

EE3014-POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS
UNIT I- INTRODUCTION

1.5: QUALITATIVE STUDY OF DIFFERENT RENEWABLE ENERGY RESOURCES:
HYDROGEN ENERGY SYSTEMS AND HYBRID RENEWABLE ENERGY SYSTEMS.

Hydrogen energy

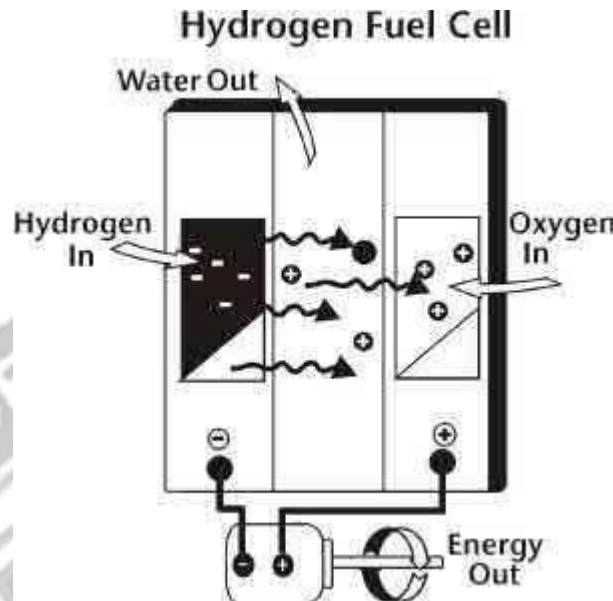
Hydrogen can be considered as a clean energy carrier similar to electricity. Hydrogen can be produced from various domestic resources such as renewable energy and nuclear energy. In the long-term, hydrogen will simultaneously reduce the dependence on foreign oil and the emission of greenhouse gases and other pollutants.

Hydrogen as an Energy Carrier

Hydrogen is considered as a secondary source of energy, commonly referred to as an energy carrier. Energy carriers are used to move, store and deliver energy in a form that can be easily used. Electricity is the most well-known example of an energy carrier. Hydrogen as an important energy carrier in the future has a number of advantages. For example, a large volume of hydrogen can be easily stored in a number of different ways. Hydrogen is also considered as a high efficiency, low polluting fuel that can be used for transportation, heating, and power generation in places where it is difficult to use electricity. In some instances, it is cheaper to ship hydrogen by pipeline than sending electricity over long distances by wire.

Hydrogen Fuel Cell

Fuel cells directly convert the chemical energy in hydrogen to electricity, with pure water and heat as the only byproducts. Hydrogen-powered fuel cells are not only pollution-free, but a two to three fold increase in the efficiency can be experienced when compared to traditional combustion technologies.



Hydrogen Fuel Cell

Fuel cells can power almost any portable devices that normally use batteries. Fuel cells can also power transportation such as vehicles, trucks, buses, and marine vessels, as well as provide auxiliary power to traditional transportation technologies. Hydrogen can play a particularly important role in the future by replacing the imported petroleum we currently use in our cars and trucks.

HYBRID RENEWABLE ENERGY SYSTEMS

Environmentally friendly power generation technologies will play an important role in future power supply. The renewable energy technologies include power generation from renewable energy sources, such as wind, PV(photovoltaic), MH(micro hydro), biomass, ocean wave, geothermal and tides. In general, the key reason for the deployment of the above energy systems are their benefits, such as supply security, reduced carbon emission, improved power quality, reliability and employment opportunity to the local people. Since the renewable energy resources are intermittent in nature therefore, hybrid combinations of two or more power generation technologies, along with storage can improve system performance. Hybrid Renewable Energy System (HRES) combines two or more renewable energy resources with some conventional source (diesel or petrol generator) along with storage, in order to fulfill the

demand of an area. The intensity of the different energy sources into time is not the same. In general, when one of the sources is intensive, the other tends to be extensive, i.e. the sources complement one another. The distribution into time and the intensity of the energy sources depend on the meteorological conditions of the chosen area, on the season, on the relief, etc. The following definition of a hybrid system with renewable energy sources can be suggested. This is a power system, using one renewable and one conventional energy source or more than one renewable with or without conventional energy sources, that works in -stand alone or -grid connected mode.

Hybrid Wind and Solar Electric Systems

A hybrid renewable energy system utilizes two or more energy production methods, usually solar and wind power. The major advantage of solar / wind hybrid system is that when solar and wind power production is used together, the reliability of the system is enhanced. Additionally, the size of battery storage can be reduced slightly as there is less reliance on one method of power production. Often, when there is no sun, there is plenty of wind. It is ideally suited to remote homes, schools and other off-grid applications. They can also be retrofitted to existing diesel-generator systems to save on high fuel costs and minimize noise.

Because the peak operating times for wind and solar systems occur at different times of the day and year, hybrid systems are more likely to produce power when need it. Many hybrid systems are stand-alone systems, which operate "off-grid" -- not connected to an electricity distribution system. For the times when neither the wind nor the solar system are producing, most hybrid systems provide power through batteries and/or an engine generator powered by conventional fuels, such as diesel. If the batteries run low, the engine generator can provide power and recharge the batteries. Adding an engine generator makes the system more complex, but modern electronic controllers can operate these systems automatically. An engine generator can also reduce the size of the other components needed for the system. Keep in mind that the storage capacity must be large enough to supply electrical needs during non-charging periods. Battery banks

are typically sized to supply the electric load for one to three days. Since hybrid systems include both solar and wind power, they allow the power user to benefit from the advantages provided of both forms of energy.



Advantages of Hybrid Energy System

- Reductions in size of diesel engine and battery storage system, which can save the fuel and reduce pollution.
- Improves the load factors and help saving on maintenance and replacement costs.
- The cost of electricity can be reduced by integrating diesel systems with renewable power generation.
- Renewable hybrid energy systems can reduce the cost of high-availability renewable energy systems.

