

Ministry of Environment of the Republic of Lithuania

**Policies & Measures and
Projections of Greenhouse Gas
Emissions in Lithuania**

**Report pursuant to Article 3(2) of the European Parliament and
Council Decision No 280/2004/EC concerning a mechanism for
monitoring Community GHG emissions and for implementing
the Kyoto Protocol**

Vilnius - 2011

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1 Introduction

Lithuania has signed the United Nations Convention on Climate Change (UNFCCC) as an Annex I Party in 1992 and ratified it in 1995, signed the Kyoto Protocol in 1998 and ratified in 2002. Lithuania undertook to reduce its greenhouse gas emissions by 8% below 1990 levels during the first commitment period 2008-2012.

As a member of the European Union, Lithuania is obliged to report to the Commission, in accordance with the Decision 280/2004/EC of the European Parliament and the Council, information on national policies and measures which limit and/or reduce greenhouse gas emissions by sources or enhance removals by sinks, as well as national projections of greenhouse gas emissions by sources and their removal by sinks as a minimum for the years 2005, 2010, 2015 and 2020.

The report presents GHG projections to 2020 in accordance 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 report is based on available information and existing plans and strategies on development of the Lithuanian economy and its separate sectors.

The report is started with description of the general status and development of the Lithuanian economy in Section 2.

Section 3 provides description of national policies and measures in different sectors.

Section 4 contains description of GHG emission projections for separate sectors - energy, industrial processes, agriculture, land use, land use change and forestry, and waste management.

Section 5 contains basic data on aggregate emission of GHG in CO₂ equivalents.

2 Greenhouse gas emissions in 1990–2009

Lithuanian economics have declined substantially after declaration of independence in 1990. In 1994 GDP dropped to 54% of 1989 level but later started to increase again. GDP growth reached 7.3% in 1998 but, as a result of banking crisis in Russia, decreased again in 1999. Since 2000, GDP was growing continuously, average annual increase in 2000-2005 was 7%, average GDP change from 1995 to 2005, including the decline during the banking crisis in Russia, was 5.7%.

As a result of the global economical crisis Lithuania's economic development has slowed down by the end of 2008. In 2008 GDP growth has decreased by 2.9% and in 2009 GDP contracted by 14.7% causing corresponding reduction of GHG emissions.

Greenhouse gas (GHG) emissions decreased significantly as a consequence of the reconstruction of economy: the decline in industrial production engendered a sharp decrease in fuel consumption and, as a result, in greenhouse gas emissions (Fig. 2-1). Once rehabilitation of the economy started, reductions were also achieved through energy efficiency and measures taken to reduce emissions.

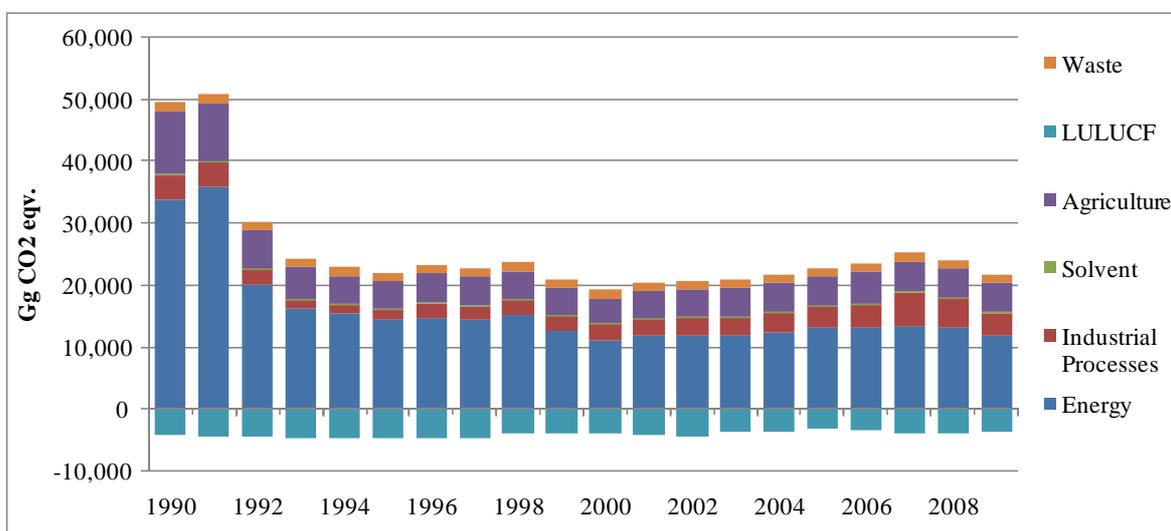


Fig. 2-1. Greenhouse gas emissions in Lithuania by sector in 1990-2009

Aggregated emissions of GHG expressed in Gg CO₂ equivalent (without CO₂ removals and emissions from the LULUCF sector) in 2009 have decreased by approximately 56% compared to the base year (1990).

Emissions of all three gases were increasing continuously from 2000 to 2007 but some reduction of emissions was observed in 2008-2009 (Fig. 2-2). Emission variations actually follow fluctuation of industrial output as reflected by the growth of GDP.

Overall CO₂ emissions in 2009 compared to 2008 decreased by 1832 Gg including LULUCF (-16.6%) or 2033 Gg excluding LULUCF (-13.5%). Overall CO₂ emissions (excluding LULUCF) from 1990 have been reduced by 23,455 Gg (64.4%).

CO₂ emissions in energy sector in 2009 decreased by 9.0% compared to 2008 mainly due to reduction of fuel consumption in transport and manufacturing sectors in which CO₂ emissions were reduced by 17.3% and 19.4% accordingly.

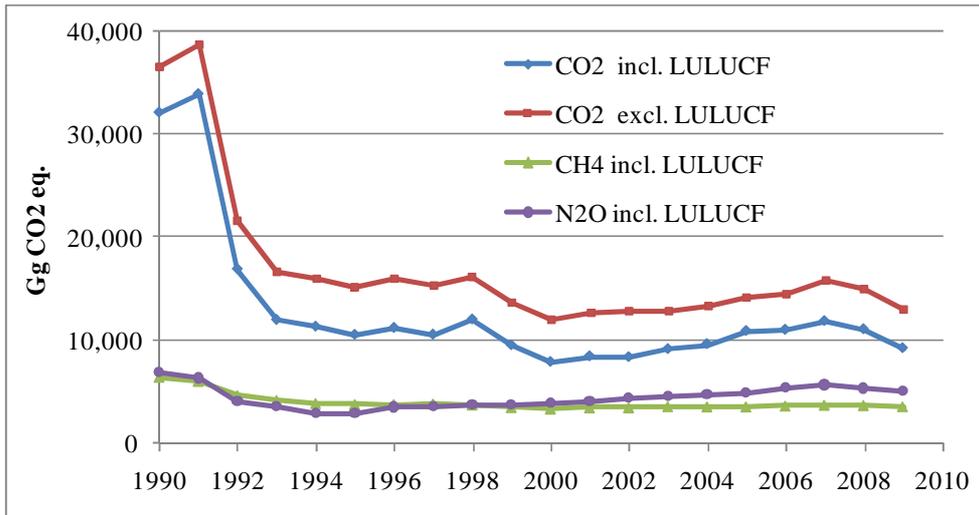


Fig. 2-2. Trends of GHG emissions by gas in CO₂ equivalent, Gg

As a result of significant contraction of industrial output caused by economic recession, CO₂ emissions in mineral products manufacturing sector in 2009 decreased by 41.1% compared to 2008. Corresponding reduction of CO₂ emissions in chemical industries reached 34.3%.

Overall methane emissions in 2009 compared to 2008 decreased by 5.2 Gg (3.0%) mainly due to reduction of number of cattle.

Overall N₂O emissions in 2009 compared to 2008 decreased by 0.9 Gg (5.3%) mainly due to contracted nitric acid production.

3 Information on national policies and measures

3.1 National Strategy for Implementation of the UNFCCC till 2012

National Strategy for Implementation of the UNFCCC till 2012 (Official Gazette, 2008, Nr. 19-685) was adopted in January 2008. The Strategy defines the priorities and principles of the UNFCCC and the Kyoto Protocol to 2012. The objectives of the Strategy are: to ensure more effective monitoring of climate change; to ensure the assessment of vulnerability of the landscape, ecosystems and biological diversity, and planning of the agreeable adoption options; to reduce the impact of energy, industry, transport, agricultural and forestry sectors on the climate; to upgrade waste management systems with a view to reducing the generation of greenhouse gases and their impact on the climate; to reduce the impact of climate change on human health; and, to develop research and to raise public awareness in combating the climate change. The Strategy defines the goals and mitigation as well as adaptation measures to reach the above listed objectives. Among the measures are the following: to create a system for public information on the climate change and impact on human health; to increase the forest area by 3-5%; and to enhance the development of ecological farms.

3.2 Policies and measures

3.2.1 Cross-cutting policies

EU emission trading scheme

In January, 2005, the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) commenced operation as the largest multi-country, multi-sector Greenhouse Gas emission trading scheme in the European Union.

The scheme is based on Directive 2003/87/EC, which entered into force on 25 October 2003. For the implementation of the Directive, establishing a scheme for greenhouse gas emission allowance trading, the Order of the Minister of Environment of the Republic of Lithuania No. D-231 "On the Approval of Guidelines of the Procedure for the Issue and Trade in Greenhouse Gas Emission Allowances" was approved on 29 April 2004.

General description and background information on the National registry has been included in the Lithuania's Initial Report, submitted to the UNFCCC. Lithuanian Registry has been completely operational since 2005. Secretariat completed the live connection between the UNFCCC International Transaction Log (ITL) and the Lithuanian Registry on the 6th of October, 2008. The whole process was synchronized between ITL, the European Union Community Independent Transaction Log (CITL) and 26 EU greenhouse gas emissions trading registries in 2008. There was a migration of registry data from GRETA (UK) to Community Registry (EC) software in October 2009, followed by the successfully performed EU ETS and Annex H of Data Exchange Standards for Registry Systems under the Kyoto Protocol (Technical specifications) tests.

Lithuanian National allocation plan for the second trading period (2008-2012) has been approved by Ministers of Environment and Economy on 19th of November, 2007.

The existing installations in Lithuania have been allocated 35.7 million emission allowances for the period 2008 to 2012. In addition to that there is a reserve for new entrants that amounts to 7.2 million tonnes of carbon dioxide for the entire period.

National development strategies

In the **Long-term Development Strategy of the State** (Official Gazette, 2002, Nr. 113-5029) environmental protection stands out as one of the basic targets ensuring secure growth of the Lithuanian society. The targets are determined for water, air, soil, waste and other sectors.

The **Long-term Economic Development Strategy of Lithuania until 2015** (Official Gazette, 2002, Nr. 60-2424) is an integral part of the Long-term Development Strategy of the State. It sets forth long-term economic policy trends that are essential for acceleration of the national economy restructuring and also enabling adaptation to changes of the internal and international situation as well as maximum increase and effective use of the national economic potential.

The National Lisbon Strategy Implementation Programme (Official Gazette, 2008, Nr. 124-4718). The Government of the Republic of Lithuania approved the National Lisbon Strategy Implementation Programme for 2008–2010 (hereinafter referred to as the Programme) by its Resolution No. 1047 adopted on 1 October 2008. The Programme identifies the goals for the national economy growth and employment promotion as well as their implementation measures containing measures related to the development of low carbon economy with a positive effect on climate change. It also sets the key indicative targets and aspirations of Lithuania until 2010.

In September 2009, the **National Sustainable Development Strategy** (Official Gazette, 2003, No. 89-4029; 2009, No. 121-5215) was updated, which can also be considered as a major step forward. It sets out the sustainable development priorities, principles, objectives and tasks of Lithuania, defines the strengths, weaknesses, opportunities and threats of the country's development, and provides an updated list of national sustainable development indicators and responsible authorities. Once more, energy and climate change issues are put forward, with a particular focus on energy security.

In 2010 a draft of **the National Reform Programme** was developed. The Programme summarises the main structural reforms that Lithuania projects in its effort to eliminate obstacles to economic growth and achieve the nationally established quantitative targets in the context of the Europe 2020 strategy.

Lithuania's National Reform Programme provides an overview of the present situation in the areas evaluated by the quantitative targets, their projections for 2015 and 2020 and priorities for action planned to achieve the identified national-level objectives. The progress when moving in the intended direction will be measured by five quantitative targets and one of them is energy and climate change. Key policy directions in energy and climate change are: increasing the use of renewable energy sources, improving energy efficiency and limiting greenhouse gas emissions.

The programme does also introduce the main measures foreseen in implementing the priority actions, reviews the related strategies, their duration, the institutions with lead responsibility and the scheduled budgetary support. Sustained macroeconomic stability remains the guiding principle in planning the structural reforms.

Besides to the aspects of thematic coordination, the National Reform Programme does also identify key structural obstacles to successfully reducing unemployment, raising productivity levels and reorienting economic activity towards the high value-added activities and trade sectors. The headline directions for removing those bottlenecks include structural reforms in energy, transport, education, social and healthcare infrastructures, creating an inclusive labour market, increasing the share of services in the Lithuanian export structure, improvements in the business environment to encourage entrepreneurship and attract foreign investments.

Lithuania's National Reform Programme is coordinated with existing planning and strategic documents to be implemented by the government as well as the Convergence Programme. The

aspects of the sustainability of the public finances and the stability of the financial sector are considered in the latter.

The National Energy (Energy Independence) Strategy was developed by the Ministry of Energy and endorsed by the Government in 2010. The Strategy defines the main objectives of the Lithuanian state in the energy sector, setting national targets for implementation of strategic initiatives through the years 2020, 2030 and 2050. The main goal of the Strategy is Lithuania's energy independence before the year 2020. The initiatives outlined in the Strategy will have a positive impact on the environment – by 2020 Lithuania will reduce CO₂ emissions by 23% (compared to 2008). In 2020 Lithuanian energy sector will be fully independent of energy supply.

The National Renewable energy sources development strategy (Official Gazette, 2010, Nr. 73-3725) and **Action Programme** (Official Gazette, 2010, Nr. 78-4030) were adopted in 2010.

The main goal of the strategy – to increase renewable energy sources share in energy balance; to satisfy energy demand with domestic resources in electricity, heat production and transport sectors; to eliminate the use of imported fossil fuel; to increase energy supply safety, energy independence and to contribute to international endeavours to reduce greenhouse gas emissions. The strategy sets the target to increase use of renewable energy sources in energy sector from 15.3% in 2008 to 23% in 2020.

In February 2009, the Government approved the **Economy Stimulation Plan (ESP)** providing for EUR 1.65 billion support for business. One of the five parts of the Plan concerns the extension of energy efficiency of buildings. The measures in this field comprise an envelope of EUR 232 million from the Structural Funds dedicated to the insulation of public buildings and EUR 290 million from the Structural Funds and from EIB loans for the multi-apartment house modernization program. As a result of energy efficiency of buildings the proportion of energy expenses, especially heating, is expected to decrease in the households' budgets.

After the termination of the **National Environmental Strategy** (Official Gazette, 1996, Nr. 103-2347) a new National Environmental Strategy is started to be developed in 2011. The Strategy provides the main objectives, tasks and the regulations that have to be implemented for the sustainable development of different environmental sectors by 2020.

Long term Lithuanian transport system development strategy up to 2025 adopted by the Resolution of the Government in 2005 (Official Gazette, 2005, Nr. 79-2860) sets the general direction and different targets of transport policy including transport development and environmental protection directly related with UNFCCC and Kyoto regulating areas: local renewable energy sources should satisfy up to 15% Lithuanian fuel needs up to 2025 and the conditions should be created to satisfy 15% of fuel used in transport sector by producing biodiesel and bioethanol. Middle range targets (up to 2013) have to help better organize and regulate transport traffic seeking to reduce air pollution and noise and to attain that air pollution and noise in cities do not exceed established normative. The short term targets are: to create economic and legal conditions to develop more environmentally friendly and more safe transport, increase use of liquefied and natural gas or low sulphur heavy fuel oil and alternatives such as biodiesel and bioethanol.

Law on Environmental Protection (Official Gazette, 2002, Nr. 2-49 and subsequent amendments) defines responsibilities of various institutions in the area of environmental protection, the main environmental issues and ways of their solution.

Detailed procedures for JI and CDM projects implementation are laid down in the **Guidelines for the implementation of Kyoto protocol JI and CDM projects**, adopted by the Order No D1-470 of the Minister of Environment in June 2010 (Official Gazette, 2010, No 66-3304).

