

# Renewable energy sources in Poland and selected EU countries

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**Abstract** This paper presents the essence of Renewable Energy Sources (RES) in Poland and chosen UE countries based on selected economic regulations. Further, the benefits and restrictions coming from implementation renewable energy sources have also been pointed out. The aim of the article is to present and assess the state of knowledge on renewable energy sources and ecology in selected EU countries. The analysis is based on the questionnaire, which was main tool of conducted research. The study aims to answer the question: whether and how the state of knowledge of the EU inhabitants about renewable energy sources can affect the development of renewable energy. The study uses the descriptive, statistical and analytical methods. As a preliminary tool, the descriptive method is used. The following part of the study presents the results of research carried out among citizens of some EU states. Based on obtained results it was possible to draw reliable conclusions about how promote ecology among Polish society.

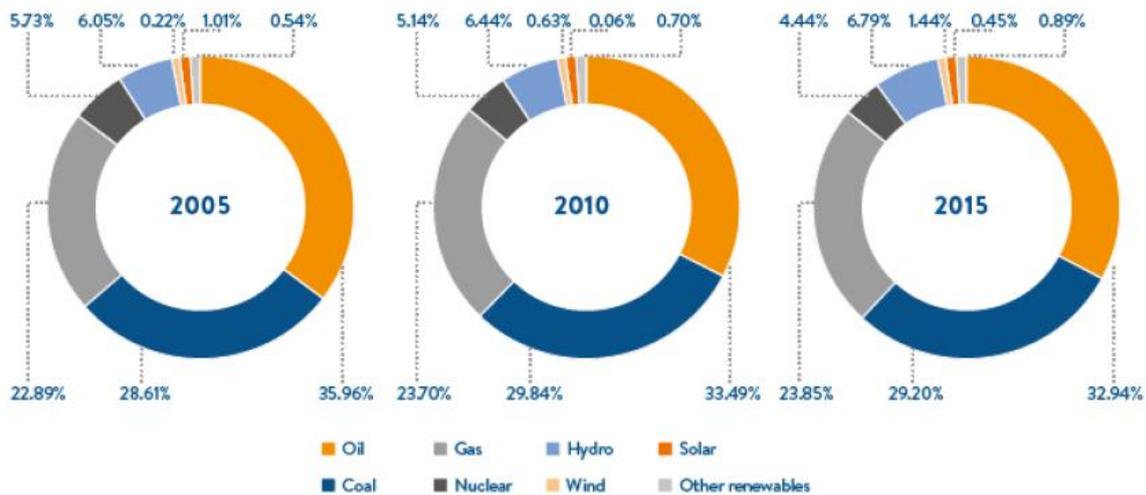
**Keywords:** Renewable Energy Sources, Development of Renewable Energy

## 1. Introduction

With each stage of civilization development there is an increasing demand for energy. Since the ancient time supply of energy have relied on the Renewable Energy Sources (RES) like: wind mills or water machines. Nowadays Renewable Energy Sources are considered by the World Energy Council as the energy of the future. Their potential is thought to fulfill increasing energy demands of the Earth population. Yearly their usage grows approximately by 4 -7 % and this rate should continue till 2020 r. (World Energy Council Statement 2000).

The Energy Law Act defines RES as 'sources which derive energy from the following natural phenomena: wind, solar radiation, geothermal springs, waves, tides, the fall of rivers, biomass, dumping ground biogas, and also biogas produced in the process of cleaning wastewater or decomposition of plant and animal remains'. RES exploitation does not cause their long-term deficit. This means that the resources are renewed in a short time. Their opposite is non-renewable energy sources that are sources, the depletion of which progresses much faster than their natural renewal. The feature distinguishing renewable energy sources from the conventional ones, is the lack of (or a significantly smaller amount of) negative impact on the environment. This is due to the renewal of primary energy (sun, water) and a limited emission of waste, dust and gases (Wolanczyk 2009, Ligus 2010). Among renewable energy sources, we can distinguish those whose impact on nature can be described as non-confrontational and those with associated environmental and spatial constraints. The non-conflicting RES include: waste biomass - waste from agriculture and industry (including wood) and communities, biogas from dumping grounds, sewage treatment plants, and solar energy derived from distributed systems. The RES conflicting with the environment include: wind energy, hydropower, and geothermal resources (Kawalczevska 2006).

Currently RES cover about 8 % of global energy consumption, where hydropower accounts for about 6.7 % of use and other renewable energy sources cover 2.2 % of energy demand. Figure 1 shows the global shift in energy consumption in form various resources. The most abundant energy sources are oil and coal, which cover 63 % of energy consumption during 15-year period.



