Implementation and Power Flow Analysis of a Multi-Microgrid in Oman's Rural Power System

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Abstract

Electricity is a basic need for the economic development of any country. The process of modernization, increase in productivity in industry and improvement in the standard of living of the people, basically depends upon an adequate supply of energy. So, the design and construction of the electrical system has to be done professionally and according to international standards.

Transmission and distribution of power electricity from one point to another through the electrical system, a conductor via either an overhead line (OHL) or an underground cable (UGC), is needed. In general, a typical power network consists of power generation, transmission and distribution. Of course, different resources could be used in Oman for generating power like diesel, gas, wind and solar. So, investing in these resources for increasing the reliability and efficiency of the system could be done by using the principle of microgrid to develop the electricity system. Microgrid is a small system which can generate, distribute, and regulate the flow of electricity to consumers. It can work in grid-connected mode or islanded mode.

Accordingly, this research proposes the possibility of constructing a microgrid by interlinking the rural area systems in Al Wusta governorate by switching off the small diesel stations and replacing them with wind turbines. The interlinking between systems was studied by taking into consideration the type of conductors, design of step up and step down substations, types of poles and types of insulators. Moreover, a power flow study as well as the performance of the proposed structure was taken into consideration for constructing the microgrid. This work is based upon a study of the combined use of wind and diesel resources. It hopes to discover and determine to what extent the energy produced from wind turbines is capable of satisfying the demand for energy.

This thesis is based on studying the wind/diesel hybrid system for constructing a microgrid using the ETAP software program in order to study the impact of this hybrid system on the power flow in an existing network.