

**Meeting the Challenge
Ultra-Clean Fuels
for the 21st Century**

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Office of Fossil Energy

Major Utilization Thrusts of Programs

- **Central Power Generation (Vision 21)**



- **Distributed Power Generation**



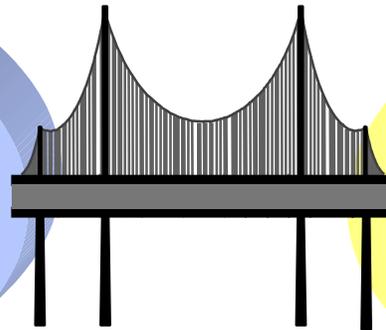
- **Ultra-Clean Fuels**



Ultra-Clean Fuels...a key piece of the complex and dynamic puzzle...

Fuel Industry

- **Resource Owners**
- **Technology Developers**
- **Refinery Equipment Suppliers**
- **A&E Firms**



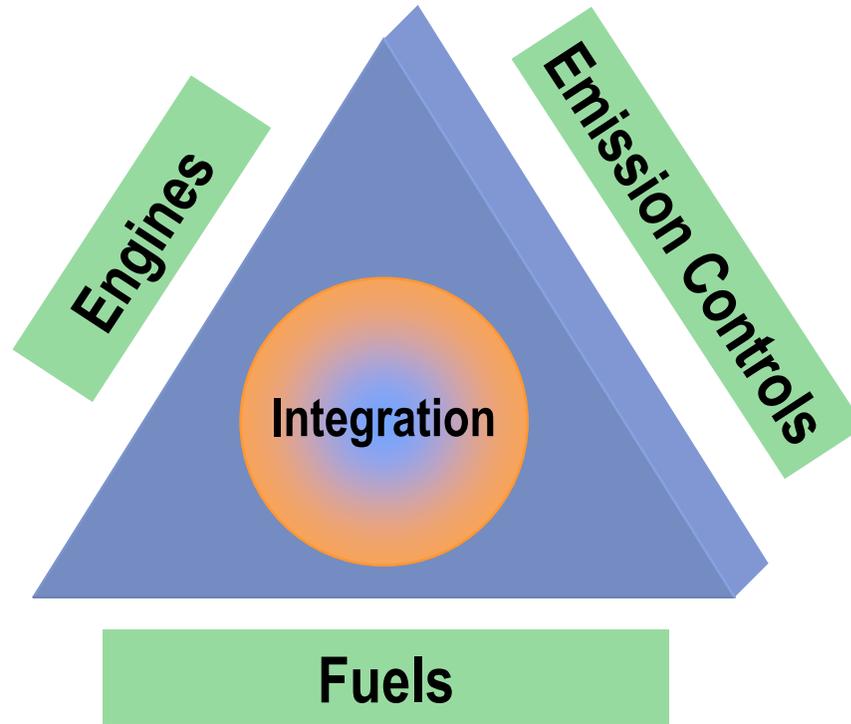
Transportation Industry

- **Autos, Heavy Vehicles, Aircraft
Coastal Marine Vessels**
- **Engines (diesel, gasoline, jet)**
- **Fuel Cells**
- **Emission Controls**

*The U.S. Department of Energy's
Ultra-Clean Fuels Program...partnering
in the identification and development
of advanced fuels for today's and
tomorrow's transportation vehicles*

Technology Integration

21st Century Ultra-Clean Transportation Systems



System Requirements

- *Ultra-low emissions*
- *High performance*
- *Long-term durability*
- *Low toxicity*
- *Affordability*

Transportation Fuels Program

Commercial and Military Applications

Supply and Delivery of Clean Transportation: Land, Air, Sea Fuels

■ Oil Supply: Energy Security, Affordability, Acceptability

- Exploration and production
- Enhancing current domestic resources
- Policy and environmental impacts



■ Ultra-Clean Fuels for the Existing Transportation Infrastructure

- Advanced petroleum processing
- Natural gas to liquids
- Coal fuels and chemicals
- Additives and lubricants



