

Solar Panel Power System Solution

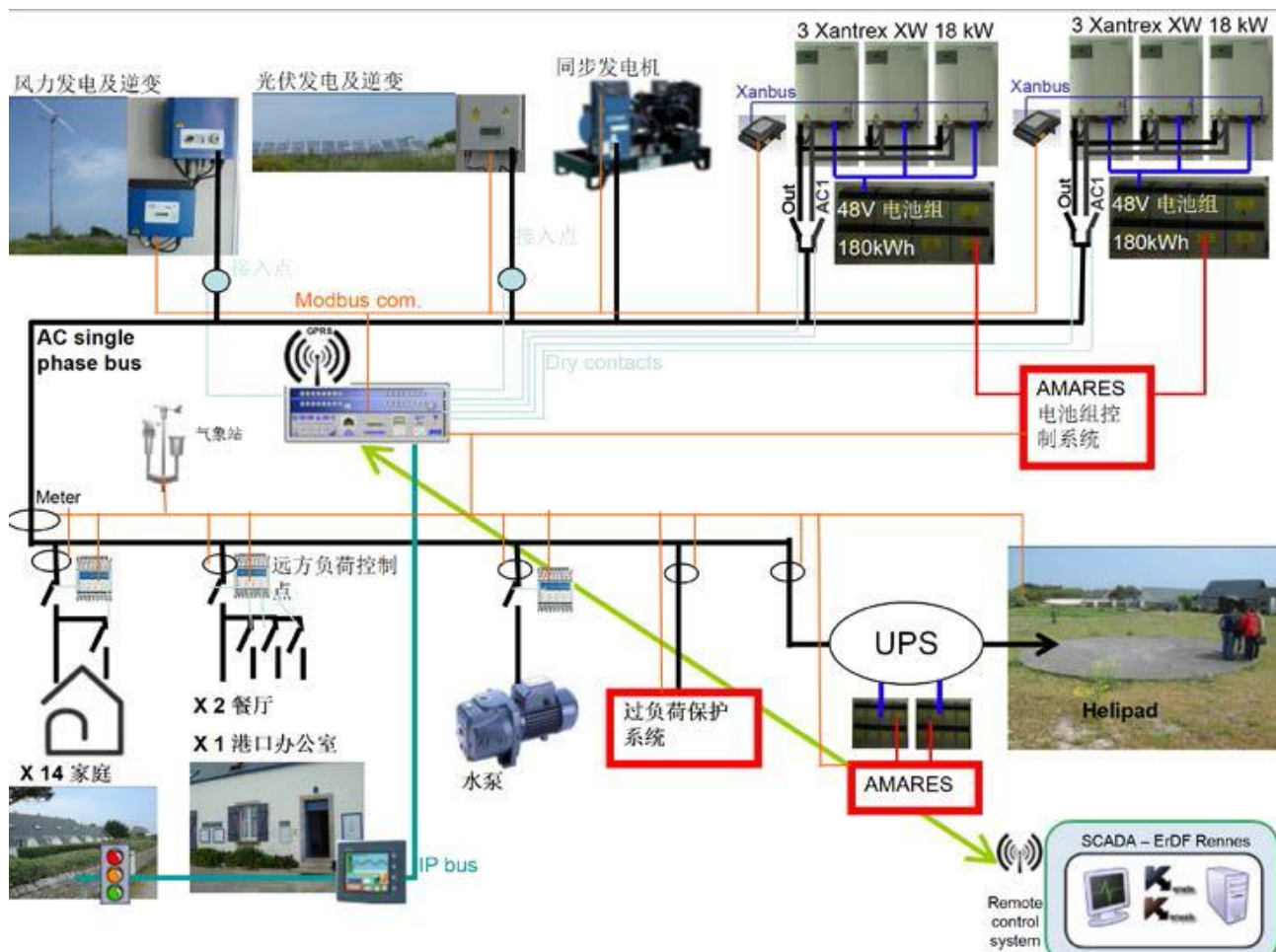


One of the primary needs for socio-economic development in any nation in the world is the provision of reliable electricity supply systems. This work is a development of an indigenous technology hybrid Solar -Wind Power system that harnesses the renewable energies in Sun and Wind to generate electricity. Here, electric DC energies produced from photovoltaic and wind turbine systems are transported to a DC disconnect energy Mix controller. The controller is bidirectional connected to a DC-AC float charging-inverter system that provides charging current to a heavy duty storage bank of Battery and at the same time produces inverted AC power to AC loads.

1. INTRODUCTION

1.1 Importance of Renewable energy

The global search and the rise in the cost of conventional fossil fuel is making supply-demand of electricity product almost impossible especially in some remote areas. Generators which are often used as an alternative to conventional power supply systems are known to be run only during certain hours of the day, and the cost of fueling them is increasingly becoming difficult if they are to be used for commercial purposes. There is a growing awareness that renewable energy such as photovoltaic system and Wind power have an important role to play in order to save the situation.



