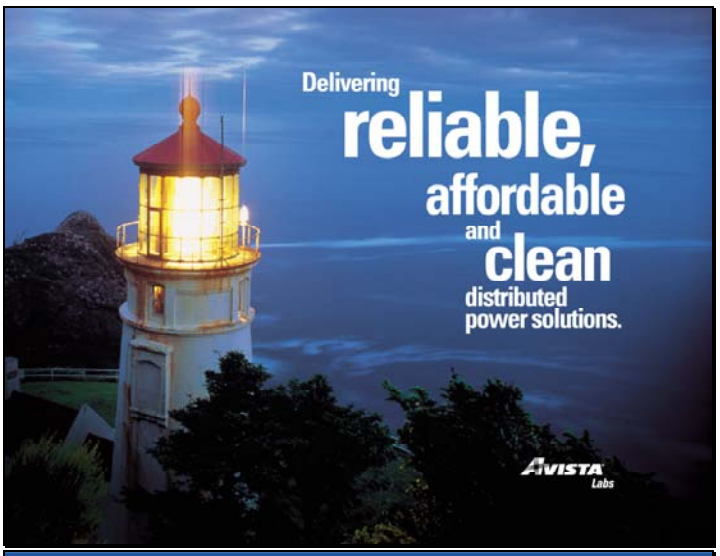
3. APPENDICES

3.A. Presentations

Slide 1



Slide 2

AVISTA Labs

Welcome to Avista Labs!

Avista Labs

- Incorporated in 1995
- Headquartered in Spokane, Washington
- IP: 2 Patents; 230 claims
  - ✓Modular PEM fuel cell
  - ✓Control electronics
- Design, Develop and Market
  - ✓Fuel cell systems
  - ✓Related components
- Moved into new building in 2000
  - 22,800 square feet
  - ✓Office Space
  - ✓Test Facilities
  - ✓Machine Shop
  - ✓R&D Labs

Slide 3

AVISTA Labs

Electricity & Fuel

Production, Sale, Delivery & Use

At Avista Labs, electricity is more than a commodity business

Specialization

On site electricity solutions bring availability, reliability and quality cleanly and affordably to the point of use

Value Proposition

Point of use specific
Custom solutions using standard components

On-Site Electricity

Generation
Storage
Distribution
↓
Quality

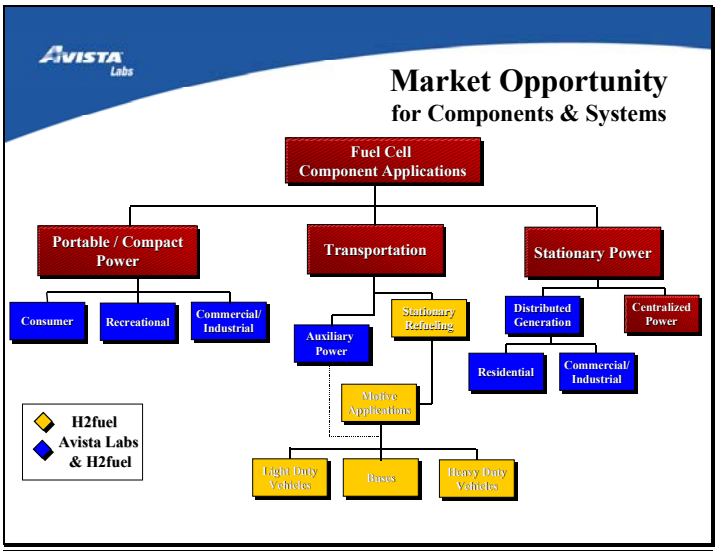
99.999% Reliable
5.3 minutes off-line per year

↓

End User

"25% of all electricity demand will require digital quality by 2006"

