

U.S. DEPARTMENT OF
ENERGY

Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**

Bioenergy Technologies Office Peer Review

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Sustainable Transportation

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TRANSPORTATION IS FUNDAMENTAL TO

OUR WAY OF LIFE



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

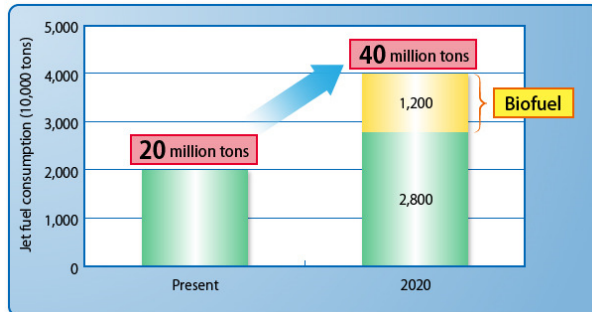
30 Quads of energy

~ 1/3 of all energy used in the US

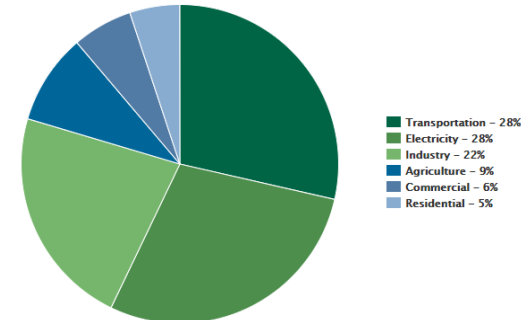


70% of petroleum used for transportation.

85% of it used for on-road vehicles.



