

# LITHUANIA

## AUTHORS

### Lina Seduikyte

Kaunas University of Technology  
Faculty of Civil Engineering and Architecture  
Studentu st. 48, LT-51367, Kaunas, Lithuania,  
E: lina.seduikyte@ktu.lt

### Andrius Jurelionis

Kaunas University of Technology  
Faculty of Civil Engineering and Architecture  
Studentu st. 48, LT-51367, Kaunas, Lithuania,  
E: andrius.jurelionis@ktu.lt

### Rokas Valancius

Kaunas University of Technology  
Faculty of Civil Engineering and Architecture  
Studentu st. 48, LT-51367, Kaunas, Lithuania,  
E: rokas.valancius@gmail.com

## 1 OVERVIEW OF THE REGION

### Characteristics of the Region

Kaunas district municipality is located near one of the largest cities in Lithuania – Kaunas. The district area covers 1,496 km<sup>2</sup>. About 86,600 people live in the district. It is one of the densest districts in Lithuania. Kaunas district municipality has 25 sub-districts, which include 371 villages, 9 towns and 3 cities.



Figure 1 – Map of Kaunas district municipality

The decision making body of the municipality is Council elected in general elections every four years. The Council comprises 27 members. The Council composes the Council Board consisting of 7 members. The Council, by the Mayors proposal, appoints the Director of Administration of the municipality who heads the administration and carries out decisions of the Council. The head of the municipality is the Mayor.

Figure 2 presents the evolution of Lithuania GDP Annual per Capita and the total GDP. In 2012, 19.6 % of total Lithuanian GDP was produced in Kaunas Region. This region includes six districts, Kaunas; Kedainiai; Kėstiai; Jonava; Prienai; Raseiniai; and major cities as Kaunas and Birštonas.

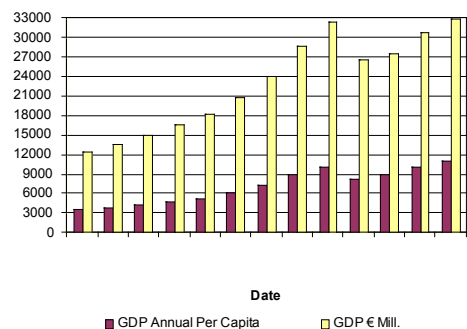


Figure 2 – Lithuania GDP Annual per Capita evolution and GDP in Million Euro  
(<http://countryeconomy.com/gdp/lithuania>)

By 2007, unemployment rate in Kaunas region had declined reaching 4.2%, lower than the national average (4.3%). However, the unemployment rate in the period of 2007 – 2009 increased rapidly to 13.2%. Unemployment and employment rates (15 – 64 years) for Kaunas region are presented in Figure 3. According to the data from Kaunas territorial employment office, unemployment in Kaunas city and Kaunas district municipality was 8.9% for September, 2013.

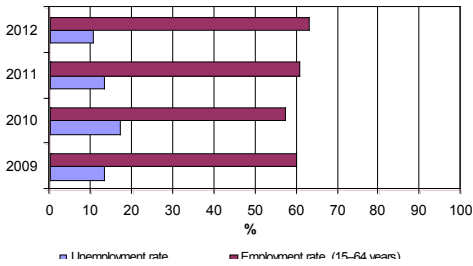


Figure 3 – Unemployment rate and employment rate (15 – 64 years) for Kaunas region

**Energy demand and supply of the Region**

By order of the Ministry of Economy of the Republic of Lithuania, the Lithuanian Energy Institute has prepared a study on “The use of existing renewable sources (biomass, hydropower, solar energy, geothermal energy) and municipal waste for energy production in municipalities of Lithuania”. The data from the study, regarding total energy consumption for Kaunas district municipality, is presented in Table 1.

The most important problem related to energy consumption is GHG emissions, since the largest source of air pollution is represented by the burning of fossil fuel. It is important to use less polluting resources and ensure lower heat losses during heat transfer processes.

Table 2 presents GHG emission factors for electricity and heat production (VI LRTI (2012)).

