SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade

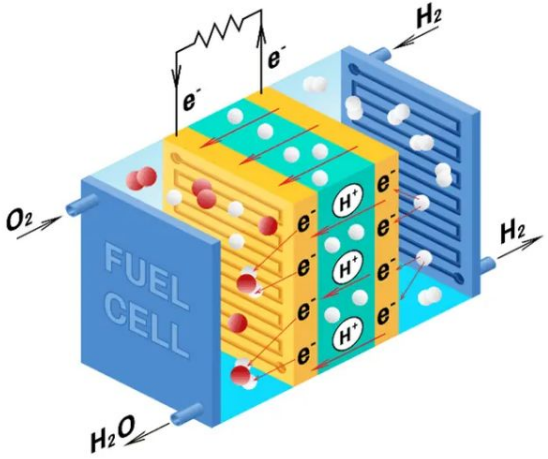
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

UNIT III: REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES

TOPIC: **Fuel Cell based energy storage and its analysis**

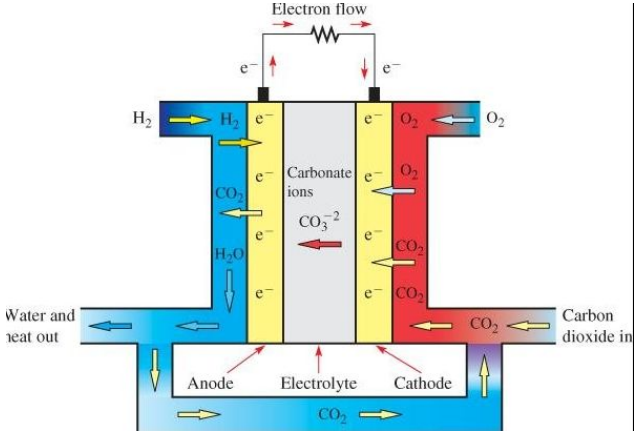
Introduction

- Define **Fuel Cell**: An electrochemical device that converts chemical energy into electrical energy.
- Importance of energy storage in renewable energy systems.
- Role of fuel cells in modern energy solutions.



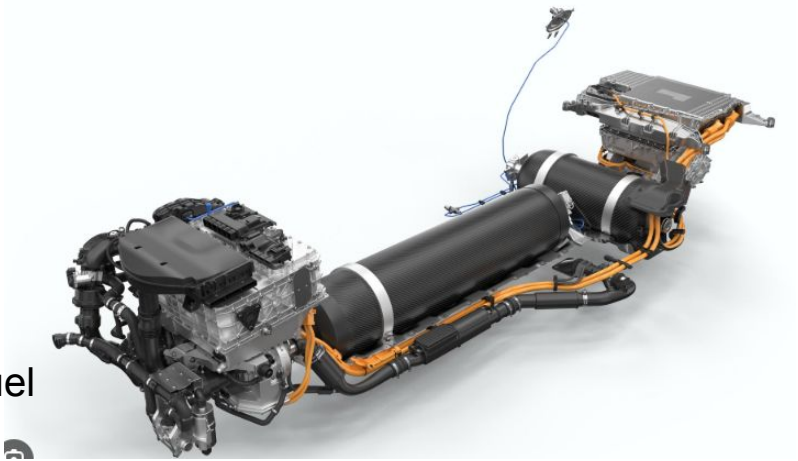
Working Principle of Fuel Cells

- Diagram of a typical fuel cell.
- Explanation:
  - **Anode**: Oxidation of fuel (e.g., hydrogen).
  - **Cathode**: Reduction of oxygen.
  - **Electrolyte**: Facilitates ion movement.
- Highlight efficiency and zero-emission operation.



Types of Fuel Cells

- **Proton Exchange Membrane Fuel Cell (PEMFC)**
- **Solid Oxide Fuel Cell (SOFC)**
- **Alkaline Fuel Cell (AFC)**
- **Molten Carbonate Fuel Cell (MCFC)**
- Comparison table: Operating temperature, fuel type, and applications.



Applications of Fuel Cell-Based Energy Storage

- Stationary power (grid backup, remote areas).
- Portable power (laptops, smartphones).
- Transportation (fuel cell vehicles).
- Industrial applications.

Advantages of Fuel Cell Energy Storage

- High efficiency.
- Low environmental impact.
- Scalability for various applications.
- Potential for energy independence.

Recent Advancements and Innovations

- Research on alternative fuels (e.g., ammonia).
- Integration with renewable energy sources.
- Hybrid energy storage systems (fuel cells + batteries).

Challenges and Limitations

- High initial costs.
- Hydrogen storage and distribution issues.
- Durability and lifetime.
- Technological maturity and market adoption.