Law on Environmental Pollution Tax (Official Gazette, 1999, Nr. 47-1469 and subsequent amendments) establishes taxpaying procedure and control. Its basic goals are: to employ economic measures for encouraging polluters to mitigate pollution of the environment, to pursue waste prevention and management, not to exceed the limits imposed on waste discharged into the atmosphere, and to accumulate income for the implementation of environment protection measures. Tax-exemption cases are foreseen for the pollution from stationary.

Law on Ambient Air Protection (Official Gazette, 1999, Nr. 98-2813) is the main legal act harmonizing the general requirements of Lithuania in the area of air protection with those of the EU establishing the fundamental requirements for ambient air quality assessment and management, and setting out the principles regulating ambient air pollution from mobile sources.

Law on Environmental Monitoring (Official Gazette, 2006, Nr. 57-2025) sets the fundamental principles of environmental monitoring in Lithuania. The Law requires continuous and systematic observation of the state of the natural environment and its elements in the territory of the Republic of Lithuania, systematization, evaluation and forecast of the spontaneous changes and the changes caused by an anthropogenic impact occurring in the natural environment, tendencies of changes in the natural environment and possible consequences. Information concerning the state of the natural environment required to ensure sustainable development, adoption of decisions regarding territorial planning and social development, for scientific and other needs are to be accumulated, analysed and provided to state institutions and the public.

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. Under the new law, a National Strategy for Climate Change Management Policy covering most areas of public administration is to be drafted by the relevant ministries together with a Plan of implementation measures in 2012. This Strategy will enter into force in 2013 after termination of the National Strategy for the Implementation of the UNFCCC until 2012. It is foreseen in the Law on Financial Instruments for Climate Change Management that for the sake of development and raising of additional funding for the measures of climate change management, a **Special Program for Climate Change** is composed. The Program funds are kept in a separate State Treasury account. Income and expenses of the Program shall be planned in the budget of the state according to the special principles of the funding program. The Program funds are used for implementation of the GHG emission reduction projects under Green investment Scheme (GIS). A development of GIS started in the early 2009, when it became clear that in order to proceed with AAUs surplus sales, a new mechanism must be established. Under the Law on Financial Instruments for Climate Change Management GIS established a Special Climate Change Programme generates revenues from AAUs sales and EUAs auctions. The finances of the Programme must be used for mitigation projects or greening activities that minimize greenhouse gasses emissions in Lithuania. The Programme is coordinated by the Ministry of Environment, which is also responsible for the procedural requirements for AAU transactions. Through the Programme, additional funding for climate change mitigation and adaptation measures is to be raised and used for the following:

- energy consumption and production efficiency enhancement processes,
- the promotion of the use of renewable energy resources,
- the introduction of environment-friendly technologies,
- the implementation of the plan of implementation measures of the National Strategy for Climate Change Management Policy
- reforestation and afforestation,
- the provision of information to and education of the public,
- scientific research and dissemination thereof, etc.

It is very important to point out that energy efficiency improvement and renewable energy use are the key areas where the revenues from the AAUs sales and EUAs auctions and other financial income must be used for. The Law on Financial Instruments for Climate Change Management states these types of projects that promote such activities must not get less than 80 % of all the money flow. A secondary legislation, which sets out norms and regulations on further implementation of the GIS was developed in 2010. Those include Minister's Orders on the use of funds from Special Climate Change Programme and a procedural manual on AAUs sales. An establishment of full GIS legislative package was one of the top priorities for the Ministry of Environment for the year 2010.

For the coordination of issues related to formulation and implementation of the national policy on climate change management the **National Climate Change Committee** (established in 2004) was renewed in 2010. The Committee consists of 21 representatives of state institutions (Ministries: Environment, Economy, Energy, Agriculture, Transport and Communications, Finance, Health, Foreign Affairs, etc.), non-governmental organisations, academia and research. Among its main functions are to coordinate the development and implementation of national climate change management strategies and its implementation programs. The Committee also plays an advisory role with regard to the use of funds in the context of the Special Climate Change Programme.

In 2010 the draft **Law on Renewable energy sources** was developed and envisaged to be adopted in the beginning of 2011. The law sets the legal basis for state's management, regulation, supervision and control in the field of renewable energy sources use in energy sector. The provisions of the law regulates relationships between network operators, energy producers using RES and State's supervision and control maintaining institutions in the area of RES use for electricity, heat and fuels production.

The law aims to ensure balanced renewable energy sources use development, to promote new technologies development and produced energy consumption taking into account Lithuania's international obligations, environment protection, fossil fuel saving, dependence on fossil fuels, energy import reduction and other State's energy policy targets.

Basic climate policy instruments

“Polluter pays” principle: waste management expenses should be paid by waste keeper and (or) waste producer (Lithuanian Law on Waste Management (Official Gazette, 1998, Nr. 61-1726 and subsequent amendments)).

Limitation of emissions of volatile organic compounds: legal act of the Ministers of Environment, Social Security and Labour, and Transport and Communications was approved in 2000 and revised in 2001(Official Gazette., 2000, Nr. 108-3470 and subsequent amendments) determining limitations for emissions of volatile organic compounds from modern equipment of petrol storage, distribution and transportation.

Pollution emission standards for large combustion plants (Official Gazette., 2001, Nr. 88-3100 and subsequent amendments)in 2001, the Minister of Environment approved pollution standards for large fuel combusting facilities. This legal act defines not only environment pollution standards but also evaluation rates for air quality parameters.

Product charges: according to the Law on Packaging and Packaging Waste Management (Official Gazette., 2002, Nr. 81-3503), producers and importers not following the instructions of packaging and packaging waste collection, processing and other utilization have to pay charges for products placed on the national market.

Application of excise concessions: the Lithuanian Law on Excises adopted in 2001 and last update in 2010 November (Official Gazette., 2001, Nr. 98-3482 and subsequent amendments) stipulates excise exemption for electrical energy generated using renewable energy resources. Excise

concessions are granted to the part of biofuels corresponding to the part of biological admixtures (%) per ton of a product.

To reduce the unfavourable effect of heat energy on the environment **combined heat and power generation, and heat generation from biofuels and renewable energy resources** is being promoted (the Lithuanian Law on Heat Economy, 2003) (Official Gazette., 2003, Nr. 51-2254).

Raising public awareness about the interrelation between health and environment.

According to the Procedure on the Assessment of the Effects on Certain Plans and Programs on the Environment, adopted by the Government Resolution in 2004 (Official Gazette., 2004, Nr. 130-4650), Law on the Assessment of the Proposed Economic Activity on the Environment (Official Gazette., 1996, Nr. 82-1965 and revised 2005, Nr.84-3105) and other legal acts, the environmental impact assessment (EIA) is carried out to determine, specify and evaluate possible direct and indirect impact of specific plans and programs, planned economic activity on human health, fauna and flora, soil, land surface and its depths, air, water, climate, landscape and biodiversity, material values and immovable cultural values, as well as on the interaction of all these environmental components.

Economic factors for environmental protection: the Strategy of Economic Factors of Environmental Protection is part of the Long-term Economic Development Strategy of Lithuania until 2015, and includes the reform of pollution charges with a view to strengthening their incentive character, introduction of a possibility of emissions trading via the transferability of pollution permits, implementation of an efficient waste management system accompanied and promoted by a wider application of product charges and deposit-refund systems, initiation of the “green budget” reform and establishment of the “green purchases” rule for public procurements, promotion of the subsidiary principle by extending municipal rights and responsibilities in the area of local environmental control.

3.3 Energy sector

3.3.1 Current status of energy sector

As a result of economic recession which started after restoration of independence of Lithuania in 1991, energy consumption decreased considerably in all branches of economy (Fig. 3-1, Fig. 3-2). In 1991–1994, both primary and final energy consumption decreased approximately by 2.1 times.

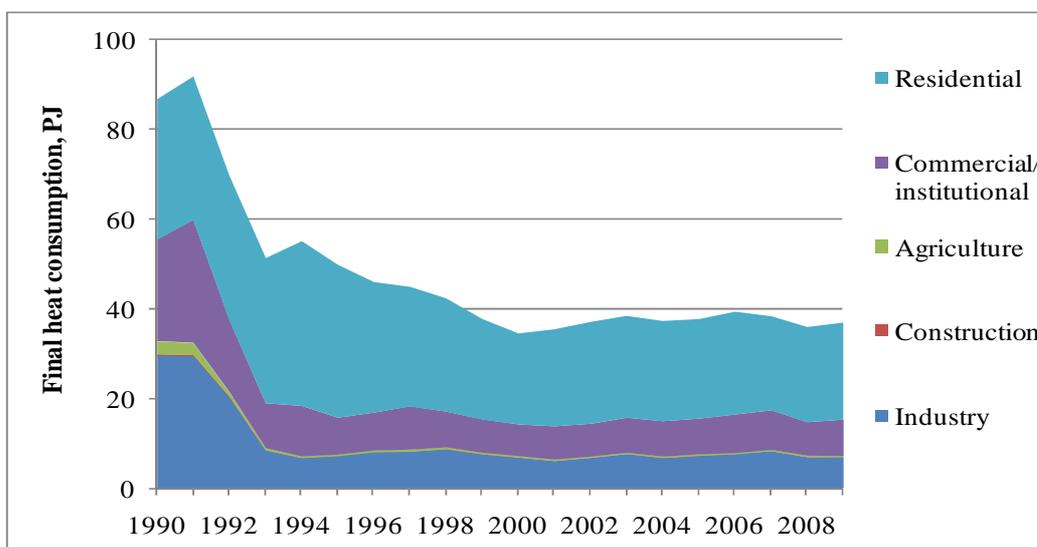


Fig. 3-1. Final heat consumption by sectors in 1990-2009, PJ

(Source: Statistics Lithuania)

When the national economy started to recover between 1995 and 2000, decrease of final energy consumption continued at average annual rate of 3.8%. This was already predetermined by structural changes in the national economy, introduction of new technologies replacing energy-consuming technologies inherited from the past, as well as implementation of other measures improving energy efficiency.

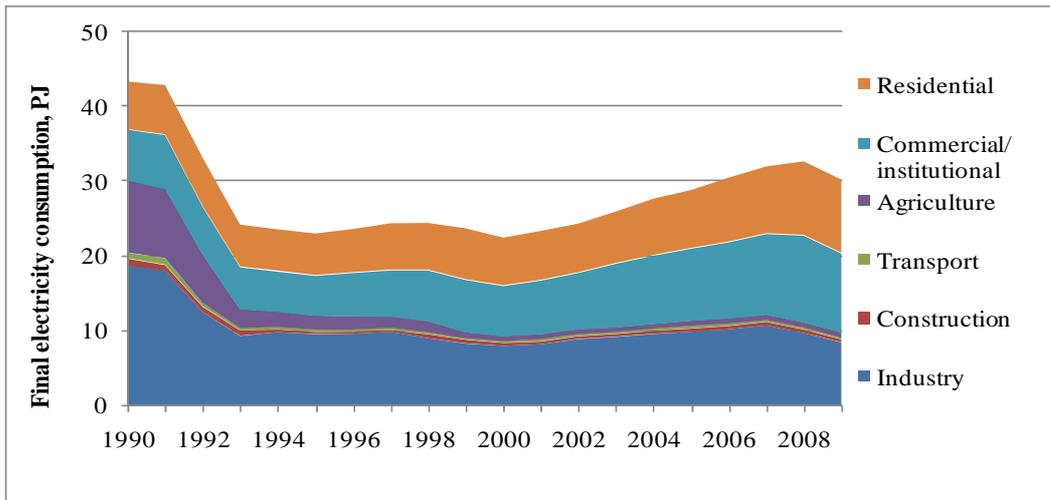


Fig. 3-2. Final electricity consumption by sectors in 1990-2009, PJ

(Source: Statistics Lithuania)

After 2000, the national economy manifested particularly rapid growth. In 2000–2007, gross domestic product (GDP) (at current prices) of Lithuania increased by 2.1 times and amounted to EUR 28 billion in 2007. In the same time, final energy consumption grew by 4.7% on average and increase only 1.4 times, primary energy consumption 1.3 times.

Lithuania has a developed centralized heating system with around 65% of consumed heat produced in centralized systems. The share of centralized heating in the whole heating sector remained fairly constant over the last years.

The major problem in the heating system is inefficiency at the point of consumption – the average yearly heat consumption of Lithuanian buildings is 220 kWh/m², which is substantially higher than the average of Nordic countries (128 kWh/m²). Reducing this inefficiency can bring substantial savings of heating costs and would lower emissions of greenhouse gas.

In addition, the heat is being produced mainly from fossil fuels – approximately 70% is produced from gas, which is imported from a single source. Increasing energy production from renewable energy sources can diversify energy sources for heat production and reduce negative impact of the heating sector on the environment.

Crude oil and natural gas are mainly imported from Russia. In 2008 Lithuania imported 9.13 million tonne of crude oil and 3.12 billion m³ of natural gas. In 2009, because of economic recession, imports were a bit lower, 8.38 million tonne of crude oil and 2.74 billion m³ of natural gas. Small quantities of high quality oil is extracted in Lithuania which is mainly used in manufacturing of lubricants and other petroleum derivatives.

Together with oil and natural gas, major source of energy production in Lithuania was nuclear power (Fig. 3-3).

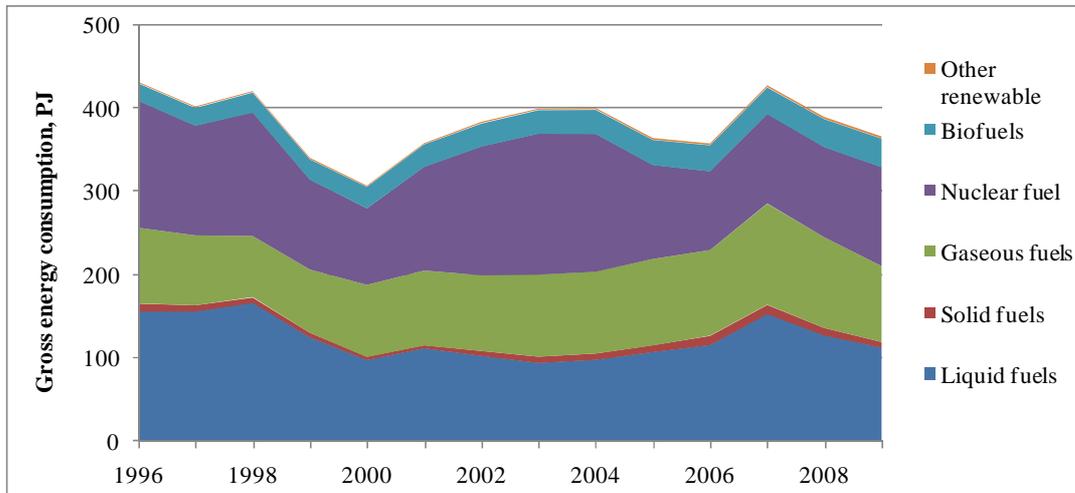


Fig. 3-3. Gross fuel consumption by fuel type in 1996-2009, PJ

The Ignalina Nuclear Power Plant (NPP) played a key role in the Lithuanian energy sector producing up to 70-80% of the electricity until its closure by the end on 2009. It had installed capacity of 3000MW in two RB MK-1500 (large power channel reactor) reactors. The structure of electricity generation in 1990-2009 is shown in (Fig. 3-4).

Capacity of the NPP far exceeded Lithuanian requirements and substantial portion of produced electricity was exported depending on market conditions (Fig. 3-5).

Following the Accession Agreement to the EU, Lithuania closed the first reactor on the 31st December 2004, and the second reactor was closed at the end of 2009. The share of electricity produced in Ignalina NPP has been taken over mainly by the Lithuanian Thermal Power Plant and the largest combined heat and power plants at Vilnius and Kaunas. Thus, the projected energy demand after the decommissioning of Ignalina NPP has been met by using the existing generating capacities.

After shutdown of Ignalina NPP, Lithuania turned from net electricity exporter into net electricity importer. Consequently, Lithuania is facing major shortcomings in electricity production. Around half of the electricity consumed is imported from neighbouring countries, mostly from Russia. The country is also very dependent on electricity produced from fossil fuels which are imported from the single source.

