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DEMAND FOR WOOD BIOMASS FOR ENERGY PURPOSES IN POLAND BY 2015

The article contains the results of research, in which the estimated consumption of wood biomass for energy purposes in Poland in 2010 and the anticipated demand for this energy carrier by 2015 was determined in a systemic manner.

Keywords: wood biomass, energy from renewable sources, energy from wood biomass, demand, surveys

Introduction

The basis for the efficient operation of every economy, including the Polish economy, is an assurance of appropriate amounts of energy. This fact makes energy raw materials extremely important strategic resources.

In Poland the power industry is focused mainly on the consumption of domestic resources of hard coal and brown coal, which are considerable and assure a high level of energy safety. Almost 90% of the demand for electric energy and 77% of the demand for central heating is satisfied by coal [Polska 2011. Raport... 2011]. However, at the same time, fulfilment of the commitments resulting from the Climate and Energy Package of the European Union, especially the framework directive on the promotion of the use of energy from renewable sources [OJ EC L 140 2009], makes the use of energy carriers, other than natural minerals, important. Power engineering from renewable sources is an alternative to power engineering from minerals. The environmental potential of the former is also very important.

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In Poland the demand for energy from renewable sources has been growing for a few years (in the period 2006-2010 it increased respectively from 5.0 Mtoe to 6.3 Mtoe, i.e. by 26%), while at the same time the demand for primary energy decreased (in the analysed period it decreased by 5%, i.e. from 97.8 Mtoe to 93.2 Mtoe) [Polityka energetyczna Polski... Zał. 2. 2009]. Among the renewable energy carriers a special role falls to biomass, in particular to wood biomass. In Poland in 2010 the energy produced from biomass accounted for approximately 50% of the electric energy generated from renewable energy sources [Krajowy Plan Działania... 2010]. It should be stressed that, despite the great significance of using renewable energy carriers, thus far there has been a huge informational and cognitive gap related to the demand for these types of energy carriers, including wood biomass. This incomplete knowledge of the demand for wood biomass as an energy carrier is the rationale for research in this field. The research facilitated an in-depth and comprehensive analysis of the demand for this energy carrier and, as a result, a determination of the potential size of such demand.

Research methodology

Despite the great importance of the issue, the actual demand for wood biomass for energy purposes in Poland is not known. There is also a lack of methodological study which would enable us to determine the demand for wood biomass as an energy carrier. The need to widen knowledge in this field is important not only for scientific and cognitive reasons, but primarily for practical reasons stemming from the indispensability of the development and systematic increase in the use of renewable energy sources in accordance with the assumptions of the European Union's energy policy, and the country strategies based thereon.

The aim of the research was to determine, in a systematic way, the consumption volume of wood biomass for energy purposes in Poland, as well as the anticipated potential demand for wood biomass as an energy carrier by 2015.

Spatially the analysis concerned Poland and the research was both retrospective and prospective. The time scope in the diagnostic research was the year 2010, and in the case of prognosis, the year 2015.

The subject of the research encompassed:

- the wood sector, including the sawmilling industry, the wood-based industry, the wooden window and door industry, the furniture industry and the wood pulp industry,
- the power industry, including public power plants and industrial power plants,
- municipal utility management units and public utility buildings (housing estates, residential buildings, hospitals, schools etc.).

The research process in the form of desk research was supplemented with a direct survey carried out among business entities which are prospective users

of wood biomass as an energy carrier. The main aim of the survey was to widen knowledge of the basic aspects (e.g. availability, terms of purchase/sale, the technologies applied) of the use of wood biomass for energy purposes in economic practice. The questionnaire was sent to 40 business entities within the sectors of power industry and municipal utility management units and public utility buildings. 15 business entities responded to the questionnaire and these entities were further analysed. Within the group of surveyed entities from the power industry sector, power plants were dominant (57%), 29% of the respondents were representatives of CHP plants and 14% of heat-generating plants. Within the group of municipal utility management units and public utility buildings, schools and hospitals made up the majority of the surveyed institutions (61%). The remaining percentage was composed of community centres, housing estates, residential buildings and industrial buildings [Ratajczak, Szostak, Bidzińska, Herbeć 2011].

