Bioenergy Technologies Office Peer Review

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TRANSPORTATION IS FUNDAMENTAL TO

OUR WAY OF LIFE

3 Trillion Vehicle Miles

11 Billion Freight Tons

The U.S. population is growing and aging

Population density is increasing—75% of the population lives in urban mega-regions

Technologies and fuel choices are expanding

Transportation costs are high—second only to housing expenses
Transportation and National Energy Use

Transportation sector use

30 Quads of energy
~ 1/3 of all energy used in the US

70% of petroleum used for transportation.
85% of it used for on-road vehicles.

Industry expects Jet fuel use to double over the next 20 years, with 30% potential from biofuels

In 2016, transportation accounted for the largest portion (28%) of total U.S. greenhouse gas emissions.

Source: TEDB, 2017
Our Energy Future: Competition and Unpredictability
Vehicle Technologies ($344M)
- Electrification
- Combustion engines
- Low cost lightweight materials
- New mobility & transportation systems

H2 & Fuel Cell Technologies ($120M)
- Hydrogen production (photoelectrochemical, electrolysis)
- Fuel Cell systems
- H2@Scale

Bioenergy Technologies ($226M)
- Biofuels and bioproducts
- New products, fuels, and chemicals from waste
- Energy crops
DOE IS CONDUCTING RESEARCH AT ALL LEVELS

Component Vehicle Transportation System

H₂
Affordability – Lowering the cost of Drop-In Biofuels
Integrating Buildings, Solar and Vehicles

- Supports DOE Grid Modernization Initiative
- Develop innovative, critical materials free, battery storage technology

**Draft BTMS Battery Target**
- $100/kWh (or $/Wh throughput)
- 8000 cycle
- 20 year life
Co-Optimization of Fuels and Engines (Co-Optima)

Objective: fuel and engine technologies working in tandem to achieve significant efficiency and emissions benefits

<table>
<thead>
<tr>
<th>Blendstocks which increase turbocharged engine efficiency the most</th>
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<tbody>
<tr>
<td><strong>Alcohols</strong></td>
</tr>
<tr>
<td>ethanol</td>
</tr>
<tr>
<td>isobutanol</td>
</tr>
<tr>
<td>prenol</td>
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<tr>
<td>n-propanol</td>
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High RON/S fuels are one path to high efficiency but these fuels can be expensive.
Goal: leverage multimode approaches to achieve 10% target with less highly-refined fuels

<table>
<thead>
<tr>
<th>RON</th>
<th>Sensitivity</th>
<th>Co-Optimized Solution</th>
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<tbody>
<tr>
<td>91 RON</td>
<td>2.5%</td>
<td>10% Target</td>
</tr>
<tr>
<td>95 RON</td>
<td>4.4%</td>
<td></td>
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<tr>
<td>98 RON</td>
<td>7.5%</td>
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</tbody>
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FY18 Accomplishments
- Identified 10 blendstocks that can improve efficiency for boosted spark-ignition engines
- Began blendstock screening for
  - Multi-mode for light duty
  - Mixing controlled compression ignition
- Six new FOA awards

“rewiring” the carbon cycle allows electricity to power CO₂ reduction to utilize diverse sources of carbon
Power-to-Gas Technology for Grid-Scale Seasonal Energy Storage

- Pipeline-quality methane
- Energy storage as renewable natural gas
- Leverage existing infrastructure
- Upgrade landfill gas
**Total Federal funding: $51.5M**

**Integrated, multi-fuel approach**
- Natural gas, Hydrogen, Biopower, and Electrification Technologies

**Topic 1B: Cost-effective Biopower Production from Municipal Solid Waste**
- Low-cost biogas cleanup
- Innovative anaerobic digestion/gasification
- Lower the cost of electricity from incineration

Further information available at: [http://eere-exchange.energy.gov](http://eere-exchange.energy.gov)

Concept papers due March 29
SUSTAINABLE TRANSPORTATION

OUR VISION

more choices

more efficient technology

when & where it is needed

more affordable