Hybrid Wind-Diesel System for Remote and Isolated Areas

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Abstract

Isolated hybrid wind-diesel system with double fed induction generator based wind turbine and adjustable speed diesel generation unit with permanent magnet generator is presented. Wind turbine equipped with electronics converter is able to operate in standalone mode without support of diesel generation unit, if there is enough wind energy. Deficit of wind energy causes, that diesel generation unit is enabled. However, wind and load variations cause the engine load fluctuates and to obtain the best efficiency, engine speed is adjusted to the load. Standardization of AC generated voltage is provided by the power electronics converter connected to the rotor of DFIG. Limited power diesel generation unit is coupled with wind turbine on the DC side. Optional energy storage system can be used for improvement of voltage quality during transient states.

Objectives

The goal of research was to develop of a hybrid power system based on internal combustion engine and renewable energy sources to obtain reduced fuel consumption. The objectives has been obtained by selection of the system topology, control methods and laboratory tests of the system components.

Methods

Proposed topology of hybrid wind-diesel power generation set:

Comparison of fixed speed and adjustable speed internal combustion engine based power generation units.

Conclusions

- Wind turbine equipped with electronics converter is able to produce standard AC voltage during standalone operation mode
- Adjustable speed operation of internal combustion engine provide reduction of the fuel consumption
- Multipolar permanent magnet generator increases reliability and reduces weight and volume of ICE based power system
- Energy storage system can improve the voltage quality during transient states caused by step loading of the power system

References