

### **Working Principle- HYDROGEN FUEL CELL**

- A fuel cell is a device that generates electricity (DC) through an electrochemical reaction. In a fuel cell, hydrogen and oxygen are combined to generate electricity, heat and water.
- A fuel cell is composed of an anode, cathode, and an electrolyte membrane. A typical fuel works by passing hydrogen through the anode of a fuel cell and oxygen through the cathode.

#### **At the anode site**

- A catalyst splits the hydrogen molecules into electrons and protons.
- The protons pass through the porous electrolyte membrane, while the electrons are forced through a circuit, generating DC volt and excess heat.

#### **At the cathode site**

- The proton, electrons, and oxygen combine to produce water molecules.
- As there are no moving parts, fuel cell operates silently and with extremely high reliability

### **Case Study**

FUEL CELL INNOVATIVE REMOTE ENERGY SYSTEM FOR TELECOM (FIRST), Maria del Pilar Argumosa, INTA Thomas H. Schucan, IEA Hydrogen Implementing Agreement, 2004.

#### **• General Description of project: -**

➤ Photovoltaic power systems are widely used in telecommunication applications when AC mains are not available due to the remoteness of the location, reliability or safety issues. However, the deployment of solar power systems depends on the amount of available solar radiation. The variability of solar radiation usually requires some form of energy back-up such as batteries or a diesel generator. Alternatively, the use of fuel cells in combination with solar power could improve power availability and system reliability. Two novel approaches for a power supply application in the range of 150 W and an energy consumption of 3.6 kWh/day have been developed and tested within this international and interdisciplinary collaborative project: Showcase 1: PV–Fuel Cell Hybrid System

In this system a fuel cell is deployed with photovoltaics along with batteries for short-term energy storage. Effectively the fuel cell acts as an emergency system for powering the telecoms equipment. Hydrogen is delivered to the system externally. The main advantage of the addition of the fuel cell is that power system availability is increased. With a good maintenance schedule, it is possible to ensure that the telecommunication system will be properly powered with availability very close to 100%. Maintenance requirements compared with the alternative of a conventional diesel generator will be reduced significantly.

#### **Showcase 2: PV system with long term energy storage**

Solar energy excess generated during sunny periods is stored in the form of hydrogen in metal hydrides. The hydrogen is produced by an electrolyze and consumed when required by the fuel cell. This system enables the use of solar power systems in places where operation of conventional back-up systems is not possible or would incur very high costs. The use of solar power increases the system availability while reducing the maintenance costs significantly. This system has the following features:

- It fulfils safety regulations for hydrogen.
- The Advanced Energy System is built inside a compact rack.
- Outdoor telecommunication specifications are fulfilled in terms of temperature and reliability.

Name of some Hydrogen Fuel Cell manufacturer

- a) Bloom energy corporation
- b) Panasonic
- c) Toshiba corporation
- d) Hazer Group Limited
  - e) Nikola corporation
  - f) Robert Bosch GmbH
  - g) Doosan Fuel cell America
  - h) Intelligent energy
  - i) Ceramic fuel cell
  - j) Plug Power Inc.

- ❖ Distributed generated cost from DOE Technical Targets for Hydrogen Production from Electrolysis, Converting \$ into INR. (1\$ = 73.69 Rs, according to October-2020)