Slide 4



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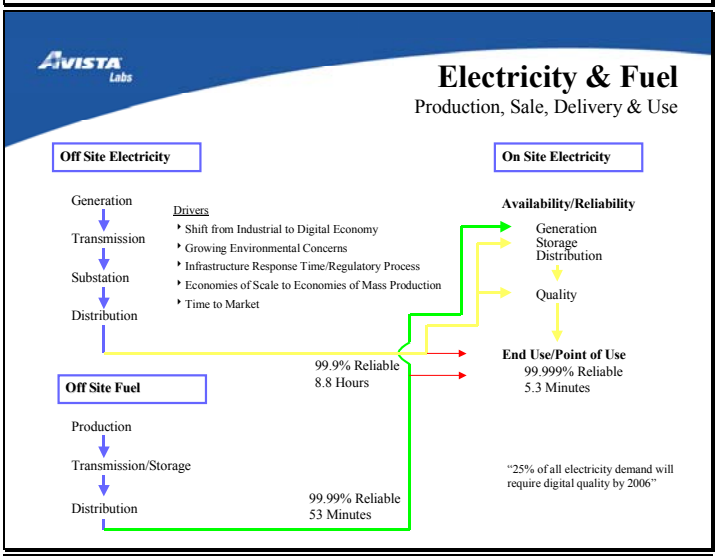

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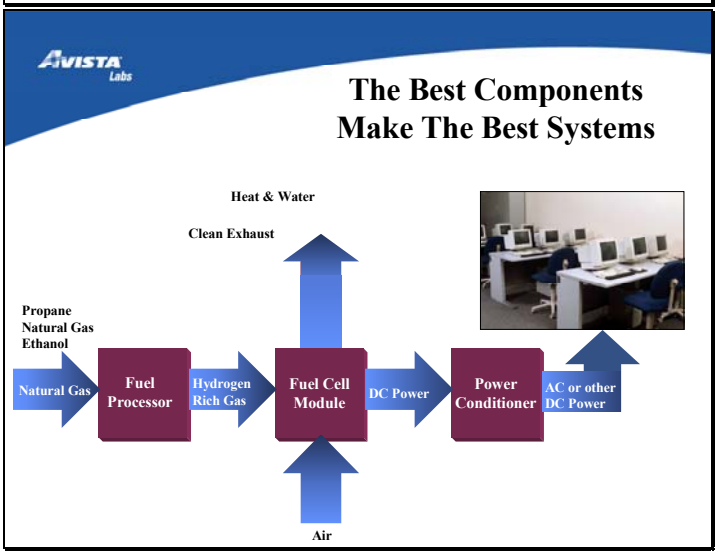

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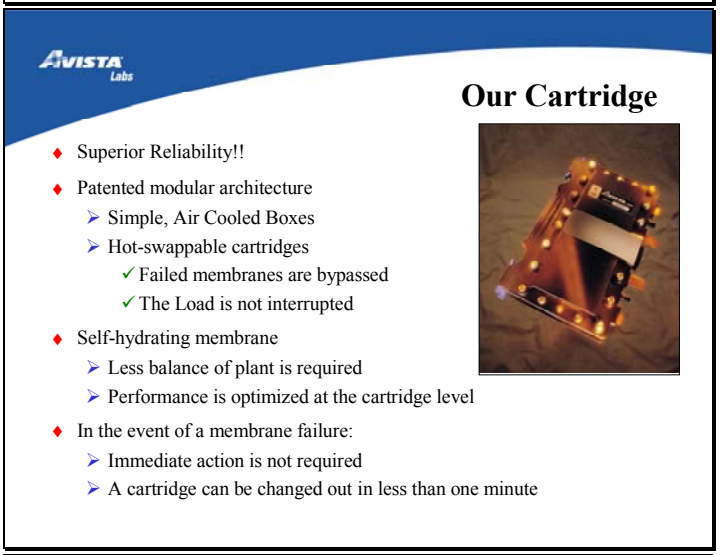
Slide 8



