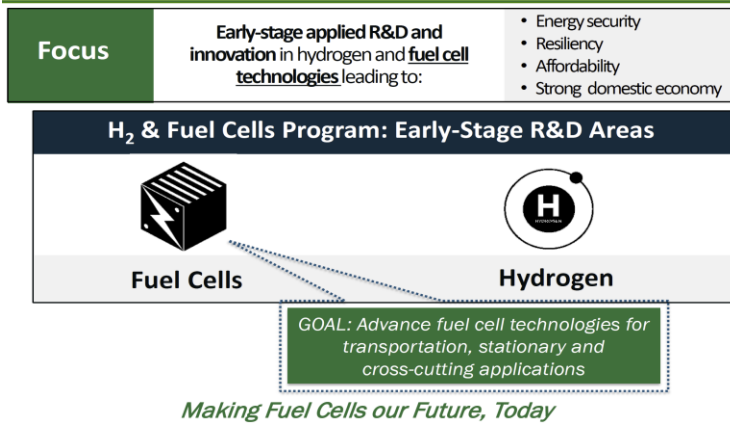


Research:

Fuel Cells: Pillar of H₂ & Fuel Cell Technologies R&D





Objectives and Targets

1. R&D to enable a direct hydrogen fuel cell power system for transportation competitive with incumbent and alternative technologies on a lifecycle cost basis
 2. R&D of efficient, resilient and affordable fuel cell systems for distributed power generation (primary, back up, CHP)
 3. Enable fuel cell technology advancements for cross-cutting applications (e.g. APUs, rail, material handling)
- Fuel Cells MYRD&D Plan**

http://energy.gov/eere/fuelcells/downloads/fuel_cell_technologies_office_multi_year_research_development_and_22

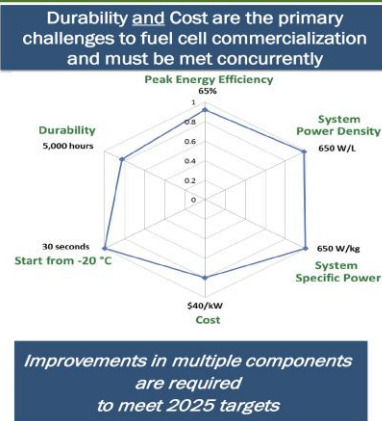
2025 Targets by Application

	Automotive	Stationary
		
Fuel Cell Cost	\$40/kW \$30/kW*	\$1,000/kW** \$1,500/kW***
Durability	5,000 hrs 8,000 hrs*	80,000 hrs
Efficiency	65%	50% † 90% ‡

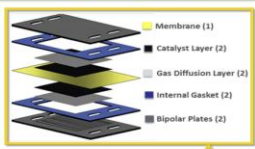
* Ultimate (Beyond 2030) ** For Natural Gas
 *** For Biogas
 † Electrical
 ‡ CHP


Market-driven targets allow fuel cells to compete with incumbent and advanced alternative technologies

Challenges and Strategy




Early-stage materials and components R&D to achieve low-cost, high-performance fuel cell systems





Fuel Cell Car



Fuel Cell Stack

R&D portfolio focused on PEMFCs, but also includes longer-term technologies (e.g. AEMFCs) & higher temp fuel cells (e.g. MCFCs) for stationary applications