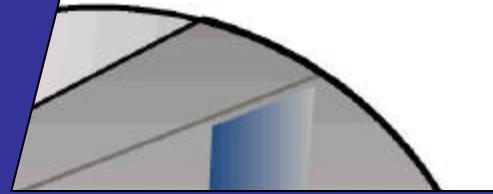


NATIONAL FUEL CELL RESEARCH CENTER (NFCRC)



- **INITIALLY ESTABLISHED WITH SCE IN 1992**
- **RELOCATED AND ESTABLISHED AT UCI IN 1997**
- **DEDICATED IN 1998**
- **U.S. DEPARTMENT OF ENERGY CALIFORNIA ENERGY COMMISSION**

April, 2003

NATIONAL BASED MEMBERSHIP

Agencies

Air Resources Board

CA Institute of Energy Efficiency

Department of Energy

**South Coast Air Quality
Management District**

CA Energy Commission

Department of Defense

Electric Power Research Institute

Industry

Air Products & Chemicals

ChevronTexaco

LA Dept. of Water and Power

Plug Power, Inc.

Siemens-Westinghouse Power

Southern California Gas

Capstone Turbines

FuelCell Energy Corp.

Horiba Limited

Parker Hannifin

Southern California Edison

Toyota



NATIONAL FUEL CELL RESEARCH CENTER

- **NATIONAL MISSION**

~~TO FACILITATE AND ACCELERATE THE~~ **DEVELOPMENT** ~~AND~~
~~DEPLOYMENT OF FUEL CELL TECHNOLOGY AND FUEL CELL~~
~~SYSTEMS, AND PROMOTE STRATEGIC~~ **ALLIANCES** ~~TO~~
~~ADDRESS THE MARKET CHALLENGES ASSOCIATED WITH THE~~
~~INSTALLATION AND INTEGRATION OF FUEL CELL SYSTEMS~~
~~INTO THE BUILT ENVIRONMENT~~

- **APPROACH**

RESEARCH
EDUCATION
BETA TESTING
MARKET DYNAMICS



APPROACH

UNIVERSITY ROLE

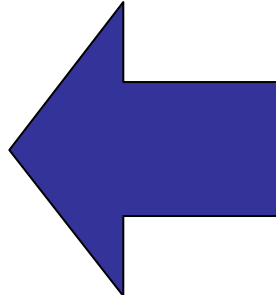
TRADITIONAL

NON-TRADITIONAL

EDUCATION	RESEARCH & DEVELOPMENT	BETA TESTING	DEMO	FACILITATE POLICY / MARKET
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INPUTS