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



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

CRITICAL ENERGY IMPLICATIONS



**Shared
Mobility**



**Mobility
On Demand**



**Goods
On Demand**



**Connected &
Automated Vehicles**



**Emerging Fuels
& Powertrains**



**New Modes
of Transport**

Our Energy Future: Competition and Unpredictability

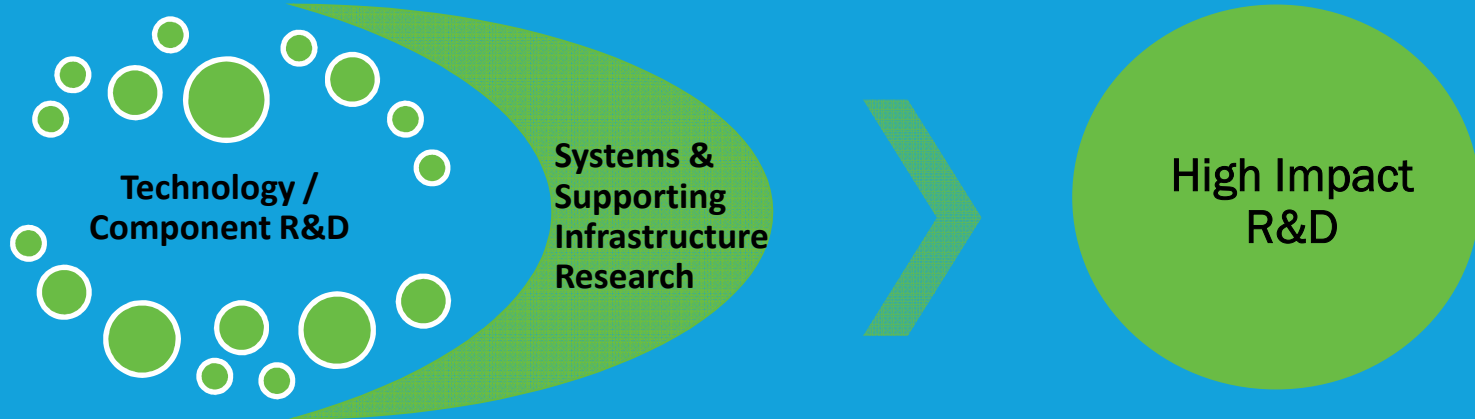


