Renewable energy in the European Union: support policy and outcomes

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The article deals with the study of support schemes for renewable energy promotion in the European Union member states. The main strategic documents that declare short-term and long-term goals to increase the share of green energy in final energy consumption of the European Union are considered. The primary motivational mechanisms aimed at encouraging the production of energy from renewable energy sources, namely feed-in tariff models, feed-in premium model, and tradable green certificate scheme are analyzed. In addition, a number of secondary motivational tools such as tender systems, net metering, tax and customs privileges which are used in combination with the primary mechanisms for more effective promotion of renewable energy are described. The results of the influence of policy in renewable energy field on increasing the share of green energy in the total energy mixes of European Union member states are presented.

Key words: renewable energy; motivational mechanisms; support schemes; the European Union; policy.

Introduction

At present, energy is one of the most valuable resources for human life, and global demand for it is increasing in geometric progression. So, according to International Energy Agency forecasts, global demand for energy will increase up to 56% by 2040 [i]. Such forecasts are challenges for a number of countries, including member states of the European Union (EU), and create conditions to find new ways in order to meet growing demand.

Today one of the criteria for meeting the energy demand in the EU is the consideration of sustainable development values, which is possible, first of all, through renewable energy (RE) development. That is because renewable energy sources (RES) are inexhaustible and energy production on their basis is not accompanied by greenhouse gases emission that has significant positive impact on inhibiting processes of global warming and climate change. However, despite the obvious advantages of RES, RE plants deployment requires significant financial resources, and, therefore, cannot take place without governments support [ii].

Thus, today the main driver of RE development is the

introduction of effective economic support schemes, the world leaders in the use of which are the EU member states.

The goal of article

is to study motivational mechanisms aimed at promoting RE in the EU and their impact on RE plants deployment.

Theoretical foundations

The study of the EU policy in RE field is covered by a number of scientific researches. Thus, R. Haas, C. Panzer, G. Resch, M. Ragwitz, G. Reece, and A. Held [iii] have analyzed the historical aspect of forming support schemes to stimulate RE development in the EU; Z. Abdmouleh and R. Alammari [iv] have examined examples of successful and unsuccessful practices in the use of various motivational mechanisms in different countries of the EU; E. Dogan and F. Seker have studied the impact of RE development on reducing greenhouse gases emission [v]. Of particular interest are publications of C. Gagnon [vi], M. Ramli, and S. Twaha [vii], which are devoted to considering different designs of feed-in tariffs; M. Hustveit, J. Sveen, and F. Fleten

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[viii], K. Linnerud and M. Simonsen [ix], which are focused on considering theoretical and applied aspects of the tradable green certificate scheme; P. Rio and P. Mir-Artigues [x], which are devoted to analyzing the combination of several economic mechanisms for more effective promotion of RE development.

However, there are no studies regarding the various support schemes for RE development with an emphasis on analyzing their impact on increasing the share of RES in the total energy mixes of the EU member states. Therefore, it is this study that focuses on the study of this issue.

Results

The vector for RE development in the EU is declared in Directive 2009/28/EC [xi], according to which the share of RES in the total energy mix of the EU by 2020 should be at least 20%. The longer-term strategy for RE development is outlined in the "Energy Road Map 2050" [xii] according to which the share of RES in the final energy consumption of the EU by 2050 should be 49%. These targets were distributed among all the EU member states and were indicated in their National RE action plans.

The EU member states were given the opportunity to independently choose types of economic mechanisms to achieve the projected share of RES in the total energy mixes. As a result, today the countries of the EU use various motivational tools to encourage production and consumption of energy from RES [xiii].

First of all let us consider the primary motivational tools in more detail.

All range of motivational tools can be divided into two conditional categories:

- primary motivational tools that include feed-in tariff models, feed-in premium model, and tradable green certificate scheme;
- secondary motivational tools that include tender or bidding systems, net metering, tax and customs privileges.