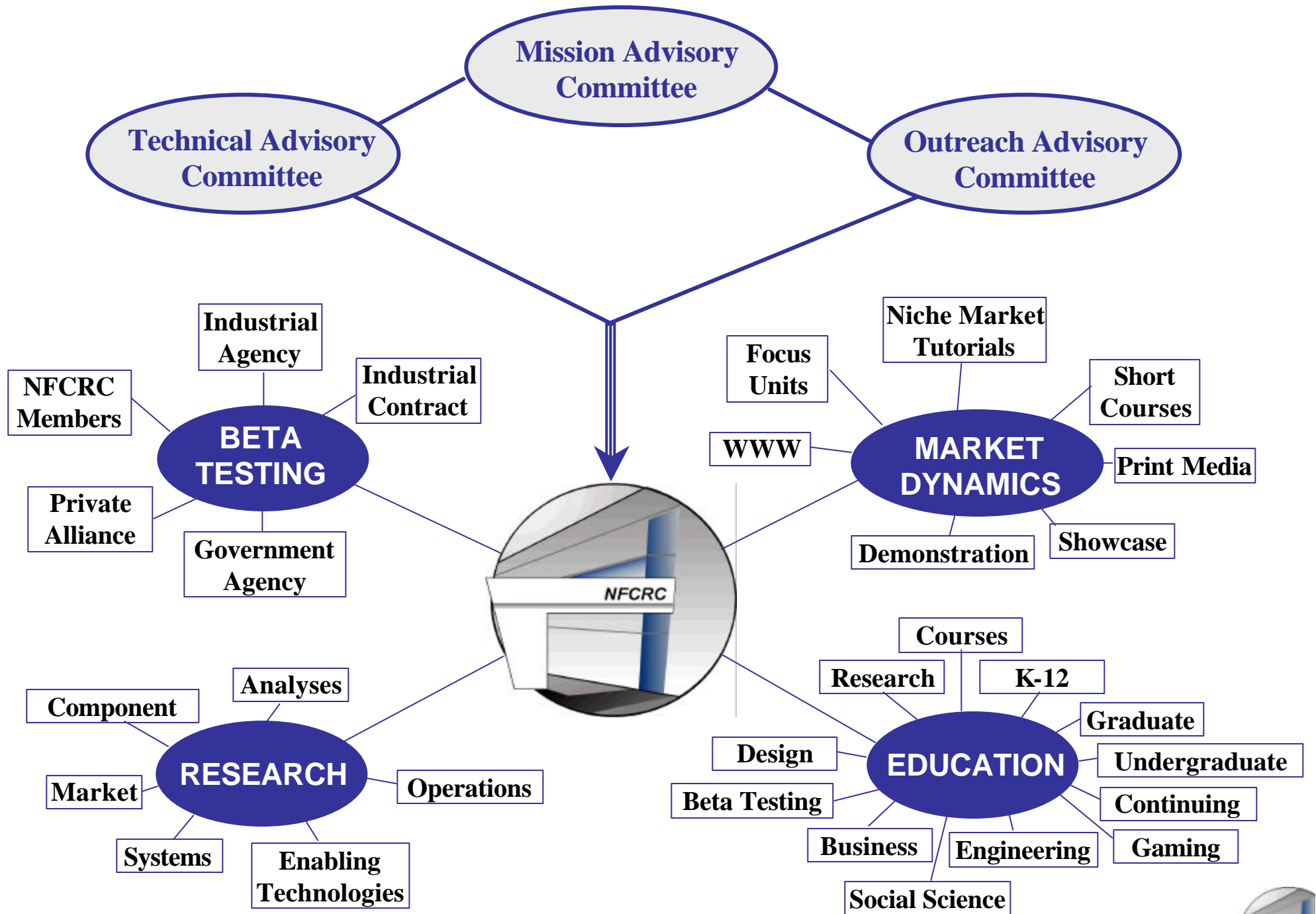
- R&D needs
- Education
- Stakeholders
 - Industry
 - Agencies
 - Market
 - Regulators
 - Codes



OUTPUTS

- Trained personnel
- Information
- Tools
- Accelerated development
- Market connectiveness
- Public benefit
- Experiential data



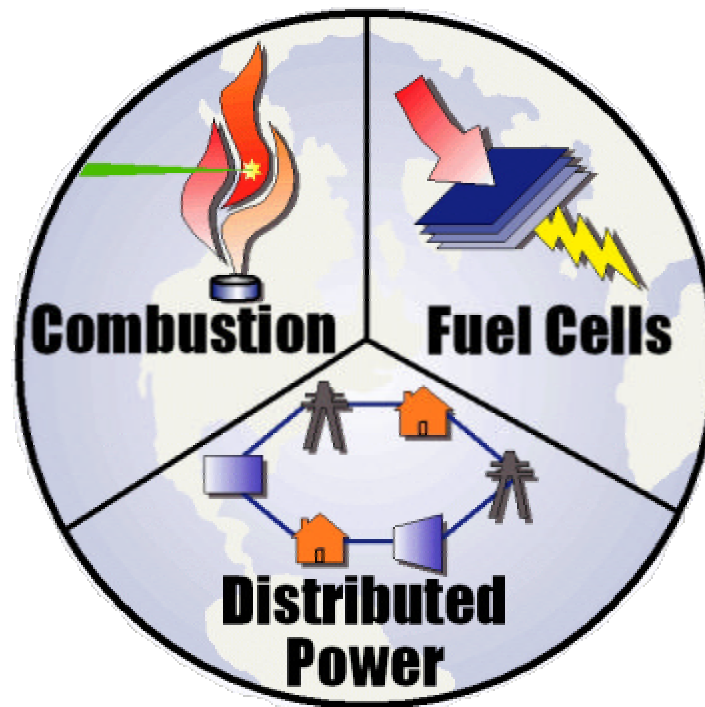


APPROACH

Advanced Power & Energy Program (APEP) context

APEP the official umbrella organization since 2000

- National Fuel Cell Research Center (NFCRC)
- UCI Combustion Laboratory (UCICL)
- Pacific Rim Consortium on Energy Combustion and Environment (PARCON)