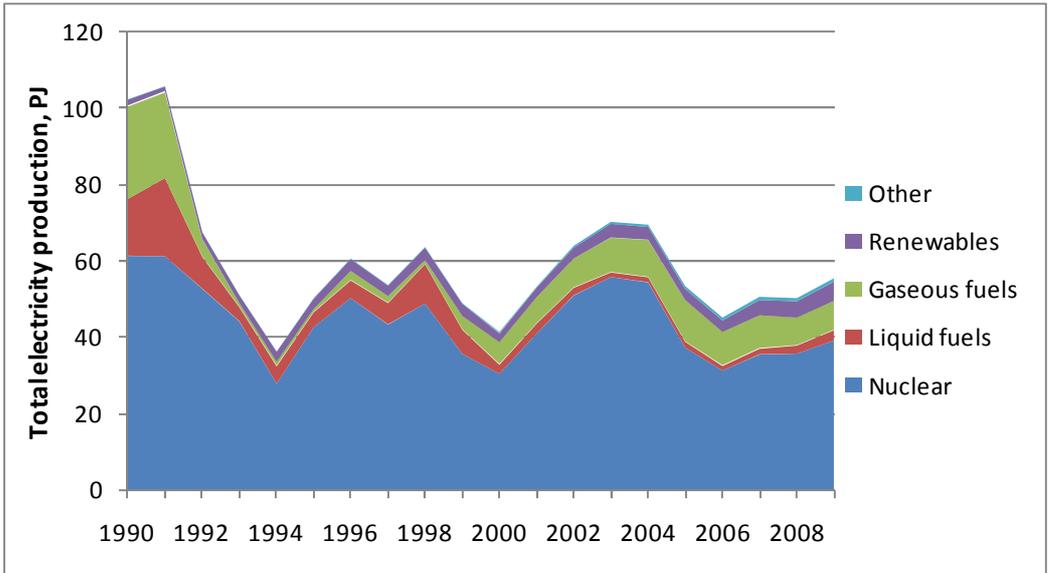


Fig. 3-4. Structure of electricity generation in 1990-2009 by fuel types, PJ

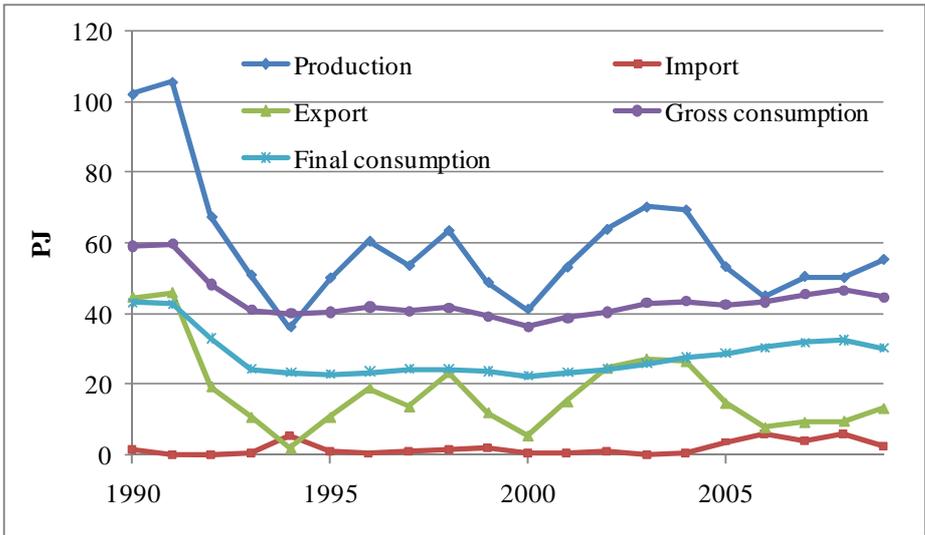


Fig. 3-5. Electricity production and consumption in 1990-2009, PJ

Currently, the share of renewable energy sources in the final energy consumption amounts to around 14%. The largest part of it is covered by biomass, which will continue to play a leading role in the energy production from renewable energy sources. Given Lithuania’s natural conditions, the potential of wind and hydro energy is also not fully exploited yet (Fig. 3-6).

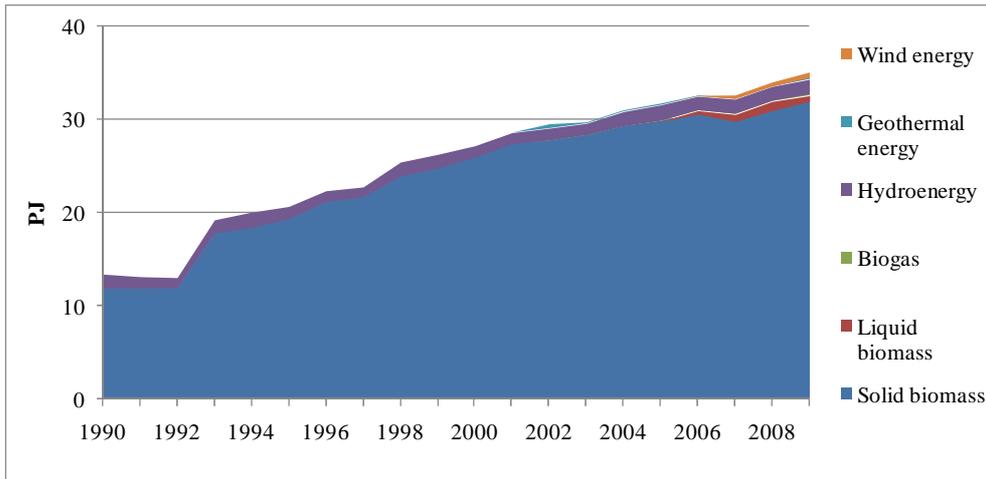


Fig. 3-6. Consumption of renewable resources in 1990-2009, PJ

Though primary and final energy consumption intensity has decreased approximately 50% during the period 1996-2009 (Fig. 3-7), energy intensity per unit of GDP is 2.5 times higher than the EU average. This reveals vast untapped potential for energy efficiency, especially in heating and transport sectors.

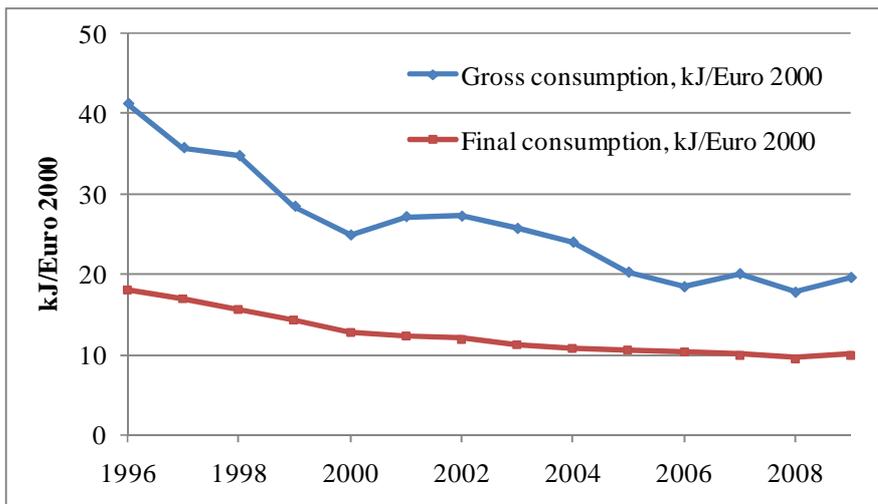


Fig. 3-7. Energy intensity variations in 1996-2009, kJ/Euro 2000

Lithuania's dependence on fossil fuels has caused CO₂ emissions to increase, especially after the closure of the Ignalina NPP. This creates additional difficulties for sustainable development of the energy sector.

3.3.2 Power generation

The National Energy (Energy Independence) Strategy was developed by the Ministry of Energy and endorsed by the Government in 2010. The Strategy defines the main objectives of the Lithuanian state in the energy sector, setting national targets for implementation of strategic initiatives through the years 2020, 2030 and 2050. The main goal of the Strategy is Lithuania's energy independence before the year 2020.

The Strategy outlines a number of initiatives to be achieved in the fields of electricity, heating, gas, oil, renewable energy and energy efficiency.

In power sector, the focus will be on implementation of strategic projects aimed at achieving energy independence including ensuring sufficient local power generation capacities to cover domestic demand (estimated at 12–14 TWh in 2020) through:

- Construction of a new nuclear power plant in Visaginas;
- Increase of electricity generation from renewable energy sources.

3.3.3 Sustainability

Emissions of greenhouse gas and resource depletion will be reduced to make the energy sector sustainable. Nuclear energy and promotion of renewable energy sources will ensure sustainable energy production.

After shutdown of the Ignalina Nuclear Power Plant (NPP) at the end of 2009, local electricity generation capacities are being increased and electricity sector is being restructured in order to ensure competitive and continuous electricity supply. Currently a new electricity generation capacity is being built in Lietuvos elektrinė power plant, internal electricity network is being strengthened, construction of electricity links with Sweden and Poland has been started, and electricity power exchange has been established.

3.3.4 New nuclear power plant

The main strategic project in electricity generation until 2020 is the construction of the Visaginas nuclear power plant. Although the investment is large, it is equal to around 10 years of payments for imported gas to produce the same quantity of electricity. In this regard, the Visaginas NPP is the most viable option to close the electricity supply gap. It will additionally bring a number of benefits. At the same time, the issue of nuclear waste management will be taken care of already in the planning phase of the Visaginas NPP project. The NPP will operate for more than 50 years.

The NPP will provide a high degree of energy independence and power supply for the whole region. The new build will have a favourable impact on the local economy by attracting unprecedented levels of investment to Lithuania, creating jobs and orders for local companies. Visaginas NPP will pay a substantial contribution to curbing CO₂ emissions in the power sector in the Baltic countries. The amount reduced (2.4 million tons) amounts to 10% of CO₂ emissions in 2008. Depending on capacity, the NPP will cost 12.4–15.4 billion LTL. The plant is scheduled to be commissioned in 2020.

3.3.5 Finalization of ongoing projects

Construction of 9th block in Lietuvos elektrinė power plant will be finished (price – 900 million LTL) and 5th block of Kruonis Pumped Storage Plant will be built (price – 300 million LTL).

3.3.6 Heat consumption efficiency

The major problem in the heating system is inefficiency at the point of consumption – the average yearly heat consumption of Lithuanian buildings is 220 kWh/m², which is substantially higher than the average of Nordic countries (128 kWh/m²). Reducing this inefficiency can bring substantial savings of heating costs and would lower emissions of greenhouse gas.

There is a possibility to decrease annual heat consumption of households and public buildings by 2–3 TWh by 2020. Compared to 2009, these savings would amount to 30–40% of final heat consumption. Lithuania will strive to realise most of the identified savings potential, as reducing heat consumption is very beneficial for the state – increased energy independence and positive impact on the local economy, energy consumers – reduced heating bills, and the environment – reduced emissions of greenhouse gas. Lithuania will implement all economically justified energy efficiency initiatives.

3.3.7 Heat Savings in Production and Distribution

Apart from savings in heating consumption, further savings will be sought in production and transportation of heat by identifying of economically viable investments into the network. In heat transmission, as much as 0.4 TWh is expected to be saved by gradual replacement of outdated heat transmission grid. In heat production, savings will be achieved by replacing old less efficient boilers with newer heat production technologies and CHP plants.

3.3.8 Renewable Energy Resources

National renewable energy resources development strategy approved by the Government June 21, 2010, sets the target to increase use of renewable energy resources in energy sector from 15.3% in 2008 to 23% in 2020.

Lithuania will progressively increase the use of renewable energy resources in the production of electricity and heating as well as in the transport sector. The state will aim to reach the target of 23% of renewable energy in final energy consumption in 2020, including no less than 20% of renewable energy in the electricity sector, 60% in the district heating sector and 10% in the transport sector.

Projected use of renewable energy resources is shown in Fig. 3-8.

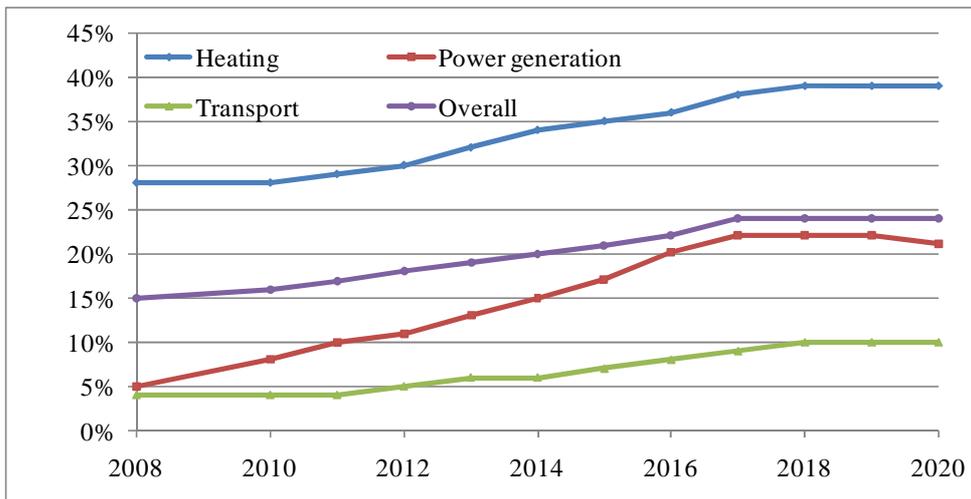


Fig. 3-8. Projected use of renewable energy resources in 2008-2020

Power Generation from Renewable Energy Sources

Power generation from renewable energy sources will be among state’s top priorities in the energy sector. Major focus is put on the use of biomass in the CHP plants and on the use of wind power.

The state will create conditions to reach 500 MW of installed wind capacity by 2020. Priority is also put on full realization of hydro energy.

The state will aim for at least 20% of electricity to be generated from renewable energy sources, mainly coming from biomass CHP plants and wind power plants. In order to reach this goal, Lithuania will have 500 MW of installed wind energy capacity, 10 MW of solar energy, at least 224 MW of biomass, and 153 MW of hydro energy. However, the development of renewable energy sources will not be promoted beyond the technical and economically feasible level.

District heating. Renewable energy sources will cover at least 60% of centralized district heating, mainly by unlocking the biomass potential. In this regard, it is very important to ensure that sufficient biomass resources availability at competitive prices. Infrastructure for wood biomass collection will be developed, proper management of flows of wood products will be ensured and the use of straw substantially increased.

Increasing the share of renewable sources in district heating

Increasing the use of biomass. The state will encourage economically viable investment into heat production from biomass with priority on CHP plants (yearly additional production of 1.4 TWh). Another 1.1 TWh of heat will be produced in biomass boilers. Investment into this production will not increase heat prices.

Utilization of waste energy potential. Waste incineration plants will be first built in or near the largest cities. It is projected that the waste energy plants will produce 0.8 TWh of heat annually. Possible locations for other waste incineration plants will be decided upon on a national level taking into account that it is crucial to ensure that all waste incineration plants get sufficient supply of waste.

Use of solar energy. The use of solar energy for preparation of hot water will be encouraged.

Residual heat. Wherever it is economically feasible, residual heat from electricity plants will be used, a potential example being the proposed Elektrėnai–Kaunas line, allowing use of heat generated by Elektrėnai power plant to provide heat for Kaunas residents.

3.3.9 Impact on GHG emissions

At present Lithuania is facing a major rise in greenhouse gas emissions due to the closure of Ignalina NPP and the resulting increase in use of older thermal power plants.

The potential for the reduction of total emissions by 2020 is 23% compared to the emissions in 2008. The industry, agriculture, and electricity production sectors have most potential for the reduction. There is a potential to reduce the emissions by approximately 20–30% in each of the three sectors. GHG emissions in the transport sector can be curbed by 5–10%.

Measures ensuring reduction of emissions of GHG:

- Promotion of CHPs;
- Increasing energy production from renewable energy sources;
- Increasing efficiency of energy consumption;
- Construction of the Visaginas nuclear power plant.

3.4 Transport sector

3.4.1 *Promotion of biofuels use in transport*

The first biodiesel production plant in Lithuania was put into operation in 2002. At present four biodiesel production plants are in operation with the total nominal capacity 150 thou. tonnes.

Currently bioethanol is produced in two plants with the total capacity 60 thou. tonnes.

