

Assumptions to the construction of a complex system of production and utilisation of alternative fuels in Silesia

Założenia do budowy kompleksowego systemu produkcji i wykorzystania paliw alternatywnych na Śląsku

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Abstract

The growing ecological awareness of the society, implementation of European Union's law and development of the market economy caused in the last years an increase in the interest in wastes that could constitute energy raw materials in the form of alternative fuels. This growth, however, is limited by factors, of which the main comprise disposal of a considerable waste quantity at waste dumping sites and a low level of waste recycling. Currently the production and utilisation of alternative fuels both in Poland and Silesia are insignificant. In 2006 in Silesia only about 20 thousand tons of alternative fuels, prepared from combustible wastes, were utilised. The possibility of gaining and application of an alternative fuel should be closely connected with waste management realised in the given area, and the producers of alternative fuels and the local heat-generating plants should be units cooperating with the remaining elements of the waste management system (dumping sites, segregation stations, fuel producers, distributors and deliverers). The increase in the utilisation of wastes as alternative fuels should be also one of the main objectives of the electrical power engineering industry. For a proper waste management in Silesia essential is to establish a system of logistic-technological solutions for the optimum production and utilisation of alternative fuels. In the paper essential aspects determining the construction of a complex system of production and utilisation of alternative fuels were presented.

Słowa kluczowe: odpad, system gospodarki odpadami, paliwa alternatywne, termiczna destrukcja

Abstrakt

Rosnąca świadomość ekologiczna społeczeństwa, implementacja prawa Unii Europejskiej oraz rozwój gospodarki rynkowej spowodowały w ostatnich latach wzrost zainteresowania odpadami, mogącymi stanowić surowce energetyczne w postaci paliw alternatywnych. Wzrost ten jest jednak ograniczony wieloma czynnikami, z których główne to kierowanie znacznej ilości odpadów na składowiska oraz niski stopień recyklingu odpadów. Aktualnie produkcja i wykorzystanie paliw alternatywnych zarówno w Polsce, jak i na Śląsku są znikome. W 2006 roku na Śląsku zużyto jedynie około 20 tys. ton paliw alternatywnych, przygotowywanych z palnych odpadów. Możliwości pozyskiwania i stosowania paliwa alternatywnego powinny być ściśle związane z gospodarką odpadami, realizowaną na danym terenie, a producenci paliw alternatywnych i lokalne ciepłownie organizmami współpracującymi z pozostałymi elementami systemu gospodarki odpadami (składowiska, stacje segregacji, producenci paliwa, dystrybutorzy i dostawcy). Zwiększenie wykorzystania odpadów, w charakterze paliw alternatywnych, powinno być także jednym z głównych celów przemysłu elektroenergetycznego. Dla prawidłowej gospodarki odpadami na Śląsku istotne jest stworzenie systemu rozwiązań logistyczno-technologicznych w optymalnej produkcji i wykorzystaniu paliw alternatywnych. W artykule zawarto: bilans odpadów do produkcji paliw alternatywnych, analizę możliwości wykorzystania paliw alternatywnych w śląskich elektrociepłowniach, a także przedstawiono istotne aspekty determinujące budowę kompleksowego systemu produkcji i wykorzystania paliw alternatywnych.

Introduction

The notion “alternative fuels” is functioning since a dozen or so of years, however, it is not explicitly defined. Often under this notion all substitutes of commonly used conventional fuels, such as coal and crude oil, are understood. However, recently more and more frequently as alternative fuels are understood: “combustible wastes in a solid form, designed for use as fuels in industrial processes, generated through processing of some wastes other than hazardous ones, which as a result of thermal transformation do not cause exceeding of emission standards”. When interpreting this definition appears the problem, if alternative fuels are still a waste or already a product? This has key significance from the formal point of view, because the proceeding in both cases is different. In extreme situations fuels obtained from the same raw material and with identical parameters will require different proceeding procedures, among others connected with the necessity to gain permissions.

Alternative fuels constitute a huge energy potential, and the technologies of energy generation from wastes do not disturb the ecological equilibrium. The high content of biogenic substance (45–65% by weight) in alternative fuels contributes considerably to the reduction of greenhouse gas emissions (about 1 Mg of CO₂ per 1 Mg of fuel), natural resources are saved through the substitution of fossil fuels, and the costs of electrical energy can be considerably lower than 0.05 €/kWh, what is one of the objectives of the EU in the sphere of renewable energy production [1].

