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## **BIOMASS AS THE PRIMARY RAW MATERIAL OF BIOECONOMY IN THE EUROPEAN UNION**

### **Introduction**

Today the concept of bioeconomy encompasses a wide range of established and emerging policy areas at global, European, national and regional levels, which share and adhere to its objectives, yet result in a complex and sometimes fragmented policy environment. This is due to the fact that unsustainable exploitation of natural resources, potentially irreversible changes in the global climate and the lack of ability to stop the loss of biodiversity form a serious threat to the welfare and growth of the society today and tomorrow. These complex and inter-connected challenges will need to be addressed by integrated and effective policies combined by extended research and innovation in order to facilitate sustained changes in lifestyle and resource use across all levels of the economy. One of the core concepts addressing these challenges is the bioeconomy.

In the “Bioeconomy for Europe<sup>1</sup>” strategy of the European Union it is stated, that in order to cope with an increasing global population, rapid depletion of many resources, increasing environmental pressures and climate change, Europe needs to radically change its approach to production, consumption, processing, storage, recycling and disposal of biological resources. The “Europe 2020 Strategy<sup>2</sup>” calls for

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<sup>1</sup> *European Commission: Innovating for Sustainable Growth: A Bioeconomy for Europe*, COM(2012) 60 final, 2012

<sup>2</sup> *European Commission: Europe 2020. A strategy for smart, sustainable and inclusive growth. Communication from the Commission*, COM (2010) 2020 final, 2010.

a bioeconomy as a key element for smart and green growth in Europe. It is expected that the advancements in bioeconomy will allow Europe to improve the management of its renewable biological resources and to open new and diversified markets in food and bio-based products as well as maintain and create economic growth and jobs in rural, coastal and industrial areas, reduce fossil fuel dependence and improve the economic and environmental sustainability of both primary production and processing industries.

From the conceptual point of view, the bioeconomy is widely recognized as a concept, which core function is the use of natural resources by applying a cross sectoral and innovative approach, with a basis in circular economy. In the circular economy the material flows are of two types: biological nutrients, designed to reenter the biosphere safely; and technical nutrients, which are designed to circulate at high quality without entering the biosphere<sup>3</sup>. It encompasses more than the production and consumption of goods and services, including a shift from non-renewable resources to renewable and from fossil fuels to the use of renewable energy, and the role of diversity as a characteristic of resilient and productive systems<sup>4</sup>. Several authors [i.e. Takács and Takács-György<sup>5</sup>, Pfau et al.<sup>6</sup>, Maciejczak and Hofreiter<sup>7</sup>] point out that wider application of circularity and use of renewable resources is a basic contribution of bioeconomy to development based on sustainable principles. In this context, bioeconomy is perceived as a concept that could contribute to a more sustainable growth in various ways, achieving a positive environmental and social impact, while ensuring economic growth through innovative products and the preservation of traditional sectors, such as food production. As such bioeconomy is perceived very

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<sup>3</sup> European Commission: Towards a Circular Economy. A Zero-Waste Program for Europe. Com (398), 2014.

<sup>4</sup> *World Economic Forum: Towards the Circular Economy: Accelerating the scale-up across global supply chains*, Geneva, 2014, pp. 2-11.

<sup>5</sup> I. Takács, K. Takács-György, *Arguments for the optimisation of using biomass for energy production*, „Applied Studies in Agribusiness and Commerce”, Volume 07, Number 2-3, 2013, pp. 45-51

<sup>6</sup> S. F. Pfau, J. E. Hagens, B. Dankbaar, A. J. M. Smits, *Visions of Sustainability in Bioeconomy Research*, Sustainability 2014, 6, p. 1222-1249.