In both the diagnostic and forecast depictions, the demand for wood biomass means its prospective (calculated, estimated) consumption. When consumption in 2010 was determined, priority importance was attached to the demand for gross electric energy from solid biomass in the analysed year in Poland, and eventually to the share of wood biomass within the solid biomass. Therefore, the starting point for the determination of the consumption volume of wood biomass in 2010 was an estimation of the share of wood biomass within the solid biomass¹ and the assumption of an average conversion factor of a fuel unit into a unit of fuel wood raw material.

The consumption of wood biomass for energy purposes in 2010 in Poland was determined based on two research procedures.

The first approach, which used fragmentary information existing in subject literature, assumed:

- the consumption volume of solid biomass at a level of 14.4 M tonnes, i.e. 20.5 M m³ (in the sectors of public power plants, industrial power plants, and individual consumers)² [Flakowicz 2011; Parkiet biomasy... www.energetyka.pl],
- the share of wood biomass within solid biomass consumed by public power plants and industrial power plants at 60% [Flakowicz 2011],
- the share of wood biomass consumed by individual consumers at a level of 80%.

In the second methodological approach, calculations were based on the following assumptions:

- the volume of the demand for gross final energy (electric and thermal) from solid biomass was at a level of 4613.6 ktoe in 2010 [Polityka energetyczna Polski... Zał. 2. 2009],

¹ Based on knowledge of the structure of biomass burnt in the Polish power industry [Forowicz 2010; Gajewski 2010].

² In conversion calculations, the specific gravity of softwood was assumed to be 700 kg/m³.

- the share of wood biomass within solid biomass was 80% [Forowicz 2010; Gajewski 2010],
- an average conversion factor of 1 tonne of fuel wood into a unit of energy was ≈ 0.3215 toe [Survey of Energy... 2009].

The research procedure aimed at the determination of the future demand for wood biomass for energy purposes generally used a methodological approach similar to that employed in the diagnostic depiction. However, in this case the starting values concerning the anticipated structure of the energy carriers were different.

Eventually the calculations were based on the following assumptions:

- the demand for gross final energy (electric and thermal) from solid biomass was determined at a level of 5098.9 ktOE in 2015 [Polityka energetyczna Polski... Zał. 2. 2009],
- the share of wood biomass within solid biomass was 80% [Forowicz 2010; Gajewski 2010],
- an average conversion factor of 1 tonne of fuel wood into a unit of energy was ≈ 0.3215 toe [Survey of Energy... 2009].

It should be added that, although the procedures of diagnosis as well as the forecast of the demand for wood biomass for energy purposes take into consideration the whole territory of Poland and all the consumer groups (i.e. public power plants, industrial power plants, and individual consumers), the share of these groups within the total demand was not accurately defined.

Consumption of wood biomass for energy purposes in Poland in 2010

Among the carriers of renewable energy, wood biomass is classified as solid biomass, which together with biogas and bioliquids makes up a category described as biomass.

In 2010 in Poland the electric energy produced from biomass was 6028 GWh, which accounted for approximately 57% of the electric energy generated from renewable energy sources [Krajowy Plan Działania... 2010]. The energy from solid biomass amounted to as much as 95% (i.e. 5700 GWh) of the gross electric energy generated from biomass. On the other hand, the gross electric energy produced from solid biomass amounted to 54% of the total energy generation from renewable energy sources.

In 2010 the domestic consumption of solid biomass was 245543 TJ and compared to the year 2006 it was an increase of 35% [Energia... 2011].

In 2010 the greatest amount of solid biomass was consumed by end-users (179075 TJ, i.e. 73%), amongst whom households were important consumers and their consumption amounted to 112746 TJ, i.e. 63% of this energy carrier. Production companies consumed 21% of solid biomass (37186 TJ), while the main consumers were the pulp and paper and the printing industries (51%) and the

wood industry (41%). In the discussed year the consumption of solid biomass for transformation input³ in power plants, heat-generating plants and CHP plants was 66119 TJ, i.e. 27% of the domestic consumption of this energy carrier.

On the basis of the assumptions of the first methodological approach, it was estimated that in 2010 in Poland the consumption of wood biomass amounted to 14.5 M m³ (i.e. over 10 M tonnes⁴) – table 1.

