

# Foreign Trade of Biomass for Energy Purposes in Poland in the Years 2008–2014

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## Abstract

*The obligation of renewable energy production and the opportunities for additional large revenue from green certificates has led to an increased interest in biomass derived from imports. During the period under study, imports of biomass to Poland increased nearly eight times: from 423 thousand tons to 3 591 thousand tons. Agro biomass imports showed higher dynamics (1160%), including in particular sunflower husks and sunflower and palm oil cake. During the same period, imports of forest biomass increased by 478%, of mainly firewood and wood chips. By 2007, the vast majority of imported biomass had come from the current European Union countries (nearly 50%, the highest amounts from Lithuania, Latvia, Slovakia and Germany), and the structure of imports was divided roughly evenly into agro and forestry sourced biomass. The introduction of mandatory restrictions on the use of forest biomass resulted in a significant increase in non-forest biomass share in the total imports of biomass, which have also significantly increased from year to year. In the last three years, agro biomass imports from the EU and Ukraine have accounted for almost 65% of total imports of biomass for energy purposes. A dramatic increase has also been observed in the imports of exotic biomass, although in relatively small absolute values: from 0 in 2009 to about 65 thousand tonnes in 2010 and 2011, and to more than 600 thousand tonnes in 2014.*

**Keywords:** renewable energy sources, biomass, foreign trade

## Introduction

Energy is the main determinant force behind any economic activity and development of civilization. It is a driving force in all production and consumption processes. Alvin Toffler (1997) put it aptly saying that “a necessary condition for any civilization to exist—either old or new, is the availability of energy resources.” Fritjof Capra (1987), when analyzing the causes for rises and declines of particular civilizations in the history of humanity pointed at the fact that access to energy resources coupled by abilities to use them effectively marked the beginning and end of any civilization. A human being, just to sustain basic physiological and metabolic processes, needs from 3 to 5 GJ of energy annually. However, with a rapid development of societies, energy consumption steadily increases, and in the second half of the 19th century, the amount was at the level of 38 GJ, and in 1985 it increased to 85 GJ per person. If this tendency of primary energy<sup>1</sup> demand is sustained, the world’s population of 8 billion people will need an astonishing 630 billion GJ of energy (Czaja and Becla 2002).

According to the International Energy Outlook 2002, a report prepared by the International Energy Agency, energy consumption in 2000–2020 will increase from 382 to 612 quadrillion (1024) Btu<sup>2</sup> (by 60%). Fossil fuels such as petroleum, coal and natural gas are at present the major

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1. It is the sum of energy contained in primary energy mediums.

2. British Thermal Unit, a unit of heat used in English speaking countries; it is the amount of heat needed to

sources of primary energy. World deposits of these fossil fuels are still quite significant. Without negating the fact that such resources are in fact limited and in the long term will eventually run out, it is necessary to emphasize that thanks to geological research new deposits are being discovered, and the total increase in reserves is still higher than that of consumption (Gradziuk 2015).

A study carried out by the International Institute for Applied Systems Analysis (IIASA) shows that there will be a decrease in the share of conventional fuels (petroleum, natural gas and coal) in the overall consumption after 2020, as the natural reserves deplete and prices rise. In 2060 the last of operating nuclear power plants will be shut down. Such fuels are replaced by renewable energy sources, using in the conversion process the power of wind, solar, aerothermal, geothermal, hydrothermal, wave, tidal, fall of rivers energy; biomass, biogas derived from landfills, as well as biogas produced in the process of sewage disposal and treatment or decomposition of plant and animal remains.

The Directive on the promotion of energy from renewable sources (2009/28/EC) shows that the most important role among renewable energy sources will continue to be played by biomass, although its share in final RES energy balance in 2020, as compared to 2010, will decrease from 62,9% to 60,7%. In Poland, the share of biomass was even higher, and in 2013 amounted to 95%. This follows from the fact that biomass is one of those renewable energy sources that do not require the maintenance of the so-called “hot standby” power available in the system, as in the case of wind or photovoltaic farms. The need to maintain “hot standby” energy has been a subject of disputes for many years in the energy sector and has led to legal solutions that are of key importance for the development of renewable energy sources, evident especially in the form of dedicated economic mechanisms (Żylicz 2012). In 2014, 30 of the 39 Polish coal power plants were co-incinerating biomass. The ecological criticism of this practice, however, increases. Most co-incinerating coal power plants do not use the emerging waste heat: about 75 per cent of the electricity from biomass is produced without using it. As a result of the booming co-incineration in Poland, prices for energetically used biomass have almost doubled since 2006. This demand has led to an increasing import of biomass. Therefore the main objective of the study is evaluation of foreign exchange biomass for energy purposes in Poland.