<sup>7</sup> M. Maciejczak, K. Hofreiter, *How to define bioeconomy?* „Annals of Polish Association of Agricultural Economists and Agribusiness”, vol. XIV, issue 6, 2013.

holistically in a wide systemic approach. As argued by Maciejczak<sup>8</sup>, bioeconomy brings together processes that have thus far been disparate: business and sustainability, ecosystem services and industrial applications, innovations and technologies, biomass and products, all for mainstream economies in order to meet growing consumers' expectations. It actively establishes links between industries, both old, that for a long time form a chain of added values, and new, that previously had no connections, within a new, symbiotic relationship where one industry utilizes the by-products of another. Thus it forms a new network oriented platform. The bioeconomy creates a new dimension within existing elements of the socio-economic system, in which on the large scale progress in various forms, especially biological and technical, is created, and when product and process innovations are successfully introduced.

However the bioeconomy is not only considered as a remedy for all sustainability problems. Over the last decades, many policies at both European and national levels, have been put in place or revised to tackle these challenges and drive the transformation of the European economy. As pointed out by the European Commission the complex inter-dependencies that exist between challenges can lead to trade-offs, such as the controversy about competing uses of biomass. The latter arose from concerns about the potential impact on food security of the growing demand for renewable biological resources driven by other sectors, the use of scarce natural resources and the environment. Nonetheless, and incontrovertibly, the bioeconomy provides a useful basis for such an approach, as it encompasses the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy. Its sectors and industries have strong innovation potential due to their use of a wide range of sciences, enabling and industrial technologies, along with local and tacit knowledge.

As Maciejczak<sup>9</sup> argued, having in mind the common definition of bioeconomy, stating that it is the knowledge-based production and use of biological resources to provide products, processes and services in all economic sectors within

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<sup>8</sup> M. Maciejczak, *How to analyze bioeconomy?*, „Annals of Polish Association of Agricultural Economists and Agribusiness”, vol. XVI, issue 6, 2015a.

<sup>9</sup> M. Maciejczak, *What are production determinants of bioeconomy?*, „Problems of World Agriculture”, vol. XV, issue 4, 2015b.

the frame of a sustainable economic system, it also needs to be stated that the sources of biomass are the primary production determinants of bioeconomy. The biological resources exclusively are acting as substitutes for other (fossil) resources. Additionally, Allen et al. suggest that with regard to biomass utilization, the governments in many countries are beginning to realize a shift in the main focus from bioenergy, which generally has been the primary market for biomass outside the conventional agricultural and forest sectors, to the broader bio-economy and higher value-added applications. In the future wastes would be a significant source of biomass. The focus on waste resources as a core component of the bioeconomy remains underdeveloped in many countries, but the importance of waste in providing value-added resource streams is increasing<sup>10</sup>. As noted by Scarlat et al., it is necessary however to ensure that these expected increases in biomass use take place within a sustainable framework and biomass sustainability is thus a key issue<sup>11</sup>.

### **Objectives, Data and Method**

The paper aims to present the state of the art of biomass utilization in the bioeconomy sectors in the European Union, with the prerequisites of the heterodox economics and describe them on the example of the Member States of the European Union. The presented researches are based on the heterodox assumptions of deductive and descriptive reasoning, with the secondary data coming from the Bioeconomy Observatory of the European Commission, using the data management tool DataM2, which is capturing statistics related to bioeconomy<sup>12</sup>. In order to present a comprehensive picture of the situation in the analyzed region, the time frame was limited to the years 2011-2013. It is worthwhile however to mention after the European Commission's Joint Research Centre staff that documenting the bioeconomy is a challenge for science as official statistics only report on traditional sectors with no distinction between synthetic and bio-based production (e.g.

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<sup>10</sup> B. Allen, S. Nanni, J-P. Schweitzer, D. Baldock, E. Watkins, S. Withana, C. Bowyer, International review of Bio-economy Strategies with a Focus on Waste Resources. Report prepared for the UK Government Department for Business, Innovation and Skills. Institute for European Environmental Policy, London, 2015, pp. 4-12.

