

SECA - The Challenge for Small-Scale, Ultra-Low Cost SOFC Power Systems

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March 2002

3rd Annual SECA Workshop (Solid State Energy Conversion Alliance) Washington, DC

AGENDA



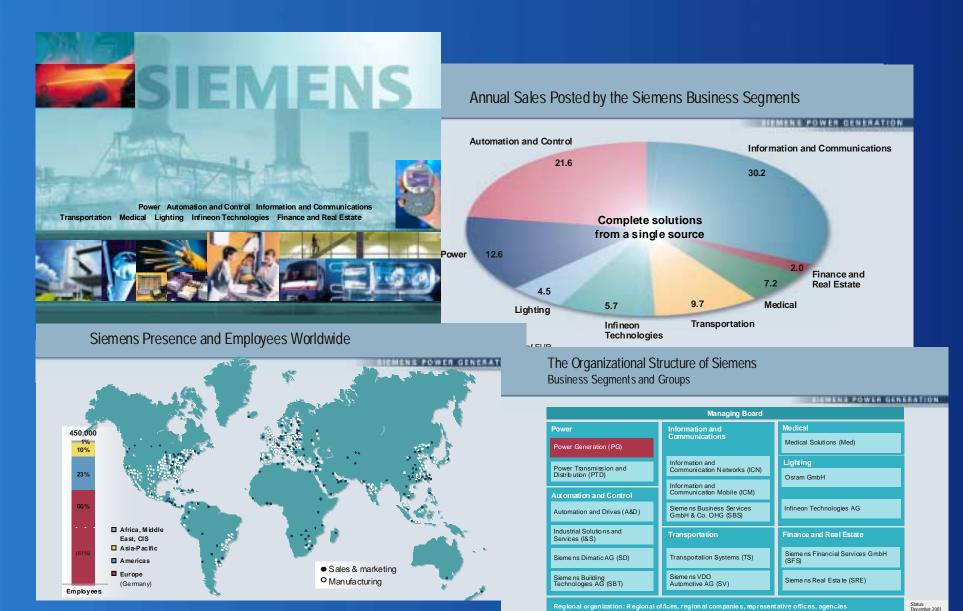
SECA - The Challenge for Small-Scale, Ultra-Low Cost SOFC Power Systems

- O Introduction
- O Vision / Mission / SECA Focus
- Market Needs / Customer Applications
- O Path to SECA Program
- **O** Conclusions

Fuel Cells are a good strategic fit at Siemens Westinghouse

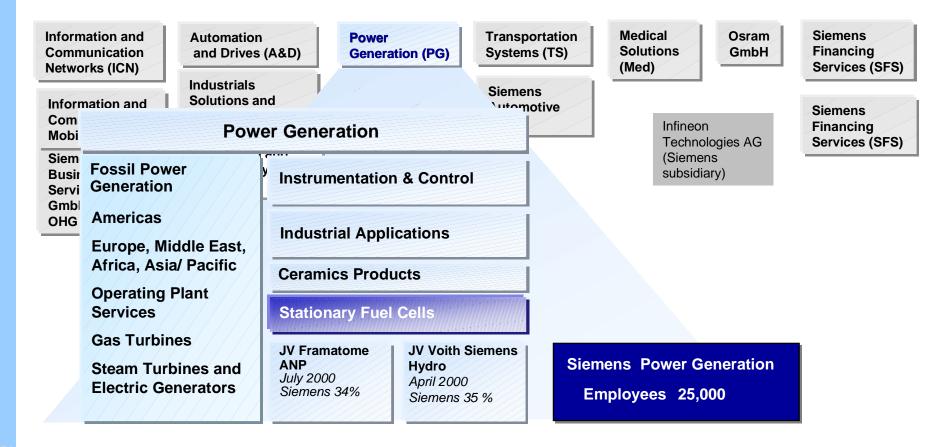


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Siemens AG Power Generation





Developing Clean Power in Pennsylvania



- R&D activities started early 1970s in Pittsburgh, Pennsylvania
- Siemens Westinghouse Stationary Fuel Cells converted from R&D department to an entire business unit with a new manufacturing facility
- First environmental friendly commercial product CHP 250 (no SOx; no CO; NOx < 1ppm; 50% of CO₂ from MTG's)

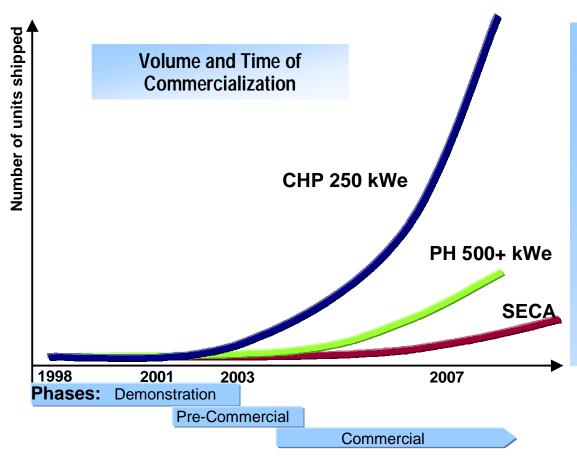


- New Commercial factory (Milestones):
 - Site Selection/Groundbreaking
 - 2- Finalized Manufacturing Building
 - 3- Implemented Manufacturing Equipment
 - 4- Qualified Production Processes
 - 5- Start Commercial Shipments



