 2216/2004 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council.

On 8 October 2008, Commission Regulation (EC) No. 994/2008 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No. 280/2004/EC of the European Parliament and of the Council was adopted. Articles 2 to 88 of the regulation shall apply from 1 January 2012 and it will provide possibilities for the creation of a consolidated register of the Community. From 1 January 2012 Regulation No. 994/2008 will replace Regulation No. 2216/2004 of 21 December 2004.

The national registry has joined the Independent Transaction Log (hereinafter as ITL). The registry activity corresponds to the UNFCCC states conference guidelines of decision No. 13/CMP.1 and decision 5/ CMP.1.

The registry accords with functions and technical specifications which are applicable to registry system data Exchange under the Kyoto protocol standards and adopted by the UNFCCC states conference decision No. 12/CMP.1.

The registry managing institution (competent authority) is the Ministry of Environment and the registry administrator is the Lithuanian Environmental Investment Fund.

The internet address of the Registry is http://etr.am.lt. It is also accessible via registry management office web page www.laaif.lt.

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

1.10 Joint Implementation projects

If all JI projects are implemented, GHG emissions would be reduced by 10373913 tCO_2e in 2008-2012. Most of the JI projects in Lithuania are related to the use of RES. In December 2009, out of 20 projects, 13 were wind energy projects.

More detailed information about JI projects is presented in Chapter 5.3.1.

1.11 Projections of GHG emissions

In the table below prognoses of GHG emissions together with the existing measures are presented, Gg CO_2e. More detailed projections of GHG emissions are presented in Chapter 5.

Table 1. GHG projections, Gg CO_2e

Sector / Year	1990	2007	2008	2010	2015	2020
Energy (excluding transport)	27811.40	8220.76	8034.97	17209.75	18535.82	19646.38
Transport	5787.93	5290.57	5240.11	4945.28	5592.31	6351.94
Industrial Processes, including Solvent and Other Product Use	4227.98	5632.01	4963.76	4839.44	6867.23	8899.51
Agriculture	10588.36	5225.34	5011.96	4642.40	4705.41	4730.88
Waste	1307.66	1164.43	1141.18	1112.38	923.00	725.05
LULUCUF	-15566.11	-13052.17	-13690.19	-13690.36	-13690.23	-13690.66
Total, excluding LULUCUF	49723.32	25533.12	24391.98	32749.26	36623.77	40353.76
Total	34157.21	12480.95	10701.79	19058.90	22933.54	26663.09

1.12 Climate change impacts and adaptation measures

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 most vulnerable areas to climate change.

The Coastal Zone Management Programme was approved of by the Order of the Minister of Environment of the Republic of Lithuania in 2003 (Official Gazette, 2003, No. 88-4004). On this basis coastal management projects were prepared and implemented during the period of 2004-2007. The project "Re-creation and Reservation of Lithuanian Baltic Coastal Zone" was commenced in 2005 and completed by the middle of 2008. The project was supported by the European Union funds. New Coastal Zone Management Programme for 2008-2013 was prepared and approved in 2008 (Official Gazette, 2008, No. 17-612).

For a proper adaptation to climate change and minimization of adverse effects on human health and environment, respective measures, deadlines and responsible actors are set in the National Strategy for the Implementation of the UNFCCC until 2012, approved by the Government of the Republic of Lithuania in 2008 (Official Gazette, 2008, No. 19-685).

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 restituted its independence after a long-lasting annexation of the country by the Soviet Union. Since then the creation of the present Republic of Lithuania government and administration structure started. The governance of Lithuania is performed by the Seimas /Parliament, the President of the Republic and the Government as well as the Judiciary according to the Constitution of the Republic of Lithuania (enacted by citizens of the Republic of Lithuania since 25 October 1992). The members of the Republic of Lithuania Seimas are elected for four years in seventy one single-member constituencies and in one multi-member constituency by universal and equal suffrage by secret ballot in direct mixed system elections. The Seimas consist of 141 members. On an annual basis the Seimas meets in two ordinary - spring and autumn - sessions, the chairman of the Seimas' sessions should be either the Speaker of the Seimas or his deputy. 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 heads, assenting to the candidature of the Prime Minister submitted by the President of the Republic. The Seimas considers the program of the Government, presented by the Prime Minister and decides whether to give an assent or not. 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 a draft law to the Seimas and the Seimas must consider it. 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. The adopted laws shall come into force after they are signed and officially promulgated by the President of the Republic, unless the laws themselves establish a later date for their coming into force. Other acts adopted by the Seimas and the Statute of the Seimas shall be signed by the Speaker of the Seimas. [1]

The fifth Seimas elected on 12 October 2008 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 submit 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 2009:

- Ministry of Environment,
- Ministry of Energy,
- Ministry of Finance,
- Ministry of National Defense,
- Ministry of Culture,
- Ministry of Social Security and Labour,
- Ministry of Transport and Communications,
- Ministry of Health,
- Ministry of Education and Science,
- Ministry of Justice,

- Ministry of Foreign Affairs,
- Ministry of Economy,
- Ministry of the Interior,
- Ministry of Agriculture. [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 was responsible for preparation of the National Long-term Development Strategy and the National Lisbon Strategy Implementation Programme, which sets out the measures to accelerate economic growth, economic competitiveness 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.

Currently, the most important law regulating climate change policy is the Law on Financial Instruments for Climate Change Management adopted on 7 July 2009 (Official Gazette 2009, No. 87-3662). It provides the creation of the National Strategy for Climate Change Management Policy and its adoption till 1 September 2012. Preparation of the law was determinate by the 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, define powers of public authorities and institutions, provide measures to manage climate change in Lithuania in order to implement obligations of the Republic of Lithuania under the UNFCCC (Official Gazette 1995, No. 23-521) and the Kyoto Protocol (Official Gazette 2002, No. 126-5735). It is envisaged that the National Strategy for Climate Change Management Policy and its implementation plan will cover the following areas: environmental protection and rational use of natural resources, energy, taxation and finance, science, industry, health care, education and public awareness, international cooperation, transport, domestic affairs, agriculture and other management areas related to adaptation to climate change and implementation of climate change mitigation. It is foreseen in this law that in order to develop and raise additional funding for climate change management measures the Special Programme for Climate Change shall be composed. (For more details on policies and measures see Chapter 4 and on the Special Programme for Climate Change - Chapter 4.1.4.).

The entire territory of the Republic of Lithuania is divided into counties (10) and municipalities (60). 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). 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, it is accountable to the executive and other municipal authorities and bodies. Municipalities and counties are governed by the Law on the Local Self-Government (2004, current version from 30-06-2009) and Law on the Governing of the County (2004, current version from 18-07-2006). The county is defined as the Republic of Lithuania higher territorial administrative unit; the management of the county organizes the Government through the county governor, the Ministries and other Government institutions [6, 7]. In its work program for 2008-2012 the fifteenth Lithuanian Government made provision that the counties would be liquidated, leaving regions and regional councils. Part of the counties' functions will be transferred to the municipalities. The State will maintain those functions, which are necessary for implementation of the national policy in specific sectors and ensure supervision of the state.

Fig. 2. Lithuanian territorial administrative division [6]

2.2 Population

The population of Lithuania takes a declining trend. In the beginning of 2009 population in Lithuania made 3349.9 thousand, i.e. 16.5 thousand less than in the beginning of 2008. Over the past nine years Lithuania's population decreased by 162.2 thousand or 4.6%.

In the period of 2000-2008 the population decreased by 145.7 thousand. Two factors have been revealed for this: negative natural population change (for that reason the number of population declined by 86.1 thousand (59.1%)) and negative net migration (for that reason the population declined by 59.6 thousand (40.9%)).

It the beginning of 2008 the number of urban population in 103 Lithuanian towns accounted for 2250.8 thousand (66.9%) individuals while 1115.6 thousand (33.1%) people lived in rural residential areas. In the period of 2000-2007 rural and urban population remained almost unchanged.

The most densely populated towns and districts are those of Mazeikiai, Kretinga, Palanga, Taurage, Jonava, Kaunas, Marijampole, Druskininkai and Vilnius. The national average of population density makes 51.6 inhabitants per square kilometer (51.6 inh./km^2).

In terms of gender distribution at the start of 2008 the number of population in Lithuania was as follows: 1567 thousand (46.5%) men and 1799.4 thousand (53.5%) women. During the period of 2000-2008 the ratio between men and women has changed: in the beginning of 2000 - 1000 men vs. 1136 women; in the beginning of 2008 – 1000 vs. 1148.

Declining number of population changes the age structure of inhabitants. Low birth rate declines the number of children (0-14 years old). In the beginning of 2008 children composed 15.4 % of the country's population (2000 - 20.2%). [8]

Table 2. International migration in 2002-2008 [9]

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Emigrants	7 086	11 032	15 165	15 571	12 602	13 853	17 015
Emigrants number for 1000 inhabitants	2.0	3.2	4.4	4.6	3.7	4.1	
Immigrants	5 110	4 728	5 553	6 789	7 745	8 609	9 297
Immigrants number for 1000 inhabitants	1.4	1.4	1.6	2.0	2.3	2.6	
Net migration	-1 976	-6 304	-9 612	-8 782	-4 857	-5 244	-7 718
Net migration for 1 000 inhabitants	-0.6	-1.8	-2.8	-2.6	-1.4	-1.5	

Table 3. Average annual number of population [9]

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Rural and urban	3 549.3	3 524.2	3 499.5	3 481.3	3 469.1	3 454.2	3 435.6	3 414.3	3 394.1	3 375.6	3 358.1
Urban	2 387.8	2 367.1	2 345.6	2 330.2	2 321.7	2 307.3	2 289.4	2 275.1	2 264.5	2 255.5	2 245.7
Rural	1 161.5	1 157.1	1 153.9	1 151.1	1 147.4	1 146.9	1 146.2	1 139.2	1 129.6	1 120.1	1 112.4

2.3 Geographic profile

Lithuania is a Central European country on the Baltic Sea. The size of the territory is 65302 km² - by its area Lithuania is very similar to Ireland and Latvia.

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 - 3873 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 (6400 km³) meets the Swedish waters. The length of Lithuanian coast is 90.6 km.

Lithuania is the region of plains. The highest hill is 293.6 m above the sea level. According to the data reported by the Institute of Geology and Geography, the highest hill in Lithuania is Aukstojas (293.8 m), Kruopyne (293.7 m) and Juozapine (292.7 meters). Padvarionys, Nevaisiai, Barsukyne and other elevations are of similar height (from 292 to 228 m). [8]

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). [11]

According to the data of Department of Statistics as of 1 January 2009, the Lithuanian land fund consisted of 6530 thousand ha, more than half of the land reported suitable for agriculture, i.e. the land area used for agricultural production. Farming lands occupy 53.1% (3465.3 thousand ha) of the entire territory of the country. Forests occupy 32.5% (2123 thousand ha), roads - 2% (132.1 thousand ha), urbanized territories - 2.8% (180.1 thousand ha), water - 4% (262. 5 thousand ha), other land - 5.6% (367.0 thousand ha). [13]

Protected areas in Lithuania cover 15.6 % of the country's territory (1018.8 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. [12]

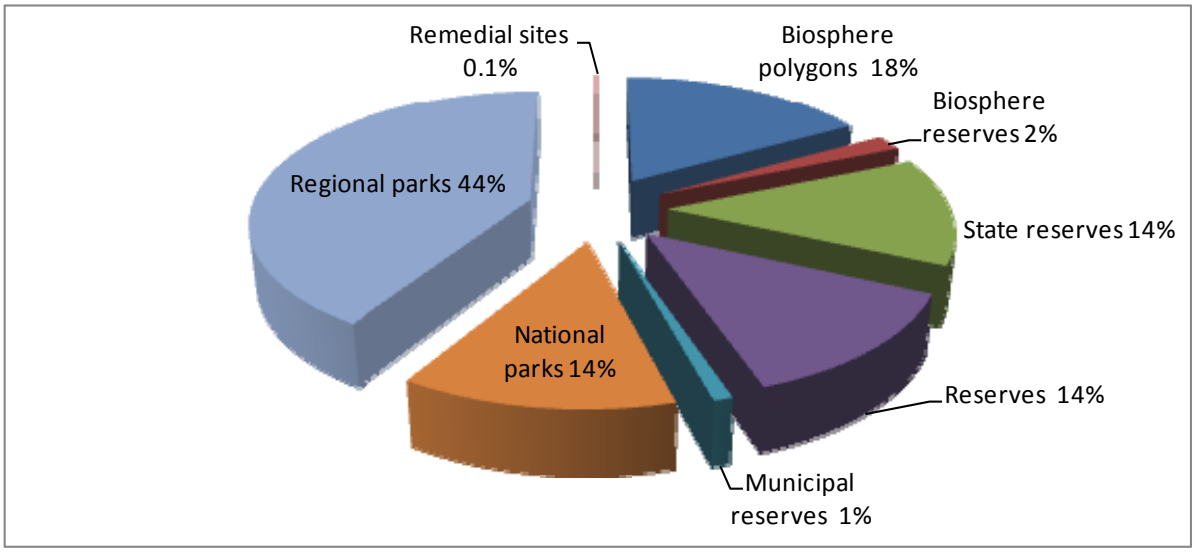


Fig. 3. Protected area distribution by type [12]

According to the State Forest records, the forested areas increased by 1.9% (as of 1 January 2009 the forest area amounted to 32.9%). 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 2001) it increased by 112.2 thous. ha. On 1 January 2008 the stands amounted to 2040.0 thous. ha. [14]

Rivers in Lithuania take an area of 332 km^2, namely 0.5% area of the country. According to the data of the Lithuanian Energy Institute, Lithuania has 22.2 thousand rivers and streams (waterways), with the total length of 76.8 thousand km. The longest river is the Nemunas (its length in the country is 475 km), the Neris (235 km), the Šešupė (209 km), the Mūša (133 km) and the Merkys (190 km). Rivers flowing only in Lithuania are the Nevėžis (209 km), the Minija (202 km) and the Šventoji (146 km). Lithuania has 2830 lakes with an area more than 0.5 hectares. The total area of lakes amounts to 880 km^2. The deepest lake Tauragnas is 62.5 meters deep. [8]

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 2008 the following valuable mineral resources were registered in Lithuania: petroleum (2.8 million tons), therapeutic peat (0.5 million m^3), peat (207.4 million tons), limeston (371.5 million tons), dolomite (108.4 million. cubic meters), marl (33.7 million tons), sapropel (4.3 million m^3), anhydrite (101.5 million tons), gypsum (23.3 million tons), chalk marl (13.1 million tons), limeston tuff (0.6 million cubic meters), clay (104.3 million cubic meters), sand and gravel (707.4 million. cubic meters). In the beginning of 2008 the following resources were extracted: oil, therapeutic peat, peat, limeston, dolomite, clay, sand and gravel, chalk marl. Of particular importance is abundant building materials and their raw material resources.

2.4 Climate profile

Lithuanian climate is formed affected by global factors and local geographical circumstances. Key features of the climate depend on the country's geographical location. Lithuania is located in the middle latitudes climate zone and in accordance by B.Alisov climate classification belongs to the Atlantic forest area in the continental southwest region. Only the Baltic coastal region is closer to the climate of Western Europe and the climate can be attributed to individual Southern Baltic climate region. [15]

Temperature

Over the past 16 years (1991-2006) the average annual air temperature throughout the territory of Lithuania broke through 6ºC threshold, and reached 6.5-7.9°C. The average annual air temperature in Lithuania in 1991-2006 compared to 1961-1990 rose 0.7-0.9°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. [15, 25]

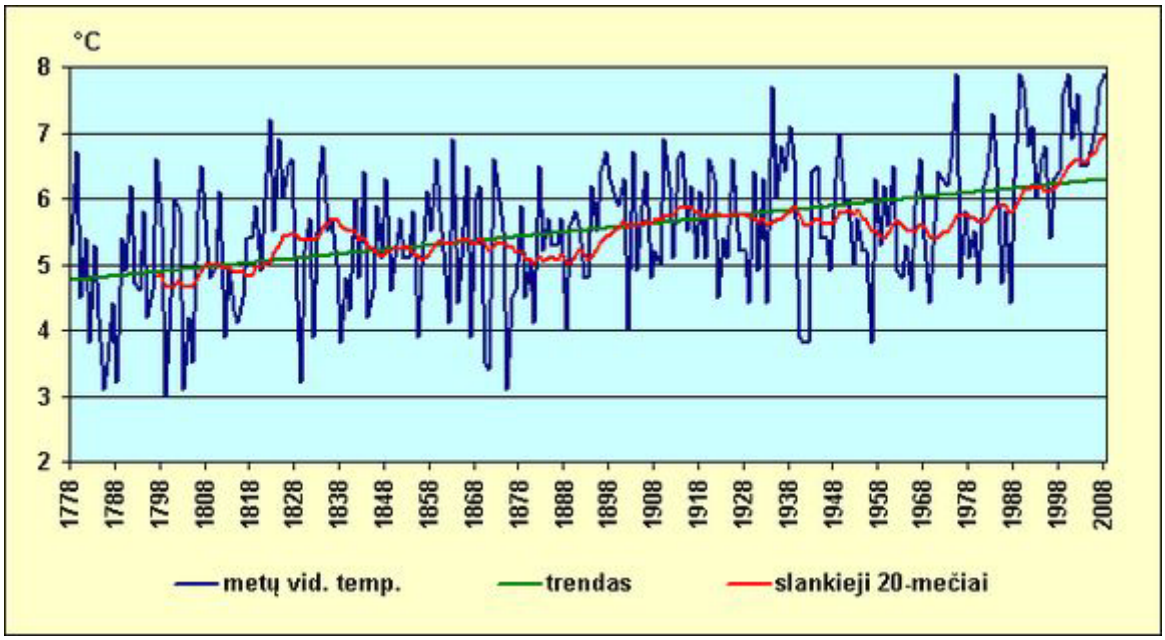


Fig. 4. The annual air temperature in Vilnius 1778-2008 [30]

The hottest month in Lithuania is July, the coldest is January. In the period from 1995 to 2008, the average temperature in July was about 19.7°C and in January - about -2.9°C [27]

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. [15]

Precipitation

Average annual rainfall in 1991-2006 compared to 1961-1990 in western and central part of Lithuania decreased by 12-56 mm, and in the South and the North-East of Lithuania increased by 20-66 mm. [15]. 2008 precipitated rainfall (697 mm) was close to the 1961-1990 climatic standards, which is 675 mm [25].

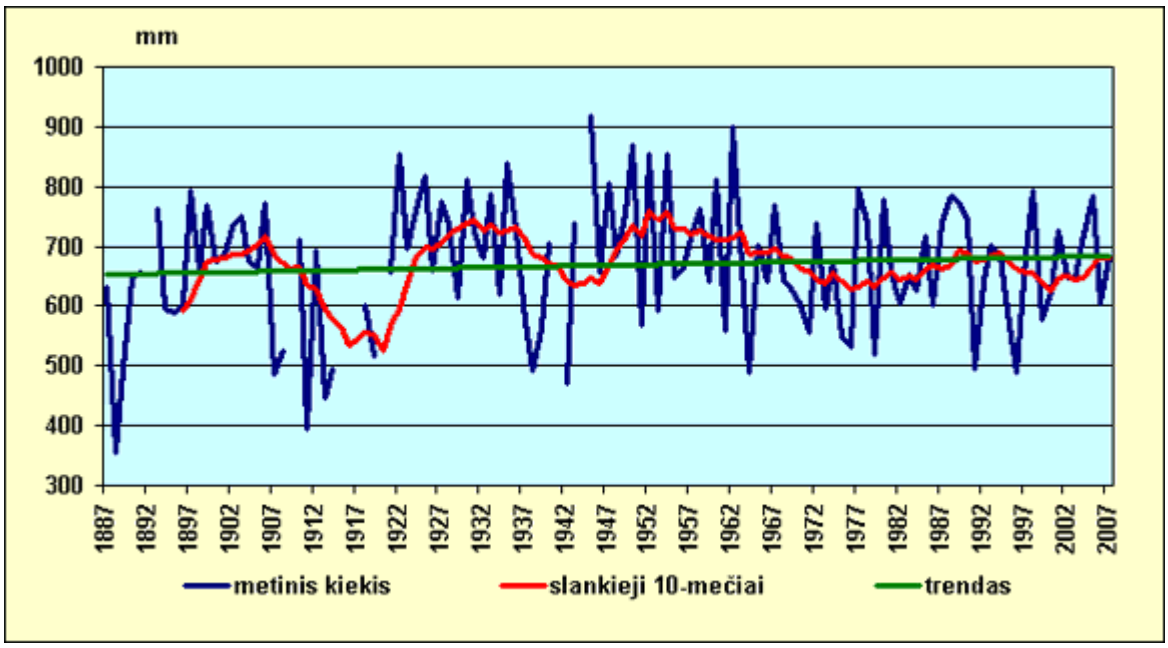


Fig. 5. The annual rainfall in Vilnius, 1887-2007. [31]

From April to October in Lithuania precipitates 60-65% of annual rainfall. In summer each year very strong falls occur with 30 mm of rainfall per day.

An average number of days with snow cover comparing the period of 1961-1990 with 1991-2006 decreased by 4-10 days. However, the maximum snow thickness increased by 0.8-2 cm. This relates to increasing precipitation in the cold period and more frequent snowfalls in the recent years. [15]

Solar radiation

The largest amount of sunny hours 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 May to August (an average of 230-270 hours), the least sunny - from November to January (an average of 30-45 hours). Over the past sixteen years (1991-2006) compared to 1961-1990, the number of sunny hours increased by 80-200 hours, mainly in the Western and South-East Lithuania, and the least is witnessed in the east.

In Lithuania the average general solar radiation to the horizontal surface during the year is 3400 MJ/m^2 (half less than the equatorial areas). However, the quantity per year is distributed very unevenly: in June solar radiation amounts to 17%, and in December it makes just 1% of the annual volume. The largest amount of solar radiation goes to the southwest of the country (3500 MJ/m^2), while the lowest - to cloudy western part of the Zemaiciai highland (about 3300 MJ/m^2). [15]

Wind

The strongest winds blow from November to January (at the seaside 5-6 m/s, elsewhere 3-5 m/s), the weakest - from May to September (the seaside 4-5 m/s, elsewhere 2-3 m/s). Comparing the average annual wind speed in the two periods 1971-1990 and 1991-2006 deduced the weakening trend of 0.2-0.4[1] m/s^2. Most, by 0.5-1.1 m/s, winds weakened in Klaipeda in the late summer and autumn.

Wind with the speed increase to 15 m/s becomes a serious meteorological event. 15 m/s and stronger wind blows on average for 60 days per year at the seaside. An average number of days per year with the gust speed reaching 15 m/s and more decreased by 1-8 days almost all over Lithuania comparing the period of 1971-1990 and 1991-2006. 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 1971-2006 no significant changes have been identified in their long-term trends. However, it should be noted that during the period of 1999-2006 at the seaside three wind cases with wind speed stronger than 30 m/s were recorded. All in all, during 1971-2006, wind cases with the speed 30 m/s and stronger were recorded eight times. This it is the reason to believe that the frequency of winds with hurricane strength may continue to increase as a result of climate warming.

In autumn and winter most often south, southwest and west winds blow while in summer west and north-west winds dominate. [15]

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 10.2%), after recovery from the Russian crisis (in 1999 GDP decreased by 1.5 %). 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 rapidly developing countries in the EU during this period. [8] In the table below GDP alteration is shown from 1998 to 2008.

Table 4. Gross domestic product, GDP

	1998	1999	2000	2001	2002	2003
GDP at current prices, mln. LTL	45 016.222	43 885.439	45 736.766	48 636.928	52 070.031	56 959.424
GDP at current prices, mln. EUR	10 020.528	10 274.733	12 364.630	13 567.165	15 046.968	16 496.590
GDP at current prices, mln. USD	11 254.055	10 971.360	11 434.192	12 159.232	14 175,273	18 614.799
Index, comparing with previous period, %	107.629	98.927	103.251	106.736	106.863	110.247

	2004	2005	2006	2007	2008
GDP at current prices, mln. LTL	62 697.850	72 060.363	82 792.802	98 669.117	111 189.823
GDP at current prices, mln. EUR	18 158.552	20 870.124	23 978.453	28 576.552	32 202.798

[1] The possibility should not be excluded that changes in wind speed might be due to changes in meteorological stations environment (building, planting, etc.) rather than on the characteristics of atmospheric circulation.

	2004	2005	2006	2007	2008
GDP at current prices, mln. USD	22 546.695	25 971.442	30 092.248	39 107.855	47 176.300
Index, comparing with previous period, %	107.351	107.802	107.845	109.84	102.761

In the table above the reviewed data of 1995 - 1999 years are presented, the data of 2007-2008 years are corrected.

The global crisis of banks in 2008 affected Lithuania as well followed by GDP growth just by 2.8 % and its decrease to negative factor in 2009.

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. [18, 19] Demand for labor force took a respective increase (an unemployment rate in the country declined from 2002) and the salaries increased however the inflation factors also increased (see the pictures below).

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

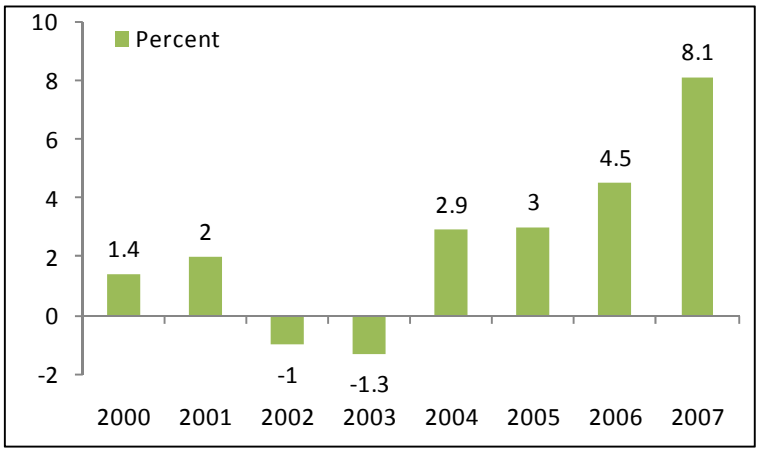


Fig. 6. Annual change in inflation [8]

Below the unemployment level change in the country is presented.

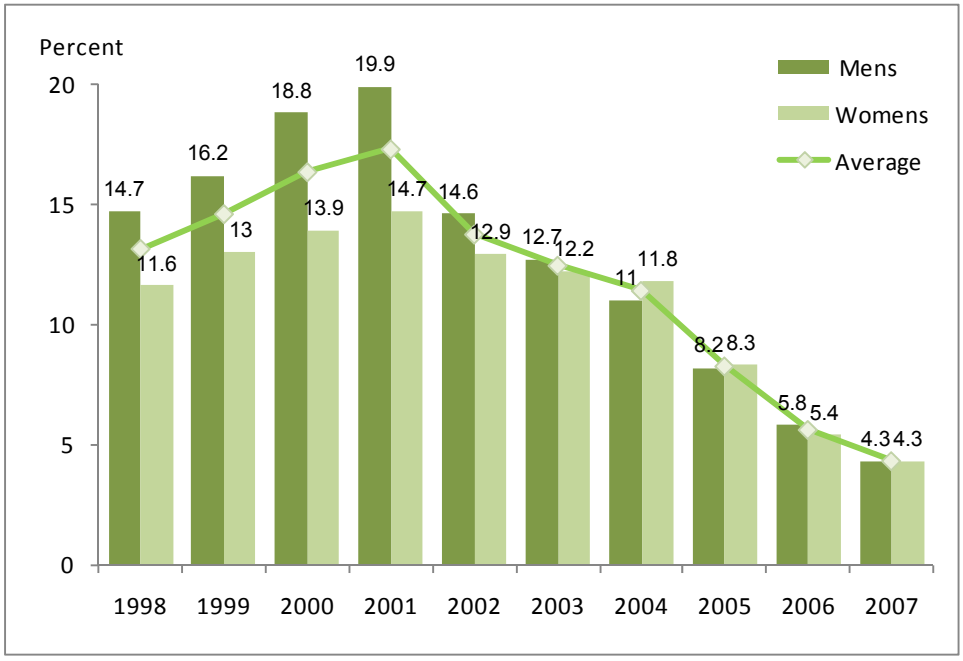


Fig. 7. Unemployment level [8]

The situation in the labour market worsened in the second quarter of 2008, when the first signs of the crisis have appeared. [19]

The most rapid growth of value added was in construction, real estate, rent and other business, transport, warehousing and communication, wholesaler and retail trade companies. The added value of these companies composed 50 % of gross value added and the growth ranged from 7 to 23%. Manufacturing production value added growth rate was also rapid: 2003 - 14 %, 2004 - 11.8 %, 2005 – 8.6 %, 2006 – 9.5 %, 2007 – 7.5 %. [8]

In 2007 compared with 2000 Lithuanian industry production increased by 83.9%, and in 2007 compared with 2006 - by 4 %. This was influenced by chemical production growth - 2.6 times and 53.2 % respectively, other non - metallic mineral products production – 2.97 times and 3%, metal products, except machinery and equipment, production – 5.6 times and 31.5%, furniture – 4.2 times and 16.5 %, food and drinks production - 59 and 14.6 %, wood and wooden products (except furniture) production – 2.4 times and 7.6%. In 2007 compared with 2006 the production volume decreased by 3.4% in electrical machinery and hardware production, 27.1 % – refined oil products production, 0.5 % – rubber and plastic products production.

Gross value added (GVA) by the type of economic activity and Gross domestic product are presented in the table below.

Table 5. GVA by the type of economic activity and GDP [8]

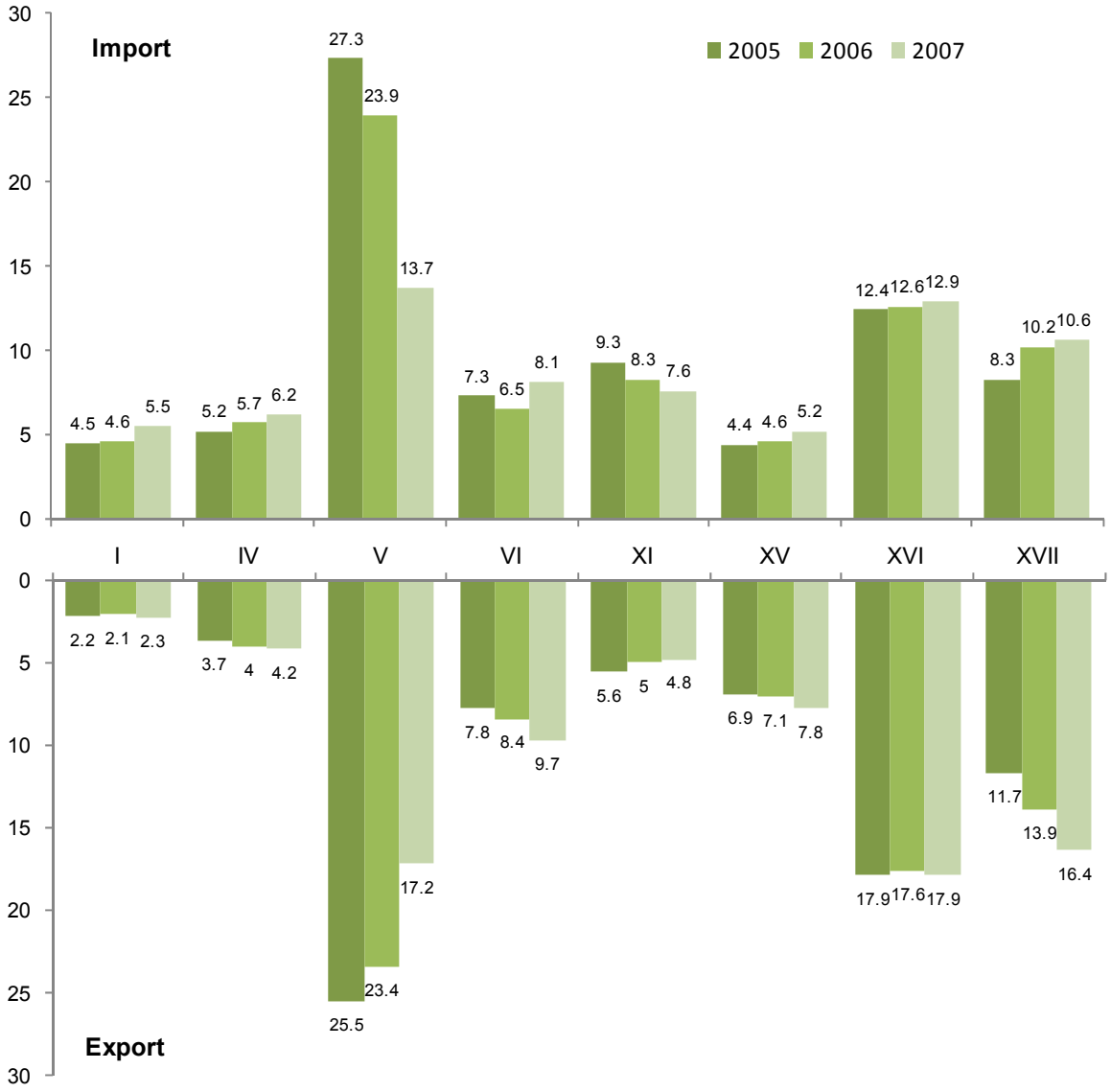
	2004	2005	2006	2007	2008
Agriculture, hunting, forestry and fishery					
At current prices, mln. LTL	2,640.815	3,137.738	3,211.706	3,483.820	4,357.741
Index, to compare with previous period, %	99.515	101.998	89.980	113.141	100.545
Industry					
At current prices, mln. LTL	14,638.054	16,494.024	17,985.855	19,772.205	21,383.271
Index, to compare with previous period, %	110.560	106.814	107.841	104.189	101.091
Construction					
At current prices, mln. LTL	4,102.028	4,916.494	6,553.992	9,047.988	9,982.093
Index, to compare with previous period, %	107.256	111.357	120.953	121.431	100.790
Trade; hotels and restaurants; transport, storage and communication					
At current prices, mln. LTL	17,957.747	20,471,092	23,024.788	27,187.579	29,957.490
Index, to compare with previous period, %	108.203	110.013	108.164	112.783	104.098
Financial broking; real estate, rent and other business activity					
At current prices, mln. LTL	7,030.950	8,985.172	11,186.704	14,449.293	16,545.423
Index, to compare with previous period, %	108.174	110.978	112.633	112.723	103.502
Public management; services in social sphere and community activities					
At current prices, mln. LTL	10,313.053	11,159.096	12,714.149	14,470.399	17,413.884

	2004	2005	2006	2007	2008
Index, to compare with previous period, %	103.314	103.297	102.658	103.157	103.560
Gross value added					
At current prices, mln. LTL	56,682.647	65,163.616	74,677.193	88,411.285	99,639.901
Index, to compare with previous period, %	107.357	107.808	107.845	109.840	102.761
Taxes on products					
At current prices, mln. LTL	6,671,142	7,832.897	9,037.605	11,298.241	12,800.784
Index, to compare with previous period, %	107.296	107.746	107.845	109.840	102.761
Subsidies on products (minus)					
At current prices, mln. LTL	655.940	936.150	921.997	1,040.409	1,250.863
Index, to compare with previous period, %	107.296	107.746	107.845	109.840	102.761
GDP gross domestic product					
At current prices, mln. LTL	62,697.850	72,060.363	82,792.802	98,669.117	111,189.823
Index, to compare with previous period, %	107.351	107.802	107.845	109.840	102.761

Export of goods and services increased in 2008 in comparison with the previous years. Export and import in 2007 compared with 2006 increased by 11.1 and 15.4 % respectively.

