Integration of Wind System with Diesel System to Improve the Available Transfer Capability Using Fact Device

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Abstract-*Optimization and modelling of a hybrid energy system to meet the electrical requirements of a remote area with industrial development has been done. It emphasizes the renewable hybrid power system to obtain a reliable autonomous system with the optimization of the components size and the improvement of the capital cost. This hybrid energy system consists of Photovoltaic array, wind turbine and biomass plant accompanied with battery and diesel generator for emergency backup considering uncertain availability of these weather dependent sources. As a first step, an operational scheme has been organized for measuring the electrical load profile, renewable sources availability, their condition and specifications like solar irradiation, wind rate. Then, the whole system is simulated in Hybrid Optimization model for Electric Renewable (HOMER) environment. Finally, simulation results are presented for the proposed hybrid energy system and economical, environment aspects for the same have been discussed.*

Keywords-Hybrid Energy, Wind Energy, Power System.

Introduction

This paper is based on Mat lab simulation, optimization and sensitivity analysis of small power generating systems based on renewable energies. To allow, however, the modeling, simulation and analysis of a large variety of systems based on renewable energy and to manage these systems, the software Matlab was expanded with the RegenSim library. This library was designed to implement the above functions for hybrid systems based on renewable energy sources, but also their components interfacing with components from other libraries, particularly those of Matlab Simulink Power Systems library. Basic components of RegenSimulink library are: Wind generators, PV generators, Hydro generators and Storage devices. Each of these components was basically modeled on studies of mathematical models and has associated specific parameters such as in The interfacing with Matlab libraries components was realized in order to make a thorough study of the modeled hybrid system from local automatic control systems to the

centralized operational management system. Except for Storage device component, each of the other three components has, as input parameters, the specific primary source of energy and, through interconnection with different types of measurement and display blocks of Matlab, voltages, currents, powers and energy flows from the system, depending on the nature of the consumer, can be watched. The Storage device component was designed with the primary function of serving as a buffer to store the energy produced by renewable sources, from its terminals being directly supplied the DC consumers and the AC through the inverter blocks. At the batteries level can be monitored by using measure and display blocks from Matlab, the size and state of battery charge (SOC), the terminal voltage or currents absorbed by consumers.

One of the advantages of Matlab software is that libraries offer a wide range of basic components for modeling the consumers. Thus, it can be modeled both single-phase or three phased consumers with different powers, nature and types (e.g.: resistive, capacitive or inductive consumers). Non uniformity and high initial investment are the problems associated in solar energy technologies. Biomass power plant demands a huge amount of fuel feed which may not be available readily in all the places and times. A feed control in biomass fuel with variable solar radiation avoids the need of solar energy storage and saves the storage cost. In this work, solar parabolic collectors and biomass combustion have been arranged in parallel to produce steam for power generation. Solar energy is limited to a maximum share of 50% to avoid the operation of biomass combustion at low fuel feed rate in daytime. The performance characteristics of hybrid power plant have been developed with turbine inlet condition (pressure and temperature) and variation in solar energy sharing. The focused results are cycle thermal efficiency, hybrid plant thermal efficiency, plant fuel efficiency and specific power. The mass, energy and performance variations are studied under variable solar radiation. Energy plays a crucial factor in technological and economic development of present society. It has always been the key to man's greatest dream of a better world. Throughout the history of human race, major advances in civilization have been accompanied by increased consumption of energy. There is a positive relation between per capita energy consumption and per capita income. Therefore, adequate supply of energy at a reasonable cost is a key factor in the advancement of a country in almost all sectors. India is a country with numerically dominant rural population, where its village inhabits about 70 percent of its human resources. Hence, the development of country as a whole is intimately related with the rural development. In developing countries like India, it is very difficult as well as uneconomical to transmit power over long distances through transmission lines, to electrify remote and rural areas. The lack of an electrical network in remote areas and prohibitively high connection cost of grid extension and rough topography often leads to exploration of other options. Stand-alone hybrid systems consisting of renewable sources are found promising ways to satisfy the electrification requirements of these areas. The need for energy efficient electric power sources in remote locations is a driving force for

research in hybrid energy system. In addition to that, use of renewable help in reducing fossil fuel consumption levels and the consequent effect of carbon dioxide and other greenhouse gases. The hybrid energy systems also provide an effective solution to meet the power demand in case of shortage from the grid supply. In the present study optimization and modelling of a hybrid energy system to meet the electrical requirements of a remote area with industrial development has been done. It emphasizes the renewable hybrid power system to obtain a reliable autonomous system with the optimization of the components size and the improvement of the capital cost. This hybrid energy system consists of Photovoltaic array, wind turbine and biomass plant accompanied with battery and diesel generator for emergency backup considering uncertain availability of these weather dependent sources. As a first step, an operational scheme has been organized for measuring the electrical load profile, renewable sources availability, their condition and specifications like solar irradiation, wind rate. Then, the whole system is simulated in Hybrid Optimization model for Electric Renewable (HOMER) environment. Finally, simulation results are presented for the proposed hybrid energy system and economical, environment aspects for the same have been discussed.