Performance Analysis

- Key performance metrics:
  - Efficiency.
  - Energy density.
  - Power output.
- Comparison with other storage technologies (batteries, flywheels, etc.).
- Graphs or tables to illustrate analysis

Environmental Impact Analysis

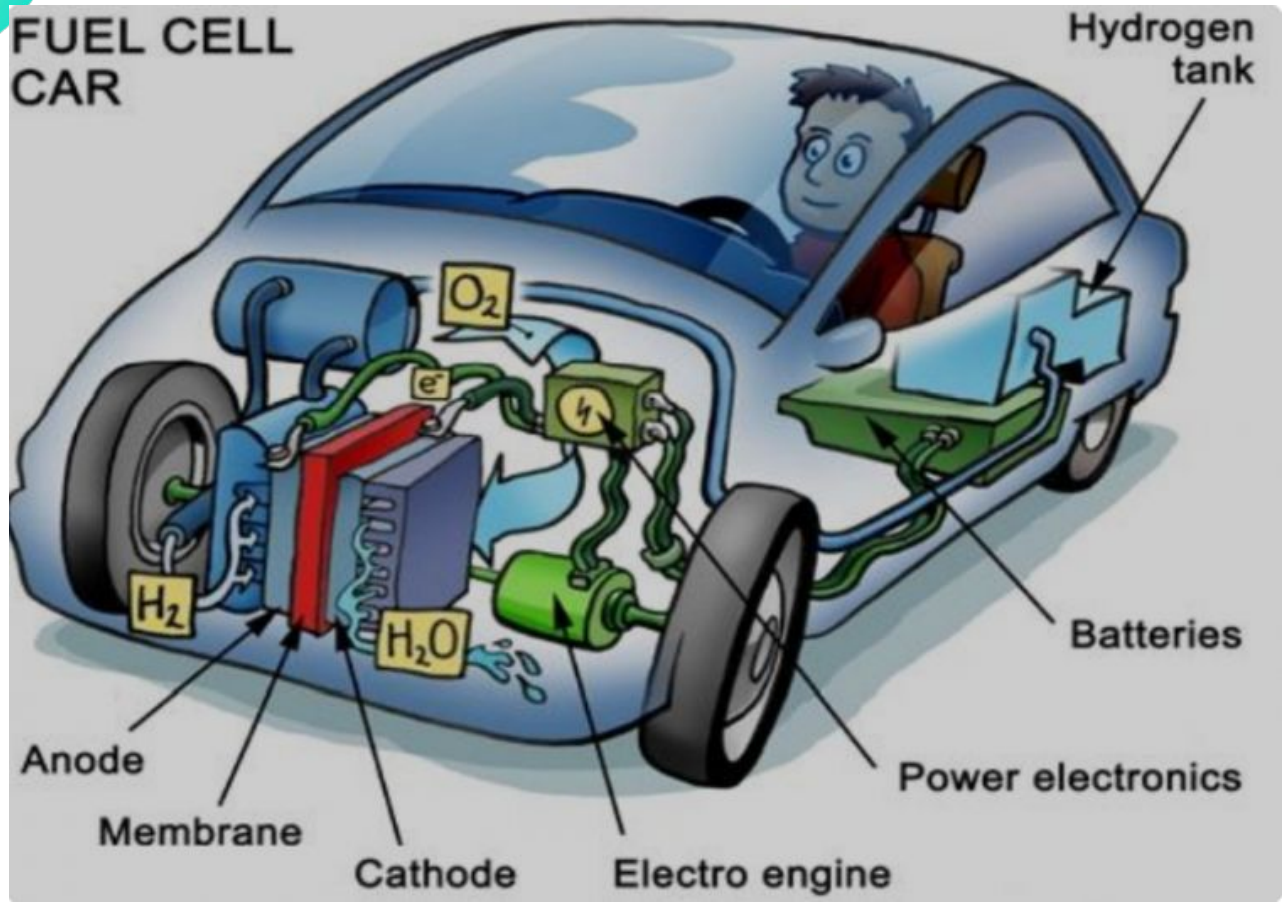
- Emissions comparison with fossil fuel technologies.
- Lifecycle assessment of fuel cells.
- Contribution to achieving net-zero carbon goals.

Future Prospects

- Trends in fuel cell technology adoption.
- Potential breakthroughs in hydrogen production (e.g., electrolysis).
- Policy and incentives promoting fuel cells.

Conclusion

- Summary of the key points discussed.
- Fuel cells as a promising solution for sustainable energy storage.
- Challenges to overcome for large-scale implementation.


FUEL CELL CAR
Hydrogen tank
O_2
e^-
H_2
H_2O
Batteries
Anode
Membrane
Cathode
Electro engine
Power electronics

…THANK YOU