Table 1. The consumption of wood biomass in 2010 in Poland (according to the two methodological approaches)

Tabela 1. Zużycie biomasy drzewnej w Polsce w 2010 roku (według dwóch podejść metodycznych)

Detailed list <i>Wyszczególnienie</i>	Wood biomass consumption <i>Zużycie biomasy drzewnej</i>	
	Methodological approach <i>podejście metodyczne</i>	
	I	II
	M m ³ <i>mln m³</i>	
Wood biomass consumers in total, of which: <i>Ogółem odbiorcy biomasy drzewnej, w tym:</i>	14.5	16.4
– public power plants <i>energetyka zawodowa</i>	3.8	–
– industrial power plants <i>energetyka przemysłowa</i>	2.1	–
– individual consumers <i>odbiorcy indywidualni</i>	8.6	–

Source: [Ratajczak, Szostak, Bidzińska, Herbec 2011]

Źródło: [Ratajczak, Szostak, Bidzińska, Herbec 2011]

On the other hand, in accordance with the assumptions of the second methodological approach, where the demand for gross final energy from solid biomass was the starting point, the calculative consumption of wood biomass was 16.4 M m³ (i.e. approximately 11.5 M tonnes).

The presented calculative demand for wood biomass is the first comprehensive information on the consumption of this energy carrier in Poland. It also indicates that the demand for this energy carrier is considerable.

The interest in biomass, including wood biomass, for energy purposes has been growing in recent years in Poland, which confirms that power plants and heat-generating plants have, to a larger and larger extent, decided to co-burn bio-

³ The sum of consumption of particular energy carriers used as input raw material
[Gospodarka paliwowo-energetyczna... 2010]

⁴ In conversion calculations the specific gravity of softwood was assumed to be 700 kg/m³

mass with coal, and some of them have installed boilers fed with biomass only. According to the Energy Development Agency S.A. (Agencji Rozwoju Energii S.A.) [Flakowicz 2011] there were 53 plants in 2010 using biomass (solely or in co-burning) for energy purposes (46 public power plants/ CHP plants and 7 industrial power plants/CHP plants) as opposed to, in 2006 when there were 32 such plants (24 and 8, respectively). It should be noted that the 18 biomass power plants operating in Poland generated 629797 MWh of energy, i.e. approximately 6% of the total energy from renewable sources [Polska 2011... 2011].

Current research at the Wood Technology Institute in Poznań [Ratajczak, Szostak, Bidzińska, Herbeć 2011] has demonstrated that in 2010 the wood sector industries consumed for their own energy needs approximately 3.0 M m³ of wood biomass originating from this sector, which accounted for 58% of the calculated total supply of this carrier for energy purposes (table 2). The largest share of wood biomass was consumed for energy purposes in the sawmilling industry (930 thou. m³, i.e. 31%) and the wood-based panel industry (800 thou. m³, i.e. 26%). The research also suggests that the wood-based panel industry and the wood pulp industry, both of which are classified as energy-consuming industries, use up all the wood biomass they produce for their own energy purposes.

Table 2. The consumption of wood biomass produced in the Polish wood sector for its own energy needs in 2010 in Poland

Tabela 2. Wykorzystanie biomasy drzewnej powstającej w polskim sektorze drzewnym na własne potrzeby energetyczne w Polsce 2010 roku

Detailed list <i>Wyszczególnienie</i>	Wood biomass <i>Biomasa drzewna</i>	
	thou. m ³ <i>tys. m³</i>	%
Consumption in the wood sector, within the following industries: <i>Zużycie w sektorze drzewnym, z tego w przemysłach:</i>	3030	100.0
– sawmilling <i>tartacznym</i>	930	30.7
– wood-based panel <i>plyt drewnopochodnych</i>	800	26.4
– wooden windows and doors <i>stolarki budowlanej otworowej</i>	130	4.3
– furniture <i>meblarskim</i>	620	20.4
– wood pulp <i>mas włóknistych</i>	550	18.2

Source: [Ratajczak, Szostak, Bidzińska, Herbeć 2011]

Źródło: [Ratajczak, Szostak, Bidzińska, Herbeć 2011]

The survey among the collective consumers of wood biomass, i.e. a group of public power plants, municipal utility management units and public utility buildings (hospitals, schools etc.) revealed that these entities consume wood biomass from all its sources, while the majority of respondents use wood biomass from the wood sector (43%). Approximately 25% of the respondents pointed to forestry as the source of wood biomass they use, while the same percentage pointed to agriculture, and approximately 6% to municipal utility management.

