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*Review*

# Promotion of Renewable Energy for District Heating in Lithuania as EU Member

**Lina Murauskaitė**

Lithuanian Energy Institute, Breslaujos str. 3, LT-44403 Kaunas, Lithuania

E-Mail: lina.m@mail.lei.lt; Tel.: +370-674-21-723

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**Abstract:** Promotion of use of renewable energy sources is among the priorities of energy policy in Lithuania. District heating (DH) technology is promising tool for implementing energy and environment policy goals. Lithuania acceded to the European Union (EU) in 2004. Integration of new member states to the EU has created a new situation in the frame of implementation of EU sustainable development. At the moment the use of renewable energy is relevant for Lithuania not only for sustainable development targets, but also for practical reasons. After the closure of Ignalina Nuclear Power Plant Lithuanian energy sector development faced with significant challenges. Energy sector, including district heating, became dependent on natural gas. Lithuania receives natural gas from the sole energy supplier - Russia (Gazprom). New challenges for district heating sector are related to the possibilities of integration of renewable and local energy resources. A wider use of renewable energy can help to diversify of energy supply and to meet the targets of sustainable development. The paper presents an overview of the present Lithuanian and EU legal regulation of the use of renewable energy sources. Also the problems related to the use of renewable energy sources in district heating supply and measures that promote the use of these sources are analysed in the article.

**Keywords:** renewable energy, district heating

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## 1. Introduction

The energy sector is central in sustainable development and it affects all aspects of development – social, economic and environmental. Sustainable energy is the provision of energy such that the need of the present without compromising the ability of future generation to meet their needs. A sustainable energy system has been commonly defined in terms of its energy efficiency, its reliability and its environmental impacts [1]. Achieving sustainable economic development on a global scale requires the diversification and use of local energy resources, technologies, appropriate economic incentives and strategic policy planning at the local and national levels [2].

The recent crisis between Ukraine and the Russian operator Gazprom (first in 2006 and more recently in 2007–2008) has reinforced two of the four targets of the EU energy strategy: the need to reduce primary energy dependency and also the stress of demand on primary energy resources [7]. In addition, the greenhouse gas abatement due to a more intensive use of RES would contribute to improve the EU target related to climate change, this being the fourth target in its energy strategy [4].

Transition economies, especially Lithuania and other Baltic states, are positively disposed to the promotion of renewable energy sources (RES). Many countries view renewables as a way of promoting the development of small and local businesses in selected areas and diversifying supply patterns at the regional level. RES (including biomass, solar, wind, geothermal and hydropower) that use indigenous resources have the potential to provide energy services with zero or almost zero emissions of both air pollutants and greenhouse gases [3].

District heating (DH) technology is promising tool for implementing energy and environment policy goals. District heating has various advantages compared to individual heating systems. DH is usually more energy efficient due to the simultaneous production of heat and electricity in combined heat and power generation plants. However, DH is less attractive for areas with low population densities. The importance of DH in EU would justify a more intensive use of RES applied to this type of heating system, and must be considered in the design of energy policies [4].

General characteristics of Lithuania DH sector – its high heat market share especially in big cities indicate strong position and therefore the important role in cities' energy supply. Developed in planned economy DH systems, however, not always were based economically and networks in many cases were shortened after disconnection of collapsed industries. Initially designed pipes appeared oversized and resulted high heat losses. Bearing in mind general European energy policy strategy and targets it is evident, that district heating technology in Lithuania will remain as the main technology supplying energy to buildings in large cities and towns [6].

## 2. Legal Regulation of the Use of Renewable Energy Sources in Heating Sector

As IEA [8] recently pointed out, renewable energy sources will have to play a central role in moving the world onto a more secure, reliable and sustainable energy path. The greatest scope for increasing the use of renewables in absolute terms lies in the power sector. Although RES are expected to become increasingly competitive as fossil-fuel prices rise and renewable technologies mature, the scale of government support is set to expand as their contribution to the global energy mix increases. The important role gain national and international regulation of RES.

The European Union is one of the most active developers of energy security assessment methods and assurance measures. Its initiatives expressed in the directives to increase the percentage of renewable energy resource in the common energy balance up to 20%, to reduce energy consumption by 20%, to reduce greenhouse gas emissions by 20% up to 2020 would lead to a drastic reduction of EU energy dependence on import [1].

Most experience with supporting RES is available in the electricity sector. The EU Directive 2001/77/EC required member states to increase the share of RES in electricity sector using national support instruments. In contrast, no legislative framework at EU level was available in the heating sector before the Directive 2009/28/EC [9] was implemented. Later, following the implementation of Directive 2009/28/EC, every member state has developed its own National Action Plan that fixes specific objectives for each member state in the use of RES for each sector, including heating [4].

