

**Filip Kalinowski**

**Summary of Doctoral Dissertation**

**Diagnosis of the state of renewable energy in Greater Poland as the perspective of the plans to increase the use of renewable energy sources by 2030**

**Dissertation supervisor: Professor Sławomir Jankiewicz**

The main objective of the work is to assess the development of renewable energy sources (RES) in the Greater Poland Voivodeship in the context of the region's strengths and weaknesses, as well as opportunities and threats created at the national and international level. In addition, defining the assumptions for the support system for renewable energy sources in Greater Poland.

The surveyed region has one of the highest GDP per capita in Poland. Maintenance of its growth and improvement of residents' quality of life will require a change in the economy's structure. Efforts should be taken to develop modern technologies that do not taint the environment and allow biodiversity to be preserved. One such area may be activities related directly and indirectly to renewable sources. They improve economic and natural conditions. Concerning the Greater Poland Voivodeship, there has not yet been a work that comprehensively analyses the possibilities in this area. This is essential because each region has individual characteristics that determine its potential in relation to RES. However, no universal approach (strategy, program, plan) allows for the automatic copying of external solutions. Each country and even region has its own unique conditions. This does not mean that we cannot benefit from the experience of others. However, this should be borne in mind when adapting external patterns.

The adopted goal and assumptions had a decisive impact on the adopted research methods used in work. The basis was the analysis of legal acts and documents developed at the central and local government levels. Due to the great importance of public administration activities in developing renewable sources, political and legal conditions are of great importance. Active actions affect the appearance of favorable conditions. The administration creates opportunities or threats for the functioning of this type of enterprise. Critical studies made another vital contribution to scientific publications (both internal and foreign), especially the presenting approach to RES in the case of international institutions and individual countries.

Among the research methods, the analysis of statistical materials obtained, i.a. GUS, Eurostat, OECD, International Energy Agency, the World Bank, the European Commission, poszczególnych

national ministries and local government units of Greater Poland Voivodeship, organizations representing OZE. The expert interview was a great importance for the quality of applications and the created assumptions for the support system for renewable sources in Greater Poland. The experience and opinions of specially selected people may be considered as a reliable message regarding the state of knowledge in the area of work undertaken by the issue of work. They are an element of the verification of hypotheses, which served as a reference point for the developed findings and results. In order to organize the obtained data related to the analyzed sector and the region, the SWOT analysis was used as a heuristic technique of scientific inquiry. As a result, both the descriptive and comparative analysis methods as well as direct interviews were used in the construction of the work. It was also based on the historiographic and statistical method, which allowed to assess the relationships between the studied variables. In addition, the work uses its own experiences and observations collected during work at the bank on the redistribution of funds from aid programs and financing investments in renewable energy.

The work was prepared in five stages. The first stage was a theoretical analysis of renewable energy sources. The second stage was studies in the field of law and policy of the European Union and Poland. The next two stages concerned mainly the identification of support factors influencing the development of renewable energy sources, including forecasts, and a detailed description, including the OZE analysis. The last stage is the analysis of the obtained research results and the formulation of final conclusions. Individual research stages are reflected in the chapters of the work.

The first chapter is theoretical considerations on the genesis of renewable energy sources in global and national terms. It presents such issues as: the concept and essence of renewable energy sources presented in scientific works, law, documents of public administration and organizations dealing with this industry, and the approach in this respect of countries that are leaders in their development. The characteristics of individual types of renewable energy were also made, along with the history of their formation. Finally, an analysis of the state of development of renewable energy was presented (along with a SWOT analysis).

The second chapter deals with the issues of legal and political conditions regarding renewable energy sources and the paradigm of social changes, which are closely related to the relationship between man and the environment. It discusses the problem of sustainable development in a global perspective, which is the basis of the climate policy of Poland and the European Union. This chapter analyzes the most important treaties, directives, regulations and decisions on environmental protection along with the effectiveness of their implementation and the approach of major political parties to the issue of renewable energy.

The third chapter is a description of the main programs dedicated to RES. The analysis covered the approach of the European Union in this regard, along with its translation into the Polish

market. The chapter discusses the impact of EU funds on co-financing projects aimed at meeting the zero emission requirements. The forecasts for the development directions of individual renewable energy sources along with situational scenarios as well as the potential outline of the Polish decarbonisation process are also presented here.

