



Indigenous Fuel Cell System

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On the occasion of the **Council of Scientific and Industrial Research (CSIR) Foundation Day**, the President of India recently introduced India's **first indigenously developed** high-temperature based **Fuel Cell System**.

- It is developed under the **Public-Private Partnership (PPP)** model by the Council of Scientific and Industrial Research (CSIR) in partnership with Indian industries.
- It is built under India's flagship programme named '**New Millennium Indian Technology Leadership Initiative (NMITLI)**'.

Specifications

- The developed fuel cells are based on **High-Temperature Proton Exchange Membrane (HTPEM)** technology.
- It is a **5.0 kW** fuel cell system that generates power in a green manner.
It takes **methanol or bio-methane as the input** and produces **heat and water** as its bi-products, which can be further used.
- This helps to attain an efficiency that is greater than 70%, which is difficult to achieve by other energy sources.

High-Temperature Proton Exchange Membrane (HTPEM) Technology

- High-Temperature Proton-Exchange-Membrane (HTPEM) is the core of the fuel cells that run above 150 °C. It works on two modes of operation with respect to the **source of fuel**.
- One mode is based on the **conversion of natural gas into Hydrogen** by means of **steam reforming**. This mode is used to fulfill **stationary power** demands.
Steam reforming or **steam methane reforming** is a chemical synthesis process for producing **syngas (hydrogen and carbon monoxide)** from hydrocarbons such as natural gas.

- The second mode is based on the **operation of Hydrogen with Oxygen** obtained by the process of **electrolysis**. This is generally used in the space-related applications.
Electrolysis is a **chemical decomposition process** in which an electric current is passed through a liquid or a solution containing ions.

Council of Scientific and Industrial Research (CSIR)

- CSIR is an autonomous research and development body established by the **Government of India on 26 September 1942**.
- It is established under the **Ministry of Science and Technology**.
- It covers a wide spectrum of science and technology fields from radio and space physics, oceanography, geophysics, chemicals, drugs, genomics, biotechnology, and nanotechnology to mining, aeronautics, instrumentation, environmental engineering, and information technology.

New Millennium Indian Technology Leadership Initiative (NMITLI)

- It is the largest **Public-Private-Partnership** effort within the R&D domain in the country.
- NMITLI seeks to **catalyze innovation** centred **scientific and technological** developments as a vehicle to attain for Indian industry a global leadership position, in selected niche areas. It synergizes the best competencies of publicly funded R&D institutions, academia, and private industry.
- NMITLI has so far evolved 60 largely networked projects in diversified areas viz. Agriculture & Plant Biotechnology, General Biotechnology, Bioinformatics, Drugs & Pharmaceuticals, Chemicals, Materials, Information and Communication Technology, and Energy.

Applications

- This fuel system is most suitable to fulfil **distributed stationary power applications** demands like in small offices, commercial units, data centres, etc. **where highly reliable power is essential** with simultaneous requirement for air-conditioning.
- This system will meet the **requirement of efficient, clean and reliable backup power generators** that are demanded by telecom towers, remote locations, and strategic applications.
- The Fuel Cells fit well in India's mission of replacing **Diesel based Generating (DG) sets** with the green and alternate fuels.
This development is therefore expected to **reduce India's dependence on crude oil**.
- The technology has placed India in the league of developed nations which are in possession of such a knowledge base.

Way Forward

- In the field of clean energy, Fuel Cell distributed power generation systems are emerging as a promising **alternative to grid power**.
- The development of indigenous fuel cell technology carries immense national importance in terms of **energy security**.

Source: PIB