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Renewable Energy Outlook in Lithuania

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Bio-Fuels

Agriculture in the Economy

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Report Highlights:

Lithuania's energy sector played an important role in the country's economic development over the past decade as the country graduated to energy self-sufficiency. That ended with decommissioning of the Ignalina Nuclear Power Plant in December 2009, a condition for EU accession as that facility employed the same nuclear technology as the Chernobyl facility. That facility satisfied 70 percent of the country's electricity demand. Lithuania is now reliant on energy-generating raw materials imported from Russia but is actively developing renewable energy sources (RES), from biomass to wind and geothermal, to gain energy independence again.

General Information:

1. Energy overview

Current situation

According to Statistics Lithuania, in 2008, Lithuanian's sourced their energy as follows: oil and oil products (32 percent), natural gas (28 percent), nuclear energy (27 percent), coal and coke (two percent), and renewable energy (11 percent, including eight percent from biomass). The sectors that consumed the most energy were transport (almost 35 percent) and households (over 30 percent). Other energy consumers were: industry (about 17 percent), services (about 13 percent) and construction, agriculture and fishing (five percent altogether).

According to the Department of Statistics, Government of the Republic of Lithuania, 2009 energy production totaled over 4.3 million tons of oil equivalents (TOE). The forms of energy were: nuclear power (65 percent or 2.8 million TOE); solid fuel (25 percent or 1 million TOE); chemical processes (5 percent or 210,000 TOE); crude oil (three percent or 117,000 TOE), and renewable energy (RES) (four percent or 168,000 TOE). RES was comprised of liquid bio-fuel and biogas (over 67 percent), hydropower (22 percent), wind power (12 percent), and geothermal energy (three percent).

In 2010 the structure of energy production in Lithuania changed significantly, after the shutdown of the Ignalina Nuclear Power Plant (NPP). Ignalina NPP consisted of two nuclear reactors, each of 1,500 MW electrical power capacities. The first reactor was shut down on 31 December 2004 and the second on 31 December 2009. The closure of the Ignalina NPP was a precondition of the EU accession as it did not meet the EU safety standards. After decommissioning of the Ignalina NPP, Lithuania became more dependent on gas imports from Russia. As a consequence energy prices increased, but energy shortages did not materialize. Lithuania intends to build another nuclear power plant "Visaginas," but not until 2018-2020. The preliminary plan is for that plant to consist of two reactors with a total energy generating capacity of 3,200 MW. The plan is for the facility to be completed by 2025 with the first reactor coming on-line in the 2018-2020 time frame. The consortium of Lithuania, Estonia, Latvia, and Poland is planning this new nuclear facility.

Energy production

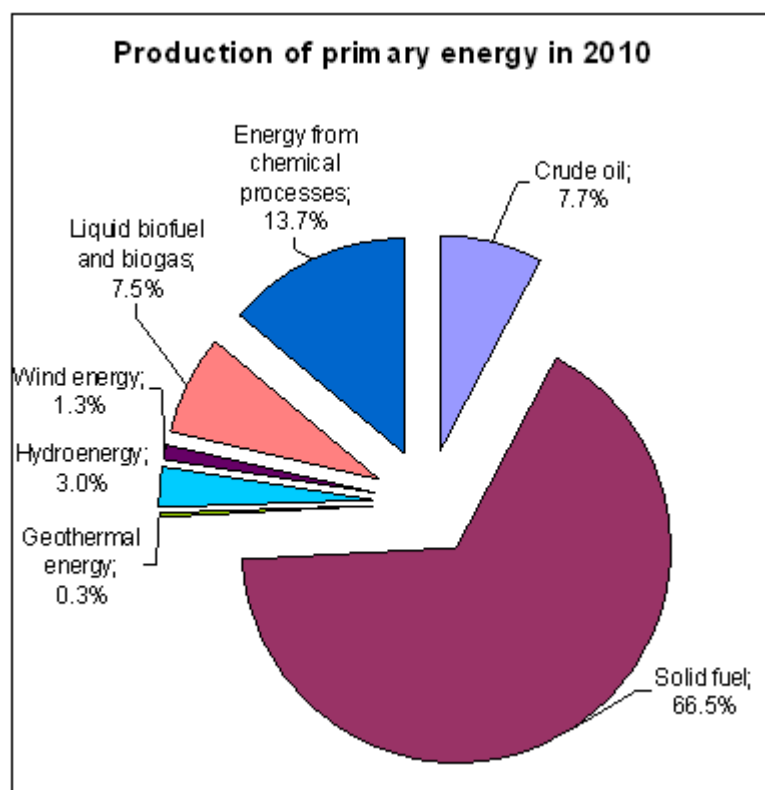
Total energy production decreased from 4,346 thousand TOE (KTOE) in 2009, to 1,523 KTOE in 2010 (or a 65 percent decrease). In comparison with 2009, production of renewable energy increased slightly in 2010.