Siemens Westinghouse: Strong Initial Interest in Fuel Cells





Fuel Cell Manufacturing Pittsburgh, PA



- 22 acre
- 430,000 Sq. Ft.
- \$122 million investment
- Capacity 105,000 fuel cells/m

Well on the Way to Commercialization

Two Product Classes Focus for Near Term Commercialization



Atmospheric Pressure CHP - System:

250 kWe class

CHP: Combined Heat and Power

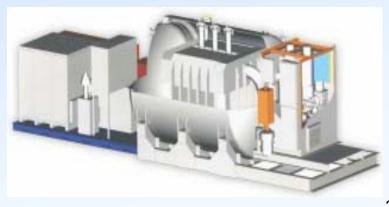


Oct.03

Pressurized Hybrid PH - System:

500+ kWe class

PH: Pressurized Hybrid



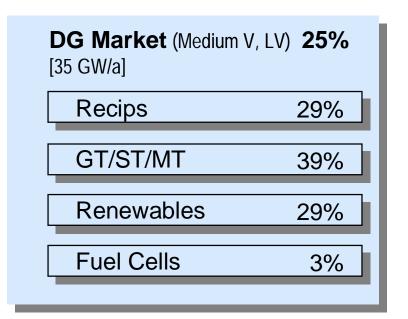
2004/05

Power Generation ... Central and Distributed Generation



Power Generation Market 100% [145 GW/a, Ø/01-/06]

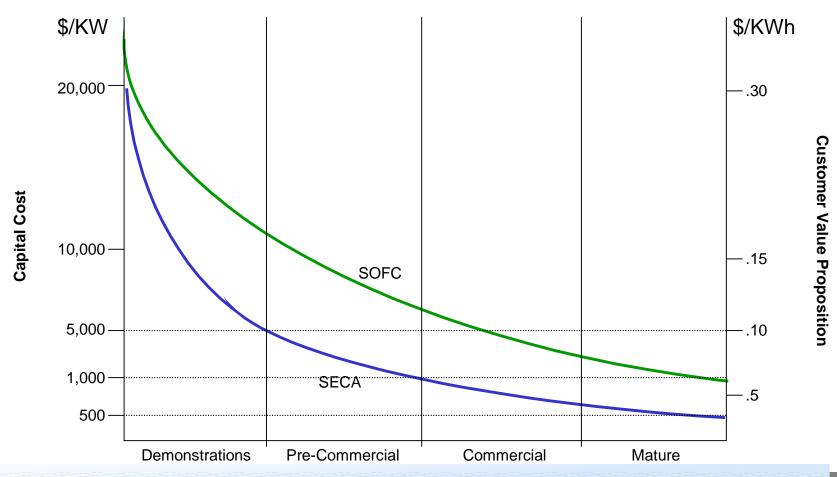
Central (HV grid) 75% [110 GW/a]



SOFC technology offers customer competitive solutions to the Distributed Generation (DG) market / customer grid





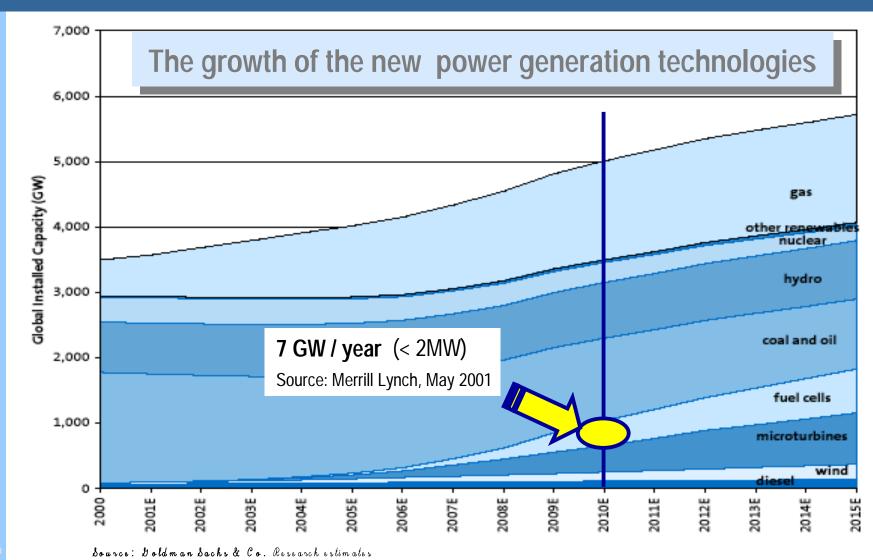


Costs Decrease with Standardization,
Cost Improvements and Continued R&D Increases Market Demands



