

Report of the Republic of Lithuania on the First Evaluation of the Progress towards Increasing the Share of High Efficiency Cogeneration

1. Overview of the electric power and heat sectors of the country

The Lithuanian electric power system fully meets the needs of the country for electric power. In 2006, the installed capacity of the power plants in Lithuania was over 5000 MW. The greatest share of the installed capacity belonged to: the Condensation Power Plant of Lithuania (1800 MW), the Ignalina Nuclear Power Plant (1300 MW), cogeneration power plants (over 800 MW), the Kruonis Pumped Storage Plant (900 MW). The main producer of electric power is the Ignalina NPP, which generates about 70% of the total production in Lithuania. According to the preliminary figures for 2006, Lithuania produced 12.5 TWh of electricity, exported 2 TWh and imported 1.55 TWh of electricity. The total need of the country for electric power was 11 TWh, the maximum load of the power plant system was about 2 GW.

In 2006, there were 28 fully operational cogeneration power plants (hereinafter referred to as CPP) in the country. The capacity of 18 CPP was over 1 MW. The total installed capacity for power generation was 812 MW. In 2006 all the CPPs produced nearly 2 TWh.

The first CPPs were constructed in Lithuania in the 50's of the last century. They have been generating power and heat to this day. The biggest CPPs (in Vilnius and Kaunas) were constructed in the 80's).

Table 1. Indicators of the CPPs for 2006

Name of the cogeneration power plant	Electric power capacity, MW	Heat capacity, MW	Generation of electricity, GWh
Vilniaus Energija AB	384	706	703.5
Kauno Energija AB (Petrašiūnai CPP)	8	60	1.2
Kauno Termofikacinė elektrinė UAB	170	280	663.6
Klaipėdos Energija AB	10.8	32	22.7
Mažeikių elektrinė AB	160	600	199.8
Achema AB	24.5	27.8	144.3
Lifosa AB	31	85	197.2
Šiaulių energija AB	3	32	10.0
Panevėžio energija AB	2.5	25	13.0
Druskininkų šiluma, a branch of Litesko UAB	0.75	23.5	1.8
Palanga rehabilitation hospital VšĮ	0.12	0.2	0.1
Vakarų laivų remontas UAB	2.4	2.8	10.4
Biomass-fired power plants	3.9	45.7	25.6
Other power plants	11.3	164.2	5.3
Total:	812.2	2084.2	1998.5

In 2005-2006, 5 cogeneration units were installed, three of which use biomass. The total of capacity of the new cogeneration units is 14 MW. The specific data are presented in the table below.

Table 2. Cogeneration units installed in Lithuania in 2005-2006

Name of the power plant	Electric power capacity	Heat capacity	Fuel	Technology
Noreikiškiai regional boiler house power plant	0.75	1.05	Biogas	Internal combustion engine
Plungės bioenergija UAB	1.2	16	Biofuel	Pre-pressure gas turbine
Marijampolės šiluma, a branch of Litesko UAB	2.5	15	Biofuel	Pre-pressure gas turbine
Alytaus šiluma, a branch of Litesko UAB	9.2	40.7	Natural gas	Pre-pressure gas turbine
Salininkai power plant of Vilniaus energija UAB	0.6	0.9	Natural gas	Internal combustion engine
Total:	14.25	73.65		

The efficiency of cogeneration is directly related to heat demand. Lithuania has a well-developed centralised heat supply (hereinafter referred to as ‘CHS’) system. In urban areas about 75% of the area of residential houses as well as industrial and commercial buildings and some industrial enterprises are heated via the CHS systems. In 2006, there were 56 big CHS enterprises. According to the preliminary figures for 2006, the heat generated by all the enterprises reached over 10 TWh, 5 TWh of which were generated by CPPs. The final consumers received 8.2 TWh via the CHS system, including 5.8 TWh for heating residential houses and hot water supply, the remaining part was supplied to the industrial and service sectors. Natural gas accounted for the greatest share - 80% - in the fuel mix used for the generation of power, while biomass made up 12%.

The CPPs in Vilnius and Kaunas can fully meet the needs of these cities for central heat supply. The capacities of the CPPs in Klaipėda, Panevėžys and other towns are smaller and they cannot generate the quantity of heat that could be sufficient for the needs of those towns. In 2006, the main fuel used in CPPs was natural gas accounting for about 80% in the fuel mix.

2. Cogeneration potential

In 2005, at the request of the Ministry of the Economy of the Republic of Lithuania, the consultancy COWI Baltic UAB and Termosistemų projektai UAB conducted an analysis of the high efficiency cogeneration potential in the country.

The analysis concentrated on the investigation of the Lithuanian heat market, which is an indispensable condition for the existence and development of cogeneration. Information on the demand of the CHS systems and the industrial sector for heat was obtained from the direct analysis of the data of CHS enterprises and the detailed questionnaires sent out to industrial companies.