Category	Total energy consumption, ktne				
	Electricity	Heating	Natural Gas	Fuel for stoves, mazut	Renewable energy (biomass)
Industry	1.91	-	1.23	-	1.02
Construction	0.11	0.02	0.01	0.21	0.05
Agriculture	0.48	0.69	2.94	1.17	0.3
Municipality facilities	8.01	1.74	-	5.91	-
Domestic	1.72	2.12	3.32	10	26
Transport	0.14	-	0.5	0.1	-

Table 1 – Total energy consumption for Kaunas district municipality (2008), ktne (LEI (2009)

Used emission factors	Units		Comments
	t/MWh	t/tne	
Electricity emission’s factors of the country	0.185	2.15	Based on data of GHG inventory for 2008 and the production of electricity in Lithuania in 2008.
District heating’s, locally produced, emission factors	0.228	2.64	Based on data of GHG inventory for 2008 and the production of heating energy in Kaunas district municipality in 2008.

Table 2 – HG emission factors for electricity and heat production (VI LRTI (2012)

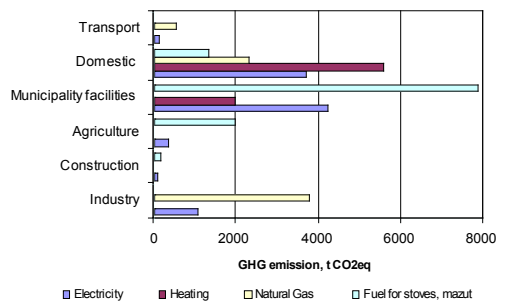


Figure 4 – GHG emission due to total energy consumption for Kaunas district municipality (2008), CO<sub>2</sub>eq (VI LRTI (2012)

GHG emissions due to total energy consumption for Kaunas district municipality (2008) are 9,590 tCO<sub>2</sub>eq and are presented in Figure 4 (VI LRTI, 2012).

Table 3 shows major projects planned for heating supply systems which directly influence the opportunities for GHG emissions reduction in Kaunas district municipality.

Nr.	Central heating supply system	Period of implementation	Project
1.	Babtai town	2011 – 2016	Gasification of Babtai town.
2.	All analysed region	2011 – 2016	Renovation of district heating, stakehold conversion to burn biomass, renovation of consumers' heating system.
3.	All analysed region	2011 – 2016	Implementation of buildings' heat energy savings – insulation of buildings, replacement of windows and doors, reconstruction of heating systems.

Table 3 – Heating supply projects planned for Kaunas district municipality

## 2. CURRENT SITUATION: TARGETS RELATED TO ENERGY POLICY

After the adoption in 2008 of the EU Climate and Energy Package, the European Commission launched the Covenant of Mayors to endorse and support the efforts deployed by local authorities in the implementation of sustainable energy policies. By their commitments, Covenant signatories aim to meet and exceed the European Union 20% objective of reduction in CO<sub>2</sub> emissions by 2020.

Signatories	Population	Adhesion	Status
Akmene district municipality, LT	25,729	26 Oct 2011	
Anykščiai, LT	32,137	30 Oct 2008	
Elektrėnai, LT	24,920	24 Apr 2013	
Jurbarkas, LT	29,706	29 Nov 2012	
Kaunas, LT	353,800	22 Jan 2009	
Kaunas District Municipality, LT	88,800	28 Feb 2013	
Pakruojis, LT	27,008	25 Sep 2008	
Šilalė, LT	29,775	30 Oct 2008	
Šilutės, LT	54,500	16 Oct 2008	
Telšiai, LT	47,818	13 Dec 2012	
Trakai, LT	33,804	27 Dec 2012	
Utena, LT	31,940	29 Nov 2012	
Vilkaviskis, LT	47,978	31 Oct 2008	
Vilnius, LT	553,904	15 Oct 2012	

Table 4 – Signatories of the Covenant of Mayors in Lithuania  
([http://www.covenantofmayors.eu/about/covenant-of-mayors\\_en.html](http://www.covenantofmayors.eu/about/covenant-of-mayors_en.html))

There are 14 signatories in Lithuania at this moment, including Kaunas district municipality. Local governments play a crucial role in mitigating the effects of climate change, all the more so when considering that 80% of energy consumption and CO<sub>2</sub> emissions is associated with urban activity. Development of sustainable energy is the main energy policy set out in the National Energy Strategy (Ministry of Energy of the Republic of Lithuania, 2010). In the National Strategy sustainable development is understood as a compromise between the environmental, economic and social goals of society, providing opportunities for the welfare of present and future generations within the permissible limits of environmental impact. While preparing the development plan for sustainable energy action, big consideration is given to climate change and the mitigation of the problem. The main methods to decrease GHG emissions in the energy sector are increasing of the energy efficiency and increasing the use of renewable energy sources.

