

Comparison of Fuel Cell Technologies

Fuel Cell Type	Common Electrolyte	Operating Temperature	Typical Stack Size	Efficiency	Applications	Advantages	Disadvantages
Polymer Electrolyte Membrane (PEM)	Perfluoro sulfonic acid	50-100°C 122-212° typically 80°C	< 1kW-100kW	60% transportation 35% stationary	<ul style="list-style-type: none"> • Backup power • Portable power • Distributed generation • Transportation • Specialty vehicles 	<ul style="list-style-type: none"> • Solid electrolyte reduces corrosion & electrolyte management problems • Low temperature • Quick start-up 	<ul style="list-style-type: none"> • Expensive catalysts • Sensitive to fuel impurities • Low temperature waste heat
Alkaline (AFC)	Aqueous solution of potassium hydroxide soaked in a matrix	90-100°C 194-212°F	10-100 kW	60%	<ul style="list-style-type: none"> • Military • Space 	<ul style="list-style-type: none"> • Cathode reaction faster in alkaline electrolyte, leads to high performance • Low cost components 	<ul style="list-style-type: none"> • Sensitive to CO₂ in fuel and air • Electrolyte management
Phosphoric Acid (PAFC)	Phosphoric acid soaked in a matrix	150-200°C 302-392°F	400 kW 100 kW module	40%	<ul style="list-style-type: none"> • Distributed generation 	<ul style="list-style-type: none"> • Higher temperature enables CHP • Increased tolerance to fuel impurities 	<ul style="list-style-type: none"> • Pt catalyst • Long start up time • Low current and power
Molten Carbonate (MCFC)	Solution of lithium, sodium, and/or potassium carbonates, soaked in a matrix	600-700°C 1112-1292°F	300 kW-3 MW 300 kW module	45-50%	<ul style="list-style-type: none"> • Electric utility • Distributed generation 	<ul style="list-style-type: none"> • High efficiency • Fuel flexibility • Can use a variety of catalysts • Suitable for CHP 	<ul style="list-style-type: none"> • High temperature corrosion and breakdown of cell components • Long start up time • Low power density
Solid Oxide (SOFC)	Yttria stabilized zirconia	700-1000°C 1202-1832°F	1 kW-2 MW	60%	<ul style="list-style-type: none"> • Auxiliary power • Electric utility • Distributed generation 	<ul style="list-style-type: none"> • High efficiency • Fuel flexibility • Can use a variety of catalysts • Solid electrolyte • Suitable for CHP & CHHP • Hybrid/GT cycle 	<ul style="list-style-type: none"> • High temperature corrosion and breakdown of cell components • High temperature operation requires long start up time and limits

For More Information

More information on the Fuel Cell Technologies Program is available at <http://www.hydrogenandfuelcells.energy.gov>.