

Fuel Cells In Evolving Energy Markets

EPRI Perspective

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Strategic Options

DOE / EPRI / GRI Fuel Cell
Conference

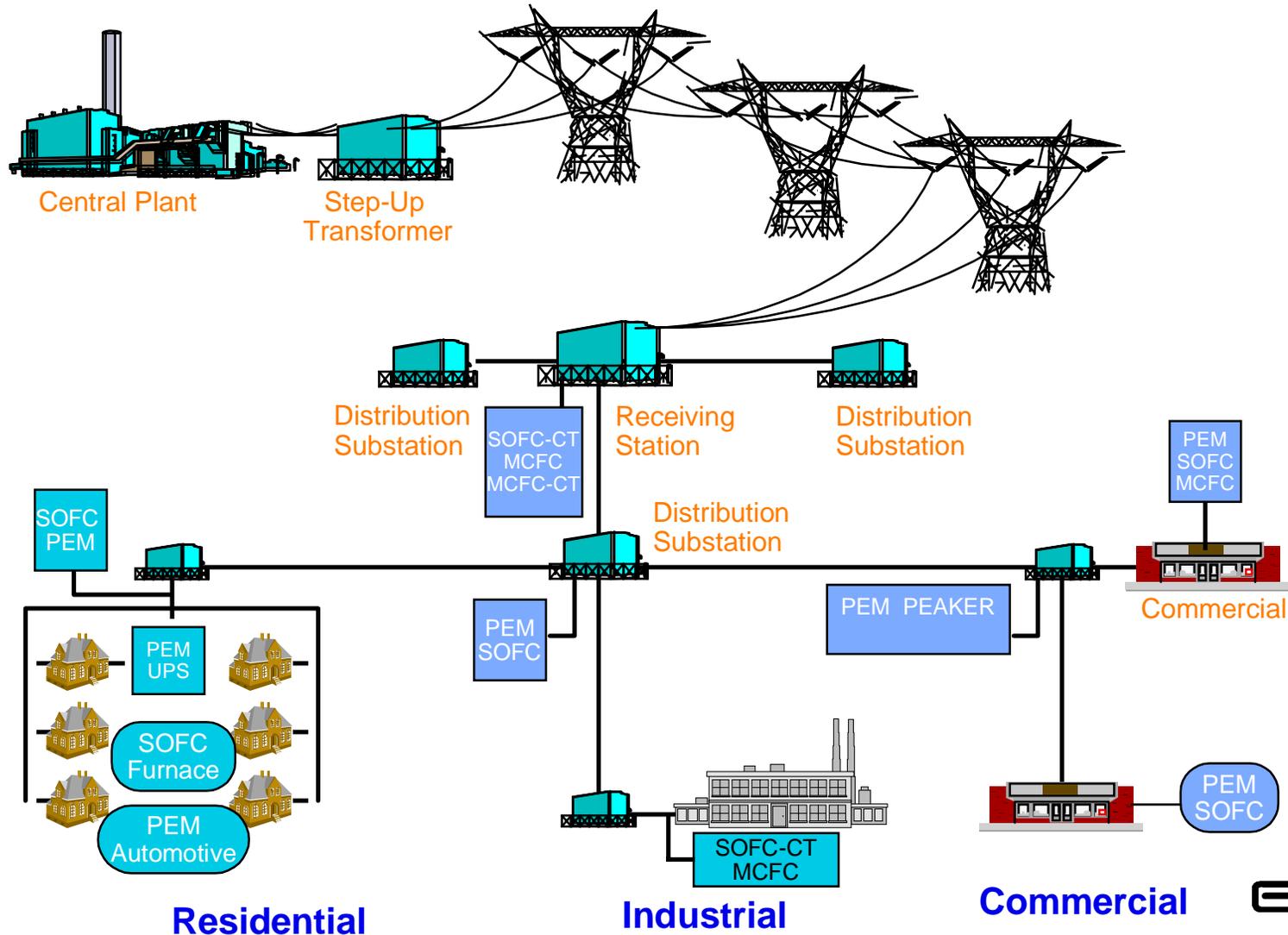
August 3, 1999
Chicago, Ill

EPRI

Fuel Cells in Evolving Energy Markets

- Where Fuel Cells Fit in Stationary Power
- Plausible Markets and Applications
- Technology Positioning
- Technology Road map
- EPRI's Program

Fuel cells will be deployed as distributed resources to provide energy solutions for retail energy providers, end-users and to enhance grid operations.