In 2012, Kaunas district municipality prepared a plan for strategic development for the period of 2013 – 2020, where two of the main parts are the development of sustainable energy and the mitigation of climate change.

In Lithuania, climate change policies and implementations are defined by the country's international agreements: the United Nations Framework Convention on Climate Change, the Kyoto Protocol and the commitments to the European Union. The "Energy Efficiency Plan" (Ministry of Economy of the Republic of Lithuania, 2008) provides a summary of tools to increase energy efficiency. These measures are summarised in Table 5. From the table it can be seen that there are targets of energy efficiency tools addressing the domestic, trade and services, industry and transport sectors, but also there are additionally separated horizontal and cross-sectoral tools.

Sector	Tools	Expected savings until 2016, GWh	%
Domestic	Domestic strategy, Program of modernisation of multifamily houses, EU structural funds	1770	37.5
Trade and services	EU structural funds, Program of modernisation of public houses, Green purchase and requirements of effectiveness for purchase	229	5
Industry	Voluntary agreements with industry, co-generation, EU Structural Funds	395	8.5
Transport	Program of Energy efficiency in transport, checkup, etc.	460	9.5
Horizontal and cross-sectoral tools	NES, NEVEDP STR (building envelope, heating, ventilation, air conditioning), qualification and certification schemes, "smart" energy meters, fiscal measures, information, education	1871	39.5
Total		4725	100

Table 5 – Tools to increase energy efficiency

The National overall targets for 2020 are:

- 1) the renewable energy part in the transport sector increase to at least 10%;
- 2) electricity produced from the renewable energy sources increase to at least 20%;
- 3) district heating energy produced from the renewable energy sources increase to at least 60% and for the households - the renewable energy sources increase to at least 80%.

According to the national emission factors and prediction of energy consumption by different fuels, evaluation of GHG emission for Kaunas district municipality is presented in Figure 5. Reduction of GHG emission because of increase of renewable energy sources (RES) and reduction of organic fuel consumption by 2020 is evaluated in Table 6.

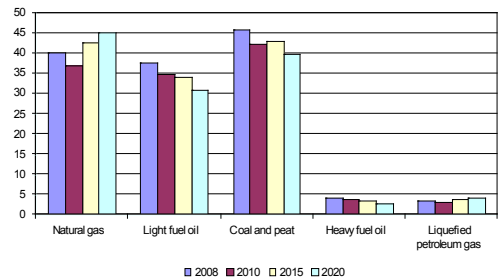


Figure 5 – GHG emissions from final energy consumption in Kaunas district municipality (VI LRTI (2012))

Organic fuel	Changes in the consumption of the organic fuel, tne	Reduction of GHG emission, t CO <sub>2</sub> eq
Natural gas	2.13	4.57
Light fuel oil	-2.28	-6.48
Coal and peat	-1.51	-5.79
Heavy fuel oil	-0.45	-1.40
Liquefied petroleum gas	0.29	0.83
Total	-1.82	-8.28
%	4.6%	7%

Table 6 – Reduction of GHG emission because of increase of AES in Kaunas district municipality (VI LRTI (2012))

### Other Regional targets, barriers and drivers

Kaunas district municipality's Strengths:

Economic development:

- great location;
- a large number of professionals;
- an attractive tourist environment; increasing

- foreign investment;
- a well-developed business infrastructure;
- a relatively large part of the country's agricultural production;
- the district has a free economic zone;
- road network connecting the region with other regions and municipalities is well-developed;
- a relatively low air pollution index;
- an increase of secondary raw materials collection;
- the municipality's administrations is focusing on the development of engineering infrastructure, and environmental issues;
- residents are interested in solar power and energy crops and investments in the production of biomass crops.

*Social development:*

- declining number of social risk families and children living in such families;
- development of infrastructure for people with disabilities;
- the school network is well developed and meets the current needs; the education level is high and corresponds to the national average;
- increased number of culture, sports and health facilities.

*Kaunas district municipality's Weaknesses:*

*Economic development:*

- the economic crisis has affected Kaunas district economic development and growth of the unemployment;
- a small purchasing power;
- emigration;
- industry concentration in large cities;
- slow growth of ecological farms and non-traditional crafts;
- limited financial capacity of municipality to provide funds for maintenance of roads;
- poorly developed telecommunications system in rural areas, poor communication lines (or not installed) prevents the development of information technology;
- regional heating network is relatively old with poor insulation;
- poor water network in villages with high water losses.

