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 CO$_2$ 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

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Cost</td>
<td>$400 / kW</td>
</tr>
<tr>
<td>Power Rating Net</td>
<td>3-10 kW</td>
</tr>
<tr>
<td>Efficiency (AC or DC/LHV)</td>
<td>30 - 50% [APU]</td>
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<tr>
<td></td>
<td>40 - 60% [Stationary]</td>
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<tr>
<td>Fuels (Current infrastructure)</td>
<td>Natural Gas, Gasoline, Diesel</td>
</tr>
<tr>
<td>Design Lifetime</td>
<td>5,000 Hours [APU]</td>
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<tr>
<td></td>
<td>40,000 Hours [Stationary]</td>
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<tr>
<td>Maintenance Interval</td>
<td>&gt; 1,000 Hours</td>
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Program Structure

Industry Input

Program Management

Industry Integration Teams

Research Topics

Project Management

Needs

Technology Transfer

Core Technology Program

Strategic Center for Natural Gas
Core Technology Program
The Technology Base

<table>
<thead>
<tr>
<th>University</th>
<th>National Lab</th>
<th>Industry</th>
<th>Small Business</th>
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<tbody>
<tr>
<td>Fuel Processing</td>
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<td>Manufacturing</td>
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<td>Controls &amp; Diagnostics</td>
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<td>Power Electronics</td>
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<td>Modeling &amp; Simulation</td>
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<td>Materials</td>
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SECA Core Technology

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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

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Industrial Team Progress

**GE - Honeywell**
- Demonstrated a unique unitized sealless radial design
- Single cell performance at 700\(^\circ\) 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)

Request
Aprop.
Future SECA Considerations

COAL

DIESEL