Management of combustible waste in Silesia

The economic development of Silesia and increasing consumption cause a dynamic growth of waste quantities (mainly of municipal origin). A considerable part of produced wastes has energy advantages, however, their utilisation for electric energy and heat generation is insignificant.

The small quantity of implementations with respect to the production of alternative fuels results from a number of reasons, among others from:

- lack of legal regulations distinctly distinguishing fuels formed of wastes,
- non-understanding of legal regulations that regulate the process of energy utilisation of wastes and organisational weakness of potential investors,
- insufficient knowledge of technical requirements, which should be fulfilled in order to

obtain a fuel being a product for the power industry and local heat-generating plants,

- unfamiliarity with the power industry requirements connected with technical conditions of alternative fuel feeding to the boiler,

as well as functioning of a system of waste management, which still does not force the reduction of waste disposal.

Currently only 0.5% of the entire waste quantity is subject to thermal transformation, first of all in cement building kilns. A chance for the solution of this ecological problem is the increase in production and thermal utilisation of solid alternative fuels.

Such a form of waste utilisation should constitute a key element of the conception of integrated waste management as a result of bringing into effect the Directive 1999/31/EC on the landfill of waste. Additionally the production of alternative fuels and their utilisation favours the Directive 2001/77/EC in the part concerning the production of electricity from renewable energy sources (OZE-RES-E).

In 2006 the quantity of municipal wastes produced in Silesia amounted to 1.56 million Mg. The quantity of collected wastes by companies having appropriate permissions, amounted according to the Central Statistical Office (GUS) to 1.38 million Mg; from this fact it results that about 180 thousand Mg is directed in a non-controlled way to the environment. It should be stressed that at municipal waste dumping sites in 2006 were disposed 1.21 million Mg of wastes, a part of them can constitute a raw material for energy recovery. The results of tests of waste morphology at municipal waste dumping sites [1, 2] have indicated that on average 60% of disposed there wastes constitute the combustible fraction. It should be emphasised, however, that the possibilities of their recovery and selection are limited.

Alternative fuel (code 19 12 10) can be produced from wastes other than hazardous ones and hazardous wastes, and its physicochemical parameters should meet the compulsory standards in conformity with the order of the Minister of Economy of 2 November, 2000.

The estimation of “waste resources” for energy utilisation takes into consideration these fractions of municipal and industrial wastes, which currently as non-managed wastes can constitute an essential component of fuels with considerable calorific value. The calculations were carried out on the basis of data predicting waste production in Silesia in 2007 [3].

Summarising it can be stated that the maximum for recovery, in the scale of the voivodeship (province), quantity of wastes for energy utilisation in the scale of a year amounts to about 200 thousand Mg.

Essential aspects of production and energy utilisation of alternative fuels in Silesia

In order to satisfy the potential needs of the national power engineering it is necessary to increase the performances of existing installations producing alternative fuel and to establish new plants producing fuels from wastes, for example at municipal waste dumping sites. An essential problem constitutes gaining of an appropriate quantity of fuel with accurately determined parameters and assurance of delivery continuity. Taking into consideration the diversity of input streams of wastes used in the production of alternative fuels, there exists the necessity to implement the system of production management and alternative fuel utilisation, ensuring effective and ecological production and utilisation of alternative fuels. This system should cover the entire production process from waste delivery to the final product [4, 5].

The development of the system of production management and utilisation of alternative fuels should be preceded by a number of investigations; particular attention should be paid to the following problems:

1. The real quantities of possible for gaining combustible wastes from the selective collection and municipal dumping sites are inconsiderable and limited to big agglomerations. The lack of selective collection and waste segregation stations causes that mixed wastes are disposed at the dumping site, therefore the possibilities of their gaining and selection are limited. In such a situation significant is the **estimation of possible for gaining real quantity of alternative fuels for the needs of the power engineering / industry.**

In order to estimate the raw material potential for the production of alternative fuels it is necessary to supplement:

- The evidence of individual waste groups

According to the existing legal standards all participants of removal chains are obliged to keep quantitative evidence of wastes that they produce, possess, store, collect, transport, sell, transfer, process and deposit, however, the reliability of these data is at the present time very low and frequently conducted in an irregular manner. This problem

influences all stages of proceeding with wastes.

- Morphological tests of arising wastes

Still rarely are conducted quantitative and qualitative tests of arising wastes, therefore strongly impeded are all design activities connected with the waste economy.