**Figure 1.**Comparative primary energy consumption over the past 15 years

**Source:**World Energy Resources 2016. World Energy Council.

## 2. Material and methods

Issues related to renewable energy sources and their economic assessment are important both from theoretical and practical points of view. Attitudes towards RES, their formation and development should be a priority for every human being not only for organizations or governments. The aim of the study is to assess the knowledge about RES among EU citizens. The study uses a method of research which is a diagnostic survey.

The study was carried out in period between November and December 2016. The countries that participated in the survey were from: Poland, Greece and Hungary. Questionnaires were initially distributed among chosen 89 persons. The questionnaire was anonymous. The interviewer did not intervene in the data collection given the specificity of the places (e.g. internet). The first part of the survey questionnaire concerned general issues related to renewable energy sources, e.g. RES provisions, types of RES. The remaining part of the questionnaire addressed the issue of the practical application of RES in the respondents' residence and the benefits of the RES investment. Discussion of the results of the survey will focus on highlighting the basic results obtained through the questionnaire survey. The results are presented in chart format.

## 3. Result and discussion

Renewable energy has an impact on the environment. However, it is far less damaging than traditional energy production. The most eco-friendly form of RES from is the battery-powered by solar radiation and geothermal sources. Another ecological way of involving renewable energy to the processing of what might seem to have anyone unnecessary waste, or use of, e.g. landfill biogas or biomass from animal manure or plant waste. Less popular among citizens is knowledge about obtaining energy from waves and tides. On the other hand, hydropower and wind

farms (use of water and wind), are recognized as not polluting like traditional coal, however their construction and operation interferes with the existing ecosystem.

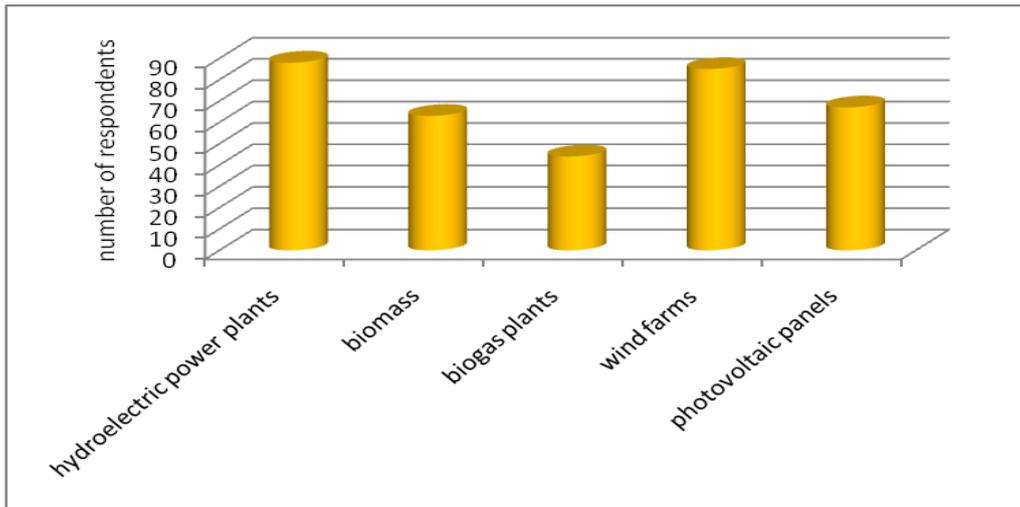
The energy from unconventional sources which in the process of its production use: solar, biomass, geothermal energy, kinetic energy stored in the power of the wind and the water is conducive to environmental protection. Burning of primary fuels has a negative impact on the environment, because during this process substantial amounts of oxides of carbon, sulfur and nitrogen penetrates the atmosphere. Moreover, renewable energy sources are mostly recognized by citizens as a tool in reduction of greenhouse effects and these dangerous gases limitation, Awareness among citizens about so-called of concomitant impurities, such as dust, sulfur dioxide, nitrogen oxides, or contaminants that directly or indirectly affect the health of everyone and is important.

The Authors discussed below the results of research. The age structure is of the respondents is: 50 years old and more (40.4%), 34.8% are citizens 41-50 years, and smallest group are people in age 20-30 (5.7%).

The educational structure of respondents is compatible with the general population data. However it is negligible, because the small proportion of people with basic education. People with higher education (57,3%) or secondary education were majority of questioned group.