The promotion of the production and use of biofuels is foreseen in the Law on Biofuel, Biofuels for Transport and Bio-oils (Official Gazette, 2000, Nr. 64-1940 and subsequent amendments).

The Programme for Promotion of Production and Use of Biofuel in 2004-2010 approved by the Government in 2004 (Official Gazette, 2004, Nr.133-4786) foresees sowing of 66.7 thou. ha under rapeseeds intended for the production of biodiesel and 16.22 thou. ha under cereals intended for the production of bioethanol in 2010.

National renewable energy resources development strategy sets the target to increase use of renewable energy resources in transport sector from 4.3% in 2008 to 10% in 2020.

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.

3.4.2 *Increasing of energy efficiency in transport sector*

The National Energy Efficiency Programme for 2006–2010 (Official Gazette, 2006, Nr. 54-1956) states that the energy efficiency potential in the transport sector is 0,9 TWh. The measures aimed at increasing energy efficiency in transport sector include promotion of public transport by strengthening its competitiveness, investments in new routes of public transport, pedestrian and bicycle tracks, promotion of competitiveness of railway transport by zoning and planning the transport network.

Long term Lithuanian transport system development strategy up to 2025 adopted by the Resolution of the Government in 2005 (Official Gazette, 2005, Nr. 79-2860) sets the general direction and different targets of transport policy including transport development and environmental protection directly related with UNFCCC and Kyoto regulating areas: local renewable energy sources should satisfy up to 15% Lithuanian fuel needs up to 2025 and the conditions should be created to satisfy 15% of fuel used in transport sector by producing biodiesel and bioethanol. Middle range targets (up to 2013) have to help better organize and regulate transport traffic seeking to reduce air pollution and noise and to attain that air pollution and noise in cities do not exceed established normative. The short term targets are: to create economic and legal conditions to develop more environmentally friendly and more safe transport, increase use of liquefied and natural gas or low sulphur heavy fuel oil and alternatives such as biodiesel and bioethanol.

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.

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.

3.5 Industry

For achieving environmental targets, the industry sector should be reorganized: the amount of its waste should be reduced, production should be more ecological and environmentally friendly, natural and energy resources should be saved, secondary raw materials should be processed, multi-use packaging and materials should be produced and utilized, waste (especially hazardous) should be securely managed, and equipment needed for environmental protection should be manufactured. In the programme of the actions undertaken for the reduction of NO_x, SO₂, CO₂, VOC emissions from stationary sources stipulated in Environment Protection Strategy, it is indicated that enterprises should constantly implement the most advanced technologies, not demanding too heavy expenses, and also design, produce and implement technologies for decontamination of volatile organic compounds, and cleaning equipment, and control their utilization.

Pollution prevention in industry

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.

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 CO₂ 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 GgCO₂e/year. Currently the project is under implementation.

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.

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.

JI projects in industry

In December 2009 two JI projects in chemical industry were under implementation: AB "Achema" N₂O emissions reduction in UKL-7 installations and N₂O reduction in the GP unit. Planned GHG emissions reduction for 2008-2012 from the first project amount to 4 732 541 tCO₂e, and from the second project - up to 2 603 560 tCO₂e.

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.

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.

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.

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.

3.6 Agriculture

The most important goals pointed out in the Agricultural and Rural Development Strategy developed in 2006 are environmental protection and ecological farming nurturing biodiversity and landscape. The implementation measures are foreseen in the **Rural Development Programme for Lithuania 2007-2013**, adopted in the EU Rural Development Committee on 19 September 2007. Non-food agricultural production, ecological farming, liquidation of the foci of pollution, partial financing of the construction of manure yards, conversion of unusable land into pastures or its afforestation, and reduction of nitrate pollution are strongly emphasized. Furthermore, cultivation of energy plants should be promoted, as well as reconstruction of boilers for utilization of fuel from unsorted wood and other organic waste. Code of Good Agricultural Practice (CGAP) had to be worked out. CGAP is a compendium of compulsory and recommended measures for the management of agricultural production. In the nitrate vulnerable zones CGAP is compulsory, whereas in other areas it is optional. CGAP sets requirements for farm management that have an impact on emissions of N₂O and CH₄ from fertilizer application and manure management.

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 N₂O pollution out of agricultural activities.

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.

The amended Ecological Agriculture Development Programme for 2007-2010 establishes conditions for ecological food and agriculture products production, their conversion, realization and use development and for improvement of production certification system. This will allow to reduce environmental impact and GHG emissions from agriculture sector. The main tasks are: to support research and development in ecological production, ecological products quality and market fields, to achieve that ecological farms would implement the optimal technologies and take into account market demand, seeking to ensure than more high quality and higher assortment of ecological products are available on the market; to increase public awareness about ecological products, to create conditions for compensating producers for their investments and promote ecological production in farmers farms, promote cooperation of ecological farms. One of the main assumptions of this programme is increasing environmental motivation and one of the main motives is maintain and improve productivity of arable lands and reduce water and atmospheric pollution and preserve stability of ecosystems.

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 certified 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.

Enforcement of environment protection requirements

Observing the requirements of a good agrarian and environmental condition may 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 (CO₂ 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.

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.

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.

Implementation of Nitrates Directive (91/676/EEC)

Implementation of the Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC) (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).

Strengthening of the carbon concentration function by the soil in agriculture

In the process of growing every plant absorbs atmospheric CO₂ 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 CO₂ gases one must aim that the farming is performed so that a part of unused biomass is returned to the soil and CO₂ 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 CO₂ 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.

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.

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.

3.7 LULUCF

The Lithuanian Forestry Policy and its Implementation strategy, adopted in 2002 (Official Gazette, 2002, Nr. 93-4029) set the targets of forests economy: to ensure sustainable development of forests economy, to satisfy needs of various groups of society and ensure preservation of forests for future generations. The priority direction of forests resources prevention and increase is directly related with the implementation of UNFCCC and Kyoto protocol. The strategic priorities are: to plant 3 thou ha forests on the land area from the state land fund during 2007-2010 and to increase oak-wood area by 1500 ha up to 2010 by implementing Oakery restoration in state forests programme.

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.

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.

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 Curonian 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. 2152/2003 of 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.

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.

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.

The first afforestation of agricultural, non-agricultural and neglected land

See description of measures for agricultural sector.

3.8 Waste

Statistical data on waste generation and disposal in Lithuania are collected by the Lithuanian Environmental Protection Agency (EPA) since 1991. Starting from 1999 the amount of generated municipal waste has stabilised at approximately 1.2-1.4 million tonne (**Error! Reference source not found.**).

Table 3-1. Municipal waste generation in Lithuania in 2006-2009

| Municipal waste generation | 2006 | 2007 | 2008 | 2009 |
|-----------------------------------|-------------|-------------|-------------|-------------|
| Per capita, kg per year | 392 | 401 | 408 | 361 |
| Total, million tonne | 1.3 | 1.35 | 1.4 | 1.2 |

Municipal waste include mainly waste generated in households but also similar waste generated in institutions and organisations. According to the statistics collected by the Lithuanian EPA, household waste comprise about 75 to 85 per cent of the total amount of municipal waste.

Comparison of variations of data on GDP and waste disposal per capita (Fig. 3-9) shows that changes of waste generation and disposal per capita are clearly correlated with the changes of GDP, but annual changes in waste generation are approximately 10 times lower than changes of GDP.

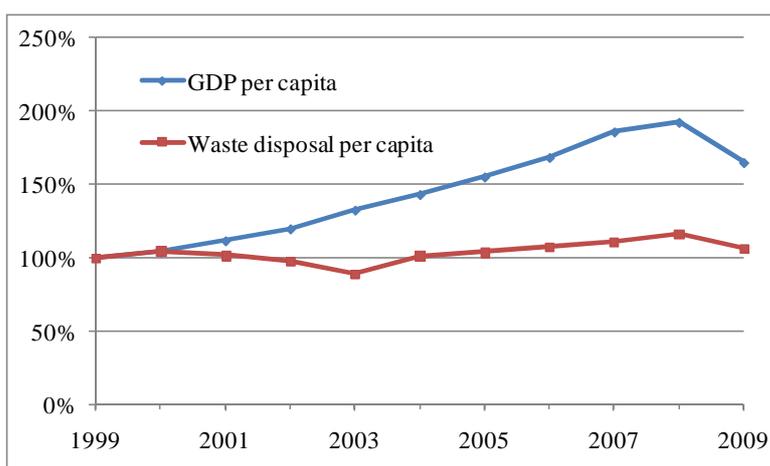


Fig. 3-9. Variations of GDP and waste disposal per capita in 1999-2009

The major part of generated municipal waste is disposed of in landfills. According to evaluation of the Lithuanian EPA, fraction of waste disposed of in landfills was 91.8% in 2007, 90.6 % in 2008 and 90.6% in 2009.

As a result of implementation of the landfill directive 1999/31/EC, 10 municipal waste management regions were established in Lithuania and new landfills complying with the requirements of the landfill directive were constructed. Most of old landfills and dumps were closed and major part of wastes including waste from small towns and rural areas are currently disposed of in new managed landfills. The fraction of waste disposed of in the newly constructed regional landfills complying with the requirements of the landfill directive increased from 5.2% of the total amount of disposed municipal waste in 2007 to 72.2% in 2008 and 84.1% in 2009.

The principles and guidelines for development of waste management system in Lithuania are set in the **National Strategic Waste Management Plan** approved by the Government in 2002. The Plan is being amended periodically and the last amendment approved by the Government in December 2010 set the requirement to dispose of in landfills only pre-treated waste which is not suitable for recycling.

The Plan envisages establishment of systems for treatment of biodegradable waste setting priority to its separate collection, composting or biogas production and use of remaining substrate for compost production.

The Plan defines the targets for reduction of biodegradable waste disposed of in landfills (Table 3-2) based on the targets set in the landfill directive (1999/31/EC).

Table 3-2. Targets for reduction of biodegradable waste disposed of in landfills

| Region | Disposed of in 2000, thou. t | Disposal targets, thou. tonne | | |
|--------------|------------------------------|-------------------------------|--------------|--------------|
| | | 2010 | 2013 | 2020 |
| Alytus | 34.0 | 25.5 | 17.0 | 11.9 |
| Kaunas | 155.3 | 116.5 | 77.6 | 54.4 |
| Klaipėda | 97.6 | 73.2 | 48.8 | 34.2 |
| Marijampolė | 35.4 | 26.5 | 17.7 | 12.4 |
| Panevėžys | 59.2 | 44.4 | 29.6 | 20.7 |
| Šiauliai | 70.5 | 52.9 | 35.3 | 24.7 |
| Tauragė | 15.9 | 12.0 | 8.0 | 5.6 |
| Telšiai | 32.7 | 24.5 | 16.3 | 11.4 |
| Utena | 28.0 | 21.0 | 14.0 | 9.8 |
| Vilnius | 196.6 | 148.0 | 98.3 | 68.8 |
| Total | 725.2 | 544.5 | 362.6 | 253.9 |

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.

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.

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 Projections of GHG Emissions

4.1 Economic Development

Lithuanian economics have declined substantially after declaration of independence in 1990. In 1994 GDP dropped to 54% of 1989 level but later started to increase again). GDP growth reached 7.3% in 1998 but, as a result of banking crisis in Russia, decreased again in 1999.

Economic growth in the period 2000-2007 was comparatively fast, faster than forecasted in the Long-term Economic Development Strategy of Lithuania until 2015 approved by the Government in 2002 (Official Gazette, 2002, Nr. 60-2424). According to the Ministry of Finance, GDP growth during that period was close to 7-8 per cent on average.

As a result of the global economical crisis Lithuania's economic development has slowed down by the end of 2008. In 2008 GDP growth has decreased to 2.9% and in 2009 GDP contracted by 14.7%.

According to the data by the Department of Statistics, gross domestic product in the 1st quarter of 2010, as compared with the same period in 2009, decreased by 2.9 per cent – it shows that GDP fall is in line with GDP growth path for 2010 envisaged in the central scenario of the Ministry of Finance. It is envisaged that due to the investment climate in Lithuania and recovery of export markets as well as the absorption of advanced EU assistance the annual growth in the 2nd quarter is expected to make up about 4 – 5 per cent. Therefore, GDP growth scenario of 1.6 per cent for 2010 created in February will basically remain unchanged.

According to the projections of the Ministry of Finance, all the aforementioned positive factors will create conditions for GDP growth of 1.6 per cent in 2010 and 2.8 per cent in 2011. It is envisaged that in 2012, due to a negative effect of decreased investments during the crisis in 2009 to economic potential growth, GDP growth will slow down to 1.2 per cent. Later, after enhance of investors' confidence in regional perspectives and increase of investments into exporting sectors, GDP could grow by 2.4 per cent in 2013.

The scenario of economic indicators for budget planning is formed on the basis of common assumptions for EU economic development used by the European Commission. Economic growth will depend on the situation in global financial markets and economies of main foreign trade partners as well as Lithuania's competitive ability.

Despite economic recovery planned in 2010, the rate of unemployment will further remain reasonably high during the entire medium term. It is envisaged that the rate of unemployment will grow up to 16.7 per cent in 2010, while from 2011 it will start gradually decreasing and in 2011–2013 it will represent 15.5 per cent, 13.9 per cent and 12.3 per cent, accordingly.

Statistical data show that, after evaluation of seasonal impact, fall in national wages slightly decelerated (especially in construction sector), while in private sector in the 4th quarter of 2009, as compared with the previous quarter, wages even increased by 0.4 per cent, therefore, the dynamics of wages will be more favourable by several percentage points than it was planned in February: in 2010 wages may fall by 5.3 per cent, while from the year 2011, in 2011–2013, wages are envisaged to grow by 0.6 per cent, 0.9 per cent and 1.9 per cent, accordingly.

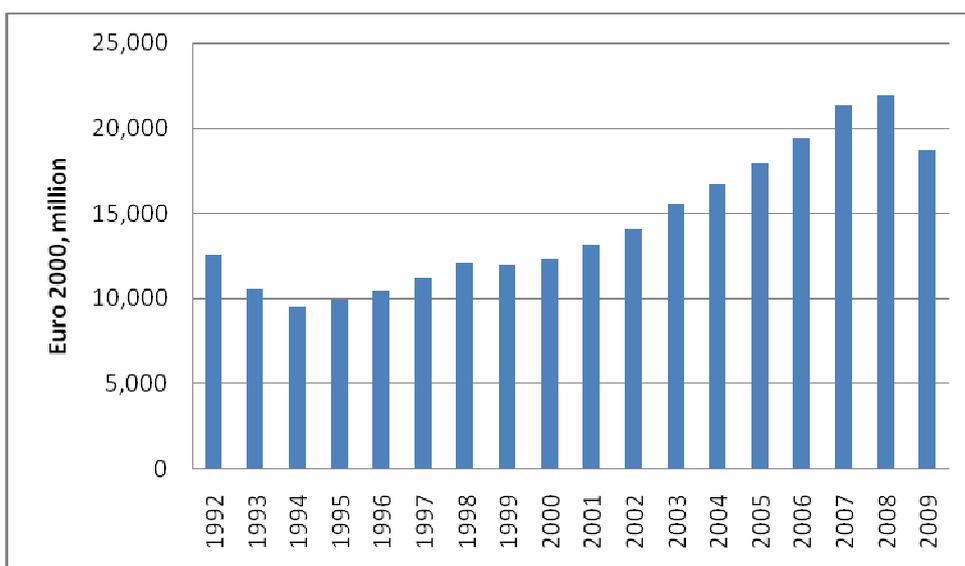


Fig. 4-1. GDP variations in Lithuania from 1992 to 2009

Due to higher growth in global prices of oil, food and other products predicted by the European Commission as well as changed wage trends, the perspective of price change estimated by coordinated consumer price index (CCPI) is changed accordingly: substantially slower deflation estimated by CCPI is envisaged in February. In 2010 the average annual deflation will represent 0.1 per cent, while inflation in December could constitute about 0.6 per cent. In 2011 the average annual inflation would make up 1.5 per cent, in 2012 – 2.0 per cent and in 2013 – 2.5 per cent.

