The Department of Energy
Fuel Cells for Transportation Program**

Nancy L. Garland
U.S. Department of Energy
Fuel Cells for Buildings Roadmap Workshop
April 10-11, 2002

**soon to be the Hydrogen, Fuel Cells, and Infrastructure Technologies Program

Outline

Program: Goal and Implementation
Fuel Pathways: Strategy, Energy Efficiency, Emissions, and Cost
Technical Challenges
Program Activities

Fuel Cells for Transportation

Our goal is to develop technologies for:

- highly efficient
- low- or zero-emission
- cost-competitive

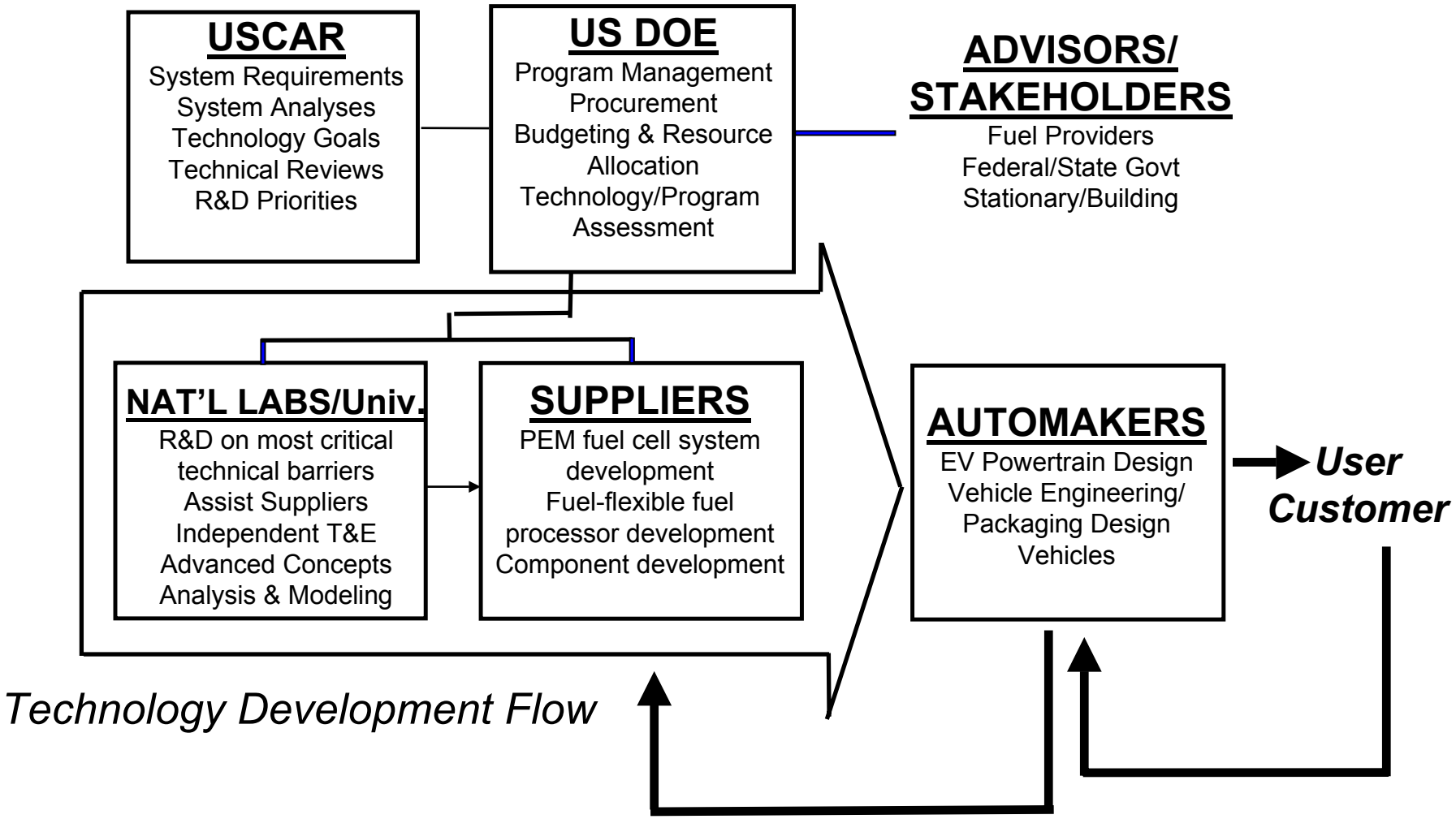
automotive fuel cell power systems that operate on conventional and alternative fuels.

