

HYDROGEN STORAGE - FOR CLEAN, SAFE & EFFICIENT

GREEN ENERGY MANAGEMENT

Primary Energy – PV Solar Energy System

Solar energy is the most readily available source of energy. It does not belong to anybody and is, therefore, free. It is also the most important of the non-conventional sources of energy because it is non-polluting and, therefore, helps in lessening the greenhouse effect.

A typical PV plant absorbs the solar radiation and produces heat which is converted into electricity through a series of photo voltaic panels arranged over fixed or tracking systems. This electricity can be either fed directly to the electricity grid or stored in a storage system to be used as a back-up source. The major impediment to the wide spread utilization of Solar energy is the failure to be source of energy supply 24x7. Due to the variable nature of electricity generation from a PV Plant it is difficult to match the electricity generation and electricity demand from the grid.

The following illustration depicts a typical PV installation



Secondary Energy – Back-up System

We can moderate the Primary System with an efficient back-up energy support system based on alternate renewable energy sources like wind, geothermal, biomass. However the challenge will be integrating these into the PV Plant

Integration of Primary and Secondary Energy Systems – HYBRID SYSTEM

At a certain point in the day during the operation of PV plant we have the highest radiation and too much electricity is generated. This additional energy available from the system can be utilized in an alternate energy system to generate energy which can be utilized as back-up system supplying energy to the grid during the absence of primary energy from the PV Plant. The alternate / hybrid systems available for



Integration with the Primary system is plenty. However the most important Alternate Fuel which is likely to become the clean energy source is HYDROGEN. The easy way of producing Hydrogen gas is by the

Electrolysis of water. This can be used to produce hydrogen, which is stored in a McPhy storage container. The plant can then either convert the hydrogen back to electricity using a fuel cell, feed into a pipeline or transport McPhy's storage container to a hydrogen consumer.

The demand for water can be met through ground water sources or by way of a desalination plant converting the sea water or brackish water into potable water. This potable water can be used for domestic consumption and processing in the electrolyser to produce Hydrogen for back up or industrial application (glass industry, oil & gas industry...)

A PV Plant coupled to a hydrogen production device using renewable energy will solve the intermittent nature of these new energy sources. The targeted applications are electricity production in isolated sites, or peak shaving of electrical networks, with an improved safety and no negative environmental impact (no release of CO₂ or wasted heat).

The following illustration gives a model renewable energy system. The electrolyser can be fed from ground water sources or through a desalination plant.

A TYPICAL PV DESERT SITE PLANT





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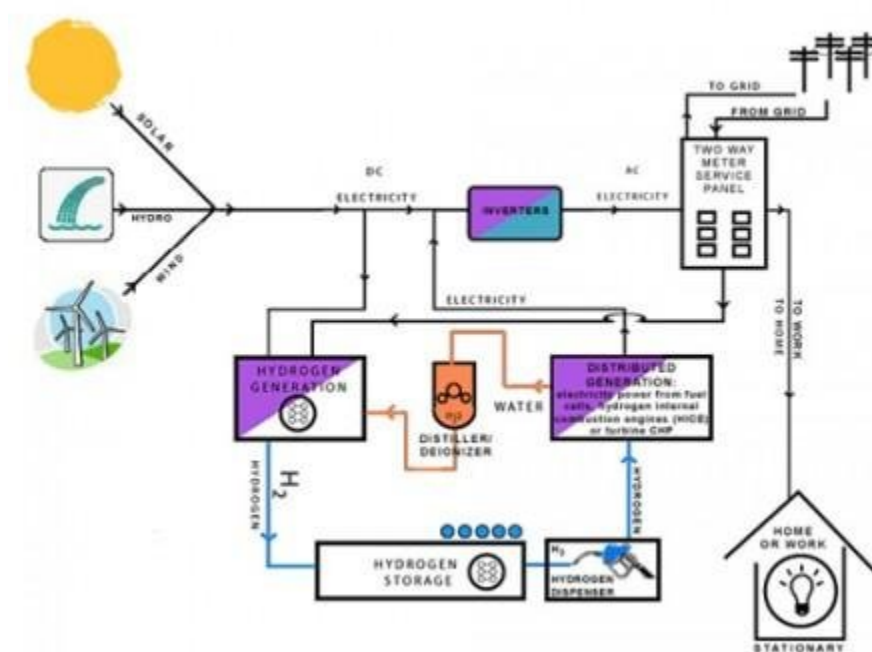
Benefits:

1. reduce the unpredictability of the renewable energies production due to climate conditions,
2. solve the time discrepancy issue between the production (offer) and consumption (demand)
3. can be adapted for kW scale to MW scale plants

Steps

1. Costing for PV Plant
2. Desalination plant – identifying energy efficient technologies
3. Hydrogen generation – identifying energy efficient technologies as alternates to available electrolyzers
4. Hydrogen Storage – Hydride storage system – techno economic studies

Further integration of the renewable energy sources with Hydrogen back up can be illustrated in the following model where in Hydrogen is integrated with various energy sources like Wind and Hydro. Today in countries like Japan, US and Europe Hydrogen is being used for Automobiles, Fuel Cell, Fuel Filling Stations...India has to follow in the coming decade in order to improve the Carbon Foot Print of the country and also to meet the Carbon Emissions cut accepted under KYOTO Protocol.





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Additional information

<http://www.aora-solar.com> – these particular installations could be coupled with the Hydrogen backup systems to create 24x7 energy supplies in villages and remote applications where water is available.