A problem constitutes also the separation and lack of coordination between individual subjects in the entire removal chain. Every subject acts “on its own account”, therefore it is difficult to optimise the routes, costs etc.

2. An essential problem constitutes gaining of appropriate fuel quantity with exactly determined parameters and ensuring of delivery continuity. The requirements relating to fuel quality are issued by the fuel users and result from the type of technological processes (anticipated contamination emissions, residual composition after combustion, impact on the combustion process). On account of the diversity of input waste streams used in the production of alternative fuels, there exists the need to implement in Poland a *sustainable system of alternative fuel quality management*, ensuring effective and ecological production and utilisation of alternative fuels. This system should cover the entire production process: from waste delivery to the final product.
3. It is necessary to refine the legal legislations classifying alternative fuels among renewable fuels.
4. Essential is the development of new / optimisation of existing production technologies of alternative fuels guaranteeing good chemical and physical properties of the fuel, as well as its constant quality.
5. The development of a logistics system of production, transport and delivery of alternative fuels to enterprises utilising them is the basic element determining mass waste utilisation. Among the more essential factors influencing the possibility of regular deliveries should be counted:
 - technological processes (collecting and storage, transport and processing of wastes into alternative fuels),
 - infrastructure (network of roads and available transportation means, location of heat-generating plants, cement plants),
 - producer and consumer markets of alternative fuels.

When starting the construction of a system of production management and utilisation of alterna-

tive fuels, particular attention should be paid to the following facts:

- Effective gaining of fuels from wastes for energy utilisation is a difficult and long-lasting process that requires consistent activities with respect to industrial plants, among others: co-operation with public administration bodies and ecological organisations, promotion and presentation of the industry, investments and organisational activities.
- The possibilities of gaining and use of an alternative fuel should be closely connected with the waste economy realised in the given area, and the producers of alternative fuels and industrial receivers should be bodies cooperating with the remaining elements of the waste economy system (dumping sites, segregation stations, fuel producers, distributors and deliverers).
- Deciding significance have activities concerning the management of all material flows, covering the spheres of receipt and storage of wastes, alternative fuel production, alternative fuel storage as well as its transport and processing in heat-generating plants. In the practice this means that necessary is the integration of flows occurring between fuel producers and receivers.

The effects that are possible to be achieved owing to the development of the *complex system of production and utilisation of alternative fuels* should be seen from three aspects:

- **financial aspect** – the effects result from resources saving, their joint utilisation, elimination of superfluous actions, and better organisation and realisation of tasks and reduction of their realisation time, as well as gaining of incomes from the economy of wastes directed for its functioning and development;
- **material aspect** – the effects result from the possibility to recovery the energy contained in wastes;
- **ecological aspect** – the effects result from the reduction of natural environmental load regarding the quantity of wastes disposed at dumping sites, elimination or decrease of the quantity of municipal wastes contaminating the natural environment.

The small quantity of objects of waste thermal utilisation results from a number of reasons: high costs of object realisation, organisational weakness of potential investors and fragmentation of subjects (self-governments, subjects involved in waste management), opposition of local societies (necessity of ecological education).

Final remark

The fundamental problem in the scale of the Silesian Voivodeship (Province) is the insufficiently developed market of alternative fuel producer. In the scale of the voivodeship there exist at the present time several professional producers of alternative fuels, among them in Siemianowice, Chorzów, Rybnik. These firms produce and deliver alternative fuels, mainly for the cement industry. It should be stressed that the existence of only three production firms concentrating their activities on the delivery of fuels mainly to cement plants does not favour the competitiveness and negotiations in respect of both required fuel parameters and fuel price.

The power industry as a more demanding partner, determining precisely the quality parameters and composition of fuels for thermal destruction, is not an attractive partner for alternative fuel production. As it was mentioned, the power industry on account of technical conditions (type of boiler, system of waste feeding to the boiler etc.) will purchase standardised fuel at a price that is competitive with conventional fuels. Currently the fuel producers propose prices about 150 zlotys per ton, what taking into account the necessary technical / technological operations in the heat-generating plant in order to receive and use alternative fuel is not an attractive price.

Effective gaining and use of alternative fuels should be an element of the waste economy programme realised in Silesia, and the alternative fuel producers and local heat-generating plants should be bodies cooperating with the remaining elements of the waste economy system (dumping sites, segregation stations, fuel producers, distributors and deliverers). For the success of the entire undertaking essential are system activities and development of a system of logistic/technological solutions for optimum production and utilisation of alternative fuels.

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