

Non-Pt Electrocatalysts

DOE Program/Targets and Workshop Objectives

**Nancy Garland, U.S. Department of Energy
Hydrogen, Fuel Cells
and Infrastructure Technologies Program
<http://www.eere.energy.gov/hydrogenandfuelcells>**

**Non-Pt Electrocatalyst Workshop
New Orleans, LA
March 21-22, 2003**



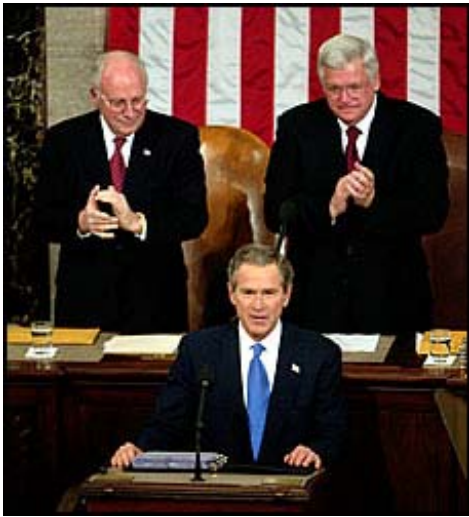


Outline

- **The Hydrogen, Fuel Cells, and Infrastructure Technologies Program**
- **FreedomCAR and Hydrogen Fuel Initiatives**
- **Technical Targets**
- **DOE Fuel Cell & Hydrogen Activities**
- **Workshop Objectives**



Hydrogen and Fuel Cells are a High Priority within DOE



"With a new national commitment, our scientists and engineers will overcome obstacles to taking these cars from laboratory to showroom so that the first car driven by a child born today could be powered by hydrogen, and pollution-free." President Bush, State of the Union address, January 28, 2003

"Hydrogen fuel cells represent one of the most encouraging, innovative technologies of our era." President Bush, February 6, 2003





DOE Hydrogen, Fuel Cells, and Infrastructure Technologies Office

Mission: Research, develop, and validate fuel cell and hydrogen production, delivery and storage technologies for transportation and stationary applications

Program Focus

- **Fuel cell stack component cost reduction (catalyst & membrane) and stationary systems development**
- **Integrated fuel cell vehicle and hydrogen infrastructure technology validation**
- **Advanced production technologies (photoelectrochemical, photobiological, reforming, and separation)**
- **Solid-state hydrogen storage materials (carbon, hydrides, etc.)**
- **Safety, codes & standards for hydrogen-fueled devices**

Major Activities	FY02 Approp.	FY03 Approp.	FY0 Reque
Hydrogen Production & Delivery	\$11.2M	\$11.8M	\$23.0M
Hydrogen Storage	\$6.1M	\$11.3M	\$30.0M
Safety, Codes & Standards, Education	\$5.9M	\$6.8M	\$21.8M
H2 Infrastructure/FC Vehicle Demo	\$5.7M	\$11.9M	\$28.2M
Fuel Cell Systems & Components	\$46.7M	\$53.7M	\$62.5M
TOTAL	\$75.6M	\$95.5M	\$165.5M



Hydrogen, Fuel Cells and Infrastructure Technologies Program

Steve Chalk, Program Manager

Tia Alexander, Administrative Support

Reeshemiah Schuler, Administrative Support

Bill Cleary, Program Support

Technology Validation - **Sigmund Gronich**

Education - **Christy Cooper**

Safety and Codes&Standards - **Neil Rossmeissl**

Hydrogen Production Team

Pete Devlin, Team Ldr.

Arlene Anderson

Chris Bordeaux

Roxanne Danz

Matt Kauffman

Mark Paster

Hydrogen Storage Team

JoAnn Milliken, Team Ldr.

Lucito Cataquiz

John Petrovic*

2 Vacancies

Fuel Cell Team

Patrick Davis, Team Ldr.