DOE EERE TRANSPORTATION SECTOR

Energy Affordability

Energy Integration

Energy Storage



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

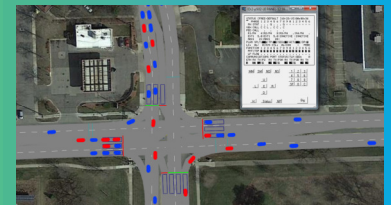
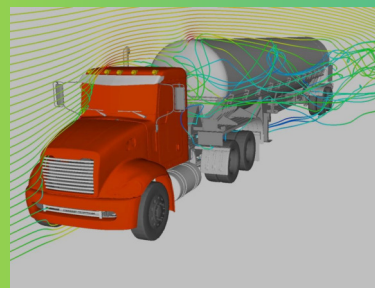
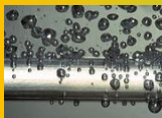
Bioenergy Technologies

(\$226M)

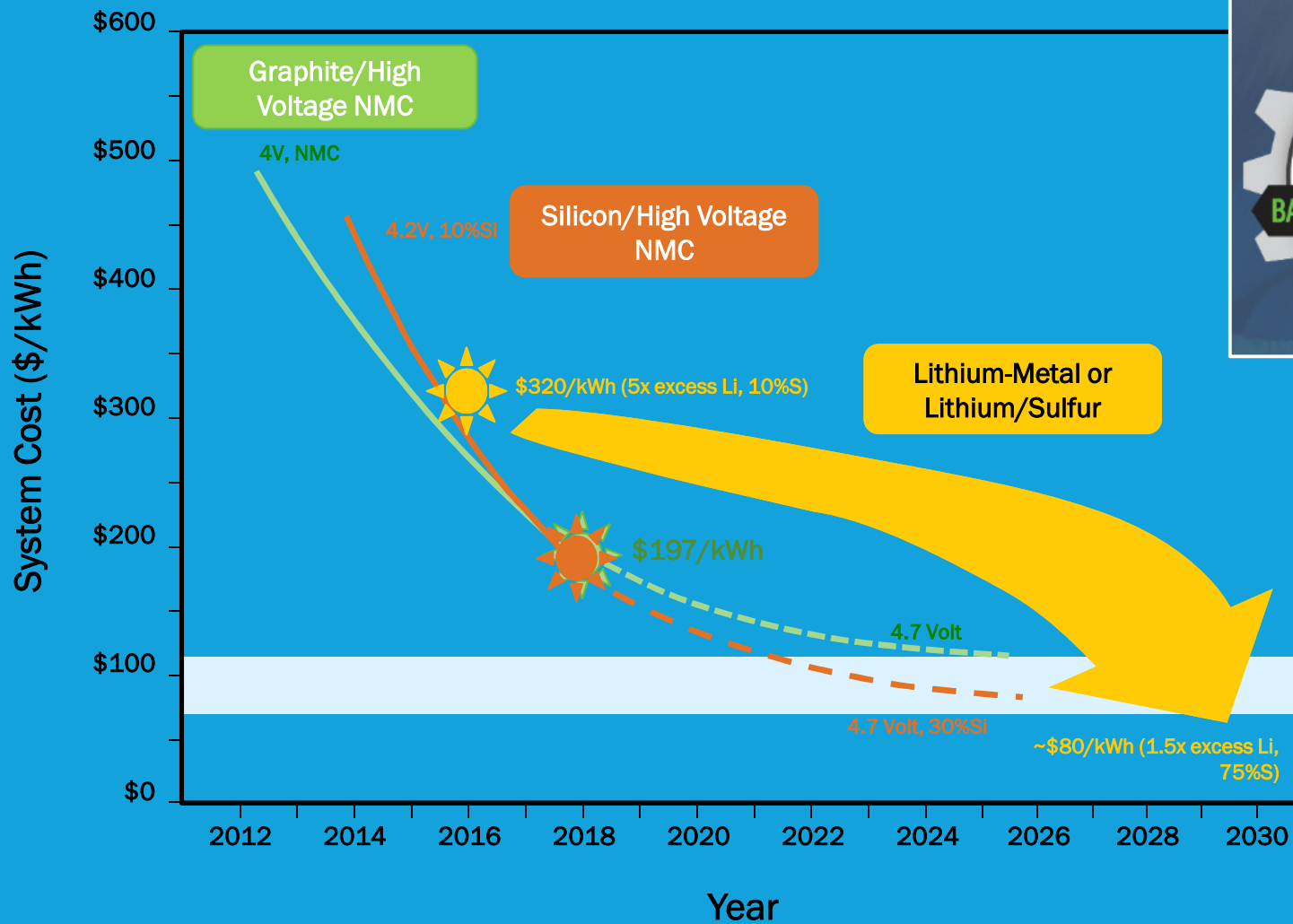
- Biofuels and bioproducts
- New products, fuels, and chemicals from waste
- Energy crops