GDP growth forecasted by the Ministry of Finance for 2009-2013 is shown in **Error! Reference source not found...**

Table 4-1. GDP forecast for 2009-2013 by the Ministry of Finance

| Indicators | 2009 | 2010 | 2011 | 2012 | 2013 |
|---------------------------------------|--------|--------|--------|--------|--------|
| GDP chain-linked volume growth | -14.7% | 1.6% | 2.8% | 1.2% | 2.4% |
| GDP chain-linked volume, LTL million | 64,583 | 65,616 | 67,453 | 68,263 | 69,901 |
| GDP chain-linked volume, EURO million | 20,038 | 20,359 | 20,929 | 21,180 | 21,688 |

The Ministry of Finance is providing GDP forecasts only for next several years. Long-term GDP growth forecast was provided in the National Energy Strategy approved by the Decision of the Seimas No. X-1046 of January 18, 2007 (Official Gazette, 2007, Nr. 11-430), however, the forecast was made in 2007 and has not taken into account the impact of economic crisis of 2008-2010.

Forecast of economic growth provided in the National Energy Strategy was reviewed assuming that economic growth in 2010-2013 will correspond to the forecast of the Ministry of Finance. Further growth from 2014 to 2020 was evaluated according to three scenarios:

1. Scenario of fast economic growth:
Average annual GDP growth 6%;
2. Basic scenario:
Average annual GDP growth 4%;
3. Scenario of slow economic growth:

Average annual GDP growth 2%.

Forecasted GDP variations according to the three scenarios are shown in Fig. 4-2.

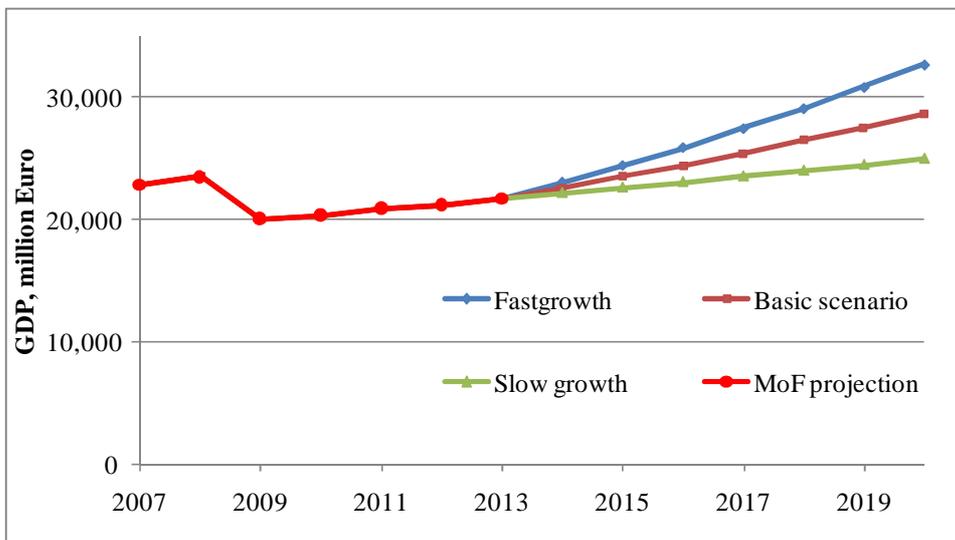


Fig. 4-2. Forecasted long-term GDP growth in Lithuania

The number of population in Lithuania is declining steadily since 1990 and, according to forecasts made by the Statistics Lithuanian, is going to decline further in the future. Variations of the number of population in Lithuania since 1990 and forecast to 2020 are shown in Fig. 4-3.

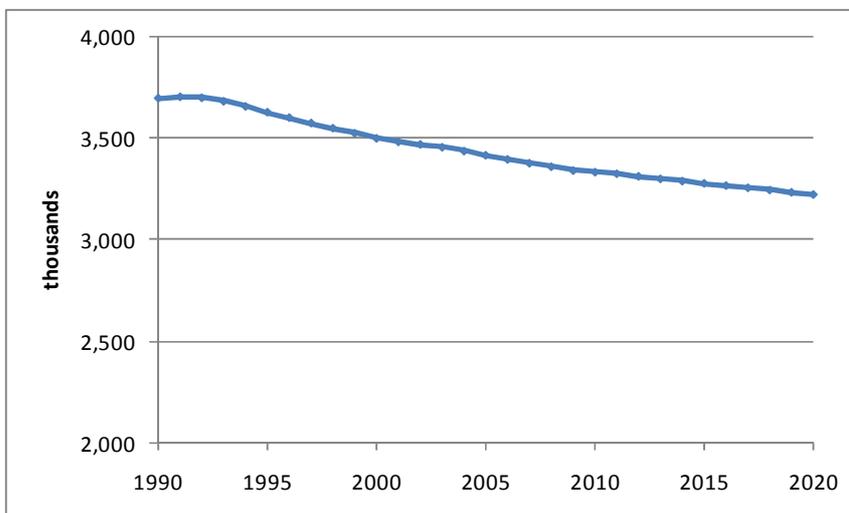


Fig. 4-3. Population variations and forecast to 2020

(Source: Statistics Lithuania)

4.2 Energy

4.2.1 Projections of energy production and consumption

After the shutdown Ignalina Nuclear Power Plant (NPP), local electricity generation capacities are being increased and electricity sector is being restructured in order to ensure competitive and continuous electricity supply. Currently a new electricity generation capacity is being built in Lietuvos elektrinė power plant, internal electricity network is being strengthened, construction of electricity links with Sweden and Poland has been started, and electricity power exchange has been established.

Though construction of new nuclear power plant is planned, it will not be completed before 2020. Therefore, nuclear power plant is not included in the projections reaching up to 2020.

The basis for projections of GHG emissions in Lithuania is the National Energy (Energy Independence) Strategy developed by the Ministry of Energy and endorsed by the Government in 2010.

Projected final energy consumption in various sectors without measures based on basic economic growth scenario is provided in Table 3.1.

Table 4-2. Forecasted final energy consumption without measures, TJ

| | 2009 | 2010 | 2015 | 2020 |
|--------------------------|--------------|--------------|--------------|--------------|
| Industry | 35.0 | 35.5 | 41.0 | 50.0 |
| Construction | 1.7 | 1.7 | 2.0 | 2.4 |
| Transport | 65.6 | 66.6 | 76.2 | 91.8 |
| Agriculture | 4.7 | 4.8 | 5.6 | 6.8 |
| Commercial/Institutional | 23.5 | 23.9 | 27.5 | 33.5 |
| Residential | 56.5 | 57.3 | 65.6 | 79.1 |
| Total | 187.0 | 189.9 | 217.9 | 263.7 |

Projected gross fuel consumption till 2020 without measures is shown in Fig. 4-4.

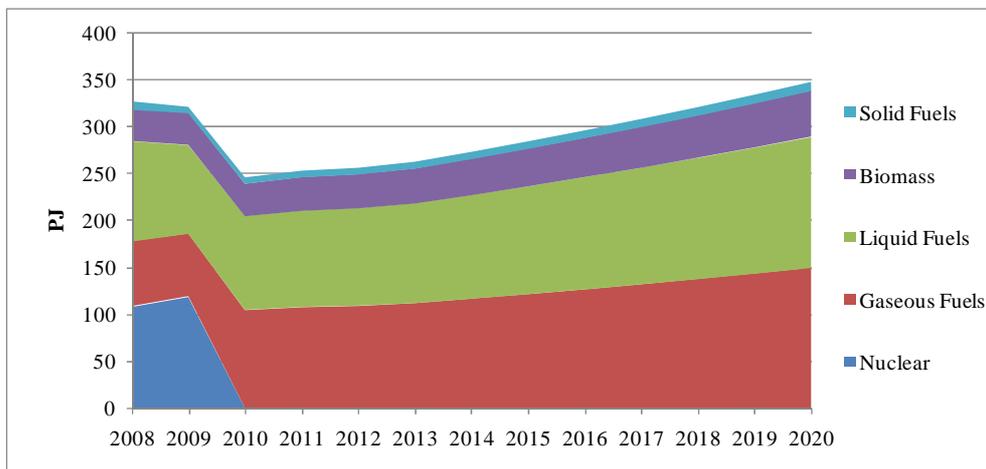


Fig. 4-4. Projection of gross fuel consumption without measures, TJ

The National Energy (Energy Independence) Strategy defines the main objectives of the Lithuanian state in the energy sector, setting national targets for implementation of strategic initiatives through the years 2020, 2030 and 2050.

Most of fuel resources used in Lithuania are imported. After the shutdown of Ignalina Nuclear Power Plant (NPP), the country is not able to satisfy its internal electricity demand.

In order for Lithuania to become a fully-fledged member of the European Union (henceforth – EU), Lithuanian energy sector should be entirely integrated into the European energy system. The country must have sufficient capacity to satisfy internal energy demand and, with regard to energy related questions, should be able to flexibly and effectively cooperate with the EU and other countries.

The Strategy outlines a number of initiatives to be achieved in the fields of electricity, heating, gas, oil, renewable energy and energy efficiency.

The vision of the heating sector is to increase energy efficiency in the heat production, distribution and consumption while at the same time shifting from mainly gas-based production towards biomass. The state will support initiatives increasing heat consumption efficiency, utilization of waste energy potential, and increase in the use of biomass. The target for decrease in households’ and public buildings’ heating consumption by 2020 is 30–40% compared to 2009, which will allow to save annually as much as 2–3TWh of heat.

In the gas sector, Lithuania will strive in the long run to decrease gas consumption while diversifying the sources of gas supply in the short run. To this end, Lithuania will construct an LNG terminal in Klaipėda, undertake all efforts to build an underground gas storage facility and a gas pipeline linking the country to Poland and the rest of the EU. Lithuania will also promote competition in the gas market by separating gas supply and gas transmission functions.

In the oil sector the goal is to gradually reduce consumption of oil and increase competition in the market.

Lithuania will progressively increase the use of renewable energy sources in the production of electricity and heating as well as in the transport sector. The state will aim to reach the target of 23% of renewable energy in final energy consumption, including no less than 20% of renewable energy in the electricity sector, 60% in the district heating sector and 10% in the transport sector. Suitable and clear market conditions will be gradually introduced while giving preference to the most economically feasible technical solutions of the renewable energy.

In energy efficiency the National Energy (Energy Independence) Strategy sets the target to achieve annual savings of 1.5% of the total final energy consumption, in the period through 2020 (Fig. 4-5).

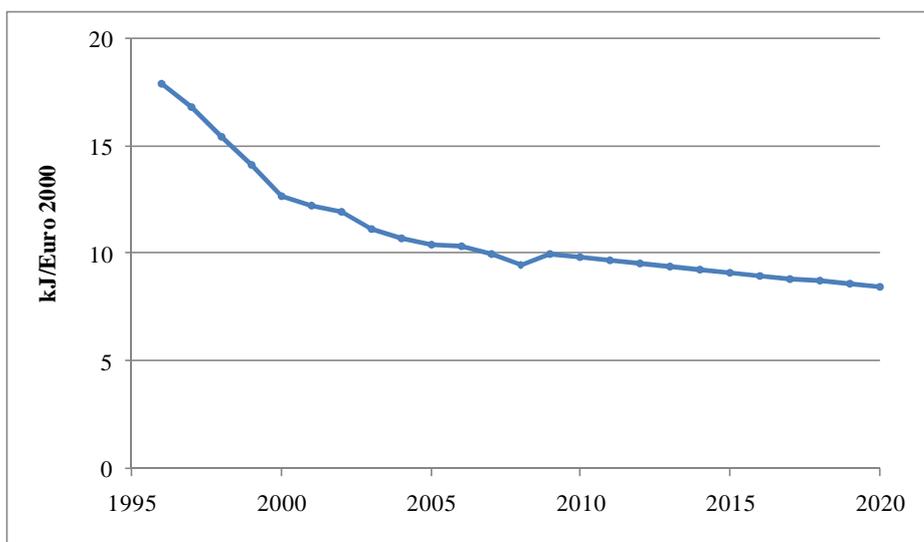


Fig. 4-5. Current and projected final energy intensity changes

According to the National Energy (Energy Independence) Strategy, the energy consumption per unit of GDP is 2.5 times higher than the EU average and can be reduced significantly if the overall energy savings are increased.

The total savings potential of final energy consumption in Lithuania by 2020 is approximately 17% compared to the final energy consumption in 2009 (Fig. 4-6). Realization of this potential would imply yearly savings of 17.8 PJ by 2020.

The largest saving potential exists in the household and transport sectors, where energy efficiency measures are constitute 65% of total energy savings. The potential for households amounts to 7.0 PJ and for the transport sector 7.2 PJ.

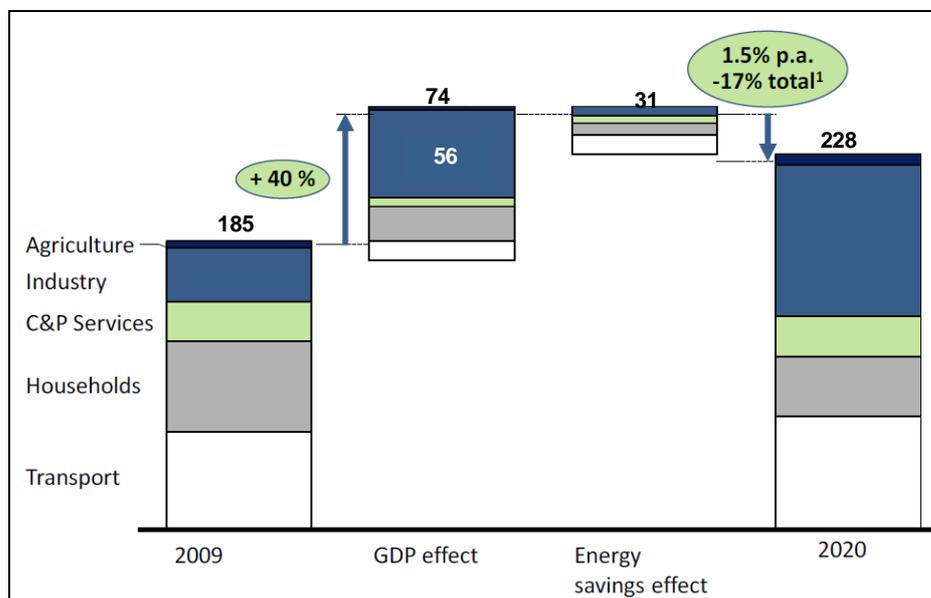


Fig. 4-6. Total energy savings potential (PJ) in Lithuania 2009-2020
 (Source: National Energy (Energy Independence) Strategy)

4.2.2 Emission projections

Emissions without measures

If mitigation measures are not taken, GHG emissions are going to increase from 11.7 Tg in 2009 to approximately 20 TG in 2020 (Fig. 4-7).

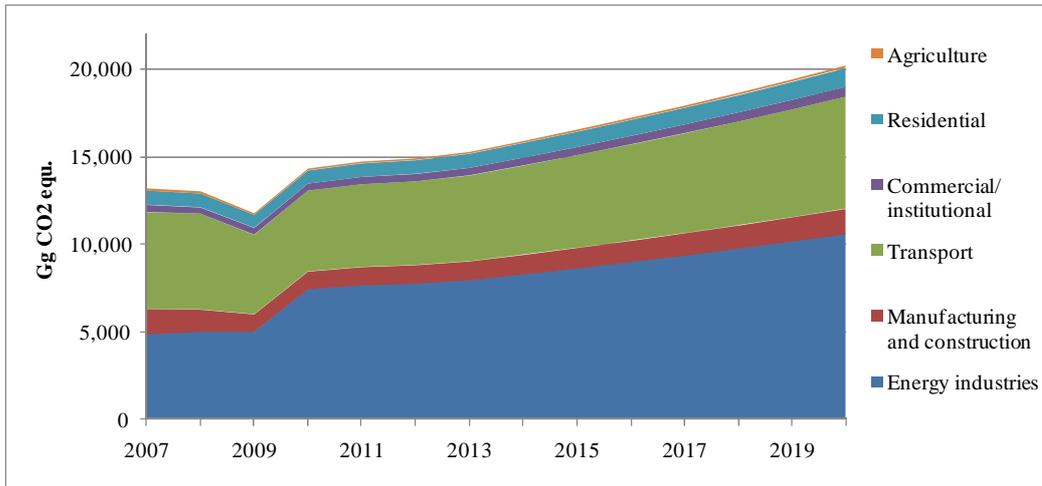


Fig. 4-7. Projection of GHG emissions (Gg CO₂ eqv.) without measures

Projected GHG emissions by separate gases are provided in Table 4-3.