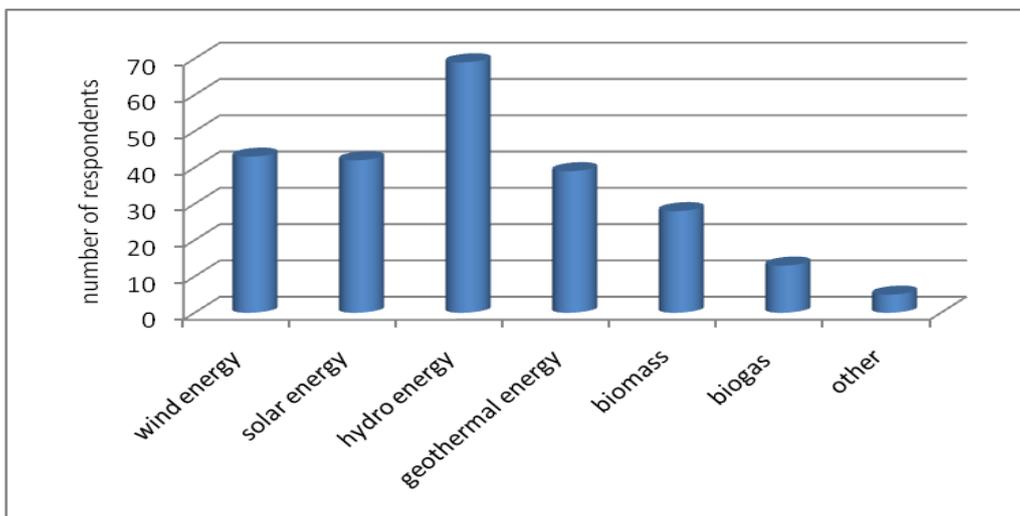
In the case of the origin, the survey is dominated by people from Poland (86.52%). The others a from Greece and Hungary.

This study found that among the respondents most known sources of renewable energy are hydropower (almost 99% of respondents) and wind farms (over 95%). The least known methods renewable energy is biogas (less than 50%). Respondents pointed hydroelectric power plants as best known RES. Water energy was pointed as a source of the greatest number opportunities in the area of their residence (figure 3) however, this is only slightly more



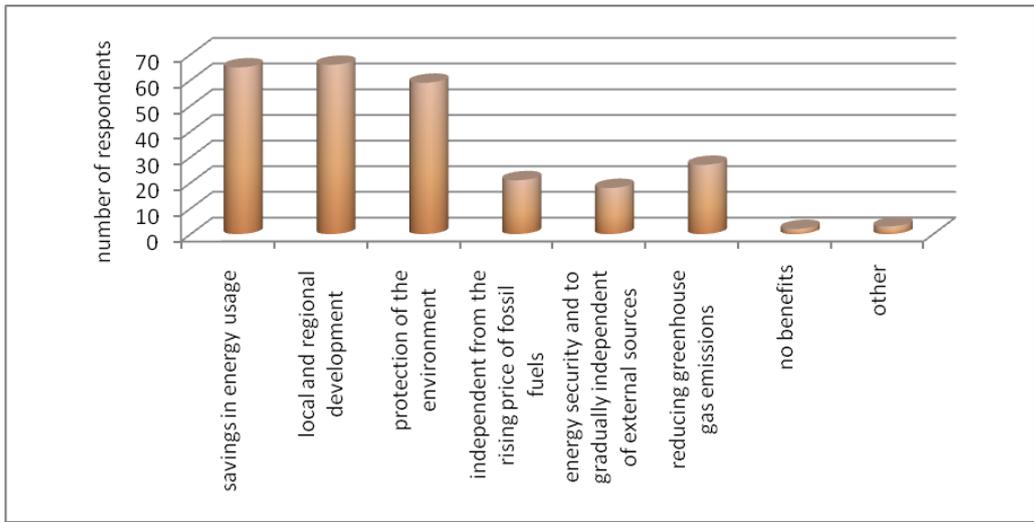
**Figure 2.** Which RES do you know?

**Source:** Results based on own research



**Figure 3.** Which kind of RES possibly have the most chance to be implemented and developed in your place of living?

**Source:** Results based on own research



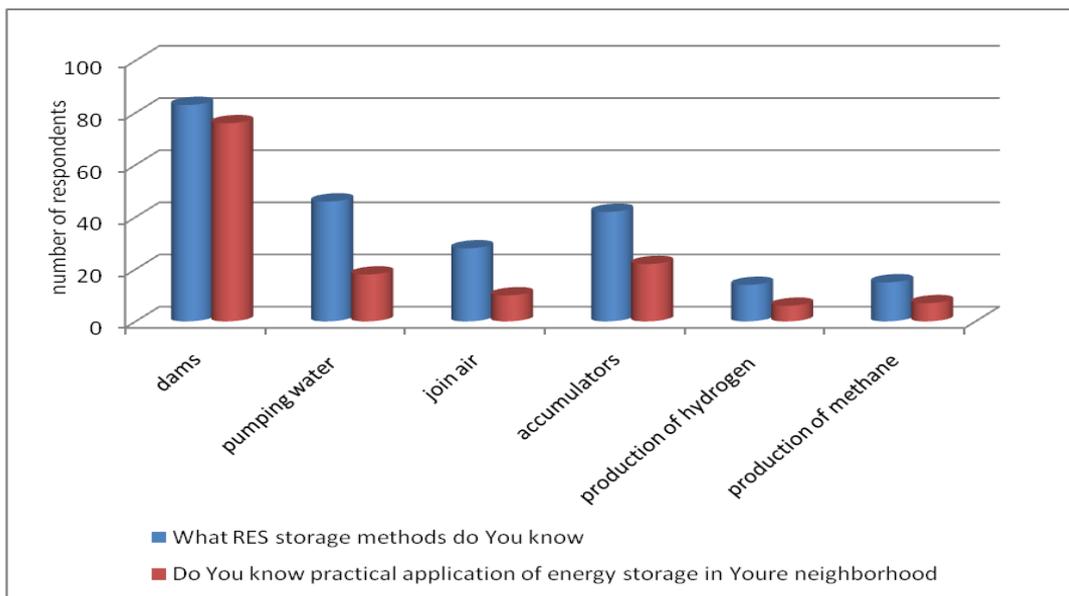
**Figure 4.** What is your opinion on benefits coming from investments in the RES?