The main part of export in 2007 composed mineral products (13.7%), machinery and mechanical, electrical equipments (12.9%), vehicles and auxiliary transport devices (10.6%). The main part of import composed machinery and mechanical, electrical equipments (17.9%), mineral products (17.2%), vehicles and auxiliary transport devices (16.4%).

The most important export partners in 2007 were Russia (15%), Latvia (12.9%), Germany (10.5%) and Poland (6.3%). The most important import partners were Russia (18%), Germany (15%), Poland (10.6%) and Latvia (5.5%).



By CN section	
I	Live animals; animal 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. 8. Lithuanian exports and imports [8]

Export was increasing and in 2008 - export volume of goods and services was large by one quarter than in 2007. [19]

2.6 Energy

2.6.1 Primary energy production and consumption

According to the data of the Department of Statistics, the general country's fuel and energy expenses in 2008, in comparison with 2000, increased by 29.6 %. [24]

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 increased from 46.6 % in 2001 to 58 % in 2008. It was influenced by the decommissioning of the Ignalina NPP unit 1 since 31 December and increasing energy consumption. Nevertheless, energy dependence of the country from import is diminished 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 said resources in the country tends to grow.

The country's primary energy balance consists of natural gas, oil and oil products, nuclear energy, local and renewable energy sources and coal. A share of natural gas in 2008 composed 27.9 % of primary energy sources, in 2001- 26.1 %. All natural gas consumed in the country is extracted in Russia and is transported to Lithuania by means of pipelines. In 2008 the imported and consumed amount of natural gas made 3.1 billion m^3. Petroleum products, including emulsified fuel in 2008 made 31.8 % of primary energy if compared with 29.1 % in 2007. Domestic oil resources are not abundant, thus the indicators of oil and petroleum products sector are dependent on imports. Lithuania is the only in the Baltic region with its oil refineries and oil imports and exports through the Baltic Sea terminal in Klaipeda. Nuclear Power in 2008 made 26.8 % of primary energy resources (2001 - 31.9 %). [35]

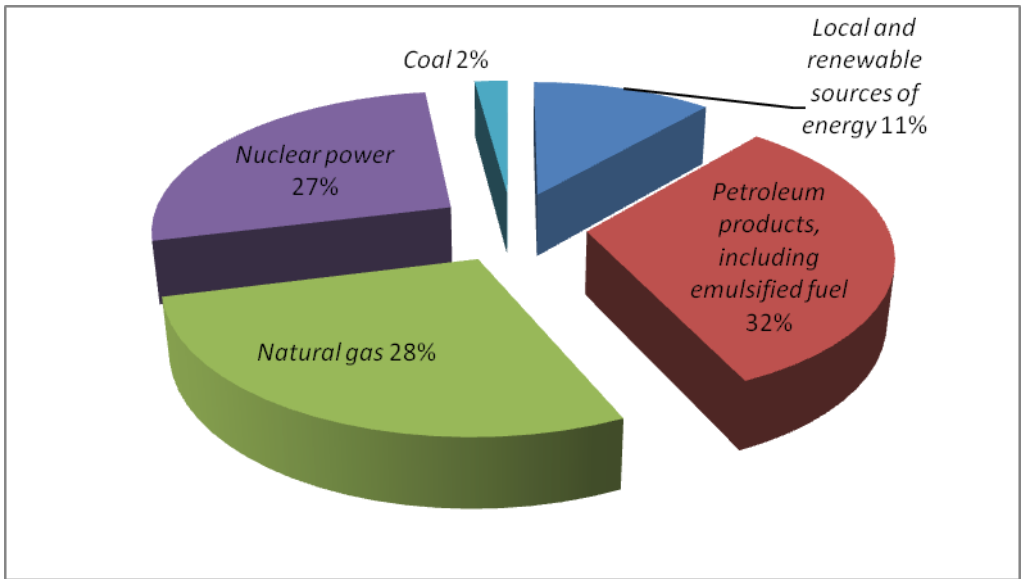


Fig. 9. Structure of Lithuanian primary energy in 2008 [35]

After closure of the second unit of the Ignalina NPP from 1 January 2010, atomic energy in primary energy balance will be replaced by natural gas and local and RES. Therefore closure of the Ignalina NPP will increase the country's GHG emissions.

Table 6. Primary energy production and consumption in thousands toe 2001 – 2008 [21]

	2001	2002	2003	2004	2005	2006	2007	2008
Primary energy production	846300	1135906	1250623	5158.0	723029	563814	678804	697980

	2001	2002	2003	2004	2005	2006	2007	2008
Crude oil	479.7	442.0	389.5	307.5	220.2	184.4	157.5	130.6
Solid fuel	640.1	679.1	688.3	715.2	742.2	774.4	747.0	784.6
Nuclear, hydro, wind, geothermal and chemical processes energy	437288	725859	856282	814493	366340	206396	336056	337668
Nuclear energy	2961.0	652081	4035.0	743390	2694.0	129418	241883	247696
Hydro energy	28.0	39933	28.0	13181	14093	12451	13181	12571
Wind energy	-	-	-	0.1	0.2	39815	40057	40120
Geothermal energy	-	40061	3.0	39853	39853	39820	39818	0.6
Chemical processes energy	108.4	162.1	178.6	155.4	167.2	173.7	211.0	199.9
Liquid biofuel and biogas	-	39818	39821	39935	39886	40075	34.0	25965
Final consumption	722330	777451	817931	879260	946405	1046818	1137944	1096884
Industry	736.8	820.7	864.6	889.6	942.5	1002.7	1009.4	922.5
Construction	13697	15738	16619	47.0	18142	19360	20546	21245
Transport	1157.6	1194.8	1220.2	1339.9	1438.1	1550.8	1842.8	1847.9
Agriculture	100.3	102.0	103.0	104.9	103.0	110.0	117.3	114.2
Fishery					39847	39907	39873	39853
Service sector	472.9	491.1	524.1	549.9	569.3	615.9	635.2	581.0
Households	1372.6	1377.0	1382.0	1376.2	1386.2	1429.3	1351.6	1376.5

2.6.2 Final energy production and consumption

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

Table 7. Heat energy balance 2001 – 2008, GWh [21]

	2001	2002	2003	2004	2005	2006	2007	2008
General production	614.3	640.2	603.0	549.9	536.1	553.7	535.4	521.5
Nuclear power plants	5357.0	1236196	1384119	6420.0	1654033	1834128	1360317	5576.0
Thermal power plants	1205393	1178090	1325710	1609291	1620399	1814893	5583.0	1340320
Power plants (main activity-power production)	156.6	159.1	159.9	113.8	33604	19207	15128	39965
Industry companies power plants	1516886	1489492	1381715	1045750	1029375	1097434	1135631	924066
Boiler houses (main activity-produce heat)	1405515	1381593	1260544	910552	877495	955262	990539	778028

	2001	2002	2003	2004	2005	2006	2007	2008
Industry companies boiler houses	304.9	295.3	331.7	370.2	415.8	389.3	397.3	399.8
Industry companies power plants	-	189.1	214.9	225.0	234.1	121.5	11780	40094
Geothermal installations	1260.9	1884.4	64406	1806.5	15888	43647	202041	155108
Other installations	**13285.4**	**13976.7**	**14267.3**	**13764.7**	**13861.2**	**14521.7**	**13655.1**	**12863.3**
General consumption	145.3	470.5	521.7	498.6	532.0	540.1	719.5	733.8
Used in other installations	695.5	692.1	624.5	624.9	729.9	1020.7	397.8	416.8
Consumption in energy companies	1.0	0.9	39814	1.0	0.5	0.8	0.8	0.8
Peat extraction and agglomeration	308.2	318.5	316.1	323.5	376.0	650.8	-	-
Refined oil products production	386.0	372.7	307.3	300.4	353.4	369.1	397.0	416.0
Electricity, gas, steam and hot water supply	237441	206455	180491	119314	62549	29799	1837.5	1680.7
Transportation and distribution loss	**2919932**	**10348.7**	**10726.8**	**10414.3**	**10527.9**	**10979.1**	**10700.3**	**10032.0**
Final consumption	1659.4	1855.7	71284	1846.6	1983.0	68058	137699	579
Industry	40021	39989	39929	39957	40016	40080	11871	11720
Construction	125.9	108.6	111.5	118.0	120.2	110.6	104.9	115.2
Agriculture	60998	49096	97338	111460	2219.9	173948	201829	64682
Service companies	1502761	1615865	1616808	1577727	1563971	1636470	1436348	1462949
Households	614.3	640.2	603.0	549.9	536.1	553.7	535.4	521.5

In order to enhance energy efficiency and promote use of RES, voluminous financing is allocated for district heating companies. During the first period about 77.3 million EUR was assigned for sustainable energy projects and in period of 2007-2013 energy efficiency and RES projects will be assigned 293 million EUR. [10]

Table 8. Electricity balance 2001-2008, GWh [21]

	2001	2002	2003	2004	2005	2006	2007	2008
General production	**14736.9**	**17721.1**	**19487.9**	**19274.3**	**14784.3**	**12481.9**	**14007.6**	**13911.7**
NPP	11362.4	14142.5	15484.6	15101.6	10337.6	8651.2	9832.9	9893.7
Thermal power plants	2606.4	2659.9	2851.8	3058.2	3425.0	2817.7	2879.5	2660.8
Power plants (main activity- power production)	2588.8	2638.7	2819.9	2893.1	3251.7	2649.7	2496.2	2449.2
Industry companies power plants	17.8	21.2	31.9	165.1	173.3	168.0	383.3	211.6
Hydro power plants	325.5	353.2	325.1	420.5	450.7	397.1	420.6	401.9
Hydro accumulation station	375.0	427.3	660.1	522.4	369.1	405.0	537.5	586.4
Wind power plants	-	-	-	1.2	1.8	13.7	106.1	131.1

	2001	2002	2003	2004	2005	2006	2007	2008
Other installations	67.6	138.2	167.3	170.4	200.1	197.2	231.0	237.8
Import	196.8	306.9	-	127.9	1064.2	1708.0	1168.2	1681.0
Export	4161.1	6793.9	7529.6	7322.8	4030.4	2136.3	2540.2	2638.4
General consumption	**10772.6**	**11234.1**	**11958.3**	**12079.4**	**11818.1**	**12053.6**	**12635.6**	**12954.3**
Used for energy companies	2878.2	3066.3	3361.3	3145.7	2609.1	2530.9	2659.6	2894.8
Peat extraction and agglomeration	3.2	3.2	3.2	4.1	5.5	6.2	6.6	5.2
Crude oil	10.5	15.7	19.1	18.9	18.8	24.6	22.0	18.1
Refined petroleum products	604.1	593.6	622.9	639.2	664.5	609.8	507.0	695.2
Electricity, gas, steam and hot water supply	2260.4	2453.8	2716.1	2483.5	1920.3	1890.3	2124.0	2176.3
The cost of water to raise the PSP	516.6	579.8	890.5	719.4	511.5	566.7	742.6	802.3
Electricity producing companies for their own use	1518.9	1642.9	1610.3	1568.2	1200.5	1089.4	1128.9	1131.2
Other energy companies for their own use	224.9	231.1	215.3	195.9	208.3	234.2	252.5	242.8
Used in electrode boilers	31.7	18.7	12.8	10.3	11.8	10.1	6.5	6.3
Transport and distribution losses	1416.4	1426.4	1405.1	1273.4	1219.8	1081.2	1110.8	1009.8
Final consumption	**6446.3**	**6722.7**	**7179.1**	**7650.0**	**7977.4**	**8431.4**	**8858.7**	**9043.4**
Industry	2250.0	2447.5	2527.6	2634.9	2715.7	2809.7	2949.7	2935.5
Construction	96.0	98.2	101.7	108.7	117.0	123.4	130.9	129.6
Transport	90.5	82.0	90.2	92.0	103.5	90.8	70.0	82.6
Agriculture	196.6	187.8	166.3	181.3	188.7	192.6	201.8	192.4
Fishery	-	-	-	-	3.9	4.8	4.8	4.2
Service companies	1995.3	2095.7	2398.3	2566.9	2707.2	2859.8	3037.1	2994.4
Households	1817.9	1811.5	1895.0	2066.2	2141.4	2350.3	2464.4	2704.7

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 neighbouring power/energy systems. The Lithuanian Power Plant is undergoing modernization and 440 MW combined cycle gas turbine unit is under construction. It is planned to accelerate the modernization and development of efficient cogeneration power capacity.

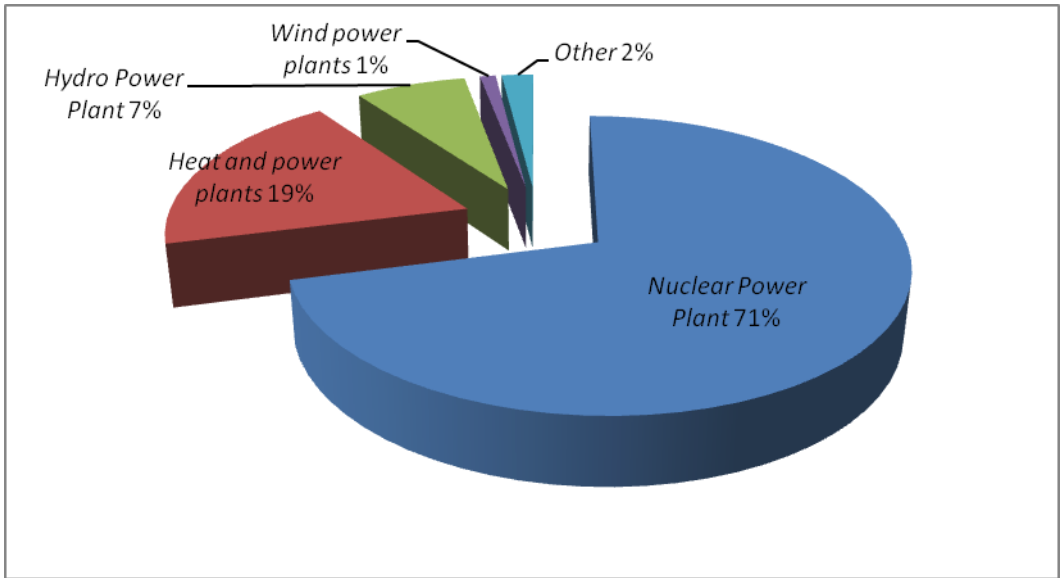


Fig. 10. Electricity production structure in 2008 [36]

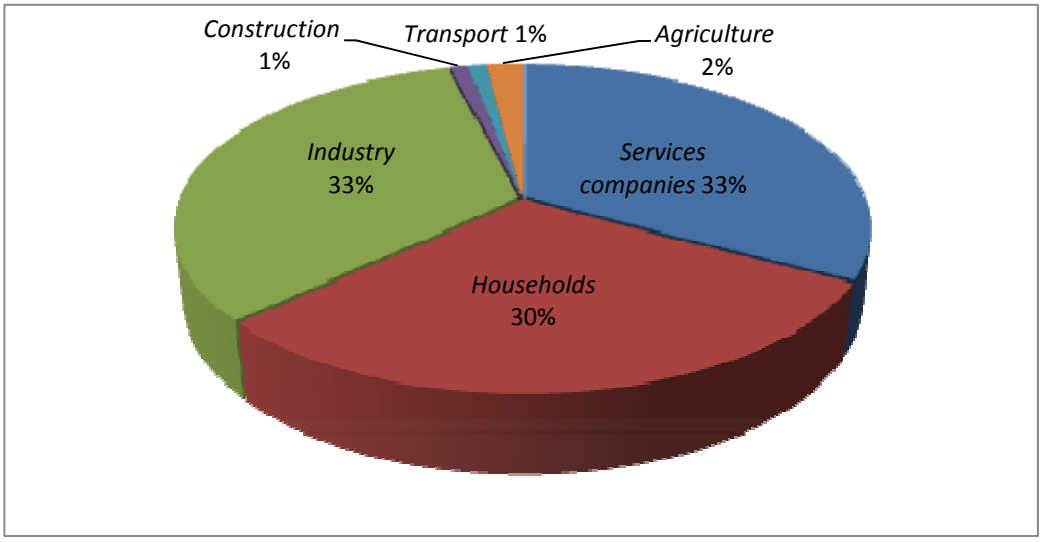


Fig. 11. Electricity consumption by sector in 2008 [36]

Since 2002 electricity market commenced its performance in Lithuania. During the first years of electricity market existence free purchase of electricity was possible only for large industrial users/consumers. Since 1 July 2007 electricity supplier could be chosen freely by all 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 in 2008 ranged from 66% to 78%, except in August when due to repairs it was replaced by the Lithuania Power Plant and imported electricity.

At an auction of 2008 the average annual sales of electricity made 36% from the supplied amount to the domestic market. Legally the opening rate of the market is 100 % however, in fact a number of eligible customers who opt for an independent supplier of consumption accounted for only 14 % of the total electricity consumed in quantity. [32]

Interest in the electricity market opportunities increased in 2009 in relation to the closure of the Ignalina NPP since 31 December 2009. From 2009 licenses of an independent supplier were issued to 11 companies and the entire number of registered independent electricity suppliers makes 32 entities [33].

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 DC voltage. It links 330 kV converter station "Harku" next to Tallinn, and the 440 kV converter station "Espoo" in the vicinity of Helsinki. [32]

It is planned to connect the Lithuanian and Polish energy systems through 1000 MW DC Box Alytus-Elk in order to integrate into the European electricity market. 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. In 2009 tender was announced for the environmental impact assessment and spatial planning documentation, which is planed to be developed in 2010.

Power connection with Sweden is planned. Feasibility study on power connection to Sweden was completed in March 2008.

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 section 4.3.2.

2.6.1 Renewable energy sources

Electricity production

A share of electricity produced in 2008 using RES accounted for 4.6 %. Of these 67 % electricity was produced by hydropower plants, 22 % by wind power and 11 % generated by bio-fuel plants.

Electricity share, generated by bio-fuel plants can be increased from the current 0.5 % to 4 % of the total electricity consumption in 2020.

One hydroelectric power station of 100.8 MW installed power, and 85 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 wind power plants makes about 70 MW. It is forecasted that by 2020 wind power plants should produce 10 % of total electricity consumption. [34]

Heat production

For heat production from RES in Lithuania are used biomass, geothermal and solar energy. Biofuels make a large proportion of the resources consumption. The main for heat generated from biomass resources are wood and wood residues, agricultural products and biogas. To increase the use of biomass for energy purposes should be encouraged so far the lack of resources, including deforestation waste, short rotation plantations, straw, municipal waste and biogas utilization for energy production.

RES in the heating sector[3] accounted for 28 % in 2008. From this part 76 % represented directly by households and other sectors. District heating make the rest part. In 2008 from RES for district heating was made 15 %. Further fastest RES use development associated with the increasing use of RES in district heating sector. [34]

[3] Renewable energy in heating and cooling sector, calculated on the total final energy consumption from renewable sources for heating (as defined in Article 5 paragraph 1, point B, and Article 5, paragraph 4) by dividing the total final energy consumption for heating.

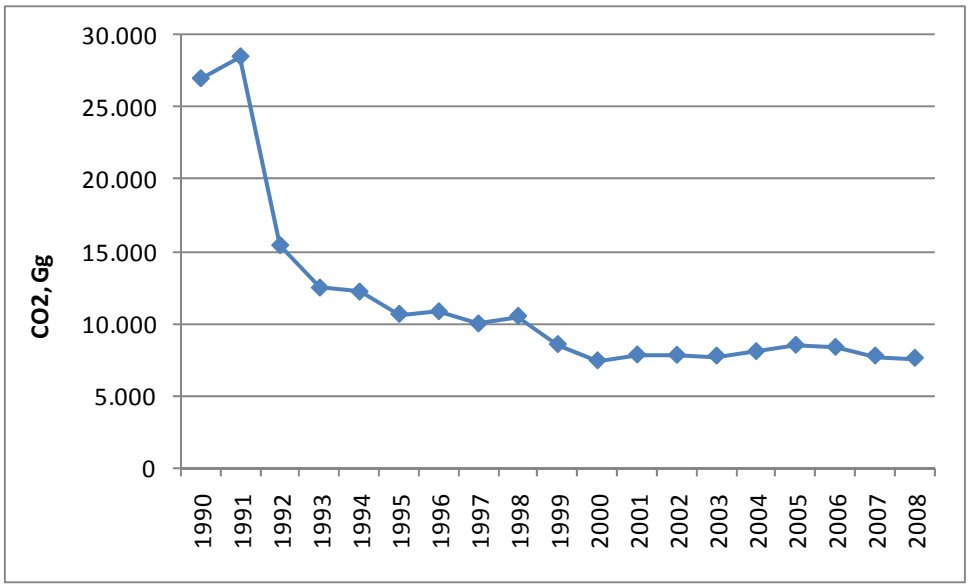


Fig. 12. GHG emission trends in the energy sector

2.7 Transport

Transport is a very important part of the Lithuanian economical and social infrastructure. The year 2008 was successful for transportation system, despite the year-end emerging signs of economic recession. In 2008 104.5 thousand people or 6.9% of Lithuanian employees worked in the sectors of transport and communication. The gross value added (GDP) created by this sector composed 12.7% (12733 million LTL) or 11.4 % more than in 2007. [22]

In the first quarter of 2008, compared with the same period a year ago, the growth of all types of transported freight (excluding shipping) in physical terms of turnover was 11.8 %. During the year freight handling operations at the Klaipeda seaport and the Butinge terminal increased by more than one third. Turnover of freight transported by rail jumped up by almost one fifth. [19]

In 2007 the haulage of freight by all transportation modes made 138.2 million tons, which was 26.7 % more than in 2000. The average annual growth during 2000-2007 composed 3.4 %. In comparison with 2000, freight transportation by air in 2007 increased by 96.1 %, railway transport - 74.2 %, road transport - 38.1%, maritime transport - 28.3 % and inland waters transport - 12.5 %. However, 43.7% decrease of transportation by pipelines was reported. The decline was reflected due to the pipeline accident in Russia after 2006, where the supply of crude oil to Mazeikiu oil refinery was interrupted. Since the, the Mazeikiu refinery receives the needed raw materials via the Butinge terminal.

If compared with 2000, the major increase in the international haulage of freight was witnessed in 2007 with the increased rate of transportation of goods by road (3 times) and air (2 times). Internal haulage of goods remained predominant by road transport, which accounted for 78.8% all domestic shipments. [8]

The Ministry of Transport and Communications presented the following indices of transportation in 2008: in 2008 considerable increase in a number of passengers travelling by air transport (53.7%) was observed along with the increased scope of cargo handling for shipping by sea transport at the Klaipeda port and Butinge terminal (22%).

Table 9. Transportation main indicators [22]

	Units	2007	2008	Compare to 2007, proc. (+,-)
Freight	Thousands t	122418.3	120672.8	-1.4
Railways	Thousands t	53503.0	54970.2	2.7
roads	Thousands t	62155.7	59426.5	-4.4
Inland water transport	Thousands t	958.8	988.5	3.1
Maritime transport	Thousands t	5794.4	5283.4	-8.8

	Units	2007	2008	Compare to 2007, proc. (+,-)
Air transport	Thousands t	6.4	4.2	-34.4
Passenger transportation	Thousands passengers	471827.7	477126.6	1.1
Railways	Thousands passengers	5186.0	5063.1	-2.4
Roads	Thousands passengers	463331.1	468304.7	1.1
Of them: trolleybus	Thousands passengers	145410.3	151008.5	3.8
bus	Thousands passengers	317920.8	317296.2	-0.2
Inland water transport	Thousands passengers	2331.8	2371.6	1.7
Maritime transport	Thousands passengers	223.5	226.1	1.2
Air transport	Thousands passengers	755.3	1161.1	53.7
Incoming and outgoing passengers number in airports	Thousands passengers	2196.9	2553.2	16.2
Cargo handling in and from sea-going ships in Klaipeda port and Butinge terminal	Thousand t	31938.8	38950.1	22.0
Of them: oil products	Thousand t	11717.2	18429.5	57.3
Other cargo	Thousand t	20220.8	20518.6	1.5
Klaipeda port	Thousand t	27362.1	29881.8	9.2
Of them: road vehicle	unit	218381	200858	-8.0
containers	TEU	321432	373263	16.1
Incoming and outgoing passengers number in port	Thousands passengers	211.6	211.6	0.0

In comparison with the previous period, the Klaipeda State Seaport and Butinge terminal handled 31.9 million tons of cargo in 2007, which made 40.6 % more than in 2000. The average annual growth during 2000-2007 was 5%.

In 2007 36.7 % of all cargo transfers (11.7 million tons) composed crude oil and oil products. It is reported to be 35 % more than in 2000. Natural and chemical fertilisers composed 7.2 million tons or 22.6 % in comparison with 2000, the transfer of this type of cargo increased by 2.5 times. 0.9 million tons or 2.9 % of all cargo transfers included primary and processed minerals and construction materials. Compared with 2000 the transfer increased by 48.5%. [8]

According to the data of the Department of Statistics the largest part of road vehicles account for cars (88.6 %). Other vehicles are freight vehicles, special vehicles, semitrailers, motorcycles, buses and trolleybuses (11.4 %). [8]

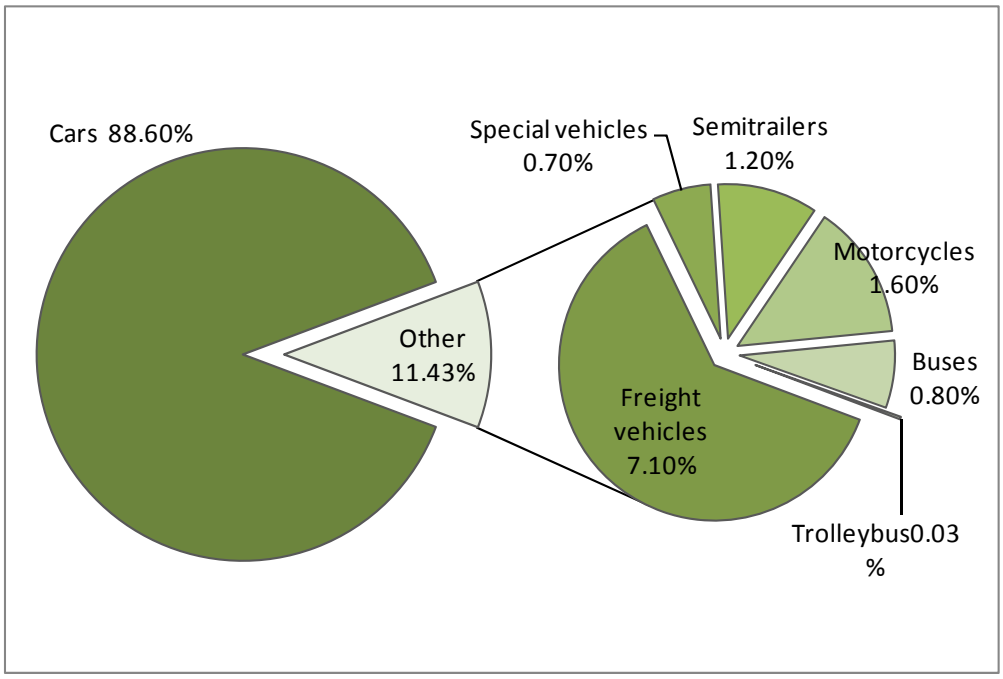


Fig. 13. Road vehicles [8]

In 2007 the volume of transportation included 471.8 million passengers, which was 10.2 % more than in 2000. The average annual growth during 2000-2007 was 1.4 %. In comparison with 2000, passenger transport in 2007 by sea increased 3.5 times, air transport - 2.2 times, inland waterway transport - 79.4 %, road transport - 10.9 %, while transportation by rail reduced by 41.4 %.

In 2007 internal passengers transportation by road was predominant and made 98.6 % of all travels, while railway transportation was 0.9 % and other types of transport - less than 1%.

As for international passenger transportation the railway transport composed 35.9% and road transport made 31.9% of all international transportation. No matter the passenger transportation via Lithuanian airlines took a rapid growth (in 2007 it increased 2.2 times in 2000); it is obvious that the indicators of 2009 will differ significantly from the previous ones. It is caused not by the global economy crisis alone - the bankruptcy of the national Lithuanian air company had the major influence on it since Vilnius international airport lost numerous direct flights. [8]

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.

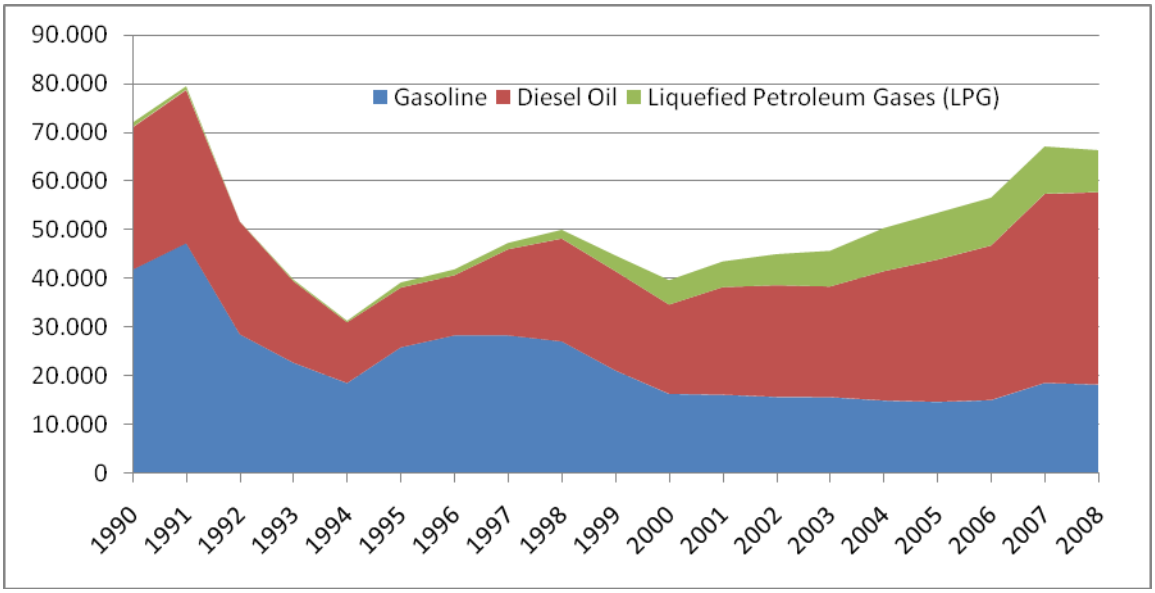


Fig. 14. Consumption of fuel by type in transport sector, TJ [29]

55 % of fuel used in transport sector is diesel oil. Lightly lower consumption of petrol and LPG is reported.

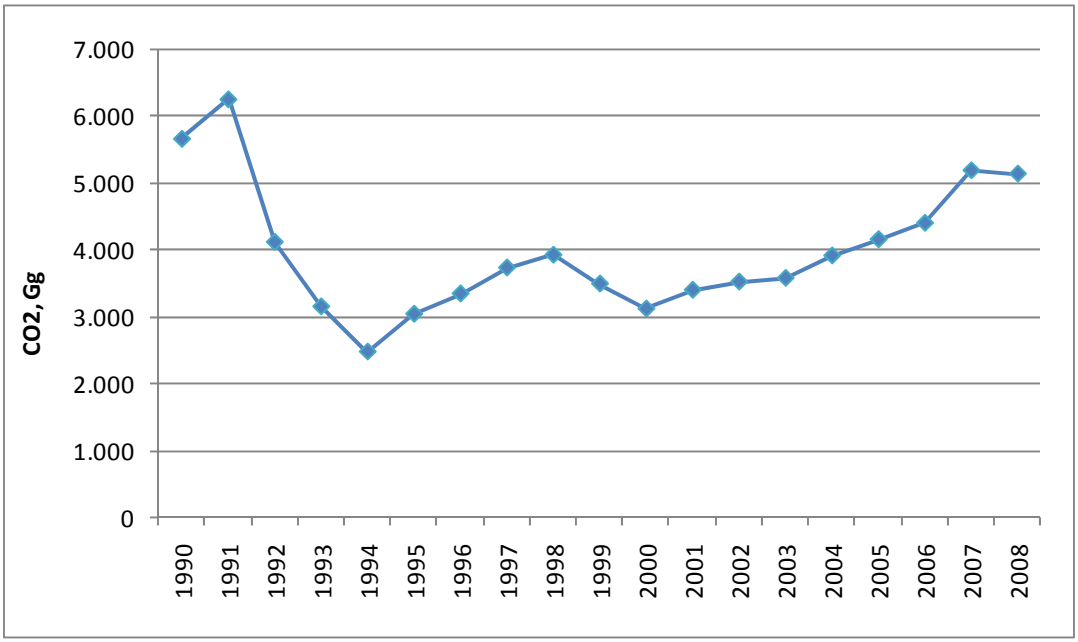


Fig. 15. GHG emission trends in the transport sector [29]

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 3 activities: extracting industry (mining), processing industry and supply of electricity, gas and water (energy), which in 2008 made 21 % of the value added in Lithuania (accordingly 0.4 %, 17.9 % and 3.1 %). [19, 24]

In 2008 compared with 2000, the volume of Lithuanian industrial production increased by 88.9 % and if compared with 2007 - by 2.7 %. It was caused by the growth of processing of refined oil products - respectively 98.9 % and 55.3 %, pulp and paper production - 129.6 % and 11.8 %, machinery and equipment manufacture - 178.4 % and 6.5 %, other transport equipment - 162.2 % and 19 %, furniture

and other production - 4.7 times and 11.3 %. In 2008 compared with 2007 the production volume decreased by 3.4 % in foodstuff and drinks production, 17 % in textile production, 20.1 % in garment sewing and tannery, 12 % in wood and wood items production (except furniture), 5 % in chemical production and petrochemical products, 6.7 % – rubber and plastics production. [24]

Turnover of extracting/mining industry sector in 2008 increased by about 7 %, internal sales developed much faster than export, a share of which in the sold production decreased by 2 %. However, mining reveals good financial indicators supported by solid profitability of the sector during the entire century. In 2008, compared with 2007, the index of quarries exploitation/mining improved further leading to noticeable enhancement of investments by oil extraction companies. In 2008 previously dominating oil production decreased, but the volume of excavated peat increased in 2008 and resulted in larger quantities of peat blocks production than a year ago. It should be noted that quarrying performance is dependent on construction development (development of construction is dealt with in chapter "Housing and Construction"). Road construction and repairs also affect quarrying and crushed stone production. General parameters of processing industry are strongly influenced by the data of the largest Lithuanian companies - Mazeikiu nafta, Akmenes cementas and Achema group. [19]

In 2008 the structural changes of the sold industrial production proceeded. The sales of foodstuff and drinks, garment sewing, tannery, wood products (except furniture) decreased. The volume of rubber, plastics and furniture production increased. Market structure of the sold manufacturing production has changed since 2000. In 2008 a share of refined oil products production increased to 30.7 % and compared with 2000, increased by 10%. A share of exports increased from 55.5 % in 2000 to 60 % in 2008.

