

The Solid State Energy Conversion Alliance



SECA Program Overview *Third Annual SECA Workshop*

March 21-22, 2002
Washington, D.C.

Joseph P, Strakey, Director
Strategic Center for Natural Gas

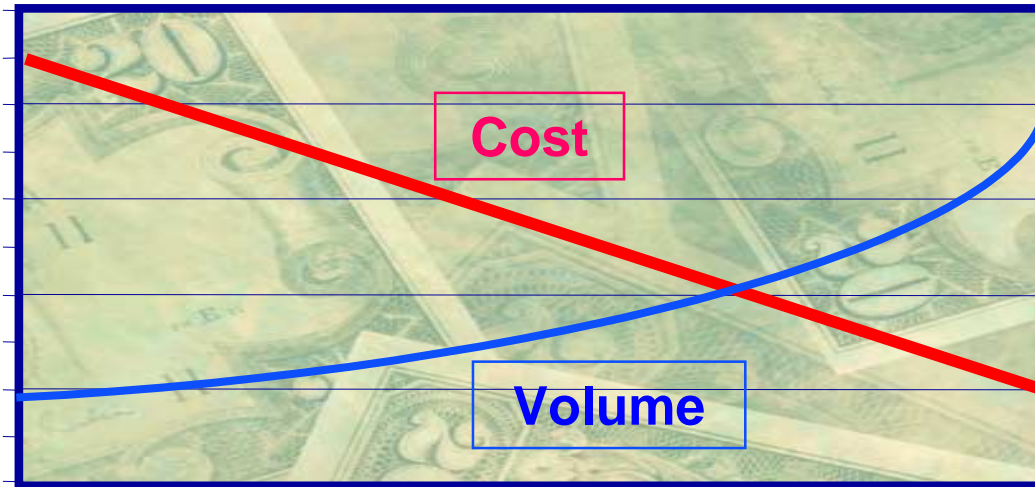


www.netl.doe.gov/scng



SECA Program Strategy

- Make the large public benefits of fuel cells widely available
- Start with the goal in mind (\$400/kW by 2010)
- High-volume / low cost manufacturing technology

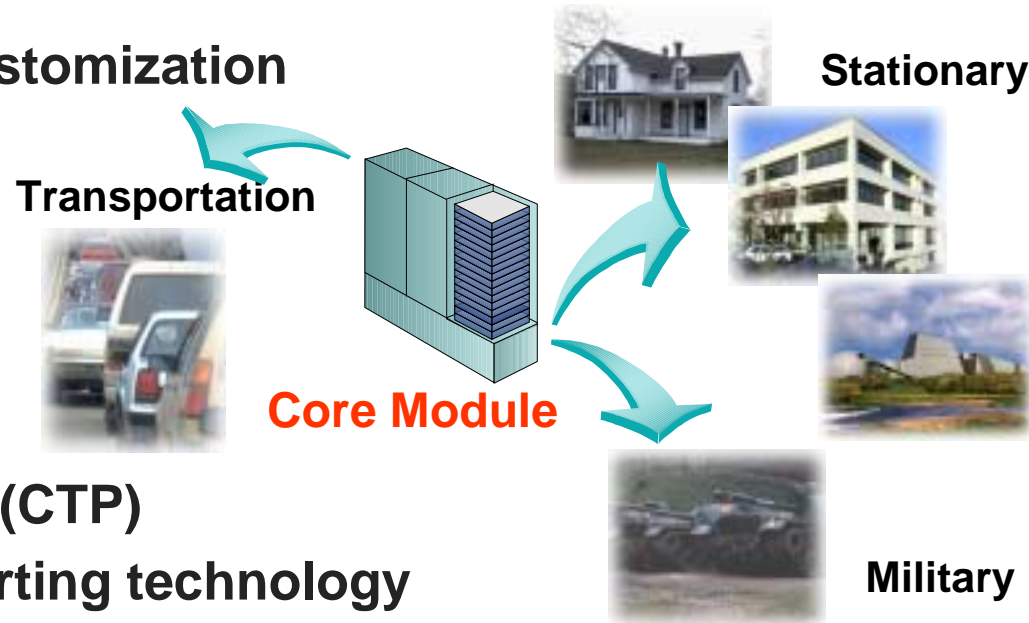


Low Cost/High Volume
\$400/kW/ > 50,000 units/yr



SECA Program Strategy

- Multiple markets / mass customization
- Industry teams with different technical approaches and market applications
- Core Technology Program (CTP) to develop common supporting technology
- Maintain balance between Industry Teams and CTP
- Intermediate, quantifiable metrics to access progress
- Leverage funding by cost sharing and encouraging broad participation by other funding organizations