Chapter four focuses on the conditions for the development of renewable energy sources in Greater Poland. On the basis of the analysis of existing data, the socio-economic situation of Greater Poland was presented (including, inter alia, demography, professional activity, economic growth, development of infrastructure and economic activity). The competitiveness and investment attractiveness of the region was analyzed. Finally, the potential of obtaining energy from individual renewable sources was assessed using the SWOT analysis for this sector in Greater Poland.

Chapter five presents data on renewable energy in Greater Poland, together with a forecast of their growth until 2030, prepared on the basis of interviews with experts. In the first part, it contains determinants and barriers to the development of renewable energy sources in Greater Poland and economic benefits related to the development of this industry in the region. This chapter ends with recommendations for the renewable energy support system by local authorities of the studied area.

The conducted analysis showed that in the historical and spatial terms the concept of renewable energy sources was understood in various ways. This applies to both the approach in the literature on the subject and in legal regulations. In the future, a change in recognizing a given method of generating energy as renewable can also be expected. This is due to the fact that the presented definitions are based on the impact of a power plant on the natural environment, and not only on the reproducibility of the fuel for energy production.

As a result, technologies related with combustion (of e.g. biomass or bioethanol) are systematically eliminated from support programs meant for RES. In the case of Poland, such tendency can also be observed, however, it occurs with a substantial delay in comparison to the leaders in this field.

We are currently experiencing a systematic development of renewable energy sources in many countries around the world, whereby it does not only concern the high developed states. This is due to the benefits (e.g. economic independence and safety, energy cost reduction, ability to export) which are given to countries that possess the favorable conditions for such types of energy sources to function (high insolation, wind conditions, rivers with a high water flow etc.). That is why among the leaders We can find countries such as:

- China, with its world's largest hydroelectric plant, solar plant and the biggest onshore wind farm.

- India, which has the second largest solar plant, the second largest wind farm and is characterized by its plans for the biggest renewable energy sources' growth by 2030.
- USA - which stands out thanks to one of the biggest solar plants and wind farms.

But also countries like:

- Brazil and Paraguay, with their second biggest hydroelectric plant.
- Great Britain, which possesses the biggest wind farm in the world.
- Germany, which is an European leader and the second biggest country with the most ambitious plans for renewable energy sources by 2030.

In the global perspective, the basis for the development of renewable energy sources are green politics, which have been gaining much significance since the end of the 20th century. Their main goal is to use the natural resources and assets in a rational manner. From the economic point of view, it takes the form of sustainable growth or development (if the quality changes are also taken into account), which means that it doesn't negatively affect the possibilities of serving the needs of the future generations. This objective takes the elimination, or at least a substantial reduction, of the negative human influence on the environment into account in the context of economic activity. Individual countries, even groups of countries, are introducing laws and regulations, as well as support programs to serve this goal.

Furthermore, they are trying to take them into consideration into various sectoral policies. This requires interdisciplinary approach though (using not only achievements in the field of economics but also law, mathematics, chemistry, physics, meteorology, Earth science, geography, archaeology etc.), which makes it harder to implement.

The analysis of Polish legal acts has shown that the key to the development of renewable energy sources are so called „support schemes”. Thanks to such schemes, the role of renewable energy sources in the structure of energy production is increased. The systems implemented, coupled with raised awareness of the society, will make it easier to reach goals set in the documents that shape the energy policy. Said systems will also aid to implement the concept of sustainable development. In Poland the popularity of programs dedicated to renewable energy sources can be seen on the rise. Such programs are financed from EU subsidies and are implemented accordingly to the set priorities. Those priorities are tied to the actions regarding implementing renewable energy sources which in turn are tied to the production and distribution of energy from such sources, increasing the energy effectiveness in SME sector, implementing such sources in housing sector, implementing low-carbon policies and increasing the energy production in high-efficiency systems. Currently, the implementation of renewable energy sources can be seen on every level of local

government in Poland. It will be those local governments that will bear the responsibility of quickly adapting „green energy”. It is only through quick implemented changes that the regions can count on energy security and cheap energy supply. Regions that will become the site of research and production of renewable energy sources will benefit from greatly accelerated economic growth and from many newly established, well-paid workplaces.