The major share of manufacturing companies' production is sold abroad. In 2008 the companies that reported to have sold most of their products abroad where those manufacturing radio, television, communication equipment and apparatus - 86.3 % of the total production, textile - 73.3 %, clothing, tannery - 73.8 %, refined petroleum products - 76.3 %, chemistry and petrochemical products - 80.3 %. [24]

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

Introduction of environmental standards, programs and cleaner technology processes in companies in 2008 revealed annual increase in the industries' costs for environmental protection if compared with 2000: from 45.4 million LTL in 2000 to 610.9 million LTL in 2008. [26]

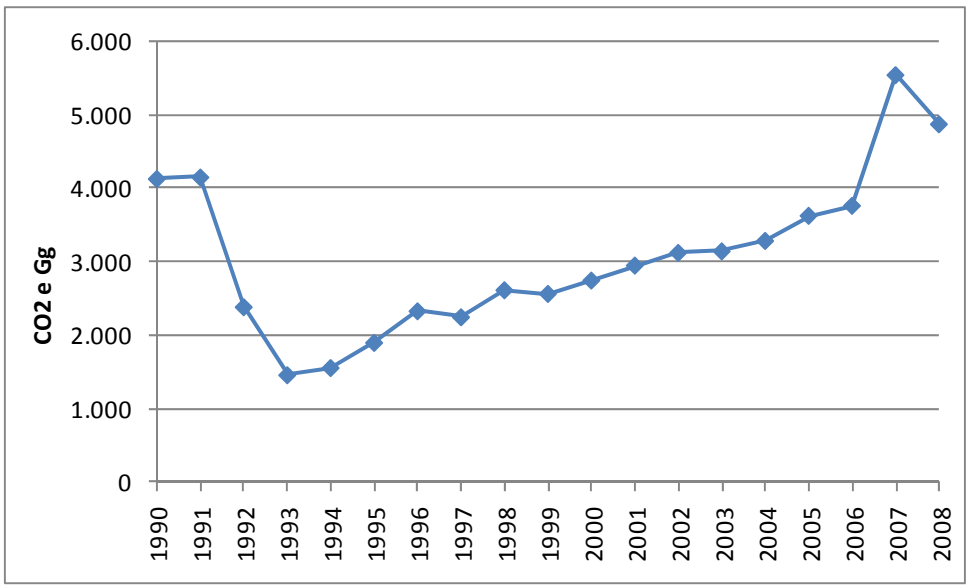


Fig. 16. GHG emission trends in industrial processes

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 non hazardous waste, to decrease waste flows and adverse impact of waste on environment and human health, to ensure rational waste recovery for recycling and energy generation.

Reorganization of waste management system to meet the requirements of the European Union concerns closure of small landfills operated previously and plans to manage all municipal waste in 10 regional landfills.

Since 2000 the national waste accounting was started in a new way -the companies that recover, dispose and export waste shall submit the national waste accounting reports to the Regional environmental protection departments each year. Formerly the reports were submitted only by the companies that generated the largest amounts of municipal and hazardous waste due to the manner of production or management. In 2008 the total amount of the collected municipal waste made 128190394 tons or 400 kg per capita and in comparison with 2007 it remained practically unchanged. This factor is closely related to the level of consumption and since 2004 it tends to grow. In Lithuania the amount of municipal waste per capita is one of the lowest among the countries of the European Union, but the set goal is turning farfetched - 300 kg per capita of municipal waste. [25]

According to the data of the Ministry of Environment, 87.22% of the Lithuanian population use the system of municipal waste collection. In 2007 it was disposed around 1.6% more of municipal waste than the year before. A proportion of waste that gets to landfills is the same from 2004 and composes 90% (in 2007 – 92 %). Despite the improvement in sorting of municipal waste (approx. 10% of the collected municipal waste is recycled and in 2008 waste recovery increased by 4 %), it is not yet appropriate to significantly reduce the proportion of this type of waste getting to landfills.

In 2007 the total amount of collected hazardous waste remained the same in comparison with 2006, however the amount of collected waste in terms of their types has changed. More vehicles unfit for use were collected in 2007 than in 2006 (29%), more components of unused mechanisms and facilities (29%) and more residues of chemical sediments (25%). In 2006 collection of glass waste decreased by 84% due to the decreased production of the companies producing this type of waste.

In comparison with 2006, 2.4% more production waste was generated in Lithuania in 2007 and gross domestic product increased by 9.4%. During the period of 2004-2007 GDP increased more rapidly than the generation of production waste. This trend in the alteration of rate between production waste and GDP corresponded to the long-term tasks set in the National sustainable development strategy. 168 thousand tons of industrial waste (approx. 4% more than in 2006) were handled in 2007, however no substantial changes in waste management have occurred so far. The industrial waste utilization and disposal to landfills tended to increase. The main cause of the increased rate of production waste recovery (recycling) is the rapid growth of construction sector in 2007 - more construction waste was produced and managed. [25]

4665.8 million m^3 of water were consumed in Lithuania in 2008 for different needs: ground water – 119.3 million m^3, surface water – 4546.5 million m^3. 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. Part of the wastewater is discharged without treatment. Most of the wastewater in need of treatment is produced in household and production sectors. 126.7 million m^3 of treated wastewater, 47.8 million m^3 of pre-treated wastewater and 0.5 million m^3 of untreated wastewater was discharged to the surface water in 2008. [24]

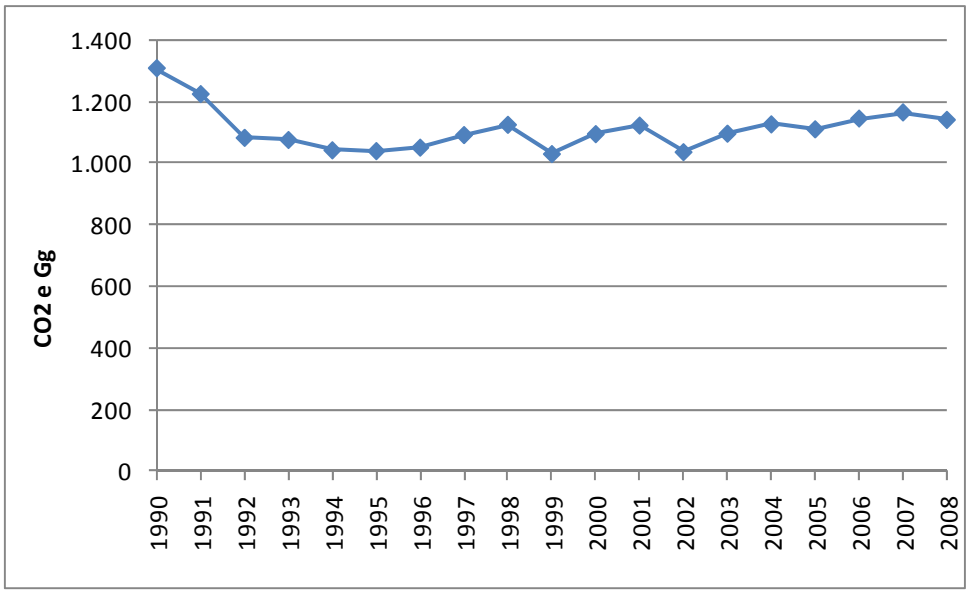


Fig. 17. GHG emission trends in the waste sector

2.10 Housing and construction

Development of construction and real estate sector in 2008 was strongly adjusted by the slowed-down pace of growth in economy and real estate market. The annual increase of overall production of the national construction sector remained double-digit, i.e. 11.1%, but this was determined by the positive indices of the first half of the year. Impressive annual increment of value added in construction sector was in 2006 and 2007 - 21.0% and 21.2% accordingly. In 2008 this factor dropped to 1.2%.

Separate analyses of every category of construction works (residential, non-residential buildings and engineering structures/facilities) revealed that the major fluctuation could be observed in the dynamics of construction works of residential buildings, which accounted for one fifth of all construction works. The scope of this type of works increased even by 1.5 times in 2007 and during the third quarter of 2008 they took a downturn. The scope of construction of non-residential buildings in the first three quarters of 2008 kept increasing rapidly, but in the last quarter they slowed-down due to the slowed growth of the real estate market. [19]

In 2008 the largest share of construction works in the country accounted for a new construction - 52.5%, reconstruction - 24.6 %, maintenance - 20.8 % and other works - 2.1%. The biggest part of works by the type of a building was performed for non-residential buildings - 42.5%, engineering structures - 39.6% and residential buildings - 17.9%. [24]

The production of the cement is highly dependent on construction market. In accordance with the data of Department of Statistics in 2006 the cement production in Lithuania increased by 300 thousand tons and in 2007-2008 reached 1.1 million tons. The bigger part of the production was used in Lithuania (table below).

Table 10. Cement production in Lithuania 2005-2008 [24]

	2000	2005	2006	2007	2008
Cement, mln.t	0.6	0.8	1.1	1.1	1.1

Construction of non-residential buildings in 2008 is divided as follows: industrial buildings and warehouses – 31.6%, commercial, catering facilities and hotels - 23.7%, agricultural – 12.7 %, institutional/offices - 11.3%, educational, healthcare, cultural and sport - 5.4%, other purpose - 10.8%. [13]

Below in the tables are presented the works performed in 2005-2008, by their type and by the type of a building .

Table 11. Performed works by type [24]

	2005		2006		2007		2008	
	mln. Lt	%	mln. Lt	%	mln. Lt	%	mln. Lt	%
Works carried out in the country	**5854.9**	**100**	**7807.6**	**100**	**10776.3**	**100**	**1189.5**	**100**
New construction	2652.2	45.3	3839.7	49.2	5956.6	55.3	6246.9	52.5
Reconstruction	1446	25	1992.3	25.5	2479.1	23	2923.9	24.6
Repair and Restoration	1574.3	26.9	1782.6	22.8	2124.4	19.7	2472	20.8
Other works	162.4	2.8	193	2.5	216.2	2	246.7	2.1

Table 12. Performed works by buildings type [24]

	2005		**2006**		**2007**		**2008**	
	mln. Lt	%	mln. Lt	%	mln. Lt	%	mln. Lt	%
Engineering constructions	2311.9	39.5	2792.8	35.8	3935.7	36.5	4707.6	39.6
Buildings	3543	60.5	5014.8	64.2	6840.6	63.5	7181.9	60.4
Total	5854.9	100.0	7807.6	100.0	10776.3	100.0	11889.5	100.0

Efficient reduction of GHG in construction sector is foreseen in the continuation of multi-apartment buildings' modernization program, which provides for modernization of no less than 70% of apartment buildings until 2020 having received building permits before 1993. This program is funded by the state aid, local governments, 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 neighborhoods/blocks.

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

Table 13. Housing 2008, mln. m^2 [24]

	2000	**2005**	**2006**	**2007**	**2008**
Total	79.5	80.8	81.4	82.1	83.3
Urban dwelling fund, m^2	50.6	51.3	51.8	52.2	53.2
Rural dwelling fund, m^2	28.9	29.5	29.6	29.9	30.1
Average living space per capita, m^2	22.8	23.8	24.1	24.4	24.9

2.11 Agriculture and forestry

Historically, agriculture is one of the most significant economy sectors in our country. According to the Department of Statistics, as of 1 January 2009, the total area of land intended for agricultural purposes made 3955.5 thousand hectares, of which agricultural land - 3364.1 thousand ha; arable land - 2879.5 thousand ha; orchards and berry gardens - 42.6 thousand ha; meadows and natural pastures - 442.0 thousand ha; forest land - 202.8 thousand ha; roads - 31.4 thousand ha; built-up area - 52.5 thousand ha; water - 59.4 thousand ha; other land - 245.3 thousand ha. [13] In a figure below the land fund distribution in % is illustrated.

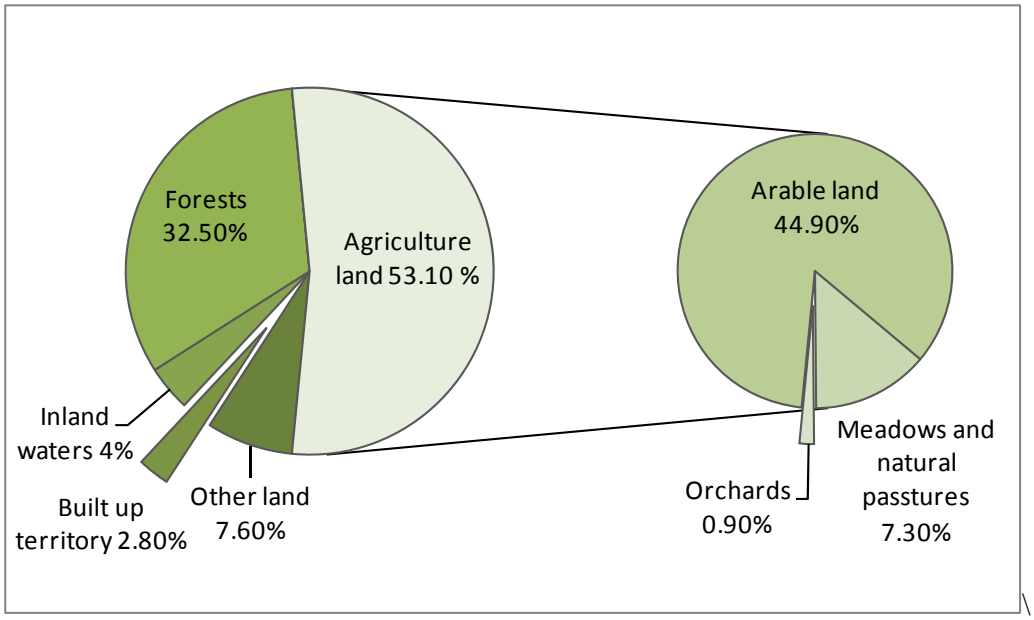


Fig. 18. Land fund distribution in 1 January 2009 [24]

In spite of agriculture in gross value added having decreased from 12.3 % to 4.5 % during 1996-2008, it still plays an important role in the current Lithuanian economy. [19]

Agricultural output in 2008 at current prices amounted to 7.3 billion Litas and, compared to 2007, its scope increased by 5.2 % (the scope of crop production increased by 8.9 %, livestock - 0.2 %). Output growth was influenced by increased yields of: 24.4 % potatoes, 13.4 - crops and other plants.

In recent years, a larger proportion of agricultural production was that of livestock raising and in 2008 it was - 21.1% (pig - 10%) milk production was 24.4, cereal/crops - 19.3%. Farmers planted more grain - 20% full-scale production of these farms, milked - 28.9%. The largest part of agricultural companies' production made livestock - 41.5 % (pigs - about 23.1%, poultry - 15.7%). In 2008 farmers and family farms produced 71.3 % of the total agricultural output, 79.4% of all vegetable and 63.2% livestock products. [24]

In agriculture a significant influence is made by the produced GHG. In assessing agricultural GHG, only direct soil GHG emissions tended to increase during 2006-2007 (+ 5%). The remaining GHG emissions from agricultural processes decreased due to the introduction of improved manure handling systems.

Table 14. GHG emissions in the agricultural sector in 2006-2007 [29]

Years	Enteric fermentation	Manure management		Agricultural soil	
				Direct GHG emissions	Indirect GHG emissions
	CH_4	CH_4	N_2O	N_2O	N_2O
1990	3 133.6	1 330.4	879.9	2 929.9	1914.7
1991	2 932.6	1 211.6	828.5	2 636.0	1693.3
1992	2 213.3	806.1	622.4	1 664.7	1014.8
1993	1 848.7	698.8	514.3	1 450.3	770.5
1994	1 586.0	686.1	443.1	1 247.7	648.7

1995	1 499.4	677.4	415.1	1 257.9	619.8
1996	1 509.8	626.8	404.2	1 531.8	764.3
1997	1 485.6	649.2	395.1	1 566.8	768.8
1998	1 390.5	620.2	362.1	1 546.2	746.2
1999	1 311.0	527.9	342.7	1 513.4	758.6
2000	1 167.6	482.7	305.0	1 539.0	740.0
2001	1 201.1	540.5	324.5	1 585.9	783.7
2002	1 237.9	564.0	340.1	1 655.1	853.1
2003	1 283.6	570.7	352.2	1 705.7	894.5
2004	1 260.9	573.7	354.1	1 702.5	902.6
2005	1 252.6	588.7	363.9	1 679.1	897.3
2006	1 299.9	599.0	380.4	1 881.7	1118.6
2007	1 348.4	608.0	339.4	1 752.6	960.4
2008	1 361.2	576.0	322.8	1 654.3	881.3

By the data of Department of Statistics, reconstituted forest areas are increasing from 2001 (table below) as 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 15. Forest renewal, ha [24]

	2000	2005	2006	2007	2008
Renewed and afforested, ha	8955	11526	11219	11429	11079
The area where have been made forest cultural works, ha	14019	21062	33642	32272	30136
Prepared soil for forest crops, ha	6554				
Planted tree seedlings for growing, thous. units	33130	77363	62090	60210	55093
Prepared trees and shrubs seeds, kg	14211	51684	73425	93496	56226

According to the data of the State Forest Management Service as of 1 January 2009, pinewoods made 723.4 thousand hectares (35.4 % of the total forest area), spruce 426.7 thousand hectares (20.9 %), birch 450.1 thousand hectares (22 %), black alders 138.0 thousand hectares (6.7 %), white alders 130.0 thousand hectares (6.4 %), asp grove 79.1 thousand hectares (3.,9 %), oak 40.,7 thousand hectares (2 %), ash 37.7 thousand hectares (1.8 %) and other tree species 19.3 thousand hectares (0.9 %) and the entire woodland area made 2045.6 thousand ha. [14]

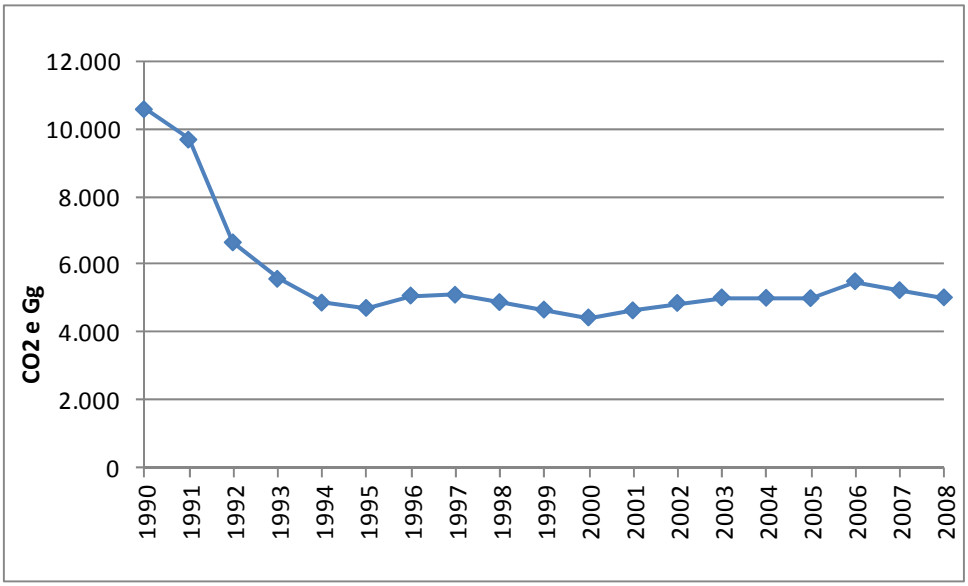


Fig. 19. GHG emission trends in the agricultural sector

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3 GHG Inventory Information

3.1 Summary tables

Summary GHG inventory tables are presented in the Annexes. The data covers period of 1990-2008.

3.2 GHG emissions trends

3.2.1 General GHG emissions trends

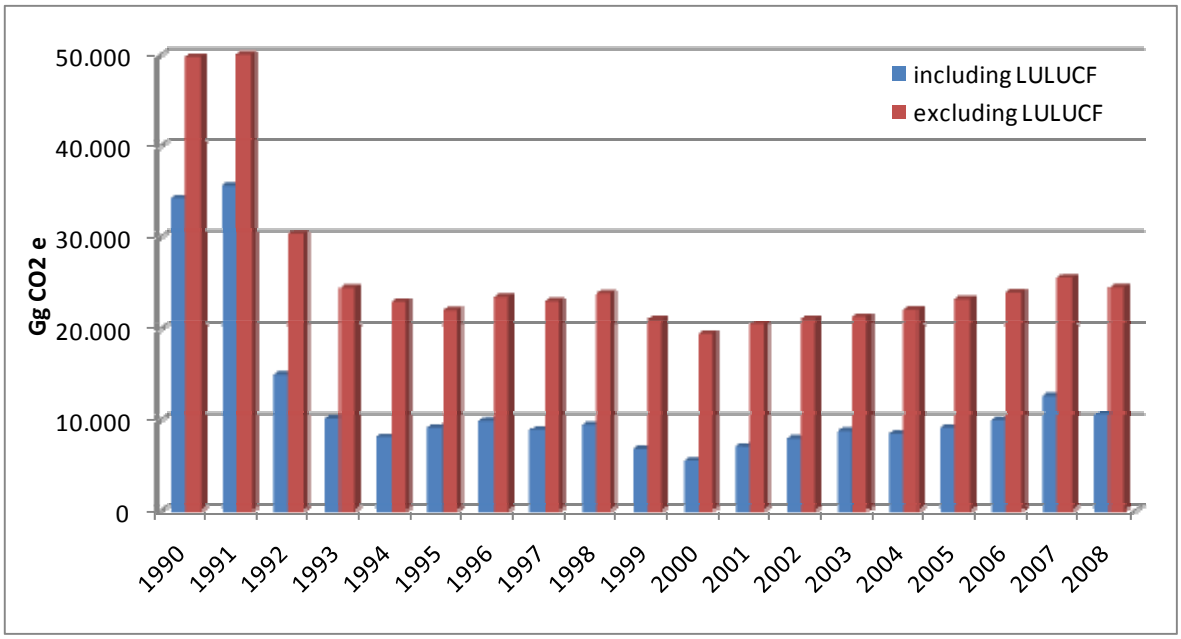

Fig. 20. GHG emissions 1990-2008

3.2.2 GHG emissions trends by gas

GHG emissions trends by gas in CO_2e are presented in the figure below. Trends of CO_2 and CH_4 emissions in CO_2e, by sectors, are presented further.

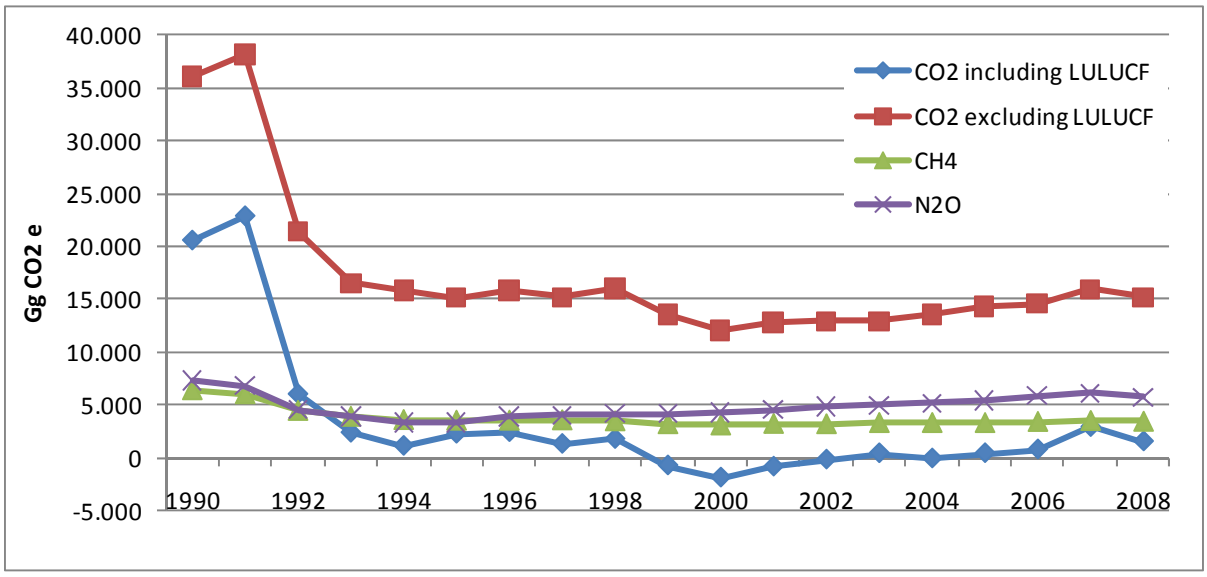

Fig. 21. GHG emissions trends by gas 1990-2008

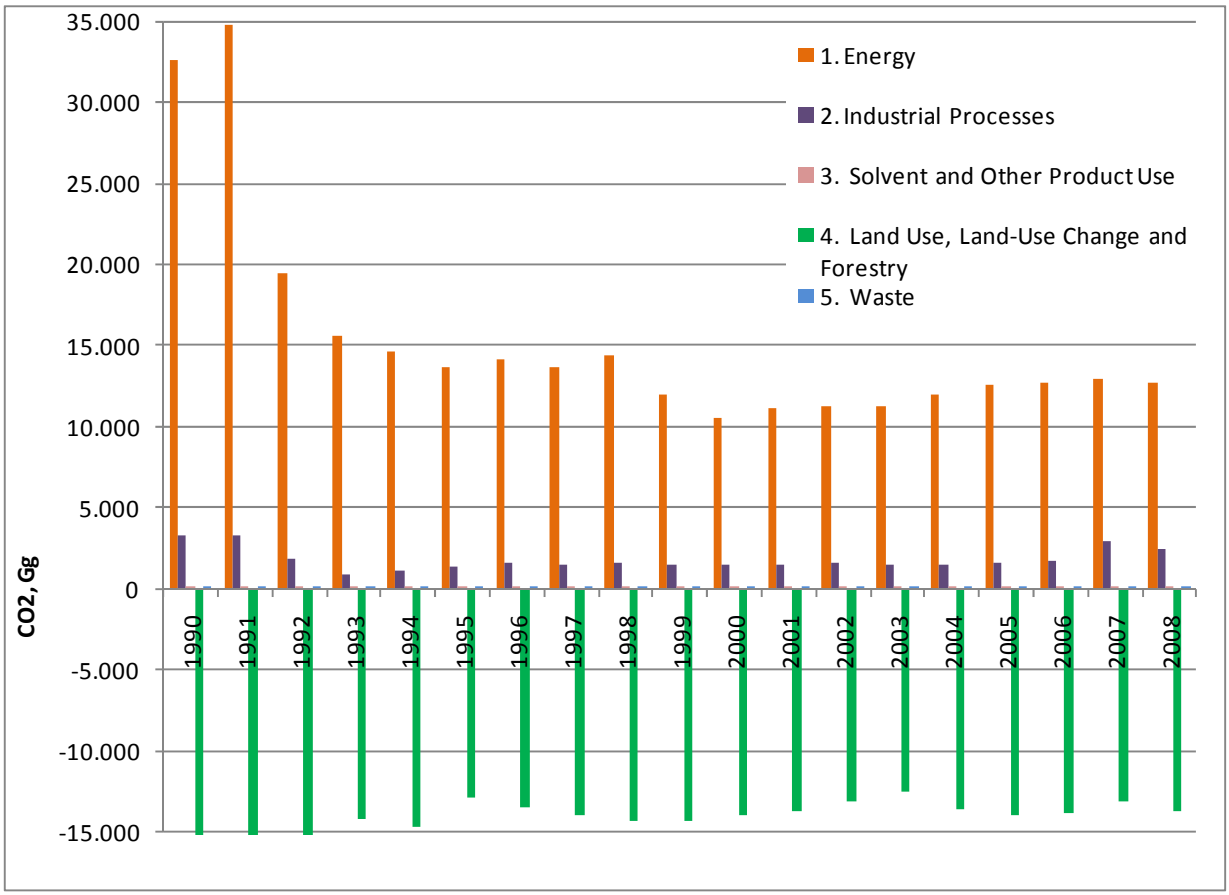

Fig. 22. CO_2 emissions trends by sectors, 1990-2008

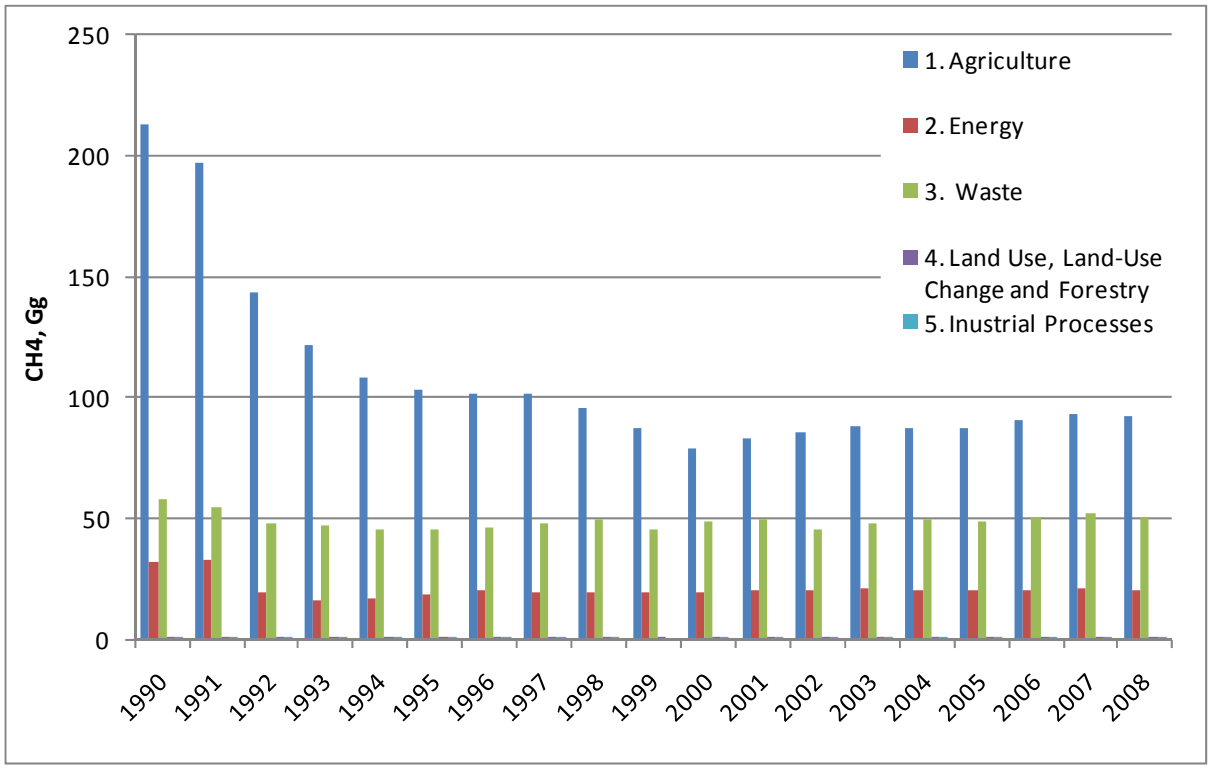

Fig. 23. CH_4 emissions trends by sectors, 1990-2008

3.3 National system

3.3.1 Institutional set-up for GHG inventory preparation

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

In 2009 the sixth National Inventory Report (NIR) covering the inventory of greenhouse gas emissions of Lithuania was presented. It 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. It also was submitted to the European Commission and complies with the Decision No. 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto protocol.

The NIR accompanies the GHG inventory. The NIR includes a description of the methodologies and data sources used for estimating emissions by sources and removals by sinks, and a discussion of their trends.

The final responsibility for the preparation of the annual GHG inventory report and its submission to the European Commission and the Secretariat of the UNFCCC is placed on the Ministry of Environment.

The Ministry of Environment is responsible for:

- Overall coordination of GHG inventory process;
- Final checking and approval of GHG inventory procedures;
- Approval of QA/QC plan and procedures;
- Checking of consistency of data, documenting, processing, archiving;
- Checking and approval of reports provided by the inventory experts.

The Ministry of Environment establishes and operates GHG inventory database and archive. The Ministry of Environment is a single location where archives of GHG submissions and all supporting reference material is stored and maintained. Backups are prepared on regular basis following the Ministry of Environment information management procedures. [1]

Following actors participate in the process of preparation and submissions of the GHG inventory: The Ministry of Environment, the National Climate Change Committee, organization preparing GHG inventory (the Center of Environmental Policy), data providers, experts (consultants).

The institutional GHG inventory report preparation and submission set-up is given below.

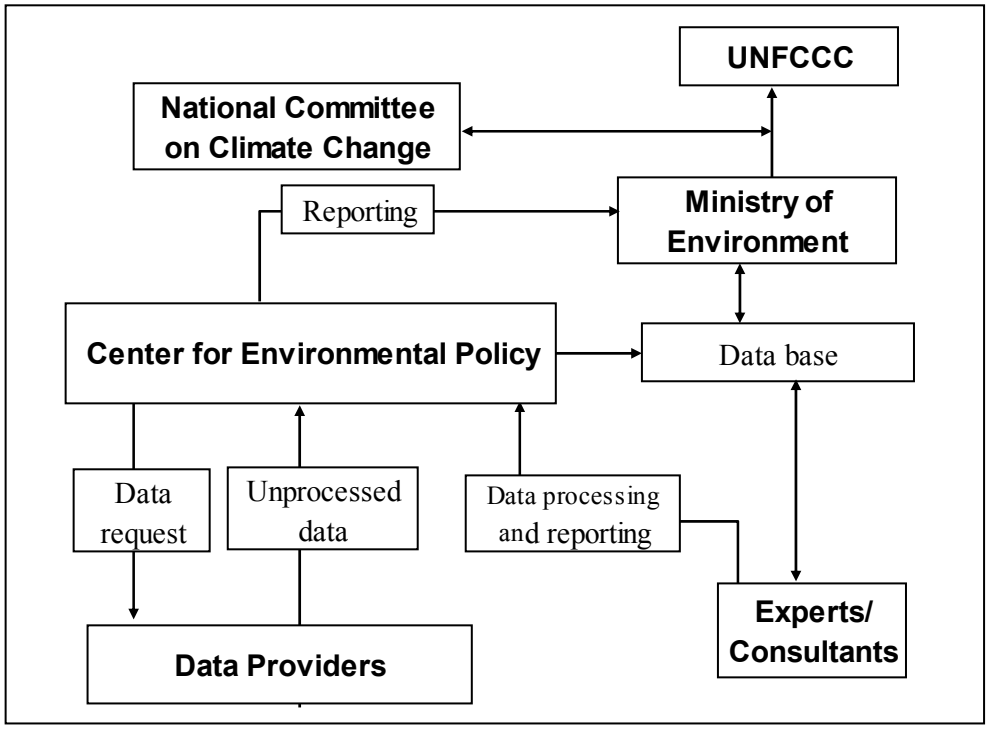

Fig. 24. Institutional set-up for GHG inventory preparation

Source: 1990-2007 GHG inventory report [2]

Before submission, reports are forwarded to the National Climate Change Committee for final approval. A National Committee on Climate Change has been set up in 2001. In 2009 the composition of the committee was updated including ministries associated with Climate change policy implementation, government and other organizations and agencies representatives. 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 ensure attaining the goals related to the restriction of GHG emissions as set in the National Sustainable Development Strategy and implementing the measures for attaining such goals. The Committee also has to organize the implementation of the provisions of the UNFCCC and coordinate compliance with the requirements of the Kyoto Protocol and EU legal acts related to the UNFCCC.

The public procurement tender is announcing every year for GHG inventory preparation. Inventory preparation is coordinated by the Center for Environmental Policy which is responsible for compilation of the final report based on the sectoral reports provided by the experts/consultants. Initial data for the sectoral reports are 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 database. The database is established and operated by the Ministry of Environment.

The Center of Environmental Policy, as the coordinator of the GHG inventory, has the following functions and responsibilities:

- Checking and archiving the supplied input data,
- Checking assumptions and data selection criteria,
- Checking data inputs and references,
- Checking data processing procedures and emission calculations;
- Checking units, conversion and adjustment factors, etc.,
- Ensuring adequate documentation,
- Checking consistency of data between the source categories,
- Checking data aggregation and transcription,
- Coordinating QA/QC activities, preparing QC and QA procedures,

- Providing the final inventory (CRF tables and NIR) for the Ministry of Environment

The Center for Environmental Policy assigns the QA/QC coordinator, who is responsible for ensuring that QA/QC system is implemented and functions.