<sup>11</sup> N. Scarlat, J-F. Dallemand, F. Monforti-Ferrario, V. Nita, *The role of biomass and bioenergy in a future bioeconomy: Policies and facts*, „Environmental Development” 15(2015), 2015, pp. 3–34

<sup>12</sup> European Commission: *DataM - Biomass estimates, database*. [www.datamweb.com](http://www.datamweb.com), data accessed on 21/12/2015.

manufacture of synthetic textile vs. bio-based textile)<sup>13</sup>. Therefore, indicators for the bioeconomy shall be estimated using a combination of multiple sources.

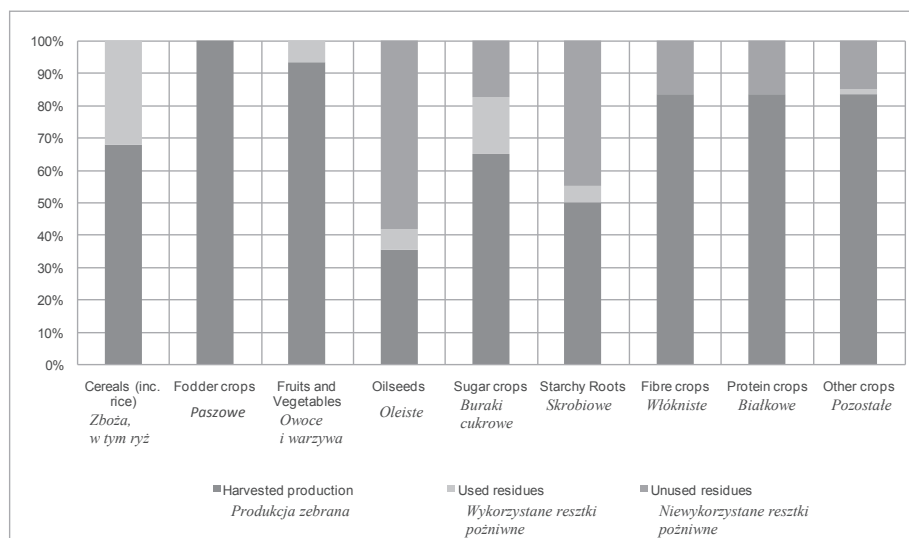
## Results and discussion

The basic bioeconomy's production determinants are sources of biomass. And the biomass could be defined as organic, non-fossil material of biological origin that can be used as biogenic feedstock in food supply, other products, and for generating energy in the form of heat or electricity. The sources of biomass are crops (excluding fodder crops): cereals, nuts, vegetables, fruits, fibres, etc.), crop residues (fodder crops and grazed biomass), animals (fishing, hunting, cultivated land/aquatic animals, animal products, etc.), wood as well as wastes (household, industrial, communal, etc.).

The largest supplier of biomass is agriculture. In figure 1 are presented shares of harvested biomass and residues for selected types of agricultural crops in the 28 Member States of the European Union. The described situation shows not only how much biomass Europeans can capture from crop production, but indicates also large potential of additional biomass supply from unused residues. In relation to over 60 billion tonnes of harvested dry matter in 2013, about one third of this capacity (ca. 20 billion tonnes) were residues that remain unused and non-harvested. As shown in the figure 1 the largest potential is in oilseed, starch roots, fiber and protein crops.

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<sup>13</sup> T. Ronzon, F. Santini, R. M'Barek, *The Bioeconomy in the European Union in numbers. Facts and figures on biomass, turnover and employment*. European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Spain, 2014, p. 4.