Plausible Long-Term Markets for Fuel Cell Systems

<u>Market</u>	<u>Relative Strength</u>
• Combined Heat and Power	++
• Premium Power	+
• Low Cost Energy	-
• Load Management & Grid Support	++

Recognition of these markets by all stake holders should form the basis for a National Fuel Development Strategy

Positioning of Fuel Cell Power Systems

Low-Cost Power

SOFC-CT

MCFC-CT

SOFC

MCFC

On-Site Power

SOFC

PEMFC

MCFC

PAFC

CHP

SOFC

MCFC

Load Mgt

PEMFC & Storage

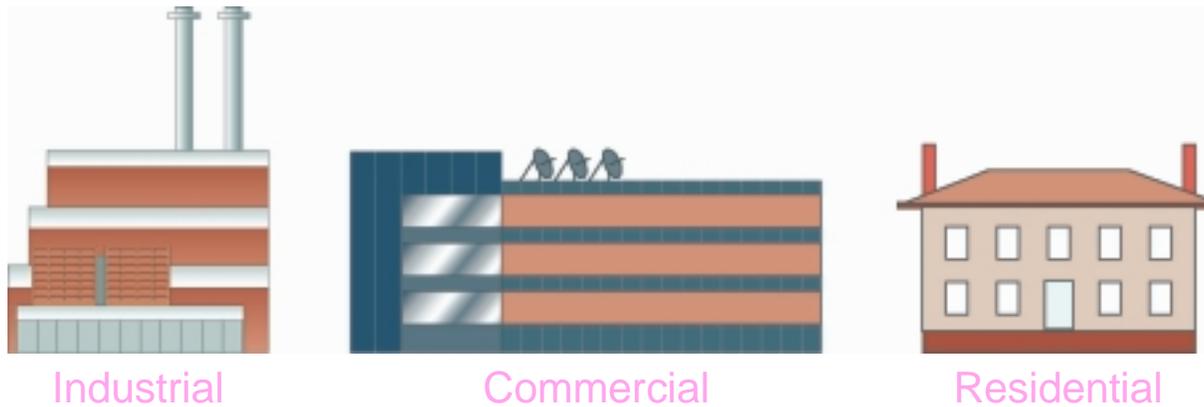
Fuel Cell Technology & Applications

... the most promising system applications

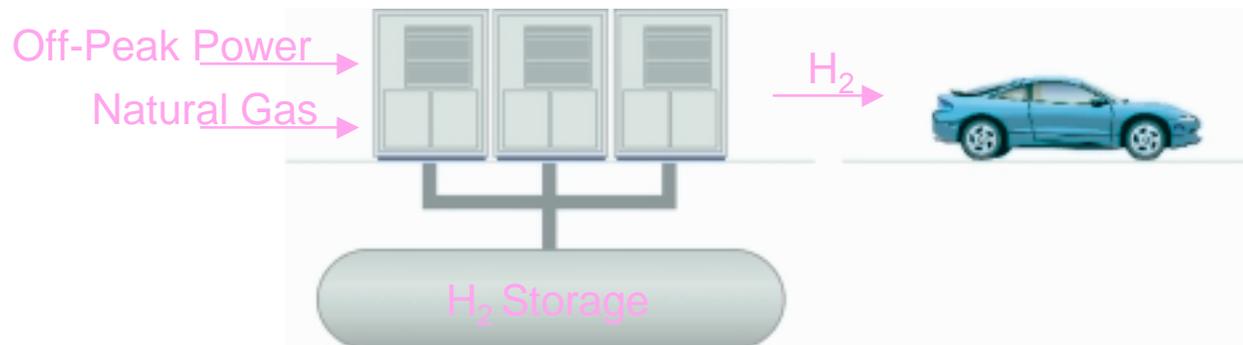
- **Residential and Commercial Power** - 5 to 5000kW units, typically PEM, MCFC and SOFC configured in all electric or co-generation
- **Premium Power** - PAFC, SOFC and PEM offer solutions for premium power.
- **Industrial** - SOFC & MCFC combined with a combustion turbine have efficiencies in excess of 60%
- **Dispatchable Peaking Power for Load Mgt.** - 50 to 2,000 kW PEM systems combined with hydrogen storage offer a low cost and environmentally clean peaking resources for load management and T&D grid support.
- **Battery Replacement and UPS Power**- PEM systems configured with hydrogen storage offer longer mission time service than battery or other currently available UPS systems

High Impact Markets for Fuel Cells

Near-Term Onsite Power Solutions



Long-Term Grid Peaker



Road-Map Destinations for Fuel Cells

Where are they Going?

1980-1990 Distributed Power → Central Power

1990-2000 Distributed Power → Distributed Power

2000-2010 Distributed Power → Grid Power

2010-2050 Grid - Power → Transportation Power

EPRI's 1999-2001 Program Strategy

- Develop PEM/UPS Systems
- Test & Evaluate 3-10 kW PEM Systems
- Test & Evaluate SOFC Systems
- Develop, Test 50 kW PEM System 2001
- Develop, Test a 100 kW PEM Grid Support System
- Field Test Emerging Systems in distributed power applications
- Develop, Commercialize High Value Fuel Cells in via “Private Collaboratives” in EPRI solutions.