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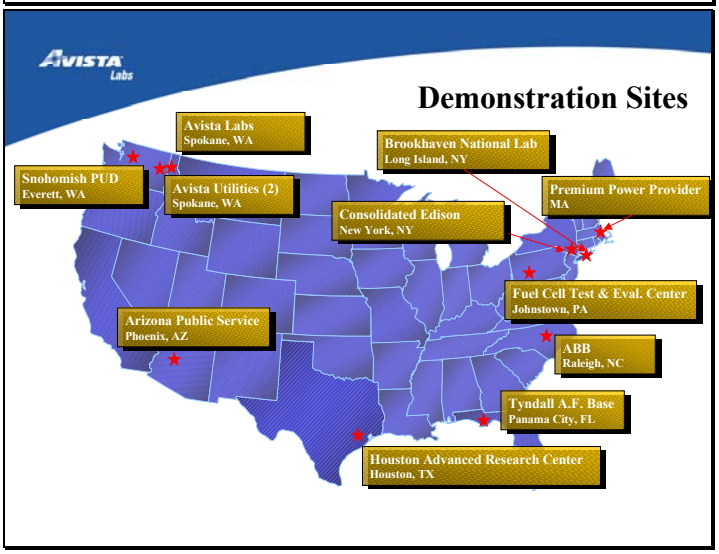


Slide 10

AVISTA Labs
COMMERCIAL PRODUCTS
SR-12: .5kW FUEL CELL
SR-72: 3kW FUEL CELL
HYDROGEN SENSOR

Fuel Cells: A Status Report

Robert Rose
U.S. Fuel Cell Council
May 30, 2001

Fuel Cell Summit 2001
Adelphi, MD 1

Executive Members

- 3M
- American Methanol Institute
- Avista Labs
- Ballard Generation Systems
- Chicago Transit Authority
- Conoco
- Conti Enterprises
- DaimlerChrysler
- Dana Commercial Credit
- Delphi Automotive Systems
- Donaldson Company
- DuPont Flouroproducts
- Energy Conversion Devices
- Energy Partners
- Engelhard Corporation
- Ford Motor Company
- Freudenberg-NOK
- FuelCell Energy
- GE Micro Generation
- Graftech
- H-Power
- Hydrogenics Corporation
- IMPCO Technologies
- International Fuel Cells

Fuel Cell Summit 2001
Adelphi, MD 3

USFCC Mission

- Fosters commercialization of fuel cells in the United States.
- Open to anyone with a commercial interest in fuel cells in the U.S., including manufacturers, suppliers, and end users.

Fuel Cell Summit 2001
Adelphi, MD 2

Executive Members cont.

- Johnson Matthey
- McDermott Technology
- Methanex Corporation
- Motorola Labs
- Nissan Technical Center
- Nuvera Fuel Cells
- Plug Power
- Poco Graphite
- Porvair Fuel Cells
- Proton Energy Systems
- QuestAir Technologies
- Renewable Fuels Association
- SGL Carbon Corp.
- Siemens Westinghouse
- Stuart Energy
- Sud-Chemie
- Syntroleum Corporation
- Texaco Energy Systems
- W.L. Gore
- World Fuel Cell Council
- ZeTek Power Corporation

Fuel Cell Summit 2001
Adelphi, MD 4

Fuel Cell Family

PEM

Solid Oxide

Phosphoric Acid

Molten Carbonate

Other

Alkaline

Direct Methanol

Regenerative

Fuel Cell Summit 2001
Adelphi, MD 6

Associate Members

- Abacus Controls
- Advanced Elastomer Systems
- Advanced Refractory Tech.
- Agile Systems
- Asbury Graphite Mills
- ATOFINA Chemicals
- California Air Resources Board
- Ceramic Fuel Cells
- CSA International
- Dais-Analytic Corporation
- Degussa Metals Catalysts
- Dow Corning
- Enable Fuel Cell Corp.
- Exergy Inc.
- Fuel Cell Technologies
- GAST Manufacturing
- Global Thermoelectric
- Heliocentris
- Houston Advanced Research Center
- Hydrogen Burner Technology
- IdaTech
- Independent Electrical Contractors
- National Fuel Cell Research Center
- NexTech Materials
- Reliant Energy
- SOCA
- South Coast Air Quality Management District
- Sure Power Corporation
- Thomas Industries
- US Army CERL
- Woodward Industrial Controls

Fuel Cell Summit 2001
Adelphi, MD 5

Fuel cell product lifecycle

Source: Citibank

Fuel cells are in the early stages of a typical product life cycle.

Industry estimates fuel cell growth to market saturation over a 30-50 year cycle from product introduction.