**Figure 1. Shares of harvested biomass and residues for selected types of crops (EU-28, 2013)**  
**Rysunek 1. Udział zebranej biomasy i resztek poźniwnych w poszczególnych grupach roślin (EU 28, 2013)**

*Sources: own elaboration based on original data coming from: DataM - Biomass estimates provided by the European Commission / Joint Research Centre, [www.datamweb.com](http://www.datamweb.com), data accessed on 21/12/2015.*

*Źródło: obliczenia własne na podstawie danych pierwotnych z bazy danych DataM-Szacunki biomasy, udostępnionej przez Komisję Europejską/Instytut Podstaw Technologicznych, [www.datamweb.com](http://www.datamweb.com), odczytane 21.12.2015*

The table 1 presents the capacity of biomass resources in the European Union's Member States. A distinction is made between agricultural resources (both plant and livestock), aquaculture resources (both maritime and inland), wood and waste resources. In 2011 three MS: France, Poland, and United Kingdom produced 38% of agricultural biomass. Accordingly, over 50% of total production of aquaculture biomass was produced by four MS: United Kingdom, Denmark, France, and the Netherlands. Similarly 53% of total production of wood biomass in Europe comes from four countries namely: Sweden, Germany, France, and Finland. The biggest biomass from waste producers in the EU are Romania, Spain, The Netherlands, and Finland, which together account for 75,7% of total biomass production from wastes. The above data show high polarization of resources of biomass production among all 28 Member States.

**Table 1. The production of biomass resources in the European Union's Member States in 2011**  
**Tabela 1 Produkcja biomasy z podstawowych źródeł w Państwach Członkowskich Unii Europejskiej**

Member State / Państwo członkowskie	Resurces of biomass / Źródła biomasy			
	Agriculture [in 1000 t of dry matter of biomass] / Rolnictwo [w 1000 t suchej masy]	Aquaculture [in 1000 t of living weight] / Akwakulturam [w 1000 t żywej masy]	Wood [in 1000 of cubic meters] / Drewno [w 1000 m kubicznych]	Waste [in 1000 t] / Śmieci [w 1000 t]
Austria / Austria	8,5	1,3	18696	179,1
Belgium / Belgia	10	22,3	5128	1120,5
Bulgaria / Bułgaria	12	16,1	6205	903,2
Croatia / Chorwacja	7	87,3	5258	75,1
Cyprus / Cypr	2	5,8	8	150,5
Czech Republic / Czechy	14	2,4	15381	196,1
Denmark / Dania	16	793,4	2583	201,1
Estonia / Estonia	20	78,4	7116	77,1
Finland / Finlandia	6	136,1	50767	3157,9
France / Francja	110	680,5	55041	1616,5
Germany / Niemcy	80	270,6	56142	648,9
Greece / Grecja	7	174,1	1196	9,9
Hungary / Węgry	15	0,1	6232	430,5
Ireland / Irlandia	5	250,5	2635	101,2
Italy / Włochy	19	376,7	7744	310,9
Latvia/ Łotwa	6	156,7	12833	2,8
Lithuania / Litwa	7	140,4	7004	455,9
Luxembourg / Luksemburg	1	0,2	261	1,2
Malta / Malta	1	6,1	1	2,6
Poland / Polska	51	201,7	37180	1952,8
Portugal / Portugalia	3	223,1	10961	83,4
Romania / Rumunia	23	8,9	14359	18352
Slovakia / Słowacja	6	1	9213	549,4
Slovenia / Słowenia	2	2,1	3388	164,8



Spain / Hiszpania	27	241,2	15428	5496,5
Sweden / Szwecja	8	195,6	71900	273,1
The Netherlands / Holandia	8	408,7	982	4946,5
United Kingdom / Anglia	31	793,6	10020	748,4

*Sources: own elaboration based on original data coming from: DataM - Biomass estimates provided by the European Commission / Joint Research Centre, [www.datamweb.com](http://www.datamweb.com), data accessed on 21/12/2015.*

*Źródło: obliczenia własne na podstawie danych pierwotnych z bazy danych DataM-Szacunki biomasy, udostępnionej przez Komisję Europejską/Instytut Podstaw Technologicznych, [www.datamweb.com](http://www.datamweb.com), odczytane 21.12.2015*