Energy production in Lithuanian in 2008-2010

Energy production [thousand tons of oil equivalent (ktoe)]			
Year	2008	2009	2010
Production of primary energy [ktoe]	3,811.1	4,346.3	1,522.6
Crude oil	130.6	117.5	117.3
Solid fuel	784.6	1,017.9	1,011.6
Nuclear, hydro, wind, geothermal and energy from chemical processes	2,824.7	3,097.9	279.6
Nuclear energy	2,578.3	2,828.2	-
Hydro energy	34.6	36.5	46.4
Wind energy	11.3	13.5	19.3
Geothermal energy	0.6	5.1	4.5
Energy from chemical processes	199.9	214.6	209.6
Liquid biofuel and biogas	71.2	113	114.1

Source: Statistics Lithuania; Energy Balance (<http://www.ena.lt>).

The chart below presents the structure of primary energy production in Lithuania in 2010.



Source: Statistics Lithuania

At the start of 2010 Prime Minister Andrius Kubilius stated that “*there will be no catastrophe after the closure. We are ready to supply as much electricity as needed.*” Energy Minister Arvydas Sekmokas also added that “*the bulk of the power needed after the immediate shutdown of Ignalina would be generated at the Elektrėnai fossil fuel power plant and imported from neighboring Baltic States Estonia and Latvia.*” However analysts had forecasted that power prices would rise, dealing a further blow to

the weak economy, and dependence on power supplies from Russia would increase. Swedbank reported that “*Lithuania's increasing import dependence on natural gas after the closure of Ignalina [...] is clearly raising import-related risks*” (source: <http://www.euractiv.com>).

Current data shows that after closure of the Ignalina NPP, Lithuania could no longer satisfy domestic electrical demand. In 2010, the National Energy (Energy Independence) Strategy (NES) was issued, wherein the main objectives for Lithuanian energy sector were defined as: energy independence, competitiveness, and sustainability. Energy independence by 2020 is the most important goal.

Lithuania has no interconnections with energy systems in the EU and thus is dependent on Russia as a sole external gas supplier. The result is that energy consumers in Lithuania are vulnerable to large price fluctuations. Though there are plans to open a new nuclear facility, Lithuania also must factor in its energy strategy its EU obligation to increase the share of renewable energy in total energy consumption.

Mandatory EU targets for renewable energy

In the National Energy Strategy (NES), the goal concerning renewable energy is in line with EU Directive 2009/28/EC. Lithuania should achieve by 2020 the mandated target of energy from renewable energy sources (RES) of 23 percent of gross energy consumption. In 2008, the share of RES in the final energy consumption topped 15 percent, with biomass (wood and wood wastes) being the largest contributor. According to the NES, Lithuania holds huge potential of wind and hydro energy. Strategic initiatives envisage the following shares of renewable energy in electricity, heat and transportation by 2020: 20 percent of electricity is to be derived from RES, mainly from biomass and partly from wind; as much as 60 percent of heat production is to be from RES (biomass) and bio-fuels are obliged to contribute to 10 percent of the share of fuels used in transportation sector. In 2009, the share of energy from RES consumed in transport sector was five percent, in electricity sector five percent, in heating and cooling 28 percent, and in district heating 15 percent.

Lithuania intends to fulfill the target of 20 percent of electricity from RES mainly by installing biomass CHP plants and wind power plants. According to the NES, by 2020 Lithuania will have 500 MW of installed wind energy capacity, 224 MW of biomass, 153 MW of hydro energy and 10 MW of solar energy. In heating sector the goal of 60 percent of energy from RES is to be covered mainly by biomass.