The pace of change set by the technology industry indicates that this could occur sooner.

Recent Highlights

- 2003 commercialization for many?
- Purchase Orders
  - Bus "Orders" Near 100
  - H-Power, FC Energy, IFC
  - Small new "buy down" program
  - Honda buys Ballard engines
  - Ze-TeK reports strong stack orders, commits to 3 manufacturing plants
- Ballard/Coleman Target Late 2001

Recent Highlights

- Increases Announced in Manufacturing Capacity
- Major Suppliers Preparing for Commercialization (e.g. DuPont, 3-M, Celanese)
- Substantial Hydrogen Activity

Recent Highlights

- Bush Administration Support
- Congressional Support
  - Purchase/Installation Tax Credits
- State Interest (NY, CA, MA, OH, etc.)
- Significant C&S Activity

Fuel Cell Summit 2001
Adelphi, MD 10

Recent Highlights

- CA Fuel Cell Partnership Grows
- GM Endurance Testing
- Internationalization Continues
  - GM/Toyota, IFC-Hyundai
  - Nuvera
  - Many JV's, Marketing Arrangements
  - New Demonstrations in France, Scandinavia, Japan, Germany, Latin America

Fuel Cell Summit 2001
Adelphi, MD 11

Fuel Cell Investment

- Government R&D Funding (Per Year)

$200M+

$41M

$80M

$30M

- Significant Private Investment (Over $2B)

Fuel Cell Summit 2001
Adelphi, MD 12

Markets and Applications

Stationary / Distributed Power →
- Backup Power
- Remote Power
- Premium Power
- Residential / Commercial Power

Transportation: Heavy / Light Duty Vehicles →
- Buses / Trucks
- Locomotives / Ships
- Passenger Vehicles

Portable / Battery Replacement →

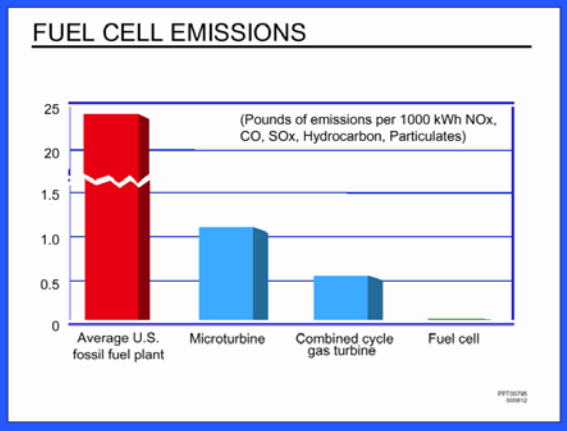
Consumer Electronics	Small Motors
Note / Subnotebooks	Boating
Cellular Phones	Lawn Mower
Camcorders, etc.	Tools, etc.

Fuel

Fuel Cell Market Drivers

- Reliable, Efficient, Clean Energy
- Move to Distributed Generation
- E-Commerce Economy
- High-Value Energy

Fuel Cell Summit 2001
Adelphi, MD 14



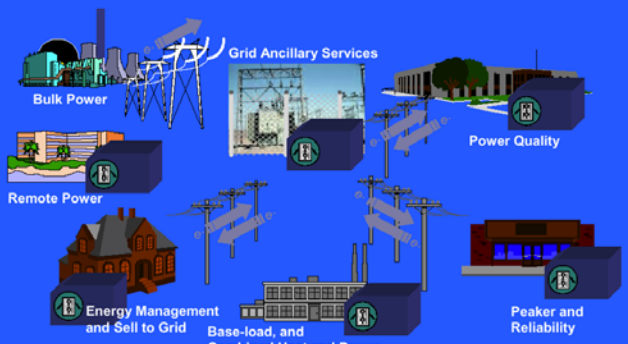
Fuel Cell Summit 2001
Adelphi, MD 15

High Efficiency

- Energy Efficiencies of 40-50% or Greater
- - Energy Security
- - Energy Savings
- - Greenhouse Gas Emission Reductions

Fuel Cell Summit 2001
Adelphi, MD 16

Move to Distributed Generation



Fuel Cell Summit 2001
Adelphi, MD 17

Source: NREL

High-Value Energy

- Poor Power Quality Costs U.S. Economy $150 Million to $450 Million Each Year
- Computer Servers Operate Reliably 99.999% of the Time
- Electric Utility Grid is 99.9% Reliable

Fuel Cell Summit 2001
Adelphi, MD 18

High-Value Energy

- "The most expensive kilowatt is the one that is not available."