## 1 Material and methods

Information on imports of biomass is based on the Foreign Trade Database of the Central Statistical Office of Poland (GUS)<sup>3</sup>. The scope of research covered the years 2008–2014; the adoption of such period resulted from the fact that in 2008 there was a significant increase in imports of biomass for energy. According to information obtained from the Polish Chamber of Biomass, energy imports encompassed the following types of biomass:

- cereal straw and husks, unprepared, not chopped, ground, pressed or in the form of pellets (Cn 121300)
- husks of sunflower, hazelnut, etc. (Cn 140490)
- bran, ground grain and other residues from the sifting, milling or other processing of wheat, including granulates or pellets (Cn 230630)
- oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils of palm nuts or kernels (Cn 230660)
- oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils, shea nut residues (Cn 230690)
- firewood, in logs, billets, twigs, fagots or in similar forms (Cn 440110)
- wood in chips or particles, coniferous (Cn 440121)
- wood in chips or particles, deciduous (Cn 440122)
- sawdust and wood waste and scrap, whether or not agglomerated in logs, briquettes, pellets or similar forms (Cn 440130, 440131)

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heat 1 lb of water by 1 °F (degree Fahrenheit) usually at a prescribed temperature—i.e., Btu<sub>39</sub>—amount of heat needed to heat 1 lb of water from the temperature of 39 °F to 40 °F, 1 Btu<sub>39</sub> = 1059,52 J; 1 Btu (average) = 1 055,06 J. [In the journal European practice of number notation is followed—for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style).—Ed.]

3. In Polish: Główny Urząd Statystyczny.

## 2 Results

The basic legal document regulating biomass consumption in Polish power plants is the ordinance of the Minister of Economy from 14 August 2008 on green certificates, payment of substitute fees, purchase of electricity and heat produced from renewable energy sources and the obligation to validate the data about the amount of electricity generated from renewable energy sources. This regulation defines biomass as: liquid or solid substances of plant or animal origin, agricultural, food industry or timber production wastes, biodegradable wastes and low quality cereal grains not covered by the State intervention purchase. In addition it defines which kind of biomass can be used in Polish power plants. Power plants are obligated to use a certain amount of agricultural biomass in their overall fuel balance. This amount is dependent on biomass combustion technology (co-firing, hybrid combustion or biomass dedicated boilers).

The obligation of renewable energy production and the opportunities for additional large revenue from certificates of origin (green certificates) has led to an increased interest in biomass derived from imports. During the period under study, imports of biomass to Poland increased nearly eight times: from 423 thousand tons to 3 591 thousand tons. During the same period exports of biomass from Poland increased about two times: from 459 thousand tons to 1 058 thousand tons. Tables 1 and 2 show the detailed amounts of imports and exports, with prices applicable on the Polish border. Prices are calculated on the basis of the value of imports to the Polish port or the Polish border CIF (i.e., including the costs of transport and insurance to the Polish border).

By 2007, the vast majority of imported biomass had come from the current European Union countries (nearly 50%, the highest amounts from Lithuania, Latvia, Slovakia and Germany), and the structure of imports was divided roughly evenly into agro and forestry sourced biomass. The introduction of mandatory restrictions on the use of forest biomass resulted in a significant increase in agro biomass share in the total imports of biomass. Agro biomass imports showed higher import dynamics (1 160%), including in particular sunflower husks and sunflower and palm oil cake. During the same period, imports of forest biomass increased by 478%, of mainly firewood and wood chips. Poland is mainly an exporter of wood biomass (in 2014—94%).

In 2014 among the imported agricultural biomass, by-products from the oil industry dominated:

- husks of sunflower, hazelnut, etc. (Cn 140490)—1 190 thousand tons;
- oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of sunflower (Cn 230630)—487 thousand tons.

Over 64% of imported agricultural biomass came from Ukraine, and they were the by-products from the processing of sunflower seed (cake or husk) in the loose form, briquettes or pellets (tab. 3). Significant amounts of this type of biomass were also imported from Russia (4,9%).