The Center for Environmental Policy as a coordinating institution is responsible also for establishing quality assurance system comprising review procedures conducted by personnel not directly involved in inventory compilation/development. Its responsibilities include:

- Identification and prioritization of sets of data for review based on key category and uncertainty analysis;
- Identification of review personnel;
- Conclusions and corrective actions based on the review results.

Prioritized data and identified review personnel are to be approved by the Ministry of Environment. [2]

3.3.2 GHG inventory preparation process and data collection

The most important data providers are Statistics department of Lithuania, Environmental Protection Agency, Lithuanian Energy Institute, State Forest Survey Service, Lithuanian Forest Research Institute, Institute of Physics, Lithuanian Institute of Agrarian Economics, Lithuanian Institute of Agriculture, Geological Survey of Lithuania, industry companies etc.

The tasks and responsibilities of the participants in inventory-related activities are defined as follows:

Data providers are responsible for:

- Collection of activity data,
- Applying QC procedures (documentation in checklists to be provided to Center for Environmental Policy),
- Evaluation of uncertainties of the initial data.

The GHG Inventory Experts Team is formed from leading Lithuanian specialists in areas related to GHG emissions.

GHG Inventory expert's team is responsible for:

- Evaluating requirements for new data, based on internal and external reviews
- Identification of data providers for specific information,
- Formulation of requests to provided needed data,
- Selection of (= complying with IPCC Good Practice Guidance) methods (complying with IPCC Good Practice Guidance) for calculation of emissions giving the priority to key categories and categories with high uncertainty,
- Determination of activity data,
- Determination of appropriate emission factors,
- Calculation of emissions,
- Data quality control,
- Filling sectoral CRF tables.

The team is made of technical experts responsible for GHG inventory in separate sectors. The group has to meet in decided periods but at least two times per year to discus new items related to GHG inventory.

The main functions and responsibilities of the persons participating in the inventory process are as follows:

- Team Leader: responsible for all aspects of the inventory preparation including supervision, evaluation of uncertainties, coordination of actions, etc.

- Sectoral experts: responsible for preparation of the inventory for specific sectors assigned to them, taking decisions regarding collection and processing of data related to their specific sectors and for supervision of other persons involved in data collection and processing in corresponding sector.
- QA/QC Manager: responsible for management and implementation of the QA/QC plan and procedures, for reviewing and checking reports provided by the sectoral experts, as well as for personnel involved in QA/QC process.
- 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. [2]

3.3.3 Methodology and data sources

The sixth and the seventh GHG inventory contain information on anthropogenic emissions by sources and removals by sinks for the following direct (CO_2, CH_4, N_2O, HFCs and SF_6) and indirect (CO, NOx, NMVOCs, SO_2) greenhouse gases. GHG inventory covers the years 1990-2008 [2,3].

The GHG inventories are compiled in accordance with the methodology recommended by the Intergovernmental Panel on Climate Change (IPCC) in its Revised 1996 Guidelines for National Greenhouse Gas Inventories (IPCC, 1997), Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000) and Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC, 2003). Emission factors used are either country specific (used for Energy sector, except fugitive emissions) or internationally recommended default factors, mainly those provided in IPCC Good Practice Guidance and in EMEP/CORINAIR Emission Inventory Guidebook.

Lithuania's GHG emission inventory includes all major emission sources identified by the IPPC Good Practice Guidance with some exceptions, which supposed to have 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, if it is possible. Not published data is gathered from relevant authorities (institutes, industry companies etc.) on the request of the Ministry of the Environment.

The main data providers for GHG inventory estimation are the Department of Statistics under the Government of Lithuania (Statistics Lithuania), the State Forest Survey Service and the Environmental Protection Agency:

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

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

The State Forest Survey 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 Survey Service is established under the Ministry of Environment.

The Environment Protection Agency (EPA) is a subsidiary institution of the Ministry of Environment. It is responsible, among others, for environmental quality monitoring, collection and storage of environmental data and information as well as for assessment and forecast of environmental quality. One of the main tasks of the EPA is managing, processing and reporting of information. [1, 2]

3.3.4 The main category of sources

Key sources for the GHG inventory for year 2008 were analyzed according to Good Practice Guidance (2000). The Level assessment of the key source analysis was conducted, following the Tier 1 approach. The contribution of each source category to the national total was calculated. Any source category that met the 95% threshold was identified as a key source category.

The results of the analysis are provided in the table below.

Table 16. Key source categories analysis 1990 including LULUCF

Key Category	GHG emissions, Gg CO_2e	Level assessment	Cumulative total
5.A.1 Forest Land remaining Forest Land, CO_2	14,549.32	22.0%	22.0%
1.AA.1 Energy industries liquid fuel, CO_2	7,647.99	11.6%	33.6%
1.AA.1 Energy industries gaseous fuel, CO_2	5,981.61	9.1%	42.7%
1.AA.2 Manufacturing and construction liquid fuels, CO_2	3,896.97	5.9%	48.6%
1.AA.4.A Commercial/Institutional, CO_2	3,090.19	4.7%	53.2%
1.AA.3.B Road transportation gasoline, CO_2	3,054.32	4.6%	57.9%
4.D.1 Direct Soil Emissions, N_2O	2,929.86	4.4%	62.3%
1.AA.4.B Residential, CO_2	2,379.86	3.6%	65.9%
1.AA.3.B Road transportation diesel, CO_2	2,166.42	3.3%	69.2%
1.AA.2 Manufacturing and construction gaseous fuels, CO_2	2,110.76	3.2%	72.4%
4.D.3 Indirect Emissions, N_2O	1,914.72	2.9%	75.3%
2.A.1 Cement Production, CO_2	1,668.07	2.5%	77.8%
4.A. Enteric Fermentation dairy cattle, CH_4	1,603.33	2.4%	80.2%
1.AA.4.C Agriculture/Forestry/Fisheries, CO_2	1,503.66	2.3%	82.5%
4.A. Enteric Fermentation non-dairy cattle, CH_4	1,413.27	2.1%	84.6%
5.A.2 Land converted to Forest Land, CO_2	1,403.70	2.1%	86.8%
4.B. Manure Management, CH_4	1,330.44	2.0%	88.8%
2.B.1 Ammonia Production, CO_2	1,189.56	1.8%	90.6%
4.B. Manure Management, N_2O	879.85	1.3%	91.9%
2.B.2 Nitric Acid Production, N_2O	771.30	1.2%	93.1%
6.A. Solid Waste Disposal on Land, CH_4	618.95	0.9%	94.0%
6.B. Waste-water Handling, CH_4	604.80	0.9%	94.9%
4.D.2 Pasture, Range and Paddock Manure, N_2O	399.91	0.6%	95.5%

Table 17. Key source categories analysis 1990 excluding LULUCF

Key Category	GHG emissions, Gg CO_2e	Level assessment	Cumulative total
1.AA.1 Energy industries liquid fuel, CO_2	7,647.99	15.4%	15.4%
1.AA.1 Energy industries gaseous fuel, CO_2	5,981.61	12.0%	27.4%
1.AA.2 Manufacturing and construction liquid fuels, CO_2	3,896.97	7.8%	35.2%
1.AA.4.A Commercial/Institutional, CO_2	3,090.19	6.2%	41.5%
1.AA.3.B Road transportation gasoline, CO_2	3,054.32	6.1%	47.6%
4.D.1 Direct Soil Emissions, N_2O	2,929.86	5.9%	53.5%
1.AA.4.B Residential, CO_2	2,379.86	4.8%	58.3%
1.AA.3.B Road transportation diesel, CO_2	2,166.42	4.4%	62.6%
1.AA.2 Manufacturing and construction gaseous fuels, CO_2	2,110.76	4.2%	66.9%
4.D.3 Indirect Emissions, N_2O	1,914.72	3.9%	70.7%
2.A.1 Cement Production, CO_2	1,668.07	3.4%	74.1%
4.A. Enteric Fermentation dairy cattle, CH_4	1,603.33	3.2%	77.3%
1.AA.4.C Agriculture/Forestry/Fisheries, CO_2	1,503.66	3.0%	80.3%

4.A. Enteric Fermentation non-dairy cattle, CH_4	1,413.27	2.8%	83.2%
4.B. Manure Management, CH_4	1,330.44	2.7%	85.9%
2.B.1 Ammonia Production, CO_2	1,189.56	2.4%	88.3%
4.B. Manure Management, N_2O	879.85	1.8%	90.0%
2.B.2 Nitric Acid Production, N_2O	771.30	1.6%	91.6%
6.A. Solid Waste Disposal on Land, CH_4	618.95	1.2%	92.8%
6.B. Waste-water Handling, CH_4	604.80	1.2%	94.0%
4.D.2 Pasture, Range and Paddock Manure, N_2O	399.91	0.8%	94.8%
1.B. Fugitive Emissions from Fuels, CH_4	357.84	0.7%	95.6%

Table 18. Key source categories analysis 1990 including LULUCF

Key Category	GHG emissions, Gg CO_2e	Level assessment	Cumulative total
5.A.1 Forest Land remaining Forest Land, CO_2	14,549.32	22.0%	22.0%
1.AA.1 Energy industries liquid fuel, CO_2	7,647.99	11.6%	33.6%
1.AA.1 Energy industries gaseous fuel, CO_2	5,981.61	9.1%	42.7%
1.AA.2 Manufacturing and construction liquid fuels, CO_2	3,896.97	5.9%	48.6%
1.AA.4.A Commercial/Institutional, CO_2	3,090.19	4.7%	53.2%
1.AA.3.B Road transportation gasoline, CO_2	3,054.32	4.6%	57.9%
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2.A.1 Cement Production, CO_2	1,668.07	2.5%	77.8%
4.A. Enteric Fermentation dairy cattle, CH_4	1,603.33	2.4%	80.2%
1.AA.4.C Agriculture/Forestry/Fisheries, CO_2	1,503.66	2.3%	82.5%
4.A. Enteric Fermentation non-dairy cattle, CH_4	1,413.27	2.1%	84.6%
5.A.2 Land converted to Forest Land, CO_2	1,403.70	2.1%	86.8%
4.B. Manure Management, CH_4	1,330.44	2.0%	88.8%
2.B.1 Ammonia Production, CO_2	1,189.56	1.8%	90.6%
4.B. Manure Management, N_2O	879.85	1.3%	91.9%
2.B.2 Nitric Acid Production, N_2O	771.30	1.2%	93.1%
6.A. Solid Waste Disposal on Land, CH_4	618.95	0.9%	94.0%
6.B. Waste-water Handling, CH_4	604.80	0.9%	94.9%
4.D.2 Pasture, Range and Paddock Manure, N_2O	399.91	0.6%	95.5%

Table 19. Key source categories analysis 2008 excluding LULUCF

Key Category	GHG emissions, Gg CO_2e	Level assessment	Cumulative total
1.AA.3.B Road transportation diesel, CO_2	2,926.48	12.0%	12.0%
1.AA.1 Energy industries gaseous fuel, CO_2	2,600.44	10.7%	22.7%
2.B.2. Nitric Acid Production, N_2O	2,408.05	9.9%	32.5%
1.AA.1 Energy industries liquid fuel, CO_2	2,338.23	9.6%	42.1%
2.B.1. Ammonia Production, CO_2	1,906.70	7.8%	49.9%
4.D.1. Direct Soil Emissions, N_2O	1,654.26	6.8%	56.7%
1.AA.3.B Road transportation gasoline, CO_2	1,332.32	5.5%	62.2%
4.D.3. Indirect Emissions, N_2O	881.29	3.6%	65.8%
4.A. Enteric Fermentation dairy cattle, CH_4	848.99	3.5%	69.3%
6.A. Solid Waste Disposal on Land, CH_4	757.64	3.1%	72.4%

Key Category	GHG emissions, Gg CO_2e	Level assessment	Cumulative total
1.AA.2 Manufacturing and construction gaseous fuels, CO_2	685.99	2.8%	75.2%
1.AA.4.B Residential, CO_2	652.33	2.7%	77.9%
4.B. Manure Management, CH_4	575.76	2.4%	80.2%
1.AA.3.B Road transportation LPG, CO_2	559.98	2.3%	82.5%
1.AA.2 Manufacturing and construction solid fuels, CO_2	474.31	1.9%	84.5%
2.A.1. Cement Production, CO_2	454.11	1.9%	86.3%
4.A. Enteric Fermentation non-dairy cattle, CH_4	452.59	1.9%	88.2%
1.AA.4.A Commercial/Institutional, CO_2	339.66	1.4%	89.6%
4.B. Manure Management, N_2O	322.83	1.3%	90.9%
6.B. Waste-water Handling, CH_4	306.17	1.3%	92.2%
1.AA.3.C Railways, CO_2	231.92	1.0%	93.1%
1.AA.4.C Agriculture/Forestry/Fisheries, CO_2	224.74	0.9%	94.0%
4.D.2. Pasture, Range and Paddock Manure, N_2O	216.65	0.9%	94.9%
1.B. Fugitive Emissions from Fuels, CH_4	205.76	0.8%	95.8%

Table 20. Key source categories analysis 2008 including LULUCF

Key Category	GHG emissions, Gg CO_2e	Level assessment	Cumulative total
5.A.1. Forest Land remaining Forest Land, CO_2	12,677.15	32.6%	32.6%
1.AA.3.B Road transportation diesel, CO_2	2,926.48	7.5%	40.1%
1.AA.1 Energy industries gaseous fuel, CO_2	2,600.44	6.7%	46.8%
2.B.2. Nitric Acid Production, N_2O	2,408.05	6.2%	53.0%
1.AA.1 Energy industries liquid fuel, CO_2	2,338.23	6.0%	59.1%
2.B.1. Ammonia Production, CO_2	1,906.70	4.9%	64.0%
4.D.1. Direct Soil Emissions, N_2O	1,654.26	4.3%	68.2%
5.A.2. Land converted to Forest Land, CO_2	1,403.70	3.6%	71.8%
1.AA.3.B Road transportation gasoline, CO_2	1,332.32	3.4%	75.3%
4.D.3. Indirect Emissions, N_2O	881.29	2.3%	77.5%
4.A. Enteric Fermentation dairy cattle, CH_4	848.99	2.2%	79.7%
6.A. Solid Waste Disposal on Land, CH_4	757.64	1.9%	81.7%
1.AA.2 Manufacturing and construction gaseous fuels, CO_2	685.99	1.8%	83.4%
1.AA.4.B Residential, CO_2	652.33	1.7%	85.1%
4.B. Manure Management, CH_4	575.76	1.5%	86.6%
1.AA.3.B Road transportation LPG, CO_2	559.98	1.4%	88.0%
1.AA.2 Manufacturing and construction solid fuels, CO_2	474.31	1.2%	89.2%
2.A.1. Cement Production, CO_2	454.11	1.2%	90.4%
4.A. Enteric Fermentation non-dairy cattle, CH_4	452.59	1.2%	91.6%
1.AA.4.A Commercial/Institutional, CO_2	339.66	0.9%	92.5%
4.B. Manure Management, N_2O	322.83	0.8%	93.3%
6.B. Waste-water Handling, CH_4	306.17	0.8%	94.1%
1.AA.3.C Railways, CO_2	231.92	0.6%	94.7%
1.AA.4.C Agriculture/Forestry/Fisheries, CO_2	224.74	0.6%	95.2%

Table 21. Trend assessment 1990-2008 excluding LULUCF

Key Category	GHG emissions, Gg CO_2e		Level assessment 2007	Trend assessment		Cumulative total
	1990	2007				
5.A.1. Forest Land remaining Forest Land, CO_2	14,549.32	12,677.15	32.6%	18.0%	18.3%	18.3%
1.AA.1 Energy industries liquid fuel, CO_2	7,647.99	2,338.23	6.0%	9.5%	9.6%	27.8%
1.AA.2 Manufacturing and construction liquid fuels, CO_2	3,896.97	189.27	0.5%	9.2%	9.3%	37.2%
2.B.2. Nitric Acid Production, N_2O	771.30	2,408.05	6.2%	8.5%	8.7%	45.8%
1.AA.3.B Road transportation diesel, CO_2	2,166.42	2,926.48	7.5%	7.2%	7.3%	53.2%
1.AA.4.A Commercial/Institutional, CO_2	3,090.19	339.66	0.9%	6.5%	6.6%	59.7%
2.B.1. Ammonia Production, CO_2	1,189.56	1,906.70	4.9%	5.3%	5.4%	65.1%
1.AA.1 Energy industries gaseous fuel, CO_2	5,981.6	2,600.44	6.7%	4.0%	4.1%	69.1%
1.AA.4.B Residential, CO_2	2,379.86	652.33	1.7%	3.3%	3.3%	72.5%
1.AA.4.C Agriculture/Forestry/Fisheries, CO_2	1,503.66	224.74	0.6%	2.9%	2.9%	75.4%
5.A.2. Land converted to Forest Land, CO_2	1,403.70	1,403.70	3.6%	2.5%	2.6%	78.0%
1.AA.2 Manufacturing and construction gaseous fuels, CO_2	2,110.76	685.99	1.8%	2.4%	2.5%	80.4%
2.A.1. Cement Production, CO_2	1,668.07	454.11	1.2%	2.3%	2.3%	82.8%
1.AA.3.B Road transportation LPG, CO_2	59.80	559.98	1.4%	2.3%	2.3%	85.1%
1.AA.3.B Road transportation gasoline, CO_2	3,054.32	1,332.32	3.4%	2.0%	2.1%	87.1%
6.A. Solid Waste Disposal on Land, CH_4	618.95	757.64	1.9%	1.7%	1.7%	88.9%
4.A. Enteric Fermentation non-dairy cattle, CH_4	1,413.27	452.59	1.2%	1.7%	1.7%	90.6%
1.AA.2 Manufacturing and construction solid fuels, CO_2	176.47	474.31	1.2%	1.6%	1.6%	92.2%
4.D.3. Indirect Emissions, N_2O	1,914.72	881.29	2.3%	1.1%	1.1%	93.3%
4.B. Manure Management, CH_4	1,330.44	575.76	1.5%	0.9%	0.9%	94.2%
4.B. Manure Management, N_2O	879.85	322.83	0.8%	0.9%	0.9%	95.1%

Table 22. Trend assessment 1990-2008 including LULUCF [3]

Key Category	GHG emissions, Gg CO_2e		Level assessment 2007	Trend assessment		Cumulative total
	1990	2007				
5.A.1. Forest Land remaining Forest Land, CO_2	14,549.32	12,677.15	32.6%	18.0%	18.3%	18.3%
1.AA.1 Energy industries liquid fuel, CO_2	7,647.99	2,338.23	6.0%	9.5%	9.6%	27.8%
1.AA.2 Manufacturing and construction liquid fuels, CO_2	3,896.97	189.27	0.5%	9.2%	9.3%	37.2%
2.B.2. Nitric Acid Production, N_2O	771.30	2,408.05	6.2%	8.5%	8.7%	45.8%
1.AA.3.B Road transportation diesel, CO_2	2,166.42	2,926.48	7.5%	7.2%	7.3%	53.2%
1.AA.4.A Commercial/Institutional, CO_2	3,090.19	339.66	0.9%	6.5%	6.6%	59.7%
2.B.1. Ammonia Production, CO_2	1,189.56	1,906.70	4.9%	5.3%	5.4%	65.1%
1.AA.1 Energy industries gaseous fuel, CO_2	5,981.6	2,600.44	6.7%	4.0%	4.1%	69.1%
1.AA.4.B Residential, CO_2	2,379.86	652.33	1.7%	3.3%	3.3%	72.5%
1.AA.4.C Agriculture/Forestry/Fisheries, CO_2	1,503.66	224.74	0.6%	2.9%	2.9%	75.4%
5.A.2. Land converted to Forest Land, CO_2	1,403.70	1,403.70	3.6%	2.5%	2.6%	78.0%
1.AA.2 Manufacturing and construction gaseous fuels, CO_2	2,110.76	685.99	1.8%	2.4%	2.5%	80.4%
2.A.1. Cement Production, CO_2	1,668.07	454.11	1.2%	2.3%	2.3%	82.8%
1.AA.3.B Road transportation LPG, CO_2	59.80	559.98	1.4%	2.3%	2.3%	85.1%
1.AA.3.B Road transportation gasoline, CO_2	3,054.32	1,332.32	3.4%	2.0%	2.1%	87.1%
6.A. Solid Waste Disposal on Land, CH_4	618.95	757.64	1.9%	1.7%	1.7%	88.9%
4.A. Enteric Fermentation non-dairy cattle, CH_4	1,413.27	452.59	1.2%	1.7%	1.7%	90.6%
1.AA.2 Manufacturing and construction solid fuels, CO_2	176.47	474.31	1.2%	1.6%	1.6%	92.2%
4.D.3. Indirect Emissions, N_2O	1,914.72	881.29	2.3%	1.1%	1.1%	93.3%
4.B. Manure Management, CH_4	1,330.44	575.76	1.5%	0.9%	0.9%	94.2%
4.B. Manure Management, N_2O	879.85	322.83	0.8%	0.9%	0.9%	95.1%

3.3.5 Repeated calculations and improvements

More transparent National Inventory report (NIR) was prepared providing more precise descriptions of the methodologies, activity data and emission factors. Activity data for large number of emission sources were checked and reviewed. QA/QC plan was updated and implemented.

3.3.5.1 Energy

1.AA.1.A: Public electricity and heat production, consumption of not liquefied petroleum gas. Use of not liquefied petroleum gas was started in public electricity and heat production sector from 2007.

1.AA.1.A: Public electricity and heat production, consumption of natural gas. In previous submissions (1996-2007) natural gas consumption for methanol production was not excluded from natural gas consumption for energy use. Now natural gas used for methanol production is excluded from calculations.

1.AA.1.A: Public electricity and heat production, consumption of wood/wood waste. In previous submissions (2004-2007) use of wood for charcoal production was not excluded from consumption for energy production. Now it is excluded from energy production and included in manufacture of solid fuels.

1.AA.1.B Petroleum refining, consumption of refinery gas. The data on consumption of refinery gas for 2007 were corrected by the Statistics Lithuania.

1.AA.1.C Manufacture of solid fuels and other industries, consumption of wood/wood waste. In previous submissions (2004-2007) use of wood for charcoal production was included in public electricity and heat production. Now it is excluded from energy production and included in manufacture of solid fuels.

1.AA.2.E: Food processing, beverages and tobacco, consumption of biogas. Biogas consumption started from 2007.

1.AA.3.B: Road transportation, consumption of gasoline, LPG, Diesel oil, bioethanol and biodiesel in road transportation. The data on consumption of gasoline, LPG, Diesel oil, bioethanol and biodiesel in road transportation in 2007 were corrected by the Statistics Lithuania.

1.AA.3.E: Other transportation: natural gas transportation in pipelines. New category added.

1.C1.B: International bunkers, Marine, Residual fuel oil. From 2000 low sulphur HFO was used in international bunkers that were not included in previous submissions. Corresponding recalculations were made.

1.B.2.A.3: Fugitive emissions from fuels, oil transportation by pipelines. Data for 2006-2007 recalculated using corrected statistics data.

Peat production and consumption: The data provided by the Statistics Lithuania include separately production and consumption of peat, peat pellets and peat briquettes. In previous submissions these three types of peat were summed and added to calculations. Actually, peat pellets and briquettes are produced from peat and the data on their production should be excluded from the sum. On the other hand, import, export, stock change and final consumption are provided in the statistics separately for each type of peat and should be summed. The data for the whole period 1990-2007 were reviewed together with the Statistics Lithuania and recalculated.

Coke used for cast iron production was subtracted from energy production in other non-specified category and added to cast iron production category.

Emissions in energy sector reported in 2009 submission and recalculated emissions are provided in the table below.

The data on fuel consumption were checked and verified with the data available at the Statistics Lithuania and adjusted accordingly.

Table 23. Emissions in energy sector reported in 2009 submission and recalculated emissions

	CO_2, Gg		CH_4, Gg		N_2O, Gg		Total, Gg			
	Previous submission	This submission	Previous submission	This submission	Previous submission	This submission	Previous submission	This submission	Difference	
									Gg	%
1990	32,674	32,634	668	668	298	297	33,640	33,599	-40	-0.1%

1991	34,789	34,752	699	699	320	320	35,808	35,770	-38	-0.1%
1992	19,529	19,496	411	411	186	186	20,127	20,092	-34	-0.2%
1993	15,611	15,586	345	345	161	160	16,117	16,091	-25	-0.2%
1994	14,666	14,634	352	352	149	149	15,168	15,134	-33	-0.2%
1995	13,677	13,652	387	387	139	138	14,203	14,177	-26	-0.2%
1996	14,172	14,133	419	419	145	144	14,736	14,696	-40	-0.3%
1997	13,728	13,680	412	412	143	143	14,284	14,235	-49	-0.3%
1998	14,427	14,396	407	406	156	156	14,990	14,959	-31	-0.2%
1999	12,033	12,006	403	403	134	134	12,571	12,543	-28	-0.2%
2000	10,526	10,501	417	417	117	117	11,060	11,035	-25	-0.2%
2001	11,229	11,189	435	435	126	126	11,791	11,750	-41	-0.3%
2002	11,334	11,286	428	428	130	130	11,892	11,844	-48	-0.4%
2003	11,348	11,290	436	436	130	130	11,915	11,856	-59	-0.5%
2004	11,998	11,936	425	425	139	138	12,562	12,500	-63	-0.5%
2005	12,671	12,617	430	430	145	145	13,246	13,192	-54	-0.4%
2006	12,768	12,718	434	434	151	150	13,352	13,301	-51	-0.4%
2007	12,895	12,906	450	448	157	157	13,502	13,512	10	0.1%

3.3.5.2 Industry

For the first time emissions from cast iron production were evaluated. In the previously submitted GHG inventory those emissions were not included. Additional CO_2 emissions (Gg) from cast iron production and their impact on the total emissions from industrial processes are shown in the table below.

Table 24. Additional CO_2 emissions (Gg) from cast iron production and their impact on the total emissions from industrial processes

	Emissions from cast iron production	**Impact on total emissions by industrial processes**			
		Previous submission	**This submission**	**Difference**	
				Gg	**%**
1990	21.41	4,106	4,127	21	0.5%
1991	17.17	4,131	4,149	17	0.4%
1992	8.50	2,374	2,383	9	0.4%
1993	6.21	1,452	1,458	6	0.4%
1994	5.79	1,550	1,555	6	0.4%
1995	5.59	1,891	1,897	6	0.3%
1996	5.45	2,321	2,326	5	0.2%
1997	5.96	2,239	2,245	6	0.3%
1998	6.56	2,605	2,611	7	0.3%
1999	7.00	2,553	2,560	7	0.3%
2000	7.47	2,734	2,742	7	0.3%
2001	7.80	2,937	2,944	8	0.3%
2002	7.20	3,109	3,116	7	0.2%
2003	7.27	3,127	3,134	7	0.2%
2004	7.05	3,266	3,273	7	0.2%
2005	7.19	3,603	3,610	7	0.2%
2006	6.87	3,736	3,743	7	0.2%
2007	6.54	5,509	5,515	7	0.1%

3.3.5.3 Agriculture

Enteric fermentation

Productivity of cows grown principally for meat production in 2007 was specified in the report. In the group of the cattle over 2 years of age net energy for growth was recalculated according to Eq. 4.3a provided in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (p. 4.15). IEF for non-dairy cattle was also recalculated resulting in 56,2 kg CH_4/head/year in 2007.

Manure management

In the Liquid/slurry and Pit storage below confinements / deep bedding manure storage systems the MCF was changed (instead of previously used 10%, the 39% was started to use), given in the IPCC Good Practice Guidance and Uncertainty management in National Greenhouse Gas Inventories[4]. As a result, the emission factor and CH_4 emission has changed since 1990.

Table 25. Reported (the 2008 submission) and recalculated (the 2009 submission) CH_4 emissions from manure management in 1990–2008, (Gg CO_2e)

GHG inventory report	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2008	411.3	378.1	252.7	220.7	214.0	210.0	196.3	201.4	191.6	165.7
2009	1,330.4	1,211.6	806.1	698.8	686.1	677.4	626.8	649.2	620.2	527.9

GHG inventory report	2000	2001	2002	2003	2004	2005	2006	2007	2008	
2008	151.0	167.7	174.5	178.4	179.3	184.1	187.2	182.7		
2009	482.7	540.5	564.0	570.7	573.7	588.7	599.0	608.0	575.8	

Considering the productivity in the year 2000 – 2007, the annual amounts of N excretion per head of dairy cows were recalculated.

Table 26. Reported (the 2008 submission) and recalculated (the 2009 submission) N excretion per head of dairy cows in 2000–2008, (kg/head/year)

GHG inventory report	2000	2001	2002	2003	2004	2005	2006	2007	2008
2008	70	70	70	70	70	70	70	70	
2009	77	82	84	84	88	91	94	99	99.4

In the group of non-dairy cattle N excretion per head in 2007 was: reported – 50, recalculated - 57,6 kg/head/year.

Direct emissions from agricultural soils

Data of application of synthetic N fertilizers in 2006-2007 was specified. In the chapter "Crop residue" the value of Frac NCRBF and FracNCRO was revised. In the chapter "Cultivations of histosols" data of area of cultivated organic soils were revised. The change of MCF for manure management systems also had influence on the change of data.

[4] IPCC 2000. Agriculture. Table 4.10-4.11. P. 4.36-4.37.

Table 27. Reported (the 2008 submission) and recalculated (the 2009 submission) N_2O emissions from direct soil emission in 1990–2008, (Gg CO_2e)

GHG inventory report	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2008	2,724.0	2,430.1	1,524.8	1,259.8	1,114.3	1,103.2	1,331.0	1,354.4	1,340.7	1,341.8
2009	2,929.9	2,636.0	1,664.7	1,450.3	1,247.7	1,257.9	1,531.8	1,566.8	1,546.2	1,513.4
GHG inventory report	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	
2008	1,336.1	1,369.4	1,450.5	1,494.9	1,498.5	1,482.0	1,462.0	1,535.9		
2009	1,539.4	1,585.9	1,655.1	1,705.7	1,702.5	1,679.1	1,881.7	1,752.6	1,654.3	

Indirect emissions from agricultural soils

The data of the year 2006-2007 of application of synthetic N fertilizers was specified. The specification of the amount of N fertilizers had influence on the change of data as well.

Table 28. Reported (the 2008 submission) and recalculated (the 2009 submission) N_2O emissions from indirect soil emission in 2000–2008, (Gg CO_2 e)

GHG inventory report	2006	2007	2008
2008	909.9	915.2	
2009	1,118.6	960.4	881.3

3.3.5.4 LULUCF

All data related to forestry including releases and sinks of GHG were recalculated using NFI database maintained at the State Forest Survey Service. Recalculation has taken into account changes recorded during forest inventory and afterwards, including forest felling and reforestation-/-deforestation activities as well as changes in forest ownership. Impact of recalculation on CO_2 emissions from forest land is shown in the tables bellow.

Table 29. Impact of recalculation CO_2 emissions (Gg) from forest land

	Previous submission	This submission	Difference	
			Gg	%
1990	-10,924	-15,953	-5,029	46.0%
1991	-10,676	-15,744	-5,068	47.5%
1992	-10,669	-15,766	-5,097	47.8%
1993	-9,383	-14,519	-5,136	54.7%
1994	-9,855	-15,033	-5,178	52.5%
1995	-7,976	-13,183	-5,207	65.3%
1996	-8,476	-13,725	-5,249	61.9%
1997	-8,931	-14,199	-5,269	59.0%
1998	-9,340	-14,584	-5,244	56.1%
1999	-9,377	-14,587	-5,210	55.6%
2000	-8,781	-14,219	-5,438	61.9%
2001	-8,553	-13,937	-5,384	63.0%
2002	-7,989	-13,410	-5,421	67.9%
2003	-8,397	-12,876	-4,479	53.3%
2004	-8,704	-13,940	-5,235	60.1%
2005	-9,174	-14,031	-4,856	52.9%
2006	-9,351	-13,897	-4,546	48.6%
2007	-9,364	-13,446	-4,082	43.6%

Table 30. Impact of recalculation on CH_4 emissions (Gg CO_2 e) from forest land

	Previous submission	This submission	Difference	
			Gg	%
1990	0.64	0.80	0.16	25.2%
1991	0.31	0.38	0.07	24.3%
1992	4.86	5.84	0.98	20.2%
1993	1.55	1.90	0.35	22.5%
1994	1.57	1.91	0.34	21.7%
1995	1.59	1.92	0.33	20.8%
1996	1.61	1.93	0.32	20.0%
1997	1.61	1.94	0.33	20.5%
1998	0.28	0.33	0.05	18.4%
1999	1.81	2.13	0.32	17.6%
2000	1.76	2.04	0.29	16.2%
2001	0.60	0.70	0.09	15.6%
2002	3.91	4.51	0.60	15.4%
2003	2.39	2.77	0.38	15.7%
2004	1.40	1.62	0.22	15.5%
2005	0.28	0.32	0.04	14.8%
2006	6.67	7.65	0.98	14.7%
2007	0.22	0.24	0.02	10.2%

Table 31. Impact of recalculation on N_2O emissions (Gg CO_2e) from forest land

	Previous submission	This submission	Difference	
			Gg	%
1990	17.8	20.9	3.1	17.5%
1991	17.8	21.0	3.2	17.9%
1992	18.3	21.6	3.4	18.4%
1993	17.9	21.3	3.4	18.8%
1994	17.9	21.4	3.4	19.2%
1995	17.9	21.4	3.5	19.7%
1996	17.9	21.5	3.6	20.1%
1997	17.9	21.6	3.7	20.5%
1998	17.8	21.5	3.7	21.0%
1999	17.9	21.8	3.8	21.4%
2000	17.9	21.9	3.9	21.8%
2001	17.8	21.8	4.0	22.3%
2002	18.2	22.3	4.1	22.6%
2003	18.0	22.2	4.2	23.3%
2004	17.9	22.2	4.3	23.8%
2005	17.8	22.1	4.3	24.0%
2006	18.4	22.8	4.4	23.7%
2007	18.6	22.2	3.6	19.2%

Recalculation on GHG emissions from wetlands included estimation of CO_2 emissions from forest land converted to wetlands which were not calculated in previous submissions. Impact of recalculations is shown in the table below.

Table 32. Impact of recalculations on CO_2 emissions (Gg) from wetlands

	Previous submission	This submission	Difference	
			Gg	%
1990	72.7	104.6	31.8	43.8%
1991	72.7	104.7	31.9	43.9%
1992	72.7	104.8	32.0	44.0%
1993	63.3	95.4	32.1	50.7%
1994	75.3	107.5	32.2	42.8%
1995	74.9	107.1	32.3	43.1%
1996	74.7	107.1	32.4	43.3%
1997	67.1	99.5	32.5	48.4%
1998	68.0	100.5	32.6	47.9%
1999	67.7	100.4	32.6	48.2%
2000	71.1	103.9	32.7	46.0%
2001	71.4	104.2	32.8	46.0%
2002	58.2	91.1	32.9	56.6%
2003	50.8	99.2	48.4	95.3%
2004	53.6	91.5	37.9	70.6%
2005	55.8	62.5	6.7	12.0%
2006	57.6	63.8	6.2	10.8%
2007	56.5	106.8	50.3	89.1%

Recalculation on GHG emissions from settlements included estimation of CO_2 emissions from forest land converted to settlements which were not calculated in previous submissions. Impact of recalculations is shown in the table below.