National Benefits



- **Energy Security**
 - Reduced dependence on imported petroleum
 - Multi-fuel capability
 - Currently available fuels
 - Coal-derived syngas
 - Hydrogen
- **Reduced CO₂ emissions**
 - Double the efficiency of producing power from fossil fuels compared to grid average
 - Ideal for CHP applications



National Benefits



- **Health benefits**
 - Negligible emissions of sulfur, NOx and particulates
- **Grid-independent capability**
 - Environmentally friendly power source for use in rural and pristine areas of the nation.
- **Provides power choices for homes and businesses**



Annual U.S. Emissions Saved Using APUs in Class 8 Trucks (vs. Idling)



- **Diesel fuel saved:**
 - 419 million gal/yr
- **CO₂ reduced:**
 - 4.64 million tons/yr
- **Assumes:**
 - 2.1 million Class 8 trucks
 - 311,000 have overnight routes (APU candidates)



Source: ANL study for DOE, March, 2001

Goals and Applications



2005

- \$800/kW
- **Prototypes (Beta)**
 - Long Haul Trucks
 - RV's
 - Military
 - Premium Power

2010

- \$400/kW
- **Commercial Products**
 - Transportation APUs
 - Residential & Industrial CHP

2015

- \$400/kW
- **Hybrid Systems**
 - 60-70% efficient
- **Vision 21 Power Modules**
 - 75% efficient



Technical Requirements



Cost	\$400 / kW
Power Rating Net	3-10 kW
Efficiency (AC or DC/LHV)	30 - 50% [APU] 40 - 60% [Stationary]
Fuels (<i>Current infrastructure</i>)	Natural Gas Gasoline Diesel
Design Lifetime	5,000 Hours [APU] 40,000 Hours [Stationary]
Maintenance Interval	> 1,000 Hours



Program Structure



Industry Input



Program Management



Project Management

Needs

Research Topics



Industry Integration Teams

	University	National Lab	Industry	Small Business	
Fuel Processing					→
Manufacturing					→
Controls & Diagnostics					→
Power Electronics					→
Modeling & Simulation					→
Materials					→