It is characteristic that the market in wood biomass is a much dispersed market and thus a very difficult one, especially for prospective consumers of large amounts of this energy carrier. Among these consumers we find public power plants. In the direct survey, 71% of this respondent group indicated that they purchased wood biomass from more than 10 suppliers, while sometimes the number of suppliers exceeded 30. Moreover, the respondents pointed out that their wood biomass suppliers were business entities located within 70 to 200 km, and even 300 km. In contrast, public utility buildings purchased wood biomass from no more than 5 suppliers and these were entities located within no more than 20 km from the purchaser (67% answers of the respondents). It was also revealed that the contracts drawn up with the wood biomass suppliers were most often short-term and medium-term.

Demand for wood biomass for energy purposes in Poland in 2015

The prospective demand for wood biomass for energy purposes is even more difficult to anticipate than its diagnostics and should be considered against the complex issues of the comprehensively understood development of the Polish power industry.

The forecasts and types of needs of Polish power engineering were defined in "The energy policy of Poland by 2030" adopted by the Council of Ministers on November 10, 2009 [Monitor Polski 2010]. These forecasts and the types of needs are in line with the goals that the European Union has set in this field, and they are: the improvement of energy efficiency, enhanced safety of fuel and energy supplies, diversification of the electric energy generation structure through the introduction of nuclear power engineering, the development of the use of renewable energy sources (including biofuels), the development of competitive markets in fuels and energy, and the reduction of the impact of power engineering on the environment.

It is anticipated [Energetyka... 2010] that after a period of decrease in the demand for primary energy (a 5% decrease in the period 2006–2010), in 2015 this demand will reach a level of 95.8 Mtoe, which will mean an approximate increase of 3% in relation to 2010. However, the demand for energy from fossil fuels will still decrease. In 2015, the demand for this type of energy carriers will probably amount to 47.9 Mtoe, thus it will be 2.5% lower than in 2010. This concerns ma-

inly hard coal and the demand for primary energy from this source will probably reach 35.3 Mtoe (this means a decrease of approximately 7% in relation to 2010). On the other hand, the demand for energy from renewable sources will increase significantly – from 6.3 Mtoe in 2010 to 8.4 Mtoe in 2015, i.e. as much as by 33%. The existing strategy documents indicate that the net electric energy produced from renewable energy carriers will reach a level of 17.0 TWh in 2015 (i.e. it will increase more than 2.5 times compared to 2010) and it will have a 12.2% share of the energy generated from all the carriers [Polityka energetyczna... Zał. 2. 2009].

The increase in importance of the energy from renewable sources means that at the same time the role of one of its main carriers, i.e. solid biomass, becomes more important. It is anticipated that in 2015 the electric energy generated from all biomass types will account for 50% of the electric energy generated from renewable energy sources (fig. 1). On the other hand, electric energy from solid biomass will amount to 90% of the energy from biomass and 45% of the electric energy from all renewable energy carriers.