■ Delivery System Reliability

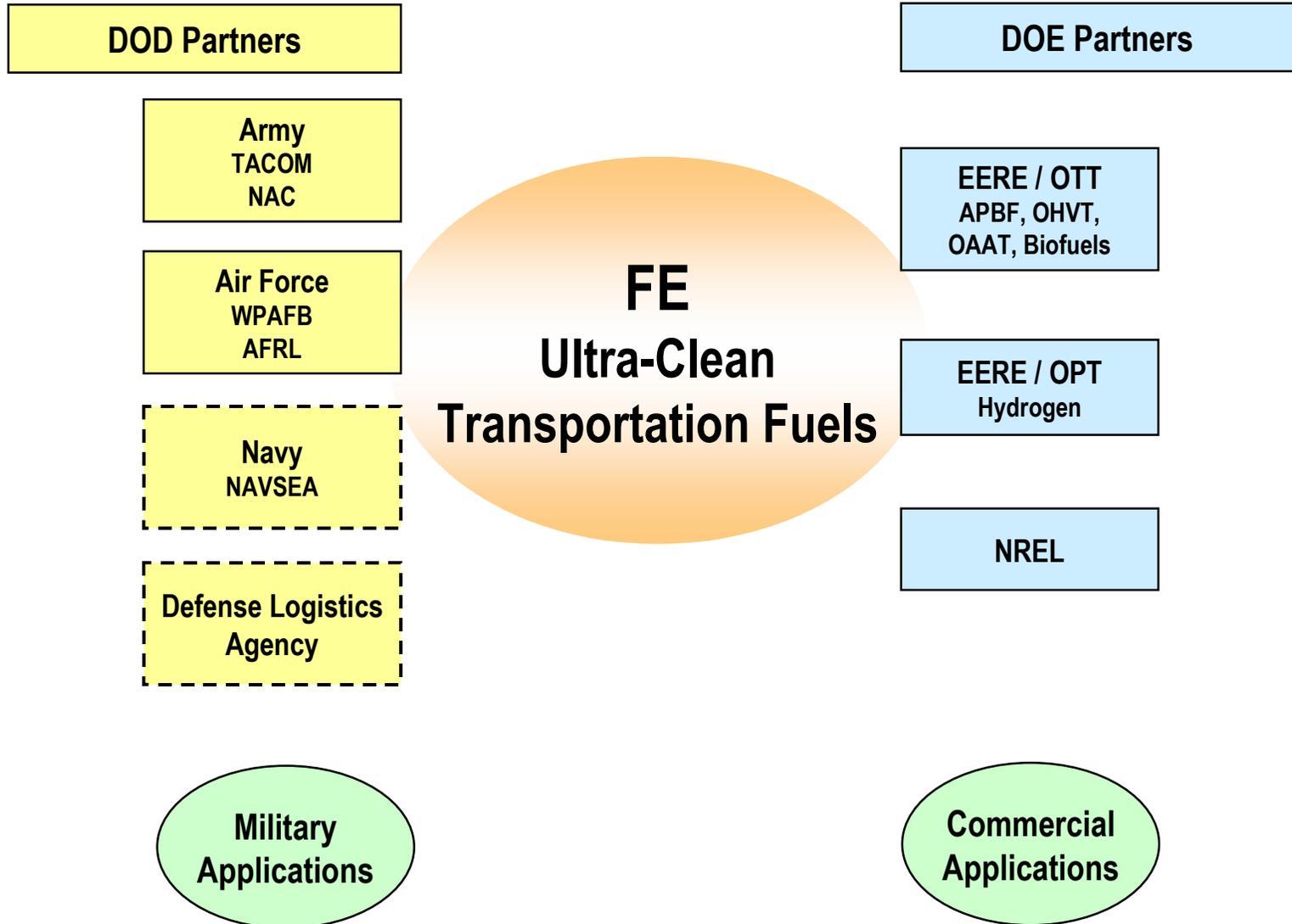
- Integrity of existing systems
- Increasing complexity of products into distribution system
- Hydrogen distribution/transportation system reliability



■ Future Fuels: New Fuel/Transportation System Infrastructure

- Hydrogen
- Biofuels
- Novel fuels

Strategic Partners



FE/NETL - EERE/Hydrogen Program Areas of Cooperation

- **Memorandum of Agreement (MOA) on hydrogen**
- **Proposal reviewers for NETL and OPT solicitations**
- **Hydrogen Program Peer Review participation**

MOA Work Agreements

- **Systems Study with NREL on hydrogen production from low rank coal**
- **Proposal review from PRDA for Advanced Fuels R&D**
- **Dense Phase Ceramic Membrane Development**
- **Workshop on Hydrogen Production from Fossil Fuels**

Estimated FY2000 Budgeted Activities Fossil-Related Hydrogen Program at NETL

(Dollar estimates in \$K)

Fully Related

Membrane Reactors	3650
Membrane Separations	3220
CO ₂ Hydrate Separations	2150
Total	\$9,020

NETL-OST In-House

Facility Development	1050
Membrane Reactor Concepts	440
Advanced H ₂ Production Concepts	300
Application Concepts	695
Membrane Characterization	180
Total	\$2,665

Grand Total
Fossil Energy
Hydrogen Program
at NETL

\$ 33,200

Partially Related

Multi-Product Process Development & Studies	525
Early Entrance Coproduction Plant Design	1777
Ultra-Clean Synthesis Gas Cleaning	315
Advanced Concepts - Reactions/Separations	49
CO ₂ Removal/Capture	109
Other	100
Total Allocated Portion *	\$2,875

Related Programs

Other Gasification	5320
Fuel Cells	8900
ATS	4420
Total Allocated Portion *	\$18,640

* Estimated portion of the total budget activity applicable to H₂ program was allocated as a percentage.