Conducted research have shown that Wielkopolska has the potential to become a great renewable energy production site, even on the scale of the whole country. It is estimated that, when using the full potential of only the wind energy, the annual energy production can reach up to 15TWh which is more than the region uses right now. Which is why aside from sun energy, the wind energy is dominant in the region. Wielkopolska is one of the most economically developed regions.

Greater Poland is characterized by a high level of employment, which is reflected in one of the highest employment rates and the lowest unemployment rate in the country, which has been maintained for many years. The research and scientific potential, along with the educational base, which enables education at all education levels are also favourable in comparison with the rest of the country. It is important because in the day of current economic transformations the value of knowledge as an intangible resource determining development is constantly rising. Another major factor is the long-established entrepreneurial culture, which is of great relevance for the success of any economic activity. The analysis of the situation regarding the development of renewable energy sources in Greater Poland shows that strengths and opportunities outweigh disadvantages and risks, especially in the field of investments related to wind and solar energy. It is apparent that Greater Poland has considerable potential in the field of energy production from renewable energy sources although, without specific, formalized, and practical measures, it will remain unexploited for a long time. The realisation of this potential requires appropriate actions of local and provincial authorities and their cooperation in this area. Local government units, with a view to improving cooperation with the government, should lobby for the creation of a unit dealing with renewable energy or a plenipotentiary person at the government level. The task of such a person (department) would be to coordinate actions at the level of specific ministries and cooperate with local authorities. In addition, in order to take advantage of the opportunities for development created by this type of enterprise, Greater Poland ought to become a pioneer in the approach to the industry in question. In this way, it will create conditions better than other regions and dominate in terms of investment in this area. The reason for that will be the synergy effect. Nonetheless, for this to happen, it is necessary to change the policy towards renewable sources. That calls for the creation of a system that will eliminate or at least reduce the current flaws and thus facilitate the development of the industry. The starting point should be the creation of a “one-stop shop” for entities willing to invest in renewable sources in

Greater Poland. This implies dedicating at least one person (representative) in each borough, district, and voivodship to this task, or even creating a specialized organizational unit.

Its tasks should cover all matters related to RES, including, but not limited to:

- support for stakeholders in dealing with all issues in a timely manner in the Authority,
- participation in works of other units in the authority which have direct or indirect influence on RES (e.g. in creation of spatial development plans, strategic plans, local law) in order to take into account the postulates of the sector,
- establishing and developing cooperation with other territorial self-government units (JST) in the field of RES,
- establishing and developing cooperation with organisations established by renewable sources,
- giving opinions on governmental projects, initiating own solutions and lobbying with other territorial self-governmental units (JST) for RES on a central level,
- exerting pressure on energy distribution system operators in order to increase the potential of RES connection to the grid,
- establishing cooperation with scientific centres.

In general, it can be said that the establishment of RES dedicated persons at the local level will allow to focus responsibility for the development of this sector in a specific place and change the directions of influence from unilateral to multilateral (not only from central authorities to the region and RES units, but in the opposite direction and between TSUs). Moreover, due to their human resources, self-governments can jointly apply for EU funds and lobby at the Community level for solutions favourable to RES in Poland. The potential they will have in this respect will enable self-governments to establish cooperation with scientific centres (e.g. thanks to the possibility to obtain grants) in the scope of not only technical and technological issues, but also the analysis of trends, e.g. demand, prices, development trends which will facilitate the decision-making process of investors and determine the directions of activities to be undertaken by officials. A positive feedback effect should appear in this case.

One of the important issues to be addressed within such a system is the development and implementation of a RES technology transfer model. The starting point should be the creation of a flow of information on technical and economic issues (currently this is one of the significant barriers to the development of renewable sources) and the organisation of meetings between potential investors and scientific centres. In their activities, plenipotentiaries for RES should be guided by the principle of a long-term approach, i.e. the investor must be sure that given aid programmes, organisational and legal situation will be stable in the long term. This will result in "attracting" to the region not only actors interested in renewable energy generation but also businesses directly and

indirectly related to it. Moreover, they must be active (e.g. identify convenient places for such investments, support interested entities organizationally and, if possible, also financially).