The role of bioenergy in Europe

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Abstract. The paper considers the main provisions of the European Union's Renewable Energy Directive, which gave an additional impetus to the further development of bioenergetics in Europe. The distinctive features of national bioenergy policies in some European countries are analyzed. The current state of bioenergy in the EU is considered. Possible scenarios for the development of bioenergy in Europe from 2020 up to 2050 are also presented.

1. EU Bioenergy Policy

The interest in biofuels is caused by the objective necessity of states that do not have sufficient reserves of natural energy resources to maintain their independence from oil exporters. At present, practically in all countries of the world, both developed and developing, bioenergy programs have been adopted. Bioenergy is developing especially rapidly in the European Union; the probability that by 2020 the biomass in the energy balance of Europe will exceed 10% is very high. It is estimated that the global biotechnology market will reach $ 2 trillion in 2025, with growth rates in individual market segments ranging from 5-7 to 30 percent annually.

A set of measures has been developed to stimulate the production of biofuels in different countries - legislative regulation, indicative planning of production volumes, preferential taxation and budgetary support. According to the forecasts of the European Commission, the production of heat and electricity from biomass in the EU by 2020 will increase by 850 TWh compared to 2007. This increase will be about half of all current energy consumption from coal.

In April 2009, the European Union's Renewable Energy Directive [1], which applies to all EU member states. The Directive sets out the following targets for 2020: achieving a 20% share of renewable energy sources (biomass, biofuels, biogas) in the total final energy consumption in the EU; achieving a 10% share of used biofuels in the transport sector; reduction of greenhouse gas emissions when using biofuels by 6%. The ways to achieve these goals are chosen by each country independently. In the case of active government support for the industry, the creation of a favorable investment environment and a system of taxation of production, this indicator may turn out to be even higher. To achieve the set objectives, a significant increase in the share of biofuel consumption is required. Several EU countries have already taken measures to stimulate the use of biofuels, but after the adoption of the Directive, all countries were obliged to develop such measures.

The development of the Directive was motivated by the need to reduce greenhouse gas emissions in response to the EU signing the Kyoto Protocol and to strengthen energy security by reducing dependence on oil imports.

In addition, the Directive gave a significant impetus to the development of the raw material base for the production of biofuels. Since the Directive only takes into account market share and not production volumes, if there is an insufficient supply of biofuels in some of the EU countries it becomes possible to import the missing volumes.

The Directive also addresses issues related to the possible social impact of biofuel production by introducing an appropriate monitoring mechanism, for example, the possible impact on food prices. These criteria apply to biofuels both produced in the EU and imported.

However, the flip side of the coin turned out to be the problem of removing agricultural areas from the "food" turnover, processing of food oil crops for biofuel. EU guarantees high subsidies to farmers who have invested in equipment on processing of agricultural food crops "in place".

In recent years, issues related to the production and use of biofuels have caused more and more controversy, in particular, in connection with their possible impact on prices on food and questionable positive effects on the environment. To address these problems "criteria for compliance with the principles of sustainable development" related, firstly, to greenhouse gas emissions and, secondly, related to land use were included. The greenhouse gas emission reduction criterion establishes the minimum level of emissions of CO_2 or other gases in equivalent when using biofuels, including greenhouse gas emissions from the production, processing and transportation of fuels, as well as emissions associated with changes in land use structure.

At the end of 2012, the EU adopted a Directive limiting the share of first generation biofuels (from 10 to 5% by 2020) and encouraging the development of second generation biofuels [2]. After 2020, only such biofuels will receive EU funding that contribute to greenhouse gases emission reduction (they must emit at least 35% less greenhouse gases than fossil fuels) and produced from non-food plants and biomass. This Directive aims to prevent direct use of forests, wetlands and high value areas for biofuel production.

The second criterion refers to the land used for the production of biofuel feedstocks. Certain types of land cannot be used to grow plants for biofuel production. These lands are especially protected areas, meadows with high levels of biodiversity, or lands with high carbon reserves. World experts unequivocally advocate the use of second generation biomass as feedstock.

