Imperial Journal of Interdisciplinary Research (IJIR)
Vol-3, Issue-11, 2017
ISSN: 2454-1362, http://www.onlinejournal.in

Hybrid Power Generation System Using Solar and Wind Energy

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Abstract *: Intermittent energy resources and energy resources unbalance are the most important reason to install a hybrid energy supply system. Electric Power generation from solar energy is based on the Photovoltaic Effect.Where photo stands for light and voltaic implies producing voltage.Photovoltaic (PV) systems convert light directly into electricity (using semi-conductor technology). Power generation from wind can be done by convrteting Kinetic Energy of Wind to Mechanical power .*

Introduction

The system components are as follows

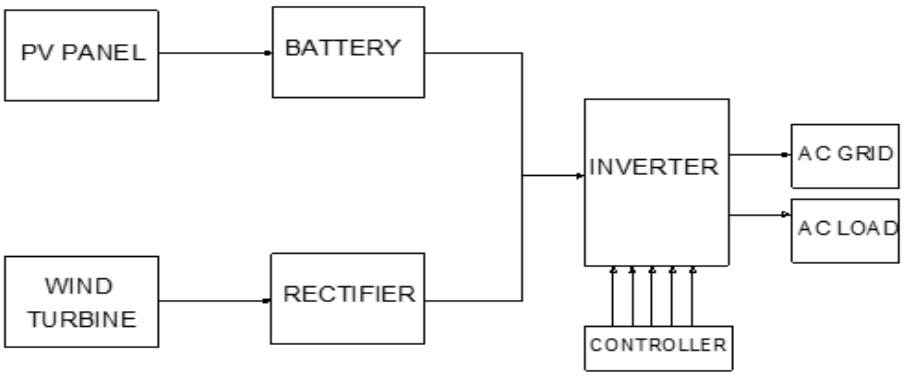

Fig.1 Proposed System Block diagram

1. Major System Components

A) Photovoltaic Panel :

Photovoltaic cells represent the fundamental power conversion units. They are made from semiconductor and convert sunlight to electricity they are made of Cells made from crystal silicon (Si), are made of a thinly sliced piece (wafer). Works on principle of photo electric effect converting sunlight energy into electric energy . Figure 2 shows output characteristic of the PV cell.

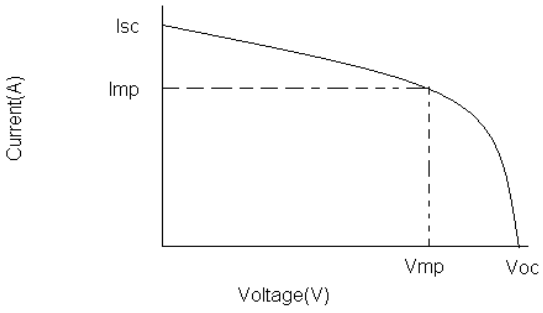

Fig 2 Output Characteristic of PV cell

B) Battery :

The battery plays very important role for both power balance and voltage stability. Batteries

are use to store Dc power produced from PV panel. In order to increase power storage batteries are connected in Series & to have reliable operation batteries are connected in parallel. Solar PV application Valve Regulated Lead-acid battery [VRLAB] batteries are used

C) Rectifier :

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction.it is placed next to Battery. Since Solar power output is DC & load application wise required AC power output can be taken directly through rectifier.

D) Wind Turbine :

Wind turbine works on energy conversion principal of converting Kinetic Energy of Wind into Mechanical Energy. Generator takes wind as input to blades around rotor. The rotor is connected to the main shaft, which spins a generator to create electricity.

E) Inverter :

Inverter is use to convert DC power to AC . The inverter does not produce any power; the power is provided by the DC source. Efficient inverter has the ability to produce regulated AC output with un regulated DC input. Its output can be given to AC grid or AC load.

2. Hybrid Renewable/Alternative Energy Systems Control, Configuration and Applications

This century is expected to witness unprecedented growth and challenges in power generation, delivery, and usage. Environmentally friendly (renewable and clean alternatives) power generation technologies will play an important role in future power supply due to increased global public awareness of the need for environmental protection and desire for less dependence on fossil fuels for energy production. These technologies include power generation from renewable energy (RE) resources, such as wind, photovoltaic (PV),Wind energy system etc.

