U.S. Department of Energy’s Transportation and Hydrogen and Fuel Cell Perspectives

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NASEO 2020 Energy Policy Outlook Conference and Innovation Summit
February 7, 2020
Transportation Sector and DOE Activities

Transportation sector uses 30 Quads of energy.

~ 1/3 of all energy used in the US.

Transportation is the 2nd largest expense for U.S. households.

Transportation is the largest source of CO₂.

17 National Laboratories

$700m/year in Transportation Research

World-class capabilities:
- High Performance Computing
- Artificial Intelligence
- Tools and Modeling

Driving Innovation:
- Reduced cost of batteries by 80%
NEW TECHNOLOGIES & BUSINESS MODELS ARE DRIVING DISRUPTION
Vehicle Technologies ($396M)
- Electrification
- Combustion engines
- Low cost lightweight materials
- New mobility & transportation systems

H2 & Fuel Cell Technologies ($150M)
- Hydrogen production (e.g. electrolysis), storage
- Fuel cell systems
- H2@Scale

Bioenergy Technologies ($259M)
- Biofuels and bioproducts
- New products, fuels, and chemicals from waste
- Energy crops
Clean Cities Coalitions

Promote alternative fuel and advanced vehicle technologies through educational outreach

Speed adoption through strategic deployment efforts

Facilitate change by localizing policies and resources

Share best practices through stakeholder collaboration

Light, Medium & Heavy-duty Vehicles

Alternative Fuel Infrastructure

Connectivity and Automation
Clean Cities Coalitions

Nearly 100 Clean Cities coalitions with thousands of stakeholders, representing ~80% of U.S. population

Clean City Coalition Results

- Since 1993, cumulative energy impact of Clean Cities coalition activities surpassed 9.8 billion GGEs through alternative fuel use, fuel economy improvements, idle-reduction measures, and other strategies.
- In 2018, nearly 1 million of the AFVs in operation were a result of Clean Cities coalition efforts.
- Coalitions leveraged nearly $7 of project funding for every $1 directed to coalitions by DOE.
Snapshot of Hydrogen and Fuel Cells Applications in the United States

Examples of Applications

- **>500MW**
  - Stationary Power

- **>28,000**
  - Forklifts

- **>30**
  - Fuel Cell Buses

- **>45**
  - H₂ Retail Stations

- **>8,000**
  - Fuel Cell Cars

Examples of stationary fuel cell installations

- **Over 8,000 stationary units** include telecom/cell phone towers

Hydrogen Stations: Examples of Plans Across States

- **California**
  - 200 stations planned
  - CAFCP goal, 1000

- **Northeast**
  - 12 – 20 stations planned

- **HI, OH, SC, NY, CT, MA, CO, UT, TX, MI, and others** with interest
H2@Scale: Enabling Affordable, Reliable, Clean, & Secure Energy Across Sectors

Conventional Storage

Hydrogen and Fuel Cell Program Budget (FY 2019): $150M

H2@Scale demonstration projects just awarded in Texas, Illinois and Florida
Nearly $300M in Funding Announced

• Hydrogen and Fuel Cells - $64M (DE-FOA-0002229)
  – Concept papers due Feb 25; full applications due April 20.
  – 6 Topics from electrolyzer manufacturing; carbon fiber for compressed gas tanks; fuel cells and membranes for heavy duty applications; new markets for hydrogen (e.g. steel production); demonstrations for emerging applications (e.g. maritime, data centers), and workforce and training development).

• Vehicles - $133M (DE-FOA-0002197)
  – Concept papers due Feb 21; full applications due April 14.
  – 16 topics from advanced batteries and electrification in support of the recently-announced DOE Energy Storage Grand Challenge; advanced engine and fuel technologies, including technologies for off-road applications and alternative fueled engines; lightweight materials; new mobility technologies and alternative fuels technology demonstrations).

• Bioenergy - $96M (DE-FOA-0002203)
  – Concept papers due March 5; full applications due April 30
  – 7 topics from Scale up of Bench Applications to Biomass to Plastics Recycling to Restore Natural Resources to Scalable CO2 Electrolysis).
EMERGING FEEDSTOCKS (+traditional)

POTENTIALLY LOW-COST CARBON RESOURCES

- **Economically Advantageous Feedstocks**
  - **Gaseous Wastes:** CO and CO₂
  - **Wet Wastes:** Biosolids, Food Wastes, Manures
  - **Solid Wastes:** Sorted Municipal Solid Waste including Plastics

**Wet Wastes**
- Biosolids
- Food Wastes
- Manures

**Solid Wastes**
- Sorted Municipal Solid Waste including Plastics

**Gaseous Wastes**
- CO and CO₂
# FY 2020 Budget Plans Sustainable Transportation Technology Offices

## Vehicles

<table>
<thead>
<tr>
<th>Subprograms</th>
<th>FY 2020 Enacted ($K)</th>
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<tbody>
<tr>
<td>Batteries and Electrification Technologies</td>
<td>174,700</td>
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<tr>
<td>Energy Efficient Mobility Systems and Vehicle Systems</td>
<td>45,000</td>
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<tr>
<td>Advanced Engines and Fuel Technologies</td>
<td>70,000</td>
</tr>
<tr>
<td>Materials Technology</td>
<td>40,000</td>
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<tr>
<td>Technology Integration</td>
<td>60,300</td>
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<tr>
<td>Data, Modeling and Analysis</td>
<td>6,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>396,000</strong></td>
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## Bioenergy

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<thead>
<tr>
<th>Subprograms</th>
<th>FY 2020 Enacted ($K)</th>
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<tbody>
<tr>
<td>Feedstock Supply and Logistics</td>
<td>40,000</td>
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<tr>
<td>Advanced Algal Systems</td>
<td>40,000</td>
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<tr>
<td>Conversion Technologies</td>
<td>110,000</td>
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<tr>
<td>System Development and Integration</td>
<td>60,000</td>
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<tr>
<td>Data, Modeling, and Analysis</td>
<td>9,500</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>259,500</strong></td>
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## H₂ and Fuel Cells

<table>
<thead>
<tr>
<th>Subprograms</th>
<th>FY 2020 Enacted ($K)</th>
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<tbody>
<tr>
<td>Fuel Cell R&amp;D</td>
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<tr>
<td>Hydrogen Fuel R&amp;D</td>
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<tr>
<td>Hydrogen Infrastructure R&amp;D</td>
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<tr>
<td>Technology Acceleration</td>
<td>41,000</td>
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<tr>
<td>Safety, Codes and Standards</td>
<td>10,000</td>
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<tr>
<td>System Analysis</td>
<td>3,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>150,000</strong></td>
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For more information

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https://www.energy.gov/eere/
Hydrogen and Fuel Cell Resources

Celebrate National Hydrogen & Fuel Cell Day
October 8 or 10/08
(Held on its very own atomic-weight-day)

Save the Date:

- Feb 18 @ noon ET - H2IQ Hour: What’s New with the Hydrogen and Fuel Cell Program.
  Register: www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-webinars


Download the H2IQ resource for free:
energy.gov/eere/fuelcells/downloads/increase-your-h2iq-training-resource

Sign up to receive hydrogen and fuel cell updates
www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-newsletter

Learn more at: energy.gov/eere/fuelcells AND www.hydrogen.energy.gov