

# Solid State Energy Conversion Alliance Core Technology Workshop & Peer Review



**Wayne A. Surdoval**  
**SECA Coordinator**

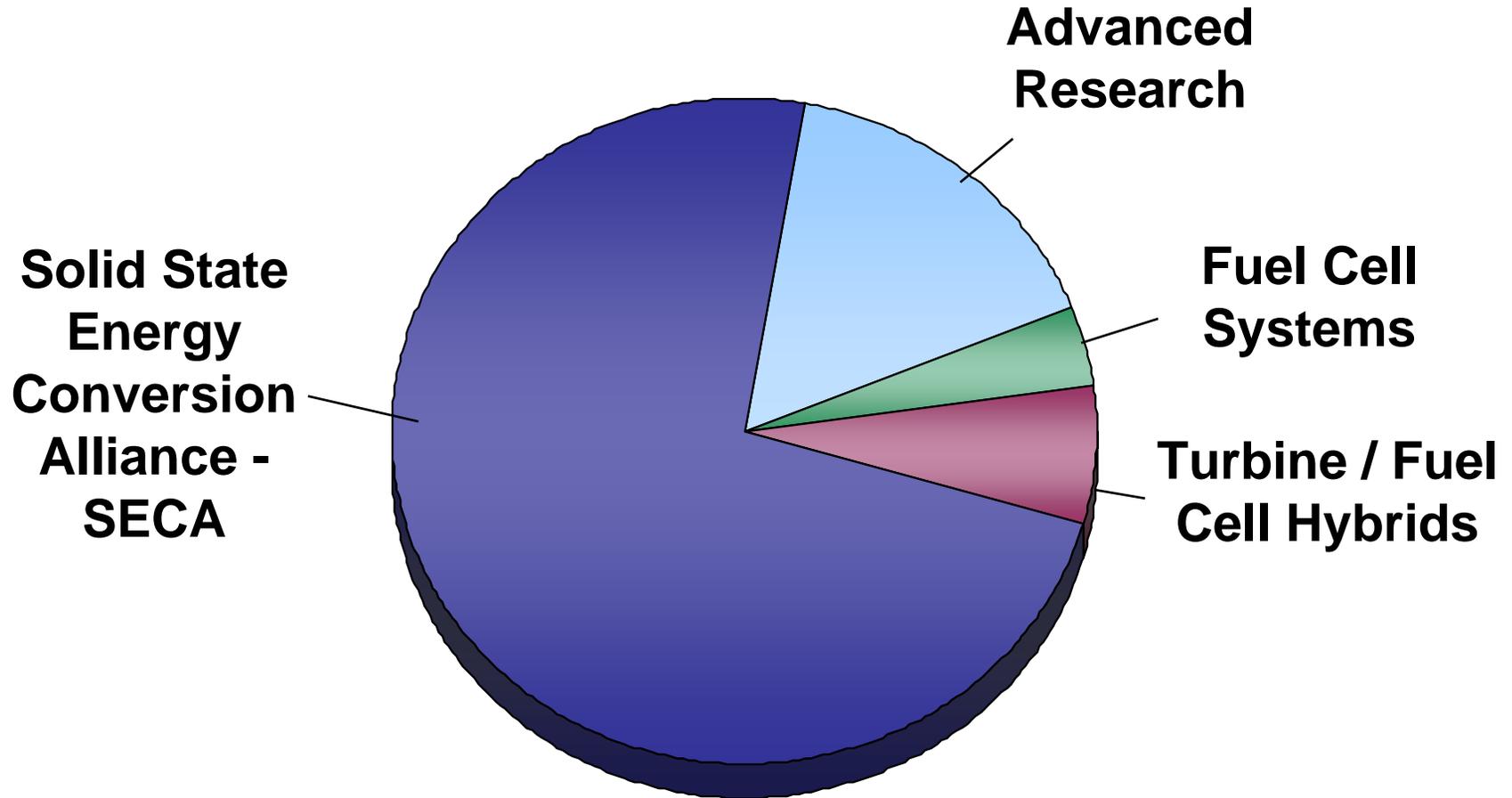
*Golden, CO*  
*October 25<sup>th</sup> 2005*