Kathi Epping

John Garbak

Nancy Garland

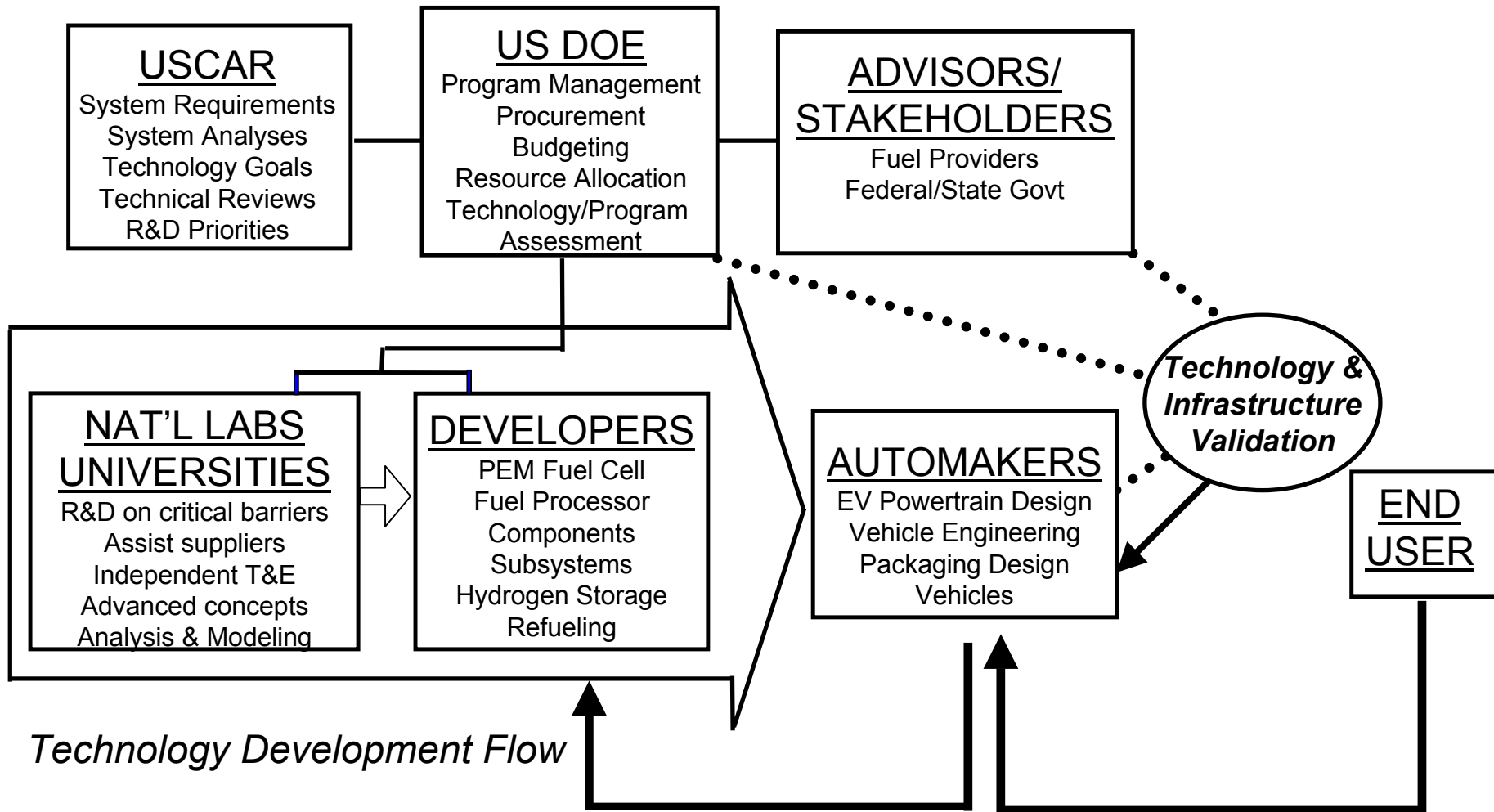
Donna Ho

Valri Lightner

*on detail from LANL



Program Implementation





Technical Targets: Fuel Cell Stack Systems Operating on Gasoline Reformate in 50 kWe (net) Fuel Cell Systems

(Excludes fuel processing/delivery system)

Characteristic	Units	2003 status	2005	2010
Stack system power density	W/L	200	400	550
Stack system specific power	W/g	200	400	550
Stack system efficiency @ ¼ power	%	45	50	55
Stack system efficiency @ rated power	%	40	42	44
Precious metal loading	g/rated kW	<2.0	0.6	0.2
Cost	\$/kW	200	100	35
Durability	hours	>2000	>2000	>5000
Transient response (10% to 90%)	s	<3	2	1
Cold start-up time to rated power @ -20°C ambient temperature	min	2	1	0.5
@ +20°C ambient temperature	min	<1	0.5	0.25
Survivability	°C	-40	-30	-40
CO tolerance				
steady-state (with 2% maximum air bleed)	ppm	50	500	500
transient	ppm	100	500	1000



FY03 EERE Fuel Cell Activities

Activities Focus on Removing High Risk Technical Barriers

FY 2003 Budget = \$55M

Technology Validation

Transportation Systems

- Modeling/Analyses
- Balance-of-Plant (sensors, compressors)

Distributed Energy

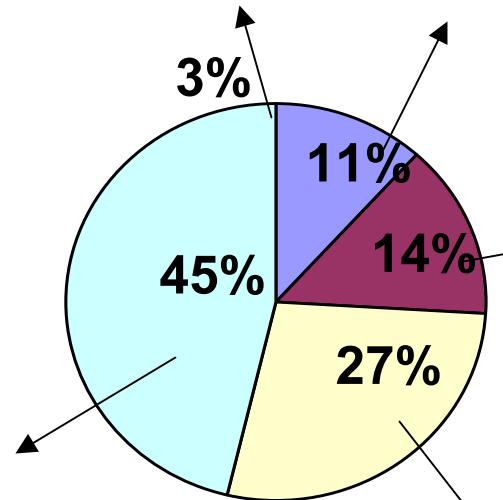
- Reforming Technology
- High-Temperature Membranes
- Durability Studies
- Systems Development

Stack Components

- **Catalyst loading reduction**
- MEA/bipolar plate manufacturing
- Durability studies

Fuel Processing

On-board Fuel Processor R&D



R&D is carried out by industry suppliers, National Labs, and universities.



