



# ISRO Tests Polymer Electrolyte Membrane Fuel Cell

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## Why in News?

The [Indian Space Research Organisation \(ISRO\)](#) successfully tested a **100 W class Polymer Electrolyte Membrane Fuel Cell (PEMFC) based Power System** aboard the orbital platform, **POEM3**.

## What are the Major Takaways from the Recent PEMFC Test?

- **Technology Tested:** ISRO tested a **100-watt class PEMFC**, which **converts hydrogen and oxygen into electricity, water, and heat**. This technology offers several advantages over traditional power sources in space, including:
  - **High Efficiency:** PEMFCs **convert fuel directly into electricity**, resulting in significantly higher efficiency compared to batteries.
  - **Clean Operation:** PEMFCs **produce only water as a byproduct**, eliminating the need for complex waste management systems.
    - The water produced by the PEMFC can be used for onboard consumption or for electrolysis to generate additional oxygen.
- **Test Platform:** The PEMFC was tested In orbital platform, **POEM3**, launched aboard **PSLV-C58** on 1<sup>st</sup> January, 2024.
  - POEM3 serves as a platform for testing new technologies in space under real-world conditions.
- **Implications for Future Missions:** The successful test of the PEMFC paves the way for several exciting possibilities for future space missions:
  - **Powering the Indian Space Station:** The high efficiency and water production capabilities of PEMFCs make them **ideal for powering the proposed Indian space station**.
  - **Deep Space Exploration:** PEMFCs can provide **a reliable and sustainable source of power** for long-duration missions to deep space destinations like Mars.

## Note

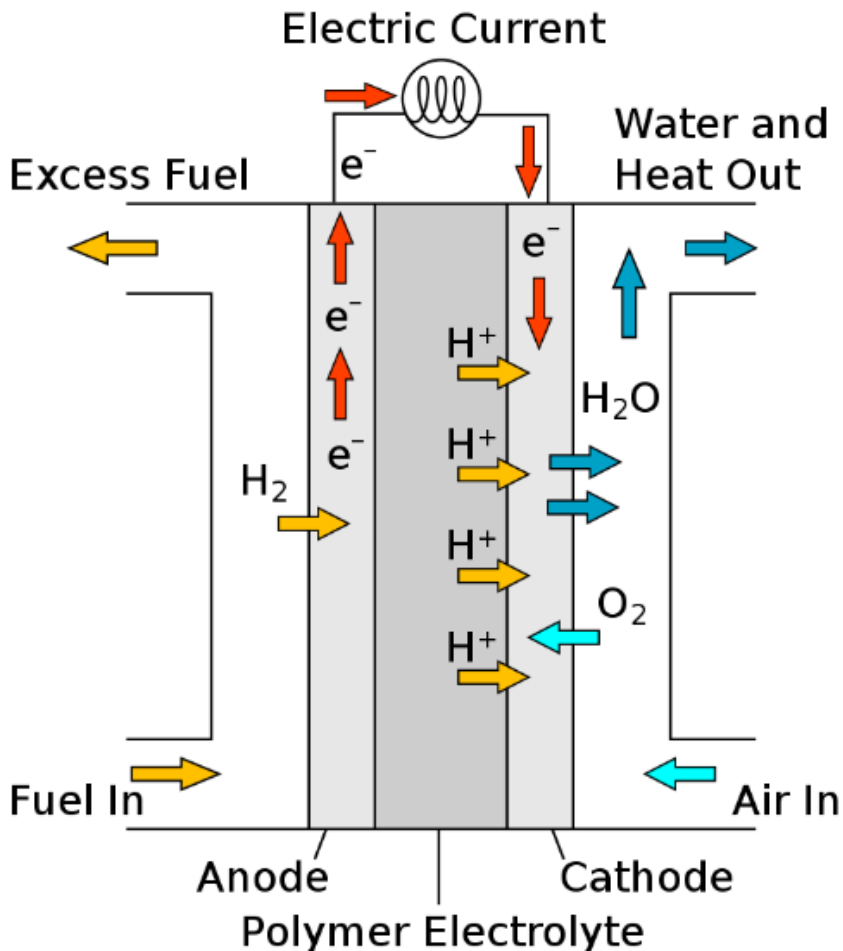
ISRO also noted that it has qualified **10 Ah Silicon-Graphite anode based high energy density Li-ion cells** as a low weight and low cost alternative to present cells being used.

## What is a Fuel Cell?

- **About:** A **fuel cell** is an **electrochemical device** that converts the chemical energy of a **fuel (like hydrogen) and an oxidant (like oxygen)** directly into electricity.
  - Unlike batteries, which store chemical energy that gets converted to electrical energy, fuel cells continuously **produce electricity as long as they are supplied with fuel and oxidant**.
- **Major Types of Fuel Cells:**

- **Polymer Electrolyte Membrane Fuel Cells:** They use a **thin, solid polymer membrane as the electrolyte** and are well-suited for portable applications.
- **Solid Oxide Fuel Cells (SOFCs):** SOFCs use a **ceramic electrolyte** that can operate at high temperatures. They are highly efficient but are more expensive and complex than PEMFCs.
- **Alkaline Fuel Cells (AFCs):** AFCs use a **liquid electrolyte made of potassium hydroxide (KOH)**. They are less efficient than PEMFCs and SOFCs but are less expensive and can be more tolerant of impurities in the fuel.

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▪ **Applications of Fuel Cells:**

- **Transportation:** Fuel cells can be used to power electric vehicles, **boats**, and **even airplanes**.
  - Fuel cells can also power space missions, providing electrical power for spacecraft, and a dependable energy source for long-duration missions.
  - Highly efficient with zero emissions, making them ideal for space missions
- **Portable Power:** Fuel cells can be used to power laptop computers, cell phones, and other portable devices.
- **Stationary Power:** Fuel cells can be used to power homes, businesses, and even entire cities.

**UPSC Civil Services Examination Previous Year Question (PYQ)**

**Q. Hydrogen fuel cell vehicles produce one of the following as “exhaust” (2010)**

- (a)  $NH_3$
- (b)  $CH_4$
- (c)  $H_2O$

(d)  $\text{H}_2\text{O}_2$

Ans: (c)

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