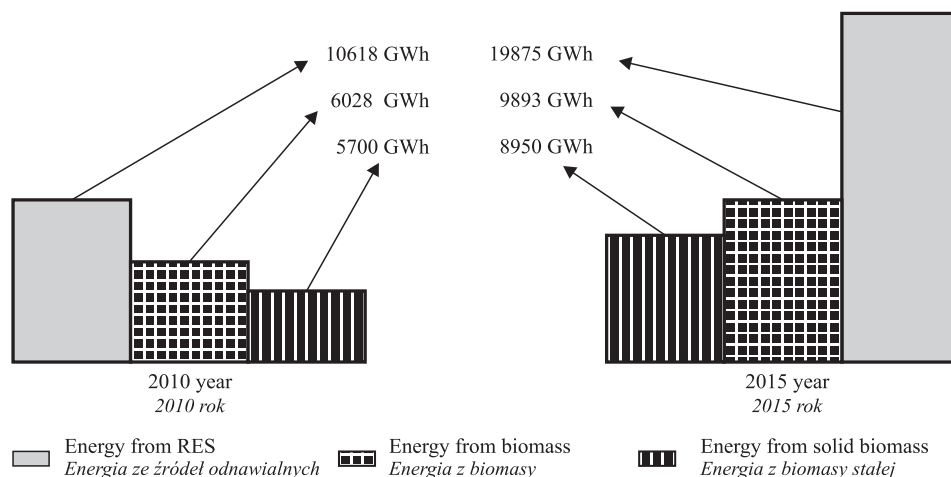


Fig. 1. The forecast of gross production of electric energy from biomass in 2015 in Poland compared to 2010

Rys. 1. Prognoza produkcji energii elektrycznej brutto z biomasy w Polsce w 2015 roku w porównaniu do 2010 roku

Source: Authors' own study based on [Krajowy Plan Działania... 2010]

Źródło: Opracowanie własne na podstawie: [Krajowy Plan Działania... 2010]

The presented assumptions concerning the anticipated volume of demand for energy in Poland by 2015 and the structures of energy carriers were the basis for the preparation of a forecast of the demand for wood biomass for energy purposes by 2015.

The calculations made allow us to estimate that in 2015 the demand for wood biomass in Poland will most probably amount to over 18 M m³ (12.7 M tonnes).

It would mean an increase of 10% to 25% in relation to the wood biomass consumption estimated for the year 2010 (fig. 2).

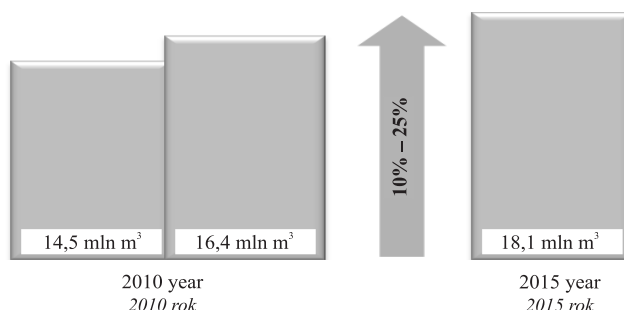


Fig. 2. The approximate demand for wood biomass for energy purposes in 2010 in Poland and the forecast for 2015

Rys. 2. Orientacyjne zapotrzebowanie na biomasę drewną na cele energetyczne w Polsce w 2010 roku i prognoza na 2015 rok

Source: [Ratajczak, Szostak, Bidzińska, Herbeć 2011]

Źródło: [Ratajczak, Szostak, Bidzińska, Herbeć 2011]

Although we lack complete information to determine the future structure of the demand for wood biomass for energy purposes, fragmentary data allow us to make an attempt at illustrating and pointing out the trends in the future needs of the main groups of wood biomass consumers (users).

As previously mentioned, in 2010 there were 53 plants in so-called public power plants which consumed biomass (solely or in co-burning) for energy purposes. There are plans to execute further biomass-based investments in the Polish power industry sector by 2015. These will most probably be 7 installations in already existing power plants and CHP plants⁵. The incomplete and dispersed information only enables the identification of part of the biomass consumption for energy purposes in such plants. It is estimated that in 2015, 26 plants will most probably consume approximately 14 M m³ of wood biomass (i.e. 10 M tonnes).

Individual consumers and the ever growing group of municipal utility management units and public utility buildings (housing estates, schools, hospitals etc.) will still remain significant consumers of solid biomass, mostly wood biomass. Due to the lack of any type of records, this group of consumers is hard to identify in terms of their number and demand for this energy carrier. The direct survey carried out among the public utility buildings, suggests that the need to reduce energy costs is a significant reason for the installation of biomass-fed boilers. This survey also indicates that in the face of increasing energy prices the use of solid biomass for energy purposes in this consumer segment will become a more and more common interest.

⁵ For instance, power plants in Jaworzno, Połaniec, and Konin, and CHP plants in Łódź, Poznań, and Elbląg [Flakowicz 2011].