FY04 EERE Fuel Cell Activities

FY 2004 Request = \$77.5M

Transportation Systems

- Modeling/Analyses
- Balance-of-Plant (sensors, compressors)

Distributed Energy

- Reforming Technology
- High-Temperature Membranes
- Durability Studies
- Systems Development

Technology Validation

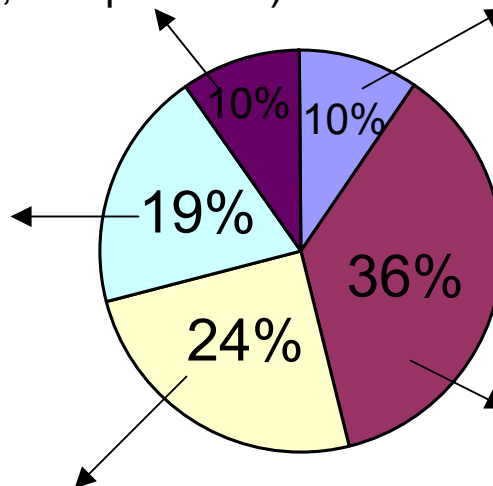
Field Evaluation

Fuel Processing

On-board Fuel Processor R&D

Stack Components

- **Catalyst loading reduction**
- High Temperature membranes
- MEA/bipolar plate manufacturing
- Durability studies





FY03 Programmatic Highlights

Transportation Fuel Cells:

- Continuation of R&D through 30 new cost-shared industry contracts and National Lab projects to address key barriers such as cost reduction
- Field Evaluations - Initiate activity to perform field evaluations of fuel cell vehicles in fleets; solicitation expected in April 2003

Distributed Generation:

- Solicitation released in January 2003
- Program will continue to focus on critical component and systems development

Hydrogen Program:

- Increased efforts in hydrogen storage and infrastructure in support of the FreedomCAR program; solicitations expected in April and June 2003
- Support for Power Parks and Uninterruptible Power Sources

Portable Power/APU

- New starts (\$24M Government over 3 years)
- Anticipated release of solicitation March 2003



Workshop Objectives

- Review the impact of platinum cost and availability on PEM fuel cell commercialization.
- Review the state-of-the-art in electrocatalysts for PEM fuel cells.
- Identify potential, new candidate electrocatalysts that are non-platinum (and non-precious metal).
- Develop a strategy, including a draft research plan, to explore the potential development of new, non-platinum electrocatalysts for PEM fuel cell applications.



Key Points

The focus of this workshop is on new catalysts - building on the existing foundation, when and where appropriate, **BUT primarily exploring new ideas.**

This is a working meeting - not an information meeting. We ask that everybody open up and contribute.

System level targets must be considered.



Merci beaucoup!!!

Organizing Committee

- **Thomas Benjamin (ANL)**
- **Larry Blair (consultant to DOE)**
- **Krista Long (Sentech)**
- **John Petrovic (LANL on detail to DOE)**
- **Phil Ross (LBNL)**



Agenda

Friday, March 21

8:30-8:45	Registration, Continental breakfast
8:45-9:00	Administrative, Tech Targets/ Workshop Expectations - Nancy Garland, DOE
9:00-9:30	Analysis of Pt/PGM Availability and Cost - R. Weber, Tiax
9:30-10:00	Why Pt is Unique – Phil Ross, LBNL
10:00-10:30	Oxide catalysts – P. Atanassov U. of New Mexico
10:30-10:45	Break
10:45-11:15	Macrocycles – J.P. Dodelet, INRS, Varennnes
11:15-11:45	Combinatorial Methods – G. Smotkin, U. of Puerto Rico
11:45-1:00	Lunch
1:00-2:30	Short individual presentations

2:30-2:45	Break
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2:45-5:30	Breakout sessions meet Organic concepts (Facilitator: Rajat Sen, Scribe: Erin Cready) Inorganic concepts (Facilitator: Russ Chianelli, Scribe: Irv Weinstock)
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Saturday, March 22

8:30-8:45	Continental breakfast
8:45-10:30	Breakout Groups Meet
10:30-10:45	Break
10:45-11:45	Breakout Group Final Report Presentations
11:45-12:00	Discussion
12:00-12:15	DOE Closing Remarks