E-Commerce Economy

- Fuel Cells are Reliable to Six "Nines" or 99.9999% of the Time
- 1,000,000,000 watts of standby power generation sold every year.
- Fuel Cells are not subject to distribution pole failures.

Transportation Fuel Cell Applications

Automotive Fuel Cells

DCX Investing $940M in fuel cell development by 2004.

"Fuel cells will finally end the 100-year reign of the internal combustion engine."

Ford Chairman William Ford Jr.

HONDA "Fuel cell vehicles will probably overtake gasoline-powered cars in the next 20-30 years"

Honda R&D Director Takeo Fukui

Recent Developments

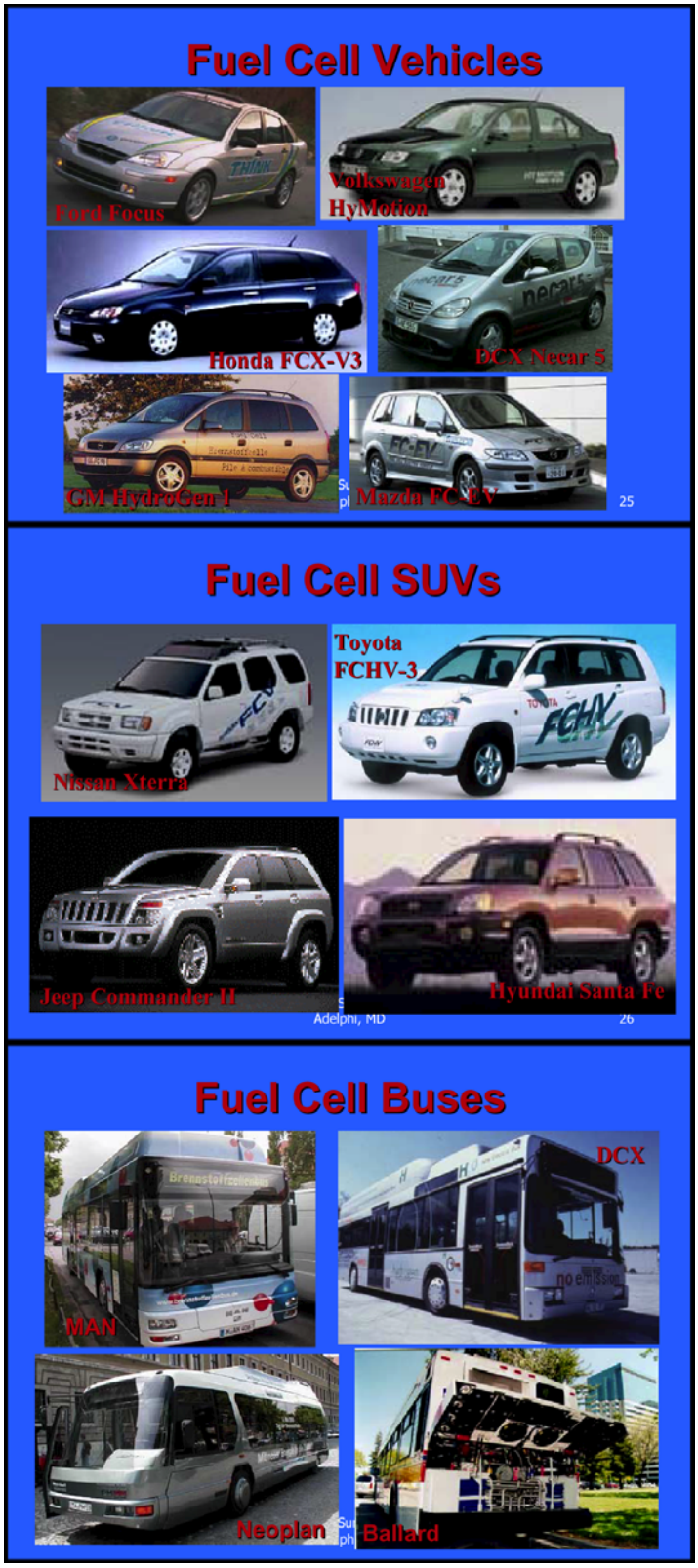
- GM/Toyota Join California F.C. Partnership
- Bus "Orders" Approach 100
- Roll-Outs of Test Vehicles Continue
- Bush DOE Supports Federal R&D Program
- SAE Activity Accelerates