A separate place is occupied by environmental problems: the destruction of forests for cultivation of fast-growing energy plants and pollution of the atmosphere with exhaust gases as a result of the combustion of biofuel.

2. Regulation and control of biomass and biofuel production at the national level in the EU

At the moment, the receipt of subsidies is the main lever of influence on producers of biomass and biofuel: if the producers fail to comply with the requirements of the approved regulations, they are deprived of the right to subsidize their costs. EU member states are required to submit to the European Commission every six months reports on the impact of biofuel production on biodiversity, water and soil quality, greenhouse gas reductions, as well as energy prices and changes in land areas used for woody biomass production. National and regional standards (initiatives) differ significantly in terms of structure, concepts used, sustainability criteria, monitoring methodology, reporting requirements, etc.

Germany. In 2006, the German Council of Ministers launched a project aimed at defining basic sustainability criteria for biofuel production. As a result, by 2007, the Biomass Sustainability Regulation (BSR) was developed, which were abolished with the introduction of the pan-European Renewable Energy Directive. However, Germany was the first EU state to bring its legal framework in line with the requirements of the Directive, which was advisory at the time. Germany also supported the development of the ISCC (International Sustainability and Carbon Certification), an international certification scheme for the sustainability and carbon footprint of biofuels, which was first recognized and adopted at the national level in 2010 to fulfill the requirements of the Renewable Energy Directive. In 2011, another certification scheme was adopted in Germany - REDcert. Since 2015, Germany has moved from quoting biofuel production in volumetric units to quoting in conventional

units of carbon dioxide emissions, which has significantly increased the importance of greenhouse gas balance for biofuels.

Belgium. The Belgian government included sustainability criteria in a regional program to support electricity generation from renewable sources in 2006. In the Flemish region, biomass, a by-product of production, was not subject to certification as green energy - for example, wood waste with potential for use in board or pulp and paper production. Energy used for the transportation and primary processing of biomass was also not excluded from the amount of energy subject to certification as "green energy". In the Brussels and Walloon regions, the reduction in greenhouse gas emissions from biofuels was compared to the best natural gas power plant in the region, and only the difference between these indicators was subject to certification as "green" energy. Moreover, all calculations must be verified during an independent audit.

Great Britain. Since April 2008, under the UK Renewable Transport Fuel Obligation, the Renewable Fuels Agency has introduced biofuel types and source reporting requirements for fuel suppliers to ensure that biomass energy production meets current environmental and social sustainability requirements. The reporting should also include the volumes of reduced greenhouse gas emissions when using these types of biofuels. Failure to comply with these requirements did not provide for any punitive measures other than public criticism, which was of importance for commercial companies with public records. In 2011, a similar procedure was applied for electricity from renewable sources. Since 2011, the requirements for reporting compliance with the sustainability criteria outlined in the Renewable Energy Directive are being phased in.

Netherlands. In the Netherlands, a sustainability analysis was carried out for all forms of biomass production and consumption. In 2007, the Government Commission on the Environment published a list of sustainability principles for biomass use for bioenergy (for solid, liquid and gaseous fuels). These criteria are partly covered by the current Renewable Energy Directive. The Dutch Normalization Institute has developed the NTA 8080 and NTA 8081 standards for sustainable biomass production for bioenergy. This is a voluntary scheme recently recognized by the European Commission and used by commercial companies to demonstrate that the biomass they produce is sustainable. In October 2012 in the Netherlands, energy biomass consumers signed a Green Deal, where they pledged to submit annual reports to the government on the amount of biomass used and how to verify or certify the sustainability of its production.

3. Development of the European biogas market

By the end of 2017, there were 17,783 biogas plants in the European Union. There was a steady growth in the number of such installations from year to year. The dynamics of growth in the number of biogas plants in recent years is shown in Figure 1.