The industries of the wood sector will remain a numerous and permanent consumer group using wood biomass for energy purposes. It should be noted that this biomass is wood biomass produced by particular industries in this sector and consumed by them for their own purposes. The conducted research [Ratajczak, Szostak, Bidzińska, Herbeć 2011] indicates that in 2015 the amount of wood biomass consumed in this sector will most probably equal 3.5–3.8 M m³, depending on trends in the supply of and the demand for wood materials and products (variant I and II) (table 3). The largest amounts of this carrier should be consumed by the sawmilling industry, i.e. 1.0–1.1 M m³ (i.e. 30% of total consumption in the wood sector) and the wood-based panel industry, i.e. 0.9–1.1 M m³ (i.e. approximately 29%).

Table 3. The anticipated use of wood biomass produced in the wood sector for energy purposes in 2015

Tabela 3. Przewidywane wykorzystanie biomasy drzewnej powstającej w sektorze drzewnym na cele energetyczne w 2015 roku

Detailed list <i>Wyszczególnienie</i>	Wood biomass <i>Biomasa drzewna</i>	
	Variant I <i>I wariant</i>	Variant II <i>II wariant</i>
	thou. m ³ <i>tys. m³</i>	
Consumption in the wood sector, within the following industries: <i>Zużycie w sektorze drzewnym z tego w przemysłach:</i>	3495	3800
– sawmilling <i>tartacznym</i>	1050	1140
– wood-based panel <i>plyt drewnopochodnych</i>	965	1125
– wooden windows and doors <i>stolarki budowlanej otworowej</i>	160	165
– furniture <i>meblarskim</i>	755	795
– pulp and paper <i>celulozowym</i>	565	575

Source: [Ratajczak, Szostak, Bidzińska, Herbeć 2011]

Źródło: [Ratajczak, Szostak, Bidzińska, Herbeć 2011]

On the basis of the survey, while fully aware that it is not statistically representative, it can be added that in some industries of the wood sector the amount of biomass that can possibly be used for their own energy purposes will be insufficient, and in others it will surpass their own needs. The first group consists of highly energy-consuming industries, i.e. the wood pulp and the wood-based

panels industries, while the second mainly consists of the sawmilling and the furniture industries. It is forecast that in 2015 the industries of the wood sector that will have a surplus of wood biomass for energy purposes will be able to sell this energy carrier to various customers. It is estimated that the wood biomass amount in question may be 2.6–2.8 M m³, i.e. approximately 43% of the total supply of this carrier for energy purposes.

Conclusions

In Poland wood biomass is a relatively easily-available energy carrier. At the same time, forest wood of poor quality and dimensional parameters, side products (residues) from wood processing, post-consumer wood, and wood from fast-growing tree plantations are the most accepted energy carriers both politically and socially, the use of which contributes to the reduction of the coal share in electric and thermal energy generation. The most important point here is that wood biomass can be directly burnt in power plants based on coal. The biomass share in so-called dispersed power industry, mainly generating thermal energy (local heat-generating plants, individual households), is important as well.

The research indicates that in Poland the demand for wood biomass for energy purposes is great. The domestic demand for this energy carrier is created by the public power industry sector, the industries of the wood sector, municipal utility management units and public utility buildings (schools, hospitals, residential and industrial building etc.), and individual consumers, and it amounts to approximately 16 M m³ and will increase in the near future – probably to a level of 18 M m³ in 2015. The research verified the hypothesis regarding the consumption of a significant percentage of the biomass produced in the wood sector for its own energy needs (this is mainly observed in the sawmilling industry and the wood-based panel industry). This percentage amounts to approximately 3.0 M m³ of wood biomass, which accounts for 58% of its supply for energy purposes.

The supplementary direct research revealed that the surveyed wood biomass users, i.e. public power plants and municipal utility management units and public utility buildings, pointed to the wood sector as currently the main source of wood biomass, followed by agriculture and forestry.

The survey confirmed that the market in wood biomass is a dispersed one. In most cases wood biomass is supplied to consumers within 70 to 200 km, but this may even extend to 300 km. Additionally, the survey suggests that the majority of wood biomass users, especially public power plants, purchase biomass from a dozen or so suppliers, and the contracts drawn up between the purchasers and the sellers are most often medium-term and short-term.