Fuel Cell Summit 2001
Adelphi, MD 23

Vehicle Demonstrations

- California Fuel Cell Partnership
  - Over 70 cars and buses by 2003.
- Clean Urban Transport for Europe (CUTE)
  - 30 buses in 8 countries by 2003.
- Fuel Cell 'Joint Project' (Japan)
  - Field testing several vehicles.
- World Bank / GEF Project
  - 30 buses in Brazil, Egypt, India, China & Mexico.

Fuel Cell Summit 2001
Adelphi, MD 24


Fuel Cell Vehicles
Ford Focus
Volkswagen HyMotion
Honda FCX-V3
DCX Necar 5
GM HydroGen I
Mazda FC-EV
25
Fuel Cell SUVs
Nissan Xterra
Toyota FCHV-3
Jeep Commander II
Hyundai Santa Fe
Adelphi, MD
26
Fuel Cell Buses
MAN
DCX
Neoplan
Ballard

Auxiliary Power Units

IFC 5 kW APU

BMW 7-Series

Specialty Vehicles

Fuel Cell Mining Locomotive

Issues

- Fuel Choice
- Cost
- Heat rejection
- Performance issues
  - Startup Time
  - Range

Stationary Power Applications

Recent Developments

- Residential units are in the field
- Strong interest (demand?)
- Market is desperate for fuel cell attributes
  - High-tech growth needs high quality/high reliability power
- California story is increasing interest

Current Fuel Cell Applications

- Remote Power
- Specialty Power
- Reliability Power
- Cogeneration
- Landfill / Waste Treatment Gas
- Portable Unit