I. Primary motivational tools:

1. Feed-in tariff models refer to special increased tariffs at which energy, produced by RE plants, is purchased. The basis of feed-in tariff models are a long-term contract to purchase green energy produced during a certain period that guarantees the return of initial investment and getting a profit by the investors.

There are some varieties of feed-in tariff models [vi, vii], namely:

- Fixed feed-in tariff is a tariff that does not change during the contract's term, does not depend on the retail price for conventional energy, inflation, etc., thereby creating stable conditions for investors;
- Front-end loaded feed-in tariff is a tariff within which higher payments are offered in the first years of the investment project implementation, after that the payments are reduced. Such a design of the tariff policy allows to get more financial resources to producers at the time when it is necessary to pay for the loans that were taken for RE plant construction and to maintain reliable sources of revenue after that the initial investment were fully or substantially returned.
- Adjusting feed-in tariff is an unfixed tariff that

allows to taken into account the inflation (fully or partially). It, on the one hand, provides a high level of payments for producers at the end of the contract that enables to avoid reducing the revenue from the project implementation. On the other hand, it creates an additional burden on the countries' budgets.

2. Feed-in premium model implies a guaranteed premium that is paid in the form of an additional payment to the market price of conventional energy. The premium that is paid to producers of green energy varies depending on the level of the market price for conventional energy. Thus, producers receive the higher premium if a market price for conventional energy is reducing and the lower one if a market price for conventional energy is increasing. For owners of RE plants that work under the feed-in premium model, the price for the unit of produced energy is less predictable in comparison with those who work under the feed-in tariff models [xiv].

3. Tradable green certificate scheme. It is a market mechanism for renewable energy promotion based on the establishment of a mandatory quota for production/consumption of energy from RES and implementation of green certificates to reimburse the cost of such energy.

The obligation to produce/consume energy from RES can be imposed on any energy market participant: producers, consumers or energy supply companies. Thus, on the supply side, a mandatory quota is being implemented in Italy, where the obligation is imposed on energy producers, but it is more widely used on the demand side, in particular, in Romania, the obligation is imposed on energy supply companies, in Sweden and Denmark on final energy consumers [xv].

In the tradable green certificate scheme producers of green energy have two sources of income. Firstly, they sell the produced energy from RES on the wholesale energy market at the market price of conventional energy. Secondly, they sell green certificates on a specialized market (national, regional or state depending on the design country's energy market).

The green certificates are given to the producers of energy from RES in exchange for the produced amount of energy. It proves that a certain amount of energy has been produced, and when green certificates are bought by obligated entities – it proves that a certain amount of energy has been consumed. If the obligated entities cannot fulfill the obligation in full, they are required to pay penalties.

The green certificate price directly depends on the average market price for conventional energy and cost for energy production from RES.

Special attention is paid to state's interference degree in the process of the green certificates price regulation. Today there are two main approaches based on experience of other countries.

- market self-regulation of prices under conditions of competition based on supply and demand for energy from RES. In this case the tradable green certificate scheme aims to achieve the set goal (desired amount of green energy) at any price [xvi]. Under given condition the tradable green certificate scheme functions with price risks, because during deficit/surplus of the green certificates on the market their price can reach economically unjustified level;

– state regulation by setting the minimum and maximum price cap for green certificate. The minimum price of green certificate is established in order to protect producers from low price for energy, which will cause the situation when investments for RE plants construction will not be returned. The maximum price of green certificate is to protect energy consumers from high price for energy. In this case the green certificate price can fluctuate only within the minimum and maximum thresholds [xvii].

The main benefits of the tradable green certificate scheme are promotion of competition among energy producers and shift the cost for green energy production to final consumers.

The disadvantage of the tradable green certificate scheme is its extension mostly on the cheapest RE technologies, the production of energy on the basis of which can bring significant profits to producers. It does not stimulate the development of less developed RE technologies.

The above mechanisms are the main drivers for RE growth in the EU. However, it should be noted that for a more effective stimulating effect, most the EU member states simultaneously use a number of secondary motivational tools. Therefore, let us consider peculiarities of their application in more detail.