**U. S. Department of Energy**  
**National Energy Technology Laboratory**



# Office of Fossil Energy Fuel Cell Program

*\$78.2.1M FY 05 Funding*

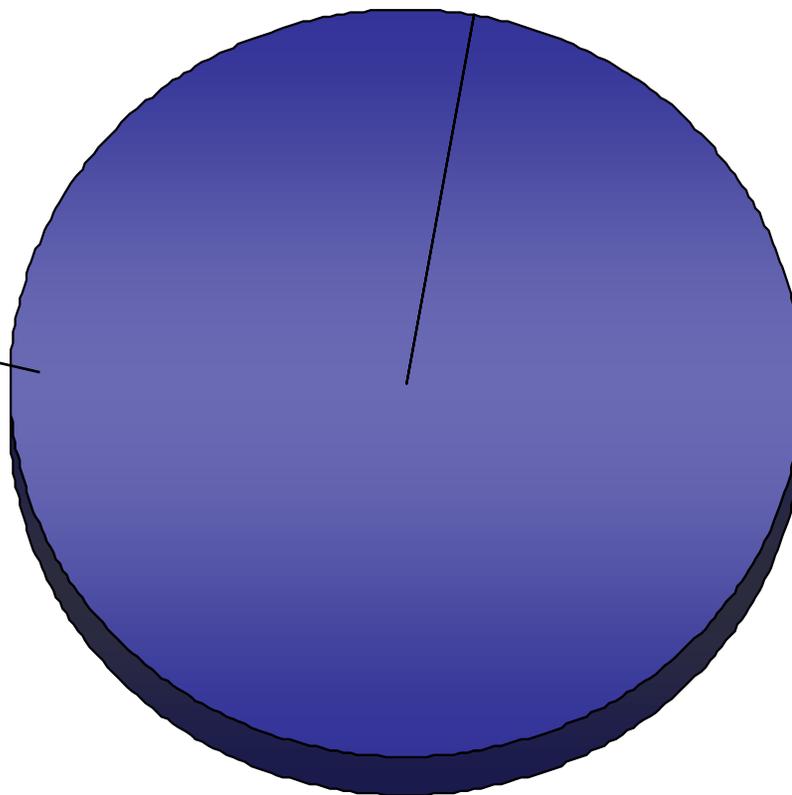


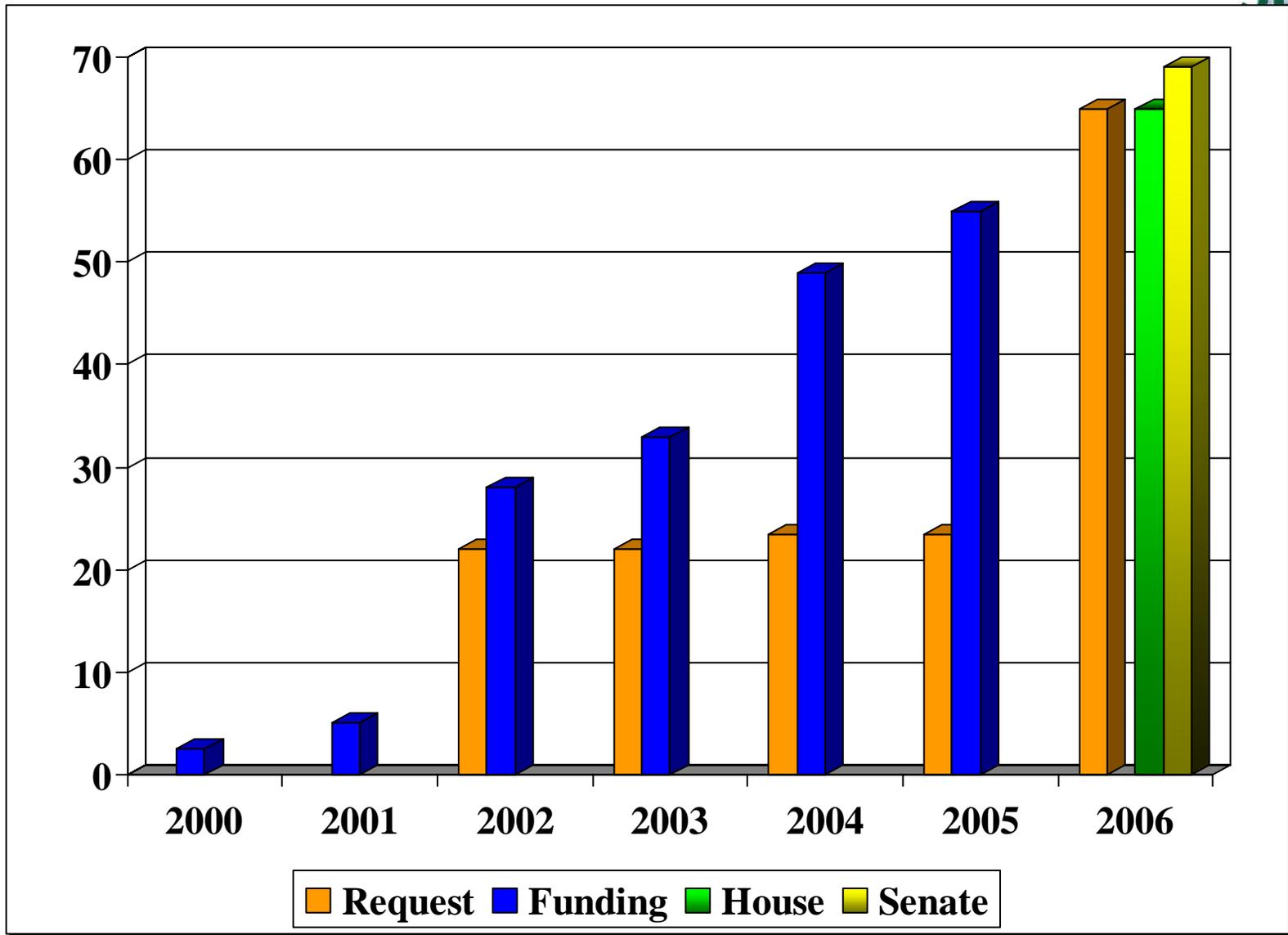
# Office of Fossil Energy Fuel Cell Program

