

Switch from Gas to Biomass in DH: Success Story of Lithuania

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ABSTRACT

For Lithuania dependence on imported fossil fuels from Russia was an economic and political challenge. At the same time, indigenous biomass resources were and still are abundant. From 2000 to 2015 biomass use in DH sector increased from 2 % to 61 % - the share of biomass used in DH first time exceeded the share of imported gas. Lithuania has already reached the targets of the EU Directive regarding the Incentives for Consumption of Renewable Energy Resources for Lithuania to increase this rate to 23 percent until 2020. The main reason for this growth is enormous renewable energy resources in Lithuania (for example, forests cover ~ 33.2 percent of Lithuania (2,2 M ha)), also the price of using biomass for heating is up to 3 times lower than price of natural gas). The amount of biomass per capita in Lithuania is one of the highest in the European Union and it is estimated that in 2020 Lithuania will take the lead in the EU according to the quantity of available biomass for energy needs.

ARTICLE

Heating has always been one of the most important and problematic global issues for people living in the altitudes like Lithuania. Over a span of 6 to 7 month a year, when the temperature at night time drops below 0°C (and sometimes even below -30°C), only a well prepared person (family, community, city, nation) can survive and develop the country.

Lithuania is unitary parliamentary republic with a population of around 3 million people only. It is a part of the so-called “Nordic Baltic” region of Europe, occupying the area of 65.300 sq. kilometers with the capital of Vilnius (est. 1323, population- 543.000). The first written mention of Lithuania is found in a medieval German manuscript the “Annals of Quedlinburg” dated 9th of March, 1009. The country has a great history: in the 15-18th centuries The Grand Duchy of Lithuania was part of the Polish-Lithuanian Commonwealth, ruling the territory from the Baltic to the Black sea.

Lithuania was part of the Soviet Union (1940-1990), and since the country got back its independence on 11th of March 1990 the issues of energy supply and security have become of major importance. The energy system during the Soviet times was developed in the same way as in all the other Republics of the Soviet Union: the electricity supply system was based on large generators, including nuclear (Lithuania had two nuclear blocks at Ignalina NPP, 1600MW each),

the heating of the cities was based on heat generation from gas and supplied through well developed, but poorly maintained district heating systems. Also, all the gas supply was designed only by the pipe-line from Russia, and all the electricity system was connected only with the neighboring Byelorussia and Latvia (in so called BRELL ring, there was no connection to the West). Therefore, the transformation of such “inheritance” was inevitable, the question was only how to get out of this situation.

We can discuss endlessly about models and reforms, when you look back, having all the necessary information, knowing “mistakes”, “advantages” and different aspects of one way or another. But I would like to leave this for others, instead introducing you shortly to a reformed energy system of Lithuania, focusing on the main topic – development of Biomass energy in District Heating systems of Lithuania.

At present Lithuania is a country, where final electricity consumption is about 10 TWh annually, the heating requires around 20 TWh, and liquid fuels for transport another 20 TWh. Ignalina NPP was closed (in 2009), but it still requires a lot of man power, investment and public money spent on the process of closing and on insuring its safety. Local generation of electricity is still based on improved gas-using technology, but with around 15% of market share of renewables (wind, hydro and around 2,5% of biomass electricity). But the electricity grid already has a connection to Sweden (NordBalt, 700 MW), and a connection to Poland (LitPolLink, 500 MW) completed, so Lithuania will become a part of a new – Baltic electricity ring. Of course, the consumption of electricity dropped significantly from 1990, because of the transformation of the industry (there are not any more large ineffective old style plants and factories), also because of the growing effectiveness of the electricity consumption.

When we come to the heating issue in Lithuania, we need to understand, that the prevailing heating model in the cities (including smaller towns and even bigger villages in the countryside) is district heating, as it was developed during the Soviet regime. 55% of heat consumers are served by district heating companies. For this purpose we have 2683 km of DH pipes in Lithuania, 478 boiler houses with installed capacity of 8200 MW, and 1530 MW of biomass boiler houses among them. 41 municipal and 12 private companies are involved in the process of heat production and supply to the consumers, 7 private companies are involved in heat generation only as independent heat producers. Up to 10 TWh of heat is produced annually and supplied to consumers, with average losses in the grid of around 15%. (Another 7-9 TWh is produced and consumed in private houses and other premises not connected to DH). DH model is a really effective, clean and consumer-friendly for heating buildings, but only in the way, when such heat is cheap or - to put it better - affordable. And this was the major problem as well as an opportunity for the development of biomass energy in Lithuania.