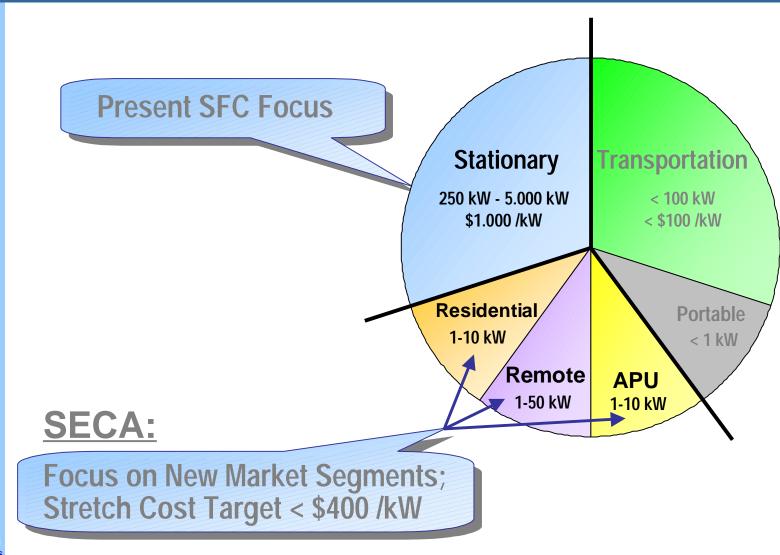
Power GenerationGlobal Installed Capacity





Projected Fuel Cell Market in 2012





Our Vision for SECA



Vision:

Ultra-low cost SOFC design for a wide variety of fuel and kW-class applications.







Mission:

- 10 x cheaper
- 2 x output
- 1/3 volume







o output: 5 - 10 kW

efficiency: 45% net AC/LHV

useful energy: > 80% total system efficiency

o fuel: - natural gas

- methanol/ethanol

o - propane

o - logistic fuels (e.g. diesel)

o production: world-class mass-production

o cost: \$400 /kW







New market segments: - Residential

- Remote

- Transportation / APU

- Military

• Fuel flexibility: Today = natural gas

... need for liquid fuels, syn fuels

Production: Six sigma mass-production

Stretch cost target: \$400 /kW



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SECA Program – Multiple Market Applications

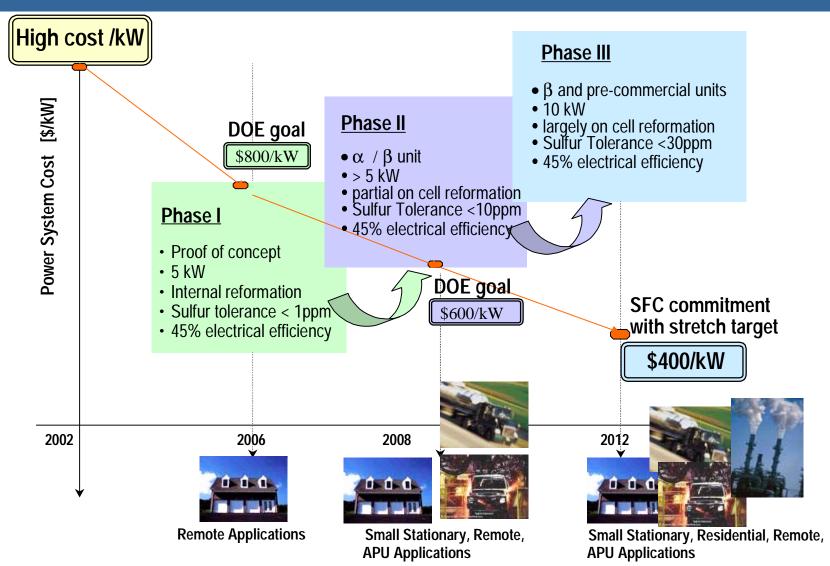
Technology Team	Customer / Market Team		
	Remote/Residential	Transportation	Military
SWPC	Fuel Cell Technologies	Ford	Newport News
Fuel Cell Technologies	Lennox	Eaton	Eaton
Blasch Precision Ceramics	Trane		
Zircar Refractory Ceramics	Dominion		

Key Team Members provide Market Access and Specific Industry Expertise
To broaden Market Opportunities and New Applications



Stationary Fuel Cells (SFC) **Concept for SECA Program**





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SECA is a Great Opportunity for Siemens Westinghouse



Conclusions



SECA - a challenging Program requiring breakthroughs in:

- Process and System Simplifications
- Potential for Lower Cost Materials at Lower Operating Temperature
- Fuel Processing (diesel, kerosene, gasoline)
- Effective Mass-Production

Strong Team needed to achieve success

Our Industrial Partners provide Key Input and Expertise to access Current Served Markets as well as **Develop New Market Initiatives.**



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SECA program needs:

- Industry Collaboration
- Sustained DOE Funding

But for the new market segments we need <u>additionally</u>:

- ... Key legislation for net metering principles
- ... Automotive technology breakthrough to provide the volume for full scale adoption of APU technologies
- ... Alternative fuel development to provide full deployment of fuel cell operation in remote, and military logistic operations