2.1 Hybrid Energy System Configuration

Renewable energy sources have different operating characteristics; ; it is, therefore, essential to have a well-defined and standardized framework/procedure for connecting them to form a hybrid system, or more widely a microgrid, where a local cluster of distributed generation sources, energy storage, and loads are integrated together and capable of operating autonomously. A robust microgrid should also have “plug-and-play” operation capability.

There are many ways to integrate different renewable energy power generation sources to form a hybrid system. The methods can be generally classified into three categories: dc-coupled, ac-coupled, and hybrid-coupled. .The ac-coupled scheme can further be classified into power frequency ac (PFAC)-coupled and high-frequency ac (HFAC)-coupled systems.

2.1.1 DC-Coupled Systems

In a dc-coupled configuration, shown in Fig. 3 , the different AE sources are connected to a dc bus through appropriate power electronic (PE) interfacing circuits. The dc sources may be connected to the dc bus directly if appropriate. If there are any dc loads, they can also be connected to the dc bus directly, or through dc/dc converters, to achieve appropriate dc voltage for the dc loads. The system can supply power to the ac loads(50or60Hz),or be interfaced to a utility grid through an inverter, which can be designed and controlled to allow bidirectional power flow.

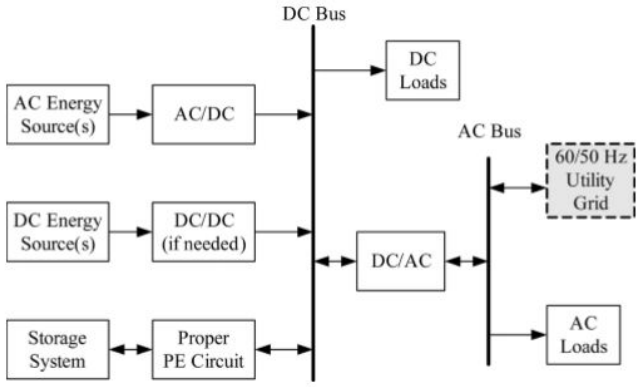

Fig 3 Schematic diagram of a dc-coupled hybrid energy system

2.1.2 AC-Coupled Systems

AC coupling can be divided into two subcategories :PFAC-coupled and HFAC-coupled systems. The schematic of a PFAC-coupled system is shown in Fig.4, where the different energy sources are integrated through their own power electronic interfacing circuits to a power frequency ac bus. Coupling inductors may also be needed between the power electronic circuits and the ac bus to achieve desired power flow management.

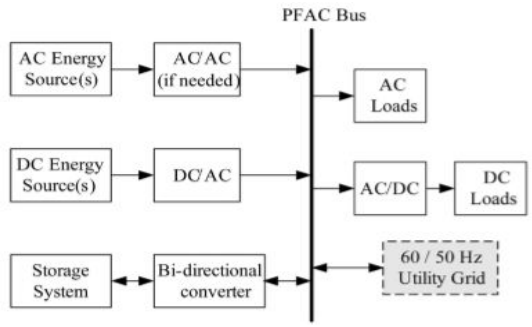

Fig.4 Schematicofac-coupled hybridenergysystem PFAC

Hence With System Configuration System Control is also necessary factor.

3. Centralized Control Paradigm

In a centralized control paradigm, the measurement signals of all energy units in a group, i.e., a microgrid, are sent to a centralized controller, as shown in Fig 4.6 The centralized controller acts as an energy supervisor. and makes decisions on control actions based on all measured signals and a set of predetermined constraints and objectives. It will prioritize and manage energy utilization among the various energy sources of the microgrid.

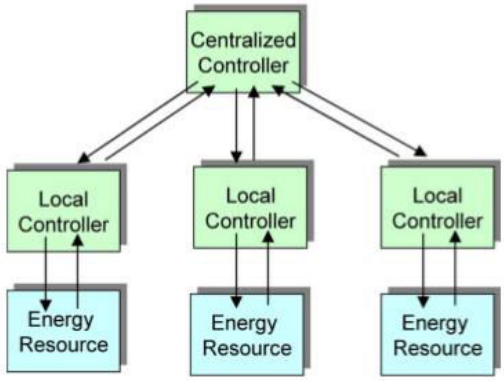

Fig.5 Centralized control paradigm

Conclusion

This paper provides a summary of available power generation sources in which are abundant in nature & approaches and those currently under research for optimal design of hybrid energy systems. Different approaches for system configuration, unit sizing, and control and energy management of hybrid systems are presented. Current status and future trends of renewable Power Generation, the challenges facing the widespread deployment of renewable energysystems, and research vision for the future of renewable power generation technologies have been discussed.

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