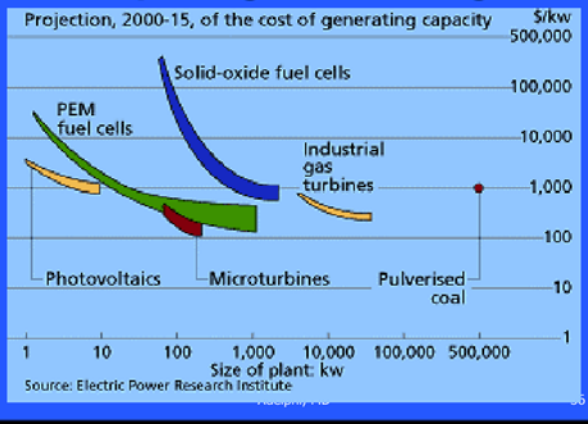
Fuel Cell Summit 2001
Adelphi, MD 34

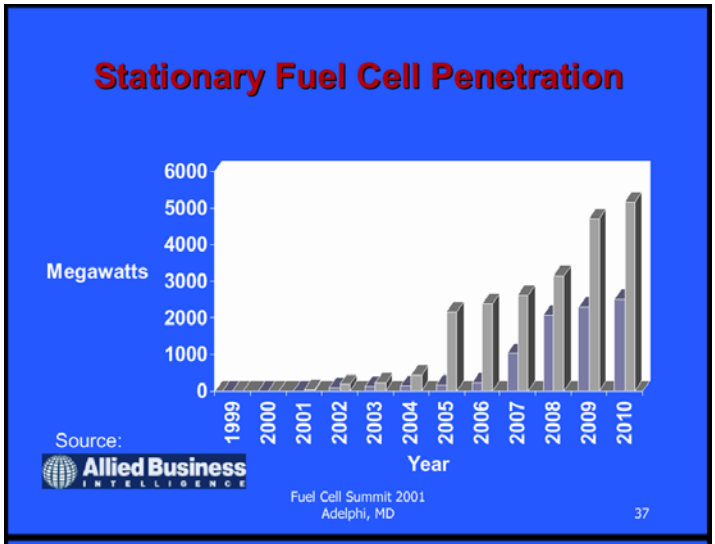
Commercial Fuel Cells

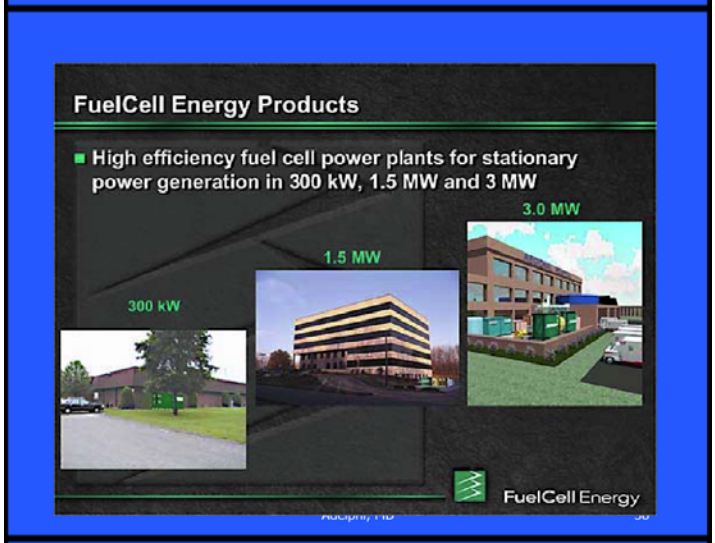
- The cost for commercial fuel cell systems is between $3,000 and $4,500 per kilowatt.
- Costs are expected to come down to $800 - $1,200 per kilowatt.
- For some customers, like the Omaha Bank, they are more concerned with reliability than per kilowatt costs.

Fuel Cell Summit 2001
Adelphi, MD 35

Competing Technologies




Stationary Fuel Cell Penetration
Megawatts
6000
5000
4000
3000
2000
1000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Source:
Allied Business
INTELLIGENCE
Fuel Cell Summit 2001
Adelphi, MD
37


FuelCell Energy Products
High efficiency fuel cell power plants for stationary power generation in 300 kW, 1.5 MW and 3 MW
3.0 MW
1.5 MW
300 kW
FuelCell Energy

Premium Markets
4 Times Square, New York
US Post Office, Anchorage
© 2000 Andrew Gordon
Courtesy of International Fuel Cells, LLC
Adelphi, MD
39

Premium Markets

Central Park Police Station, New York

1st National Bank, Omaha

Issues

- Cost
- Availability
- Competition

Residential Power Applications

Residential Fuel Cells

- Residential units with capacities of 3 kW to 10 kW are now being demonstrated.
- These units will be fueled by natural gas, propane or methanol.
- The fuel cell power unit can be used for primary and/or backup power.

Nuvera Test Platforms

1 kW Hydrogen	1 kW Propane
A simple demonstrator for super premium applications	Test bed for industrial vehicles and premium power

5 kW NG/Propane
Evaluation test bed for residential & premium applications

H-Power -- ECO

- H Power has received an $81 million contract with Energy Co-Opportunity, a consortium of rural electric cooperatives
- Marketing fuel cells exclusively through 300 cooperatives.
- ECO buying 12,300 of H Power's 10-kilowatt fuel cells for $10,000 each.
- Installation to start in the second half of this year.