DOE IS
CONDUCTING
RESEARCH AT

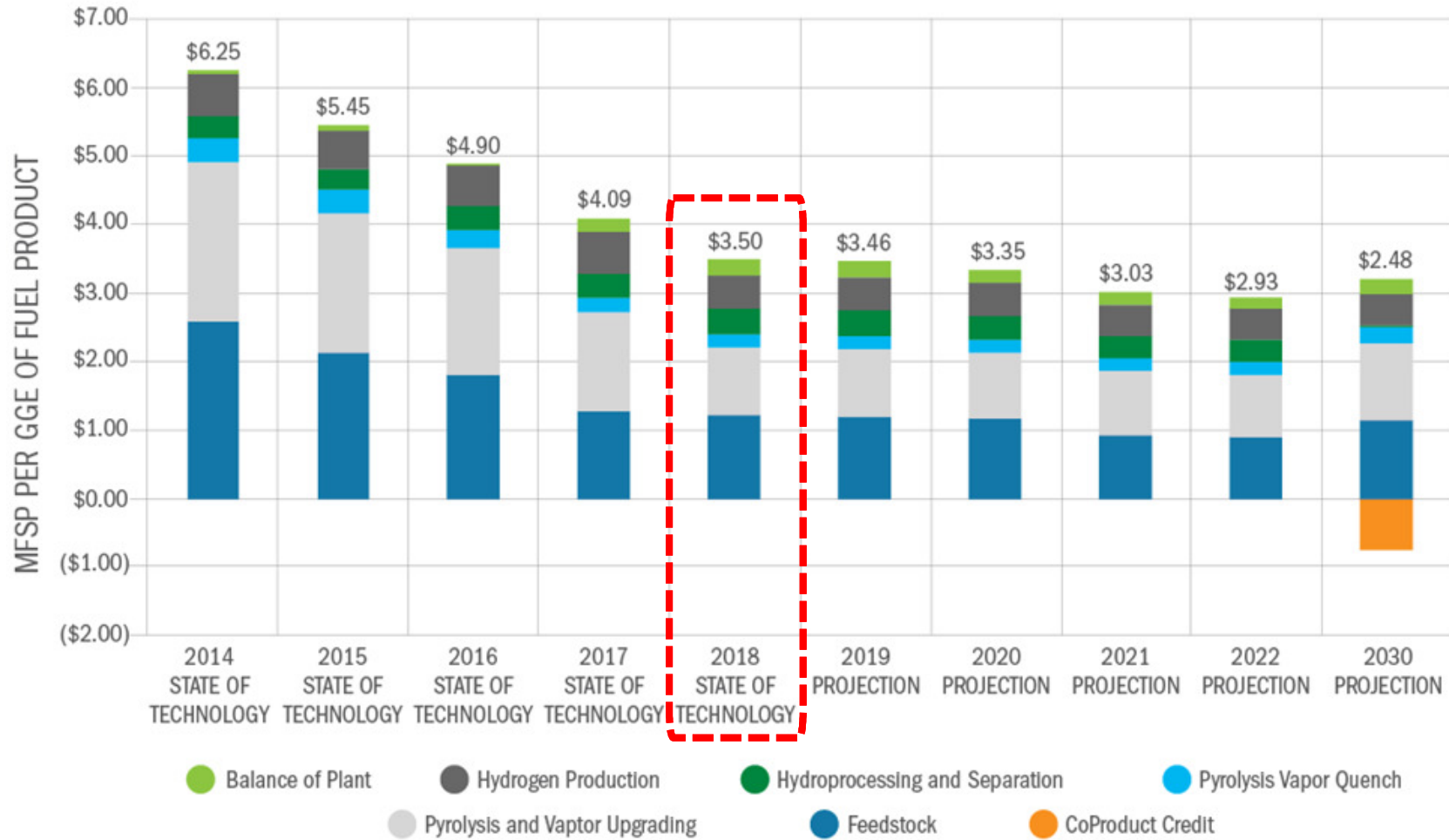
ALL
LEVELS



BATTERY COSTS DECREASING



Affordability – Lowering the cost of Drop-In Biofuels

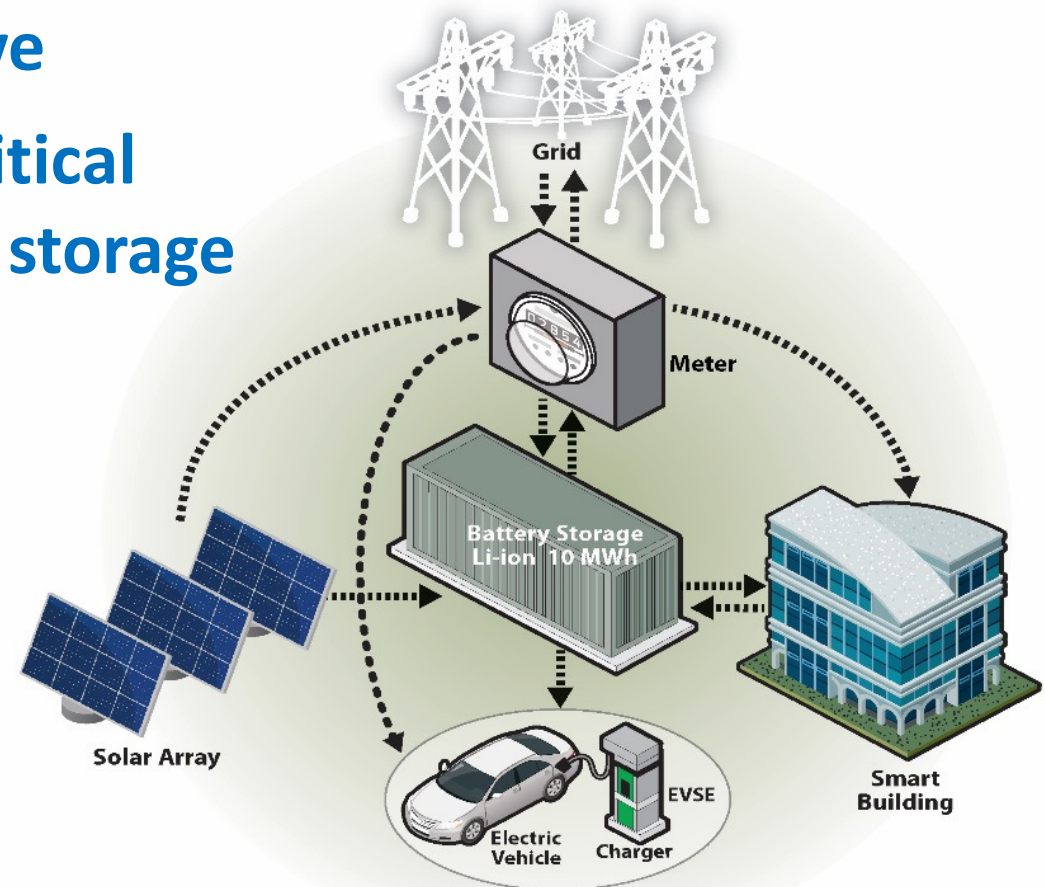