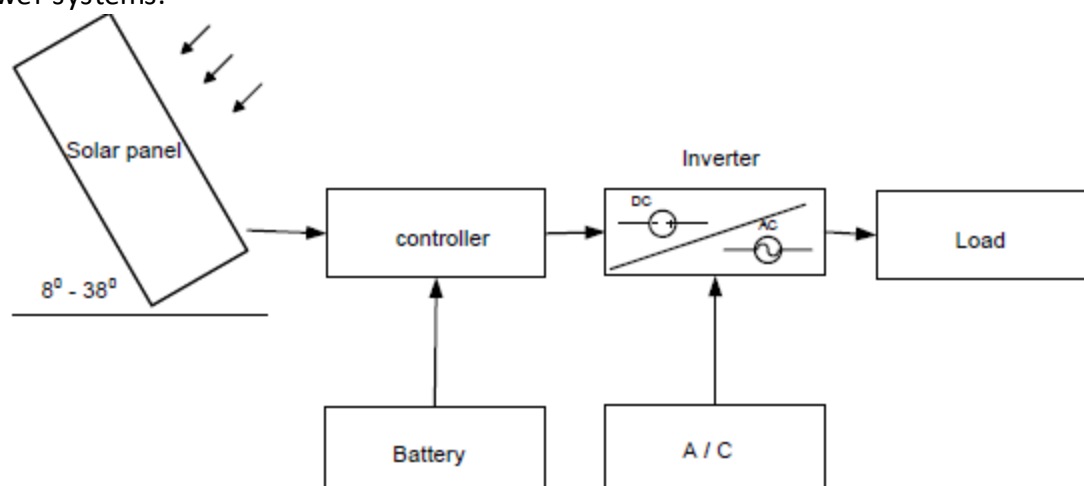
2. SOLAR ENERGY

Solar energy is energy from the Sun. It is renewable, inexhaustible and environmental pollution free. Solar charged battery systems provide power supply for complete 24hours a day irrespective of bad weather. There are two types of solar systems; those that convert solar energy to D.C power, and those that convert solar energy to heat. The Solar-generated electricity is called Photovoltaic (or PV). Photovoltaic are solar cells that convert sunlight to D.C electricity. These solar cells in PV module are made from semiconductor materials. When light energy strikes the cell, electrons are emitted. The electrical conductor attached to the positive and negative scales of the material allow the electrons to be captured in the form of a D.C current. The generated electricity can be used to power a load or can be stored in a battery.

2.1 Basic Components of Solar Power

The major components include P.V modules, battery and inverter. The most efficient way to determine the capacities of these components is to estimate the load to be supplied. The size of the battery bank required will depend on the storage required, the maximum discharge rate, and the minimum temperature at which the batteries will be used . When designing a solar power system, all of these factors are to be taken into consideration when battery size is to be chosen. Lead-acid batteries are the most common in P.V systems because their initial cost is lower and also they are readily available nearly everywhere in the world. Deep cycle batteries are designed to be

repeatedly discharged as much as 80 percent of their capacity and so they are a good choice for power systems.



2.2 Photovoltaic (P.V) Solar Modules

The photovoltaic cell is also referred to as photocell or solar cell. The common photocell is made of silicon, which is one of the most abundant elements on earth, being a primary constituent of sand. A Solar Module is made up of several solar cells designed in weather proof unit. The solar cell is a diode that allows incident light to be absorbed and consequently converted to electricity. The assembling of several modules will give rise to arrays of solar panels whose forms are electrically and physically connected together. To determine the size of PV modules, the required energy consumption must be estimated. Therefore, the PV module size in Wp is calculated.

3 Controllers

The need for Charging Controllers is very important so that overcharging of the batteries can be prevented and controlled.. The controllers to be used required the following features:

- Prevent feedback from the batteries to PV modules
- It should have also a connector for DC loads
- It should have a work mode indicator.

4 Inverter

The inverter are electrical device meant to perform the operation of converting D.C from array or battery to single or three phase A.C signals. For the Systems, the inverter is incorporated with some inbuilt protective devices. These include:

- Automatic switch off if the array output is too high or too low.
- Automatic re-start
- Protecting scheme to take care of short circuit and overloading.

Generally the inverter to be used that would produce the quality output must have the following features

- Overload protections
- Miniature Circuit Breaker Trip Indicator.
- Low - battery protection
- Constant and trickle charging system
- Load status indicator

6 Batteries

As mentioned above, the batteries in use for the systems are the storage batteries, otherwise deep cycle motive type. Various storage are available for use in the system, The batteries are meant to provide backups and when the radiance are low especially in the night hours and cloudy weather.

The battery to be used:

- (a) must be able to withstand several charge and discharge cycle
- (b) must be low self-discharge rate
- (c) must be able to operate with the specified limits.

The battery capacities are dependent on several factors which includes age and temperature.

Batteries are rated in Ampere-hour (Ah) and the sizing depends on the required energy consumption. If the average value of the battery is known, and the average energy consumption per hour is determined.

7 Main components

PV	15kW (250Wp*60pieces)
Controller & Inverter	15KW (off grid single phase)
Batteries	24 pieces 12V 200Ah maintain-free lithium battery

Composition	Model No	Qty	Specification
Solar Panel	MP-250WP	60pieces	Output Power 250W Output Voltage (Vmp) 30.4V Output Current (Imp) 7.18A Open Circuit Voltage (Voc) 37.1V Short Circuit current (Isc) 8.04A System Voltage 1000V Power Tolerance 0/+5% Operating temperature -40°C - +90°C Type of solar cell Monocrystalline No. of solar cell in series 60 pieces Module Size 1650×992×40mm Installation Hole Size 1 390mm,φ9X14mm Installation Hole Size 2 1566mm,φ9X14mm Weight 19.5kg Package 2pieces/box
Solar Controller & Inverter Off Grid Single Phase	PVS1-15KW	1 set	Rated power: 15KW Rated voltage input: 144vdc Rated voltage output: 220Vac Rated frequency output: 50Hz
Battery	12V200AH	24 pieces	12V 200Ah maintain-free lithium battery*24pieces

8 Hybrid Energies Solution for one isolated island or village