2. Renewable energy sources (based on Lithuanian Statistics data)

Biomass

In 2010, 33 percent of Lithuania's land area, or 2.15 million hectares, was forested. In recent years expansion of the land's forestry resources has taken place resulting with readily available wooden biomass material for energy production. The NES involves use of biomass generated energy for the heating sector. Statistical data for 2010 shows final consumption of firewood and wood waste at 3.495 million CUM. This material was used mainly for heating purposes.

The Lithuanian Biomass Energy Association (LITBIOMA) notes that there are about 2.4 million tons of straw available each year. However, only a minor portion is used for energy production. Only about a half million tons of straw can be economically harvested and converted into energy. Potentially energy

production would be around 1500 GWh.

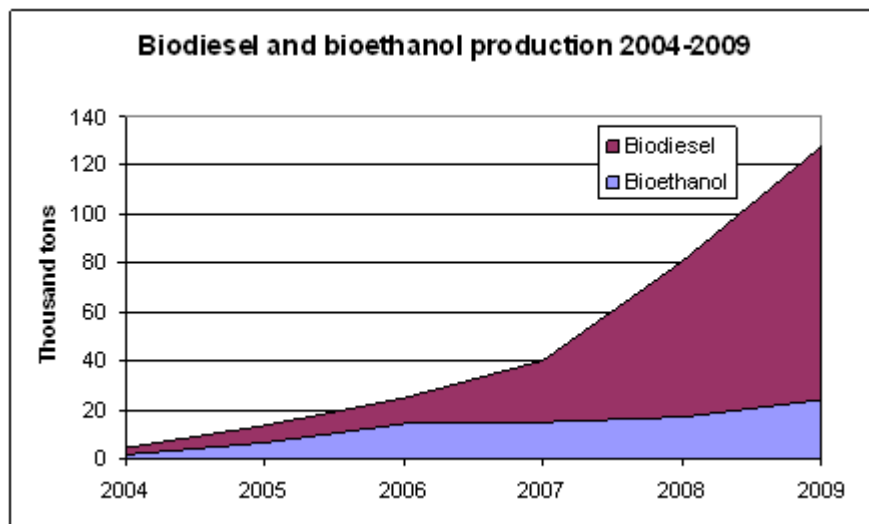
Bio-fuels

Lithuania produces two types of bio-fuel - biodiesel and bio-ethanol. The main feed stocks for biodiesel and bio-ethanol production are rape seed, wheat, and rye, respectively. In 2010 88 thousand metric tons (TMT) of rapeseed and 56 TMTs of cereal grain were purchased for bio-fuel production. These crops were produced on 63 thousand hectares (THa) of farm land (total sown area in 2011 is estimated at 2,057.3 THa).

In 2010 biodiesel production was estimated at 104 TMT and bio-ethanol at 24 TMT. In 2009, total bio-fuel consumption was 42 TMT of biodiesel and 22 TMT of bio-ethanol. In 2010 consumption of bio-ethanol for transport was 19 TMT. Biodiesel consumption for transport was 39TMT. The changes in total bio-fuel production and consumption in the recent years are presented in the table below and on the chart.

Year		2004	2005	2006	2007	2008	2009
Production [1000 tons]	Biodiesel	2.2	7	10.3	24.8	64	104
	Bio-ethanol	1.7	6.6	14.3	15	17	24
	Total	3.9	13.6	24.6	39.8	81	128
Consumption [1000 tons]	Biodiesel	0.8	3.2	15.8	47.6	51.8	42.7
	Bio-ethanol	0.1	0.9	8.4	18.3	24.2	22.4
	Total	0.9	4.1	24.2	65.9	76	65.1
Bio-fuel share in total fuel consumption [percent]		0.082	0.35	1.9	4.33	4.91	5.14

Source: Calculated on the basis of the data published by Lithuanian Department of Statistics (www.stat.gov.lt).



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Since 2004, bio-ethanol production has increased over 10 fold. Biodiesel production's increase during this six-year period has been even more dramatic, rising almost 50 fold. Bio-fuel consumption is also on the rise. The bio-liquids production in Lithuania started in 2002 and has expanded continuously since then. The share of bio-fuel as a percentage of total fuel consumption has been increasing as well,

starting in 2005 at less than 0.5 percent to over 5 percent by 2009.