Integrating Buildings, Solar and Vehicles

- 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



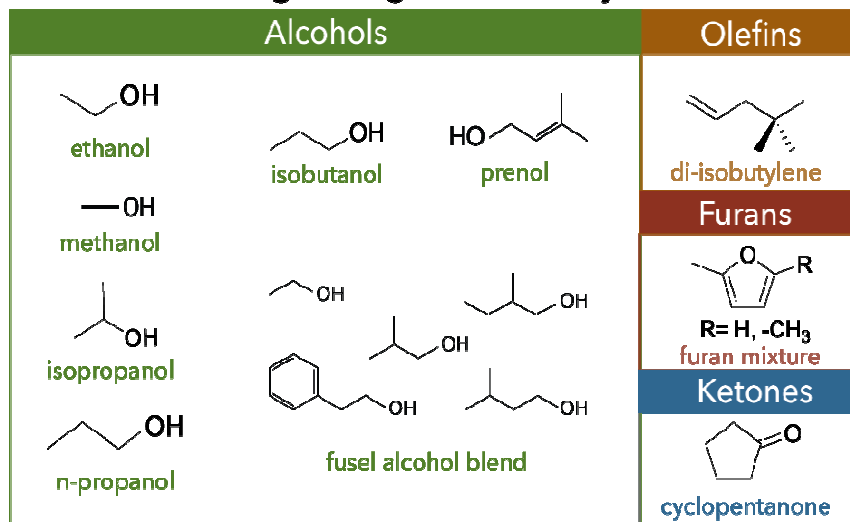
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Co-Optimization of Fuels and Engines (Co-Optima)