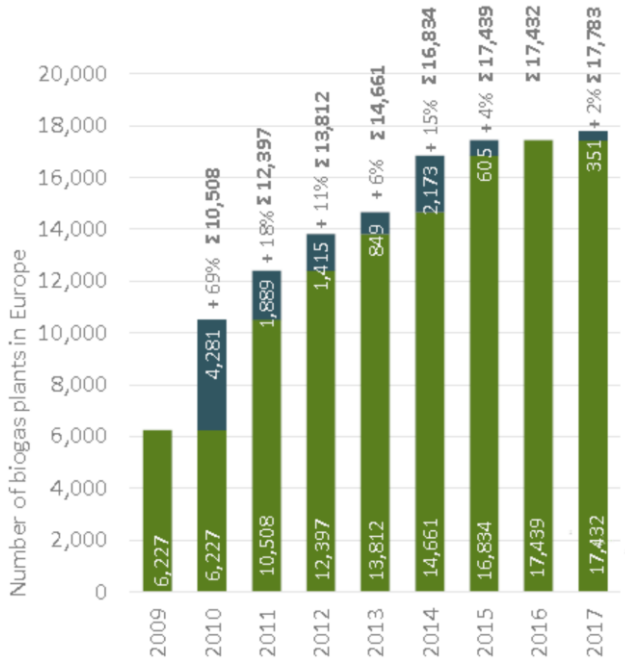

Figure 1. Development of the number of biogas plants in Europe [3]

Germany has been the leader in biogas production and the number of biogas plants in recent years. Figure 2 shows the number of biogas plants in operation. Figure 2 shows that Italy and France follow Germany.

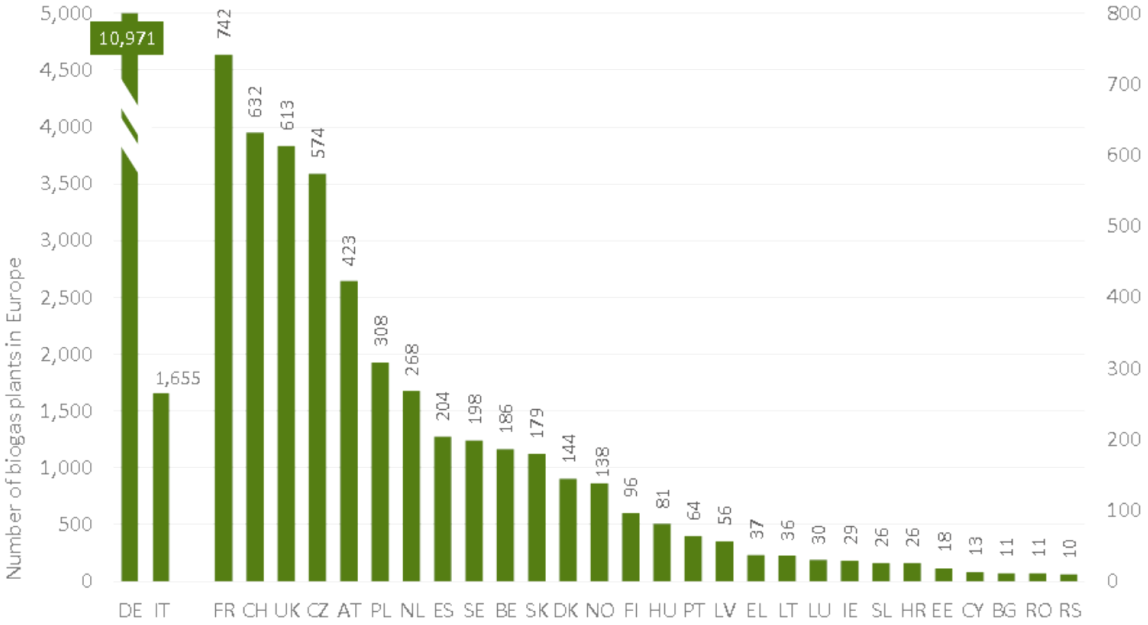

Figure 2. Number of biogas plants in European countries, arranged in descending order [3]

Figure 3 shows the number of biogas plants in relation to the population of each country. Germany is still the leader. Although in this case it is followed by Switzerland and the Czech Republic.