*\$65M FY 06 Lower Congressional Mark*



**Solid State  
Energy  
Conversion  
Alliance -  
SECA**





# SECA: A Path to Making Fuels Cells a Reality



## 2005

- **1<sup>st</sup> Generation Prototypes**
  - Testing & Evaluation

## 2010

- **\$400/kW Modules**
  - Residential, Commercial, Industrial CHP
  - Transportation APUs

## 2012 - 2015

- **FutureGen - SECA fuel cells available**

## 2020

- **MW-Scale SECA fuel cells for Advanced Coal Power Plants**



# Key Roadmap Milestones

(SECA - SECA/Fuel Cell Coal-Based Systems – FutureGen – Central Generation)

- **2005 – Phase I SECA prototypes**
- **2005 – Select Fuel Cell Coal-Based System Teams**
- **2008 – SECA Phase II prototype testing**
- **2008 -- Modular fuel cell stack test on coal gas**
- **2010 – Phase III SECA \$400/kW modules**
- **2010 – MW-class (250-kW) aggregated, \$400/kW fuel cell module test on coal gas**
- **2012-2015 – MW-class scaleable fuel cell or fuel cell /hybrid on coal at 50% HHV efficiency at FutureGen**
- **2018-2020 – Test MW-class hybrid system on coal at 60% efficiency**
- **2020 – 100 MW-class fuel cell systems**

# Current Priorities: *SECA Core Technology Program*



1	<b>Gas seals</b>	<ul style="list-style-type: none"> <li>▪ <b>Glass and compressive seals</b></li> <li>▪ <b>Compliant Seals</b></li> <li>▪ <b>Self-healing materials</b></li> <li>▪ <b>High Temperature Seal</b></li> <li>▪ <b>Brazes</b></li> </ul>
1	<b>Interconnect</b>	<ul style="list-style-type: none"> <li>▪ <b>Modifying composition of alloys</b></li> <li>▪ <b>Coatings</b></li> <li>▪ <b>Electrode to interconnect interface contact material</b></li> </ul>
1	<b>Failure Analysis</b>	<ul style="list-style-type: none"> <li>▪ <b>Models with electrochemistry</b></li> <li>▪ <b>Structural characterization</b></li> <li>▪ <b>Structural failure analysis &amp; design criteria</b></li> </ul>
2	<b>Cathode performance</b>	<ul style="list-style-type: none"> <li>▪ <b>Micro structure optimization</b></li> <li>▪ <b>Mixed conduction</b></li> <li>▪ <b>Interface modification</b></li> <li>▪ <b>Electrocatalysts</b></li> <li>▪ <b>Mechanism</b></li> <li>▪ <b>Cathode Task Force</b></li> </ul>
2	<b>Anode / fuel processing</b>	<ul style="list-style-type: none"> <li>▪ <b>Catalyst surface modification</b></li> <li>▪ <b>Characterize thermodynamics/kinetics</b></li> <li>▪ <b>Multi-component catalysts</b></li> </ul>
3	<b>Materials cost</b>	<ul style="list-style-type: none"> <li>▪ <b>Lower cost precursor processing</b></li> </ul>



