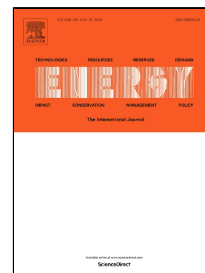


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The energy value and economic efficiency of solid biofuels produced from digestate and sawdust

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Keywords

Solid biofuels, digestate, economic efficiency, energy analysis

Abstract

Primary energy sources have limited deposits and their exploitation has a negative impact on the environment. Biofuels production is an efficient and profitable method of environmentally-friendly energy production in terms of economic reasons. In recent years use of renewable energy sources (RES) in the Polish energy balance can be noticed. The main sector in which can be observed a dynamic growth is the biomass market, with the solid biofuel market in particular. The aim of this research was to perform an economic and energy analysis of briquettes and pellets production. The obtained results of economic analyzes have shown that the individual production of solid biofuels from digestate is more profitable than using sawdust as a substrate. The costs of producing solid biofuels from solid fraction of digested pulp, as well as their calorific value, make the discussed substrate to be used to produce energy. The calorific value of the solid biofuel produced from the digested pulp solid fraction (DSF) can be compared to the calorific value of biofuel generated from sawdust. The digested pulp can be considered as an alternative to the sawdust in the production of solid biofuels.

1. Introduction

The increasing global demand for electricity is among others caused by the growth in both population and gross world product. In recent years the global and domestic energy sector has greatly developed (Esso et al., 2016). Currently the most common fuels used in heating by households are: black and brown coal as well as the biomass (Zhao et al., 2017; Wang et al., 2017). The Polish urban economy is dominated by the consumption of coal, which is a high-energy fuel available in Poland (Mocek et al., 2016; Rybak and Rubak, 2016). However, primary energy sources have limited deposits and their exploitation has a negative impact on the environment (Kozłowski et al., 2016). It becomes necessary to start looking for efficient and profitable methods of environmentally-friendly energy production in terms of economic reasons (de Carvalho et al., 2016; Markowska et al., 2016; Rahiminejad et al., 2016; Neugebauer et al., 2014). One solution is to invest in distributed generation technologies of renewable energy sources (RES) and coherent energy policy (Moran et al., 2017; Wang et al., 2017; Brown and Ulgiati, 2016). However, it should be pointed out that these solutions must not only be lawful and highly efficient but also cost-effective for both the producer and the consumer.

In recent years, an increasing use of RES in the Polish energy balance can be noticed (Paska and Surma, 2014). The main sector where dynamic growth can be observed is the biomass market, with the solid biofuel market in particular (Kowalczyk-Juśko et al., 2015). In Poland, due to large forest areas (approx. 30%) wood, paper and furniture industry has highly developed. The main raw material being processed in this sector is wood (Nguyen et al., 2017; Whittaler and Shield, 2017). During processing and using the substrate a considerable amount of waste is being produced. Sawdust account for about 10% of logs being processed at the sawmill and approximately 6% in carpentry workshops. According to estimates, up to 27.6 million m³ of wood can become a feed material for the production of solid fuel. Such favorable conditions have given rise to a dynamic development of solid biofuels market. Among the produced briquettes and pellets out of sawdust, around 90% is being exported out of Poland. This is often due to high retail prices for the Polish consumers. For private investors, the cost of purchasing raw materials in the form of sawdust is very high and amount 45 – 70 €·Mg⁻¹. Therefore, this high cost makes it unprofitable for the fuel production out of

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