Table 33. Impact of recalculations on CO_2 emissions (Gg) from settlements

	Previous submission	This submission	Difference	
			Gg	%
1990	NE	87.6	87.6	100.0
1991	NE	87.8	87.8	100.0
1992	NE	88.1	88.1	100.0
1993	NE	88.3	88.3	100.0
1994	NE	88.5	88.5	100.0
1995	NE	88.8	88.8	100.0
1996	NE	89.0	89.0	100.0
1997	NE	89.3	89.3	100.0
1998	NE	89.5	89.5	100.0
1999	NE	89.8	89.8	100.0
2000	NE	90.0	90.0	100.0
2001	NE	90.3	90.3	100.0
2002	NE	90.5	90.5	100.0
2003	NE	133.2	133.2	100.0
2004	NE	104.1	104.1	100.0
2005	NE	18.4	18.4	100.0
2006	NE	17.1	17.1	100.0
2007	NE	138.4	138.4	100.0

Recalculation on GHG emissions from other land included estimation of CO_2 emissions from forest land converted to other land which were not calculated in previous submissions. Impact of recalculations is shown in the table below.

Table 34. Impact of recalculations on CO_2 emissions (Gg) from other land

	Previous submission	This submission	Difference	
			Gg	%
1990	NE	79.6	79.6	100.0
1991	NE	79.8	79.8	100.0
1992	NE	80.1	80.1	100.0
1993	NE	80.3	80.3	100.0
1994	NE	80.5	80.5	100.0
1995	NE	80.7	80.7	100.0
1996	NE	80.9	80.9	100.0
1997	NE	81.2	81.2	100.0
1998	NE	81.4	81.4	100.0
1999	NE	81.6	81.6	100.0
2000	NE	81.8	81.8	100.0
2001	NE	82.1	82.1	100.0
2002	NE	82.3	82.3	100.0
2003	NE	121.1	121.1	100.0
2004	NE	94.7	94.7	100.0
2005	NE	16.7	16.7	100.0
2006	NE	15.6	15.6	100.0
2007	NE	125.8	125.8	100.0

3.3.5.5 Waste

3.3.5.5.1: Solid waste disposal on land, Managed waste disposal. Waste disposal data was recalculated assuming that approximately 1 million tonne of municipal waste were disposed of in municipal landfills annually from 1990 to 1998. The assumption was based on the fact that there was no waste weighing at that time and most probably the amounts of disposed municipal waste provided by the statistics are substantially overestimated. As methane emissions calculated using first order decay model depend on the amounts of waste disposed of in the past, obtained emission results had changed for the whole period up to 2008.

3.3.5.5.2.1: Unmanaged waste disposal on land, deep (>5 m). Waste disposal data was recalculated assuming that approximately 1 million tonne of municipal waste were disposed of in municipal landfills annually from 1990 to 1998. The assumption was based on the fact that there was no waste weighing at that time and most probably the amounts of disposed municipal waste provided by the statistics are substantially overestimated. As methane emissions calculated using first order decay model depend on the amounts of waste disposed of in the past, obtained emission results had changed for the whole period up to 2008.

3.3.5.5.2.2: Unmanaged waste disposal on land, shallow (<5 m). Waste disposal data was recalculated assuming that approximately 1 million tons of municipal waste was disposed of at municipal landfills annually from 1990 to 1998. The assumption was based on the fact that there was no waste weighing at that time and most probably the amounts of the disposed municipal waste provided by the statistics have been substantially overestimated. As methane emissions calculated using first order decay model depend on the amounts of waste disposed of in the past, the obtained emission results had changed for the whole period up to 2008.

Impact of recalculations on CO_2 emissions (Gg) from solid waste disposal on soil is shown in the table below.

Table 35. Impact of recalculations on NH_4 emissions (Gg CO_2 e) from solid waste disposal on soil

	Previous submission	This submission	Difference	
			Gg	%
1990	1,077	619	-458	-42.5%
1991	1,110	634	-476	-42.9%

1992	1,143	647	-496	-43.4%
1993	1,121	659	-462	-41.2%
1994	1,140	669	-470	-41.3%
1995	1,166	679	-487	-41.8%
1996	1,153	687	-466	-40.4%
1997	1,136	695	-441	-38.8%
1998	1,121	702	-420	-37.4%
1999	1,114	708	-406	-36.4%
2000	1,073	717	-355	-33.1%
2001	1,042	729	-312	-30.0%
2002	1,012	737	-275	-27.2%
2003	982	739	-243	-24.7%
2004	950	734	-216	-22.7%
2005	931	740	-190	-20.4%
2006	917	748	-169	-18.5%
2007	907	756	-150	-16.6%

3.3.6 Quality assurance and quality control

In order to improve further data integrity, correctness, and completeness, QA/AC plan was developed and implemented. 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.

The Quality Assurance and Quality Control (QA/QC) Plan has been prepared in order to improve transparency, consistency, comparability and completeness of Lithuania's GHG inventory. 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. The Center for Environmental Policy is responsible for co-ordination and implementation of the Plan. [2, 3]

3.3.6.1 Good practice

Good Practice is a set of procedures intended to ensure that greenhouse gas inventories are accurate in the sense that they are systematically neither over nor underestimates so far as can be judged, and that uncertainties are reduced so far as possible. Good Practice covers choice of estimation methods appropriate to national circumstances, quality assurance and quality control at the national level, quantification of uncertainties and data archiving and reporting to promote transparency.

Quality control (QC)

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

- Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
- Identify and address errors and omissions;
- Document and archive inventory material and record all QC activities.

QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardized procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. Higher tier QC activities include technical reviews of source categories, activity and emission factor data, and methods.

Quality assurance (QA)

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.

Additional terms, explanations and specifications for QA/QC are given in chapter 8 of IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC 2000). [1, 2, 3]

3.3.6.2 Quality control process

Analysts of the inventory must adopt adequate procedures for development and modification of the spreadsheets to minimize emission calculation errors. Checks ensure compliance with the established procedures as well as allow detecting the remaining errors.

Parameters, emission units and conversion factors used for the calculations must be clearly singled out and specified. Also, additional procedures should be followed to ensure that the parameters and emission factors are correctly written down and that relevant conversion factors are used.

Emission units, parameters and conversion factors shall not be directly included in the formulas; any value used for the calculations more than once shall be given in the spreadsheets (preferably at the top of the page and in bold) and in the calculations, where they should be taken from one cell as a reference.

Units shall be properly marked and correctly maintained during the entire calculation.

Correct conversion factors shall be used.

Temporary coefficients shall be used correctly.

The analysts must ensure data consistency in the databases and spreadsheets:

- Confirm that respective data processing steps have been correctly represented in the spreadsheets (e.g. correct formulas have been used);
- Confirm that data relations have been properly presented (e.g. that the data is of the same year and given in the same units);
- Clearly distinguish between the input data and the calculable data in the spreadsheets (e.g. by setting a respective color coding system).

The managers of sectors shall present the spreadsheets with the input data, calculation results and descriptions of the respective chapters of the NIR to the Manager of the Inventory and to the Manager of Quality Control.

Quality control 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 spreadsheets to CRF tables;
- Correctness of repeat calculations.

- Evaluation of the preparation of respective chapters of the National Inventory Report, 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 National Inventory Report correspond to the text;
  - Whether all necessary information on the data sources, assumptions and calculation methodology have been provided.

For the purpose of data quality control, the Visual Basic Code shall used, which calculates the main statistical parameters and draws a diagram of the data.

The results of the check are recorded in a verification-data correction protocol.

After the check, the protocol is given back to the sector managers who respond to the comments of the QC Manager and, if necessary, correct the data, calculation methodology or the report (NIR) accordingly. [2, 3]

3.3.6.3 Quality assurance

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 general, reviewers that have not been involved in preparing the inventory should be used. Preferably these reviewers would be independent experts from other agencies or a national or international expert or group not closely connected with national inventory compilation.

However, due to limited resources, hiring external agencies for review of the inventory is currently not possible. Actually objective and independent assessment of GHG inventories is made annually by the Expert Review Team. Bearing in mind existing constrains it is considered that in-country reviews performed by the ERT fulfill requirements of the QA and no additional QA activities are planned for the time being.

The last in-country review was performed in September 2009. Comments provided by the expert team are summarized in the Plan of Improvements for GHG Inventory 2009 (Section 6.1) of the QA/QC Plan. GHG Inventory Expert Team shall be guided by the Plan but also take into consideration detailed comments provided by the ERT to ensure that all estimates or explanations as indicated by the ERT will be corrected and included in the 2009 submission. [3]

3.3.6.4 Plan for the improvement of the GHG inventory report

The main following measures for the improvement of the GHG inventory are set in the latest GHG inventory report from 2010:

*In the energy sector: improve description of the methods and emissions factors; establish new emission factors (CO_2, CH_4 and N_2O) by fuel sources used in Lithuania.

* Improve collection of the data on fluorinated gases (HFCs, PFCs and SF_6) used in industry, fire-safety equipment, high voltage installations, cooling and air conditioning systems, in accordance to the provisions of the Order No. D1-12 of the Minister of Environment of 7 January 2010 "On submission, collection and management of data on fluorinated gases and ozone-depleting substances, and recording of the equipment and systems having those gases and substances" (Official Gazette, 2010, No. 5-200).

* Produce more comprehensive data on LULUCUF incorporating data on afforestation, reforestation and cutting in line with the requirements of the Kyoto protocol Article No. 7.1.

* Perform analysis of emissions factors used for GHG emissions records in waste and waste water sectors.

3.4 National registry

The National Green House Gases Registry (hereinafter as the registry) is an integrated part of Community registry system. Community registry system consists of Community and Member States registries according to the Decision No. 280/2004/EC Article 6 which includes the existing registries under Directive 2003/87/EC Article 19 and Community Independent Transaction Log (hereinafter as CITL) under the same Directive Article 20. Community registry system is necessary to ensure orderly holding, transfer and cancellation of allowances and compatibility of these transactions with the UNFCCC and the Kyoto protocol commitments.

The registry works implementing the Commission Regulation (EC) No 2216/2004 of 21 December 2004 for standardized and secured registries system pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council and its amendments made by the Commission Regulation (EC) No 916/2007 of 31 July 2007 amending Regulation (EC) No 2216/2004 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council.

On 8 October 2008, Commission Regulation (EC) No 994/2008 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council was adopted. Articles 2 to 88 of the regulation shall apply from 1 January 2012 and it will provide possibilities for the creation of a consolidated register of the Community. From 1 January 2012 Regulation No. 994/2008 will replace Regulation No 2216/2004 of 21 December 2004.

The national registry has joined the Independent Transaction Log (hereinafter as ITL). The registry activity corresponds to the UNFCCC states conference guidelines of decision No. 13/CMP.1 and decision 5/ CMP.1.

The registry accords with functions and technical specifications which are applicable to registry system data Exchange under the Kyoto protocol standards and adopted by the UNFCCC states conference decision No. 12/CMP.1. The registry managing institution (competent authority) is the Ministry of Environment and the registry administrator is the Lithuanian Environmental Investment Fund (LEIF). The country administers the registry in consolidated registry system by itself.

3.4.1 Technical specifications of the registry

The registry started to work in November 14, 2005 with installed software GRETA. In August 2009 by the decision for data migration, after the necessary testing in the registry system, on 1 of October the software was changed. Currently, software created by the Community, is used. This software corresponds to all requirements of Commission decision No. 2216/2004 of 21 December 2004.

Main Community Registry software features:

The CR was developed by the Trasys s.a. on behalf of the European Commission. It was developed as a standardized electronic Emissions Trading Registry according to the guidelines of the Kyoto Protocol (or the resolutions of the subsequent COP and COP/MOP conferences respectively) and the European Registry Regulation. The system described is a web-based solution. It provides an internet based access for all of its end users.

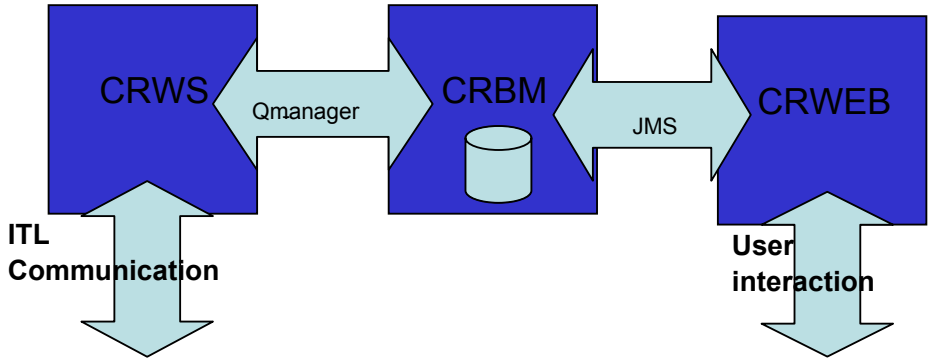

Fig. 25. Principle scheme of the Community Registry software

Looking at the top-level design of the Community Register software system three components can easily be identified:

- The CRWS component implements the web service in accordance to the DES#7
- The CRBM component implements the central business logic and the database access layer.
- The CRWEB component represents the user interface and is hence basically a web application.

The Application is using the J2EE 1.4 standard and makes widely use of EJB technology. The database is Oracle (Oracle RDBMS Version 9i resp. 10g). A Web Logic Application Server is used (Version 8.1 SP5). The communication link between the components CRWS and CRBM is implemented on the basis of JMS queues, using a common set of classes and interfaces derived from the implementation of the Web Services as messages.

The communication link between the components CRWEB and CRBM is implemented using a common Query Manager class that is used to carry objects of the additionally defined set of value classes from one end to the other.

From a security point of view the CRWEB component would usually be placed into the DMZ since it needs to be accessible from the Internet (Extranet) and the CRBM component can be placed into the intranet alongside with the database.

The communication with the International Transaction Log is secured by a VPN, which implies that the security aspects will be separated from the application. The application in this case CRWS will be able to use HTTP within a VPN tunnel. For security reason is there furthermore established a 2ways SSL in the communication between the ITL and the National Registry.

3.4.2 Registry functional and technical specifications conformity

The registry activity compatibility with the UNFCCC International Transactions Log and CITL is ensured by performing the verification of community registry system operations related to allowances, amount of emissions, accounts and Kyoto units. The ITL performs the verification of operations with Kyoto units. These verifications ensure protection from contravention. The operations that do not correspond to the verification requirements are cancelled.

All registry transactions are carried out in accordance with standardized procedures and, if it is needed, concerted schedule, in order to ensure the compliance with requirements of Directive 2003/87/EC and detail requirements of the UNFCCC and the Kyoto protocol and to ensure the system integrity.

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

3.4.3 Legislation regulating the registry activity

The registry activity is regulated by the national legislation, which implements Community legislation: Green house gas emissions registry articles, confirmed by the Ministry of Environment, Registry management rules and Rules of registry use, adopted by the LEIF.

The data security and emergency management is regulated by the data protection regulation confirmed by the Minister of Environment.

3.4.4 The registry website address and information available in the website

The internet address of Registry is http://etr.am.lt. It is also accessible via Registry management Office web page www.laaif.lt.

Implementing the Commission regulation (EC) No 2216/2004 (21 December 2004) for standardized and secured registry system pursuant to European Parliament and Council Directive 2003/87/EC and European Parliament and Council Decision No 280/2004/EC, final amendments (31 July 2007) by Commission Regulation (EC) No 916/2007, where the preference for 28 January 2003 European Parliament and Council Directive on public access to environmental information in accordance with the UNFCCC States conference decision No. 13/CMP.1 that the information provided in the public zone of registry is about account holdings, account list, Transaction information, Project list and consult fee.

Literature

1. 1990-2006 GHG Inventory report
2. 1990-2007 GHG Inventory report
3. 1990-2008 GHG Inventory report
4. Commission regulation (EC) No 2216/2004 of 21 December 2004 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council
5. Commission regulation (EC) No 916/2007 of 31 July 2007 amending Regulation (EC) No 2216/2004 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council
6. Lithuanian Environment Investment Fund: http://www.laaif.lt
7. GHG registry web-site http://etr.am.lt

4 Policy and Measures

4.1 General policy

Chapter 4.1 contains a description of cross-sectorial policies and measures. Strategies and plans for individual sectors are presented in Chapter 4.3.

4.1.1 Key development

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

On 23 January 2008 the Government of the Republic of Lithuania by the Resolution No. 94 approved of the Strategy for Implementation of the UNFCCC until 2012 (Official Gazette, 2008, No. 19-685). 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.

In 2008 Climate Change Division was established at the Ministry of Environment. In 2009 the division employed 5 officials. By the end of the year 2009 the Climate Change Division was restructured to the Climate Change and Hydrometeorology Division.

In 2009 the composition of the National Committee on Climate Change was renewed.

4.1.2 Transposition of international legal acts

The national legal acts, related to the Kyoto protocol, are elaborated in accordance with the provisions of the UNFCCC, the Kyoto protocol and other international legal acts related to climate change. According to Article 138 of the Constitution of the Republic of Lithuania, international treaties, ratified by the Seimas of the Republic of Lithuania, are the component of the Lithuanian legal system. According to the Law on Treaties (Official Gazette, 1999, No. 60-1948, available in English on http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=265678) Article 11 part 2, if a 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 of the Republic of Lithuania shall prevail.

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

4.1.3 Ratification of the UNFCCC and the Kyoto protocol

Together with other 155 countries Lithuania has signed the UNFCCC in the Rio de Janeiro conference on July 1992. Seimas of the Republic of Lithuania ratified the UNFCCC on 23 February 1995 (Official Gazette, 1995, No. 18-413, 23-521), and the Kyoto protocol - on 19 November 2002 (Official Gazette, 2002, No. 126-5728). Ratifying the Kyoto protocol, Lithuania as I Annex country, undertook the obligation to reduce GHG emissions by 8% till 2008-2012, compared to 1990 level.

4.1.4 The law on Financial Instruments for Climate Change Management

On 7 July 2009 the Seimas of the Republic of Lithuania adopted a new Law on Financial Instruments for Climate Change Management (Official Gazette, 2009, No. 87-3662, available in English on http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=353938). The purpose of the law is to regulate social relations, related to measures, assigned to mitigate climate change, that obligations of the Republic of Lithuania under the UNFCCC and the Kyoto protocol would be implemented using most efficient and cost-effective measures. This Law shall stipulate the rights, duties and liability of the persons engaged in

the economic activities resulting in greenhouse gas emissions as well as the sphere of competence of state institutions and bodies; stipulate the rights, duties and liability of economic entities, which participate in GHG accounting; provide National climate change strategy preparation provisions; provide the EU GHG emission allowances trading system and the Kyoto protocol flexible mechanisms guidelines; define climate change special program.

The law implements provisions of the following EU legal acts: 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/E (OJ 2004 special edition, Chapter 15, Volume 7, p. 631) with the latest amendments done by Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 (OJ 2009 L 140, p. 63); Commission Regulation (EC) No 2216/2004 of 21 December 2004 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council (OJ 2004 L 386, p. 3) with the latest amendments done by Commission Regulation (EC) No 994/2008 of 8 October 2008 (OJ 2008 L 271, p. 3); 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 (OJ 2009 L 140, p. 136).

According to the law, ministries or other institutions appointed by the Government are responsible for preparation and implementation of the National Strategy for Climate Change Management Policy and the action plan of its implementation. The National Strategy for Climate Change Management Policy shall be approved by the Seimas of the Republic of Lithuania, while the plan of its implementation measures – by the Government. The Government establishes and regulates the Registry thereof approve it. It is planned, that the Government will present to the Seimas the National Strategy for Climate Change Management Policy for the years 2013-2020 till 1 September 2012.

Minister of Environment in conjunction with other institutions authorized by the Government shall draw up and approve the National Allocation Plan for greenhouse gas emission allowances and/or a list of the operators participating in the EU GHG emission allowance trading scheme. The Minister of Environment also approves the composition and terms of reference of the National Committee on Climate Change. The Minister of Environment lays down procedures for implementation of JI and CDM projects.

According to the law, the leading Register management body of the Greenhouse Gas Registry is the Ministry of Environment, and the Register management body – the public entity Lithuanian Environmental Investment Fund. The Ministry of Environment in conjunction with other institutions authorized by the Government administrates JI and CDM projects and performs the following functions:

- Accept, examine and evaluate applications and other documents related to implementation of projects;
- Allow implementation of projects or refuse to allow implementation thereof;
- Perform control of implementation of projects.

In this law the requirement for operators that own and/or operate the installations emitting GHG located in the territory of the Republic of Lithuania is set,, obliging to use the funds obtained from the transfer of allowances and Kyoto units for the implementation of GHG reduction measures and other measures reducing environmental pollution (introduction of environment-friendly technologies, enhancement of energy efficiency, use of renewable energy sources, reforestation and/or afforestation, scientific research and dissemination thereof, consulting and training of economic entities, public information and education on the issues of climate change policy management and implementation and other measures). An economic penalty can be imposed against operators which fail to carry out the obligations set in this law.

It is foreseen in this law that in order to develop and raise additional funding for climate change management measures the Special Programme for Climate Change is composed. The funds from different financial sources in the State Treasury account shall be used for energy efficiency enhancement projects, promotion of use of RES, implementation of the measures set in the action plan of the National Strategy for Climate Change Management Policy, reforestation and afforestation, implementation of measures of adaptation to climate change and mitigation of climate change effects as stipulated under legal acts of the European Union, UNFCCC, the Kyoto Protocol and other international agreements in the territory of the

Republic of Lithuania and third countries, provision of information to and education of the public, implementation of other measures of efficient management of climate change policy.

4.1.5 The National Strategy for the Implementation of the UNFCCC until 2012

The objectives of the National Strategy for the Implementation of the UNFCCC (Official Gazette, 2008, No. 19-685) are to evaluate climate change impact on Lithuanian economy and environment and to set measures for mitigation and adaptation to the climate change impacts. The following main elements are discussed in the strategy:

- Climate variations analysis and trends;
- Evaluation of the climate variation impacts;
- Long-term economic planning and management and the provision of adaptation measures.

Among various planning objectives the strategy defines the climate aspect as follows: improvement of residential environment quality; reduction or elimination of the impact of unfavorable climate conditions and dangerous meteorological phenomena on human activities; evaluation and mitigation of the anthropogenic impact on the climate on the global and regional scale; the impact of climate variability on the economic and political cooperation of countries, and adaptation to the changing climate conditions.

Strategy contains priorities and main principles of the UNFCCC and the Kyoto protocol, summed-up existing scientific information about Lithuanian environment and economy, performed strategic analysis of economical, social and regional development of the country, presented information on climate variations' analysis and trends in the context of global changes, performed SWOT analysis for different economy sectors, related to the climate change problems, set objectives and measures aiming to implement provisions of the UNFCCC and the Kyoto protocol. Prepared action plan for different economy sectors, environment, science and education sectors.

4.1.6 The National Strategy for Sustainable Development

On 16 September 2009 the Government of the Republic of Lithuania approved the updated National Strategy for Sustainable Development (Official Gazette, 2003, No. 89-4029; 2009, No. 121-5215) by its Resolution No. 1247. Main objectives of the sustainable development are: to coordinate environmental protection, economic and social development concerns; to ensure a clean and healthy environment, effective use of natural resources; to ensure overall economic welfare of the society and strong social guarantees, and, according to economic, social and eco-efficiency indicators, to achieve the 2003 average level of the EU-15 countries; to comply with the EU allowable standards according to environmental pollution indicators, as well as implement requirements of international conventions limiting environmental pollution and input into the global climate change during the implementation period of the Strategy (until 2020). Reports on the implementation of the Strategy shall be prepared every two years. Reports shall be processed through the National Commission for Sustainable Development, regulation of which is approved by the Resolution No. 888 of the Government of the Republic of Lithuania of 28 July 2000 (available in English on http://www.am.lt/VI/en/VI/index.php#a/37). A specific expert group, approved by the Order No. 672 of the Minister of Environment of 19 December 2003, performs regular analysis of external and internal changes, evaluates the progress in the implementation of the Strategy, and prepares recommendations on how to eliminate defects.

The strategy sets a list of national sustainable development indicators and institutions, responsible for the assessment of:

- Environmental quality indicators – the Environmental Protection Agency, the Lithuanian Geological Survey under the Ministry of Environment, the State Protected Areas Service under the Ministry of Environment, the State Forest Survey Service, the National Land Service under the Ministry of Agriculture, the Public Procurement Office under the Government of the Republic of Lithuania.
- Economic development indicators – the Department of Statistics to the Government of the Republic of Lithuania, the Environmental Protection Agency, the Lithuanian Standards Board

under the Ministry of Environment, the Ministry of Agriculture, the State Plant Protection Service, the Association of Local Authorities.

- Social development indicators – the Department of Statistics to the Government of the Republic of Lithuania, the Police Department under the Ministry of the Interior, the State Labour Inspectorate, the State Environmental Health Centre, the Ministry of Education and Science, the Environmental Protection Agency, the State Forest Survey Service.

Based on the provisions of the National Strategy for Sustainable Development an implementation plan is prepared, which sets forth the objectives, measures and responsible institutions for sustainable development of different sectors till 2020. The following measures, mostly influencing GHG emissions, can be listed: to implement requirements for large combustion plants under the EU directives till 2015; to prepare of the National Strategy for Climate Change Management Policy and its implementation action plan for 2013–2020; to provide economic incentives; to promote the use of biofuel for energy purposes and combined heat and power production; to enhance - by economic or regulatory means, also by implementing appropriate projects - the use of technologies, materials, that do not have an impact on the ozone layer; to ensure, that emissions of SO_2 and NO_x for 2009–2010 from electricity production would not exceed norms set out in the EU accession treaty; to prepare national emissions to the air management (limiting) programme and to coordinate its implementation.

4.1.7 The Long-Term Development Strategy of the State

In 2002 the Seimas 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.

4.1.8 The National Lisbon Strategy Implementation Programme

In 2000 the European Council approved the Lisbon Strategy (2000/03/24 No. 100/1/00) for the EU member states. The Government of the Republic of Lithuania approved the National Lisbon Strategy Implementation Programme by its Resolution No. 1270 adopted on 22 November 2005 (Official Gazette, 2005, No. 139-5019).

Four priority areas to be reformed were approved in the conclusions of the European Council on 13-14 March 2008 – knowledge and innovations, realization of the business potential, investments in people and modernization of the labour market, energy and climate change.

The Government of the Republic of Lithuania approved the National Lisbon Strategy Implementation Programme for 2008–2010 by its Resolution No. 1047 adopted on 1 October 2008 (Official Gazette, 2008, No. 124-4718, available in English on http://www.ukmin.lt/en/strat_prog/). The goal of the Programme is to increase competitiveness of Lithuania in 2008-2010. Lithuania drafts annual progress reports on the Programme for the EC in which it provides information about measures implemented in the areas of macroeconomics, microeconomics and employment policy highlighting actions taken by Lithuania on the grounds of the EC recommendations, focus areas and conclusions of the European Council.

4.1.9 The National Committee on Climate Change

On 27 April 2009 the regulations of the National Committee on Climate Change have been approved by the Minister's of Environment Order No. D1-221. According to these regulations the National Committee on Climate Change consists of the representatives from ministries, other governmental or municipal institutions, public organizations, associations, science and education institutions, that have the competence to solve strategic and other important tasks, related to the climate change national policy formation and implementation. The regulations form the following purpose of the committee -

coordinating national climate change policy formation and implementation tasks. The committee's main functions set in the regulations are as follows:

- Coordinate implementation of the National Strategy for the Implementation of the UNFCCC and its action plan;
- Coordinate and submit proposals on the new projects of national climate change policy strategies and their implementation measures;
- Submit proposals regarding priorities for financing the climate change policy and measures under the approved special climate change programs.

By the same order Minister of Environment approved members of the National Committee on Climate Change. The committee consists of 21 representatives of different institutions: Ministries of Environment, Economy, Foreign Affairs, Health, Transport and Communications, Finance, Social Security and Labour, Education and Science, Agriculture, Education and Science, Lithuanian Green Movement, Government of the Republic of Lithuania, European Law Department under the Ministry of Justice, Lithuanian Energy Institute, Confederation of Lithuanian Industrialists, Energy Agency and Vilnius University.

4.2 National and regional programs or treaties, warranty of implementation and administration procedures

4.2.1 Description of the Kyoto protocol flexible mechanisms administrative structure

Law on Financial Instruments for Climate Change Management (Official Gazette, 2009, No. 87-3662) sets forth the main provisions on administrative structure of JI and CDM projects' organization and implementation.

Below are presented the functions of different institutions, participating in the administration of the Kyoto protocol flexible mechanisms:

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. Seconds implementation of projects or refuses the permission of implementation thereof (issues Letter of Approval, Letter of Endorsement);

6. Exercises control over implementation of projects;

7. Submits to the UNFCCC and the Kyoto protocol 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.

Environmental Protection Departments

Environmental Protection Departments participate in performing the environmental impact assessment procedures according to the Environmental Impact Assessment law (Official Gazette, 2005, No. 84-3105), and issue IIPC permit to the JI project operator according to the provisions of the IIPC Issuance, Renewal and Cancelation rules (Official Gazette, 2005, No. 103-3829).

4.3 Policy and measures, impact on GHG emissions

4.3.1 Existing measures

The existing measures (the ones under implementation or just approved of), are presented in this chapter. Firstly the cross-sectoral measures are described and later on the measures of separate sectors are reviewed.

4.3.1.1.1 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 Litas and will be used for financing the projects included in the programmes and priorities listed below.

1. Human Resources Development Operational Programme (approved by the EC on 18 May 2009, amended on 17 July 2009) is dedicated to mobilization of all employable Lithuanian citizens, since investments on knowledge, competence, activity and enterprise of people of Lithuania ensure long term economical growth. 13.8% of EU structural funds (or 3.2 billion Litas) are 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. Economic Growth Operational Programme (approved by the EC on 14 May 2009, amended on 23 July 2009) will be allocated with the largest part of funds – 45.72% of total funds from the EU structural assistance, or 10.7 billion Litas, for the period 2007-2013. It is extremely important that 10% will be allocated to 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. Favorable 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. Cohesion Promotion Operational Programme (approved by the EC on 14 May 2009, amended on 4 November 2008, 31 July 2009) could embody a vision of more harmonious society. For the improvement of environment and quality of residency by minimizing differences between separate regions, it is allocated 39.08% of total funds from the EU structural assistance, or 9.2 billion Litas, 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. Technical Assistance Operational Programme (approved by the EC on 18 December 2007) – is a special program for administration of thematic programs of actions. 1.4% of the EU structural funds, or 0.3 billion Litas, were allocated to this programme.

4.3.1.1.2 EU emissions trading system for 2008-2012

National allocation plan for 2008 - 2012 approved by the order of the Ministers of Economy and Environment on 2007. Total amount of allowances set for the 5 year period is 44,179,066, in this JI projects reserve amounts to 1,292,186, new entrants reserve – 7,216,955. At all allowances are distributed to 98 installations.

In 2008 16 installations had emitted more CO_2 emissions than allocated allowances thus they had to buy additional allowances in the market. In 2008 Lithuanian installations had an overall shortage of 203,447 allowances. The market price being 30 Eur/allowance operators of the installations could spend 6,103,410 Eur per year in order to cover their shortage.

4.3.1.1.3 Special Programme for Climate Change

The law on Financial Instruments for Climate Change Management (Official Gazette, 2009, No. 87-3662) states that a Special Programme for Climate Change shall be developed to raise additional funding for climate change management measures. Funds of the Programme shall be accumulated in a separate account of the State Treasury. According to the principles of financing of special programmes, the revenue and expenditure relating to the financing of the Programme shall be earmarked in the State budget.

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 allowances sold at auction;

3) The funds obtained in accordance with the procedure laid down in Chapter Six 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 greenhouse gas emissions in the energy, industry, construction, transportation, agriculture, waste management and other fields – at least 40 per cent;

2) Promotion of the use of renewable energy resources, introduction of environment-friendly technologies, including efficient energy production by cogeneration – at least 40 per cent;

3) Implementation of the plan of implementation measures of the National Strategy for 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 greenhouse gas emissions reduction.

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 prepared in 2009, and shall be approved by the order of the Minister of Environment in 2010.

4.3.1.2 Monitoring of energy efficiency

Implementing the European Parliament and Council Directive 2006/32/EC of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC, in 2008 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). 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 will enable 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 in the future.

4.3.1.3 Energy

In 2009 the essential changes in energy sector administration structure took place - the Ministry of Energy was established. The Ministry of Energy took over the energy sector related functions from the Ministry of Economy.

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 sectorial laws: Law on Electricity (Official Gazette, 2000, No. 66-1984, with later amendments), Law on Heat Sector (Official Gazette, 2003, No. 51-2254, with later amendments), Law on Natural Gas (Official Gazette, 2000, No. 89-2743, with later amendments), Law on Nuclear Energy (Official Gazette, 1996, No. 119-2771, with later amendments), Law on the Nuclear Power Plant (regulates implementation of the new NPP) (Official Gazette, 2007, No. 76-3004, with later amendments), Law on Biofuel, Biofuels for Transport and Bio-Oils (Official Gazette, 2000, No. 64-1940, with later amendments), Law on Construction (Official Gazette, 1996, No. 32-788, with later amendments). The Law on Use of Renewable Energy Sources is under preparation.

National Energy Strategy, approved of by the Seimas of the Republic of Lithuania in 2007 (Official Gazette, 2007, No. 11-430), is the main document, putting forward the energy sector development guidelines. In the same year the Government of the Republic Lithuania approved the National Energy Strategy implementation plan for 2008–2012 (Official Gazette, 2008, No. 4-131).

In order to coordinate the development of the Baltic States' energy sector projects, Energy Strategy of the Baltic States was prepared.

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), 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), Cogeneration Development Plan (Official Gazette, 2008, No. 130-5002), Energy Efficiency Action Plan (Official Gazette, 2009, No. 2-38, available in English on http://www.enmin.lt/en/activity/veiklos_kryptys/energijos_efektyvumas/).

National Energy Efficiency Programme for 2006–2010. Update of the programme is under preparation at present. The main difference between the former programme and the new one is that the new programe will not cover the use of RES. Enhancement of the use of RES will be considered in another document.

The Law on Use of Renewable Energy Sources and RES Action Plan is under preparation. 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 the year 2009 while the owners of multi-apartment buildings were waiting for the formulation of the new explicit rules for financing.

Further are presented the existing measures set in the programmes listed above and having impact on GHG emissions.

4.3.1.3.1 Enhancement of the use of RES

Numerous different measures aimed at the enhancement of the use of RES are available. However, in general, all these measures are targeted to reach the below listed targets:

- By 2010 7% of all the electricity consumed in Lithuania shall be produced from RES;
- By 2009 energy produced from biomass, originated in Lithuania, shall amount to 10.5% of the entire energy consumption. By 2010 electricity, produced from biomass shall amount to 1.65% of the overall electricity consumption.
- By 2020 energy from RES shall amount to 23% in the total final energy balance.
- RES (including biofuels) will make 20% in the total primary energy supply by 2025.

Evaluation of impact of RES policy on 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.

4.3.1.3.2 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 are 150 GWh, and for 2016 – 1 700 GWh. Programme started in 2005 and its completion date is the year 2020.

4.3.1.3.3 Modernization of public buildings

- Modernization of public buildings is implemented 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 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 and upgrading of libraries for 2003–2013; Savings targets for 2010 – 3 GWh, and for 2016 – 5 GWh, Programme started in 2003 and its completion year is 2013;

- 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 modernization of cultural centres for 2007–2020; Savings targets for 2010 – 2 GWh, and for 2016 – 8 GWh, Programme started in 2007 and its completion year is 2020;
- 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;
- Programme of modernization of museums for 2007–2015; Savings targets for 2010 – 4 GWh, and for 2016 – 14 GWh., Programme started in 2007 and its completion year is 2015;
- 2003, 2004, 2005, 2006, 2007, 2008 programmes of construction, reconstruction, repairs and material provision of municipal buildings used for educational, cultural, health care, social and other purposes; Savings targets for 2010 – 5 GWh, and for 2016 – 5 GWh. 2003–2007 programmes are implemented and programme for 2008 is under implementation. The programme started in 2003 while its completion time has not yet been set.