After Lithuania became a member state (MS) of the European Union (EU) in 2004, the main and only natural gas supplier Gasprom from Russia started to increase prices on gas. This process is clearly visible in the figure No.1 below.

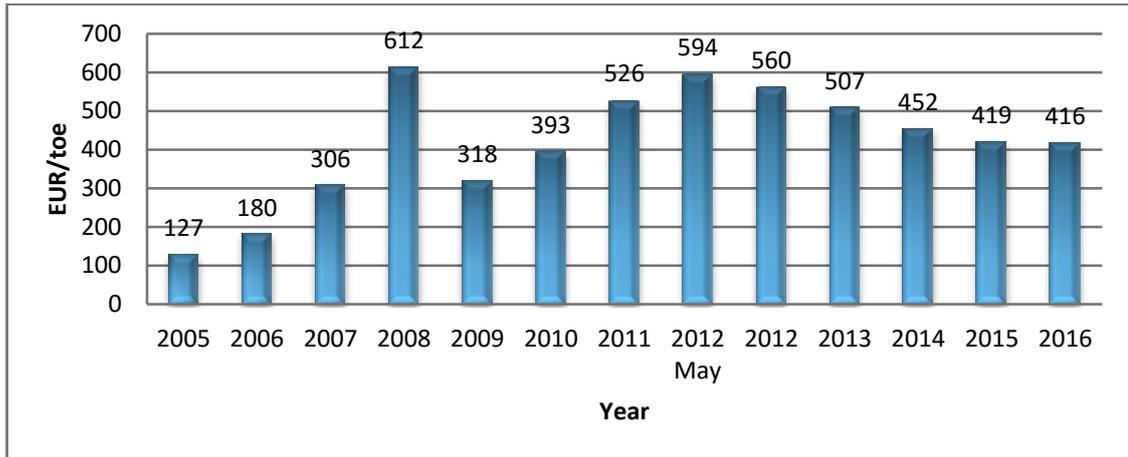


Figure 1. The dynamic of natural gas price (including transportation and capacity fee) without VAT.

The peak of gas prices was reached in 2008 and 2012, when DH companies had to pay for natural gas over 2050 Lt/toe (593 EUR/toe), including transmission and distribution fees.

Lithuania became a MS of the EU, paying the highest price for imported gas. This price became recognized as “political” price, having nothing in common with the market situation. After some Gasprom disputes and even stopping of gas delivery to Ukraine, Lithuania started to feel also insecurity of gas supply, and high prices on gas deepened the misbalance of international trade. Gas supply and “political” price regulation by Gasprom also caused the first and only fail of attempt to join EUR zone by Lithuania in 2008, as the criteria of sustainable and agreed inflation rate was not met because of the sharp price increase on gas, and consequently - on heat.

Lithuania started several international legal cases against Gasprom regarding the regulation of gas prices, and has already won one of them. Also, a LNG terminal (with the very symbolic name “Independence”) was built and started to operate in 2014.

Price increase for heat consumers is indicated in figure No.2.

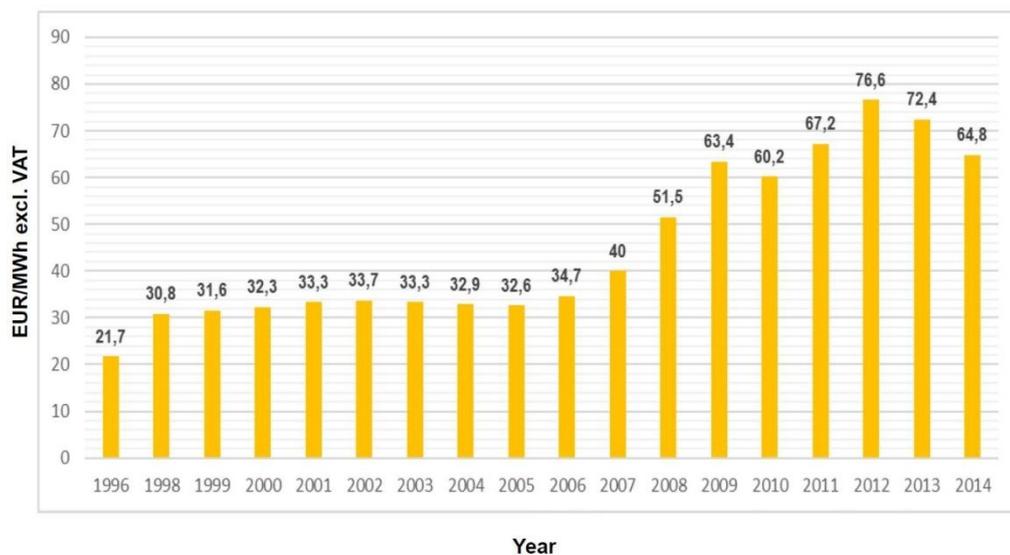


Figure 2. Average district heat prices (excluded VAT) in year 1996, 1998–2014.