Table 4-3. Projected emissions of GHG gases without measures in 2010-2020

| | 2009 | 2010 | 2015 | 2020 |
|---|---------------|---------------|---------------|---------------|
| CO₂, Gg | | | | |
| Energy industries | 4,980 | 7,405 | 8,578 | 10,527 |
| Manufacturing industries and construction | 980 | 996 | 1,156 | 1,420 |
| Transport | 4,423 | 4,491 | 5,154 | 6,234 |
| Commercial/institutional | 382 | 389 | 451 | 555 |
| Residential | 594 | 604 | 702 | 863 |
| Agriculture/forestry/fisheries | 83 | 85 | 98 | 121 |
| Total | 11,442 | 13,970 | 16,139 | 19,720 |
| CH₄, Gg | | | | |
| Energy industries | 0.43 | 0.48 | 0.55 | 0.67 |
| Manufacturing industries and construction | 0.16 | 0.17 | 0.19 | 0.24 |
| Transport | 0.59 | 0.60 | 0.69 | 0.84 |
| Commercial/institutional | 0.40 | 0.41 | 0.48 | 0.59 |
| Residential | 5.58 | 5.67 | 6.59 | 8.10 |
| Agriculture/forestry/fisheries | 0.15 | 0.15 | 0.17 | 0.22 |
| Total | 7.32 | 7.48 | 8.68 | 10.65 |
| N₂O, Gg | | | | |
| Energy industries | 0.079 | 0.088 | 0.101 | 0.123 |
| Manufacturing industries and construction | 0.017 | 0.017 | 0.020 | 0.024 |
| Transport | 0.233 | 0.236 | 0.271 | 0.328 |
| Commercial/institutional | 0.009 | 0.009 | 0.010 | 0.013 |
| Residential | 0.073 | 0.074 | 0.086 | 0.106 |
| Agriculture/forestry/fisheries | 0.002 | 0.002 | 0.003 | 0.003 |
| Total | 0.413 | 0.427 | 0.491 | 0.597 |
| Total, Gg CO₂ eqv. | | | | |
| Energy industries | 5,013 | 7,442 | 8,621 | 10,579 |
| Manufacturing industries and construction | 989 | 1,005 | 1,166 | 1,433 |
| Transport | 4,507 | 4,577 | 5,252 | 6,353 |
| Commercial/institutional | 393 | 400 | 464 | 571 |
| Residential | 734 | 747 | 867 | 1,066 |
| Agriculture/forestry/fisheries | 87 | 89 | 103 | 127 |

| | | | | |
|--------------|--------|--------|--------|--------|
| Total | 11,724 | 14,260 | 16,474 | 20,129 |
|--------------|--------|--------|--------|--------|

Detailed data on GHG emissions without measures are provided in Annex 1.

Emissions with measures

As described in Section 3.3, implementation of mitigation measures aimed at reduction of fossil fuels consumption, energy saving and increased use of renewable resources are planned in the National Energy (Energy Independence) Strategy. Planned mitigation measures can be summarised as follows:

- use of at least 20% of renewable energy in electricity sector,
- use of at least 60% of renewable energy in district heating sector,
- reduction of heat consumption in households and public buildings by 7.2-10.8 PJ,
- use of at least 10% of renewable energy in transport sector,
- installation of 5 PJ annual CHP capacity.

Implementation of the National Energy (Energy Independence) Strategy will require 29-41 billion LTL (8.4-11.9 billion Euro) investments about half of which will be spent on construction of new nuclear power plant.

The most important investment related to reduction of GHG emissions are the following:

- Renovation and better insulation of residential and public buildings - 5-8 billion LTL (1.5-2.3 billion Euro);
- Increased electricity production from renewable resources by combination of wind and biomass - 2.5-3.5 billion LTL (0.7-1.0 billion Euro);
- Increased heat production from renewable resources mainly from biomass for centralized heating sector - 2.05 billion LTL (0.6 billion Euro).

The investment will yield annual savings of 3–4 billion LTL (3–4% of Lithuanian GDP), which are currently spent on imported energy resources. Each household will on average save 500 LTL per year on heating costs alone. 5–6 thousand permanent work places will be created. The investment will also stimulate construction and services sectors.

Implementation of measures listed above will result in the total reduction of GHG emissions of 4.2 Tg or 21.4% by 2020 (Table 4-4).

Table 4-4. Projected efficiency of separate measures for reduction of GHG emissions (Gg CO₂ eqv.)

| | 2011 | | 2015 | | 2020 | |
|---|-------------------------|----------|-------------------------|----------|-------------------------|----------|
| | Gg CO ₂ eqv. | per cent | Gg CO ₂ eqv. | per cent | Gg CO ₂ eqv. | per cent |
| Increased electricity production from renewable resources | -67 | -0.5% | -382 | -2.3% | -966 | -4.8% |
| Renovation and better insulation of residential and public buildings | -86 | -0.6% | -428 | -2.6% | -857 | -4.3% |
| Increased heat production from renewable resources for centralized heating sector | -164 | -1.1% | -900 | -5.5% | -2,107 | -10.5% |
| Increased use of biofuels in transport sector | -32 | -0.2% | -178 | -1.1% | -430 | -2.1% |

| | | | | | | |
|---|-------------|--------------|---------------|---------------|---------------|---------------|
| Installation of additional CHP capacity | -71 | -0.5% | -357 | -2.2% | -714 | -3.5% |
| Total | -412 | -2.8% | -2,038 | -12.4% | -4,245 | -21.1% |

Projected total GHG emissions with measures are shown in Fig. 4-8 and Table 4-5.

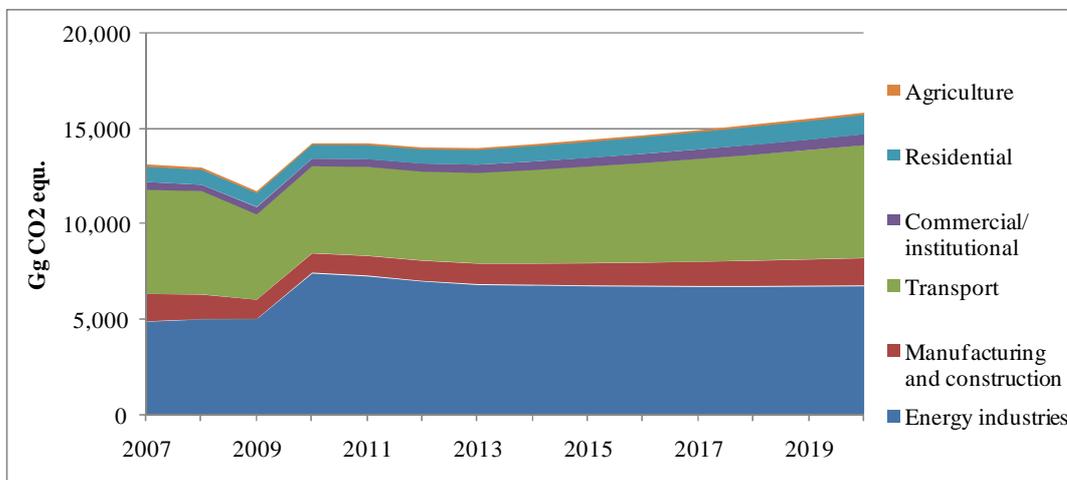


Fig. 4-8. Current and projected total GHG emissions in 2007-2020 with existing measures, Gg CO₂ eq.

Table 4-5. Projected emissions of GHG gases with existing measures in 2010-2020

| | 2009 | 2010 | 2015 | 2020 |
|---|---------------|---------------|---------------|---------------|
| CO₂, Gg | | | | |
| Energy industries | 4,980 | 7,405 | 6,693 | 6,660 |
| Manufacturing industries and construction | 980 | 996 | 1,156 | 1,420 |
| Transport | 4,423 | 4,491 | 4,978 | 5,810 |
| Commercial/institutional | 382 | 389 | 451 | 555 |
| Residential | 594 | 604 | 702 | 863 |
| Agriculture/forestry/fisheries | 83 | 85 | 98 | 121 |
| Total | 11,442 | 13,970 | 14,079 | 15,428 |
| CH₄, Gg | | | | |
| Energy industries | 0.43 | 0.48 | 0.98 | 1.57 |
| Manufacturing industries and construction | 0.16 | 0.17 | 0.19 | 0.24 |
| Transport | 0.59 | 0.60 | 0.69 | 0.84 |
| Commercial/institutional | 0.40 | 0.41 | 0.48 | 0.59 |
| Residential | 5.58 | 5.67 | 6.59 | 8.10 |
| Agriculture/forestry/fisheries | 0.15 | 0.15 | 0.17 | 0.22 |
| Total | 7.32 | 7.48 | 9.11 | 11.56 |
| N₂O, Gg | | | | |
| Energy industries | 0.08 | 0.09 | 0.15 | 0.23 |
| Manufacturing industries and construction | 0.02 | 0.02 | 0.02 | 0.02 |
| Transport | 0.23 | 0.24 | 0.26 | 0.31 |
| Commercial/institutional | 0.01 | 0.01 | 0.01 | 0.01 |
| Residential | 0.07 | 0.07 | 0.09 | 0.11 |
| Agriculture/forestry/fisheries | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 0.41 | 0.43 | 0.53 | 0.68 |

| Total, Gg CO ₂ eqv. | | | | |
|---|---------------|---------------|---------------|---------------|
| Energy industries | 5,013 | 7,442 | 6,761 | 6,764 |
| Manufacturing industries and construction | 989 | 1,005 | 1,166 | 1,433 |
| Transport | 4,507 | 4,577 | 5,075 | 5,924 |
| Commercial/institutional | 393 | 400 | 464 | 571 |
| Residential | 734 | 747 | 867 | 1,066 |
| Agriculture/forestry/fisheries | 87 | 89 | 103 | 127 |
| Total | 11,724 | 14,260 | 14,436 | 15,883 |

Additional measures

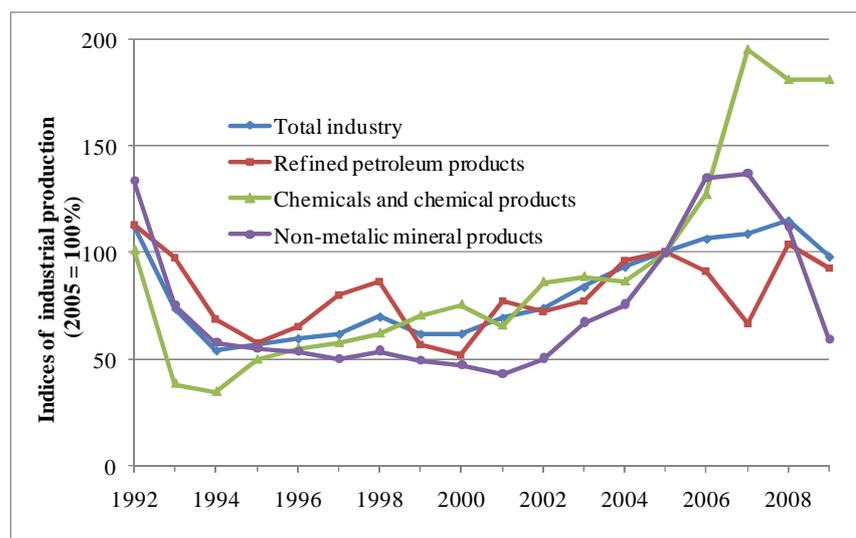
As it was indicated above, construction of new nuclear power plant is envisaged in the National Energy (Energy Independence) Strategy, but it will not be completed before 2020. Therefore NPP will have no impact on GHG emissions in the period under examination and only measures not related to construction of NPP are discussed.

As noted in the National Energy (Energy Independence) Strategy, together with GHG emission mitigation measures described above, additional energy savings leading to reduction of GHG emissions are possible in industry and agriculture sectors.

Additional 25% energy savings in industry and agriculture would ensure supplementary reduction of GHG emissions by 390 Gg CO₂ eqv. or 2.5% in 2020. The total GHG emission reduction with measures and additional measure would be 4.64 Tg or 23.0%.

4.3 Industrial Processes

Industrial production manufactured in Lithuania increased by 84% from 2000 to 2007¹. Production of chemicals and non-metallic minerals products (which are the main sources of GHG emissions in industry) was increasing even faster. However, production of both chemicals and mineral products started to decline in 2008 though the total industrial output still slightly increased. In 2009 industrial production continued to shrink which is especially notable on non-metallic mineral products (Fig. 4.1).



¹ Statistics Lithuania, <http://www.stat.gov.lt/lt/pages/view/?id=2333>

Fig. 4.1. Variations of indices of the total industrial production and production of non-metallic products and chemicals

Source: Statistics Lithuania

Fast growth of GHG emissions in 1993-2007 (Fig. 4-9) was caused by increased production of mineral products for expanding construction activities and production of chemicals mainly for export. However, because of the general economic recession emissions declined very considerably in 2008 and 2009.

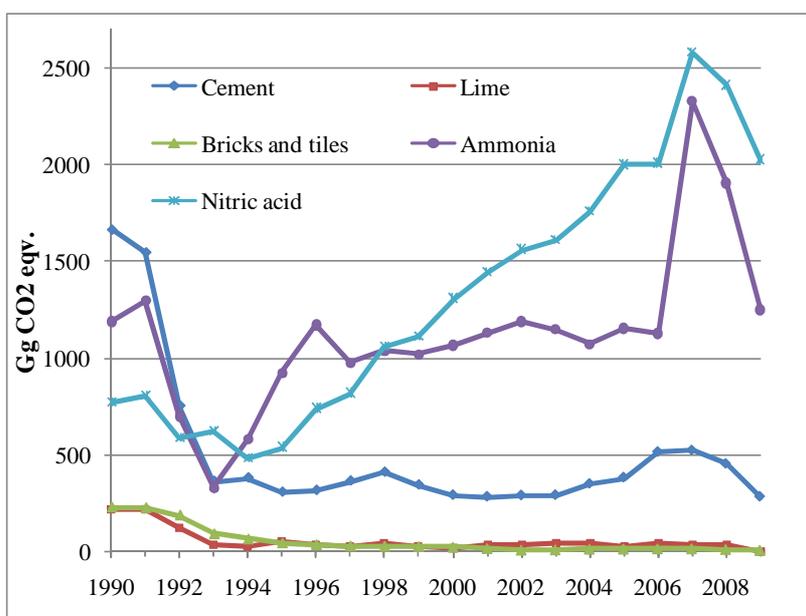


Fig. 4-9. GHG emissions by main industrial processes in 1990-2009

It is anticipated that economics will start to recover in 2010 and industrial production will increase again. GHG emissions in industry sector are determined by technological processes and notable emission reduction per production output is hardly possible. Therefore it is expected that GHG emissions will grow together with increasing industrial production.

Projections of GHG emissions from industrial processes are shown in Table 4-6.

Table 4-6. Projections of GHG emissions from industrial processes (with existing measures) (Gg CO₂ eqv.)

| | 2009 | 2010 | 2015 | 2020 |
|-------------------------------|-------|-------|-------|-------|
| Mineral industries | 300 | 304.5 | 350.9 | 426.9 |
| Chemicals | 3,275 | 3,330 | 3,837 | 4,668 |
| Other production and solvents | 95 | 95 | 96 | 97 |
| F-gases | 36 | 37 | 42 | 52 |
| Total | 3,706 | 3,767 | 4,326 | 5,244 |

4.4 Agriculture

Agricultural greenhouse gas emissions in Lithuania include CH₄ emissions from enteric fermentation of domestic livestock and CH₄ and N₂O emissions from manure management as well as direct and indirect N₂O emissions from agricultural soils. Direct N₂O emissions from agricultural soils include emissions from synthetic fertilizers, manure applied to soils, biological nitrogen fixation of N-fixing crops, crop residues and cultivation of organic soils. Indirect N₂O emission sources include emissions from atmospheric deposition and from nitrogen leaching.

The total greenhouse gas emissions in agriculture sector in 2009 were evaluated at 4.429 Gg CO₂ equivalents. The major part of emissions is related to agricultural soils. N₂O emission contributed 58.6% of the total GHG emission from the agricultural sector. The major part of the agricultural CH₄ emission originates from digestive processes. Methane emissions from enteric fermentation constituted 28.9 %, methane emissions from manure management 12.6%, nitrous oxide emissions from manure management - 6.9% and nitrous oxide emissions from agricultural soils – 51.6% of the total agricultural emissions. From 1990 to 2009 emissions from agriculture have decreased by 54.6% (Fig. 4-10).