The study assumed that the demand for heat in CHS systems will remain constant – the emergence of new consumers will be set off by heat conservation through the application of energy conservation measures in buildings.

The forecast for electric power demand in industries is presented in Fig. 1. The greatest increase in the demand for electric power is expected in industry, household and service sectors.

Industry	Construction	Agriculture	Transport
Household sector	Service sector	Energy sector	Losses in the grids

Fig. 1 Forecast of the needs for electricity in various industries, TWh

The investigators evaluated the technical cogeneration potential, which stands at 931 MW (natural gas – 881 MW, biofuel – 50 MW) of the installed power capacity in the CHS systems, and at 65 MW of power capacity (natural gas – 51 MW, biofuel – 14 MW) in industry. The main assumptions used for the evaluation of the technical potential were the following: two cogeneration units will be installed; the capacity of each unit will be selected as a mean of the capacities in the heating season and offheating season. In projecting the possible technologies, it was assumed that in areas where there is no natural gas supply and the use of combined cycle technologies is impossible the most appropriate technology would be steam turbines.

In assessing the total heat and electricity production potential based on cost-benefit analysis, the objective was to establish a cogeneration potential that would be useful to entire Lithuania and would ensure the least energy production costs for the consumers. The economic assessment of the potential was based on the comparison of long-term aggregate margin costs of power generation. The assessment model was based on the economic and social price of the resources, such as the cost of labour, resources, fuel, CO₂ emissions, rather than the commercial prices of the resources. The variants analysed included the basic situation where electricity and heat are generated separately (it was assumed that the economic production cost of electricity was equal to that incurred at the condensation power plant of Lithuania, while heat production cost was equal to the cost incurred at the new boiler house), and the alternatives of cogeneration: internal combustion engines, steam turbines, gas turbines and the combined cycle where the production of electricity is based exclusively on the need for efficient heat supplies. The analysis of both the variants included the evaluation of long-term aggregate production margin costs in generating the same quantity of energy. Table 3 presents the likely development of efficient cogeneration in 1020, 1015 and 2020 based on the projected needs for energy in the future and the obtained assessment of the potential of cogeneration.

Table 3. Possible use of the economically based potential of high efficiency cogeneration (reference year – 2005)

Indicators	Year			
	2005	2010	2015	2020
Electricity demand, TWh	11.4	12.5	13.5	15.5

Heat demand by CHS, TWh	10.1	10.1	10.1	10.1
Projected additional CPP capacity for CHS, MW _{cl}		108	215	400
Projected additional heat generation for CHS from additional PPCs, TWh		0.6	1.1	2.1
Generation of heat by cogeneration for CHS, TWh	5.5	6.1	6.6	7.6
Proportion of heat produced by cogeneration in the total demand for CHS, %	54	60	66	75
Projected additional electricity for CHS, TWh		0.5	1.0	1.9
Generation of electricity by cogeneration, TWh	2.3	3.1	3.9	4.8
Projected additional CPP capacities in industrial enterprises, MW _{cl}		30	65	
Projected additional generation of electricity in industrial enterprises, TWh		0.25	0.55	
Proportion of electricity produced by cogeneration in the total demand for electric power, %	20	25	29	31

As the market is dominated by the Ignalina NPP's cheap electric power supplies, the other power plants can have only a small part of the market as their production costs are higher. After the second block of the Ignalina NPP is decommissioned in 2009, the generating capacities, including the low-capacity CPPs slated for construction, will be able to meet the needs of the national economy until 2013. After the second block is decommissioned and before a new nuclear power plant is built, the main source of electric power will be the condensation power plant of Lithuania.

The main fuel for CPPs will be natural gas. The natural gas supply system is well developed in the country, investments are constantly made in its modernisation and expansion, but natural gas is supplied from a single source – Russia, therefore it is difficult to forecast changes in its price and there is always risk of supply disruptions and inadequate pressure for the combined cycle technologies.

3. Regulation of electricity and heat cogeneration

The Law on Electricity (*Official Gazette*, 2000, No 66-1984; 2004, No 107-3964) defines public interests in the electricity sector, which means any act or omission in the electricity sector, directly or indirectly related to the public security, environmental protection, and to electricity generation from renewable energy sources, waste or combined heat and power generation.

In the implementation of *the Law on Electricity*, the Government of the Republic of Lithuania adopted Resolution No 1474 on 5 December 2005 (*Official Gazette*, 2001, No 104-3713) on the approval of the list of public interest services in the electric power sector. In that list of public services (hereinafter referred to as 'the VIAP') the Government stated that thermal production of electricity in cogeneration power plants supplying heat to urban centralised heat supply networks is a service of public interest in the electricity power sector. The same position was reiterated in the amended version of the VIAP, which was approved by Order No 4-495 of the Minister of the Economy of 27 December 2006 (*Official Gazette*, 2007, No 1-27).