Literature Survey

Shafiuzzaman K. Khadem, MalabikaBasu and Michael F. Conlon, "Intelligent Islanding and Seamless Reconnection Technique for Microgrid With UPQC" In this paper author proposes the theory for the placement, integration,and control of unified power quality conditioner (UPQC) in distributed generation (DG)-based grid connected/autonomous microgrid/microgeneration (μG) system has been presented here. The DG converters (with storage) and the shunt part of the UPQC Active Power Filter (APFsh) is placed at the Point of Common Coupling (PCC). The series part of the UPQC (APFse) is connected before the PCC and in series with the grid. The dc link can also be integrated with the storage system. An intelligent islanding detection and reconnection technique (IR) are introduced in the UPQC as a secondary control. Hence, it is termed as UPQCμG−IR. The advantages of the proposed UPQCμG−IR over the normal UPQC are to compensate voltage interruption in addition to voltage sag/swell, harmonic and reactive power compensation in the interconnected mode. During the interconnected and islanded mode, DG converter with storage will supply the active power only and the shunt part of the UPQC will compensate the reactive and harmonic power of the load. It also offers the DG converter to remain connected during the voltage disturbance including phase jump. In IEEE journal of emerging and selected topics In power electronics, vol. 03, no. 2, june 2015

Karlis and P. Dokopoulos, "Small Power Systems Fed by Hydro, Photovoltaic, Wind Turbines and Diesel Generators" In this paper author presents software simulation and experimental verification of the dynamic behavior of small autonomous power systems with alternative power sources, such as Wind Turbines, small Hydro electrics and Photovoltaic. The combination of the hydroelectric power plants and the Diesel generators is of great interest since they have very different rates of power change. For the effective integration of the Photovoltaic (PV) devices into the utility grid, a method for controlling the Inverter's operation is proposed. According to this method the Power demand from the network is monitored and control signals adjust the angle and the magnitude of the Inverter's voltage. It is shown that this method improves power quality and stability of the interconnected system.In Aristotle University of Thessaloniki, GreeceICECS.

Shafiuzzaman K. Khadem, MalabikaBasu and Michael F. Conlon, "A New Placement and Integration Method ofUPQC to Improve the Power Quality in DG Network" in this paper author discussed the A new proposal for the placement and integration of UPQC in DG connected micro grid/micro generation (μG) system. DG converters (with storage), the load and shunt part of the UPQC will be placed at or after the PCC. The series part of the UPQC will be placed before the PCC and in series with the grid. DC link can be connected to the storage system also. Hence, it is termed UPQCμG. The advantages of the proposed UPQCμG over the normal UPQC are to compensate voltage interruptions in addition to voltage sags / swells, harmonic and reactive power compensation in the interconnected mode. The DG Converter with storage will supply the active power only and the shunt part of the UPQC will compensate the reactive and harmonic power of the load in the islanding mode. Therefore, the system can work both in interconnected and islanded mode. DG Converter does not require to be disconnected during the voltage disturbance. In all conditions, DG Converter will only provide the active power to the load and grid. Thus it will reduce the control complexity of the DG converter as well as improve the PQ of the network.

Existing system

Today's generation system are lumped generation i. e. all generation systems are individual or separate consider following systems

Solar system

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic's (PV), or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic's convert light into an electric

current using the photovoltaic effect. The International Energy Agency projected in 2014 that under its "high renewable" scenario, by 2050, solar photovoltaic's and concentrated solar power would contribute about 16 and 11 percent, respectively, of the worldwide electricity consumption, and solar would be the world's largest source of electricity. Most solar installations would be in China and India. Photovoltaic's were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system. As the cost of solar electricity has fallen, the number of grid-connected solar PV systems has grown into the millions and utility-scale solar power stations with hundreds of megawatts are being built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from the Sun.Commercial concentrated solar power plants were first developed in the 1980s. The 392 MW Ivanpah installation is the largest concentrating solar power plant in the world, located in the Mojave Desert of California. Other large CSP plants include the SEGS (354 MW) in the Mojave Desert of California, the Solnova Solar Power Station (150 MW) and the Andasol solar power station (150 MW), both in Spain. The 579 MW Solar Star, in the United States, is the world's largest PV power station. A solar cell, or photovoltaic cell (PV), is a device that converts light into electric current using the photovoltaic effect. The first solar cell was constructed by Charles Fritts in the 1880s. The German industrialist Ernst Werner von Siemens was among those who recognized the importance of this discovery. In 1931, the German engineer Bruno Lange developed a photo cell using silver selenide in place of copper oxide, although the prototype selenium cells converted less than 1% of incident light into electricity. Following the work of Russell Ohl in the 1940s, researchers Gerald Pearson, Calvin Fuller and Daryl Chapin created the silicon solar cell in 1954. These early solar cells cost 286 USD/watt and reached efficiencies of 4.5–6%