*Social development:*

- shortage of specific transport for the provision of social services for people with disabilities;

- educational institutions are not rapidly renewed, they do not meet the needs of culture, libraries, and sports facilities material base;
- passive society, youth social exclusion, poor motivation for activities.

*Kaunas district municipality's Opportunities:*

*Economic development:*

- free economic zone;
- development of ecological farms;
- opportunity to use EU structural funds to implement energy saving tools;
- education of society and involvement in environmental projects;
- wind power development;
- solar power development;
- development of energy crops;
- development of biomass production.

*Social development:*

- district may use different national and international funds for the development and implementation of social projects;
- modernisation of the material base of cultural institutions;
- development of higher education forms adapted for adults.

*Kaunas district municipality's threats:*

*Economic development:*

- the lack of attention to cultural heritage;
- errors of health care reform;
- undeveloped business culture;
- competitor municipalities for example, Kaunas and Kedainiai districts can make decisions that enhance the attractiveness of the business in those areas impacting on other districts;
- low movement of information technologies may leave local companies uncompetitive.

*Social development:*

- increase of social - economical problems due to rising unemployment.

The following objectives and priorities are raised for the implementation of strategy of development of sustainable energy and climate change mitigation in Kaunas district municipality (VI LRTI (2012):

- Growth of economics and regional competitiveness by modernisation of energy

infrastructure and reducing energy losses and implementation of innovative energy technologies;

- Social development and improvement of quality of life, proceeding to sustainable use and energy savings, by changing people's behavior and introduction of innovative energy technologies and products, ensuring energy savings and energy cost reduction;
- Maintenance of environmental quality, by introduction of new energy production and consumption technologies, increasing renewable energy use and energy saving.

### 3. CASE STUDY: COGENERATION POWER PLANT IN VILLAGE OF NOREIKISKES

Noreikiskes is a village with 926 residents located in Kaunas district municipality. The A. Stulginskis University (former Lithuanian University of Agriculture) is located in the area. Over the past few years many individual housing projects have been undertaken in Noreikiskes. It is expected that young families with average and higher incomes will become residents of these new houses.



Figure 6 – Noreikiskes

The Joint-Stock Company (JSC) “Kauno energija” provides the biggest amount of heat for Kaunas district municipality as a whole. From the 1st January, 2010 the company also provides hot water. The main shareholder is Kaunas city municipality (93.05%).

#### Objectives and methods

Stricter requirements for protecting the environment, increasing prices of traditional fuel (natural gas, fuel oil) and competition in

energy markets have all encouraged JSC “Kauno energija” to look for cheaper and environmentally cleaner energy production methods and to provide higher quality and safer products for consumers and the environment.

In 2000, JSC “Kauno vandenys” was running the largest biogas power plant, where the Kaunas' sewage sludge was processed into biogas. Annual production from the two bioreactors is about 2.8 million m<sup>3</sup> of good quality (with 70 % methane concentration) biogas. Part of the produced biogas is burned in two 1.9 MW hot water boilers. Hot water is used to heat the company's premises and the recycled sludge.



Figure 7 – JSC “Kauno vandenys”

The Lithuanian Energy Institute and Department of Thermal and Nuclear Energy of Kaunas University of Technology performed tests on JSC “Kauno vandenys” biogas composition, and found that biogas contains methane (CH<sub>4</sub>) – 67.4 %, CO<sub>2</sub> – 30 %, CO – 0.3 %. It should be noted that CH<sub>4</sub> stimulates the green house effect up to 21 times more intensively than CO<sub>2</sub>. Therefore, in order to reduce the negative impact of biogas on the environment and to get economical benefits, special emphasis was given to rational use of these gasses while burning in energy facilities.

Since only part of biogas was burned in JSC “Kauno vandenys”, a decision was made to use the remaining part in Noreikiskes.

In December of 2001, JSC “Kauno energija” and JSC “Kauno vandenys” signed agreement regarding the buying and selling of biogas.

From 2002, an ineffective old boiler was used for the biogas in Noreikiskes. Since 2004, JSC “Kauno energija” began looking for a solution to increase the effectiveness of biogas and reduce the negative impact on the environment.