GM S-10 Pickup(Gasoline)

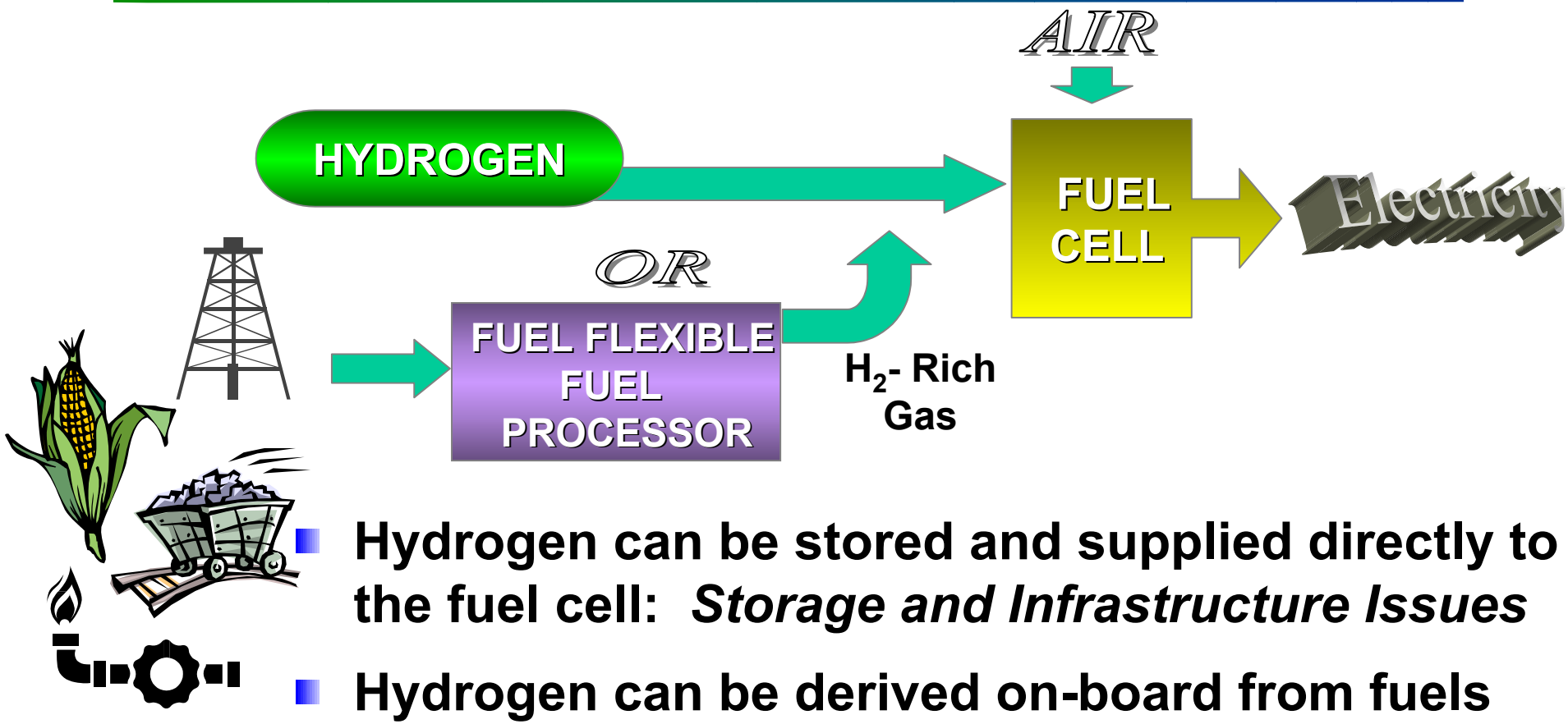

Jeep Commander (Methanol)