Main EU Directives, that has impact for district heating sector, are as follow:

- Directive 2004/8/EC of the European Parliament and of the Council on the *promotion of cogeneration* based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC (11 February 2004);
- Directive 2006/32/EC of the European Parliament and of the Council on *energy end-use efficiency* and energy services and repealing Council Directive 93/76/EEC (5 April 2006);
- Directive 2009/28/EC of the European Parliament and of the Council on the *promotion of the use of energy from renewable sources* and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (23 April 2009);
- Directive 2009/29/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as *to improve and extend the greenhouse gas emission allowance trading scheme* of the Community (23 April 2009);
- Directive 2010/31/EU of the European Parliament and of the Council on *the energy performance of buildings* (9 May 2010);
- Directive 2010/75/EU of the European Parliament and of the Council *on industrial emissions* (integrated pollution prevention and control) (of 24 November 2010).

The major changes appeared with introducing new energy policy goals by adoption the RES Directive (Directive 2009/28/EC), where district heating is recognized as promising technique for reaching overall strategic energy goals: safety of energy supply by increasing independence from imported energy resources, wider use of waste energy from industries and integration of renewable energy sources into energy supply infrastructures [6]. Article 4 of the RES Directive requires member states to submit national renewable energy action plans by 30 June 2010. These plans provide detailed roadmaps of how each member state expects to reach its legally binding 2020 target for the share of renewable energy in their final energy consumption. Table 1 shows the national targets of RES heating and cooling in 2010 and 2020 compared with 2005 (base year used to determine the national renewable energy action plans). As it shown in the table, Lithuania has quite ambitious plans to increase RES in heating sector from 27 percent in 2005 to 39 percent in 2020.

**Table 1.** National 2020 targets for energy from RES in heating and cooling

| EU member state | 2005 (%) | 2010 (%) | 2020 (%) |
|---|---|---|---|
| Austria | 24.3 | 30.5 | 32.6 |
| Belgium | 2.3 | 3.5 | 11.9 |
| Bulgaria | 15.28 | 16.5 | 23.8 |
| Cyprus | 9.1 | 16.2 | 23.5 |
| Czech Republic | 8.4 | 10.2 | 14.1 |
| Denmark | 23.2 | 30.8 | 39.8 |
| Estonia | 16.3 | 19.2 | 17.6 |
| Finland | 40 | 37 | 47 |
| France | 13.6 | 17 | 33 |
| Germany | 6.6 | 9 | 15.5 |
| Greece | 12.76 | 14.7 | 19.7 |
| Hungary | 5.4 | 9.0 | 18.9 |
| Ireland | 3.5 | 4.3 | 12 |
| Italy | 2.8 | 6.53 | 17.09 |
| Latvia | 42.7 | 45.3 | 53.4 |
| **Lithuania** | **27** | **28** | **39** |
| Luxembourg | 1.7 | 2.1 | 8.5 |
| Malta | - | 7.9 | 6.2 |
| Netherlands | 2.5 | 3.7 | 8.7 |
| Poland | - | 12.29 | 17.05 |
| Portugal | 31.9 | 30.7 | 30.6 |
| Romania | 18.72 | 17.86 | 22.05 |
| Slovakia | 6.1 | 7.6 | 14.6 |
| Slovenia | 20 | 22.3 | 30.8 |
| Spain | 8.8 | 11.3 | 18.9 |
| Sweden | 53.7 | 57 | 62.1 |
| United Kingdom | 0.7 | 1 | 12 |

Source: European Commission [10] and Cansino et al [4].

The stimulation of energy producers and consumers for efficient use RES are the major goals of energy policy, as governed by Law on Energy of Lithuanian Republic and National Energy Strategy. Promotion of local and RES usage and energy efficiency are established in the Energy Law of the Republic of Lithuania as priority objectives of energy sector regulation. Seeking to promote the use of RES, Ministry of Economy has issued an order regulating energy purchase [5]. In Lithuania promotion of renewables' use is based on such main legislation acts:

- Law on energy of the Republic of Lithuania;
- Law on electricity of the Republic of Lithuania;
- Law on bio fuel of the Republic of Lithuania;
- Law on heat sector of the Republic of Lithuania;
- Law on energy from renewable sources of the Republic of Lithuania;
- National energy strategy;
- The National Strategy for the Development of Renewable Energy Sources.

