

Fuel Cell Type	Common Electrolyte	Operating Temperature	Typical Stack Size	Electrical Efficiency (LHV)	Applications	Advantages	Challenges
Polymer Electrolyte Membrane (PEM)	Perfluorosulfonic acid	<120°C	< 1 - 100 kW	60% direct H ₂ ; 40% reformed fuel	<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 and load following 	<ul style="list-style-type: none"> • Expensive catalysts • Sensitive to fuel impurities
Alkaline (AFC)	Aqueous potassium hydroxide soaked in a porous matrix, or alkaline polymer membrane	<100°C	1 - 100 kW	60%	<ul style="list-style-type: none"> • Military • Space • Backup power • Transportation 	<ul style="list-style-type: none"> • Wider range of stable materials allows lower cost components • Low temperature • Quick start-up 	<ul style="list-style-type: none"> • Sensitive to CO₂ in fuel and air • Electrolyte management (aqueous) • Electrolyte conductivity (polymer)
Phosphoric Acid (PAFC)	Phosphoric acid soaked in a porous matrix or imbibed in a polymer membrane	150 - 200°C	5 - 400 kW, 100 kW module (liquid PAFC);	40%	<ul style="list-style-type: none"> • Distributed generation 	<ul style="list-style-type: none"> • Suitable for CHP • Increased tolerance to fuel impurities 	<ul style="list-style-type: none"> • Expensive catalysts • Long start-up time • Sulfur sensitivity
Molten Carbonate (MCFC)	Molten lithium, sodium, and/or potassium carbonates, soaked in a porous matrix	600 - 700°C	300 kW - 3 MW, 300 kW module	50%	<ul style="list-style-type: none"> • Electric utility • Distributed generation 	<ul style="list-style-type: none"> • High efficiency • Fuel flexibility • Suitable for CHP • Hybrid/gas turbine cycle 	<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	500 - 1000°C	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 • Solid electrolyte • Suitable for CHP • Hybrid/gas turbine cycle 	<ul style="list-style-type: none"> • High temperature corrosion and breakdown of cell components • Long start-up time • Limited number of shutdowns