Acknowledgements

This article includes part of the results of research commissioned and financed by the State Forests Directorate General in Warsaw [Ratajczak, Bidzińska, Szostak, Herbeć 2011] and part of the results of research financed by the Ministry of Science and Higher Education [Ratajczak, Szostak, Bidzińska, Herbeć 2011] carried out in 2011 in the Wood Industry Economics Department of the Wood Technology Institute in Poznań.

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ZAPOTRZEBOWANIE NA BIOMASĘ DRZEWNĄ DO CELÓW ENERGETYCZNYCH W POLSCE DO 2015 ROKU

Streszczenie

Rynek energetyczny w Polsce jest w coraz większym stopniu kształtowany przez odnawialne źródła energii, w tym w dużym stopniu przez biomasę drzewną. Należy podkreślić, że chociaż ranga problematyki wykorzystania biomasy drzewnej do celów energetycznych jest wysoka to, jak dotychczas, występuje duża luka informacyjna dotycząca zapotrzebowania na ten rodzaj energii.

Celem podjętych badań było określenie w sposób systemowy wielkości zużycia biomasy drzewnej do celów energetycznych w Polsce wraz z przewidywanym potencjalnym poziomem popytu na biomasę drzewną jako nośnika energii do 2015 roku.

Badania miały charakter zarówno retrospektywny, jak prospektywny. Zakres czasowy obejmował: w badaniach diagnostycznych – 2010 rok, a w wypadku prognoz – 2015 rok. Zakresem podmiotowym badaniami objęto: sektor drzewny, energetykę, gospodarkę komunalną. W ujęciu diagnostycznym punktem wyjścia do oszacowania wielkości zużycia biomasy drzewnej w 2010 roku było oszacowanie udziału biomasy drzewnej w biomase stałej oraz przyjęcie średniego przelicznika jednostki opałowej na jednostkę surowca drzewnego opałowego. Zastosowano dwie procedury badawcze. W pierwszej wykorzystano istniejące w literaturze przedmiotu fragmentaryczne informacje o zużyciu biomasy stałej, w drugiej – punktem wyjścia do obliczeń było przyjęcie zapotrzebowania na energię finalną pochodzącą z biomasy stałej. W procedurze badawczej zmierzającej do oszacowania przyszłego zapotrzebowania na cele energetyczne biomasy drzewnej zastosowano podejście metodyczne podobne jak w ujęciu diagnostycznym. Jednak w tym wypadku odmienne były wielkości wyjściowe dotyczące przewidywanej struktury nośników energii. Proces badawczy uzupełniony został badaniami ankietowymi wśród podmiotów gospodarczych będących potencjalnymi użytkownikami biomasy drzewnej (jednostki tzw. energetyki zawodowej, jednostki gospodarki komunalnej i użyteczności publicznej, np. szpitale, szkoły, przedszkola).

Z przeprowadzonych obliczeń wynika, że popyt na biomasę drzewną do wykorzystania w energetyce jest w Polsce duży. Krajowe zapotrzebowanie na ten nośnik energii kreowane przez energetykę zawodową, branżę sektora drzewnego, gospodarkę komunalną i jednostki użyteczności publicznej oraz odbiorców indywidualnych wynosi około 16 mln m³ i do roku 2015 będzie wzrastało do poziomu 18 mln m³. Badanie potwierdziło hipotezę o znaczącym odsetku zużywania biomasy powstającej w sektorze drzewnym na własne potrzeby energetyczne. Okazało się, że jest to około 3,0 mln m³ biomasy drzewnej, co stanowi 58% jej podaży dla energetycznego kierunku zagospodarowania. Badania potwierdziły rozproszony charakter rynku biomasy drzewnej. Biomasa drzewna dostarczana jest w wielu wypadkach (dotyczy to zwłaszcza dużych jej użytkowników) na odległość w promieniu 70–200 km.

Słowa kluczowe: biomasa drzewna, energia ze źródeł odnawialnych, energia z biomasy drzewnej, zapotrzebowanie, badania ankietowe