The opportunity to use biomass for the production of heat in Lithuania was also known before the independence. For instance, in 1988 a biomass boiler was installed in a regional town Birzai. However, the process gained momentum since the restoration of the independence, in cooperation with Nordic countries and using the funds of assistance programs for Lithuania (Phare, etc.). The number of biomass boiler houses (using mainly chipped wood and forest logging residues) and the amount of their installed power started to grow rapidly. But still – huge work to be done was visible ahead: in 2004 (the Year, when Lithuania entered the EU) less than 10% of heat in DH was produced from biomass.

The process of transition from gas to biomass was accelerated when foreign energy companies (e.g. Dalkia from France, Fortum from Finland) entered DH market in Lithuania. They brought clear vision of transformation of DH and relationships to Western (Scandinavian) technology companies.

Local business also discovered the sector interesting for investments. At that time specialized biomass production and supply companies were established. Their main areas of activities were collection, processing, storage and delivery, ensuring a continuous supply of biomass to boiler houses. It is important to note that the emerging biomass energy industry addressed not only the heat supply issue, but also the ecological problem: wood industry, sawmills had accumulated vast amounts of unused wood waste and residues, which caused a big headache for managers of those companies. Development of Biomass energy proposed a comprehensive acceptable solution – using such waste as fuel, and replacing imported fossil fuels. The first local companies, producers of biomass energy equipment – boilers and complete boiler houses – were also created at that time.

It became clear that this situation requires a new approach to biomass resources and biomass production processes of various related institutions: The Ministries of Economy, Energy, Agriculture and Environment, state-owned forest enterprises, private foresters, energy companies, and, of course, municipalities. There was a need for a systematic, science-based approach to biomass resources and their exploitation prospects, which had to be reflected in the legislative system. On 4th of June 2003 creation process of biomass energy association started, with the final formation and incorporation at the end of 2004. In addition to commercial issues important for companies it began to build its approach to the biomass energy perspective. Some of the most important prospective tasks included development of the biomass energy market, researches on biomass resources, development of the association membership covering the entire biomass energy chain, building cooperation and partnership relationships in Lithuania and with foreign partners, interception and dissemination of foreign experience in Lithuania. Also the number of activities and methods of operation have been confirmed as to be used: organizing conferences and seminars, writing articles in magazines and newspapers, giving interviews and participating in public discussions, taking part in decision making process as experts, promoting biomass energy in public events, initiating scientific research studies, disseminating the best practices and examples, etc.

The activity of Lithuanian biomass energy association Litbioma was started in 2004. Following its goals, Litbioma created a wide network of relationships nationally and internationally, acting as a “think tank”, generating visions and ideas, gathering and disseminating information, and as lobbying organization. Litbioma became a member of AEBIOM in 2006, and joined WBA in 2015. We are also members of World Energy Council Lithuanian committee, Lithuanian

confederation of industrialists, Lithuanian confederation of renewable energy resources, European pellet council. Litbioma has entered into partnership with Directorate general of state forests and Lithuanian association of forest owners, Lithuanian District heating association, Operator of the Lithuanian energy exchange BALTPPOOL. We have also a partnership agreement with UABIO-Bioenergy association in Ukraine. In this way Litbioma is in position to participate constantly in the flow of information, related to biomass energy industry worldwide. The number of members of the association has also been growing, reaching 57 companies by 2014, covering all the spheres of the biomass energy (R&D, biomass mobilization and production, equipment production). Companies, producing energy from biomass, are united in Lithuanian district heating association, which is a partner organization, as mentioned above.