The provision of the VIAPs included in the list is regulated by the *Rules on the Obligation to Provide Public Interest Services* approved by Order No 380 of the Minister of the Economy of 18 December 2001 (*Official Gazette*, 2001, No 110-4010; 2006, No

140-5374). These Rules establish the general terms and conditions for the provision of electricity sector services related to public security, environmental protection, and to electricity generation from renewable energy sources, waste or combined heat and power generation, and they also regulate the requirements and obligations of the holders of the licence for electricity supply and the operators of the market, transmission and distribution networks to provide these services.

The Law on Heat Energy adopted on 20 May 2003 (*Official Gazette*, 2003, No 51-2254) lays down that cogeneration of heat and electricity is a service of public interest. The calculation of the purchased yearly quantities of electric power generated by CPP and the purchasing methods were established in *the Rules for the Purchase of Energy from Cogeneration Plants* approved by Order No 4-262 of the Minister of the Economy of 30 June 2003 (*Official Gazette*, 2003, No 70-3197, 2004, No 84-3445). The Rules lay down that the yearly quantities of electric power to be purchased from individual CPPs shall be established in relation to the heat energy slated for production and sale in the relevant year. These quantities of electric power shall be purchased by the independent regulator – the National Control Commission for Prices and Energy – at the established prices that exceed market prices by 50 per cent on average. The prices are established in accordance with the Rules for the Regulation of Prices for Electricity Purchased from Cogeneration CPPs approved by Resolution No O3-84 of the National Control Commission for Prices and Energy of 29 July 2004 (*Information Notices*, 2004, No 59-567).

Generation of electricity by CPP from renewable energy sources is encouraged by purchasing the entire quantity of electric power generated in the CPPs fuelled by biomass in accordance with the Procedure for the Promotion of the Production and Purchase of Electricity Generated from Renewable and Waste Energy Resources (hereinafter referred to as ‘the Procedure’) approved by Resolution No 1474 of the Government of 5 December 2001 (*Official Gazette*, 2001, No 104-3713; 2004, No 9-228; 2006, No 100-3862). This quantity of electricity is purchased at the price – 20 cents/kWh – set in Resolution No 7 of the State Control Commission for Prices and Energy of 11 February 2002 regarding prices of public interest services in the electricity sector (*Official Gazette*, 2002, No 16-648). The aforementioned Procedure provides that these prices will be maintained until 31 December 2020. The Procedure also provides that generation of electricity in CPP from renewable and waste energy resources will be promoted through the application of 40 per cent discount to the fee such generators of electricity pay for connecting to the grids; the discount will be accounted for as purchase of public interest services and the next year it will be compensation for from the operators’ expenditure for the development of the grids.

4. Directions in energy development and cogeneration

Directions in energy development for twenty years ahead are adjusted every five years by updating the National Energy Strategy (hereinafter referred to as ‘the Strategy’). The latest Strategy update was approved by Resolution No X-1046 of the Seimas of 18 January 2007 (*Official Gazette*, 2007, No 11-430). The Strategy provides for a 35% increase of the share of electricity generated by CPP in the total production of electricity by 2025. The Strategy provides for a progressive installation of CPP in the centralised heat supply enterprises capable of generating electricity at a price competitive with the prices in the open market, and also for the construction of CPPs of a combined capacity of 400 MW in Klaipėda, Panevėžys, Šiauliai, Alytus, Marijampolė and other towns by 2020.

The *Directions in the Development of Heat Energy* approved by Resolution No 307 of the Government of 22 March 2004 (*Official Gazette*, 2004, No 44-1446) provide for the development of CPP capacities by increasing the efficiency of energy generation and decreasing environmental pollution. The document provides for the following directions:

- to modernise the CPPs in Vilnius and Kaunas and to construct a demonstration CPP in Panevėžys;
- to construct a CPP in Šiauliai and Klaipėda by 2015;
- to construct CPPs of a combined capacity of 400 MW in Alytus, Marijampolė and other towns by 2020.

There are also plans to modernise the existing heat generation installations and to construct new ones with possibilities for cogeneration and to ensure that in 2020 the electricity generated by CPP should account for no less than 35% of the total electric power generated and the heat generated by CPP should account for no less than 75% of the total quantity of heat supplied centrally.

In 2006, to implement the proposed directions, Panevėžio energija AB, a heat supply company managing the CHS system in Panevėžys, began the construction of a power plant with a combined cycle gas turbine of 35 MW electric power capacity and 35 heat capacity. The power plant will be put into operation at the end of 2007.

In 2006, Vilniaus energija UAB reconstructed the steam boiler of 60 MW heat capacity in Power Plant No 2 and adapted it for biomass. In 2008, the pre-pressure gas turbine of 12 MW capacity will be replaced by a gas turbine of 17 MW capacity and then the total capacity of Power Plant No 2 will be increased to 29 MW.

In the near future, the construction of a biomass-fuelled CPP of 9 MW electric power capacity and 20 MW heat capacity will start in Šiauliai.

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