Abstract
The paper deals with the problems of selection, sizing and obtaining energy management strategy in a hybrid energy supply system. The system consists of a number of energy storages and generators. The two-level optimization using genetic algorithm is presented. The algorithm work was considered in two states: static – while optimizing a HESS configuration with energy management strategy and dynamic while optimizing the strategy in real time. The aim of these research is to develop a method for selecting the optimum configuration of devices in a HESS and to optimize energy management strategy in real time, allowing for interference in the system configuration.

Introduction
Energy storage systems (ESS) are becoming one of the most important components that change overall system performance in various applications, ranging from the power grid infrastructure, electric traction system [1], to electric vehicles [2] and portable electronics. Yet, a homogeneous ESS has limited characteristics in terms of cost, energy and power density, lifetime, etc., by the energy storage technology that comprises the ESS. That issue can be solved by creating hybrid energy supply system (HESS) that contains not only different kinds of energy storages but also generators. That creates problems of selecting and sizing the devices and obtaining the energy management strategy, with which the paper deals.

The optimization of the HESS, consisting of several energy storage and power generation devices which have different dynamic models, can be inefficient without simultaneous optimization of energy management strategy. HESS sizing optimization was carried out in [3-5]. The interdependence between sizing and power split optimization of hybrid energy storage systems was described in [5]. To solve that problem, the two-level optimization algorithm was developed. The scheme of the DC line system considered in the research is shown in Fig. 1. On the first level of algorithm the optimization of the system configuration is carried out. In this calculation the initial energy management strategy is used. The result of the first level of calculations is power vector in which every value represents the power of each device in the system. On the second level, the energy management strategy is optimized. After selecting the best strategy for particular setup, it is given back to first level and the process is repeated.

Such an approach to the problem of selection and power control allows not only the selection of the optimal devices power and minimize system cost, but also optimal utilization of individual components even after making changes to the system configuration. This allows disconnecting and adding devices to the system without interference in energy management strategy. Different, fixed energy management strategies for HESS were described in [6-7].

Conclusions
The aim of the research is to develop a method for selecting the optimum configuration of devices in a HESS consisting of energy storages and generators. Another element of the is to optimize energy management strategy in real time, allowing for interference in the system configuration. This work is a theoretical description of the solution of these problems. The use of two-level genetic algorithm optimization and the distribution system operation on static and dynamic states was accepted. The next stages of work will be simulation and computational research for adopted algorithms. The laboratory stand implementation of the dynamic power control system is being carried out.

References
[1] Szelaż A.; Wpływ napięcia w sieci trakcyjnej 3 kV DC na parametry energetyczno-trakcyjne zasilanych pojazdów. INW Spatium. 2013


