

Abstract

Optimization of reactive power compensation systems for wind farms

The cooperation of wind farms with the power system requires that they meet the requirements related to reactive power management. All issues are defined by the engineering and historical term "reactive power compensation". It is about both the generation and production of this power, as required by grid operators and EU Regulation 2016/631. As demonstrated in the dissertation, the regulatory capacity of wind turbine generators is not sufficient to meet these requirements, in particular for farms connected to the power system utilizing a 110 kV cable line with a length of several dozen kilometers. It is required to use various additional devices – fixed or variable shunt reactors, capacitor batteries, static VAR compensators (SVC).

In the thesis, a compensation quality indicator was defined, by means of which it is possible to assess and select the optimal set of devices supporting the farm's generation and reactive power consumption capabilities. Due to the application of multicriteria optimization, this indicator unifies both the technical effectiveness of individual systems and the economies of their use. Both calculations on the simplified model of the farm as well as the heuristic optimization using the cuckoo search algorithm on the exact model indicated the advisability of using simple compensation systems (fixed shunt reactors and variable capacitors) which, if the compensation requirements are not fully met, are characterized by a relatively low price and operating costs.

Key words: reactive power compensation, heuristic, optimization, wind farms