Ford Focus (Hydrogen)

Fuel Cell Program Implementation
A Strategic Partnership

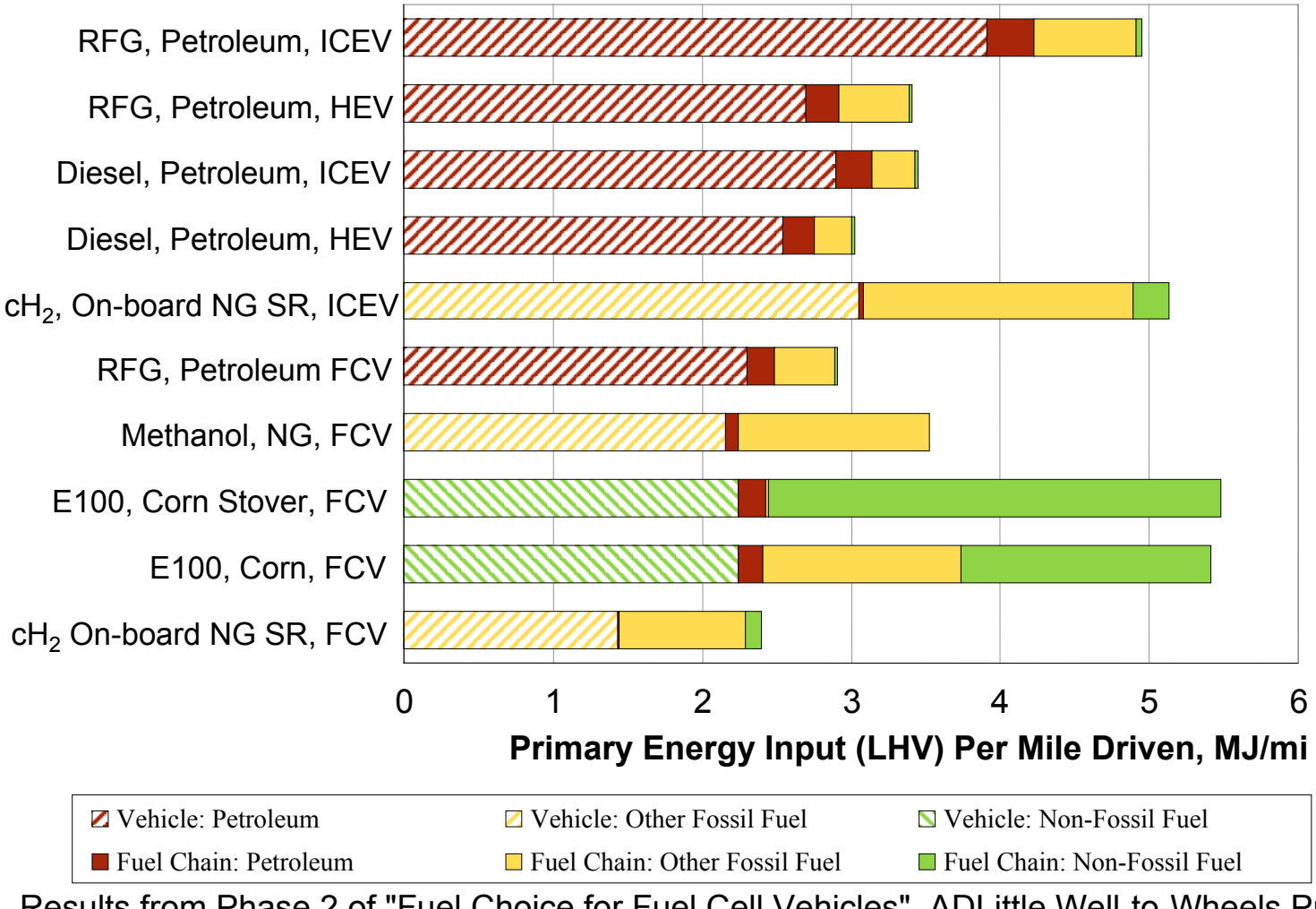


DOE Transportation Fuel Cell Program Fuel Strategy



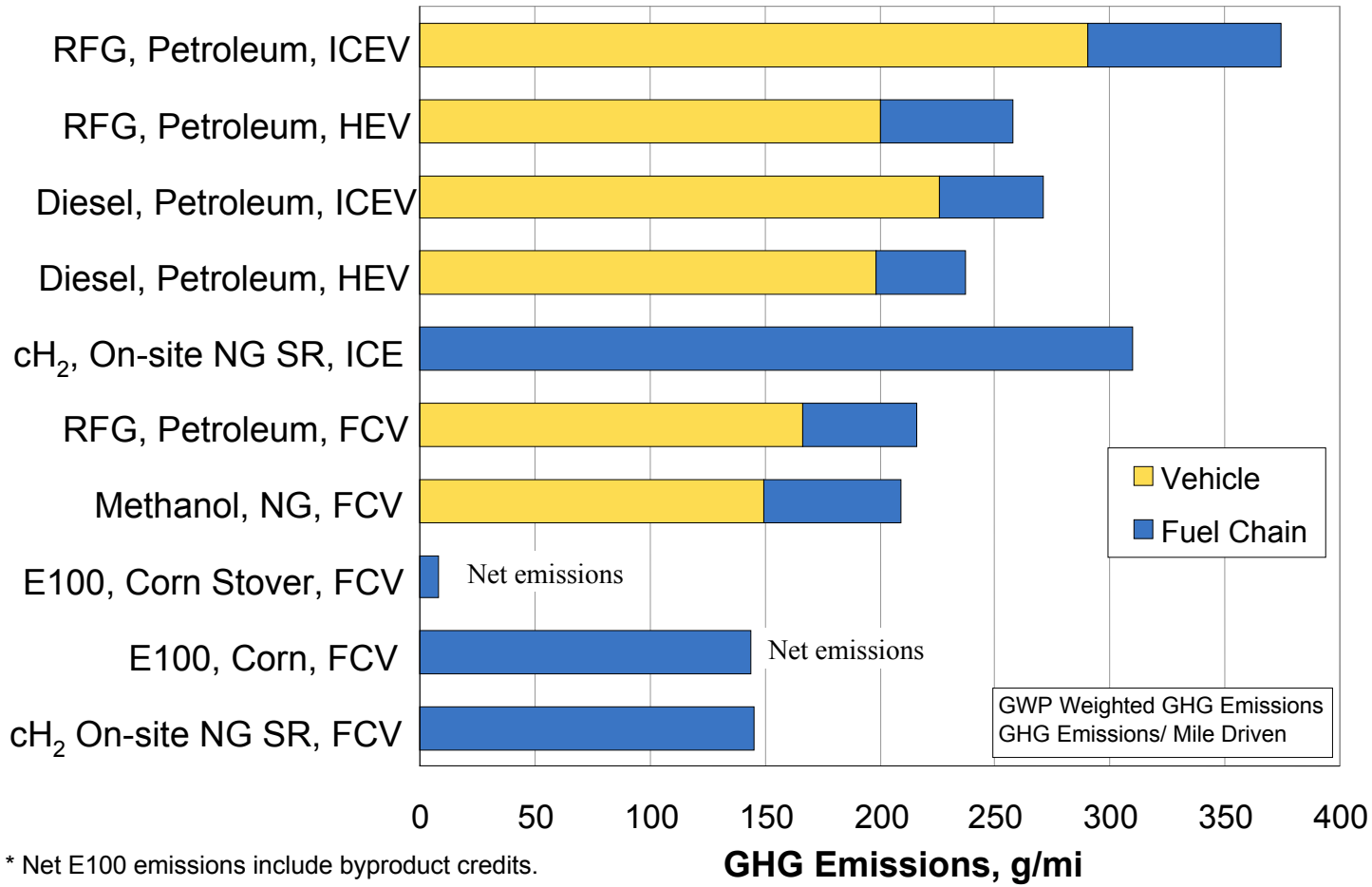
- Hydrogen can be stored and supplied directly to the fuel cell: *Storage and Infrastructure Issues*
- Hydrogen can be derived on-board from fuels such as ethanol, methanol, natural gas, gasoline or FT fuels: *Durability and Start-up Issues*