APPROACH

COLLABORATIVE INTERACTION WITH INDUSTRY

- **CONTRACTS, GRANTS, TEAMING**

SCIENCE COUPLED TO PRACTICAL APPLICATION

- **ENERGY SYSTEMS: FUEL CELLS, GAS TURBINES, MICROTURBINE GENERATORS, HYBRIDS, INVERTERS, IT, BOILERS AND FURNACES**
- **PROPULSION SYSTEMS: GAS TURBINES, ROCKETS**

PERSONNEL

- **PROFESSIONAL STAFF**
- **GRADUATE STUDENTS**
- **UNDERGRADUATE STUDENTS**
- **RESEARCH ASSOCIATES**



RESEARCH FOCUS / STRATEGY

NFCRC Focus is on Stationary Power (Distributed Power)

NFCRC Focus is on Systems Research

- **Fuel cell systems**
- **Gas turbine systems**
- **Fossil-fueled Hybrids**
- **Renewable Hybrids**
- **Fuel Processing (reformation)**

Work with other Faculty, Staff, Universities and Partners in Key Research Areas

- **Materials**
- **Systems and Simulation**
- **Fuel Processing**
- **Power Electronics**
- **Controls**
- **Manufacturing**



UCI COLLABORATORS

UCI Faculty

Civil and Environmental Engr.

- Mike McNally, Transportation
- Gerald Pardoen, Seismic
- Will Recker, Transportation

Mechanical and Aerospace Engr.

- Derek Dunn-Rankin, Micro-FCs, MEMS
- Donald Dabdub, Air Quality
- Faryar Jabbari, Fuel Cell Controls
- Scott Samuelsen, Thermodynamics, Fuel Processing

Materials Science

- James Earthman, Material Properties, Failure, Bio-Fuel Cell
- Daniel Mumm, Materials Design, Optimization, Cell Degradation
- Martha McCartney, Materials Manufacturing
- Arthur Nowick, Solid State Ionics

Electrical and Computer Engr.

- Keyue Smedley, Power Electronics

Information and Computer Science

- Richard Taylor, Information Tech.

Chemistry

- Zhibin Guan, PEM Synthesis
- John Hemminger, Diffusion
- Reg Penner, Hydrogen Sensors, PEM Cells, Electrochemistry
- Ken Shea, Proton Exchange



OUTREACH FOCUS / STRATEGY

- **FUEL CELL INDUSTRY**
- **FUEL CELL MARKET**
- **GENERAL PUBLIC**
- **UNIVERSITIES**

Universities for Fuel Cells Purpose

- **Prioritize needed R&D topics for the U.S. DOE, NSF and other state and federal agencies,**
- **Establish collaborative R&D efforts between universities, national labs, industry and agencies,**
- **Organize technology and personnel exchanges amongst participants,**
- **Establish links to web-sites describing fuel cell R&D efforts,**
- **Establish regular interactive workshops on research areas related to Fuel Cells, and**
- **Develop educational materials.**



UNIVERSITIES FOR FUEL CELLS

Focus Areas:

1. **Materials**
– *August 2001 (22 attendees)*
2. **Power Electronics**
– *August 2002 (27 attendees)*
3. **Systems and Controls**
– *April 2003 (15 invited)*
4. **Simulation**
5. **Fuel Processing**
6. **Manufacturing**



Power Electronics Workshop: Aug 2002

Fuel Cell Contests

Avista Labs Units

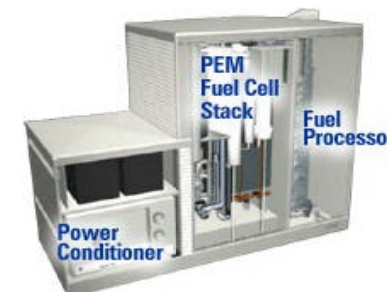
www.nfcrc.uci.edu/RESEARCH/education-outreach/education/UnivForFuelCells.htm



BETA TESTING / DEMONSTRATION

FUEL CELLS:

- 25 kW Siemens Westinghouse SOFC
- 220 kW SCE / SWPC Hybrid SOFC
- Reversible, Regenerative Fuel Cell Kit
- Residential Plug Power PEMFC Units:
 - SU-1
 - GenSysä - ECAT
- Residential FCTL SOFC Unit (This Quarter)
- Avista Labs PEMFC Units:
 - SR-12
 - Independence 100
 - Independence 1000
- Enable 15W PEMFC Unit



FUEL PROCESSOR:

Cyclic Autothermal Fuel Processor (GE-EER)