4.3.1.3.4 Increase of energy efficiency

- Modernization of multi-apartment and public buildings is the most voluminous measure aiming to increase the overall energy efficiency in this country. 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) 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 Strategy target - 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 support 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.
- Implementation of energy efficiency measures in the existing buildings. National Energy Efficiency Programme for 2006-2010 sets that heat consumption in the existing buildings shall decrease by 7%, moreover, this target is repeated in other energy efficiency measures.

4.3.1.3.5Promotion of cogeneration

Several measures are set forth for promotion of cogeneration and the following targets shall be achieved by these measures:

- Cogeneration will make up to 20% of the total energy generation balance in 2010 (National Energy Efficiency Programme for 2006–2010);
- The share of CHP plants in the total electricity generation balance should reach 35% till 2025 (National Energy Strategy);
- At least 75% of district heat shall be generated at CHP till 2020 (District Heating Development Trends).

- Planned energy savings in the Energy Efficiency Action plan amount to 0 GWh in 2010 and to 370 GWh in 2016.

Natural gas based CHP has already been started at the Lithuanian Power Plant as one of the critical measures to achieve the above goals. Lithuanian Power Plant is the main plant, replacing electricity production at the Ignalina NPP after its closure in 2009. It shall be put into operation till 2012.

4.3.1.3.6 JI projects in energy sector

Most of the JI projects in Lithuania are related to the use of RES. In December 2009, from 20 projects, to which a letter of endorsement was issued, 13 are wind energy projects. The planned reduction of GHG emissions for 2008-2012 is 1,596,300 tCO_2e (according to the data retrieved from the Lithuanian Environmental Investment fund website, except 2 JI projects in industry and suspended biofuels projects).

All JI projects performed in this country are presented in the Chapter 5.3.2.

4.3.1.3.7Energy 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_2 e. Gg			
						2005	2010	2015	2020
Enhancement of the use of RES	• By 2010 7% of all electricity consumed in Lithuania shall be produced from RES; • By 2020 energy from RES shall amount to 23% in total final energy balance; • RES (including biofuels) will make 20% in total primary energy supply by 2025.	Mainly CO_2	Variety of measures	Under implementation	Ministries of Energy, Environment and Transport and Communications		978[3]	1197[3]	1417[3]
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	Mainly CO_2	Variety of measures	Under implementation	Ministries of Energy, Environment and Transport and Communications		227*	858*	984*
Promotion of Cogeneration	• Cogeneration will make up 20% of total energy generation balance in 2010; • The share of CHP plants in the total electricity generation balance should reach 35% till 2025; • At lest of 75% district heat shall be generated in CHP till 2020	Mainly CO_2	Variety of measures	Under implementation	Ministries of Energy, Environment and Transport and Communications			13**	77**
							1205	2068	2478

* Planed annual energy savings 1092 GWh/year in 2010 and 4725 GWh/year in 2016.

** Planned energy savings in the Energy Efficiency Action plan amount to 0 GWh in 2010 and to 370 GWh in 2016.

The main assumptions: emissions ratio according to the latest GHG Inventory data 0.06 GgCO2/TJ, the primary energy conversion factor for heat – 0.5, for electricity - 2.707.

GHG mitigation impact has been evaluated using the bottom-up method, considering energy sector targets.

4.3.1.4 Transport

The main legal acts and programs of the Republic of Lithuania regulating the measures associated with climate change in the sector of transport include Lithuanian Transport System Development Strategy, Law on Biomass, Bio-fuel and Bio-oils (Official Gazette, 2004, No. 28-870), Lithuanian National Strategy Development Plan of Bio-fuel Technological Platform, Law on Environment Pollution Tax (Official Gazette, 1999, No. 47-1469; 2002, No. 13-474), 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. 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 the year 2025.

4.3.1.4.1 Stimulation of bio-fuel production and consumption

It is foreseen in Law on Biomass, Bio-fuel and Bio-oils (Official Gazette, 2004, No. 28-870) that the Government or the Government-accredited authority prepares the measures to ensure 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. In order to enforce the implementation of the Law, the Program on Bio-fuel production and consumption for the period of 2004–2010 has been developed (Official Gazette, 2004, No. 133-4786).

Under the Law of Excise and according to the procedure stipulated by the Law on Biomass the Republic of Lithuania, Bio-fuel and Bio-oils, 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 Rules on Financing of Development of Bio-fuel Production (Official Gazette, 2009, No. 153-6938), 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.

4.3.1.4.2 Stimulation of liquefied natural gas (LNG) consumption

Until 2020 the consumption of LNG shall make up to 10% in each EU member state. One LNG fuel station is in operation in Lithuania, in the territory of Vilnius bus depot. Development of LNG stations is planned to cover all major cities in Lithuania. Application of lower LNG excise tariff is intended to stimulate the use of LNG.

Vehicles driven by LNG will be given priority in the process of renovation of bus depots.

4.3.1.4.3 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.

4.3.1.4.4 Increased efficiency of fuel consumption

Stimulation of carriers by means of subsidies or application of road or other tax exemptions/privileges in procuring of EURO 5 or EURO 6 standard heavyweight vehicles.

AdBlue technology shall be applied for heavyweight vehicles.

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 in procuring passenger vehicles (cars, buses) and the related maintenance services, the entities procuring passenger transportation services shall apply environmental protection criteria based on the approved list.

4.3.1.4.5Transport 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_2 e. Gg			
						2005	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 202	Mainly CO_2	Variety of measures	Under implementation	Ministries of Energy and Transport and Communications		190	343	496

GHG mitigation impact has been evaluated using the bottom-up method, considering transport sector targets.

The main assumptions: emissions ratio according to the latest GHG Inventory data 0.07 GgCO2/TJ, amount of energy, replaced by biofuels, makes 2520, 4547 and 6574 TJ respectively in the years 2010, 2015 and 2025, the primary energy conversion factor 1.076.

4.3.1.5 Industry

4.3.1.5.1 IPPC permits

Council Directive 96/61/EC of the 24th September 1996 concerning integrated pollution prevention and control (IPPC) with all the further amendments is one of the cornerstones of the European Community legislation on industrial pollution. The purpose of this Directive is to achieve integrated prevention and control of pollution arising from the activities of major industrial and agricultural enterprises.

In Lithuania, Rules on the issuance, renewal and cancellation of the Integrated Pollution Prevention and Control permits were developed (Official Gazette, 2002, No. 85-3684) and approved by the Ministry of Environment of Lithuania in 2002, as subsequently amended. They are in full compliance with the requirements of Directive 96/61/EC as the system of integrated pollution prevention and control has been established.

Industrial enterprises wishing to obtain an IPPC permit must apply for the IPPC permit on the available 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 must be pursued to use during the industrial activities.

4.3.1.5.2 Practice of Best Available Techniques

Emission levels in the IPPC permit are set by the European Union according to the Best Available Techniques (further – BAT) reference document prepared for certain industrial activities. In this case, 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 (BAT reference document), 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.

In industry, a significant share of the GHG emissions belongs to the CO_2 emissions from cement production. In Lithuania, the only cement manufacturing company is JC "Akmenės Cementas", which 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 JC "Akmenės Cementas" to reduce GHG levels by 500 $GgCO_2e$/year [3]. Currently the project is under implementation [20].

4.3.1.5.3 Increase in energy end-use efficiency in technological processes

Energy Efficiency Action Plan (Official Gazette, 2007, No. 76-3024) was approved in 2007 and provided for the industrial sector which is not participating in the EU ETS system. This Plan is directed towards the increase in energy end-use efficiency by making voluntary agreements with industry, and promotes the general heat and electricity production inside enterprises, and supports the audit services acquisition of energy end-use during the production processes.

4.3.1.5.4 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 accents that the implementation of environmental management system is required for the provider as one of the main criteria for the green procurement.

Rules of IPPC permits issuance (Official Gazette, 2002, No. 85-3684) encourage the implementation of environmental management system in industrial enterprises as well. The companies having ISO 14001:2005 do not have to prepare the natural resources protection and waste reduction plan.

4.3.1.5.5 JI projects in industry

In December 2009 two JI projects in chemical industry were under implementation: AB "Achema" N_2O emissions reduction in UKL-7 installations and N_2O reduction in the GP unit. Planned GHG emissions reduction for 2008-2012 from the first project amount to 4 732 541 tCO_2e, and from the second project - up to 2 603 560 tCO_2e.

All JI projects performed in the country are presented in Chapter 5.3.2.

4.3.1.5.6 Limitation of emissions of volatile organic compounds

Since 1st January 2004 limitation of emissions of volatile organic compounds (hereinafter – VOC) was established and proceeds due to the use of organic solvents in certain activities and installations (Official Gazette, 2003, no. 15 – 634). 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 [3].

The pollution reduction scheme is a part of the procedure of the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations. The scheme is approved and included as Annex 3. The aim of this scheme is to give a possibility to an operator by using various implements to reduce VOC emission levels at the same degree as it would be reduced if the VOC emissions satisfied the limit levels. In this case, the operator may use any reduction scheme, prepared specially to his equipments to achieve an ultimate equivalent effect of VOC emission reduction.

4.3.1.5.7 Fluorinated GHG emission limitation

On 17 May 2006 the European Parliament and the Council approved Regulation (EC) No. 842/2006 on certain fluorinated greenhouse gases. The purpose of this regulation is to prevent emissions of fluorinated GHG included in the Kyoto Protocol and thereby reduce these emissions. Regulation 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 greenhouse gases.

4.3.1.5.8 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_2 e. Gg			
						2005	2010	2015	2020
GPGB	Decrease GHG emissions due to change of cement production technology	CO_2	Regulatory	Under implementation	Cement production company		500[3]	500[3]	500[3]
JI projects	Decrease N_2O emissions from production of nitrogen fertilizers and chemical products	N_2O	Economical	Under implementation	Fertilizer production company		1467*	1467*	1467*
							1967	1967	1967

* 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

4.3.1.6 Agriculture

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

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 Litas 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 Litas have been allocated for the increase of economic value of forests.

Trend two, which includes ecological farming, land afforestation, and improvement of the condition of risky water bodies was assigned 2.8 billion Litas.

Below are the support schemes applied in agriculture:

1. Rural development program 2007-2013 [4];
2. Support to fishery sector 2007-2013 [5];
3. Support to beekeeping sector [6];
4. National support [7];
5. Direct payments [8];
6. Support for energy plants [9];
7. Restructure of sugar industry [10];
8. Payments for white sugar [11];
9. Quotas (milk, fibre flax, dry fodder and potato starch productions) [12].

The last three measures, in fact, are the ones limiting activities in agriculture. In the following the measures, influencing each of emission sources and supported by the above support schemes, are discussed.

4.3.1.6.1 Ecological farming

The measure of ecological farming enables the reduction of GHG emissions to the atmosphere due to the stringent control exercised over the use of fertilizers for crop rising, thus reducing direct and indirect N_2O pollution out of agricultural activities.

After the Restitution of Independence in Lithuania a number of ecological farms tended to increase – 9 ecological farms covering the area of 148 ha are reported in 1993, while a number of such farms in 2005 amounted to 1811 the area covered increasing to almost 69.5 thousand ha. Certified ecological farms in Lithuania cover 2.7 % of the entire area of declared agricultural land. In 2005 an average citified ecological farm covered an area of 38 ha while in 2009 ecological farms accounted for 51,993 thousand ha, i.e. the farms receiving direct payments.

Based on RDEAF financial support schemes, direct payments to ecological farms during 2007-2013 make 154 million EUR; however, direct payments have been currently reduced and are paid only if production is realised/sold. Due to these reasons a reducing trend in ecological farms has been witnessed from 2005 to 2009 by 17.507 thousand ha or 4.4 thousand ha/years. Nevertheless, following the Rural Development Strategy, it is anticipated that a number of ecological farms in this country should make up to 5% of agricultural area by 2013, c.f. in 2009 it made up to 1.9% and in 2005 - 2.7%. Thus one may state that the forecasts used to be too optimistic.

Ecological Agriculture Development Program for 2007-2012 (Official Gazette, 2007, No. 69-2752) and the Best Farming Practice Requirements according to Lithuanian Rural Development Program for 2007–2013 (Official Gazette, 2007, No. 41-155) have been prepared.

4.3.1.6.2 Enforcement of environment protection requirements

Observing the requirements of a good agrarian and environmental condition my reduce GHG pollution. One of the efficient preventive measures enabling the reduction of indirect pollution of GHG in agriculture is the reduction or limitation of direct payments to farmers who have been found burning grass and stubble. The measure has proven to be efficient enough; moreover, the farmers are forced to apply more advanced agrarian measures which enable better utilization of agricultural waste/residue. According to the advanced farming rules there are more banned actions which lead to the increased GHG pollution if applied. These are ploughing of natural meadows and pastures (CO_2 release from the soil) and the like. Thus training sessions are arranged for the purpose of stimulating the farmers' abilities to apply adequate environmental requirements in their activities. During the training sessions the farmers are informed about the advanced and more environment-friendly farming.

4.3.1.6.3 Direct payments for farming

The essence of direct payments is to pay additional sums for the declared crops while the size of payment would differ depending on the raised crops. More payments are received by the farms with less favourable conditions to undertake agricultural activities (lower grade of soil fertility, presence of extra hindrances and nature protection limitations due to NATURA2000 territories, etc). With this instrument it is targeted to not intensify agricultural activities that would lead to further GHG reductions; however, the extent of reduction due to application of this measure has not been determined yet.

4.3.1.6.4 Termination of agricultural activities

Direct payments are made for termination of farming. Early withdrawal from agricultural production and transition to non-agricultural activities is stimulated according to the Lithuania's Rural Development Program for 2003-2012.

4.3.1.6.5 Implementation of Nitrates Directive (91/676/EEC)

Implementation of the Council Directive of 12 December 1991concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC) (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. Fiscal measures are foreseen for the implementation of the Nitrates Directive intended to support the agricultural entities implementing the measures leading to a minimized pollution of environment with nitrogen compounds. The country took an obligation that the Nitrates Directive would be implemented in two phases. During the phase one (2004-2008) implementation of the projects will take place on the farms with over 300 conventional cattle unit (CCU), while phase two will cover the farms with over 10 CCU. Thus one may expect that the nitrate-based pollution will be minimized and less nitrogen compounds will be released into the atmosphere in the future. 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).

4.3.1.6.6 Strengthening of the carbon concentration function by the soil in agriculture

In the process of growing every plant absorbs atmospheric CO_2 and releases it after it is consumed or after it perishes or gets back to the soil. Thus for the purpose of absorption and non-release of CO_2 gases one must aim that the farming is performed so that a part of unused biomass is returned to the soil and CO_2 is not released into the atmosphere. For this purpose, the following measures may be undertaken or are already being used in this country:

- Cattle keeping in smaller fenced areas. This way the grass would be stomped more often and more evenly, thus it will take root much better. Besides, the manure produced during a pasture time will penetrate into the soil much better.
- Growing of meadows in the locations with no agricultural activities.
- Fallow field coverage with straw or residue of perished plants to reduce the evaporation of water contained in the soil since such soils are attractive to CO_2 absorbing microorganisms.
- Execution of non-arable agriculture;
- Raising of fast growing plants and use of generated biomass instead of fertilizers (rape, green mustard, lupines, red clover, timothy, etc.).

No special program to stimulate this kind of farming is missing in this country. However, according to the requirements of the Good Farming Practice (Official Gazette, 2007, No. 41-155), sideratic fallow lands are among the ways enabling more efficient restoration of soil fertility by using less inorganic fertilizers. Besides, direct payments are also applied for fallow land.

4.3.1.6.7 Afforestation of low fertility soils

According to RDEAF two measures are projected to stimulate the raising of forests, i.e.:

1. The first afforestation of agricultural land. Based on this measure allocation of 47.37 million EUR is intended until 2013.
2. The first afforestation of non-agricultural land and neglected land. Based on this measure allocation of 36.34 million EUR is intended until 2013.

These measures are of a compensatory nature and are implemented with the aim of stimulating the afforestation of land and non-agricultural land as an alternative method of land use hence reducing the dependence on agricultural activities, as well as developing of forestry to achieve the goal set forth in the Lithuanian Forest Policy and its implementation strategy –to increase overall forest area of the state by 3 % by the year 2020. In 2006 the forests in Lithuania covered 2121 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. It is planned that no less than 30 % of the newly raised forests would account for leaf-bearing trees. Short rotation green plantations would make around 20 % of the total area of planted forests. Once the area is afforested and the purpose of agricultural land is altered to the forest land, no alteration of the land purpose will be allowed in the future. Due to this reason it is difficult for the future forest owners to make a decision on the forest raising.

Stimulation of energy plant growing is anticipated in the low fertility lands. The current support paid for rising of energy plants amounts to 45 euro/ha.

4.3.1.6.8 Implementation of Directives 92/43/EEC and 79/409/EEC (Natura 2000)

For the purpose of implementation of stipulations of the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and wild fauna and of the Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds, the territories of Lithuania have been divided into ''Natura 2000" zones and other territories protected by the state and municipalities, where certain limitations of human activities are set seeking preserve natural habitats of animals and plants. People farming in these zones must strictly follow environmental requirements and develop only the permissible economy branches or stop developing them at all. These areas in the country make 19% of the total area of the declared agricultural land.

4.3.1.6.9 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_2 e. Gg			
						2005	2010	2015	2020
Implementation of Nitrates Directive	Minimization of the groundwater pollution with nitrates and emission reduction	N_2O	Regulatory	Under implementation	Ministry of Agriculture	200[3]	700[3]	1200[3]	1700[3]

4.3.1.7 Forestry

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), as well as the program on the increased afforestation of Lithuania (Official Gazette, 2003, No. 1-10; 2004, No. 188-7039) provides a long-time policy of the forest economy and its trends, and the strategic goals of its development by the year 2015. 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. Following the data of national forest registration performed by the State Forest Management, annual self growing of forest is reported on approximately 4–5 thousand ha of a non-forest land, 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.

4.3.1.7.1 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. 1321''On the approval of annual norm of main felling of state forests in 2004-2008" of 23 October 2003, the approved annual norm of a state forest felling for 2004-2008 made 2 400 thousand hard meters of lumber. Under the Government Resolution No. 1178 „On the approval of annual norm of main felling of state forests in 2009-2013" of 7 November 2007, the approved annual norm of the state forest felling for 2009-2013 was the area of 10 500 hectares, calculated based on an empty forest felling area equivalent intended for felling of up to 2 800 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.

4.3.1.7.2 Restitution of forestry potential and implementation of preventive measures

This measure is primarily aimed at supporting the restitution of private and state-owned forests damaged by natural calamities and fires. Also, support of respective preventive measures is aimed at by maintaining the ecological and economic value of forests. Support for fire prevention measures is provided, if the areas of the forest manager are attributed to the fire classes I or II according to the approved Republic of Lithuania map of fire classification of forests and the lists of forestry units, and the National Park Directorate of Curronian lagoon, containing the forests attributed to the fire classes I and II. Forest areas of high and medium fire classes are defined according to the requirements of European Forest Fire Information System (EFFIS) defined in Regulation No. 2152/2003of the European Parliament and Council. Following these documents, forests of high and medium fire classes in Lithuania make 1 091.5 thousand ha, or approximately 50 % of the entire area of forests in Lithuania. Out of this area, 676.5 thousand ha are attributed to the high fire class, and 415 thousand ha – to the medium fire class areas.

4.3.1.7.3 Payments for forest environment protection

The measure is of a compensatory nature. It is used for implementation of the European Union strategy of forestry (1999/C 56/01) and the EU forest action plan approved on 15 June 2006, aimed at supporting the programs based on which the forest owners could voluntarily undertake environment protection obligations and support the increase of ecological value of forests. Maintaining of biodiversity of Lithuanian forests is one of the targets set forth in the Lithuanian Forest Economy Policy, and its implementation strategy has been approved on 17 September 2002 by the Minister's of Environment of the Republic of Lithuania Order No. 484 (Official Gazette, 2002, No. 93-4029) . This measure is aimed at supporting the natural forest surroundings and educating awareness of the forest owners by financially

supporting their initiative to undertake voluntary obligations of environment protection defined by respective legal acts. The measure provides for possibilities to develop environment friendly activities of forest economy and maintain valuable indigenous forest habitats (IFH) in private mature forests. Payments of forest environment protection are allocated for every forest hectare for owners of private forests provided they take a voluntary obligation to not undertake a main forest felling in the IFH available inside their property, or to carry out non-empty felling instead of the permitted empty felling in any other forests. As a result of such obligations the forest owners would lose income thus compensation based on this measure is planned. The proposed measures are in line with the safety measures applicable for the forest areas attributed to the high and medium fire class areas based on the approved map of the Republic of Lithuania fire classification of forests.

4.3.1.7.4 Payments due to limitations of economic activities in ''Natura 2000" territories

''Natura 2000" network in Lithuania encompasses the area of 783 thousand ha. Forests in this network account for 491 thousand ha or 25 % of the entire area of Lithuanian forests. Common economic activities associated with forest are limited to approximately 91500 ha forests inside the territories of the ''Natura 2000" network. Based on this measure, support to the owners of private forests is projected to help them to cope with the problems arising from implementation of ''Natura 2000" requirements in the forests.

4.3.1.7.5 The first afforestation of agricultural land

(See description of measures for agricultural sector).

4.3.1.7.6 The first afforestation of non-agricultural and neglected land

(See description of agricultural sector).

4.3.1.7.7Forestry 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_2 e. Gg			
						2005	2010	2015	2020
Afforestation of low fertility soils	By the year 2020 increase forest area of the state by 3 %	Mainly CO_2	Variety of measures	Under implementation	Ministries of Environment and Agriculture			-840	-1680

4.3.1.8 Waste management

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

Waste management system is instilled, planned and implemented according to the regional division of the territory of the Republic of Lithuania. Implementation of regional waste management system resulted in 10 regional municipal waste landfills and one hazardous waste landfill (Šiauliai district, since 2010).

Small landfills are being closed and redeveloped by filling waste with soil or digging, and by hauling of waste to the regional landfill.

National Strategy Plan of Waste Management includes minimization of quantities of the landfilled biodegradable and municipal waste. For the sake of this measure implementation, waste sorting, recycling and recovery takes place. The National Strategy Plan of Waste Management includes the following measures aimed at implementation of municipal waste management:

Landfilling of biodegradable municipal waste would make: until 2010 – not more than 75 %, until 2013– not more than 50 %, until 2020 – not more than 35 %, 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.

4.3.1.8.1 Use of energy potential derived from biodegradable and other waste types

The main pollution of GHG accounts for biodegradable waste disposed at landfills. At present biogas collection systems are either installed or in the process of installation at several larger landfills in Lithuania. Energy derived by the systems will be utilised for heat supply purposes. Landfill gas collection systems are being installed or will be installed at other landfills of Lithuania after the projected waste quantities are achieved. The National Strategy Plan of Waste Management provides for stimulation of management of biodegradable waste with energy or nutrients' generation.

It is envisaged in the National Energy Strategy (Official Gazette 2007, No. 11-430) that municipal and other flammable waste must be utilised for heat and electricity production - by the year 2010 municipal waste incineration plant is projected for Vilnius with annual incineration capacity of approximately 200 thousand of waste. However, from the ongoing Environmental impact assessment procedures one may judge that the construction of such plant in Vilnius should be expected not earlier than in 2012. During 2010–2025 similar plants should be erected in Kaunas, Klaipėda, Šiauliai and Panevėžys.

4.3.1.8.2 Wastewater handling

Supply of wastewater collection services to the population of this country and the extension of wastewater collection networks creates favourable conditions for collection of a major share of wastewater and for undertaking an adequate treatment of it. One of the key targets included in the Development strategy of potable water supply and wastewater collection during 2008-2015 (Official Gazette 2008, No. 104-3975) is the creation of favourable conditions for the increased accessibility to potable water supply and wastewater handling services, and achievement that the accessibility of wastewater handling services by 2015 would cover no less than 95 % of the total population of Lithuania. For the sake of implementation of this stipulation the majority of municipalities during 2008-2009 developed special plans for water supply and wastewater handling.

4.3.1.8.3 Sludge recovery

For the sake of sludge recovery and adequate use of its energy and nutritious potential the National strategy plan of waste management provides for the development and improvement of sludge treatment plants and implementation of the required sludge treatment capacities:

- By the year 2010 - taking into account the possibilities of inter-regional cooperation to ensure that each waste management region has adequate conditions for treatment (composting and/or anaerobic digestion) of municipal biodegradable waste. By 2013 the required municipal wastewater sludge handling capacities shall be created in Lithuania;
- By 2013 the required municipal wastewater sludge handling capacities shall be created in Lithuania.

So far a single biogas plant is present in Lithuania where biogas production takes place as a result of recovery of wastewater sludge. It is Kaunas biogas plant (under UAB Kauno Vandenys) with 0.6 MW installed el. capacity. Electricity production there started in 2008.

4.3.1.8.4 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_2 e. Gg			
						2005	2010	2015	2020
Biodegradable municipal waste handling	Lowered amounts of landfilled of biodegradable municipal waste	CH_4	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_4	Regulatory	Under implementation	Ministries of Energy and Environment		940[3]	1440[3]	1940[3]
							1191	1799	2478

*Only reduction of methane emissions due to the lowered amounts of landfilled biodegradable municipal waste was evaluated. Increase of CO_2 emissions due to increased waste incineration was not calculated.

4.3.2 Additional measures

4.3.2.1 Energy

In the Lithuanian Energy Strategy (Official Gazette, 2007, No. 11-430) strategic goal to build a new NPP till 2015 is clearly formulated. On 28 June 2007 the Seimas of the Republic of Lithuania approved of a special law on the new NPP (Official Gazette, 2007, No. 76-3004), which entered into force since 10 July 2007, and created essential legal, financial and organizational conditions for the implementation of such project. On 15 November 2007 the Ministry of Environment approved of environment impact assessment programme for the new NPP, prepared by AB "Lietuvos energija". Afterwards open international procurement procedures were held and Environmental impact assessment study and report were prepared by the Lithuanian Energy Institute and Finish company "Poyry Energy Oy" in consortium with other partners – 7 Lithuanian and foreign companies. On 1 February 2008 Law on replacing and amending 8, 10, 11, 20 articles of the Nuclear Power Law was adopted.

On 14 January 2009, after evaluation of possible radiological impact on the environment, society and workers, Radiation protection centre experts submitted the conclusion – as far as it concerns the radiation safety, a new NPP in Lithuania is possible.

In the newly prepared Radioactive Waste Management Strategy long term radioactive waste management attitudes are set and suggestions for radioactive waste and used nuclear fuel handling, and also recommendations for the closure of NPP, financing, operation and legal environment are given.

On 30 September 2009 business plan for the new NPP was presented at the meeting of Atomic Energy Commission. The plan was prepared by an international consortium and states that it is realistic to build a new NPP during 2018-2019.

After the plan is finished, tender for strategic investor will be launched and actual works will be started. It was planned to finalize the Lithuanian position for negotiations during December 2009 and to start the tender procedures for strategic investor. It is further planned to finalize negotiations with potential partners and strategic investors and sign contracts with them during the second quarter of the year 2010.

NPP would be built near the existing Ignalina NPP. Installed capacity of the new NPP shall not exceed 3 400 MW, and will depend on a strategic investor and the technology chosen by it. It is estimated that the new NPP will cost 10-17 billion Litas for Lithuania.

More detailed information about the new NPP is available on www.vae.lt

In evaluating impact of additional measures to GHG emissions it is assumed that new NPP will start operation in 2019 and will decrease GHG emission by 2300 $GgCO_2e$ in 2020.

4.3.2.2 Other sectors

Additional measures in other sectors are not scheduled.

4.3.3 Implemented policy and measures

EU emissions trading system for 2005-2007

In 2005-2007 103 installations were included in the EU ETS, and theirs GHG emissions amounted to 19119524 tCO_2 (source: http://ec.europa.eu/environment/climat/emission/pdf/fin_lt.xls).

From the year 2008 the second period for 2008-2012 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. 2003–2007 programmes have been implemented.

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5 Projections of GHG Emissions

5.1 Projections

5.1.1 Projections without measures

Projections without measures were evaluated as the sum of projections with the existing measures and avoided GHG emissions due to the impact of the policy and measures.

Table 36. Projections without measures, Gg CO_2e

Sector / Year	1990	2007	2008	2010	2015	2020
Energy (excluding transport)	27811.40	8220.76	8034.81	18414.76	20603.51	22123.88
Transport	5787.93	5290.57	5240.11	5135.23	5935.03	6847.44
Industrial Processes, including Solvent and Other Product Use	4227.98	5632.01	4963.76	6806.66	8834.45	10866.73
Agriculture	10588.36	5225.34	5011.96	5342.40	5905.41	6430.88
Waste	1307.66	1164.43	1140.08	2303.51	2721.75	3203.18
LULUCUF	-15566.11	-13052.17	-13690.19	-13690.36	-14530.30	-15370.80
Total, excluding LULUCUF	49723.32	25533.12	24390.72	38002.56	44000.15	49472.11
Total	34157.21	12480.95	10700.54	24312.20	29469.85	34101.31

5.1.2 Projections with existing measures

Projections with existing measures are the result of the development scenarios modeling, where objectives of the existing policy and measures were set as mandatory criteria for the future development.

Table 37. Projections with existing measures, Gg CO_2e

Sector / Year	1990	2007	2008	2010	2015	2020
Energy (excluding transport)	27811.40	8220.76	8034.81	17209.75	18535.82	19646.38
Transport	5787.93	5290.57	5240.11	4945.28	5592.31	6351.94
Industrial Processes, including Solvent and Other Product Use	4227.98	5632.01	4963.76	4839.44	6867.23	8899.51
Agriculture	10588.36	5225.34	5011.96	4642.40	4705.41	4730.88
Waste	1307.66	1164.43	1140.08	1112.38	923.00	725.05
LULUCUF	-15566.11	-13052.17	-13690.19	-13690.36	-13690.23	-13690.66
Total, excluding LULUCUF	49723.32	25533.12	24390.72	32749.26	36623.77	40353.76
Total	34157.21	12480.95	10700.54	19058.90	22933.54	26663.09

Projections with the existing measures for gas are presented in the table below. Quantity of fluorinated gases is relatively low, uncertainty of the initial data amounts to up to 20%, uncertainty of emission factors also amounts to up to 20% in the National GHG inventory, thus it was assumed, that the amounts of fluorinated gasses in 2010, 2015 2020 would be equal to the year 2008.

Since 2010 CO_2 emissions will be significantly influenced by the closure of Ignalina NPP. It is estimated, that the closure of Ignalina NPP, depending on the energy sector development scenario, will increase GHG emissions by 6-7 mln. tCO_2. The main power plant, which will replace electricity production at

Ignalina NPP, is Lithuanian Power Plant in Elektrenai, burning heavy fuel oil. Installation of the new natural gas fired cogeneration unit has been started at this power plant, but it will be launched not earlier than 2011.

Table 38. Projections with existing measures by gas, CO_2e Gg

Gas / Year	1990	2007	2008	2010	2015	2020
CO_2 emissions	20,503.04	2,858.42	1,502.90	9,884.69	12,876.26	15,701.29
CH_4 emissions	6,360.28	3,494.54	3,429.45	3,386.05	3,279.34	3,172.17
N_2O emissions	7,293.89	6,103.10	5,738.24	5,758.23	6,748.00	7,759.70
HFCs emissions		24.05	29.92	29.92	29.92	29.92
PFCs emissions						
SF_6 emissions		0.84	0.03	0.03	0.03	0.03
Total, including LULUCUF	34,157.21	12,480.95	10,700.54	19,058.90	22,933.54	26,663.09

5.1.3 Projections with additional measures

Construction of the new NPP is planned as an additional measure in the Energy sector in 2020. Additional measures are not planned in other sectors.

Table 39. Projections with additional measures, Gg CO_2e

Sector / Year	1990	2007	2008	2010	2015	2020
Energy (excluding transport)	27,811.40	8,220.76	8,034.81	17,209.75	18,535.82	17,346.38
Transport	5,787.93	5,290.57	5,240.11	4,945.28	5,592.31	6,351.94
Industrial Processes, including Solvent and Other Product Use	4,227.98	5,632.01	4,963.76	4,839.44	6,867.23	8,899.51
Agriculture	10,588.36	5,225.34	5,011.96	4,642.40	4,705.41	4,730.88
Waste	1,307.66	1,164.43	1,140.08	1,112.38	923.00	725.05
LULUCUF	-15,566.11	-13,052.17	-13,690.19	-13,690.36	-13,690.23	-13,690.66
Total, excluding LULUCUF	49,723.32	25,533.12	24,390.72	32,749.26	36,623.77	40,353.76
Total	34,157.21	12,480.95	10,700.54	19,058.90	22,933.54	26,663.09

5.2 Summary of policy and measures impact

Impact on GHG emissions by separate policies and measures is presented in Chapter 4.3. Below a summary table is presented.

Table 40. Summary on the policy and measures, Gg CO_2e

Sector / Year	2010	2015	2020
Energy (excluding transport)	1205	2068	2478
Transport	190	343	496
Industrial Processes, including Solvent and Other Product Use	1967	1967	1967
Agriculture	700	1200	1700
Waste	1191	1799	2478
LULUCUF	0	-840	-1680
Total, excluding LULUCUF	5253	7376	9118
Total, including LULUCUF	5253	6536	7438

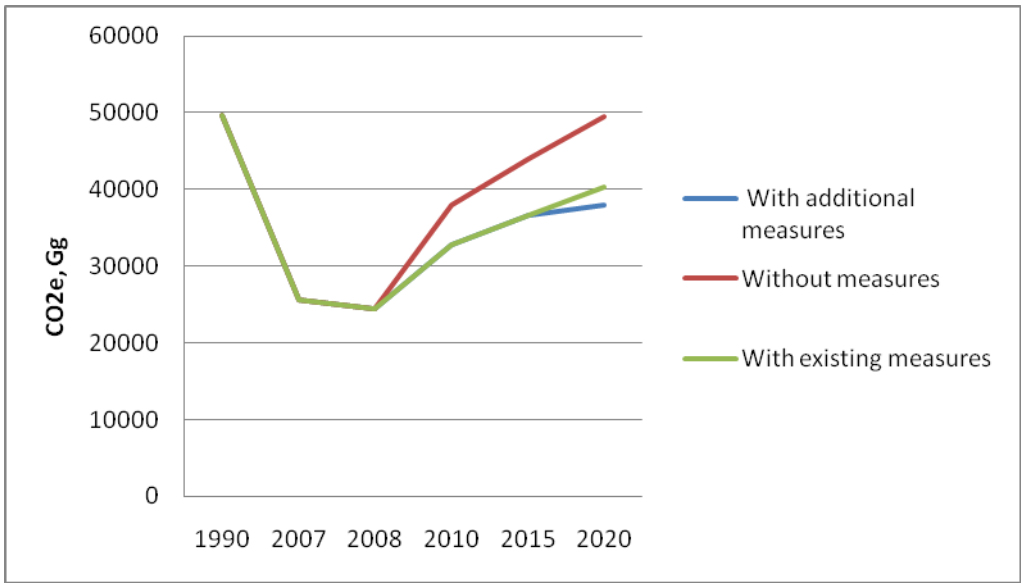

Fig. 26. GHG emissions projections

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 (Official Gazette, 2009, No., 87-3662, available in English on http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=353938) 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 for financing of GHG emissions reduction projects.