**Source:** Results based on own research

than 77% of responses. About 50% of the respondents mentioned wind, solar and geothermal energy. Slightly more than 30% indicates biomass and biogas only just under 15% (figure 2). The vast majority of respondents recognize the benefits of the investments related to the use of renewable energy sources (just over 2% believe that there will be no any benefits). Most respondents indicated that these investments lead to local and regional development and savings in energy use (74% and 73%). Slightly less pointed was response to "environmental protection" (over 66%). Significantly fewer respondents indicated that such investments are associated with a reduction in greenhouse gas (approx. 30%) and independent from rising energy prices (almost 24%) and energy security (approx. 20%).

The vast majority of respondents as a method of storing energy indicate the dams (over 93%) as also the way they consider to be used in neighborhood area (over 85%). In other cases, there is no such convergence between conventional methods and noticeable in the area of residence of the respondents. Respondents' knowledge about energy storage: exchange pumping of water (over 51%) and batteries (over 47%). These methods are also noticed in the area of possible implementation and development, but by a much smaller number of respondents (by almost 25% and over 20%). Other processes (for example production of hydrogen and methane) are known only to several percent of the respondents who actually use this source of energy.

Knowledge of the most of respondents about renewable energy sources is assessed as an average (over 66%).



**Figure 5.** What RES storage methods do You know and what RES Do You know practical application of energy storage in Your neighborhood?

#### 4. Conclusions

Based on the analysed survey results presented in this paper the conclusions are as follows. Citizens do not connect investment in renewable energy sources with proposed by some scholars green jobs or green employment as a source of the development of their region (Rutkowska-Podolowska et. al 2016). Also, they pointed the possible impact of investment in RES based on their own knowledge which can be described as an average, although majority of respondents have secondary or higher education.

This study was an attempt to understand the knowledge level among citizens of chosen countries however majority of them were Polish so to make clear estimation for other countries this survey results were insufficient.

Renewable energy sources bring many benefits to the environment, but also the entire economy and society. Furthermore, the positive impact of renewable energy sources can be observed mainly in rural areas.

Further research is recommended in this matter with larger samples and preferentially on a national level in order to evaluate the real dimension of the phenomenon and to enable wider analysis of the results.

#### References

- BP Statistical World Energy Review 2014. 16 June 2014. BP (ang.), <https://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf> [access: 16 June 2014 and 03.03.2016].
- Energy for Tomorrow's World- Acting Now! World Energy Council Statement 2000.
- Gavurova B. (2012), Source Identification of Potential Malfunction of Balanced Scorecard System and Its Influence on System Function. *E + M Ekonomie a management*. Vol.15,Iss. 3, pp.76-90.
- Kawalczevska J. E. (2006), Environmental Guide for Small and Medium Enterprises. In A. Tyszecki (Ed.). Gdansk: Eko-Konsult Consulting Office, pp. 1 et seq.
- Ligus M. (2010). Effectiveness of investments in renewable energy, cost-benefit analysis. *CeDeWu*. Warsaw, pp. 1 et seq.
- Rutkowska-Podolowska M., Sulich A., Szczygiel N. (2016) Green jobs, Proceedings of the 3rd International Conference on European Integration 2016, ICEI 2016, May 19-20, 2016, Ostrava, Czech Republic. Pt. 2 / [Eds. Eva Kovářová, Lukáš Melecký, Michaela Staničková]. Ostrava: VŠB - Technical University of Ostrava, cop. 2016: 822-829.
- Wolanczyk F. (2009), Wind power plants. Krosno: Kabe p. 114.
- World Energy Resources 2016. World Energy Council. <https://www.worldenergy.org/wp-content/uploads/2016/10/World-Energy-Resources-Full-report-2016.10.03.pdf> [access: 10.03.2017].