As shown on the figure 2 ca. 70% of biomass in the European Union comes from agricultural production, while 24% from wood. Only 1,6% of biomass comes from wastes. The biomass is mainly consumed for food and animal feed purposes, which represents 61% of the whole biomass consumption. Animal feed use alone represents 48,6% of the total use of biomass. The sector of bio-energy consumes 21,7% and the sector of bio-materials does not exceed 18% of the quantity of biomass it consumes. Each of them consumes around 18% of the whole biomass. Within bioenergy, biofuels represents around 2% of the biomass consumed in the European Union. Surprisingly 14% of available biomass is exported in various forms, mainly wood and plant products.

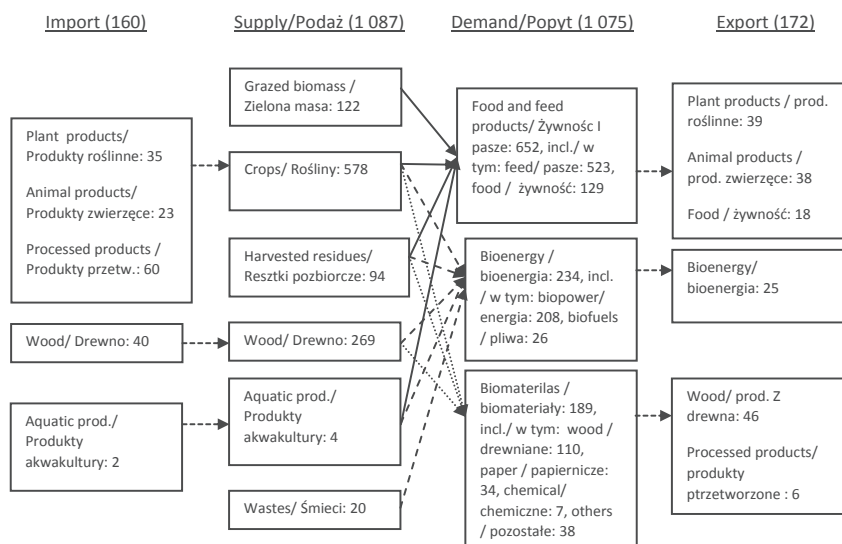


Figure 2. Biomass balance in the European Union (million tonnes of dry matter, EU-28, 2013)

Rysunek 2. Bilans biomasy w Unii Europejskiej (miliony ton suchej masy, EU-28, 2013)

Sources: own elaboration based on original data coming from: DataM - Biomass estimates provided by the European Commission / Joint Research Centre, [www.datamweb.com](http://www.datamweb.com), data accessed on 21/12/2015.

Źródło: obliczenia własne na podstawie danych pierwotnych z bazy danych DataM-Szacunki biomasy, udostępnionej przez Komisję Europejską/Instytut Podstaw Technologicznych, [www.datamweb.com](http://www.datamweb.com), odczytane 21.12.2015.

## Conclusions

The above analysis leads to the following conclusions:

1. The undergoing changes in the development of bioeconomy sector places in the first place that biomass is a basic input for all production processes that lead to satisfying private and public needs.
2. In the European Union the biomass that comes from different, not only agricultural, sources should be considered as a strategic resource, ensuring sustainable growth. However its utilization requires still some developments, especially with regard to non-harvested residues from agricultural and forestry activities, as well as wastes.
3. In the use of biomass as an input, it should be considered, that although this is renewable resource, it might become a scarce good for several industries, once they start to compete for it in order to ensure the supply of the necessary quantity and quality of raw material. Therefore the policy design should incorporate measures that prevent negative trade-offs not only in production, but also in consumption of the biomass.