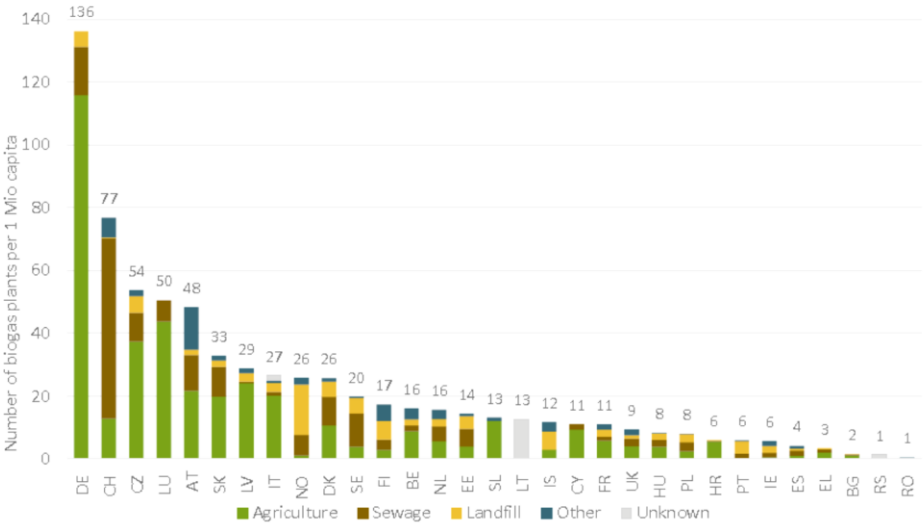

Figure 3. Number of biogas plants (total and by feedstock type) per 1 Mio capita in European countries in 2017, arranged in descending order [3]

4. EU Energy roadmap to 2050

In 2011 the European Commission adopted the communication "Energy Roadmap 2050" (European Commission, 2011). Within this Roadmap, scenarios of the European energy supply, illustrating the challenges related to the EU's long-term decarbonisation objective (reducing greenhouse gas emissions to 80-95% below 1990 levels by 2050) are presented. The following figures give an idea of the development of bioenergy according to different Roadmap scenarios. Figure 4 shows that according to the most optimistic scenario, the share of biomass for energy purposes will increase by 28% from 2020 to 2050.

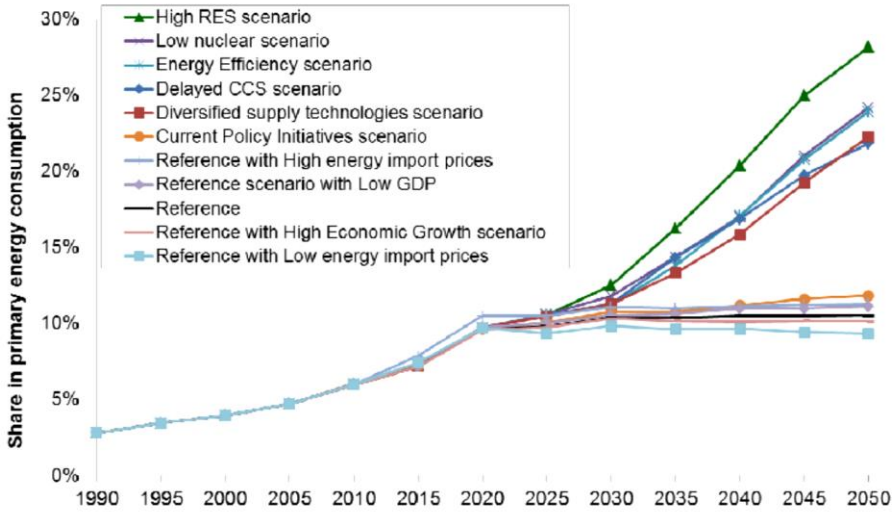

Figure 4. Development of the biomass share in the total primary energy consumption in the EU according to the Roadmap scenarios [5], [6], [7]

The share of biomass in electricity generation will increase in all scenarios (Figure 5). Heat-only production remains relatively constant in most scenarios. At the same time, the use of biofuels for transport varies widely depending on the scenario.