# SECA Core Technology Portfolio

*\$16.3M FY 05 Funding*



**Electrodes**

**Failure  
Analysis**

**Interconnects**

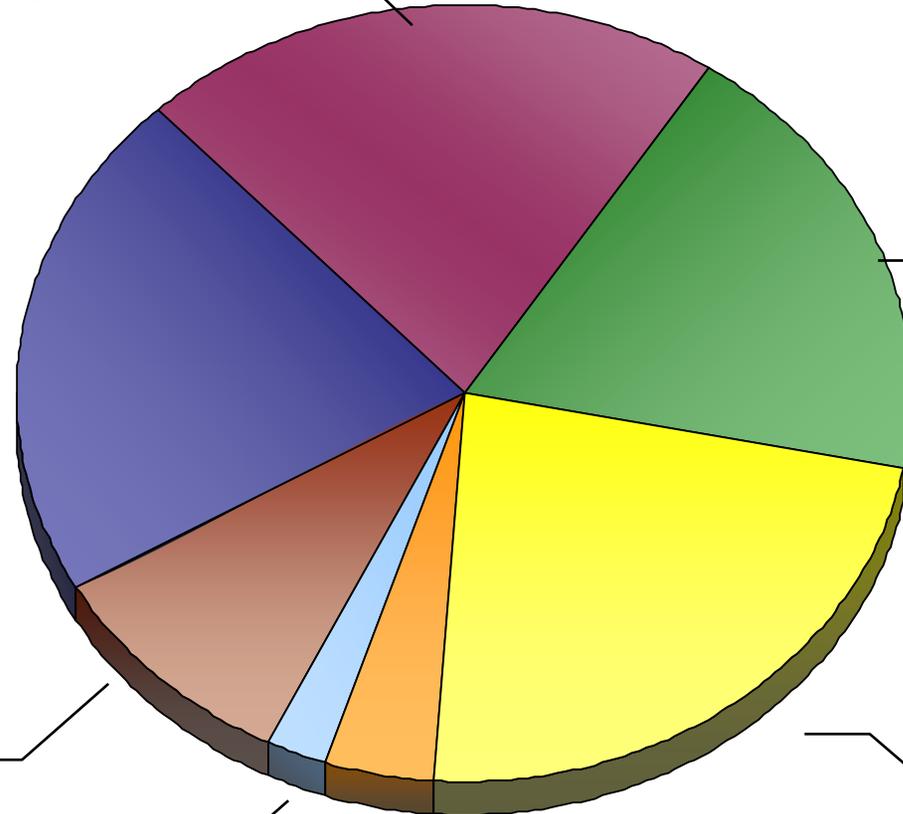
**Seals**

**Manufacturing**

**Power**

**Electronics**

**Fuel  
Processing**



# SECA Projects, Workshops & Working Groups



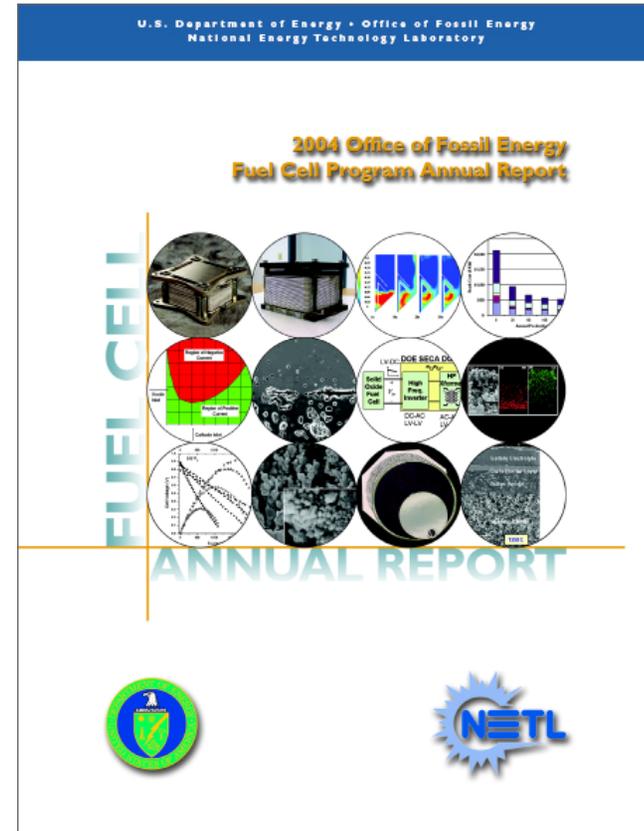
- **74 Active SECA Projects**
  - SECA Industry
  - SECA Core Program
  - Advanced Research
  - Small Business Innovative Research
  - University Coal Research
- **Twelve Public and Core Technology Workshops**
- **Five Working Groups**
  - Seals (Sandia 2004)
  - Interconnects/Chrome (PNNL 2005)
  - Fuel Processing
  - (Army Research Lab 2002 & Pittsburgh, December 2005)
  - Electrodes (January 2006)