As pointed out in Lithuania National Renewable Energy Action Plan [11], the National Strategy for the Development of Renewable Energy Sources, among other priorities of the development of energy from renewable sources, envisages utilisation of the existing district heating infrastructure and further development of necessary infrastructure while creating conditions for the development of renewable energy sources. It is envisaged that biofuel to be consumed in the district heating sector should become

the biggest contributor to the increase in the consumption of renewable energy sources. Taking into account technological possibilities of the district heating sector and economic advantage, heat production from renewable energy sources in this sector should be increased by not less than to 50 % by 2020.

The Plan of Measures for the Implementation of the National Strategy for the Development of Renewable Energy Sources for 2010–2015 envisages creating conditions for the construction of cogeneration power plants using municipal and other waste unsuitable for processing, which has energy value, in the big Lithuanian cities (Vilnius, Kaunas, and Klaipeda).

It is envisaged to prepare measures of financial support, which would promote the modernisation of heat production installations supplying heat to rural public buildings (schools, kindergartens, health care institutions, elderships etc), while adjusting these installations for the incineration of biofuel (wood, straw) including herbaceous plant biomass (grass granules).

The Law on energy from renewable sources of the Republic of Lithuania regulates that when planning the development of city and/or district infrastructure, renovation of buildings, heating and/or cooling of public and private facilities, municipalities have priority to the production of heating from renewable energy sources.

The Lithuanian National Energy Strategy adopted in 2007 defined the typical characteristics of a sustainable energy system very visibly:

— Energy security;
— Implementation of EU environmental requirements;
— Efficiency and reliability;
— Regional co-operation and collaboration;
— Increase of the renewable energy sources share;
— Increase of the electricity generated by CHP share;
— Increase of biofuel share;
— Improvements of energy sector management and etc [1].

The current energy supply in the world is mainly based on limited resources of fossil fuel, which is deemed to be environmentally unsustainable. Burning of fossil fuels in electricity and heat generation, transport and industry is the main source of greenhouse gas emissions. To reduce effects of climate change, global greenhouse gas emissions must be reduced significantly [1].

The main international documents that regulate the change of climate are the United Nations Framework Convention on Climate Change and Kyoto Protocol. According to Kyoto Protocol, Lithuania committed itself during the period of 2008–2012 to reduce the amount of greenhouse gas emission by 8%, comparing with pollution level in 1990 [1]. In 1992 Lithuania together with 154 other countries has signed the United Nations Framework Convention on Climate Change (FCCC) in Rio de Janeiro and other documents compliant with EU environment policy. Lithuanian Parliament ratified the Convention in 1995 and the Lithuanian Government approved FCCC National Programme in 1996. Its major goals are to reduce the import of energy resources, reduce the climate change impact, and cut the $CO_2$ emissions as well as address other environmental issues. In Lithuania there was developed a strong institutional basis for climate policy [5].

Against the background of the economic and financial crisis, the closure of Ignalina Nuclear Power Plant (NPP) is an additional factor, which has affected Lithuania's economic growth. The biggest risk for Lithuania after the closure of Ignalina NPP is the increased dependency on energy imports, whether

it is electricity or the means for electricity production – natural gas [12]. However, prior to 2010 Lithuania was nuclear power energy producing country. 75% of the total Lithuanian electricity production consisted of nuclear power energy. Since the very end of year 2009 none of the Ignalina NPP units are in operation. The closure of Ignalina NPP changed the electricity production structure significantly. Now Lithuania has to produce part of electricity in its thermal power plants and to import the other part [1]. The plans to build new nuclear power plant (Visaginas NPP) together with Latvia, Estonia, and Poland in 2020 seem quite real as strategic investor will be selected in 2011 [12].

A wider use of renewable energy can help to diversify of energy supply and to meet the targets of sustainable development. An overview of the present Lithuanian and EU legal regulation of the use of renewable energy sources pointed out, that promotion of use of renewable energy sources is among the priorities of energy policy in Lithuania.

## 3. Measures that Promote the Use of Renewable Energy Sources

Cansino et al. [4] analysed the main policy measures implemented in EU 27countries up to 2009. In the EU, the most widespread measure to promote RES for heating is the provision of subsidies; this has occurred in 22 of the 27 member states (except Denmark, Estonia, Lithuania, Poland, Romania). This is due to the fact that subsidies are an easy way to promote RES for heating and cooling; their application is based on a simple scheme and their straightforward manner to implement encourages the adoption of technologies that are capital intensive. Nevertheless, they are conditioned by budgetary constraints.

