Modeling and simulation of hybrid wind-diesel power generation system

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ABSTRACT

The increased environmental concerns after Kyoto Protocol and Copenhagen summit have led the development of renewable technologies. The renewable power plants are mostly implemented in rural areas as they cover large ground surface. The rural areas are far away from the main grid network and connection is possible through a weak transmission line. The concept of hybrid power system generation is proposed as effective solution for to meet our energy demands and to decrease the greenhouse gases emissions. The installation of hybrid power systems has known a constant growth in the last years. To improve the power quality of wind generation system a wind-diesel hybrid system is proposed in this paper. The simulation results confirm the smooth operations of the proposed wind-diesel system.

Keywords: *Renewable energy, Wind-diesel system, Asynchronous generator− Diesel generators*

1. Introduction

Global warming is one of the most serious environmental problems facing the world community today is interested in solving it. It is characterized by the increase in the average temperature of the earth and extreme weather conditions [1]. Plus of that, the rapid depletion of fossil fuels worldwide has necessitated an urgent search for alternative energy sources to meet the current requirements. Its renewable energy sources such as wind power have drawn attention to a large-scale [2]. The alternative energy sources are non-polluting, free in their availability, and continuous. These facts make the alternative resources attractive for many applications. Therefore, only 6.4% of total renewable energy sources available in the world are in use today. To get more consistent flow of energy to the user request, there has been a growing trend to combine renewable energy sources with diesel generators, giving a hybrid power generation system [4], they are activated to serve as electrical energy to relay telecommunications, border crossings, the isolated habitat, clinics..etc. The same systems are generally independent from large interconnected networks [5].

In the literature we find that hybrid systems have been studied for an isolated case or connected to a power grid. In [6] a study of a hybrid autonomous system was introduced, the same is presented in [7] for a power system in island in Bangladesh. Several parameters are enter in the study as well as the system design, but in the literature it is difficult to find how to size the various components of an autonomous system, most of them focus on the basic theory of technology but rarely the sizing of equipment. The variable parameter of most renewable energy often takes a complex control system [8]. In the same vision a design of a control voltage and frequency for a wind-diesel system is shown in [9]. In [10] P. S. Panickar et al study a strategy of adaptive control by a variable wind speed for an application for a wind diesel hybrid system. Modeling is also a major factor in studies developed to simulate a functioning system. Much software allows us to do that. In [11],[12] a modeling and simulation of various hybrid systems presented with MATLAB-Simulink software. In [13] a model of a hybrid power generation is made by the HOMER software.

In this study we propose a wind-diesel hybrid power system generation for to meet our energy demands and to decrease the greenhouse gases emissions. The simulation results confirm the good operations of the proposed wind-diesel system and shows the importance of the emergency generator in order to ensure the reliability and the economy of the system to reduce greenhouse gas emissions.