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Energy efficiency indicators in peat extraction industry – a case study

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Abstract

Energy prices have become a considerable cost factor for many industry sectors. However, energetically inefficient processes exist in almost every company. The best solution for energy cost reduction is to identify energy efficiency potential and take appropriate measures.

The article analyses energy consumption for the peat extraction process of a particular company located in Latvia. Energy in the peat extraction industry is mainly consumed by different types of machinery and tractors which use diesel as an energy source. The benchmark has been calculated for the peat extraction process and the results show that around 2.44 kWh diesel fuel is necessary to extract 1 m³ of peat. The comparison and analysis of differences in particular energy efficiency indicators allows for identification of inefficient use of energy, possible financial savings for the company and reduction of CO₂ emissions.

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1. Introduction

The industrial sector accounts for a great share of total energy consumption and emitted CO₂ emissions. Therefore, energy reduction by applying different energy efficiency measures has become essential [1]. Peat extraction is one such sectors where energy consumption forms a part of total production costs [2].

Until now there have been several studies analysing the environmental impact of peat extraction [3] and utilization [4] by using the life cycle analysis method. Jeswiet et al. [5] have gathered available information on energy use and main consumers in open pit and underground mines. The main focus has been put on the diesel consumption of different mining machineries. Unfortunately, research does not include specific results of the peat extraction process.

A review study related to energy efficiency in the mining sector has been conducted by Awuah-Offei [6]. The author concludes that the main energy efficiency initiatives in mining sector are focused on better mining equipment, automation and control, fuel consumption modelling, assessment of climate change impacts, etc. Nevertheless, the author stresses that there is a gap on relevant research in energy efficiency of different mining sectors.

The main consumption of energy in the mining industry is via different types of machinery and tractors. Several studies have analysed the main parameters impacting the fuel consumption of different types of mining machinery [7–8]. Motlogelwa and Minnitt [9] has carried out the research in surface iron ore mines by focusing on different aspects affecting the fuel consumption of trucks. Authors use litres of diesel per ton of load as an energy efficiency indicator. They identify the improvement of the main management and good maintenance of the fleet as the main factors which can reduce fuel consumption.

As few research is available focusing on energy consumption in peat extraction process, the main aim of the article is to analyze energy efficiency in peat bogs by identifying several energy efficiency indicators and by applying the benchmarking method.

Nomenclature

A	amount of extracted peat, m ³ per year
C _{el}	electricity consumption, kWh per year
C _{fuel}	fuel consumption, kWh per year or l per year
P _{rated}	rated power of specific tractor, kW
SEC	specific energy consumption, kWh/m ³ _{extracted peat}
SFC	specific fuel consumption, kWh/m ³ _{extracted peat}
SFC _{tractor}	specific fuel consumption per work performed of specific machinery, l/kWh
T	working hours per year
η _{power}	power use rate

2. Case study and research boundaries

The article analyses operation of a particular peat extraction and processing company located in Latvia. The company extracts around 8 % of total amount of extracted peat in Latvia [10]. The company owns 6 different peat extraction bogs and a peat processing plant where different types of peat substrate are produced. The extracted peat amount in particular bogs varies from around 50 thousand m³ per year to 300 thousand m³ per year. Nevertheless, this article mainly focuses on peat extraction process in peat bogs.

Peat is extracted in two different ways: in peat blocks by using cutting and as milled peat by using bunker machines. The extraction process can be seen in Fig. 1. The extraction methods in each peat bog depend on factors like peat quality and parameters, geographical structure of peat bog, availability of labour, etc.

Due to the specific climate conditions, peat extraction in peat bogs takes place from April to October. The amount of extracted peat reaches its peak in June and July. Thereby, the monthly historical data cannot be directly used for the analyses as they do not precisely reflect the ongoing processes and thus the annual energy consumption and operation data has been used instead.

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