

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

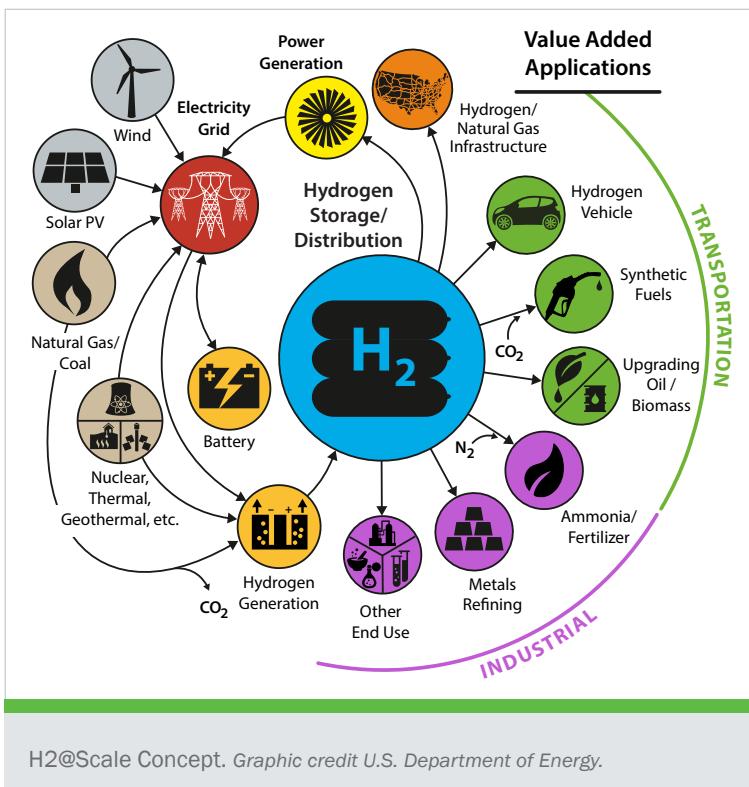
The Fuel Cell Technologies Office (FCTO) focuses on early-stage research and development (R&D) to advance hydrogen and fuel cells for transportation and diverse applications that contribute to U.S. energy independence, security and resiliency, and add to a strong domestic economy.



### 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.

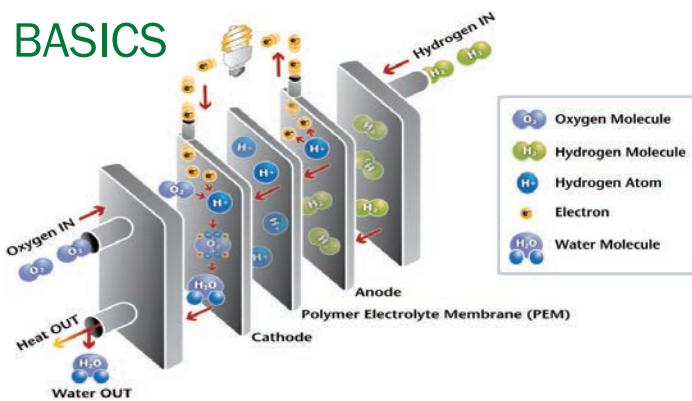
- FCTO funding enabled a 5-fold reduction in platinum based catalyst and a 60% reduction in automotive fuel cell cost since 2006, to roughly \$50 per kilowatt (/kW) when projected to 100,000 units per year manufacturing volumes.
- Fuel cell durability has been quadrupled since 2006 to 120,000 miles.
- 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



>60 MPG  
Fuel Cell

VS

<30 MPG  
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**

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**ENERGY EFFICIENCY &  
RENEWABLE ENERGY**

For more information, visit:  
[energy.gov/eere/fuelcells](http://energy.gov/eere/fuelcells)