Well-to-Wheels Comparison of Fuel Pathways



Results from Phase 2 of "Fuel Choice for Fuel Cell Vehicles", ADLittle Well-to-Wheels Project for DOE, 10/01,

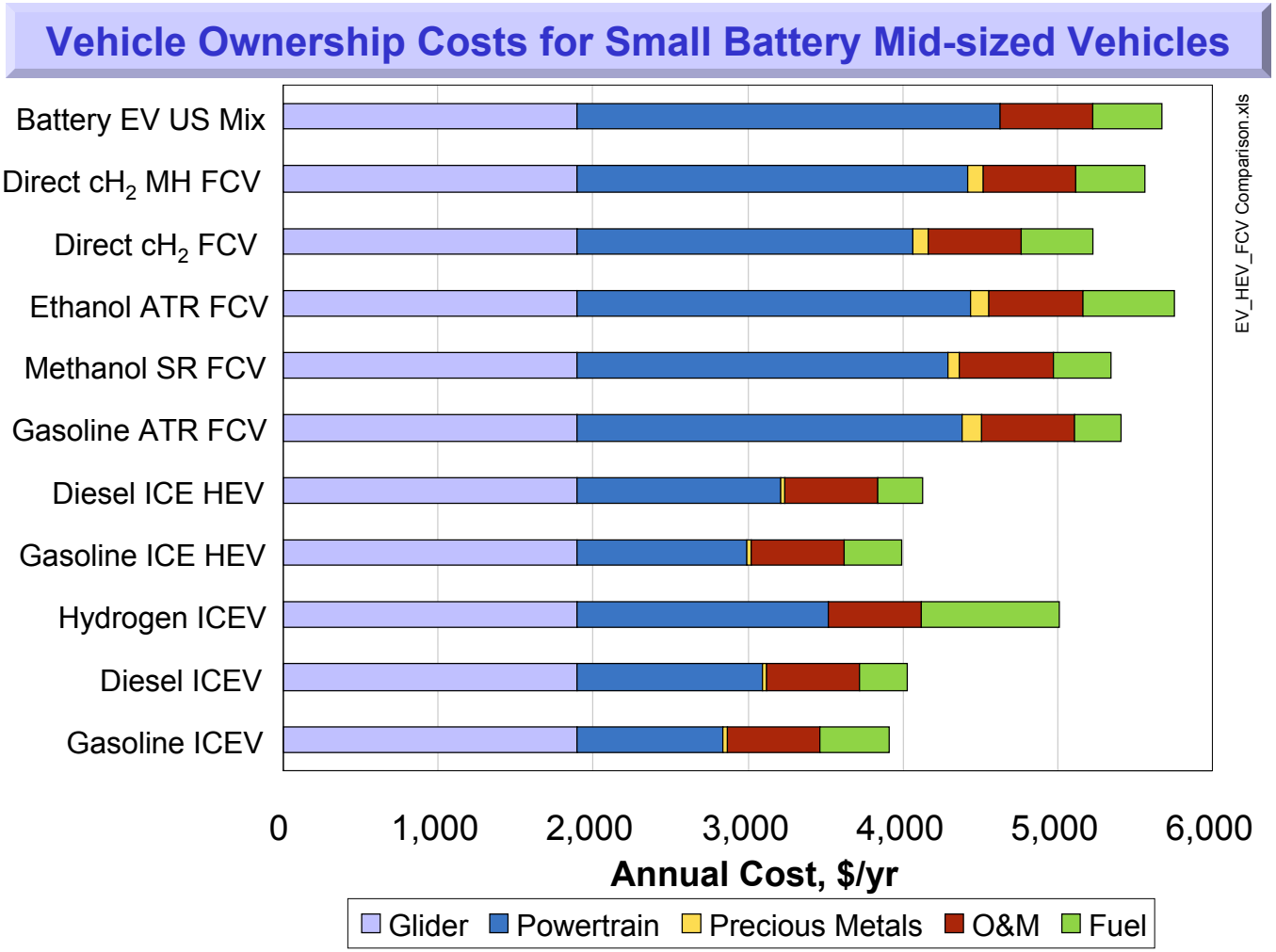
Well-to-Wheels: *Greenhouse Gases Fuel Comparison*