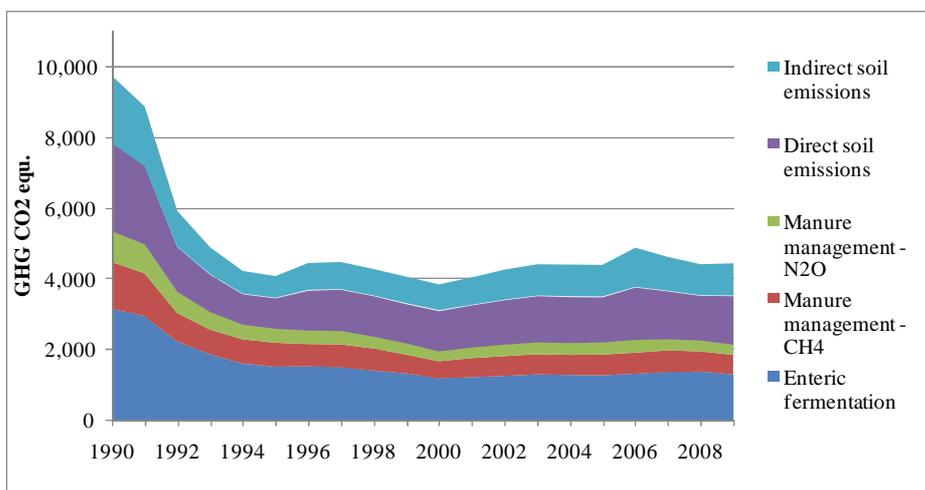


Fig. 4-10. Greenhouse gas emission variations in agriculture in 1990-2008

Projections of livestock variations are based on judgements of experts from the Lithuanian Institute of Animal Science (cattle - dr. Virginijus Uchockis, sheep and goats - dr. Birutė Zapasnikienė, horses - dr. Valė Macijauskienė, pigs and poultry - dr. Remigijus Juška).

The number of dairy cows have slightly decreased during recent years and further reduction is expected for several years in the future. Reduction is caused mainly by suspension of agricultural activities by small farmers keeping only one or several cows because of old age and national agricultural policies. Later the number of dairy cows is expected to stabilise.

Variations of the number of non-dairy cattle are determined mainly by allocation of subsidies to farmers and prices. It is anticipated that the number of non-dairy cattle will increase in the nearest future because of growing export.

The number of sheep currently is slightly increasing and the tendency is expected to continue in the future. The trend is mainly determined by increasing demand for lamb meat in Lithuania and growing export.

Traditionally goats were not popular in Lithuania and their number started to increase only in nineties when more productive breeds were brought from Western countries. However, in most cases goats are grown in small numbers and their number is expected to decrease with decreasing rural population.

The number of horses is expected to decrease with decreasing number of small farms and rural population in general.

The number of pigs is expected to increase fostered by enhancing demand for pork meat and increasing size of pig farms. The same factors should stipulate also increase in number of poultry.

Forecasted variations of the number of domestic animals are shown in Table 4-7.

Table 4-7. Projected variations of the number of domestic animals (thou)

| | 2010 | 2012 | 2015 | 2018 | 2020 |
|---------|---------|--------|---------|---------|---------|
| Cattle | 726.5 | 717.4 | 708.6 | 705.3 | 705.9 |
| Sheep | 54.5 | 55.5 | 57.0 | 58.5 | 59.5 |
| Goats | 14.6 | 14.3 | 13.8 | 13.4 | 13.2 |
| Horses | 47.0 | 43.4 | 38.4 | 33.9 | 31.3 |
| Swine | 946.8 | 985.0 | 1,045.3 | 1,109.3 | 1,154.1 |
| Poultry | 9,541.4 | 10,024 | 10,795 | 11,625 | 12,214 |

Projected GHG emissions are shown in Table 4-8.

Table 4-8. Projected GHG emissions in agriculture sector (with existing measures) (Gg CO₂ eqv.)

| | 2009 | 2010 | 2015 | 2020 |
|--------------------------------------|----------------|----------------|----------------|----------------|
| Enteric fermentation | 1,278.3 | 1,275.3 | 1,258.7 | 1,268.4 |
| Manure management - CH ₄ | 557.2 | 562.8 | 593.0 | 631.9 |
| Manure management - N ₂ O | 306.8 | 306.9 | 306.2 | 311.8 |
| Direct soil emissions | 1,368.1 | 1,369.4 | 1,375.5 | 1,386.7 |
| Indirect soil emissions | 918.5 | 919.2 | 922.6 | 933.0 |
| Total agriculture | 4,428.9 | 4,433.6 | 4,455.9 | 4,531.8 |

4.5 Land use, land use change and forestry

Average annual increase of forest area in 1990-2005 was approximately 10.7 thou. ha. The fastest increase of forest area was observed during the last 8 years reaching 20 and more thou. ha per year.

Forest expansion strategy for 2004-2020 and its implementation measures are set in the Lithuanian Forest Area Expansion Program developed and approved by the joint Order of the Ministers of Environment and Agriculture No. 616/471 on 2nd December, 2002 (Official Gazette, 2003, Nr. 1-10).

The Programme aims at additional increase of forest area by 196 thou. ha or approximately 12 thou. ha annually. It is estimated that forest area is currently expanding by approximately 4-5 thou. ha annually as a result of natural, spontaneous forest growth in unmanaged land areas. In order to attain the target set in the Programme, it is planned to plant additionally 7 thou. ha of forest each year. Current and forecasted variations of forest area are shown in Fig. 6.1.

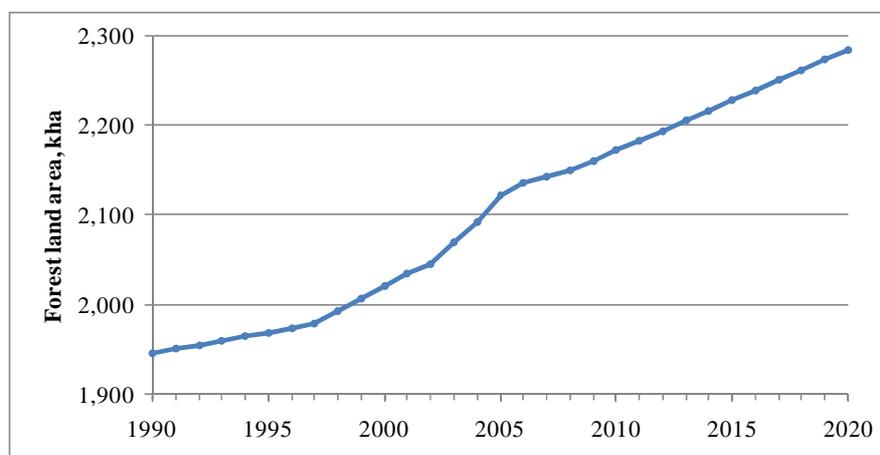


Fig. 6.1. Forecasted variation of forest area

Changes in forest carbon stocks are determined mainly by expansion of forest area and, especially, by variations in wood extraction. The extent of fallings has increased substantially after declaration of independence and transition to market economy resulting in overall reduction of annual carbon sequestration value.

According to the Lithuanian Forestry Law (Official Gazette, 2001, Nr. 35-1161 and subsequent amendments), cuttings cannot exceed annual norms set for both state and privately owned forests. Cutting norms are established in accordance with the methodology developed by the Ministry of Environment and approved in 2001 and amended in 2003. The volume of extracted wood has stabilised after approval of the methodology but certain growth of wood extraction should be expected in the future. It was assumed that the total volume of extracted wood is going to increase by approximately 70 thou. m³ (Fig. 6.2). Such increase in cuttings is balanced by the annual biomass increment ensuring stable annual carbon sequestration of approximately 2.5 thou. Gg (approximately 8.9 thou. Gg CO₂) (see Fig. 6.3).

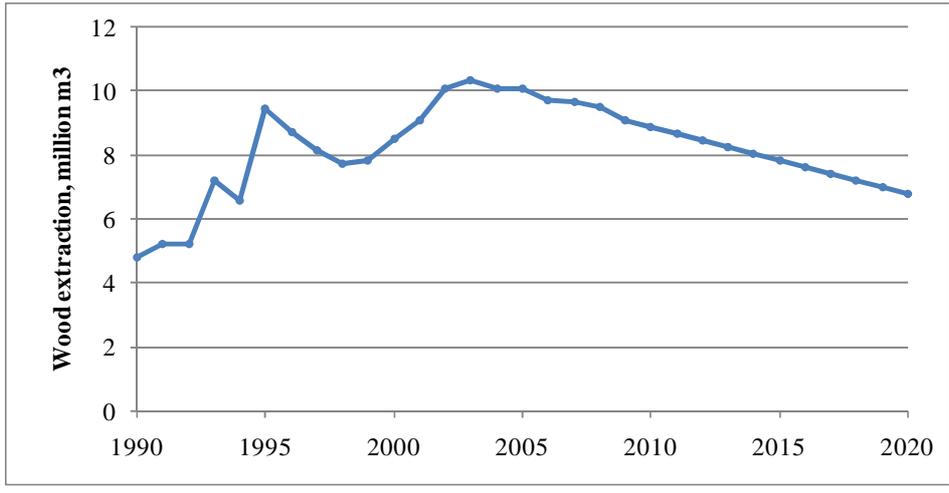


Fig. 6.2. Variations and forecasted trend of wood extraction (including round wood and fuel wood)

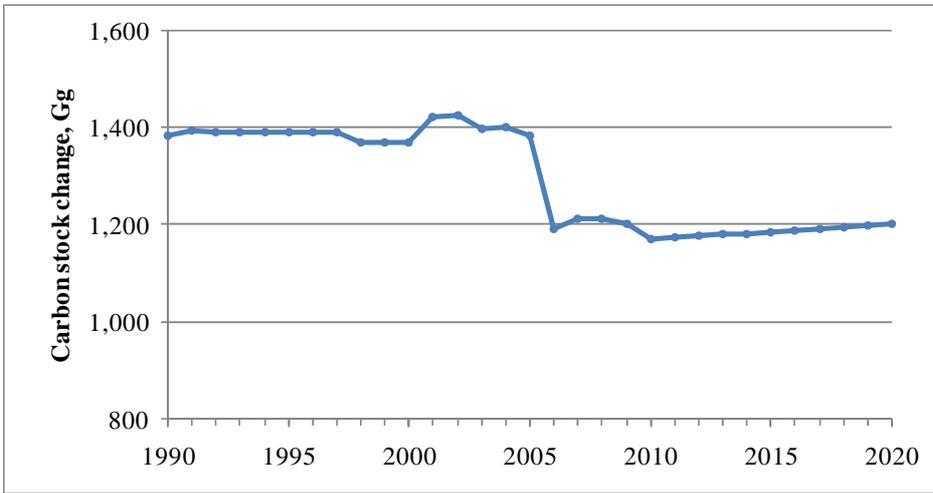


Fig. 6.3. Variation and forecast of carbon stock change

4.6 Waste management

Establishment of regional municipal waste management systems including construction of new landfills complying with the requirements of EU landfill directive and closure of old landfills and dumps has been completed in 2009. Starting from 2010 municipal waste is disposed of in new landfills, i.e. in deep managed landfills which means that methane conversion factor for all disposed waste will be 1.0 and methane generation will increase if measures to reduce methane emissions are not implemented (Fig. 4-11).

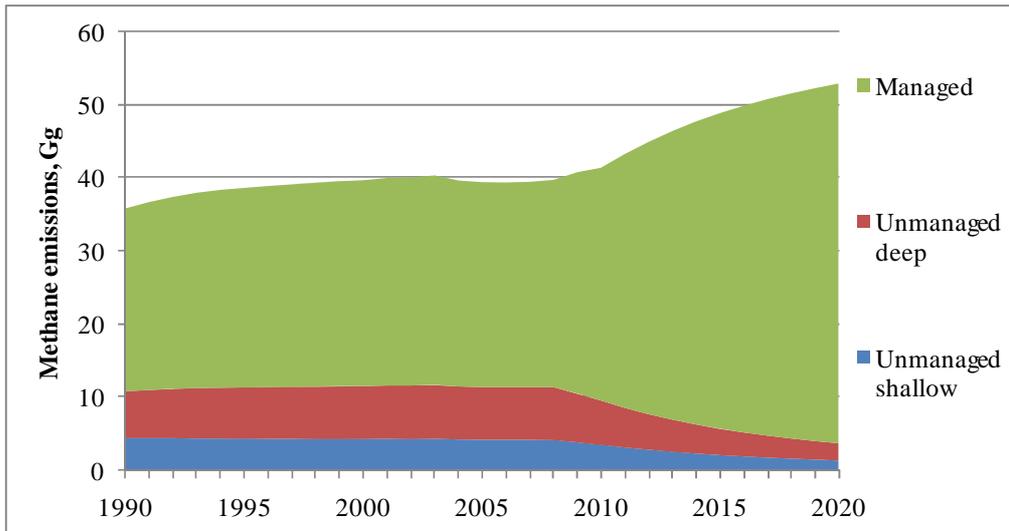


Fig. 4-11. Projected methane emissions from landfills if no mitigation measures are taken

If mitigation measures aimed at reduction of GHG emissions in are not implemented, are the overall emissions in waste sector are going to increase quite substantially ()

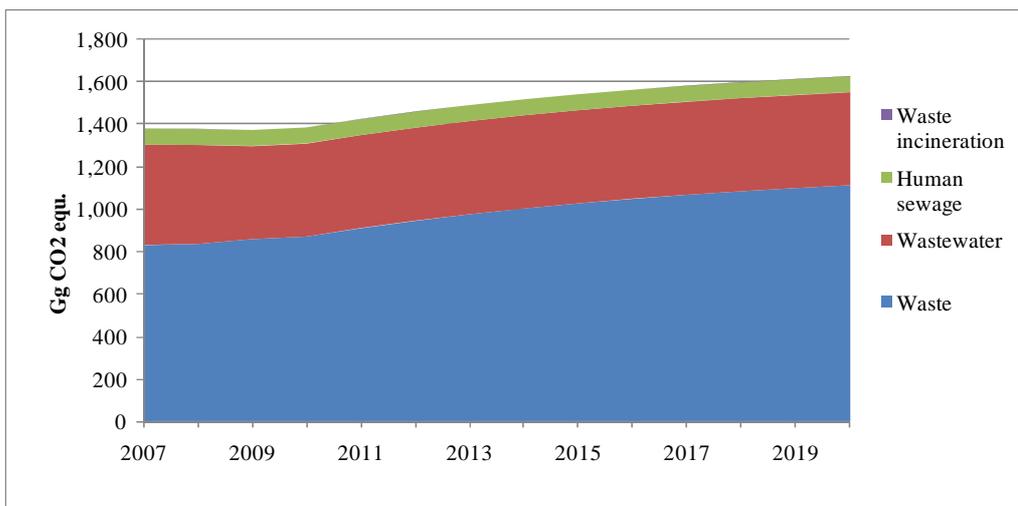


Fig. 4-12. Projected waste sector emissions without mitigation measures

Substantial reduction of waste disposal in municipal landfills is required by the landfill directive (1999/31/EC). The Lithuanian National Strategic Waste Management Plan sets the following targets for the reduction of the amount of biodegradable municipal waste disposed in landfills:

- by 2010: not more than 75 % of the total amount of biodegradable municipal waste generated in 2000;
- by 2013: not more than 50 % of the total amount of biodegradable municipal waste generated in 2000;
- by 2020: not more than 35 % of the total amount of biodegradable municipal waste generated in 2000.

As a result of substantial reduction of biodegradable waste disposed of in municipal landfills, methane generation will gradually decrease to approximately 16 Gg in 2020 (Fig. 4-13).

