



Renewable energy sector in Belarus: A review

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ABSTRACT

Belarus (BY) faces broad needs for energy security enhancement, energy diversification, and improvements in the state of the environment. Being the 13th largest importer of natural gas for energy BY has very limited energy resources of its own. Maximum reduction of energy imports is among the strategic tasks of raising the efficiency of Belarus' economy. The task fulfillment is possible through creation of a national infrastructure conducive to increasing the share of local and renewable sources of energy (RES) in heat and power energy production.

BY's geographic location has several advantages for extensive use of most of the renewable energy (RE) and bioenergy sources. However, information on existing RE sector for the second-largest landlocked country in Europe is still hardly available for a wider audience of researchers working in the field of economic, environmental, political, planning and social aspects of energy supply in global proportions.

The review on the renewable energy sector in BY so far has tried to give the background for RES, to describe their occurrence and conditions for using them, leading up to a discussion of the role of renewable energy in current and future energy systems, depending on a path of economic transition, social values, availability, and economic rules used to judge the viability of competing solutions. To ensure a simple, comprehensible and transparent presentation of the different available options of using RE for the provision of heat and power, the individual chapters describing the various renewable energy potentials and contribution options have been similarly structured whenever possible and sensible.

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1. Introduction

Being the 13th largest importer of natural gas for energy, Belarus (BY) has been showing a big interest and optimism regarding striving to develop a more secure and sustainable energy sector with a special emphasis on RE for a long time [1,2]. Maximum reduction of energy imports is among the strategic tasks of raising the efficiency of Belarus' economy. The task fulfillment is possible through creation of a national infrastructure conducive to increasing the share of local and alternative sources of energy in heat and power energy production [3,4].

However, information on existing RE sector for the second-largest landlocked country in Europe is still hardly available for a wider audience of researchers working in the field of economic, environmental, political, planning and social aspects of energy supply in global proportion. The specific nuances of transition economy path chosen by Belarus, so-called 'Belarusian Model', and 'Eastward-biased' policy propagated for many years [5]—these are the underlying factors, which have limited an ability to study Belarusian RE sector at international level, with a view towards the sustainability of it is growth. This is a notable knowledge gap, as a need for wider information diffusion is recognised as one of the key determinants for the efficient transformation of traditional energy systems towards energy systems based upon alternative energy sources.

Sustainable environment and energy are among key priorities worldwide [6–12] and renewable energy and energy efficiency initiatives will continue to be a priority in BY [1,2,13]. At present, the Republic of Belarus is in the process of implementing the 'Target electricity and heat provision program for achieving at least 25% of industrial production with the use of local types of fuel and alternative sources of energy by the year 2012' [3]. In order to provide 25% of electricity and heat with the use of local energy and fuel resources, it is necessary to increase their production up to 5.93 million tonnes of oil equivalent (Mtoe) per year, and to use the secondary resources such as heat energy, as well as primary resources from wind turbines and biogas in the amount of 0.82 Mtoe per year. In light of the above, the plans assume that by the year 2012 the use of local energy resources, including secondary heat resources, wind, solar and biomass energy, will be increased by 2.8 Mtoe [3,14].

The paper aims to deepen knowledge of existing RE sector and its potential in Belarus, a country, that can produce and utilise significant quantities of RES for energy purposes. This work is essential to evaluating the role played by different types of alternative energy sources in the energy sector; assessing the share of biomass used for energy purposes; understanding the dynamics of bioenergy and renewable energy systems; and formulating sound policies.

2. Prerequisites for development of renewable energy in Belarus

2.1. Country's location and size, landscape geography, and climate conditions

The physical geography features of the country may however facilitate or hinder development of RE sector. For BY, most of them work in favour for extensive use of almost any kind of RES.

The territory of BY covers an area of 207.6 thousand km² (39%-forests, 2%-water, 43%-agricultural land, 16%-other land) thus being ranked 13th in size among the European countries and 5th in population among the Commonwealth of Independent States countries (CIS) [15]. BY has international borders with 5 sovereign states: Lithuania (678.819 km) and Latvia (172.912 km) in the North, Ukraine (1084.2 km) in the South, Russian Federation (1283 km) in the East, and Poland (398.624 km) in the West [14]. Country's territory is subdivided into 6 regions: Vitebsk, Minsk, Gomel, Grodno, Mogilev and Brest. Each of the region in its turn splits up into 16–22 districts. There are 110 towns and 101 urban-type settlements in BY [15]. The population of 7 towns numbers from 100,000 to 200,000; 7 cities have the population from 200,000 to 500,000.

Country's relief is predominantly flat and hilly: flat plains (sandy peat soils) of southeastern (S-E) BY cover an area of almost 60% of the territory, North West (N-W) highlands (loam soils) nearly 30% and tableland 10%. The average height is ~160 m above sea level. Meadows occupy almost 3.3 million ha or 15.8% of the BY territory. Nearly 95% of them are upland meadows. According to their use, meadows are divided into pasture (1.54 million ha) and hay areas (1.76 million ha).

Climate of BY is moderate continental dominated by Atlantic cyclones. Winters are mild and humid with lengthy thaw periods and summers are temperate warm. The mean air temperatures for January and July ranges from – 4.4 °C to 18.8 °C in the S-E and from – 8 °C to 17 °C in the N-E, with the overall country's annual averages of 7.4 °C in the S-E and 4.4 °C in the N-E, respectively. The annual arrival of direct solar radiation to a horizontal face in clear sky conditions is 3500–4050 MJ/m² or 84–97 kcal/cm². The averaged annual precipitation is 550–650 mm for flat plains in the South and 650–750 mm for the hills of middle region. The vegetation period lasts on average about 184–208 day [15].

2.2. Aspects of economic transition

There is little doubt that landscape geography and climate conditions are one of the variables that impact the argued selection of RE technologies, although it is certainly never the deciding factor, since political and economic factors play the main roles in this matter.

BY's economy is an interesting case study for the specific transition path followed. After a period of fast reforms in the early 1990s, which led to price (but not wage) liberalisation, the state sector still represents an important part of the overall output [16,17]. Only about 30% of Gross Domestic Product (GDP) comes from the private sector. On the other hand, BY has always been one of the CIS countries with rapidest growth of RE sector, essentially because of the high level of human capital accumulation.

In accordance with the national accounts data the GDP of the Republic of Belarus at current prices totaled 137.4 trillion roubles in 2009, showing a 0.2% rise at constant prices as compared with 2008. The growth was determined by the increase in value added in the main branches of the economy: agriculture – 1.0%, construction – 11.3%, communications – 12.0%. In 2009 GDP per

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