5.3.1 Joint Implementation projects

Lithuania participates as a host country in JI projects. At present 20 JI projects in different implementation stages are elaborated inside Lithuania.

Most of the JI projects are projects of wind power plant parks, 3 are related to biofuels production, 1 is 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, 2 projects are related to N_2O emissions reduction at AB "Achema" plant. Elaborations of the JI projects related to biofuels production are suspended at present.

If all JI projects were implemented, GHG emissions would be reduced by 10373913 tCO_2e for 2008-2012. GHG emission reduction due to the 2 projects of N_2O emissions reduction in chemical industry amount to 4 732 541 and 2 603 560 tCO_2e.

Most of the JI projects in Lithuania are wind energy projects (13 of 20). The existing barriers for the development of wind energy projects point at the following situation: in October 2009 25 wind power plants (or wind power parks) were connected to the electricity grid. Only 5 of these are of a larger capacity than 250 kW. One of these 5 is of a 630 kW capacity, and the remaining ones - of 2 MW. Other 3 projects are implemented as JI projects.

For JI projects, which influence the reduction of GHG emissions in installations participating in the EU ETS (for example, wind power parks), the reserve is set - 1292186 ERU. ERU's from the JI projects reserve are 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. But in 2009 a project based on the order of the Minister of Environment was prepared, which established procedure for performance of the Clean Development Mechanism projects.

5.4 Methodology for GHG emissions projections

The main documents, used for GHG projections are: National Energy Strategy, Lithuanian Energy institute study ''Greenhouse gas emissions projections till 2020, estimation and proposals on the Lithuanian possibilities to reduce 20 % greenhouse gas emissions till 2020" (further - LEI study),Lithuania's Report on Demonstrable Progress prepared by the Center for Environmental Policy, 2008 (further - AAPC Report), ''Policies & Measures and Projections of Greenhouse Gas Emissions in Lithuania, 2009 m." (Further - Report Policy and Measures). and the references listed in these documents.

For the 2010 GHG projections update an updated GDP was used (projection 04-09-2009), available on the web site of the Republic of Lithuania Ministry of Finance (http://www.finmin.lt/web/finmin/aktualus_duomenys/makroekonomika). GDP forecast for 2015 and 2020 was not corrected.

In the LEI Study econometric models were used to determine projections of energy consumption. These models provide a possibility to describe a number of factors, influencing energy needs in one way or another: production capacity, number of employees, income elasticity, price elasticity, wholesale and retail trade amounts, population, fuel switching elements, the temperature factor (estimating the air temperature fluctuations) and etc. The input data was from reliable sources or previously performed projections, or from expert's estimations.

Based on the models consisting of a set of parameters, LEI elaborated the final energy and electricity demand in Lithuania 2005 - 2025, under the three growth scenarios: low growth, basic and fast growth scenario, as well as for the scenarios based on different fuels. It is forecasted that natural gas would take a significant part in the final fuel structure. It is expected that in twenty years the proportion of natural gas will increase from 17 to 22-23% in the overall final fuel balance. But in the individual sectors such as industry, service sector, natural gas part in the final energy balance shall exceed 40-50%. Based on the mathematical models GHG projections analysis was performed. GHG emission projections were simulated in proportion to the energy flow in each energy transformation process, and depends on the type of fuel (for CO_2, SO_2 and particles), as well as from fuel combustion technologies (for NO_X). For pollution simulations comparative emissions indicator was set for each technology and fuel type. Different energy sector development scenarios were modelled, taking into account GHG emissions with the existing measures and with the additional measures (new NPP). LEI Study showed close relation of GDP variations and GHG emissions from industry. GHG projections performed on the basic (most probable) GDP growth scenario, setting GDP annual increase by 5% till 2015, and 4% afterwards. Since the study had elaborated GHG forecast only for the industry sectors making up the largest part in the emissions, projections were updated covering all industry sectors in the Report Policy and Measures. It was assumed, that GHG emissions from industry will reach 2007 level approximately in 2014 and will continue to grow by around 3% annually.

Impact of separate measures on GHG emissions was evaluated in the AAPC Report. Evaluations were performed using the bottom-up approach. Then GHG emissions without measures were calculated as the sum of modeled GHG emissions with measures and GHG emissions calculated for separate measures.

5.4.1 Main assumptions

Further the main assumptions for GHG projections are presented.

Basic scenario (basic economic growth and basic energy demand) as described in the National Energy Strategy is used.

Final energy demand from 2005 to 2025 will increase from 1.4 to 2.1 times. At the same time, according to the basic scenario, annual fuel and energy consumption in 2025 will increase to 7.4 million toe (309,764 TJ) or 77% of the 1990 level.

Consumption of light liquid fuels will increase in the transport sector and will reach 2.2 million t per year in 2025. Portion of biofuels in the total balance of fuel for road transport is going to increase substantially as a result of implementation of the EU requirements. (See chapter Policy and Measures).

Energy demand for district heating will remain at the current level up until 2025. It is assumed, that the growing energy demand due to construction of new buildings will be compensated by a decreasing energy demand due to the upgrading of residential houses and public buildings (hospitals, schools, etc.).

The fraction of electricity in the final energy structure will be increasing in all sectors. It is expected that the annual increase in electricity consumption will be approximately 3.7% resulting in 2.5 time's higher consumption in 2025. In such case the final electricity consumption will reach 16.32 TWh or 6 000 kWh per capita and will be close to the current average electricity consumption in the EU-25

Final energy intensity will continue to decrease.

Considering the above listed assumptions final energy demand is presented in the table below.

Table 41. Final energy consumption in various sectors, million toe [Report Policy and Measures]

	2007	2010	2015	2020	2025
Manufacturing industry	1.013	1.126	1.323	1.550	1.826
Construction	0.052	0.056	0.066	0.080	0.095
Agriculture	0.120	0.123	0.143	0.167	0.196
Transport	1.842	1.582	1.789	2.032	2.306
Households	1.349	1.494	1.631	1.782	1.946
Services and other activities	0.638	0.661	0.771	0.899	1.050
Total	5.014	5.042	5.724	6.510	7.419

Table 42. Fuel and primary energy demand for electricity and centralized heat production, (thou t) [Report Policy and Measures]

Fuel or energy type	2007	2010	2015	2020	2025
Hydroenergy	34.8	34.4	34.4	34.4	34.4
Natural Gas	674.3	1140.4	1384.8	1536.4	1597.4
Fuel oil and shale oil	11.2	73.2	76.7	208.6	287.0
Asphaltens	0.0	693.6	737.1	737.1	737.1
Fuel emulsion	0.0	1079.7	2070.6	2047.7	2205.8
Nuclear energy	2534.8	0.0	0.0	0.0	0.0
Coal	0.0	156.8	86.8	27.4	16.8
Biomass	7.1	59.2	198.7	233.4	424.7
Wind energy	6.1	16.9	39.9	39.9	39.9
Other	160	157.7	161.2	153.9	7.2
Total	3428.2	3411.9	4790.1	5018.7	5350.2

Forecasted variations in the number of cattle, sheep and goats, pigs and poultry are shown in the table below.

Table 43. Forecasted variations in the number of cattle, sheep and goats, pigs and poultry (as 1st of January, thou heads) [Report Policy and Measures].

	2010	2015	2020
Cattle	782	796	804
Sheep	45	50	55
Goats	22	24	28
Horses	65	68	70
Swine	1110	1218	1280
Poultry	10200	11700	12000

6 Climate Change Impact, Vulnerability Assessment, Adaptation and Mitigation Measures

6.1 Potential impact of climate Change

6.1.1 Climate change impact

Global processes of climate change will inevitably affect the Lithuanian climate. There is a small number of researches on climate change impact to ecosystems, biological diversity, agriculture and forestry or public health in Lithuania. Using systematic observations (monitoring) the main needs of the country are contented.

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.

The main research centers are the Center of the Marine Research of the Ministry of Environment of the Republic of Lithuania, the Institute of Ecology of Vilnius University, the Institute of Geology and Geography, Vilnius and Klaipėda Universities. Researches of separate investigations (programmes) are not complex, and the results are not concentrated in one place. However, more attention has been drawn to climate change recently. On January 23, 2008 the Government of the Republic of Lithuania approved the National Strategy for the Implementation of the UNFCCC until 2012 by the Resolution No. 94 (Official Gazette, 2008, No.19-685; 2009, No.108-4540), renewed a member list of the National Committee of Climate Change, carried out a great number of research works. By the order and 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 remains one of the most important studies and complexly investigates the impact of climate change on ecosystems, biodiversity, water resources, agriculture and forestry and human health.

The National Strategy for the Implementation of the UNFCCC until 2012 foresees to continue the research projects, constantly observe the climate system and make related data archives in order to understand and estimate the reasons, consequences, scale and terms of climate change; to provide information for the society and to promote the society to participate in decision making, to coordinate environmental education projects.

6.1.2 Climate

The following changes of the main climate indicators are foreseen in Lithuania in the 21st century [1]:

- The weather temperature will rise significantly. The changes will be more remarkable in the cold period. Diurnal temperature variations will also grow.
- Most of the climate models forecast 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,
- Air humidity and precipitation amount will increase in the cold period of a 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 strongly decrease (especially in the western part of Lithuania).
- The wind (storms) will get stronger in the territory, recurrence of big heavy showers, a number of thunderstorms and hails 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.

The average air temperature in Lithuania in the period of 1991-2006 has grown by 0.7-0.9°C, comparing with the period of 1961-1990. This fact shows climate warming [2]. Distinct tendencies of climate warming are in the western and northern parts of Lithuania. In the recent 16 years (1991-2006) the average annual temperature exceeded the limit of 6°C in the entire territory of Lithuania, and reached 6.5–7.9°C [8]. The year 2008 was the warmest since 1961 and the average yearly temperature was 8.3°C, hence the deviation from the norm made 2.2 °C (the average yearly temperature in 2007 was 7.9 °C).

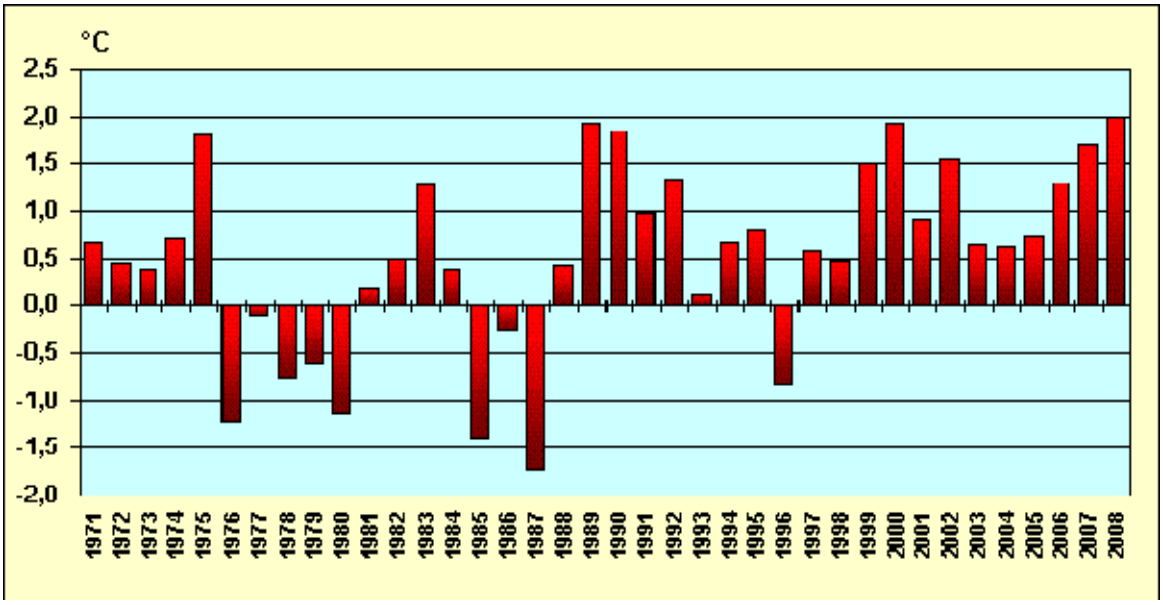

Fig. 27. Deflection form standard of average air temperature [26]

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

6.1.3 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, CO2 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 [1].

- 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.
- As a result of winters getting warmer, loss in change of plants wintering conditions can appear.
- 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.
- Waves of heat and prolonged droughts will have an impact on animal health, slow down their growing, and decrease productivity.
- Because of climatic extremes becoming stronger, losses experienced by the farmers will grow, which can decrease the interest in traditional agriculture among country people.

6.1.4 Impact on forest ecosystems

Long- term observations of the forest state show that one of the main problems influencing its change are more frequently recurring droughts of different intensity [3]. Because of a lack of humidity in soil the amount of the defoliation of trees has got bigger, chemical composition of the soil and the amount of microorganisms has changed, living cover of the soil (especially moss) has grown poor, and the amount of fallen trees has increased. The amount of storms and squalls has gotten bigger, especially in the western part of Lithuania. In the course of the last two decades, we have already registered a climate warming impact upon the forests in Lithuania - fir groves get weaker and drier, defoliation of trees gets bigger, productivity of forests changes, etc.

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 [1].

Changed climate (especially warmer winters) will predetermine new sickness and appearance of pests, which can cause great harm to the 126 tree species currently found in the forests of Lithuania. These problems will increase the forest protection costs.

6.1.5 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 [1].

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 research of the recent years lets us assume 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 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. 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 [1].

6.1.6 Impacts on groundwater regime and chemical composition, on hydrological and hydrophysical indices of the Baltic Sea, the Curonian Lagoon, lakes and rivers

Growing 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) [2, 8].

By prognoses, in the course of the 21st century, the water level in the Baltic Sea can rise by 0.3-0.6 m. Research shows, that as soon as the water level rises by 9 cm, the Lithuanian coasts transverse profile will gradually start changing, and when its rise hits 0,3 m, essential coast re-formation will start. When the water level rise reaches 0.6 m and more, coast line will start changing worryingly, part of the territory will be flooded. Changing of the water level in the Baltic Sea would mostly affect the Lithuanian coast sections by Nida, Pervalka-Juodkrante, Palanga-Butinge [1].

Climate change is also named as a factor, which could have, and, unfortunately has already had, a negative impact on the stability of Lithuanian coastline. Currently the biggest negative impact 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 [6, 9, 10].

Because of the continual change of the coast line, 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. A significant shore destruction has been taking place in the last 30 years [2, 3].

By referencing the climate change scenarios, distribution of the River Nemunas flow in time has been forecasted: more frequent floods in all seasons, less spring freshets, bigger probability of minimal flow in summer.

Rising sea level and more frequent winter storms will determine the more frequent floods on the sea-cost region (especially on the River Nemunas delta); 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 [8, 15].

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".

6.1.7 Impact on geological structures

The Lithuanian Geology service together with the Climate and water systems department of the Institute of Geology and Geography is carrying out a monitoring of melted gypsum in the coffin area (chemical denudation) [2, 13]. It has been determined, that the intensity of gypsum chemical denudation stayed quite big in 2008 - over 140 m³ of gypsum had melted in the coffin area in one square kilometer over one year. 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. In 2006 due to an especially little leakage, the chemical denudation of gypsum significantly fell down to 85 m^3/km^2 and resembled the chemical denudation of the 7-8 decade. But in 2007 it was close to average again and reached 136 m³/km². In 2008 it increased slightly and to 142 m³/km². Therefore a subsequent intensity of the gypsum denudation will depend on the results of climate change process. 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. Annual flow distribution changed during the last years - there is almost no winter minimal flow. This change evidently has its influence on the increased denudation of gypsum [20].

6.1.8 Impact on public health

Environment, air and climate conditions make big impact on human health [2]. Elderly people, children, people with chronic diseases, also socially isolated people are the most sensitive to these changes [22]. Climate warming has a clear direct and indirect impact upon human health and well-being of the society:

Direct: 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.

Indirect: 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; changes in the periods of pollen spread, changes in diseases spread by bloodsucking insects and ticks (tick-born encephalitis and Lime disease) in all the territory of Lithuania; extreme phenomena (floods, wind storms, droughts, heat waves).

Although a science research has been carried out lately striving to evaluate the impact of climate change on the society, the Gross Domestic Product, industry indexes, human health, spread of the new diseases and growth of the number of illnesses, tourism and recreation, economy indexes, the amount of information currently available is still not enough.

6.1.9 Impact on individual branches of economy

Tourism. Tourism as a branch of economy is very important to Lithuania with its countryside tourism in particular. Climate change has caused the spread of blood sucking insects thus the increasing occurrence of the insects carried diseases (tick-born encephalitis and Lime 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, duration of the heating season gets shorter in towns and settlements, therefore fuel is saved and GHG emissions to the atmosphere decrease. Nevertheless, the increasing water level, more frequent hurricanes and storms may have a negative impact on the infrastructure, beaches, etc. of summer resorts.

Fishery. Fish resources of the Curonian Lagoon undergo changes. The factor of water temperature in water ecosystems is critical to the fish stocks. Changes in spawning conditions may cause the inevitable loss of individual populations and fish stocks.

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

6.2 Vulnerability assessment

Climate change will affect all components of environment with the following being the most vulnerable ones:

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 are distinguished considering the current trends of dynamics of the foreshores and upon discussing the factors and their possible changes influencing Lithuania's coastal development within the Baltic sea [1, 9, 10].

Recreational area of Palanga. Increasing load on recreational area l 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.

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. This influence may become even stronger in the future.

Foreshore of Šventoji port – Latvia's boarder. 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 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 entire **coastline of the Curonian Lagoon the** Kopgalio 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 pears 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.

The **increase of climatic extremes** is being forecasted, which will reveal itself by heavy 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. [1]

The impact of climate change on biodiversity was started to be investigated some years ago. It is still of general character yet considering the common trends of the EU and neighboring countries of the bio-geographical region. However cases of change or reallocation of richness of some fauna and flora species have been already noticed. Nevertheless research and the existing data is not enough for analytical study on climate change impact on ecosystems of Lithuania.

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. [1]

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 Curonial 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, karst processes got intensified. The conditions of territory use and natural protection of ground hydrosphere get worse. [13].

The change of regime of temperature and precipitation amounts will continue to do impact on 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. Influence on forest productivity, especially in protected area forests will increase. Spread of new sicknesses and pests will demand more finance.

According to long-term forecasts of the Lithuanian University of Agriculture for the use of **forest resources** and considering intensive growth of forest area, size and maturity of stands as well as having assessed possible loss due to impact of climate, pests and diseases, it is likely that cuttings in the state forests should have to decease by 6 % in 15 years. However cuttings may increase by 6-7 % in private forests. Hence the change of forest property should not influence the amount of annual forests use that much. It is indicated that during the period 7−8 mln m^3 of wood could be produced in all forests. Until

2014 only the main cuttings could make 2,5 mln. m^3 in state and private forests. Until 2020 the cuttings in private forests can enlarge to 3 mln. m^3. In 15 years the forest overgrowing in abandoned agricultural areas will not have impact on quantities of forest use because of its age. According to long- term forecasts of the Lithuanian University of Agriculture for the use of forest resources, mostly the pine cuttings should grow until 2020 and make almost 1.5 times. Cuttings of fir, birch, alder trees should grow too. However cuttings of asps should become twice as less. Due to availability of extensive resources in private forests, birch and black alder trees should be cut in private areas. Poor state problem of ash trees is likely to continue [1, 3]

Climate warming has a direct and indirect influence 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. [1].

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. The altered period of vegetation will obstruct prevention and treatment of allergies. As the climate warms up, 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. New studies and methods are required in order to estimate and manage the situation.

6.3 Adaption and mitigation measures

The Coastal Zone Management Programme was approved by the Order No. 442 of the Minister of Environment of the Republic of Lithuania on 1 September 2003. On this basis the coastal management projects were prepared and implemented during the period of 2004-2007. The project „Re-creation and Reservation of the Lithuanian Baltic Coastal Zone" was started in 2005 and finished by the middle of 2008. It was supported by the European Union funding.

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 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).

Policies and measures of different sectors for climate change mitigation are presented in Chapter 4. In this chapter specific measures for mitigation or adaptation to the climate change impact are described. These measures are foreseen in the National Strategy for the Implementation of the UNFCCC until 2012 which was approved by the Resolution No. 94 of the Government of the Republic of Lithuania on 23 January 2008 (Official Gazette, 2008, No. 19-685; 2009, No. 108-4540).

The following measures are foreseen to ensure relevant adaptation to climate change and to minimize the adverse impact on human health and the environment:

Table 44. Measures aimed at ensuring more effective monitoring of climate change

Measures	Period of implementation	Implementing authority
To launch climatic analysis of the material provided by the European Organisation for the Exploitation of Meteorological	2010	Ministry of Environment

Satellites (EUMETSAT)		
To prepare measures for improving the monitoring of forest resources and their state	2010	Ministry of Environment
To prepare a study on the Lithuanian climate and a diagnosis and projections of its variation	2010–2011	Ministry of Environment
To identify parts of ecosystems and natural regions most sensitive to climate change and to expand the environmental monitoring network in them	2009	Ministry of Environment
To prepare programme for the assessment of the Baltic seashore dynamics	2009	Ministry of Environment

Table 45. Measures to ensure the assessment of vulnerability of the landscape, ecosystems and biological diversity, and the planning of adaptation options

Measures	Period of implementation	Implementing authority
To assess the impact of climate change on the landscape, ecosystems and biological diversity and to develop adaptation measures	2009–2012	Ministry of Environment, State Science and Studies Foundation
To prepare draft legislation that provides for the establishment of protected areas necessary for the implementation of the ecological network Natura 2000	2009–2010	Ministry of Environment
To prepare projects on nature management in protected areas in accordance with the existing and projected impacts of climate change	2009–2011	Ministry of Environment
To prepare and approve a plan of measures for the protection and management of the Baltic Sea coast by providing for the most appropriate development of the coastal land use structure	2010	Ministry of Environment
To prepare and implement river renaturalisation projects with a view of ensuring the protection of the natural hydrographic network	2008–2012	Ministry of Environment
To prepare a plan of measures for mitigating the impact of climate change on the karstic region and other sensitive	2011	Ministry of Environment, Ministry of Agriculture
To prepare and implement measures for wetland protection and management of closed and unused peat mines in accordance with the future impact of climate change	2009–2012	Ministry of Environment, Ministry of Agriculture

Table 46. Measures to reduce the impact of the energy, industry, transport, agricultural and forestry sectors on the climate

Measures	Period of implementation	Implementing authority
To upgrade mechanisms of support for agrarian environmental programmes	2008–2012	Ministry of Agriculture, Ministry of Environment
To prepare proposals on regulations that standardise design and construction of hydrotechnical structures in accordance with projected changes of the hydrological pattern	2010	Ministry of Environment, Ministry of Economy, Ministry of Transport and Communications
To prepare recommendations for farmers on measures of adaptation to the projected increase of climatic extremes	2011	Ministry of Agriculture
To implement measures of afforestation of unproductive land with a view of increasing Lithuania's forest coverage by 3–5 %	2008–2012	Ministry of Environment, Ministry of Agriculture
To prepare projects on reforestation and afforestation on the environmental and genetic basis and to combine afforestation with spontaneous afforestation	2009–2012	Ministry of Environment

Table 47. Measures to reduce the impact of climate change on human health, to develop research and to raise public awareness in combating climate change

Measures	Period of implementation	Implementing authority
To prepare proposals to upgrade the system for preventing diseases related to climate change impacts	2009–2010	Ministry of Health, Ministry of Environment
To prepare and implement measures for contagious disease prevention due to potential threats related to the spread of ticks and bloodsucking insects	2009–2012	Ministry of Health, Ministry of Environment
To conduct research with a view of assessing the links between allergies from pollen and climate change and to provide for preventive measures	2008–2010	Ministry of Health, Ministry of Environment
To develop a research programme for assessing biological diversity of climate change impact	2010–2011	Ministry of Environment, Ministry of Education and Science, State Science and Studies Foundation
To prepare a scientific study designed for assessing potential changes in the river discharge pattern	2011–2012	Ministry of Environment
To carry out research in the field of climate change and to use its results for improving and updating sectoral economic and	2008–2012	Ministry of Environment, Ministry of Economy,

environmental strategies approved		Ministry of Health, Ministry of Transport and Communications
To prepare a scientific study aimed at adapting agriculture to conditions of climate change	2009–2010	Ministry of Agriculture, Ministry of Environment
To prepare a scientific study aimed at adapting forestry to conditions of climate change	2010	Ministry of Environment

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31. European Commission: http://ec.europa.eu/index_lt.htm

7 Financial resources and transfer of technology

Article 4 (1) of the UNFCCC states, that all parties shall fulfill 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 UNFCCC. Lithuania is not referred to as a developed country thus previously mentioned obligations are not applicable.

The countries listed in Annex 1 of the UNFCCC supply information on the Government programs of collaboration in clean technology development, know-how transfer and experience related to the climate change topic. Lithuania has not prepared any operational Government programs that could be directly related to the development of clean technologies or active experience transfer. However, in October of 2009, at the European Council meeting seeking for the international agreement on greenhouse gas 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. A special tariff system for renewable energy generation could be identified as indirect support for the development of clean technologies in Lithuania. The country puts major efforts in strengthening of the national capacity, which is mainly done by preparation and improvement of the national science programs and other related activities. The project "Capacity Strengthening for Implementation of the Requirements of the Kyoto Protocol in Lithuania" was performed in order to strengthen the national capacity. It includes 8 activities: preparation of the revised action plan for the national strategy of the UNFCCC implementation until 2012, recommendations and proposals for GHG emission prognosis and climate change policy and evaluation of measures, preparation of improvements for GHG and fluoride greenhouse gases reporting methodology, preparation of proposals and recommendations for implementation of the Kyoto protocol flexible mechanisms and green investment scheme in Lithuania. Weaknesses and causes of the national institutions and operators involved in the implementation of the Kyoto protocol requirements were identified and evaluated.

Private sector directly participates in the development of clean technologies. 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 takes place under the market conditions with indirect support possibilities: the EU emission trading scheme and available EU support.

8 Research and Systematic Observation/Monitoring

8.1 General policy on research and systematic observation/monitoring

A new Law on Science and Studies, valid since May of 2009, enforced the Science and Studies reform from which could be seen that a policy of Research and Systematic Observation/approach in Lithuania has not changed. The majority of education and study institutions are under the state and they are within the jurisdiction of the Ministry of Education and Science. Nearly all science and study institutions are concentrated in four largest cities: Vilnius, Kaunas, Klaipėda and Šiauliai. In 2009 there were 30 public higher education institutions (10 universities, 5 academies and 15 colleges) and 19 non-public higher education institutions (7 university types and 12 colleges) in Lithuania. There are 29 independent state research institutes, a part of them are integrated into universities [14].

The Law on Science and Studies constitute the legal basis for universities and research institutions. The Lithuanian research and higher education system focuses on the basic research and educational function of research. State research establishments carry out the applied research and experimental development (social, cultural) activities.

The major part of Lithuanian science research and experimental development capacity is concentrated at university research institutes, state research institutes and sate research establishments. Scientific research establishments are public and non-public. Public scientific research establishments were founded by the Government. Non-public scientific research establishments were founded by physical and legal persons, except for the institutions of state and local administration. The same holds good for Member States of the European Union and the states which signed the Agreement on branch offices of the European Economic Area enterprises in Lithuania.

State Research Institute focuses mainly on long-term international level fundamental and basic science researches, which are important to the economy and culture of Lithuania. Groups of specialized scientists are needed for them.

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.

State research establishments aim at carrying out R&D activities significant to the Lithuanian economy and culture, to the development of industry, state government and other institutions.

The main objectives of universities, research institutes and public education institutions are to:

- Carry out the country's economic, cultural and social development towards certain important long-term direction (directions) of research and experimental (social, cultural) development;
- Carry out the applied basic scientific research and experimental (social, cultural) development, training, development of a specific promoter (legal person) or founder of the authorities carrying out functions relevant to scientific research and experimental (social, cultural) development methodologies;
- Collaborate with business, government and civil society representatives in carrying out the scientific research and experimental (social, cultural) development of custom work, to provide methodological, methodical and other assistance;
- In conjunction with universities to train researchers, to assist in training the professionals in the light of recent scientific developments and the country's economic needs, ensuring the international level of scientific excellence;
- Undertake public dissemination of scientific knowledge, introduce it into culture and education, social and economic activities that contribute to innovation and knowledge-based economy, knowledge-intensive public education;
- Dissemination of research and experimental (social, cultural) development results.

Projections for the state research and systematic observation/monitoring are provided in the National Sustainable Development Strategy (updated in 2009) (Official Gazette 2003, No. 89-4029) with the following long-term objectives: develop well-educated, independent, active and responsible members of society and enhance intellectual society potential so that the knowledge and science would ensure sustainable implementation of economic, social and environmental goals. To succeed in the above long-term objective, it is necessary inter alia to ensure continuous development of research and technologies allowing building the knowledge society based on science, newest long-environmental-impact technologies, and innovations [6].

The Government budget appropriations for research and studies in 2009 made 1.59 % of GDP (in 2008 they amounted to 1.49 % of GDP). From the EU structural assistance in 2009-2013, receive funding for integrated research, studies and business centers (valleys) (research base and technological infrastructure development) and for higher education, integration, infrastructure studies [10].

In Lithuania scientific research is mainly financed from the state budget. Currently the main problems encountered are: the absence of research strategy, the failure to formulate state orders with respect to research, partial funding of research, out-dated and inflexible system for the assessment of research institutions and researchers, which fails to stimulate the performance of works necessary for the state and fulfillment of the state orders, and lack of co-operation between the scientific institutions. Too little attention is paid to research by ministries failing to place orders for research works, whereupon international projects and orders of foreign foundations and institutions dominate at the state research institutions.

Research in the field of climate change and climate systems represents only a minor share in R&D, which is a consequence of a small number of organizations working in this field, existing national priorities in this field of R&D, and poor co-operation between institutions of all levels [4].

In 2008 the Lithuanian Government approved a list of national scientific programs, one of which is called "Lithuanian ecosystems: Climate Change and Anthropogenic impact" (Official Gazette 2008, No. 116-4427). The program aims at obtaining the latest scientific knowledge on the regularities and mechanisms for determining the global climate change and anthropogenic impact in an integrated impact on various Lithuanian terrestrial and aquatic ecosystems, their components and bio-diversity reception and presentation.

In 2005 the Government of Lithuania approved the National Environmental Monitoring program for 2005-2010 corresponding to the requirements of the European Union directives for environmental measurements of quantity and quality and meeting the key national environmental information needs (Official Gazette 2005, No. 19-608). During 2008 this program has been adjusted and optimized. The program has been developed in accordance with the Convention on Long-range Trans-boundary Air Pollution and its protocols, the United Nations Framework Convention on Climate Change and the Kyoto Protocol, Convention on Biological Diversity, European Convention on Protection of Wild Nature and Habitant, the Vienna Convention on the Protection of the Ozone Layer, the Montreal Protocol on Substances that Deplete the Ozone Layer and its additions and amendments, the Convention on the Baltic Marine Environment Protection, the Convention on Wetland of International Importance, especially waterfowl habitats, The Convention on the Conservation of Migratory Species of Wild Animals, The European Landscape Convention, the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters and the provisions of the guidelines [3].

Implementation of the program will adopt effective environmental policies and manage the environmental quality of the collection of sufficient information and data on the state level. It will communicate more detailed information to the public and the interested national and international institutions on the current state of the natural environment, particularly on persistent organic pollutants resulting from air pollution of the recent increased growth of relevant industries and on the levels of intensification of the sea coast disruption. Optimization of river condition assessment system and addition of new relevant parameters will enable a more accurate assessment of the current and future potential river pollution, identification of specific contaminants in the surface water assessment, performance of pollution control and prevention and substantial contribution to the goal to achieve positive condition of the inland water bodies in Lithuania by 2015. The adopted amendments of the program will ensure better support of the river water quality improvement measures, often requiring large investments.

A coordinated collection of data will allow the implementation of the EU environmental directives-related government obligations, will lead to already established environmental assessment efficiency and optimal planning of new towns, and will ensure sustainable economic development and assess the major national and foreign entities in regard to the environment. The national measures of environmental monitoring program will help to implement the aims of the National Sustainable Development Strategy targeted at economic development, without compromising overall quality of the environment, while maintaining a healthy and clean environment for the public and reducing the risk of degradation of the natural values.

The program defines the environmental objectives and targets, the implementation of which will require monitoring of the condition of the natural environment on the national level and provide measures for implementation of these objectives and their scope, and fulfillment of the requirements set forth for financing, and allocation of funds requirements by 2010.

According to the data of the National Environmental Monitoring Program, supervisory authorities will be communicated exhaustive information (including on-line) on the condition of environment and its changes.

The Environmental Protection Agency (EPA) being a subsidiary institution of the Ministry of Environment is responsible inter alia for environment quality monitoring, collection and storing of environmental data and information as well as for the assessment and prognosis of the quality of environment. In Lithuania several types of climate monitoring are available: air, water, soil, wildlife, ecosystems and landscape. All observations of the climate system satisfy our basic needs and assist in making the climate diversity analysis.

8.2 Research

The revised National Strategy for the UNFCCC implementation and the Action Program foresee further performance of research studies, regular monitoring of the climate system and related data archives for better understanding and identification of causes of climate change, consequences, extent and timing [2].

The Government of the Republic of Lithuania in its 13 February 2007 Resolution No. 206 "On the replacement of the Government of the Republic of Lithuania Resolution of 22 December 2003 No. 1646 "On the approval of Long-term research and development strategy and the Lithuanian Science and Technology based on White Paper on the implementation of the program" (Official Gazette 2007, No. 25-941) clarified the priority the Lithuanian research and development directions, which provide support to research studies of ecosystems and climate change area.

In 2007 the Government of Lithuania adopted new priorities for research and development (R&D) areas for the period of 2007-2010: research, ensuring the quality of life, the knowledge society and the development of nanotechnology, research and development for the Lithuanian industry (high technology), international competitiveness and high-tech program for 2007-2013. The infrastructure development plan for the national R&D programs has been elaborated [5].

The main scientific research related to the fulfillment of commitments under the UNFCCC is carried out at Vilnius University, Institute of ecology of Vilnius University, Lithuanian Energy Institute and partially, at the state research institutes (Institute of Geology and Geography, Lithuanian Institute of Agriculture, Institute of Agriculture Engineering of Lithuanian University of agriculture, and Institute of Botany) [4].

The Department of Hydrology and Climatology at the Faculty of Natural Sciences of Vilnius University performs analyses and forecasts future scenarios of the Lithuanian climate change. Based on GFDL general circulation model was made an assessment of agro climatic resources of important climate variables (air temperature, the amount of active temperatures and precipitation) forecast for Vilnius, Dotnuva and Vezaiciai. In the same general circulation model output results are relied on for the prognosis of snow cover characteristics. Air temperature change scenarios for the 21st century in Vilnius are made on the basis of CGCM1, HadCM2, HadCM2 models. Rainfall change (compared to 1961-1990 average) forecast for Vilnius for the 21st century are based on different (ECHAM, GFDL-R15, CGCM1, CSIRO-Mk2, HadCM2) climate change models. Air temperature and precipitation forecasts for the territory of Lithuania are made using the output data of general circulation models (ECHAM4 and GFDL-R30). PA index change in Lithuania in the 21st century is projected on the basis of results contained in

the global circulation model HadCM3. Expected changes in a number of hot (> 30 ° C) and cold (<-16 ° C) days in Klaipeda in the 21st century are made under e ECHAM4 and HadCM3 climate models.