Propose System

In the propose system integration of all the small scale generation is done ie. Distributed generation. The system is proposed are as shown in the diagram

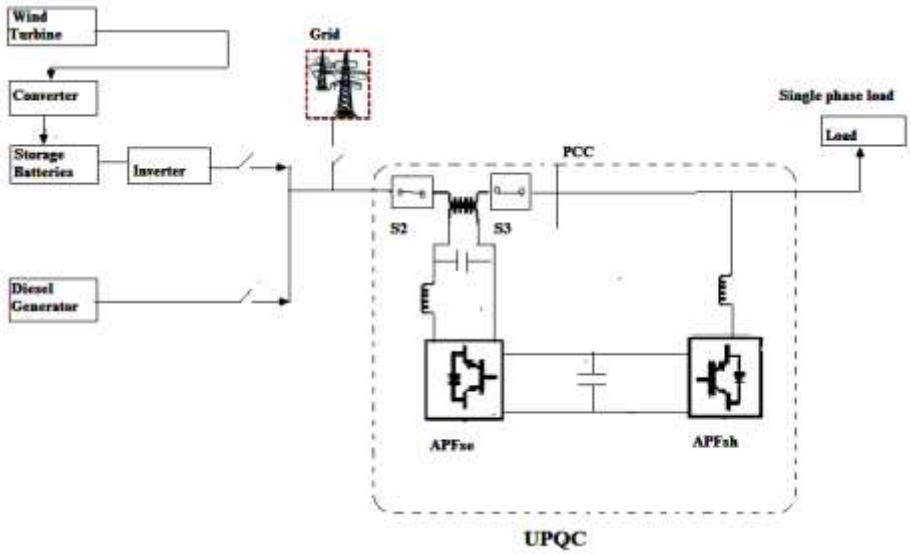

Fig 4.1. Proposed system for hybrid Generation

In today's complex electronics environment many problem scan occur because of poor quality of power. Therefore, it has become necessary to provide a dynamic solution with greater degree of accuracy as well as with fast speed of response. The active power filtering has proven to be one of the best solutions for mitigation of major power quality problems The shunt APF's are utilized to overcome all current related problems, such as current harmonics, reactive current and current unbalance. Whereas, all voltage related problems, such as voltage harmonics, voltage sag and swell, and voltage unbalance, are handled by using the series APF. With the advancement in the field of power electronic devices and control application, it is very common now these days to come across the situation where compensation of both current as well voltage related problems is must. The UPQC, an integration of shunt and series APF is one of the most suitable as well as effective device in this concern. A UPQC tackles both current as well as voltage related power quality problems simultaneously. Recently more attention is being paid on mitigation of voltage sags and swells using UPQC. The common cause of voltage sag and swell is sudden change of line current flowing through the source impedance. This thesis is based on the steady state analysis of UPQC during different operating conditions. The purpose is to maintain sinusoidal source current with unity power factor operation along with load bus voltage regulation. The major concern is the flow of active and reactive power during these conditions, which decide to amount of current flowing through the active filters and through the supply. This analysis can be useful for selection of device ratings.

Conclusion

This study deals with identifying the physical interactions between electricity and gas systems in short term interval. Therefore, an integrated model composed of independent gas and electricity models with failure effect analysis function is developed. The results obtained show us that analyzing two systems in an integrated manner provides us very important details in terms of system vulnerability. The proposed integrated model uses the advantages of including the detailed physics equations of both systems, since more realistic results according to simplified network models can be achieved. In order to construct the integrated model, first an electricity models developed and this model can also be used to analyses the cascading effects of electricity system failures in short term intervals individually. The model includes topological checking and isolation, overloading and voltage collapse analysis and reloading functions together with AC power flow model. Then a hydraulic gas model with compressors is developed and the reloading function is added to the model to further enhance the model capabilities to account for the effects of failures. The last effort carried out is for combining the electricity and gas models in the same software and it is achieved using the MATLAB environment. Different time scales of the systems are also considered to reflect the real situations. The effectiveness of the integrated model has been tested on as amplified integrated network and found that, in terms of computational requirements and quality of the solution, the model proves to be very useful. According to the results in most cases one line failures do not affect neither the system itself nor the other system. Two or more line failure effects are more visible and they can draw the systems to disruptions. Due to physical interactions a failure initially occurring in an electricity system has an effect on the gas system and vice versa. However a very important finding is related with the dynamics of the systems. This is due to the different dynamics of gas and electricity systems involved. For instance, when a failure occurs in the electricity network this will eventually have an effect on the gas system as well. However, due to the slow dynamics of gas system, the cascaded effect created from within the gas system will not be as effective as the internal effects associated within the electricity system.

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