II. Secondary motivational tools:

1. Tender or bidding systems. Tender or bidding systems are based on auctioning mechanism, which is conducted for a construction certain RE plant or production of certain amount of energy from RES. Following the results of the tender, the winner is the one who offers either the lowest price for the RE plant construction or the lowest price for the unit of energy produced from RES for a certain period.

Tender or bidding systems are cost-effective in terms of

competition development among investors. As the investor, who offers a lower price, wins the tender, the total cost for society is reduced.

However, tender or bidding systems often have significant problems in practice, as at the time of bidding, investors offer low rates in order to win, which in the future do not allow them to cover investment cost and obtain economically justified profits. As a result, some investors abandon their projects after winning the tender [x].

2. Net metering is a motivational mechanism that extends, first of all, to owners of private households that possess small RE plants. The mechanism provides an opportunity for such owners to supply unconsumed surplus of electricity from RES to the general electric grid. Therefore, if the consumer produces more electricity than consumes per month, the energy supply company must to buy the rest of such electricity. Thus, at the end of the billing period, the consumer pays only for the difference between the consumed and supplied electricity to the electric grid [xviii].

3. Tax and customs privileges. The most widespread tax and customs privileges include full or partial exemption from payment of income tax, payment of the value added tax during the buying of equipment, components that are used for energy production from RES, the payment of customs duties on imports of materials, equipment and components used for green energy production [x].

The introduction of the aforementioned motivational tools has become a significant impetus for the deployment of RE generating capacity in the EU. Thus, as of the end of 2017 the share of RES in the final energy consumption of the EU was 17.5%, and countries such as Sweden, Finland, Denmark, Estonia, Lithuania, Croatia, Italy, Bulgaria, the Czech Republic, and Hungary have already reached the indicative targets set by Directive 2009/28/EC until 2020 (Fig. 1).

Fig. 1 – Predictable share of energy from RES in final energy consumption in the EU member states by 2020 and their share in the national energy mixes as of the end of 2017 [xix]

With 54.5% of energy from RES in final energy consumption, Sweden had a leading position among EU

member states as of the end of 2017. The second and third positions were taken by Finland – 41% and Latvia – 39%. At the same time, the lowest shares of energy from RES were registered in Luxembourg – 6.4%, the Netherlands – 6.6%, and Malta – 7.2%.

It should be noted that market of electricity from RES is the most developed in the EU. By the end of 2017, 30.7% of

electricity in the EU was generated from RES. The largest amount of green electricity was provided by three RE technologies, among which are wind energy, hydropower and solar energy. Austria, Sweden and Denmark were the leaders in green electricity generation as of the end of 2017. The share of green electricity in the national electric mixes of these countries exceeded 60% (Fig. 2).

Fig. 2 – Share of electricity from RES in final electricity consumption of the EU member states as of the end of 2017, % [xix]

Heating and cooling markets hold the second position regarding the attraction of RES. Thus, the share of energy from RES in these sectors was 19.5% as of the end of 2017

(Fig. 3). The leaders in using energy from RES in these fields are Sweden – 69.1%, Finland – 54.8%, Latvia – 54.6%, and Estonia – 51.6%.

Fig. 3 – Share of energy from RES in heating and cooling in the EU member states as of the end of 2017, % [xix]

Based on the above it can be argued that the effective implementation of the aforementioned economic mechanisms has caused the rapid deployment of RE facilities in the EU. For large-scale RE development, the governments' attention should be focused on reducing subsidies for energy production from fossil fuels, which today has a significant tendency to increase and conducting scientific research in RE technologies field, which will allow to reduce the cost for energy production from RES.

Conclusion

On the basis of the conducted research it can be concluded that the established targets regarding increasing the share of energy from RES and introduced economic tools aimed at encouraging RES use for energy production have brought desirable results for most the EU member states. However, at the same time, there are countries that are

needed to make additional efforts to fulfill their

commitments under the EU policy in RE field.

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