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

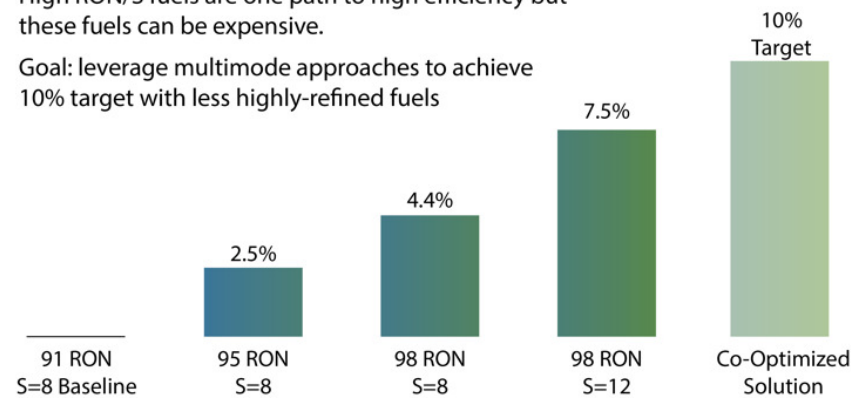


Blendstocks which increase turbocharged engine efficiency the most



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



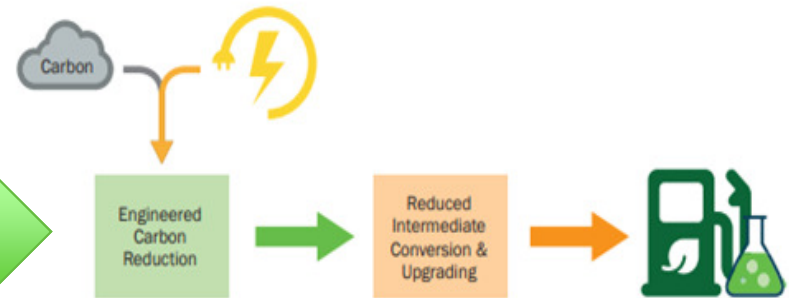
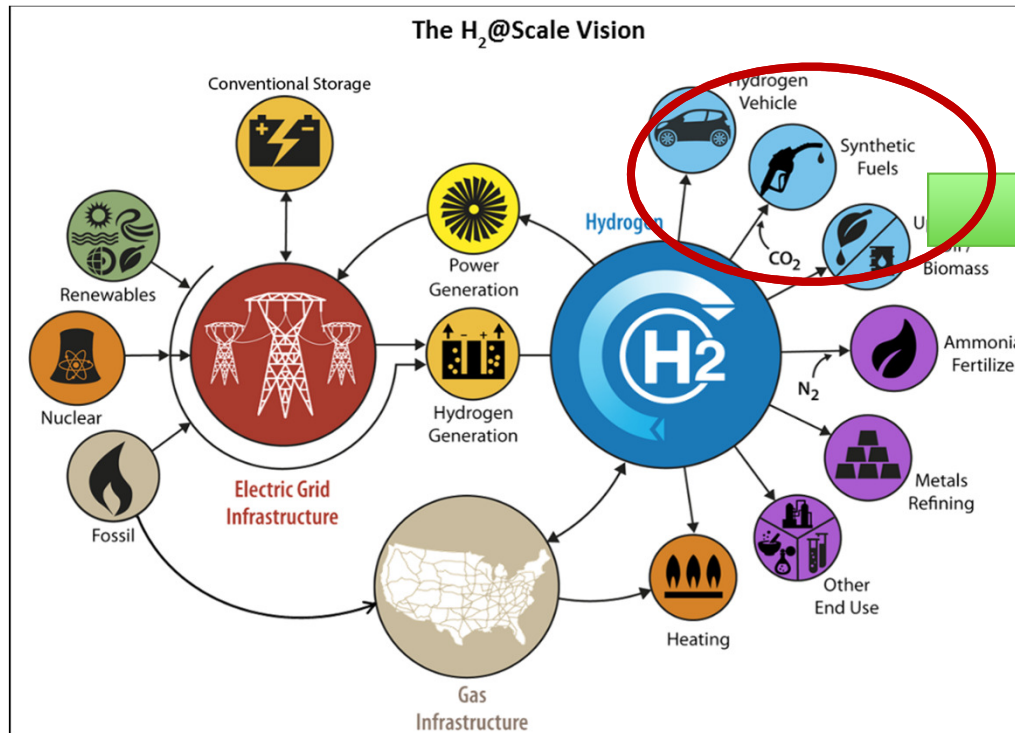
S = sensitivity = RON - MON; Engine efficiencies calculated for conditions appropriate for boosted downsized engines (K = -1.25)
 Source: Miles, Paul. "Efficiency Merit Function for Spark Ignition Engines: Revisions and Improvements Based on FY16-17 Research." Technical Report. U.S. Department of Energy, Washington, DC. 2018. DOE/GO-102018-5041.