Core Technology Program

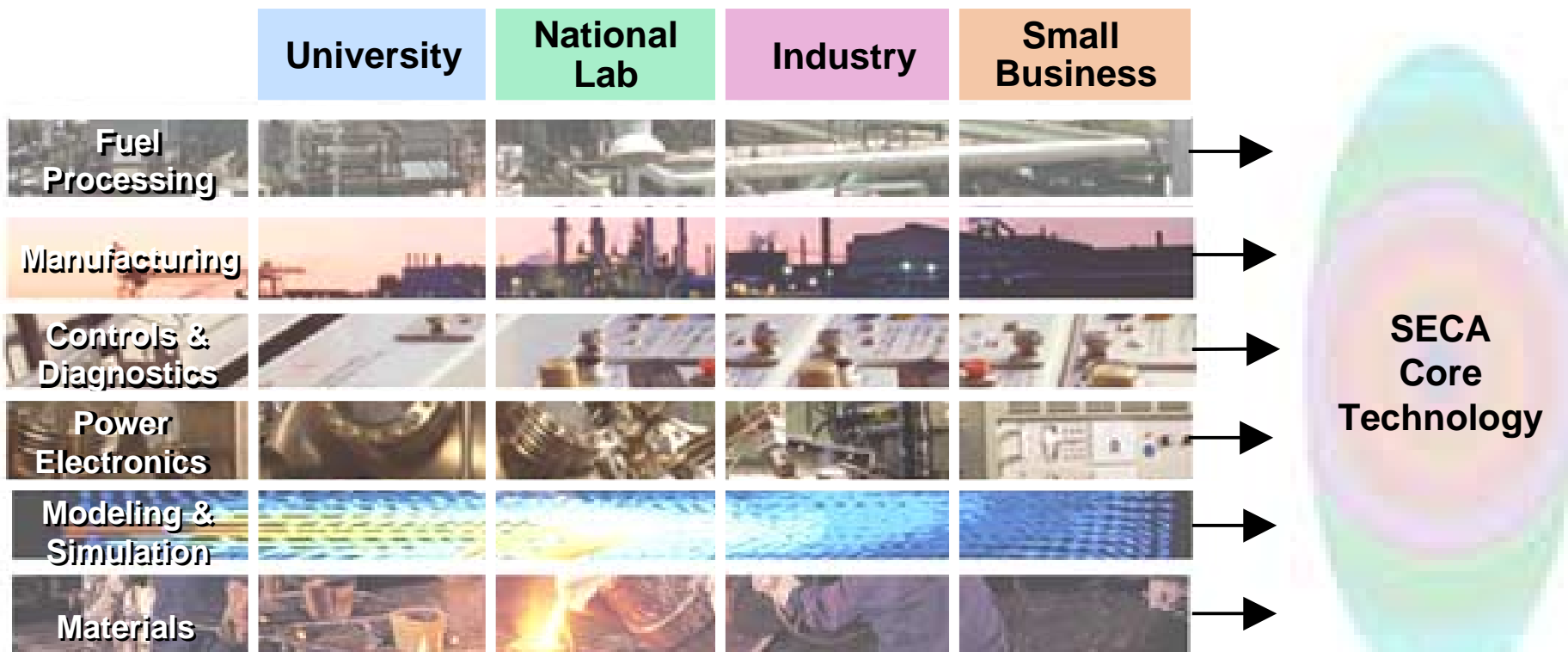
Fuel Cell Core Technology

Technology Transfer



Core Technology Program

The Technology Base



Programmatic Accomplishments



- Program jointly conceived/planned by NETL - PNNL
- Two solicitations issued (Industry Teams, CTP)
- Four Industrial Teams selected -- substantially different approaches
- Program budget received strong support in DOE and Congress
- Core Technology Program initiated
 - Universities, National Labs, small & large businesses
 - Broad participation: 23 prime participants + additional subs
 - Over 70 proposals submitted to current CTP solicitation
- Exceptional Circumstance approved
- Extensive outreach effort -- brochures, Website, Annual SECA Conference, CTP Workshop, semi-annual CTP program reviews, etc.
- SECA Focused numerous domestic and international organizations on SECA concept and supporting technology



SECA Players/Efforts

Universities, National Labs, Industry



Honeywell

ARGONNE
NATIONAL LABORATORY

THE UNIVERSITY OF UTAH



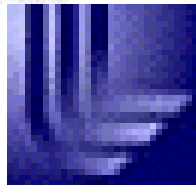
Battelle

Pacific Northwest
National Laboratory

SIEMENS
Westinghouse

Arthur D Little

OAK RIDGE
NATIONAL
LABORATORY



UNIVERSITY OF
FLORIDA



NEXTECH

MATERIALS



TMI
SYSTEMS



BERKELEY LAB

DELPHI

Automotive Systems

NORTHWESTERN UNIVERSITY

LOS ALAMOS NATIONAL LABORATORY



Georgia Institute of Technology



Strategic Center for Natural Gas

Industrial Team Progress



GE - Honeywell

- Demonstrated a unique unitized sealless radial design
- Single cell performance at 700° C is near goal

Delphi / Battelle

- Demonstrated automotive APU application
- Stack will use unique seals, anode, and cathode

Cummins / McDermott

- Demonstrated a unique design and cost-effective multi-layer manufacturing using techniques developed in the semi-conductor industry