According to Lithuanian energy policies, which deal with heat supply problems, one of the best technical solutions is the implementation of cogeneration. It was therefore planned to build 5 cogenerators in Noreikiskes. Cogeneration is the use of a heat engine or power station to simultaneously generate electricity and useful heat. Cogeneration, as rational way of using energy, allows savings in primary energy. If cogeneration is widely used, it can have significant impact on diverse economical growth in the country: while saving the money, reducing import of fuel, increasing industrial growth of equipment manufacture.

#### Long term focus

- lower atmospheric pollution;
- energy production from renewable energy sources (biogas);
- improvement in the reliability of energy supply;
- increase in the effectiveness of energy production;
- reduction of the cost of heat production, which will stabilise the rising prices of heating for residents;
- lower pollution fees;
- minor dependence on fuel import.

#### Outcomes

- in 2005, 5 cogenerators (Cento T 150SP BIO) were built with 150 kW electrical and 210 kW heat power in Noreikiskes. Total electrical power of cogeneration power plants is 750 kW, with 1050 kW of heating power;
- the main fuel is biogas, supplied from JSC “Kauno vandenys” water treatment facilities.
- the payback period of the project is expected to be 4.2 years;
- annual production of electricity – 5.7 million kWh;
- cogeneration power plant control equipment is connected by 10/0.4 kV transformer to JSC “VST” electricity distribution networks.



Figure 8 – Biogas engines in Noreikiskes power plant

- produced electricity is used for JSC “Kauno energija” needs (0.7 million kWh) and the rest is sold to the network (5 million kWh). Parameters of cogeneration power plant are presented in Table 7;
- “Green” energy produced in cogeneration power plant is provided to Noreikiskes residents, and the University’s buildings. Hot water needs are completely covered by capacity of cogeneration power plant. Up to 25% heating needs is also covered.

Parameters	Units	Per hour	Per year
Designed production of electricity by nominal capacity (7600 hours / year)	kWh	750	5.7 million
Designed production of heat energy by nominal capacity (7600 hours / year)	kWh	1050	8.0 million
Consumption of biogas at 4819 kcal/kg colorific value	Nm <sup>3</sup> /h	260	2.4 million

Total efficiency factor of fuel 87.6%.

Table 7 – Parameters of Noreikiskes cogeneration power plant  
(<http://www.lsta.lt/lt/articles/view/7>)

- After the project implementation, Noreikiskes cogeneration power plant will burn 2,398.86 thousand m<sup>3</sup> of biogas. The benefits of replacing traditional energy sources with biogas from a water treatment company include:
- using of waste products (environmental);
- saving money due to minor fuel imports (economical);
- reducing dependence from fuel importers (social);
- increasing the reliability of energy supply (technical);
- solving environmental problems and increasing its quality (environmental).

The example of Noreikiskes cogeneration power plant should encourage other companies to engage with similar projects. However, these kind of projects are very expensive, thus cost is the main barrier. The education of society is also playing a large role in this kind of projects, as companies and residents should understand the benefits of implementing alternative and smart energy systems.

#### 4. CONCLUSIONS

The implementation of cogeneration power plants in the region had the following positive impacts in different fields:

- energy security: contributing to EU and Lithuanian Energy's strategic objectives to reduce dependence on imported fuels. Utilising biogas ensures the security of supply as the fuel supply cannot be shut off as a result of political factors;
- economic benefit: saving countries' financial resources, as the price of biogas is half the cost of fossil fuel. The capital also remains in the country, on the contrary to the import of natural gas;
- social benefit: creating of new jobs and increasing employment; promoting new infrastructures for biogas production;
- ecological security: decreasing the pollution of the environment. Contributing to the national and EU environmental commitments.

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This publication is a section of the book  
“Smart Energy Regions”

Published by The Welsh School of  
Architecture, Cardiff University,  
Bute Building, King Edward VII Avenue,  
CARDIFF, CF10 3NB, UK.

Publication date: May, 2014; ISBN: 978-1-899895-14-4.



The COST Action TU1104 Smart Energy Regions brings together over 70 researchers from European institutions to investigate the drivers and barriers that may impact on the large scale implementation of low carbon technologies in the built environment. The book “Smart Energy Regions” is the outcome of the Working Group 1 of the Action and collects analysis and case studies from 26 European countries. For more information about the Action and COST please visit [www.smart-er.eu](http://www.smart-er.eu) and [www.cost.eu](http://www.cost.eu).



ESF Provides the COST Office through an EC contract

COST is supported by the EU

RTD Framework Programme



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This publication is supported by COST.