The share of bio-fuel in transport sector is increasing. 2009 statistical data show the transport sector's final bio-fuel consumption as follows:

- motor gasoline (bio-component blended): 367,100 tons
- bio-ethanol: 21,600 tons
- bio-ETBE: 300 tons
- transport diesel (bio-component blended): 892,200 tons
- biodiesel (methyl-ester): 42,700 tons

The share of bio-fuel in total fuel consumption was 5.14 percent which was close to the EU target of 5.75 percent for bio-fuel components in fuels used in transportation by 2010.

In the recent years, the bio-fuel industry has been developing rapidly. However, consumption tapered off during 2008-2009. While there are several reasons behind this development, the primary one is 'standards.' Conventional engines are not designed to burn fuel having more than 5 percent a bio-component. If the fuel blend is higher, manufacturer warranties are not valid.

A second reason is that there are still only a small number of bio-fuel using vehicles in the country. The harsh winter condition and very low temperatures in Lithuania makes use of high ethanol blends dangerous to car engines. A third reason is market limitations. Lithuanian blending companies can purchase bio-components from other EU producers who offer more competitive prices. Therefore, local producers are finding it a challenge to sell their higher cost bio-fuels.

Bio-fuel plants

In 2010, two bio-ethanol plants existed, having a combined total capacity of 100,000 MT. Both plants use wheat and rye as raw input material. The "Biofuture" plant in Silute (www.biofuture.lt) opened in 2004. Currently, the factory produces up to 40,000 MT of bio-ethanol per year. The "Leo Ir Ko" plant, located in the district of Panevezys, has a production capacity of 50,000 MT of bio-ethanol per annum. The Bioetan LT facility, under construction, is to be the largest bio-ethanol factory with a production capacity of 100,000 CUM of bio-ethanol.

Three biodiesel plants exist with total capacity of 147,000 MT. Those plants are: "Mestilla" (capacity: 100,000 tons), "Rapsoila" (capacity: 30,000 tons), and the "Arvi biodegalai" (capacity: 20,000 tons). Established in 2005, "Mestilla" is a biodiesel plant established in 2005. The main raw material for biodiesel production is rapeseed oil which is supplied by local farmers. The plant supplies bio-fuels not only to the Lithuanian market but also to Scandinavian countries, the other Baltic countries, and Poland. Biodiesel produced by Mestilla conforms to the European and Lithuanian quality standards (LST EN 14214) (www.mestilla.lt). Established in 2002, "Rapsoila" (www.rapsoila.lt) is located near Mazeikiai and is the first biodiesel plant in Lithuania. When first opened capacity was 30,000 tons of rapeseed processing and 10,000 tons of methyl ester production per year. In 2006, the company expanded production and Rapsoila's current capacity now stands at 100,000 tons of biodiesel. Rapsoila also expanded its use of raw materials to include other vegetable oils beside rapeseeds. The third plant "Arvi biodegalai" is Lithuanian newest biodiesel operation. Rapeseed is the only raw material

processed. The plant is capable of processing 25,000 tons of rapeseed and producing 20,000 tons of biodiesel (www.arvibiodegalai.lt).

Biogas

In 2008, Lithuania had 7 operating biogas power plants processing biodegradable waste and producing heat and electricity. Total electric capacity was 4.2 MW, representing a 3.5 fold increase over 2000 levels, while heat capacity was 6.1 MW, representing almost triple the capacity compared to 2000. Two of the operations use landfill gas, gas from industrial waste (bio-ethanol, dairy, slaughterhouses, etc). The main raw materials used in those biogas plants are municipal waste, wastewater sludge, but mostly animal by-products. Therefore, the large farms are the most promising to construct biogas plants. In smaller farms biogas production would be economically unworthy due to high investment costs and low biogas output. Under the measure of the Rural Development Program (RDP) which is “Modernization of agricultural holdings” Lithuanian Ministry of Agriculture supports only construction of biogas plants that use solely own farm raw materials with the generated energy used on farm.