## Bibliography

1. Allen B., Nanni S., Schweitzer J-P., Baldock D., Watkins E., Withana S. and Bowyer C.: *International review of Bio-economy Strategies with a Focus on Waste Resources. Report prepared for the UK Government Department for Business, Innovation and Skills*. Institute for European Environmental Policy, London, 2015, pp. 4-12.
2. *European Commission: DataM - Biomass estimates, database. www.datamweb.com, data accessed on 21/12/2015.*
3. *European Commission: Europe 2020. A strategy for smart, sustainable and inclusive growth. Communication from the Commission. COM (2010) 2020 final, 2010.*
4. *European Commission: Innovating for Sustainable Growth: A Bioeconomy for Europe. COM(2012) 60 final, 2012.*
5. *European Commission: Towards a Circular Economy. A Zero-Waste Program for Europe. Com (398), 2014.*
6. Maciejczak M., *How to analyze bioeconomy?*, „Annals of Polish Association of Agricultural Economists and Agribusiness”, vol. XVI, issue 6, 2015a.
7. Maciejczak M., Hofreiter K., *How to define bioeconomy?*, „Annals of Polish Association of Agricultural Economists and Agribusiness”, vol. XIV, issue 6, 2013.
8. Maciejczak M., *What are production determinants of bioeconomy?*, „Problems of World Agriculture”, vol. XV, issue 4, 2015b.
9. Pfau S.F., Hagens J.E., Dankbaar B., Smits A.J.M., *Visions of Sustainability in Bioeconomy Research*, „Sustainability 2014”, 6, 2014, p. 1222-1249.
10. Ronzon T., Santini F. and M'Barek, R., *The Bioeconomy in the European Union in numbers. Facts and figures on biomass, turnover and employment*. European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Spain, 2014, p. 4.
11. Scarlet N., Dallemand J-F., Monforti-Ferrario F., Nita V., *The role of biomass and bioenergy in a future bioeconomy: Policies and facts*, „Environmental Development” 15(2015), 2015, pp. 3–34.

12. Takács I., Takács-György K., *Arguments for the optimisation of using biomass for energy production*, „Applied Studies in Agribusiness and Commerce”, Volume 07, Number 2-3, 2013, pp. 45-51.
13. *World Economic Forum: Towards the Circular Economy: Accelerating the scale-up across global supply chains*. Geneva, 2014, pp. 2-11.

## **BIOMASA JAKO PODSTAWOWY SUROWIEC BIOGOSPODARKI W UNII EUROPEJSKIEJ**

### **Summary**

The aim of this study was to investigate the biomass production and utilization in the European Union as a basis of the growing sector of bioeconomy. It is argued that the undergoing changes in the development of bioeconomy sector places on the first place the biomass as a basic input for all production processes that lead to satisfying private and public needs. In the European Union the biomass that comes from different, not only agricultural, sources is considered as a strategic resource ensuring sustainable growth. However, its utilization requires still developments, especially with regard to utilization of non-harvested residues from agricultural and forestry activities, as well as wastes.

**Keywords:** biomass, bioeconomy, European Union

### **Streszczenie**

Celem badań było poznanie kwestii związanych z wytwarzaniem i wykorzystaniem biomasy jako podstawowego surowca sektora biogospodarki w Unii Europejskiej. Stwierdzono, iż postępujące zmiany w obszarze biogospodarki stawiają na pierwszym miejscu biomasę jako podstawowy surowiec wszystkich procesów produkcyjnych, których celem jest zaspokojenie zarówno prywatnych jak i publicznych potrzeb. Na podstawie przeprowadzonych badań wnioskowano, iż w Unii Europejskiej biomasa traktowana jest jako strategiczny surowiec gwarantujący zrównoważoną produkcję i rozwój. Jednak jej wykorzystanie wymaga dalszych dostosowań związanych z włączeniem do obiegu dotychczas nieużytkowanych zasobów powstających jako odpady z produkcji rolniczej i leśnej a także odpadów przemysłowych, komunalnych i z indywidualnych gospodarstw domowych.

**Słowa kluczowe:** biomasa, biogospodarka, Unia Europejska.