It is hard to overestimate the importance of electricity to modern civilization. With an increasing number of people living on our planet, but also increase the quality of their lives demand for electricity continues to grow. At the same time, the limited resources of fossil fuels and their impact must be taken into account. Therefore, it becomes increasingly important the issue of energy saving and producing it from renewable energy sources (RES). In both cases, an important role is played by power electronic converters that are used to convert electrical energy using the power semiconductor devices. Increasingly, a greater percentage of electrical energy is converted by means of such systems, therefore, their properties, particularly energy efficiency, are essential. In the case of energy from renewable sources such as wind and solar power converters use is practically necessary because of their electrical characteristics. In this situation it is not surprising, that in the area of power electronics intensive research on systems that meet the requirements of these applications takes place. An example of such a research is the introduction and, then, development within the last decade a new group of power converters with impedance network. They are characterized by the buck-boost characteristics and so are inherently well suited for use with renewable sources, where the voltage varies over a wide range due to factors such as wind speed or solar radiation. In the case of classical systems it is usually necessary to use two stages of power conversion, and it seemed that the new converters with single-stage conversion will quickly replace them. Unfortunately, until now is not possible to find practical applications. In the applicant's opinion this is due to the fact that in a number of fundamental areas such as design power circuits, pulse width modulation techniques and the use of new silicon carbide (SiC), power devices research has been neglected and converters with impedance networks still show less favorable features than systems with two stages of conversion (consisting of two converters: DC / DC and DC / AC). This project aims to change this situation and make significant progress in the above areas. The newly acquired knowledge will enable the development of three-phase inverters of the buck-boost characteristics and impedance networks, which show the more favorable characteristics (in terms of efficiency, power density and quality of the transformed energy) than power electronic systems with two degrees of conversion. To achieve the above mentioned goal of the project is planned to use the typical for technical sciences research cycle consisting analysis, simulation and experiments phases. In-depth analysis of the phenomena taking place in such a circuits will be undertaken and the power circuit design methodology and new pulse width modulation techniques will be developed. Finally, the issue of new SiC power semiconductor devices will be considered. In order to verify newly acquired knowledge two laboratory models will be built, rated at 10kVA each, and experimentally tested. Newly acquired during the project knowledge decisively influence the development of a scientific discipline, establishing the status of impedance source converters. Above all, it is expected that the knowledge will allow to realize the full potential of the new power converters with impedance networks and as a result develop in the future, the new, improved power electronic systems, characterized by higher efficiency and power density than currently used a solutions with two stages of conversion. Their application in the area of renewable energy, electric drives or wherever buck-boost characteristics is needed, will be translated into significant energy savings.