The increase in demand for biomass for energy purposes has meant that importers began to search for markets outside Europe. By 2009, the imports of biomass from outside Europe had virtually been non-existent. It was only in 2010 that 63 thousand tonnes of biomass in the form of agro-cake were brought into the country; from Indonesia (34 thousand tonnes), Malaysia (20 thousand tons) and Tunisia (9 thousand tons). In 2014, agro biomass imports from outside Europe accounted for 26% of such imports into Poland. This group of resources in terms of volume were the by-products from processing of other oil crops (olives, palm nuts, etc.):

- oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils of palm nuts or kernels (Cn 230660)—630 thousand tons,
- oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils, (Cn 230690)—21 thousand tonnes.

The largest supplies of such materials came from Indonesia (21.8%) and Malaysia (3,5%).

More than 80% of forest biomass imports came from the countries of the former Soviet Union: Belarus (66,4%), Ukraine (7,6%), Lithuania (4,3%). A significant amount, of mainly wood pellets, was imported from Germany (6,6%) and Slovakia (3,5%). Since 2011, wood biomass has also been imported from Liberia (tab. 3).

**Tab. 1.** Biomass imports to Poland for energy purposes by import duty codes in the years 2008–2014

Biomass Type	Quantity in thousands of Mg								Price in PLN/Mg							
	2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014		
Cereal straw and husks, unprepared, not chopped, ground, pressed or in the form of pellets (Cn 121300)	23	20	36	27	65	34	26	113	241	252	293	360	390	427		
Husks of sunflower, hazelnut, etc.(Cn 140490)	7	145	237	359	584	833	1 180	1 190	400	382	413	473	368	324		
Bran, ground grain and other residues from the sifting, milling or other processing of wheat, including granulates or pellets (Cn 230630)	170	455	558	724	1 135	402	487	523	380	433	496	556	807	713		
Oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils of palm nuts or kernels (Cn 230660)	1	1	54	38	186	543	630	523	227	250	398	425	417	403		
Oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils, (Cn 230690)	1	1	75	257	306	39	21	777	914	259	350	399	414	420		
Total agro biomass	202	622	960	1 405	2 276	1 851	2 344									
Firewood, in logs, billets, twigs, fagots or in similar forms (Cn 440110)	2	11	26	23	17	41	65	169	144	113	198	187	194	174		
Wood in chips or particles, coniferous (Cn 440121)	36	40	114	157	467	453	657	173	93	123	174	160	176	168		
Wood in chips or particles, deciduous (Cn 440122)	42	41	44	130	260	250	316	125	128	133	167	165	166	155		
Sawdust and wood waste and scrap, whether or not agglomerated in logs, briquettes, pellets or similar forms (Cn 440130, 440131, 440139)	181	179	179	310	430	241	209	231	309	325	430	455	381	329		
Total forest biomass	261	271	363	620	1 174	985	1 247									
Total biomass	463	893	1 323	2 025	3 450	2 836	3 591									

Source: Own study on the basis of Foreign Trade GUS Database

**Tab. 2.** Exports from Poland and balance of trade biomass for energy purposes by import duty codes in the years 2008–2014

Biomass Type	Quantity in thousands of Mg												Price in PLN/Mg				
	2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014			
Cereal straw and husks, unprepared, not chopped, ground, pressed or in the form of pellets (Cn 121300)	2	10	1	7	15	15	27	-21	-10	-35	-20	-50	-19	1			
Husks of sunflower, hazelnut, etc.(Cn 140490)	4	6	6	1	2	3	3	-3	-139	-231	-358	-582	-830	-1177			
Bran, ground grain and other residues from the sifting, milling or other processing of wheat, including granulates or pellets (Cn 230230)	2	5	4	5	17	46	29	-168	-450	-554	-719	-1118	-356	-458			
Oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils of palm nuts or kernels (Cn 230660)	-	-	3	-	-	0	2	-1	-1	-51	-38	-186	-543	-628			
Oil-cake and other solid residues, including ground state or in the form of pellets, resulting from the extraction of vegetable fats or oils, (Cn 230690)	-	0	0	0	3	0	0	-1	-1	-75	-257	-303	-39	-21			
Total agro biomass	8	21	14	13	37	64	61	-194	-601	-946	-1 392	-2 239	-1 787	-2 283			
Firewood, in logs, billets, twigs, fagots or in similar forms (Cn 440110)	49	86	108	73	83	171	166	47	75	82	50	66	130	101			
Wood in chips or particles, coniferous (Cn 440121)	46	45	53	35	9	34	74	10	-5	-61	-122	-458	-419	-583			
Wood in chips or particles, deciduous (Cn 440122)	13	11	11	8	5	23	38	-29	-30	-33	-122	-255	-227	-278			
Sawdust and wood waste and scrap, whether or not agglomerated in logs, briquettes, pellets or similar forms (Cn 440130, 440131, 440139)	343	363	388	346	266	593	719	162	184	209	36	-164	352	510			
Total forest biomass	451	505	560	462	363	821	997	180	224	197	-158	-811	-164	-250			
Total biomass	459	526	574	475	400	885	1 058	-4	-377	-749	-1 550	-3050	-1 951	-2 533			

