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# Prospects and Risks of the Development of Energy Production Using a Combined Heat and Power System and Taking Into Account the Characteristics of the Biomass Economy

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## Abstract

The main aim of this work is to present the current state of the electric power industry in Poland. The important part of this study is to forecast the energy consumption index using selected electrometric models, while the primary data source was the relevant literature of the subject entries. This work refers to the current issues, such as the input of biomass burning in the electricity and heat energy production. The role of the author is to inquire the selected production companies about the problems occurring in practice and related to biomass burning contribution in the cogeneration process.

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## 1. Introduction

Renewable energy sources are an important part in energy balance of a whole country. The aim of this work is to analyze opportunities and threats of using biomass for energetic purposes in Poland, with particular focus on legal and economic conditions, which significantly influenced the formation of the biomass supply system and combustion in Poland [2]. The results ascertain that biomass utilization – as the most advantageous amidst biofuels in use – is an effective way of energy production. Such an energetic policy is also a resultful way of protecting natural environment, minimizing unemployment, and increasing energetic safety in a country. In terms of economics, using biomass of

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a forest and/or agricultural origin is a profitable from ecological point of view. When it comes to the economical point of view, experts' opinions vary. Purchasing coal rich in harmful compounds and building necessary facilities for exhaust gases desulfurization or denitrifying require multimillion outlays. From the economical point of view, buying higher quality coal and with lower content of sulfur and nitrogen compounds is more beneficial than infrastructure expansion in production facilities which struggle financially [2].

A distinction must be made between biomass combustion in so-called "little energetics" and biomass combustion in energy companies, i.e. heat and power plants. Because small powers installation in specific heat stations, biomass utilization at a local scale is easier than implementing biomass incineration into cogeneration systems in enterprises. There are more opportunities for adjusting small, manually-operated boiler houses to new technologies than adapting massive caldron, which very often requires conversion to a fluidized bed. Caldrons' minor unit powers facilitate – relatively cheaper – replacement with assets that allow increased share of combusted biomass, while big boiler units require larger outlays in connection to contracts and logistics as well as additional infrastructure of an enterprise. Low calorific biomass value determines a degree of utilizing installed power and exploiting storing capabilities as well as capabilities to transport more voluminous fuels in technological systems [4, 7, 15].

## 2. Outlook on development of renewable energy sources in Poland against European Union – legal conditions

After 1989 the development in Poland has been associated with two projects: one transformational and one resulting from the entry to the European Union. The transformation project was in fact a civilization project planned on a large scale, aiming at rebuilding the foundations of the state and the economy in the direction of democracy and market economy. Despite all the limitations and side effects, the Poles benefited from these changes to an extent bigger than other countries, what resulted in blossoming of entrepreneurship, in social energy release in other areas, like great educational development among many others. The nominal value of the GDP has augmented tenfold during this time, and Polish purchasing power of wages has increased sixteen-fold [2, 4].

The dynamic economy development increased demands for electric and thermal energy [14]. People constantly face new challenges to improve natural environment and preserve its values. The environmental degradation is caused by the same problems all the countries struggle with. In the literature [1, 5, 6, 8, 11, 13], there are numerous examples of actions taken to enhance ecological condition around the world.

The renewable energy share in the so-called "gross energy" is constantly growing, but it needs to be said that this growth has begun much later in Poland than in whole Europe. In 2013 over 80% of the renewable energy in Poland came from solid biofuels (e.g. wood briquette, pellet). The data in the latest Central Statistical Office's report "Energy 2020" [10] refer to renewable energy ratio in energy used in electrical power engineering, refrigeration, heat engineering, and transport. In the report we can also find the percentage of renewable energy carriers in the overall primary energy acquisition from nonexhaustible energy sources. The document of the Central Statistical Office compares levels of energy generation from renewable sources in Poland to those in EU [4, 9].

The share of the electric and thermal power from renewable sources in total gross energy consumption in years 2005-2013 in Europe showed a strong growing tendency. In Poland this progress began only in 2008, and in 2013 the percentage of nonexhaustible energy resources reached 11.3%; while in the European Union it was 15%. According to the strategy called "Europe 2020" [10] and the report prepared by the Prime Minister of the Polish Government "Development Challenges 2030" [17], the share is to amount to 20% in Europe and 15% in Poland [4, 9, 10].

It should be noted that the ratio of energy from renewable sources in refrigerating and heat engineering in Europe is lower than in electric power: it reached 13% in 2013. Currently, both in the EU and in Poland an upward trend is being noticed. Regarding the share of carriers of power from renewable sources in total primary energy acquisition from nonexhaustible resources in 2013, solid biofuels utilization was the biggest part in Europe and reached 46%, water energy – 16,6%, wind energy – over 10%, biogas – 7%, liquid biofuels – up to 6,7%, while the solar energy accounted for 5,5%. Other important aspect is the share of energy produced from municipal waste, which amounted to 4.6%; geothermal energy was 3% [4, 9, 10].

From the beginning the usage of solid biofuels in power production process in heat and power cogeneration was much higher in Poland than in other countries of the European Union. It must be noted that in 2013 up to 80% of power obtained from renewable sources came from solid biofuels. As it was stated before, the term "solid biofuels" should be understood as firewood, and waste from forestry, wood, and paper industry. The bioliquids share was

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