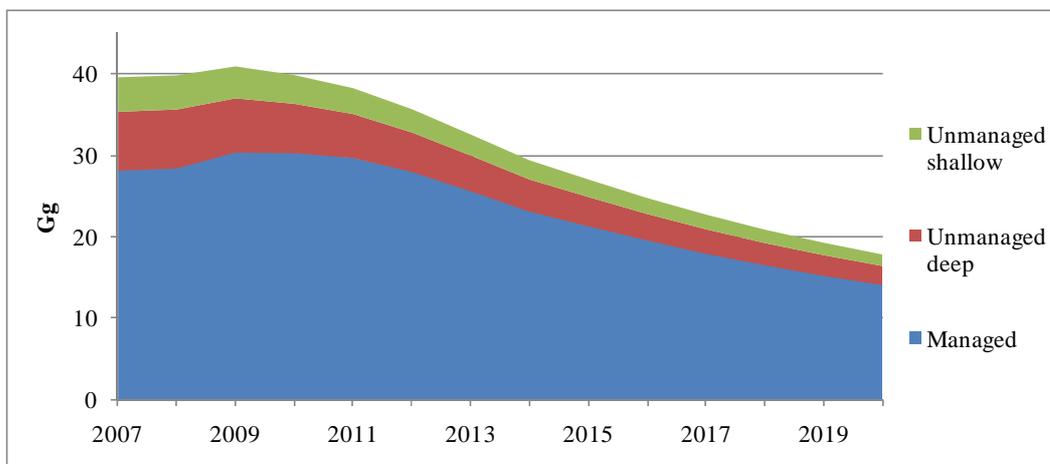


Fig. 4-13. Projected methane generation at municipal landfills

First methane recovery systems have been installed in 2008 at old closed landfills in Kaunas and Utena. In 2010 methane recovery started at closed Vilnius and Klaipėda landfills. Methane recovery equipment currently is being installed in other major closed landfills. It could be expected that methane recovery will reach approximately 40% of the total generated amount in 2020.

Projected methane recovery and emission is shown in Fig. 4-14.

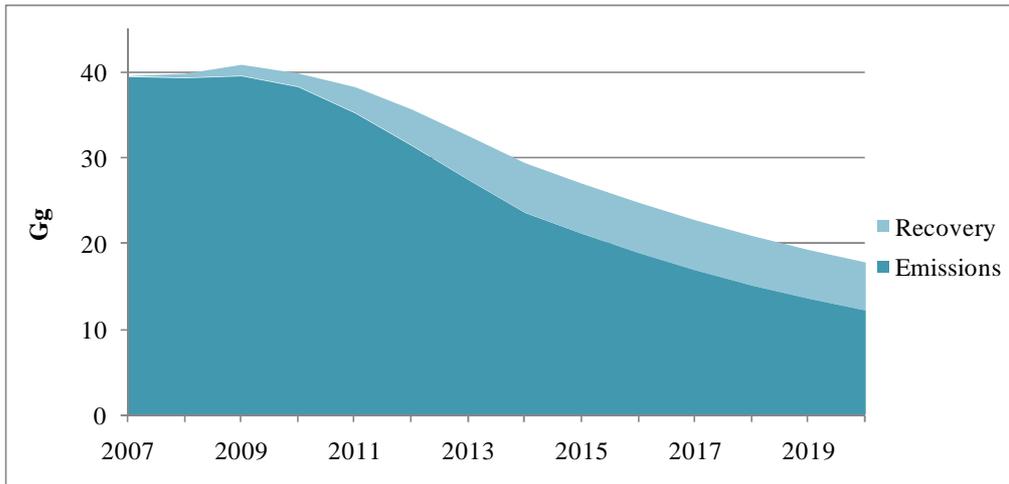


Fig. 4-14. Projected methane recovery and emissions

On the other hand, biodegradable waste diverted from landfills will be either composted or incinerated causing additional CO₂ emissions. Projected CO₂ emissions from treatment of biodegradable waste diverted from landfills are shown in Table 4-9.

Table 4-9. Projected CO₂ emissions from treatment of biodegradable waste diverted from landfills (Gg)

| | 2007 | 2009 | 2010 | 2015 | 2020 |
|-------------------------------|------|------|-------|--------|--------|
| CO ₂ emissions, Gg | 0.73 | 0.64 | 32.73 | 250.56 | 265.58 |

According to the National Strategic Waste Management Plan a development of municipal sewage sludge management capacity will be created by 2013. The mechanical-biological treatment or separate collection of biodegradable municipal waste and further treatment thereof will be introduced by 2010. The recovery of biogas from biodegradable municipal waste in anaerobic digesters and use of biogas will be implemented. Green waste (gardens, parks, greeneries and etc.) is collected and treated in composting installations. Individual composting of green waste shall be promoted as well.

Anaerobic digestion and methane recovery from sewage sludge has started in 1999 but the progress has been comparatively slow, biogas production increasing from 2.1 million m³ in the year 2000 to 4.3 million m³ in 2009. Because of economic crisis and limited public investment resources it is not likely that methane emissions from wastewater treatment will be reduced very considerably. It was assumed that realistically 2% annual reduction could be anticipated.

Projected GHG emissions in waste sector are shown in Fig. 4-15.

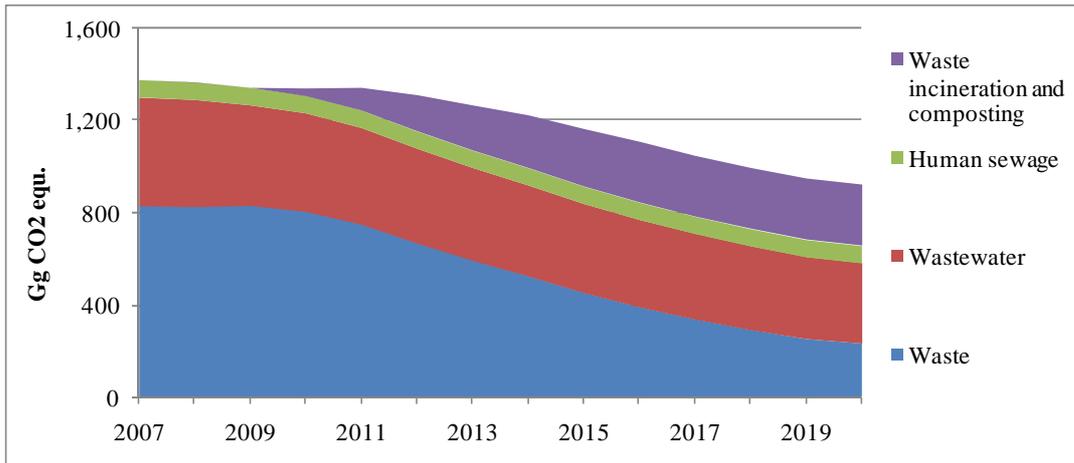


Fig. 4-15. Projected GHG emissions in waste sector (Gg CO₂ eqv.)

5 Aggregate projection

As a result of global economic crisis GHG emissions have decreased considerably in 2009. Emissions are going to increase in 2010 following closure of Ignalina NPP in 2009, however because of electricity imports and slower economic growth during recovery from crisis period GHG emissions even without special energy saving and emission mitigation measures are expected to reach only approximately 32 Tg CO₂ eqv. which is substantially lower than Kyoto target for commitment period 2008-2012.

Historical and projected aggregate GHG emissions “without measures” are shown in Fig. 5-1.

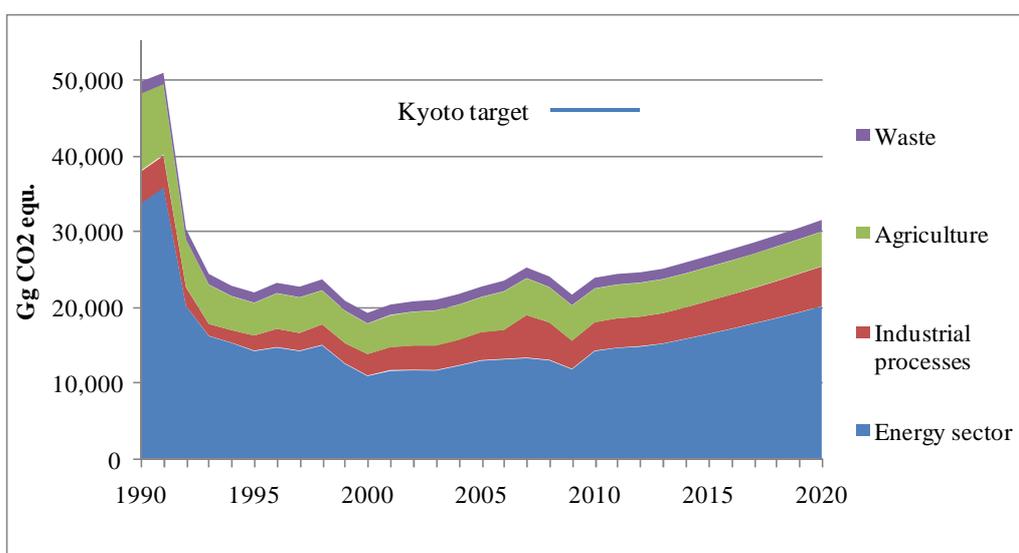


Fig. 5-1. Projected aggregate GHG emissions “without measures”

Implementation of energy saving and emission mitigation measures will further reduce GHG emissions and after implementation of planned measures the total GHG emissions in 2020 are expected be about 25 Tg CO₂ eqv. and will be substantially lower than the Kyoto target (Table 5-1).

Table 5-1. Projected GHG emissions with existing measures (Gg CO₂ eqv.)

| | 2009 | 2010 | 2015 | 2020 |
|-----------------------------------|---------------|---------------|---------------|---------------|
| Energy sector | 12,005 | 14,541 | 14,717 | 16,164 |
| Industrial processes and solvents | 3,706 | 3,766 | 4,326 | 5,243 |
| Agriculture | 4,429 | 4,434 | 4,456 | 4,532 |
| Waste | 1,345 | 1,342 | 1,158 | 947 |
| Total | 21,458 | 24,083 | 24,657 | 26,886 |

Annual variations of historic and projected GHG emissions are shown in Fig. 5-2.

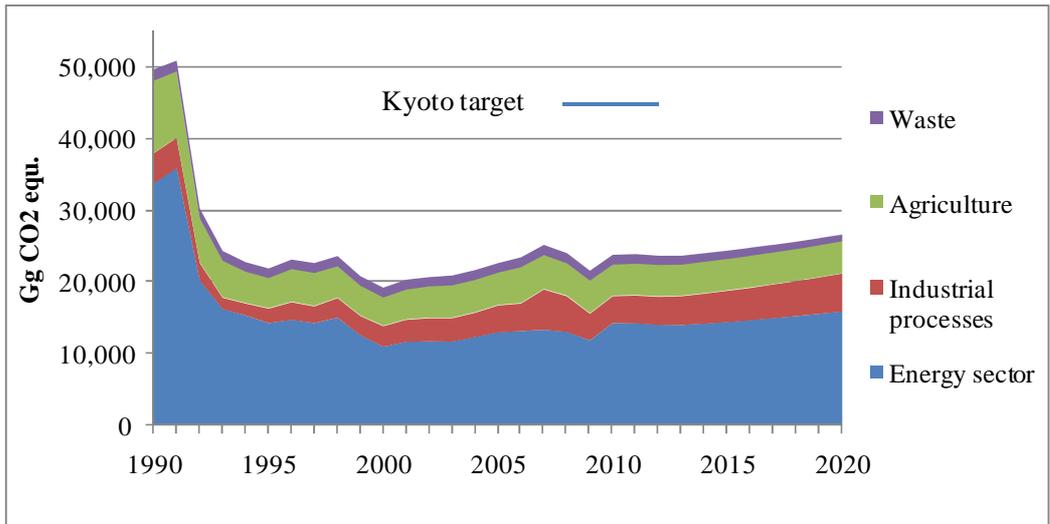


Fig. 5-2. Projected aggregate GHG emissions with energy saving and emission mitigation measures

6 Sensitivity analysis

Closure of the Ignalina nuclear power plant in 2009 will inevitably cause notable increase of GHG emissions in energy sector. However, in case of comparatively slow economic growth projected by the Lithuanian Ministry of Finance for 2010-2013, implementation of energy saving measures will prevent augmentation of emissions, which could be expected to decrease slightly. This trend should continue in case of slow economic growth (Fig. 6-1).

In case of basic economic growth scenario, emissions are expected to increase gradually and in 2020 increase approximately by 11% compared to 2010.

Fast economic growth is going to cause more significant increase of GHG emissions. Total emissions from energy sector could reach 18.4 Tg CO₂ eqv. in 2020 or approximately 16% higher than in case of basic scenario.

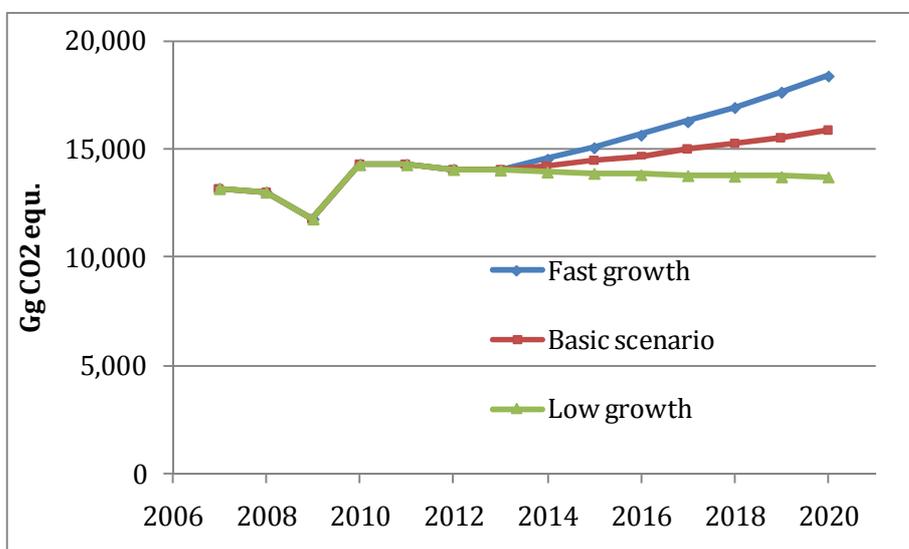


Fig. 6-1. Impact of economic growth on GHG emissions (after implementation of energy saving and emission mitigation measures)

For evaluation of impact of planned energy saving and emission reduction measures, projected final reduction of GHG emissions was calculated varying the degree of implementation of each measure, as listed in the previous section, from 25% to 175%. Results of sensitivity analysis are provided in Fig. 6-2.

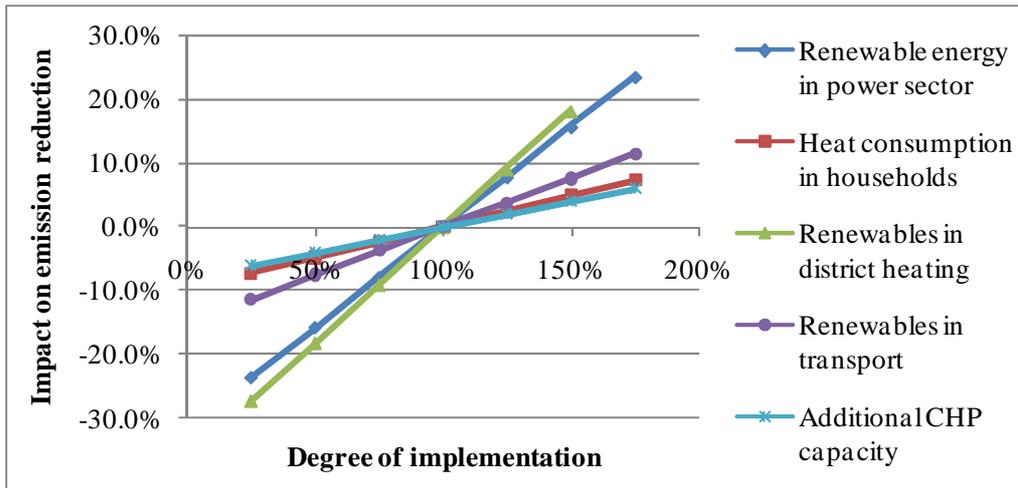


Fig. 6-2. Sensitivity analysis of GHG emission reduction measures

GHG emissions are most sensitive to changes in use on renewable energy resources. In case if the target on enhancement of use of renewable resources in district heating sector will be attained only by 50%, the overall reduction of GHG emissions will be lower than planned by 18% (bearing in mind that other measures will be fully implemented). If the target on use of renewable resources in district heating sector will be met only by 25%, emission reduction will be 27% lower than planned.

Consequences of failing to attain the target for use of renewable resources in electricity sector will be similar - 50% attainment of set target will cause 16% lower than planned emission reduction.

Impact of renovation and insulation of residential and public buildings or installation of additional CHP capacities on attainment of planned level of GHG emission reduction is less significant - failing to attain set target in energy saving in residential and public buildings by 50% will moderate planned emission reduction only 4.8%.

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