

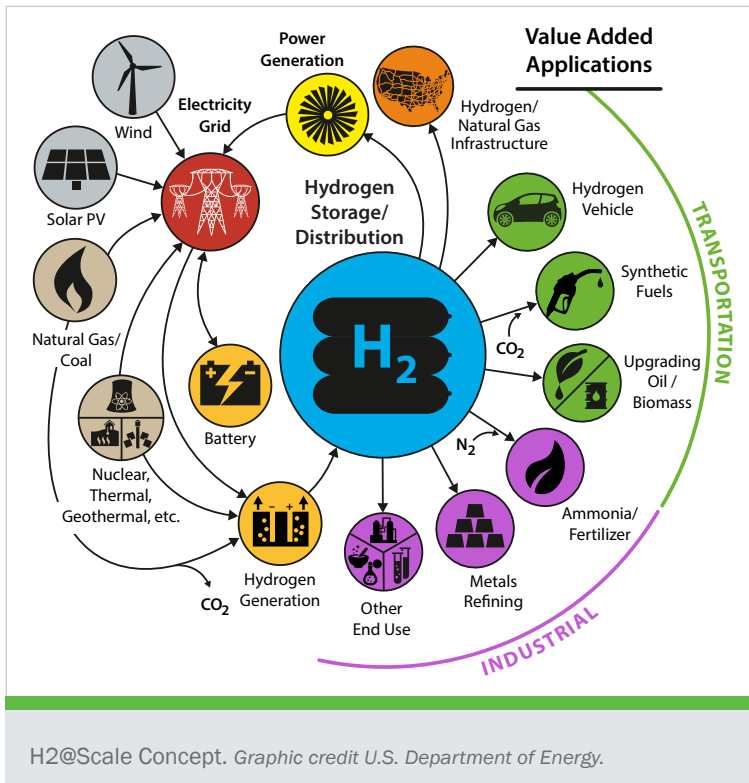
U.S. Department of Energy's Fuel Cell Technologies Office

The Fuel Cell Technologies Office (FCTO) focuses on early-stage research and development (R&D) to advance hydrogen and fuel cells for transportation and diverse applications that contribute to U.S. energy independence, security and resiliency, and add to a strong domestic economy.

Office Highlights

FCTO strengthens U.S. energy independence and security through cutting-edge technology R&D.

- Hydrogen can be produced from diverse domestic resources, such as natural gas, oil, coal, and biomass, as well as from water splitting using any form of electricity.
- Fuel cell electric vehicles using hydrogen can achieve significantly higher efficiencies than combustion engines, and domestically produced hydrogen enables energy independence.
- Stationary hydrogen and fuel cell technologies can also improve energy security and reliability providing responsive back-up power and other electric and fuel distribution services.



- The H2@Scale concept lays a framework for the potential wide-scale production and utilization of hydrogen to address key issues such as grid resiliency and energy security by generating hydrogen when power generation exceeds load for multiple applications across sectors.

FCTO focuses on early-stage R&D – projects include:

- Hydrogen production, delivery and storage R&D to achieve \$4/gasoline gallon equivalent (gge), including advanced water-splitting and materials for storage and delivery.
- Platinum-free catalysts, innovative membranes and electrodes for breakthroughs in fuel cell cost to achieve \$40/kW and 5,000 hour targets.
- Materials R&D for components to enable H2@Scale (liners, pipeline, infrastructure components etc.) and advanced liquefaction.
- Technical analysis to inform FCTO R&D strategies and prioritization.

Major Accomplishments

FCTO R&D makes cutting-edge technology advances.

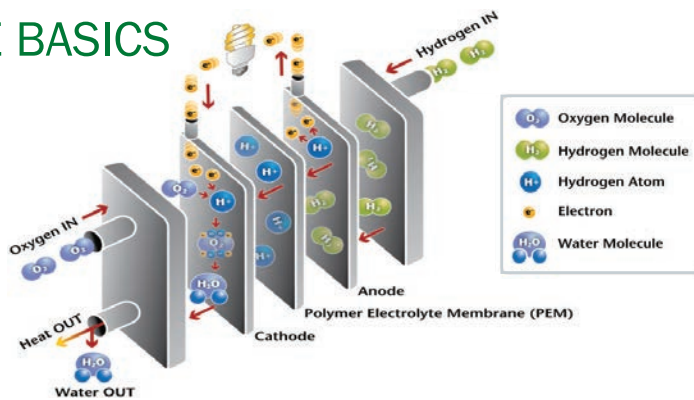
- FCTO funding enabled a 5-fold reduction in platinum based catalyst and a 60% reduction in automotive fuel cell cost since 2006, to roughly \$50 per kilowatt (/kW) when projected to 100,000 units per year manufacturing volumes.
- Fuel cell durability has been quadrupled since 2006 to 120,000 miles.
- FCTO cost-shared efforts enabled the world's first tri-generation station using natural gas or waste to co-produce power, heat and hydrogen fuel.
- FCTO reduced hydrogen production costs and cut electrolyzer stack costs by 80% in the last decade.
- FCTO continues to achieve world record breaking energy material performance through its laboratory led consortia for materials discovery and developed the H2@Scale initiative.



Honda Clarity, Hyundai Tucson, and Toyota Mirai. Photo credit Honda, Hyundai, and Toyota.

FUEL CELLS INTRODUCTION

THE BASICS



HIGHLIGHTS

- » **Electricity** produced **directly**
- » **No combustion** involved
- » **No pollution** from tailpipe
- » **Water and Heat** only byproducts

IN CARS: >2X as efficient as today's gasoline engine



JOB POTENTIAL



Today

Approximately

16,000 jobs

in the fuel cell car sector

Source: DOE, U.S. Energy and Employment Report (2017)



Future

More than

200,000 jobs

from future fuel cell car sector

Under a 20% market penetration scenario.
Sources: Preliminary results from employment study update (ANL)

U.S. DEPARTMENT OF
ENERGY

Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**

For more information, visit:
energy.gov/eere/fuelcells

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