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Hybrid solar/wind micro-grid systems

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Abstract

The primary objective of this paper is to present the design and optimization of a power converter for a hybrid wind-solar energy conversion system with an implementation of Maximum Power Point Tracking (MPPT). The power converter can transfer the power from a wind generator and photovoltaic panel and improve the safety and stability of the hybrid system. This system design consists of Permanent Magnet Synchronous Generator (PMSG), a full wave AC-DC bridge rectifier, a DC-DC boost converter, a bidirectional DC-DC converter, and a full bridge DC-AC inverter. The wind generator and the photovoltaic panel are used as the primary power sources of the system, and a battery is used for energy storage and to compensate for the irregularity of the power sources. This paper also presents the structure of the beginning rectifier stage for the hybrid windsolar energy power conversion system. This structure thereby provides two energy sources simultaneously yet independently, according to their respective availability. The rectifier stage fosters the maximum from wind and solar energy when an adaptive MPPT algorithm is used in the system. The analysis for the system will be discussed in this paper and will give an introduction to the design of the hybrid wind/solar converter circuit.

Around the word a big number of villages may never have access to electricity thanks to their remoteness. For the people living in these isolated communities, access to renewable energy sources is that the only solution to satisfy their energy needs. In these communes the electricity is principally used for household purposes like lighting. One amongst the most problems of such systems, located in isolated areas of inauspicious access, is that the reliability. The coordination protection and operation, distribution network, inverters, control strategies, and maintenance are aspects that have to be designed to urge a reliable system. Furthermore, in these applications the system should have the subsequent features: expansion flexibility and robustness, high efficiency, and adequacy to work in adverse environmental conditions. The results presented during this paper will address these problems with special attention to the control strategies, and system operation. The paper will present experimental results showing the robustness and viability of a pilot renewable hybrid electrical generation system within the Lençóis´s Island, northeast of brazil Even though there are different sorts of combinations of energy sources, the foremost common combination is that the solar photovoltaic and wind turbines. These systems have shown to be adequate for standalone applications in areas of adverse access being accountable for the decreasing or maybe the elimination of diesel usage. In a motivating review of practical applications using hybrid systems is presented. The main reported problems need to do with cost, performance and reliability, and institutional problems. These challenges have required considerable effort to attain small isolated systems that are both economically and technically sustainable. So as to optimize the planning and operation of hybrid systems several articles are published. In the optimal design of a hybrid wind and solar energy system for either autonomous or grid-linked applications is proposed. the strategy employs applied mathematics techniques to reduce the typical cost of electricity while meeting the load requirements during a reliable manner, and takes environmental factors into consideration both within the design and operation phases. In an automatic procedure to perform the optimal sizing of a grid connected Hybrid solar and alternative energy System supported formal logic and multi-objective optimization has been proposed. Both technical and economical objective functions are taken into consideration within the optimization

procedure; the technical objective, associated with system reliability, is expressed by the Energy Index of Reliability. In a support technique to assist decision makers studies the influencing factors within the design of a hybrid solar and wind generation system for grid-linked is presented. In practice, reliability, cost and sustainability factors are strongly linked. Systems with low reliability aren't attractive either for consumers or investors. This ends up in stagnation of the economy in places without voltage. Under this motivation, this paper presents the planning and implementation of a stand-alone hybrid power generation system that meets the subsequent requirements are The system must be robust and operate without the intervention of specialised people, Equipments must be projected to control in a very centralized way and in adverse conditions (marine environment and high tropical temperatures), The system must be projected to be monitored remotely, by using satellite communication service. Standalone micro-grids are associated to remote isolated small communities, some geographically concentrated, other spatially distributed during a given region, with electrical service provided by one or several sources such as: diesel generators, photovoltaic systems, wind micro-turbines, hybrid systems, frequently available only some hours by day. These communities are far away from the standard electrical grid thanks to the subsequent reasons, among others: Natural obstacles, like mountains, rivers, natural reserves; The local weather, geographic location and environmental characteristics of those small isolated demands don't allow the formulation of a singular technical solution for any scenario. Rigorously, each case is its own. Nevertheless, it's possible to spot critical issues with hard impact within the definition of most appropriated solutions for electrical service to a given isolated community. A number of these critical issues are the subsequent Poor communities: small communities with a coffee development index aren't attractive for energy investments. Very low demand is critical for sustainability of electrical service. Usually, governmental actions have subsidized initial investments so as to push economical evolution of those communities and future sustainability of the energy service Weather issues: weather includes sunshine, rain, bad weather, winds, hail, snow, sleet, freezing rain, flooding, blizzards, ice storms, thunderstorms, steady rains from a chilly front or front, excessive heat, heat waves and more. These issues determine what reasonably generating source is more appropriate. Good and regular wind speed is attractive for the exploration of wind energy. Analogously, just in case of fine solar incidence. Hazardous environment: this term is sometimes accustomed define the destructive action of the encompassing environment on a fabric. as an example, exposed structures and components within the marine environment are subjected to many factors causing or conditioning mechanical, physical, chemical, electrochemical and biological breakdowns. This can be the case on islands and coastal areas; the project must consider these issues within the development of the generating system and therefore the maintenance policies likewise

Biography

Akram Abu-aisheh is an Associate Professor of Electrical and Computer Engineering at the University of Hartford. He is a Senior IEEE Member, and he has 10 years of industry experience in the area of fiber optic telecommunication systems and power electronics. His research interests include optical communications and power electronics. He has MS and BS degrees in Electrical Engineering from the University of Florida and a PhD from the Florida Institute of Technology