Siemens-Westinghouse

- Redesigned successful tubular design to reduce stack cost

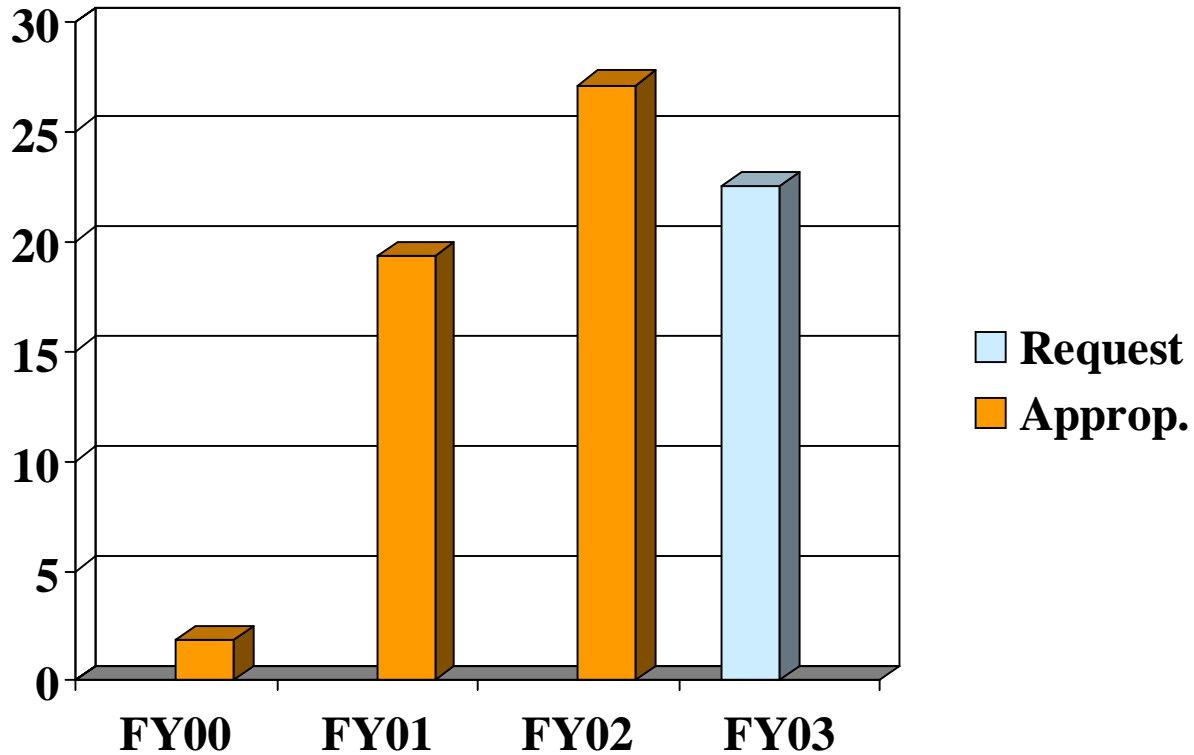


SECA Timeline

- **1st Annual SECA Workshop** June 2000
- **Industry Team Solicitation Issued** November 2000
- **SECA CTP Workshop** February 2001
- **2nd Annual SECA Workshop** March 2001
- **2001 Industry Teams Selected** May 2001
- **CTP Review** November 2001
- **CTP Solicitation Issued** January 2002
- **3rd Annual SECA Workshop** March 2002
- ***Core Technology Program Review*** *June 18-19, 2002*
- ***Industry Team Proposals Due*** *January 3, 2003*



SECA Budget (\$ - millions)



Future SECA Considerations



COAL

DIESEL



The screenshot shows a web browser window titled "Solid State Energy Conversion Alliance (SECA) - Microsoft Internet Explorer". The browser's address bar is empty, and the navigation menu includes "File", "Edit", "View", "Format", "Tools", and "Help". The website's header features the SECA logo and the text "Solid State Energy Conversion Alliance". Below the header is a "Welcome to SECA" message with a sun icon. A navigation menu includes links for "Home", "Feedback", "Contents", "Search", "NETL", "PNNL", and "SOFC". A secondary menu lists "What's New", "All About SECA", "Events", "Publications", "Participants", "Discussion", "Related Links", and "Contacts". The main content area contains a paragraph about the SECA mission, a central image of a fuel cell system with the text "SECA is working to create a solid oxide fuel cell technology by 2010 that will offer a low-cost, high-efficiency system available at less than \$400/kW for stationary, transportation, and military applications.", and logos for the Department of Energy, NETL, Pacific Northwest National Laboratory, and The Strategic Center for Natural Gas. The "Upcoming Events" section lists the "Third Annual Solid State Energy Conversion Alliance (SECA) Workshop" held at the Regency Washington on Capital Hill, Washington, DC, from March 21-22, 2002.

