

Within the last decades, the exhaustion of classical fossil fuels and the mitigation of climate changes with increase in energy demand have become major challenges for governments all over the world. Sustainable development criteria have been pushed into the front line of energy policy. Sustainable energy is consumption and energy supply that meets the needs of the present without compromising the ability of future generations to meet their own needs. However more developed descriptions of the concept of sustainable energy take into account both the issue of sustainability, as well as the inclusion of social and environmental needs for economic development.

The historic climate change agreement in Paris in December 2015 (COP21) sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C. As a result, on 30 November, 2016, the European Commission (EC) adopted the package *Clean Energy for All Europeans*. EC assumes that the carbon intensity of the European Union (EU) economy will be lower by 43% in 2030 than today, and electricity from renewable sources will account for around half of the EU energy mix.

The short-term goals states the climate and energy package targets for 2020: 20% cut in greenhouse gas emissions (from 1990 levels); 20% of EU energy production from renewables; 20% improvement in energy efficiency. Poland is obliged to achieve a 15% share of energy production from renewable sources in 2020.

In EU policy framework, the regional and local scale is a strategic dimension to translate the EU political orientation into concrete actions due to the decentralized nature of energy efficiency and renewable applications. The assessment of the regional energy is a starting point to find out the strengths and weaknesses, in order to set up customized sustainable energy strategies and to define shared index of sustainable energy implementation. The main objective of the project is to (1) obtain a synthetic index of sustainable energy development for regions of Poland and for EU countries, as well as to (2) select best sustainable energy development strategies for regions of Poland.

Unfortunately, there are no clearly defined indicators which could verify level of implementation of sustainable development energy. However there is information i.e. on number of installations and installed capacity in low-emission energy technologies but these values do not relate to the potential of a given region in any way. It seems, that the verification of the level of implementation of sustainable energy should take into account the characteristics of a given region. Therefore, the classic approach used in taxonomic analysis based on a comparison to the ideal pattern consisting of the best values of indicators for all regions is not working good. For that reason a new, modified index based on classic the so-called development index will be proposed. In this index the comparison of present state to the ideal, based on potential of the region, will be used. However, this approach requires the use of expert knowledge to determine the potential of each region. In the study the proposed index will be used to verify the level of implementation of sustainable energy and grouping regions in homogenous classes in terms of level of implementation. An attempt to make comparisons between EU countries will also be made.

The second part of the study will concern on application of multi-criteria decision making methods to choose an appropriate sustainable energy strategy and priority low-emission energy technologies. The expert knowledge will be also needed. At first experts will be asked to indicate the most important factors that should be taken into account when choosing an appropriate energy technologies and energy mix. Then the factors proposed by experts will be aggregated by multi-criteria decision making methods and specific indicators and their weights will be determined. Next, the experts will be asked to evaluate the regions in terms of established indicators. Such two-stage approach allows to create ranking of development strategies and low-emission energy technologies for individual regions, taking into account their potential.

Selected development strategies for individual regions need to be part of established sustainable development strategy for Poland. Therefore, the last stage of this part of the research will consist of comparing the aggregated energy mix for regions and established energy-mix for the country as a whole. In case of significant differences, modifications of the strategies for individual regions will be proposed.