* Net E100 emissions include byproduct credits.

Results from Phase 2 of "Fuel Choice for Fuel Cell Vehicles", ADLittle Well-to-Wheels Project for DOE, 10/01,

Fuel cell vehicles will cost more than conventional and advanced ICE vehicles



Note: All vehicles are based on the same midsized vehicle platform with 350 mile range except the Battery EV which has only a 120 mile range.

Projected Fuel Cell Vehicle Performance
Lightweight Hybrid Vehicle

Projected Mileage, MPG_e

	Gasoline Fueled Fuel Cell	Hydrogen Fueled Fuel Cell
Urban Fuel Economy	**79**	**101**
Highway Fuel Economy	**97**	**128**
Combined	**86**	***111***

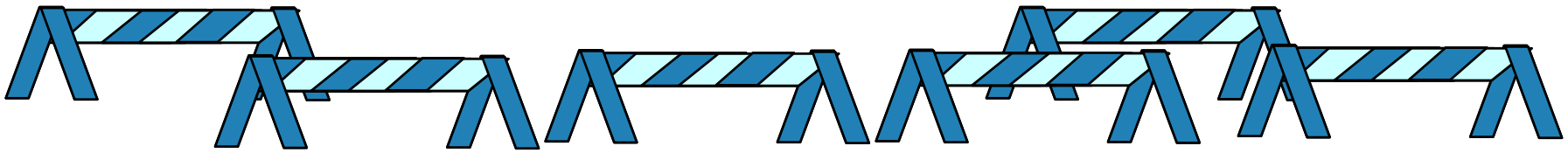
Note: Based on NREL/ADVISOR system modeling using target fuel cell efficiencies.

108 mpg_e predicted

Automotive Fuel Cells
Key Technical Challenges

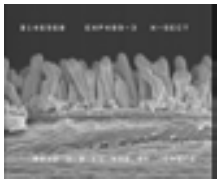
There are significant technical and economic barriers that will keep fuel cell vehicles from making significant market penetration for 10 years.

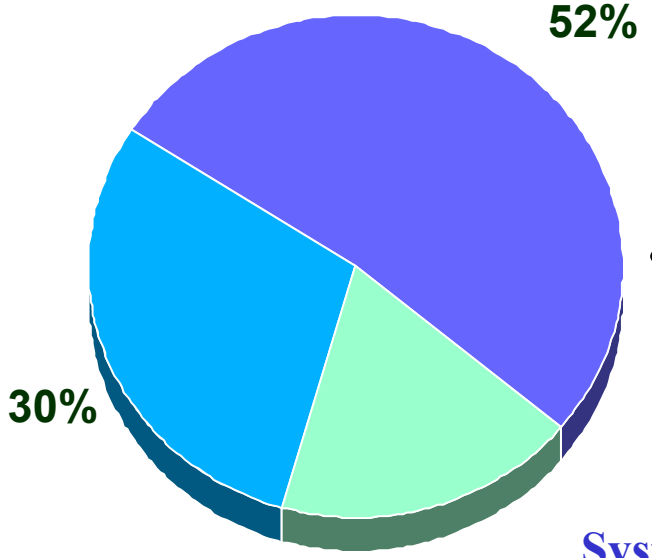
- Hydrogen Storage
- Fuel Infrastructure
- Start-Up (Fuel Processing)
- Cost/Affordability (Platinum)
- Reliability/Durability
- Air/Thermal/Water Management