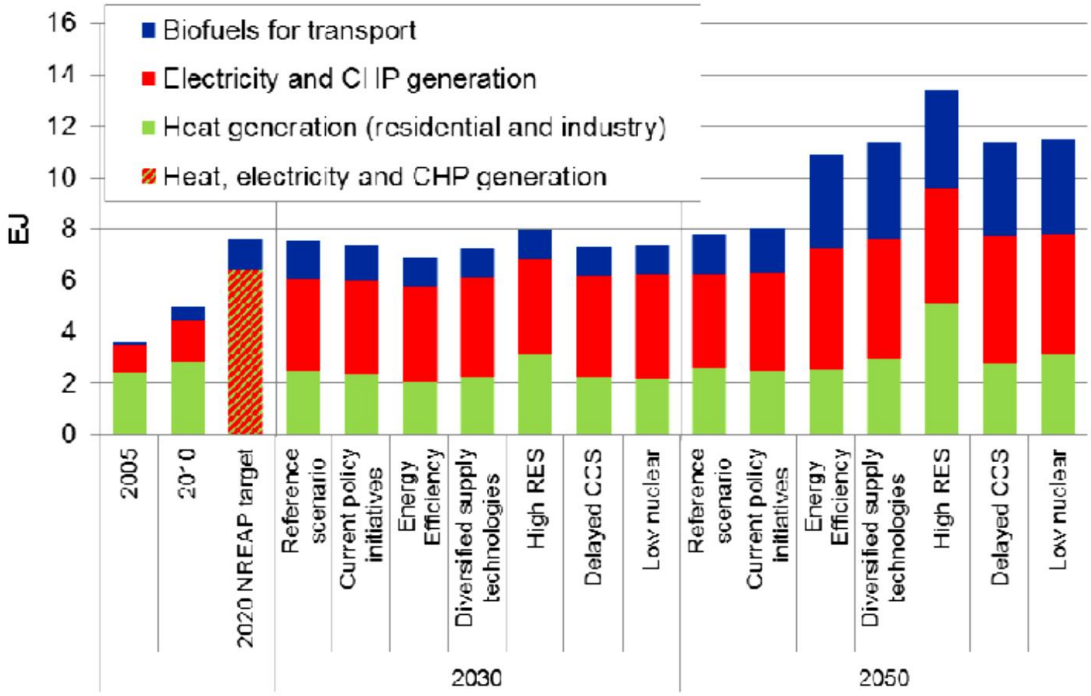

Figure 5. Biomass primary energy consumption for heat, electricity/CHP and biofuels according to the Roadmap scenarios [5], [6], [7], [8]

Conclusions

Currently, the role of bioenergy has increased significantly in various fields. The European Union is a leader in the field of bioenergy. A holistic energy policy has been developed in the European Union, which significantly stimulates the development of bioenergy. Germany is a leader among European countries in the development of bioenergy and related technologies. At the same time, along with the obvious advantages that the development of bioenergy in Europe gives, there are also certain problems. Thus, the use of biomass for biofuel production can lead to higher food prices, deforestation, and the use of valuable land for the cultivation of energy crops. So, after 2020, only such biofuels will receive EU funding that contribute to greenhouse gases emission reduction (they must emit at least 35% less greenhouse gases than fossil fuels) and produced from non-food plants and biomass. The Directive 2012/27/EC aims to prevent direct use of forests, wetlands and high value areas for biofuel production. Certain types of land cannot be used to grow plants for biofuel production. These lands are especially protected areas, meadows with high levels of biodiversity, or lands with high carbon reserves.

References

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