Estimation of biomass potential in Lithuania became the core issue for Litbioma. Only sustainable use of biomass and scientifically proven resources served as a serious argument in discussion whether biomass energy has limits of its development and where they are. The number of research studies, initiated by Litbioma with the involvement of Lithuanian forest institute, Directorate general of state forest and private forest owners' organizations gave a possibility to protect the increasing consumption of wood for biomass energy. The work was finalized in 2013, after the "Assessment of biomass potential in Lithuania, price forecast for biomass, assessment of social benefits of using biomass, and proposals of state interventions for the development of the use of biomass" (auth. M. Nagevičius) was successfully introduced to all the participants of the market and politicians. It clearly showed, that we have in Lithuania more than enough woody biomass (1,5 M toe annually), with additional reserves, coming from municipal waste, agricultural sector and peat, as a local fuel in total- 2,2 M toe annually. The fact, that Lithuanian state forests were recognized as the best protected in the world in 2012 in accordance with Yale University, issuing Environmental Performance Index on annual basis, showed to all of us, that Lithuania is also on the right way in developing the state forestry for the needs of biomass energy. The market indicated this positive trend much earlier: from the beginning of fast biomass energy development in 2004, biomass remained up to 3 times cheaper, despite the deep fluctuation of the gas price in Lithuania (Figure No.3)

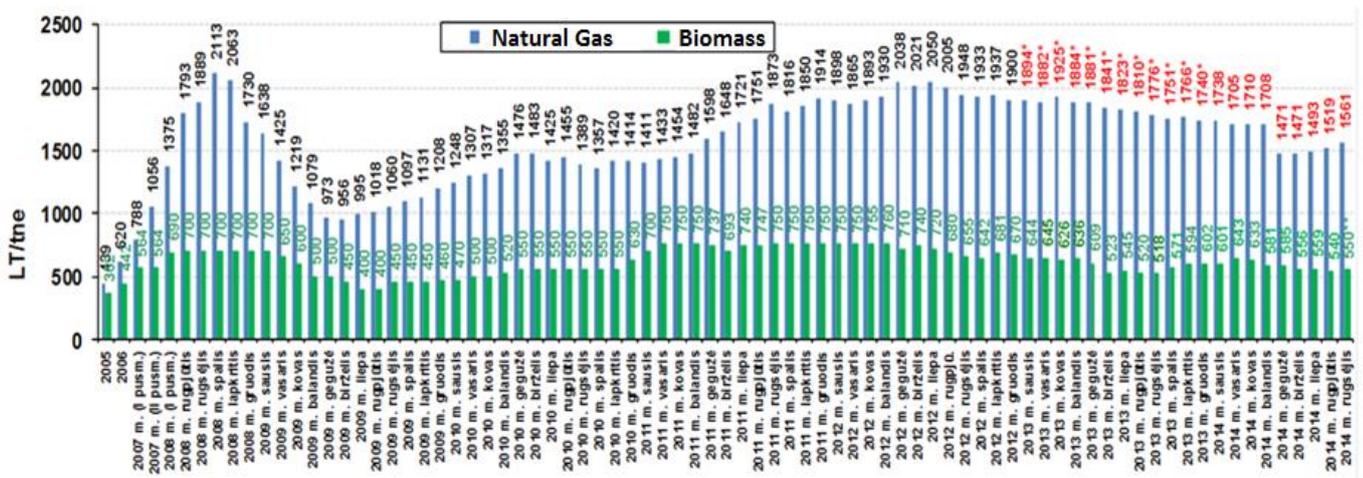


Figure 3. The comparison of natural gas and biomass price (including transportation and capacity fee) without VAT.

The next very important part of the work for Litbioma was active participation in creation of Lithuanian national energy strategy (a law from 2007) and in the process of creation on Renewable energy law and related documents (2009-2011). For the first time the potential of biomass energy was evaluated and stated in legal acts of the highest importance!

In the beginning of 2014, after 10 years of active development, Litbioma came to conclusion, that switch from gas to biomass energy in DH became a success story and very positive example of modernisation of the country. Almost 49% of heat in DH systems of Lithuania was produced from biomass in 2014, for the first time overcoming imported gas, and 61% was reached for biomass in the heating season of 2015-2016 (Figure No.4).