Program Activities – Fuel Cells

FY 2002 Budget = $41.925M





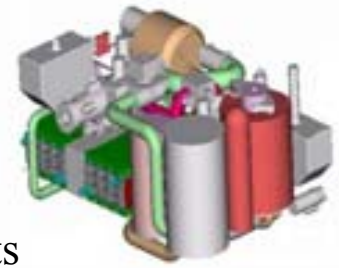
Fuel Processing/Storage R&D

- On-/Off-board fuel processing
  - Catalyst R&D
  - Fuel Effects/Durability
  - CO/Sulfur Management
  - Microchannel Components
- Hydrogen Storage
  - Advanced Chemical Hydrides, C-Based Materials
  - Independent Test Facility

Fuel Cell Stack Subsystem

- Catalyst R&D
- High Temperature Membrane R&D
- MEA/Bipolar Plate Manufacturing Process
- Cost Reduction R&D
- Durability Studies

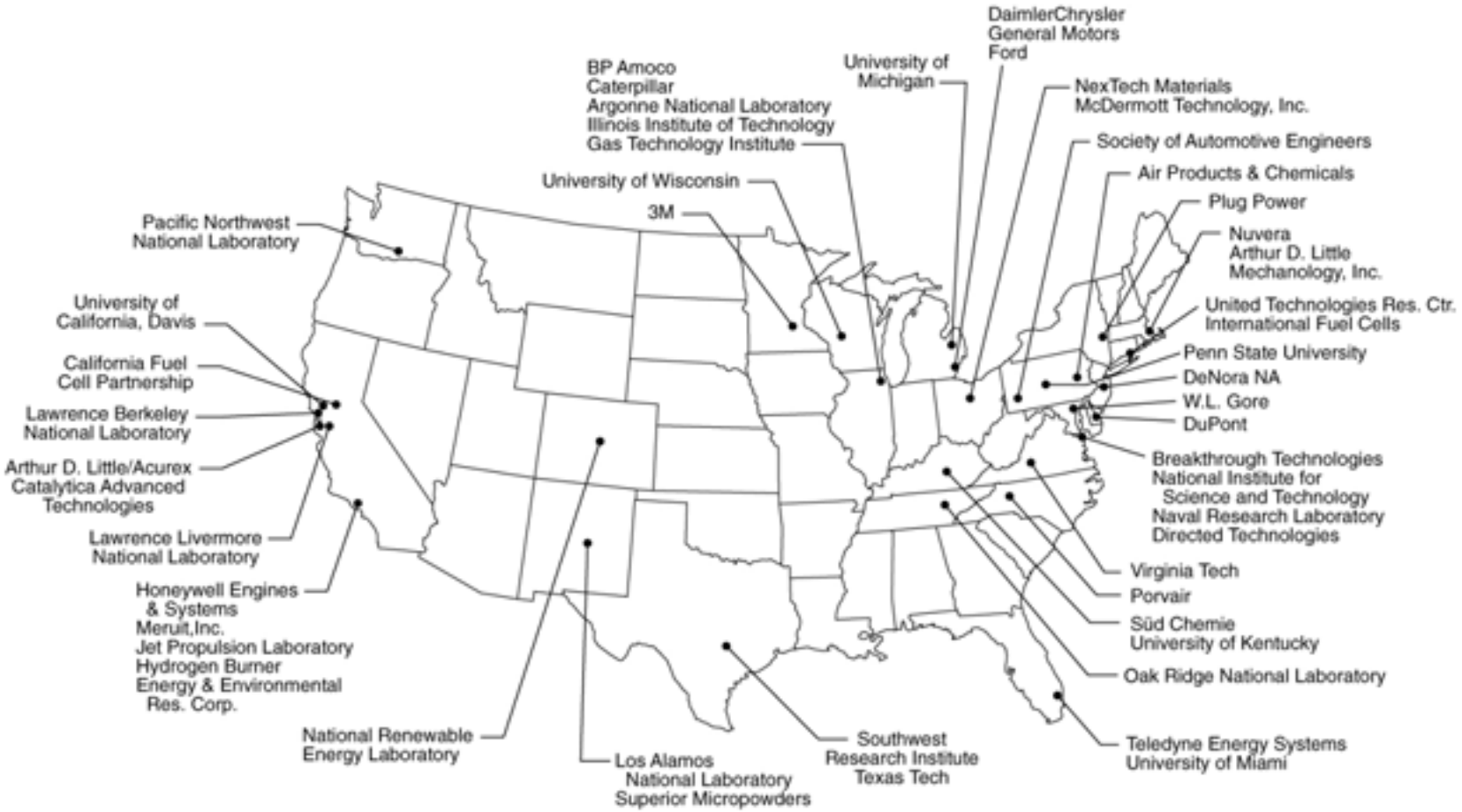
Systems



- System Validation
- System Modeling
- Ancillary Components (Compressors, Sensors)
- Cost Analyses
- Emissions Testing

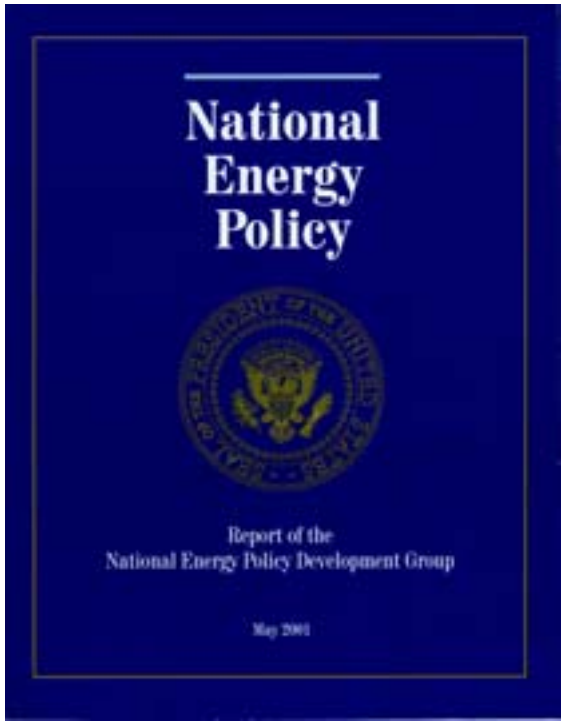
FY 2003 Request = $50M

Fuel Cells for Transportation Program Partners/Partnerships



Summary

- Improving energy diversity will increase economic and energy security (supports National Energy Policy)
- Tremendous progress has been made, however major technical challenges prevent the introduction of fuel cells into the marketplace
- DOE's Office of Energy Efficiency and Renewable Energy is addressing critical technical challenges.



For Further Information

2001 Annual Progress Reports available at www.cartech.doe.gov

DOE Fuel Cells for Transportation Program:

Pat Davis: 202-586-8061, patrick.davis@ee.doe.gov
Pete Devlin, 202-586-4905, peter.devlin@ee.doe.gov
Nancy Garland: 202-586-5673, nancy.garland@ee.doe.gov
Donna Ho: 202-586-8000, donna.ho@ee.doe.gov
JoAnn Milliken: 202-586-2480, joann.milliken@ee.doe.gov