The Hydrogen Connection

■ Natural sources of hydrogen

- Hydrocarbon (-C-H) resources
 - Coal, oil, natural gas, etc.
- Water (H₂O)

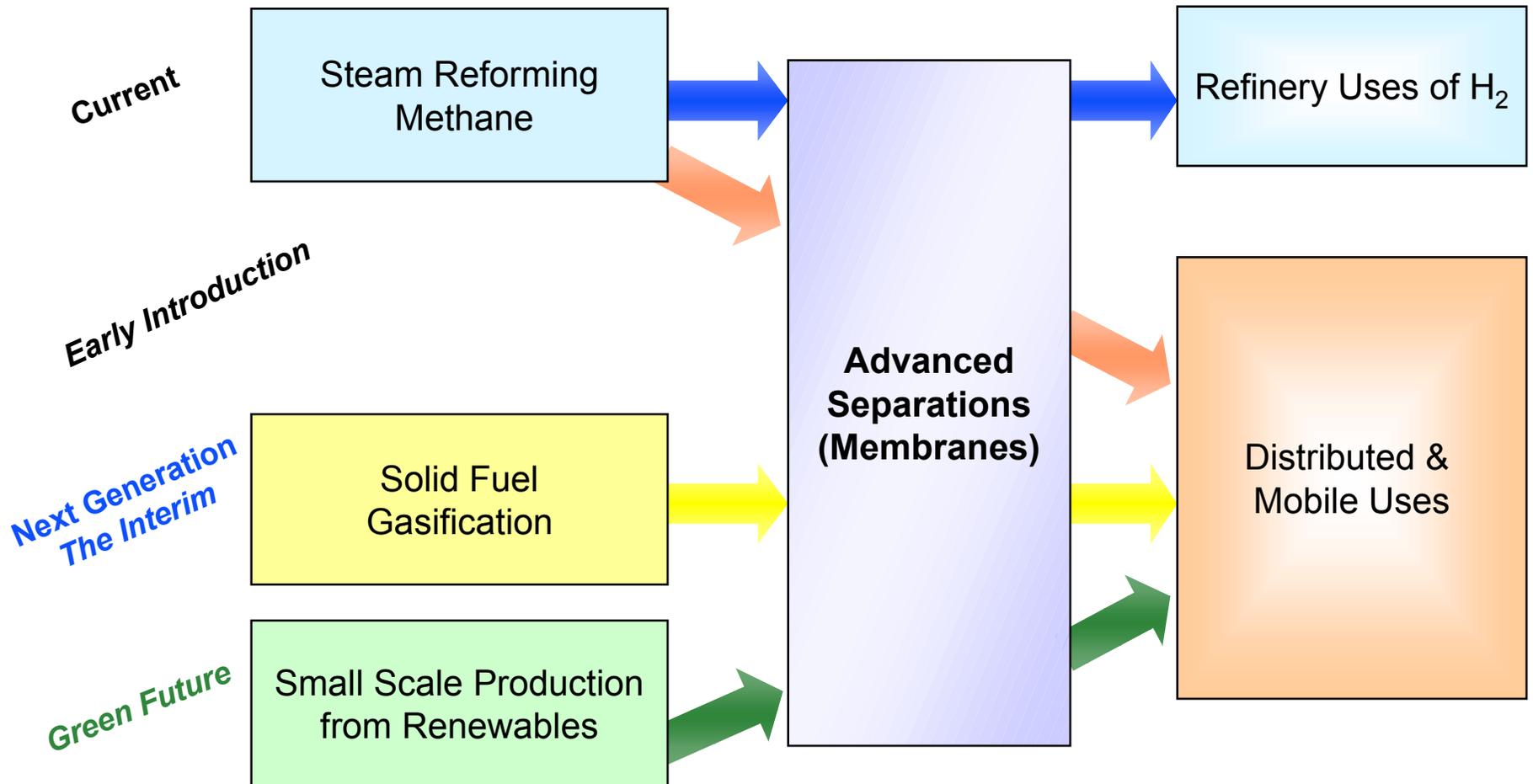
Conversion To



■ Uses of hydrogen

- Transportation fuel
- Power (e.g. fuel cells, hydrogen turbines)
- Fuels and chemicals
- Industrial Heat

Evolution of Hydrogen Capabilities



Joining DOE Capabilities