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

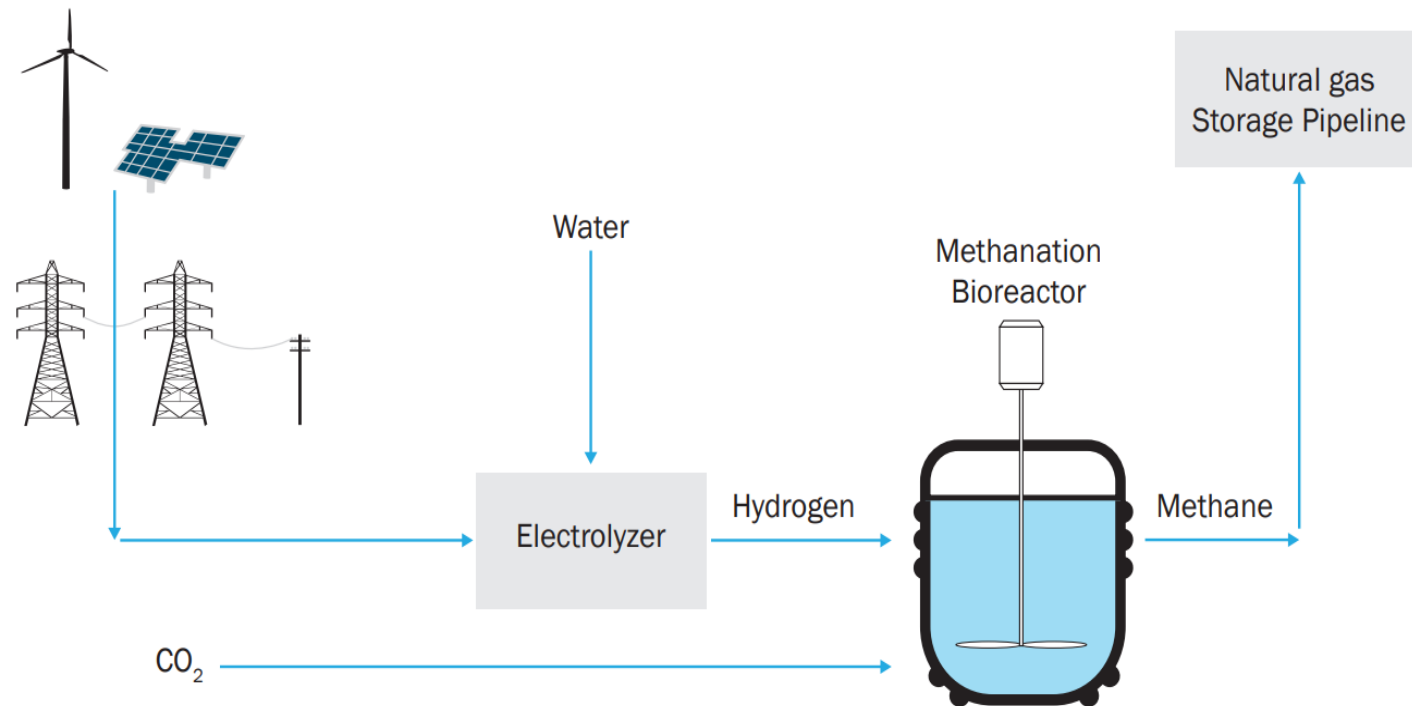
Storage/Integration/Crosscutting Collaboration

H2@Scale Energy System



“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

FY 2019 Commercial Trucks and Off-road Applications FOA

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

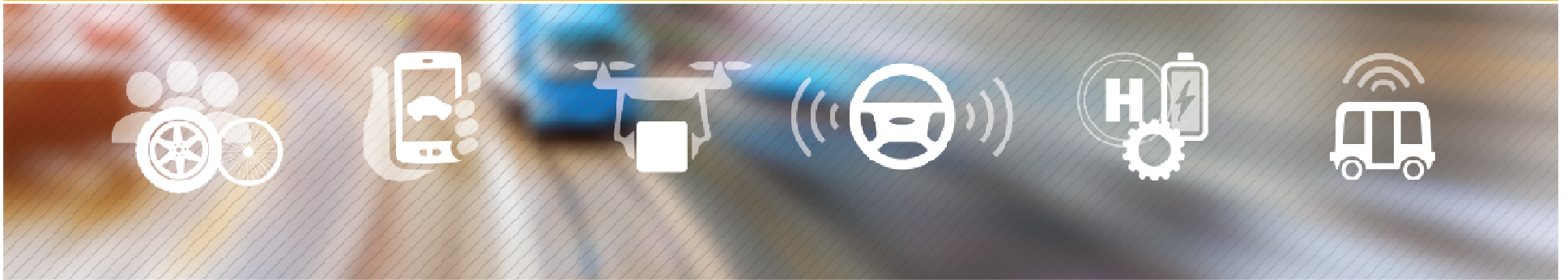


Further information available at:
<http://eere-exchange.energy.gov>

Concept papers due March 29

SUSTAINABLE TRANSPORTATION

OUR VISION



more choices

more efficient technology

when & where it is needed

more affordable