Twelve EU members (Austria, Belgium, Bulgary, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Sweden, UK) have used tax incentives with a dual purpose, to reduce investment costs and to make renewable energy profitable through a decrease in relative prices. In the first case, the use of tax deductions has the advantage of involving ex-post incentives, although they do not lower the hurdle of the initial upfront payment. Some member states have thus resorted to reducing tax (VAT) rates to overcome this. In the second case, these measures have been relatively successful when they have been accompanied by other measures that tend to increase the price of alternative energy sources. In both cases, these measures are conditioned by budgetary constraints.

Low interest loans have only been used by four countries (Germany, Portugal, Slovakia, Slovenia). However, the establishment of this type of action may be appropriate in the context of budgetary constraints since these incentives do not lead to substantial budget increases if adequate arrangements are established with private banks [4].

Policies and measures implemented in Lithuania aiming to enhance use of renewable energy sources are mainly driven by EU accession requirements. Lithuania has policies in measures in place to promote use of renewable energy sources or having impact on renewable energy source utilisation: pollution taxes, fuel taxes, VAT and excise tax allowances for biomass and biofuels, feed-in prices for electricity produced from renewable energy sources, greenhouse gas emission trading schemes to be implemented since January 2005 [13].

Lithuania has applied reduced VAT rate of 9% for district heat supplied to households to the end of 2011. This reduced tax rate for district heating can be treated as subsidy, which in general is environmentally harmful because district heat can be produced from carbon intensive fuels, for example heavy fuel oil, orimulsion or oil-shale. In general reduced VAT rate for district heating causes

distortions in energy market because it puts into the worse position decentralized heat supply. The best solution is to reduce subsidies for fossil fuel based energy sources and provide social support directly to the most vulnerable groups of population because in current situation all people receive subsidy but not only poorest one.

Pollution taxes have impact on enhanced use of renewable energy sources because renewable energy sources do not emit such pollutants like $SO_2$, $CO_2$ etc. into atmosphere and high taxes on emissions of these pollutants increase competitiveness of renewables in electricity, heat and transport fuels markets [13].

Lithuania has established fixed feed-in tariffs for wind, biomass and small hydro. Lithuania has fixed feed in prices set for different types of renewable [13]. Feed-in tariffs play only a minor role in RES heating promotion (Austria, Estonia, Luxemburg, UK) as this promotional measure is designed to guarantee an income to companies and not to households, the latter most likely to be the main heat producers in the case of RES heating. Feed-in tariffs have only had a minor impact on RES in heating promotion in comparison to the case of green electricity where such tariffs were one of the main stimulators of the promotion [4].

The attention has to be paid for the application of EU structural funds for renewable energy projects in Lithuania. Structural funds are the European Union's main instruments for supporting social and economic restructuring across the Union [13]. Structural support of the European Union for 2007–2013**.** The following is financed in accordance with the measure of the use of renewable energy sources for energy production:

- modernisation of cogeneration power plants supplying heating to heating supply systems – replacement of the usable fuel with biomass;
- construction of new effective cogeneration power plants using renewable energy sources and their connection to heating supply systems.

Funds are appropriated from the structural funds of the European Union in the course of the implementation of the Cohesion Promotion Action programme. It is possible for the same project to be supported by more than one support measure. Benefit on environmental pollution tax can be applied; support from the Lithuanian Environmental Investment Fund can be received [11].

Most widespread measure that promote the use of renewable energy sources for heating in EU are subsidies. Less common are tax incentives, low interest loans and feed-in tariffs. Policies and measures implemented in Lithuania aiming to enhance use of renewable energy sources are mainly driven by EU accession requirements.

## 4. Conclusions

In order to promote sustainable energy and reduce air pollution it is necessary to enhance utilization of renewable energy sources. A wider use of renewable energy can help to diversify of energy supply and to meet the targets of sustainable development. An overview of the present Lithuanian and EU legal regulation of the use of renewable energy sources pointed out, that promotion of use of renewable energy sources is among the priorities of energy policy in EU and Lithuania.

Most widespread measure that promote the use of renewable energy sources for heating in EU are subsidies. Less common are tax incentives, low interest loans and feed-in tariffs. Policies and measures implemented in Lithuania aiming to enhance use of renewable energy sources are mainly driven by EU

accession requirements. Lithuania promotes use of RES by pollution taxes, fuel taxes, VAT and excise tax allowances for biomass and biofuels, feed-in prices for electricity produced from renewable energy sources, greenhouse gas emission trading schemes.

## Conflict of Interest

The author declares no conflict of interest.

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