Hydro-energy

In Lithuania there are no extraordinary hydro-resources, however, the existent rivers are used as renewable energy sources. The two largest rivers, Nemunas and Neris, and numerous smaller rivers can be used for energy production. Lithuania has one hydroelectric plant with an installed capacity of 100.8 MW. In 2009, there were 85 small hydroelectric plants with a combined installed capacity of 26 MW.

For environmental reasons regulations now prohibit construction of large hydropower plants. Therefore, only small plants can now be built in Lithuania. By 2020 the capacity and electricity generation in small hydroelectric plants is estimated would double.

The Kaunas hydropower plant is the largest in Lithuania. It is constructed on the Nemunas River. The plant has the capacity of 100.8 MW (4 units 25.2 MW each). The others hydropower plants are small (less than 10 MW). In the recent years, there was a significant increase in number of small hydropower plants; in 2001 there were only 35 but by 2009 there were 85. Similarly, the capacity doubled between 2001 and 2009, from 13 MW to 26 MW.

In 2010, total gross consumption of hydro-energy was 540 GWh. Production of hydro-energy constituted 3 percent of the total production of primary energy in Lithuania. After biomass, hydro-energy is the second largest source of renewable energy.

Wind energy

Production of energy from wind started in 2002, when the first wind turbine was installed in Lithuania. Lithuania's biggest wind power plant “Vėjo Spektras Park” was installed in 2006. According to Lithuanian Wind Power Association (www.lvea.lt) Lithuania has 6 wind farms (owned by members of the Association) with the total installed capacity of 79.84 MW. Those 6 wind farms are owned by: JSC Vėju spektras (30 MW capacity), JSC Energogrupe (20 MW capacity), JSC Renėrga (16 MW), JSC Vėju gusis (9.2 MW), JSC Energoplusas (4 MW) and wind turbine owned by JSC Dalis gero (0.64 MW). The Association reports that during 2009, the number of wind turbines increased by 21 and at the

end of 2009, there were 68 wind turbines in Lithuania; attaining a capacity of over 91 MW (annual energy production 157 GWh). In 2010, the gross consumption of wind energy was 224 GWh. In Lithuania, wind turbines are one of the fastest growing renewable energy technologies. It is predicted that by 2020 wind turbines could generate 10 percent of gross electricity production.

Geothermal Energy

Lithuania is situated in the eastern part of the Baltic sedimentary basin and because of that there are numerous potential geothermal aquifers. However, only aquifers with significant thickness can be used for the energy production. The thickness of the sedimentary pile is 200 meters in South-East Lithuania and 2300 meters in West Lithuania. The aquifer in West Lithuania has the largest potential for heat energy. It was estimated that the capacity is in the range of 2-10 MW. The aquifer in South-East Lithuania has lower potential, with the capacity of 1.5-3.5 MW.

In 2000, the Klaipeda Geothermal Demonstration Plant was built, with a capacity of 35 MW, out of which 13.6 MW is produced from geothermal sources. Since 1996 small-scale heat-pump systems have also been installed. These systems are used to provide heating in single-family houses. The total capacity is estimated at above 30 MW. Significant growth was observed between 2004 and 2009 in the number of geothermal small-scale heat pump systems installation. In the mentioned period almost 3,000 units were installed with total capacity increased 10 folds. In 2010, the gross consumption of geothermal energy was 26.4 GWh. The total gross production of heat in geothermal plants was 120.5 GWh.

Solar energy

Solar energy is not a considerable source of renewable energy as Lithuania receives 1,000 kWh per square meter per year with about 80 percent of it is received during the April - September period. Due to Lithuania's geographical location and meteorological conditions, solar energy has only little potential to generate electricity production. In Lithuania, there are no photoelectric power plants, only some private small solar energy installations.

Main sources used:

1. Statistics Lithuania: <http://www.stat.gov.lt/en/>
2. Lithuanian Renewable Energy Server: <http://saule.lms.lt/lindex.html>
3. National Energy Strategy:
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5. Lithuania – Geothermal Energy Country Update by Zinevicius, F.; Sliupa, S., presented during Proceedings World Geothermal Congress 2010, Bali, Indonesia, 25-29 April 2010
6. European Commission http://ec.europa.eu/energy/renewables/biofuels/ms_reports_dir_2003_30_en.htm