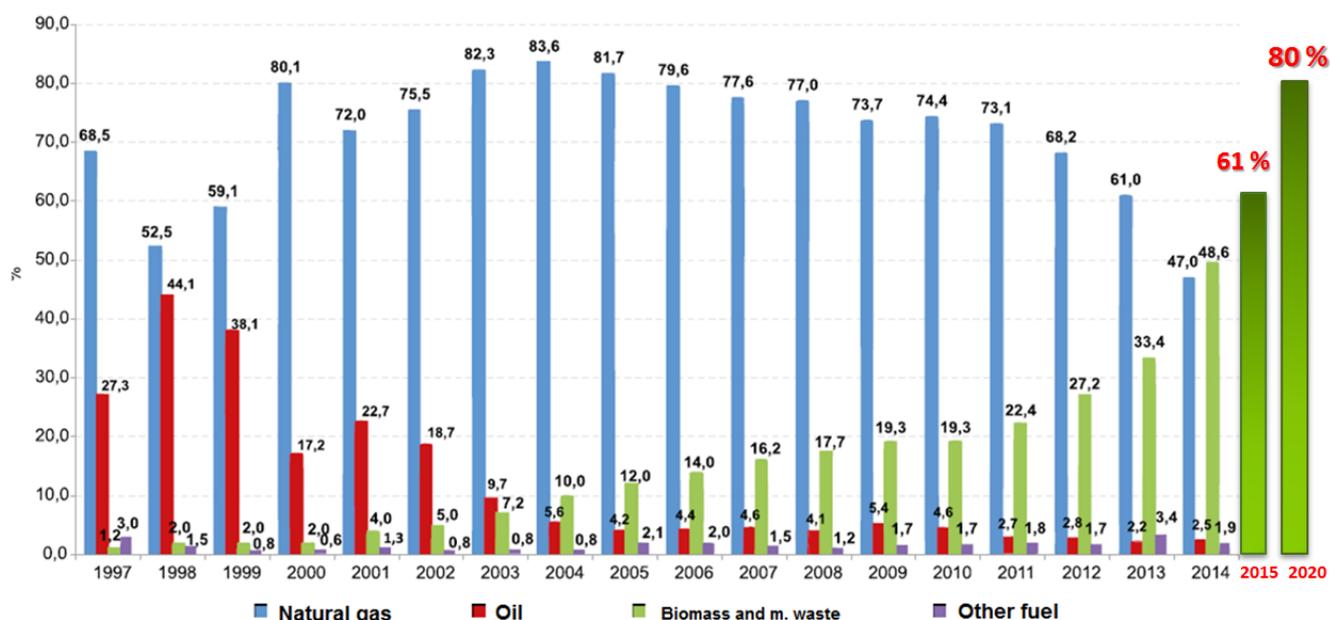


Figure 4. Years 2015-2016 finalizing the transition from gas to biomass in DH of Lithuania.

Practically all the cities, towns and bigger villages have now biomass district heating, capable to cover base load and supply heat and hot water. It is very often, that biomass energy covers 100% of necessary heat (in smaller towns). Practically, only in the capital of Lithuania Vilnius this type of transition is still in progress. A new biomass powered CHP, with WtE block built in addition, will finish this switch from gas to biomass in Lithuania in 2017. This impressive and large energy unit will be able to produce 400GWh of electricity (3,7% consumption of Lithuania), will supply to DH grid in Vilnius 1.240 GWh of heat (delivering up to 50 % of Vilnius need), and will reduce the emission of CO₂ by 230.000t annually. Together with the existing capacities of biomass boiler houses and CHP in Vilnius it will be enough to cover even more than base load, and only peaks during very cold days will require a little help of gas generators. After this is done, biomass heat in Lithuanian DH will reach not less than 80% of market share. The work will be finished!

Biomass energy also found its place in industry. Wood processing industry traditionally used to be the “ice-breaker” of the process (what is obvious having in mind the main raw material they have to deal with). But we are proud, that cheap and clean heat and steam from biomass is liked by others, like milk and fish industry, paper and tobacco plants, even chemical industry. 1.300GWh of

heat was produced from cheap and local biomass in industrial companies in Year 2015. This significantly increased compatibility of Lithuanian producers due to cost-effective and clean biomass energy applications in their factories and plants.

Biomass industry of Lithuania has grown itself as well during the last decade. More than 6500 people are employed in technological companies and production and supply of biomass. The export of technological equipment reached 50 M EUR in 2015, but is expected to grow up to 300 M EUR in 2020. The average salary is 50% higher in this sphere of Lithuanian economy, comparing to the average.

As a result, this transition from imported fossil fuel-gas to local biomass offered to Lithuania lower prices of heat to consumers and lower emissions of CO₂. Number of jobs increased significantly, and R&D, cooperation of science and business, development of technologies took place in large scale. Biomass energy helped to improve social and economic situation in rural regions, also offering in some cases solutions for better land use. It also improved foreign trade balance of the state, finally - increased energy independence and environmental situation.

REFERENCES

Sources of statistics:

The Lithuanian Biomass Energy Association LITBIOMA;

The Ministry of Energy of the Republic of Lithuania;

The Lithuanian District Heating Association;

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