# For More Information on SECA and other Projects Visit [www.netl.doe.gov/dg](http://www.netl.doe.gov/dg)

- **CDs available from the website**
- **FE Fuel Cell Program Annual Report**
- **Annual SECA Workshop Proceedings**
- **SECA Core Technology Program Peer Reviews**
- **Fuel Cell Handbook (7<sup>th</sup> ed.)**





NETL

What's New  
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## Solid State Energy Conversion Alliance (SECA)

*Encouraging the development of environmentally friendly solid oxide fuel cell modules for use with available fossil fuels at low cost*

### Origin of SECA

The Solid State Energy Conversion Alliance (SECA) was initiated in the fall of 1999 as a unique alliance between government, industry, and the scientific community. SECA promotes the development of environmentally friendly solid oxide fuel cells (SOFC) using commonly available fossil fuels thereby making it an affordable, clean and reliable source of electric power for virtually all markets.

### SECA Coordination

The SECA program is carried out under the auspices of the DOE Office of Fossil Energy. The DOE National Energy Technology Laboratory (NETL) and the Pacific Northwest National Laboratory are responsible for program development. NETL is the DOE program office responsible for managing program implementation and NETL's Strategic Center for Natural Gas coordinate activities with commercial developers, universities, government agencies and other national laboratories who are participants. The Alliance is tightly coordinated so that commercially cost-effective solid oxide fuel cell prototypes for diverse applications are produced and environmental concerns associated with current methods of generating electricity from fossil fuels are mitigated.

SECA

Overview

Events

The Alliance

Projects

Reference Shelf

<http://www.seca.doe.gov/>

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# Congratulations



## GE Completes SECA Phase I



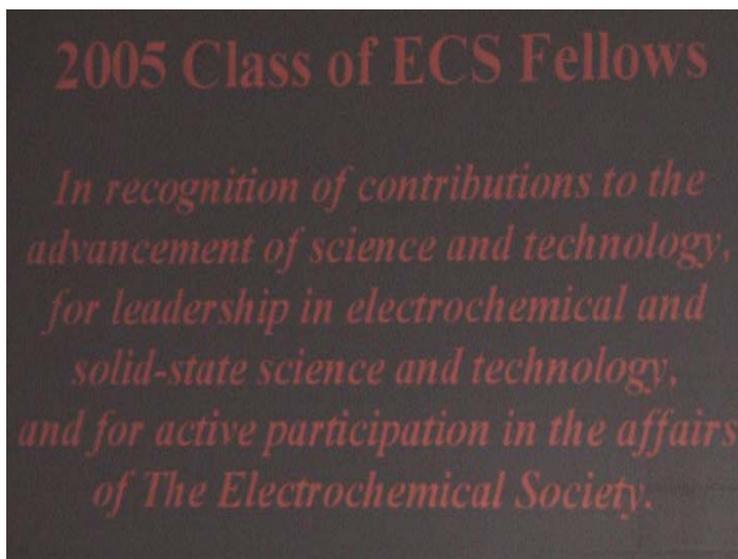
Prototype met SECA Phase I targets:

- Cost: \$746/kW (~~\$800/kW~~)
- Efficiency: 38.0% LHV-AC (~~35%~~)
- Degradation: <2%/1000 hours  
(~~<4%/1000 hours~~)



# Congratulations

## Dr. Mark Williams Elected Fellow of The Electrochemical Society



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# Special Thanks!



**Colorado Fuel Cell Center**

**Ruthie Coors Swartzlander**

**Dr. John K. Coors**

**Mr. Rick Grice**