Source: Own study on the basis of Foreign Trade GUS Database

**Tab. 3.** Agro Biomass imports to Poland for energy purposes by import duty codes and countries

Country	2008		2009		2010		2011		2012		2013		2014	
	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%
Ukraine	155	76,7	524	84,3	706	73,6	901	64,1	1429	62,8	1 092	59,0	1 513	64,5
Indonesia	1	0,5	0	0,0	34	3,5	23	1,6	130	5,7	441	23,8	511	21,8
Russia	1	0,5	2	0,3	18	1,9	83	5,9	185	8,1	80	4,3	115	4,9
Malaysia	0	0,0	0	0,0	20	2,1	1	0,1	1	0,1	52	2,8	81	3,5
Spain	0	0,0	0	0,0	66	6,9	176	12,5	146	6,4	30	1,6	20	0,9
Other	45	22,3	96	15,4	116	12,0	221	15,7	385	16,9	156	8,5	104	4,4
Total	202	100,0	622	100,0	960	100,0	1 405	100,0	2 276	100,0	1 851	100,0	2 344	100,0

Source: Own study on the basis of Foreign Trade GUS Database

<sup>a</sup>in thousands

**Tab. 4.** Forest Biomass imports to Poland for energy purposes by import duty codes and countries

Country	2008		2009		2010		2011		2012		2013		2014	
	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%	Mg <sup>a</sup>	%
Belarus	55	21,1	38	14,0	73	20,1	165	26,6	447	38,2	554	56,2	828	66,4
Ukraine	68	26,0	83	30,6	114	31,4	223	36,0	255	21,7	164	16,6	95	7,6
Lithuania	8	3,1	22	8,1	60	16,5	66	10,6	93	7,9	79	8,0	54	4,3
Germany	66	25,3	51	18,8	44	12,1	64	10,3	132	11,2	74	7,5	82	6,6
Slovakia	51	19,5	54	19,9	44	12,1	24	3,9	29	2,5	33	3,5	44	3,5
Other	13	5,0	23	8,6	28	7,8	78	12,6	218	18,5	81	8,2	144	11,6
Total	261	100,0	271	100,0	363	100,0	620	100,0	1 174	100,0	985	100,0	1 247	100,0

Source: Own study on the basis of Foreign Trade GUS Database

<sup>a</sup>in thousands

## Conclusions

About 50 per cent of the Polish electricity from renewable energies is produced from biomass and almost a third comes from co-incinerating biomass in coal-fired power plants. As a result of the booming co-incineration in Poland, prices for energetically used biomass have almost doubled since 2006. This demand has led to an increasing import of biomass, for instance husks of sunflower from Ukraine, wood from Belarus or oil-cake from Indonesia and Malaysia. The support schemes currently in force do not differentiate the place of origin of the biomass, whether it is produced locally or comes from overseas. There are serious doubts as to whether giving support to coconut-shell co-firing serves economic and environmental purposes.

Despite a number of voices raised at the European Union level, the import of biomass from remote regions of the world is completely unjustified, administrative restrictions on biomass imports to the EU cannot only be contrary to WTO rules, but also contribute to a significant increase in its prices in the Member States and more competition in relation to food production. However, one can expect that in a few years there will be restrictions introduced on the transportation of biomass over long distances due to the CO<sub>2</sub> emissions in transport. Therefore, long-term investment strategies should not be built on the sourcing of biomass originating in remote places.

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