Implemented Projects: 2005-2006 LEI Hydrology Laboratory staff participated in the project "Climate and Energy (Climate and Energy)." The main objective of this research was to identify climate change in the energy sector, "Climate Change Quantitative and Qualitative Fluctuations of the Lithuanian Water Resources" (prof. dr. Bukantis; 2004-2008); Climate change impacts on the modeling of soil testing under hydrothermal regime by lizimetric analysis (prof. dr. Bukantis, 2008); Application of large scale atmosphere circulation indexes for climate and long-term air anomaly research in Lithuania (ass. prof. G. Stankūnavičius; 2008); Policy and strategy for acclimatization to the climate change in the Baltic Sea region (Lithuanian part) (prof. dr. Bukantis; 2007); INTERREG III B project: Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region (ASTRA) (prof. dr. A. Bukantis, ass. prof. dr. E. Rimkus, ass. prof. dr. G. Stankūnavičius, E. Stonevičius; 2005–2007) http://www.astra-project.org .

With respect to the commitments of Lithuania under the UNFCCC undertaken by the **Institute of Ecology** of Vilnius University three new research priorities have been approved by the Government and financed by the state. Each year the institute carries on research to obtain new results on the impact of global warming upon ecosystems, habitats, animal communities, species and populations, as well as the condition and change in distribution areas, and the condition and change trends of populations. Furthermore, within the period since the submission of the UNFCCC NC2 to the Secretariat of the UNFCCC, researchers of the institute have implemented a number of projects directly and indirectly related to the fulfillment of the UNFCCC commitments.

T**he Institute of Ecology** pursues two research directions approved by the Government of Lithuania and related to climate change impact studies: 1) Ecosystems and their components in the sensitivity, vulnerability, adaptation and microevolution global change and anthropogenic impact patterns and mechanisms, 2) Aquatic ecosystems functioning in the conditions of global change and anthropogenic impact, adaptation and evolutionary patterns and mechanisms.

Two effects of climate change-related themes are dwelt upon in connection with these trends: a) to research regularity and mechanisms of the natural animal populations and community sensitiveness, vulnerability, adaptation and microevolution of global change and anthropogenic influence, to make an inventory of fauna of the Lithuanian ecosystems, to estimate biological diversity and resource; b) regularity and mechanisms of adaptation processes in natural aquatic populations and communities, biological diversity and resources, regularity of changes due to the natural and anthropogenic influence. Annual results related to these topics, covering the investigation of functioning research of the wildlife in their communities, are published in annual accounts of the Institute of Ecology of Vilnius University (2000-2007).

The Institute of Ecology of Vilnius University has been awarded, a contract assignment by the Lithuanian Ministry of Environment "Climate change impacts on the country's ecosystems, biodiversity, water resources, agriculture and forestry and human health assessment study and a strategic plan of mitigation of the consequences" (2007). The assignment is aimed at using the key data derived from research, publications and other published data and information on climate change effects on the Lithuanian ecosystems, biodiversity, water resources, agriculture and forestry, human health trends and providing of expert evaluation of the potential scale of climate change.

Researchers of **the Institute of Geology and Geography** carry out the research on the dynamics of the Baltic coasts with a view to determine possible impact of global warming and other related phenomena - hurricanes, sea level change - on the national coastlines, recreation, tourism and the only seaport of the country. The Institute of Geology and Geography has carried out scientific work "Valuating the change of landscape structure in problematic habitat at the local level", the purpose of which was to examine and assess changes of the landscape structure at the local level for 100 urgent problematic habitats and to create methodic guidance for determination of changes of the land cover classes and to analyze their spatial distribution and assess the degree of polarization of the landscape.

Since 1 January 2010 by the Resolution of the Government of the Republic of Lithuania, the Institute of Ecology of Vilnius University, the Institute of Geology and Geography and the Institute of Botany will be reorganized into the Nature Research Center, which will take over the rights and obligations of these institutions. [28]

The main activity directions of the **Lithuanian Geological Survey** (LGS) include organization and execution of the national geological survey, exploitation and control of mining activities in the public land, development and data collection in connection to the national geological information system and, expansion of international cooperation. Since 1994 LGS is a member of Forum of the European Geological Survey (FOREGS). The Lithuanian Geological Survey actively seeks to contribute to the sustainable development by respective focusing on the applied research goals, rapid provision of public information on the depths of the earth, positive and negative quality, examination and prediction of geological processes. Generalizations/executive summaries of analyses can be found in annual reports and newsletters ("Lithuanian Geological Survey's year performance"), for the last five years available on the website of the Lithuanian Geological Survey www.lgt.lt.

Researchers of **the Lithuanian Energy Institute** focus their research activities on several areas, some of them being directly related to the implementation of the UNFCCC - trends and potential of the development of alternative energy, technologies, problems and possible ways to mitigate GHG emissions.

The Institute of Forestry pursues research related to climate change "Contemporary digressions of forests ecosystems: influencing factors and methods of indication" 2003-2008; "Carbon turnover in Lithuanian forests on dominant mineral soils" 2008-2012; Implementation of forest monitoring program in 2006-2009"; "Further development of the Nordic database of long-term forest experiments (NOLFTOX). In the period of 2000-2008 a unified database was created and made available to anyone interested in the forest experiments - http://nolfox.metla.fi/. "Expected Climate Change and Options for European Silviculture" 2007-2012.

The journal "Forestry" is published and in cooperation with the Latvian and Estonian Institute of Forestry and the Lithuanian Universities of Agriculture. An international journal in English the "Baltic Forestry" is also published. In this magazine 7 articles are published and also included in databases WOS (Web of Science) of 7 international reportable publications and the Institute of Science Information (ISI).

The applied research conducted at **the Lithuanian Institute of Agriculture** is intended for the maintenance of soil richness, slowing down of soil degradation, improvement of soil tillage and cropping technologies, which save energy and resources under the conditions of climate change and change in the market demands, as well as enhancement of production quality. Besides the research is also done to protect crop cultures from diseases and pests, the distribution and dynamics whereof depend upon climate and its change [25].

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 will be merged into the National Lithuanian Centre of Agrarian and Forest Sciences, which will take over the rights and obligations from these institutions. [28]

The Institute of Agriculture Engineering of the Lithuanian University of Agriculture pursues research in the area "Research on shifting sources of energy and production of plant origin and its waste conversion for making non-eatable products" and "Creation and optimization of research of agriculture technologies physic mechanic and chemical influence on nature, production processes and engineering means".

The Institute of Environment of the Lithuanian University of Agriculture pursues the following activities: studies of detrimental forest regeneration processes in local contamination areas; forest conditions and environmental factors leading to an integrated assessment of the background pollution areas (national parks, integrated monitoring stations); forest ecosystem biodiversity, productivity and condition assessment of the current global network of EMAP sites in the Baltic States. The undertaken work directly or indirectly tackled the impact assessment of climate change on forest ecosystems: the biota and the environment. Studies carried out in coordination with and active involvement of the state environmental monitoring program for a relatively natural ecosystem approaches to integrated monitoring sub-program. The scores are based on the natural and anthropogenic environmental factors an integral component of the average defoliation on pine, pursues estimating. The results are published in scientific journals.

The Ministry of Health of the Republic Lithuania implements the requirements for Lithuania of the Fourth environment and health care ministerial conference (23-25 June 2004, Budapest). It also pursues the action plan of the European environmental health strategy implementation 2004-2010 with parallel

implementation of project "Establishment of Environmental Health Information System Supporting Policy Making (ENHIS2)".

The State Environmental Health Center (SEHC) takes part in the establishment of information requirements to improve the environment and health policy; pursues recommendations for information generation from the available data bases; specifies the list of specific indices of children environment health; analyses possibilities of estimation of indoor air and noise influence on public health and influence of the surrounding air on public health; national collaboration centers at workplaces; information processing, analysis and reporting (concerning all project stages). Website was made http://www.enhis.org as a result of the project implementation and included the selected criteria for determination of the environment factor, health state and policy means. Information is laid out according to the factors of risk or according to their impact on health. The site also provides an overview of the environmental and health policy at the national and international levels with the most topical references. Examples of environmental health impact assessment able to reduce the impact of various environmental factors and evaluate new strategies are provided.

The National Tourism Information System is implemented at the national level and provides a wide range of information including but not limited to the Lithuanian history, culture and natural assets, events and entertainment. Currently 51 tourist information centers are in operation. Nevertheless, insufficient development of scientifically-based tourism resources, environmental research, market monitoring, capacity building human resources development systems is stated [26].

Specialists of Lithuanian universities, institutes and other establishments constantly take an active part at different level conferences and seminars, directly connected to the UNFCCC implementation.

8.3 Systematic observations

8.3.1 State environmental monitoring

Environmental policy priorities for environmental air condition monitoring are inseparable from the Lithuanian sustainable development priorities, i.e.- reduce impact of the main industries on environment and reduce risks to human health, mitigate global climate change and its consequences [2].

In Lithuania the process of monitoring in the area of observing the ambient air condition was launched in 1967. In 1999-2004 the network of the municipal ambient air quality monitoring was updated. Now it consists of 13 automatic air quality assessment stations, incessantly measuring pollutions according to the demand of the EU directions. The system of the background air monitoring stations allows analyzing trans-boundary air pollution, general (background) pollution level in the country's air basin, its changes and factors causing such changes. The first station was equipped in Preila settlement in 1980. In 1993-1994 three more stations were established. The station in Preila is operating under the Cooperative Program for Monitoring and Evaluation of Long-range Transmission Air pollutants in Europe (EMEP) and the Baltic Marine Environment Protection Commission (HELCOM) Program, other stations for evaluation of natural ecosystems operate according to the International Cooperative Program on Integrated Monitoring (ICPIM) [3].

Wildlife monitoring

Until the year 1988, more systematic observations were carried out only re the condition of forests according to the ICP Forests program, whereas observation of other components of wildlife was quite fragmentary until 1993. Systematic observations of individual wildlife components initiated according to the first ecological Monitoring Program in 1993 were not representative on the national level. The program of the State Environmental Monitoring for 1999-2004 has already mentioned individual measures for evaluation of the condition of plants and animals, i.e. observations of the condition of forests, meadows, swamps, waters, sandy areas and fields as well as rare plants, mammals, birds, fish, rare amphibians and invertebrates. However, due to the lack of funds a part of the most complicated observations have not been launched and some of them are implemented at lower volumes than anticipated. During this period we have gathered basic information about the condition changes of the main wildlife components.

One of the most important tasks is to assess, predict and control the spread of the most serious threat to the Lithuanian biodiversity presenting non-native invasive plant and animal species, predict the most dangerous types of blood-insect population outbreaks.

Ecosystems monitoring

The Ecosystem Status Monitoring was initiated by the Convention on Long-range Trans-boundary Air Pollution signed by the EU countries in 1979. In 1988, 6 international co-operation programs including the ICP IM program aimed at determining, evaluating and forecasting the status of relatively natural ecosystems and their long-term trends with regard to long-range transmissions of air pollutants (in particular, sulphur and nitrogen compounds), impacts of ozone and heavy metals, regional peculiarities and climate change were initiated on the basis of the Convention. The results of ICP IM program enabled implementation of the requirements under the Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes, the UNFCCC, the Convention on Biological Diversity, the Vienna Convention on Protection of Ozone Layer and the Kyoto Protocol. Now 22 European countries and Canada participate in ICP IM program and supply the required data.

Lithuania together with other Baltic countries participates in the ICP IM program since 1993. In implementing the ICP IM program, 3 stations of complex monitoring of relatively natural ecosystems have been established in the main Lithuanian's landscapes, sites of minimal anthropogenic impact and reserve zones of the national parks. In 1993 the following stations were established: Aukštaitijos (LT01) station of complex monitoring, Dzūkijos (LT02) station of complex monitoring and in 1994 the establishment of Žemaitijos (LT03) station of complex monitoring took place. Since 1998 complex monitoring became an integral part of the Governmental Environment program.

Marine observations

Marine observations are concentrated in the Baltic Sea and Curonial Lagoon. The main research centers are the marine Research Centre under the Ministry of Environment, the Institute of Ecology of Vilnius University, the Institute of Geology and Geography, and Klaipėda and Vilnius universities. Researches related to the UNFCCC implementation issues are concentrated on the circulation and transformation of water masses, water pollution, impacts on costal ecosystem, dynamics of coasts, biological diversity, sound use of biological resources and their protection strategies and measures. Investigations are carried out according to both, the national and international (HELCOM) monitoring programs.

Climate observations

In 1990 the **Lithuanian Hydrometeorological Service** under the Ministry of Environment of the Republic of Lithuania (LHMS) was established. LHMS is a state institution in charge of meteorological, hydrological and agro-meteorological observations and forecasts. LHMS provides hydro-meteorological information for the Lithuanian institutions, enterprises and organizations, observes rules and regulations of the World Meteorological Organization (WMO), participates in international projects and programmes, carries out scientific research, compiles and publishes reference books, annals, and surveys.

Lithuania is a member of a specialized agency of the United Nations organization - the World Meteorological Organization (WMO) since 1992. In 1993 open general ozone content, in 2000 - Solar ultraviolet radiation measurements were carried out. In 1993 measurements of general ozone content were started and in 2000 Solar ultraviolet radiation was measured. LHMS collaborates with the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF). LHMS takes part in the following programs: WMO climate information and forecast - CLIPS (Climate Information and Prediction Services); COST European Co-operation in the field of Scientific and Technical Research; Global Climate Observation System - GCOS.

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9 Education, Training and Public Awareness Rising

The Law on Financial Instruments for Climate Change Management was approved on 7 July 2009 (Official Gazette, 2009, No. 87-3662). The Law shall stipulate the rights, duties and liabilities of the persons engaged in the economic activities resulting in greenhouse gas emissions as well as the sphere of competence of the state institutions and bodies.

On 16 September, 2009 the Government of Lithuania approved the updated version of the National Sustainable Development Strategy (Official Gazette, 2003, No. 89-4029). The document is followed by the plan of the strategy implementation measures. 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. The social education is identified as the key factor in shifting the public consciousness towards sustainable thinking thus public education is stated as the priority.

9.1 Education

General education establishments. Environmental education is incorporated into the educational programs of primary and secondary schools according to the National Sustainable Development Education Program for the period 2007-2015 (Official Gazette, 2003, No 89-4029), which was approved by the Government of the Republic of Lithuania on 2 October 2009.

Lithuanian schools continue an active participation in the International Globe Programme. Currently the country counts 31 schools which have joined the international scientific – environmental educational programme.

Tangible input for information dissemination and complete educational means (texts and visual information, presentations, etc.) is provided by the European Commission through its Internet portal.

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 climate change in particular are broadly common in study programs of higher schools. The study programs 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. Students have possibilities to broaden their knowledge in environmental design, analysis of sensitivity of ecosystems, eco design, environmental impact assessment, etc.

The National Scientific Programme "The Ecosystems of Lithuania: Climate Change and Impact of Human's Activities" (Official Gazette, 2008, No. 116-4427) was approved by the Government of the Republic of Lithuania in 2008. One of its objectives is the acquisition and supply of modern scientific knowledge related to the consistency and mechanisms that determine the integrated effect of global climate change and anthropogenic activities on the Lithuanian land/soil and water ecosystems.

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.

Public Information Division of the Ministry of Environment of the Republic of Lithuania plays an important role in 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. The most known event organized by the division which is directed towards the problem of climate change is a week of events "The day without a car".

In 2009 a draft Order of the Minister of Environment of the Republic of Lithuania was prepared which will establish public awareness and participation arrangements, preparing lists of the EU ETS operators and EUA allocation plan.

In 2008 "Crystal stack" contest was held by the Lithuanian Environmental Investment Fund initiative. Eleven industry and energy companies competed, which participated in the EU ETS in 2005-2007 and achieved the most reductions of carbon dioxide emissions. Tauragė District heating company (Taurages silumos tinklai) won the main prize, the "Crystal stack" sculpture. The company has installed biomass boilers and other energy saving measures and produces over 90 % of the city heat based on biomass firing [1].

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 in accordance with 3.1. Priority "Local and urban development, cultural heritage and nature conservation and adaptation for tourism development" tools "VP3-1.4-AM-08-V the Public Information System on the environment and development" and "VP3-1.4-AM-09-C Public Information and Education about the environment and the implementation of the measures". Totally 11,000,000 Litas for the 1st measure [3] and 20,000,000 Litas for the 2nd measure [4] was allocated for the period from the EU funds.

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) and the Lithuanian Environment Investment Fund (www.laaif.lt). Information contained in other sources usually is sectorial and fragmentary.

9.4 Participation in international programs and projects

In 2009 the Ministry of Environment of the Republic of Lithuania started preparation of the Green Investment Scheme (GIS). After a planned start in the beginning of 2010, the scheme is foreseen to enhance and provide financial support for the implementation of CO_2 reduction projects. The Green Investment Scheme will be implemented under the Climate Change Programme, which is described in Chapter "Policies and measures."

Projects of environmental education which are directed to promote the way of sustainable living, sparing consumption of natural recourses and preservation of biological diversity will receive the EU funding.

In 2008 the fund of Youth Environment Initiatives was created. The fund's mission is to support students and young scientist in their investigations in climate change topics.

In 2009 a pilot project related to the climate change was started. The project "ECO-Life - Sustainable Zero Carbon ECOTown Developments Improving Quality of Life across EU" is supported by the Seventh Framework Programme. Priority: Energy.2008.8.4.1 - Concerto. The ECO-Life project includes activities for the development of zero CO_2 emission areas in 3 urban communities of the EU.

In 2009 the Covenant of Mayors was signed by the mayors of seven municipalities: Kaunas and Panevezys cities and Anyksciai, Pakruojis, Silalė, Silute and Vilkaviskis regions/ditricts. By signing this document the municipalities have undertaken the responsibility to prepare and implement more ambitious goals than the ones set by the EU until 2020. Implementing a sustainable energy action plan for municipal competence fields, at least 20 % of GHG emissions should be reduced within the abovementioned

territories. During the first quarter of 2010, GHG emission inventories and action plans should be developed for local areas.

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Annexes

Annex 1. Summary GHG emissions

TABLE 10
EMISSION
TRENDS

SUMMARY

(Part 1 of 2)

Inventory 2008

Submission 2008 v1.3

LITHUANIA

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	20.503,04	22.799,48	5.960,49	2.324,87	1.086,67	2.229,71	2.381,22	1.273,75	1.733,75	-767,00
CO_2 emissions excluding net CO_2 from LULUCF	36.090,90	38.191,55	21.387,08	16.526,19	15.803,29	15.109,36	15.815,93	15.203,21	16.046,35	13.547,91
CH_4 emissions including CH_4 from LULUCF	6.360,28	5.987,59	4.440,31	3.887,44	3.589,26	3.524,80	3.529,39	3.562,17	3.463,71	3.197,03
CH_4 emissions excluding CH_4 from LULUCF	6.359,48	5.987,21	4.434,46	3.885,54	3.587,35	3.522,88	3.527,46	3.560,24	3.463,37	3.194,90
N_2O emissions including N_2O from LULUCF	7.293,89	6.775,20	4.501,15	3.897,27	3.319,21	3.302,25	3.917,30	4.017,38	4.175,16	4.159,18
N_2O emissions excluding N_2O from LULUCF	7.272,95	6.754,22	4.479,54	3.875,98	3.297,84	3.280,81	3.895,77	3.995,77	4.153,64	4.137,39
HFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	1,37	1,70	2,11	2,63	3,26
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,05	0,05	0,08	0,11	0,17
Total (including LULUCF)	**34.157,22**	**35.562,27**	**14.901,95**	**10.109,58**	**7.995,15**	**9.058,18**	**9.829,65**	**8.855,49**	**9.375,34**	**6.592,64**
Total (excluding LULUCF)	**49.723,33**	**50.932,98**	**30.301,08**	**24.287,71**	**22.688,48**	**21.914,46**	**23.240,91**	**22.761,41**	**23.666,09**	**20.883,64**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	33.599,33	35.770,37	20.092,45	16.091,25	15.134,46	14.177,44	14.695,76	14.234,68	14.958,55	12.543,05
2. Industrial Processes	4.127,47	4.148,66	2.382,91	1.458,46	1.555,33	1.898,20	2.328,09	2.247,12	2.614,17	2.563,74
3. Solvent and Other Product Use	100,50	100,59	100,48	100,00	99,31	98,55	97,80	97,09	96,38	95,70
4. Agriculture	10.588,36	9.689,00	6.642,01	5.561,60	4.856,23	4.699,68	5.067,50	5.090,23	4.871,74	4.650,03
5. Land Use, Land-Use Change and Forestry[5]	-15.566,11	-15.370,71	-15.399,14	-14.178,12	-14.693,34	-12.856,28	-13.411,26	-13.905,92	-14.290,75	-14.291,00
6. Waste	1.307,66	1.224,37	1.083,24	1.076,40	1.043,15	1.040,60	1.051,75	1.092,30	1.125,26	1.031,12
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[5]	**34.157,22**	**35.562,27**	**14.901,95**	**10.109,58**	**7.995,15**	**9.058,18**	**9.829,65**	**8.855,49**	**9.375,34**	**6.592,64**

TABLE 10 EMISSION TRENDS

SUMMARY

(Part 2 of 2)

Inventory 2008

Submission 2008 v1.3

LITHUANIA

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	-1.911,69	-874,58	-209,77	389,98	-106,96	391,49	749,67	2.859,24	1.504,00	-92,66
CO_2 emissions excluding net CO_2 from LULUCF	12.031,48	12.785,88	12.936,18	12.912,66	13.542,58	14.324,71	14.550,35	15.933,83	15.217,26	-57,84
CH_4 emissions including CH_4 from LULUCF	3.085,41	3.222,07	3.193,31	3.308,75	3.310,32	3.302,00	3.406,07	3.494,54	3.429,46	-46,08
CH_4 emissions excluding CH_4 from LULUCF	3.083,37	3.221,37	3.188,80	3.305,98	3.308,71	3.301,68	3.398,42	3.494,30	3.428,73	-46,08
N_2O emissions including N_2O from LULUCF	4.290,85	4.553,46	4.835,06	4.993,05	5.161,82	5.389,23	5.845,96	6.103,28	5.738,39	-21,33
N_2O emissions excluding N_2O from LULUCF	4.269,00	4.531,67	4.812,80	4.970,85	5.139,65	5.367,18	5.823,15	6.081,11	5.716,04	-21,41
HFCs	4,06	5,05	6,44	8,62	11,55	15,11	19,31	24,05	29,92	100,00
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00
SF_6	0,22	0,30	0,40	1,93	0,86	1,38	0,99	0,84	0,03	100,00
Total (including LULUCF)	**5.468,86**	**6.906,30**	**7.825,44**	**8.702,34**	**8.377,59**	**9.099,21**	**10.022,00**	**12.481,96**	**10.701,79**	**-68,67**
Total (excluding LULUCF)	**19.388,14**	**20.544,27**	**20.944,62**	**21.200,05**	**22.003,34**	**23.010,06**	**23.792,21**	**25.534,13**	**24.391,98**	**-50,94**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	11.034,84	11.750,36	11.843,57	11.855,93	12.499,66	13.191,72	13.301,50	13.511,52	13.275,08	-60,49
2. Industrial Processes	2.746,22	2.949,80	3.122,76	3.144,34	3.285,04	3.626,99	3.763,09	5.540,34	4.872,57	18,05
3. Solvent and Other Product Use	95,03	94,54	94,21	93,80	93,30	92,72	92,17	91,67	91,19	-9,27
4. Agriculture	4.416,74	4.626,68	4.846,85	5.009,34	4.998,65	4.987,80	5.490,00	5.225,34	5.011,96	-52,67
5. Land Use, Land-Use Change and Forestry[5]	-13.919,28	-13.637,97	-13.119,18	-12.497,71	-13.625,75	-13.910,85	-13.770,20	-13.052,17	-13.690,19	-12,05
6. Waste	1.095,30	1.122,89	1.037,23	1.096,65	1.126,69	1.110,83	1.145,45	1.165,25	1.141,18	-12,73
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total (including LULUCF)[5]	**5.468,86**	**6.906,30**	**7.825,44**	**8.702,34**	**8.377,59**	**9.099,21**	**10.022,00**	**12.481,96**	**10.701,79**	**-68,67**

[1] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[2] Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[3] 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_2 equivalent emissions.

[4] In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

[5] Includes net CO_2, CH_4 and N_2O from LULUCF.

Annex 2. National GHG emission factors for energy sector

No.	Fuel use category	Fuel type: **COAL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SD*
1.	Power plants	95	0.714xS%	0.36	0.097	0.015	0.002	0.015	0.04365xAs%
2.	Heat boiler houses	95	0.714xS%	0.36	0.097	0.015	0.003	0.015	0.04365xAs%
3.	Industry	95	0.714xS%	0.20	0.367	0.015	0.003	0.015	0.04365xAs%
4.	Small companies	95	0.714xS%	0.20	2.6	0.114	0.004	0.085	0.04365xAs%
5.	Households	95	0.714Xs%	0.15	4.8	0.300	0.040	0.114	0.04365xAs%

No.	Fuel use category	Fuel type: **FUEL WOOD** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	102	0.13	0.13	0.16	0.032	0.004	0.048	0.205
2.	Heat boiler houses	102	0.13	0.13	0.16	0.032	0.004	0.048	0.205
3.	Industry	102	0.13	0.13	0.16	0.032	0.004	0.048	0.205
4.	Small companies	102	0.13	0.10	2.5	0.196	0.003	0.230	0.205
5.	Households	102	0.13	0.05	5	0.400	0.003	0.600	0.205

No.	Fuel use category	Fuel type: **NATURAL GAS** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	56.9	0.0003	0.160	0.020	0.0025	0.001	0.0025	0.0015
2.	Heat boiler houses	56.9	0.0003	0.160	0.025	0.0040	0.001	0.0040	0.0015
3.	Industry	56.9	0.0003	0.080	0.050	0.0040	0.001	0.0040	0.0015
4.	Small companies	56.9	0.0003	0.080	0.050	0.0050	0.001	0.0050	0.0015
5.	Households	56.9	0.0003	0.050	0.050	0.0050	0.001	0.0050	0.0015
6.	Transport								
6.1.	Road transport	56.9	0.0003	0.439	3.313	0.0192	0.001	0.5680	0.0020

No.	Fuel use category	Fuel type: **ORIMULSION** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	81	1.93	0.24	0.13	0.003	0.0025	0.003	0.0919

No.	Fuel use category	Fuel type: **GAS OIL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	74	0.468xS%	0.150	0.130	0.0015	0.002	0.0015	0.0237
2.	Heat boiler houses	74	0.468xS%	0.150	0.150	0.0015	0.002	0.0015	0.0237
3.	Industry	74	0.468xS%	0.100	0.190	0.0015	0.002	0.0015	0.0237
4.	Small companies	74	0.468xS%	0.050	0.200	0.0015	0.002	0.0015	0.0237
5.	Households	74	0.468xS%	0.050	0.300	0.0015	0.002	0.0015	0.0237

No.	Fuel use category	Fuel type: **PETROL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*

6.	Transport		S = 0.05%						
6.1.	Road transport	73	0.022	0.666	7.4	0.0743	0.002	1.2562	0.0014

No.	Fuel use category	Fuel type: **KEROSENE** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants								
2.	Heat boiler houses			0.1	0.1				
3.	Industry	74	0.022	0.100	0.100	0.0020	0.0015	0.002	0.011
4.	Small companies	74	0.022	0.050	0.190	0.0020	0.0015	0.002	0.011
5.	Households	74	0.022	0.050	0.190	0.0020	0.0015	0.002	0.011
6.	Transport								
6.1.	Road transport								
6.2.	Railway transport								
6.3.	Water transport								
6.4.	Air transport	74	0.022	0.326	0.326	0.0010	0.0015	0.059	0.016
6.5.	Agricultural machines								

No.	Fuel use category	Fuel type: **OTHER PROCESSED FUEL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	95	0.714xS%	0.36	0.097	0.015	0.002	0.015	0.04365xAs%
2.	Heat boiler houses	95	0.714xS%	0.36	0.097	0.015	0.003	0.015	0.04365xAs%
3.	Industry	95	0.714xS%	0.20	0.367	0.015	0.003	0.015	0.04365xAs%
4.	Small companies	95	0.714xS%	0.20	3.650	0.114	0.004	0.085	0.04365xAs%
5.	Households	95	0.714xS%	0.15	4.8	0.300	0.004	0.114	0.04365xAs%

No.	Fuel use category	Fuel type: **COMBUSTIBLE AUXILIARY ENERGY RESOURCES** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	78	0.468xS%	0.24	0.13	0.0035	0.0025	0.0035	0.25xAs%
2.	Heat boiler houses	78	0.468xS%	0.19	0.17	0.0035	0.0025	0.0035	0.25xAs%
3.	Industry	78	0.468xS%	0.15	0.20	0.0032	0.0025	0.0032	0.25xAs%
4.	Small companies	78	0.468xS%	0.15	0.20	0.0032	0.0025	0.0032	0.25xAs%
5.	Households	78	0.468xS%	0.15	0.30	0.0030	0.0025	0.0030	0.25xAs%

No.	Fuel use category	Fuel type: **CRUDE OIL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	78	0,488xS%	0,150	0,13	0,0015	0,002	0,0015	0,249xAs%
2.	Heat boiler houses	78	0,488xS%	0,150	0,15	0,0015	0,002	0,0015	0,249xAs%
3.	Industry	78	0,488xS%	0,100	0,19	0,0015	0,002	0,0015	0,249xAs%
4.	Small companies	78	0,488xS%	0,050	0,20	0,0015	0,002	0,0015	0,249xAs%
5.	Households	78	0,488xS%	0,050	0,30	0,0015	0,002	0,0015	0,249xAs%
6.	Transport								
6.1.	Road transport								
6.2.	Railway transport								
6.3.	Water transport								
6.4.	Air transport								
6.5.	Agricultural machines	78	0,488xS%	1,171	0,468	0,0094	0,002	0,178	0,249xAs%

No.	Fuel use category	Fuel type: **PEAT** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	102	0,3	0,30	0,032	0,032	0,004	0,048	0,164xAs%
2.	Heat boiler houses	102	0,3	0,30	0,032	0,032	0,004	0,048	0,164xAs%
3.	Industry	102	0,3	0,21	0,12	0,032	0,004	0,048	0,164xAs%
4.	Small companies	102	0,3	0,141	0,18	0,140	0,004	0,130	0,164xAs%

5.	Households	102	0,3	0,141	4,30	0,389	0,004	0,225	0,164xAs%

No.	Fuel use category	Fuel type: **OTHER NATURAL FUEL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	102	0,18	0,13	0,16	0,032	0,004	0,048	0,17xAs%
2.	Heat boiler houses	102	0,18	0,13	0,16	0,032	0,004	0,048	0,17xAs%
3.	Industry	102	0,18	0,13	0,16	0,032	0,004	0,048	0,17xAs%
4.	Small companies	102	0,18	0,10	2,5	0,196	0,003	0,230	0,17xAs%
5.	Households	102	0,18	0,05	5,0	0,400	0,003	0,600	0,17xAs%

No.	Fuel use category	Fuel type: **HEAVY FUEL OIL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	78	0,488xS%	0,24	0,130	0,0035	0,0025	0,0035	0,249xAs%
2.	Heat boiler houses	78	0,488xS%	0,19	0,170	0,0035	0,0025	0,0035	0,249xAs%
3.	Industry	78	0,488xS%	0,15	0,200	0,0032	0,0020	0,0032	0,249xAs%
4.	Small companies	78	0,488xS%	0,15	0,200	0,0032	0,0025	0,0032	0,249xAs%
5.	Households	78	0,488xS%	0,15	0,300	0,0030	0,0025	0,0030	0,249xAs%
6.	Transport								
6.1.	Road transport								
6.2.	Railway transport								
6.3.	Water transport	78	0,488xS%	1,46		0,0020		0,0648	0,260xAs%
6.4.	Air transport								
6.5.	Agricultural machines								

No.	Fuel use category	Fuel type: **DIESEL FUEL OIL** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*

			S=0,2% S=0,05%						
1.	Power plants	74	0,094/0,023	0,150	0,130	0,0015	0,002	0,0015	0,0237
2.	Heat boiler houses	74	0,094/0,023	0,150	0,150	0,0015	0,002	0,0015	0,0237
3.	Industry	74	0,094/0,023	0,100	0,150	0,0015	0,002	0,0015	0,0237
4.	Small companies	74	0,094/0,023	0,050	0,200	0,0015	0,002	0,0015	0,0237
5.	Households	74	0,094/0,023	0,050	0,300	0,0015	0,002	0,0015	0,0237
6.	Transport								
6.1.	Road transport	74	0,094/0,023	0,534	0,570	0,0033	0,004	0,1130	0,1012
6.2.	Railway transport	74	0,094/0,023	1,100	0,470	0,0050	0,003	0,2250	0,1012
6.3.	Water transport	74	0,094/0,023	1,160	0,258	0,0030	0,003	0,1110	0,1012
6.4.	Air transport								
6.5.	Agricultural machines	74	0,094/0,023	1,171	0,468	0,0094	0,002	0,1780	0,1012

No.	Fuel use category	Fuel type: **AVIATION GASOLINE** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants								
2.	Heat boiler houses								
3.	Industry								
4.	Small companies								
5.	Households								
6.	Transport		S=0,01%						
6.1.	Road transport								
6.2.	Railway transport								
6.3.	Water transport								
6.4.	Air transport	72	0,005	0,196	1,268	0,0869	0,002	0,8182	0,0116
6.5.	Agricultural machines								

No.	Fuel use category	Fuel type: **LIQUIFIED PETROLEUM GAS** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*

1.	Power plants								
2.	Heat boiler houses	65		0,160	0,010	0,0025	0,0015	0,0025	
3.	Industry	65		0,160	0,010	0,0025	0,0015	0,0025	
4.	Small companies	65		0,100	0,041	0,0025	0,0015	0,0025	
5.	Households	65		0,100	0,050	0,0010	0,0010	0,0021	
6.	Transport								
6.1.	Road transport	65		0,898	1,610	0,0192	0,0020	0,3585	

No.	Fuel use category	Fuel type: **OTHER PRODUCTS OF REFINERY** Emission factor, kg/GJ							
		CO_2	SO_2	NO_x	CO	CH_4	N_2O	NMVOC	SP*
1.	Power plants	74	0,468xS%	0,150	0,130	0,0015	0,002	0,0015	0,024
2.	Heat boiler houses	74	0,468xS%	0,150	0,150	0,0015	0,002	0,0015	0,024
3.	Industry	74	0,468xS%	0,100	0,190	0,0015	0,002	0,0015	0,024
4.	Small companies	74	0,468xS%	0,050	0,200	0,0015	0,002	0,0015	0,024
5.	Households	74	0,468xS%	0,050	0,300	0,0015	0,002	0,0015	0,024

No.	Fuel use category	Fuel type: **SHALE OIL** Emission factor, kg/GJ							
		CO_2	SO2	NOx	CO	CH4	N2O	NMVOC	SP*
1.	Power plants	74	0,37	0,150	0,130	0,0015	0,002	0,0015	0,024
2.	Heat boiler houses	74	0,37	0,150	0,150	0,0015	0,002	0,0015	0,024
3.	Industry	74	0,37	0,100	0,190	0,0015	0,002	0,0015	0,024
4.	Small companies	74	0,37	0,050	0,200	0,0015	0,002	0,0015	0,024
5.	Households	74	0,37	0,050	0,300	0,0015	0,002	0,0015	0,024

Here: S% - sulphur content of fuel %
As% - ash content of fuel %
SD* - solid particles