Residential Systems

IdaTech

IFC

Plug Power

Avista Labs

Portable Power Applications

Recent Developments

- Ballard/Coleman may launch 1kw generator
- USFCC examining DOT fuel regulations
- Direct Methanol looking for niche
- DoD/DARPA wants miniaturized diesel reformer

Portable Power

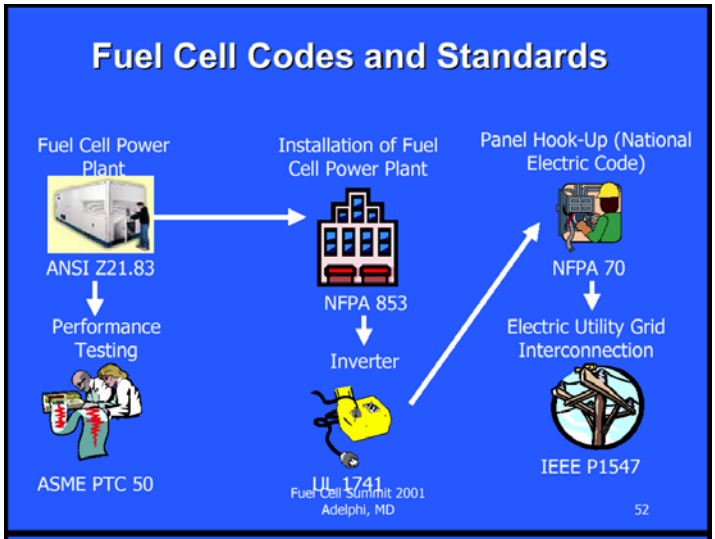
Portable Power

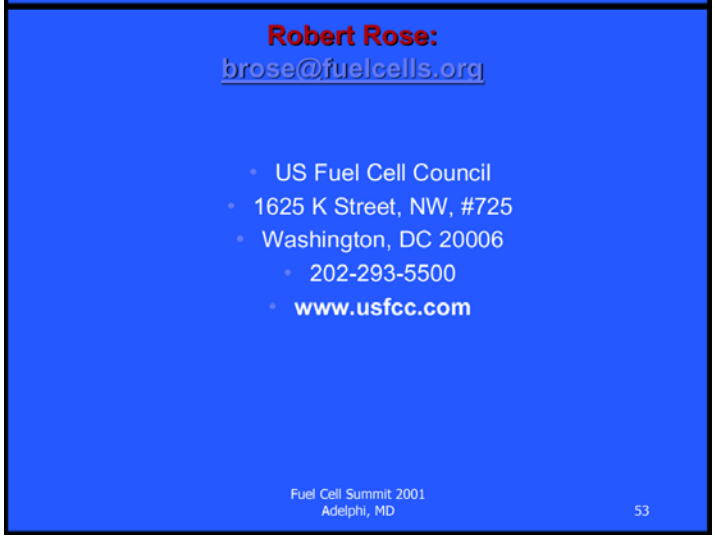
Honda

Ball Aerospace

Federal Funding Highlights FY 2001

Defense/Natl. Security	35.1
Hydrogen Program	30
Underground Mine vehicle	2
Transportation FCs	41.5
Stationary FCs	52.7
Fuel Cells in buildings	5.5
Transportation	11


Fuel Cell Codes and Standards
Fuel Cell Power Plant
ANSI Z21.83
Performance Testing
ASME PTC 50
Installation of Fuel Cell Power Plant
NFPA 853
Inverter
UL 1741
Panel Hook-Up (National Electric Code)
NFPA 70
Electric Utility Grid Interconnection
IEEE P1547
Fuel Cell Summit 2001
Adelphi, MD
52


Robert Rose:
brose@fuelcells.org
US Fuel Cell Council
1625 K Street, NW, #725
Washington, DC 20006
202-293-5500
www.usfcc.com
Fuel Cell Summit 2001
Adelphi, MD
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Slide 1

Codes, Standards and Regulations - An Update

US DOE Fuel Cells Summit V

May 30, 2001

David R. Conover, CEO

National Evaluation Service, Inc.

Slide 2

Goal

A better understanding of current codes and standards initiatives that affect all fuel cell technologies, a focal point for discussion on those activities and identification of future needs in this area to facilitate fuel cell acceptance

Slide 3

Objectives

- Review the status of U.S. and international initiatives to develop new and maintain existing codes and standards
- Enhance the information presented through audience participation
- Identify holes that my need to be filled and how to fill them

Slide 4

Why Pay Attention to Codes and Standards?

Codes and Standards can support fuel cells
- reduce expenditure of manpower
- save time and money
- enhance technology marketing and deployment
- facilitate a manufacturing and servicing infrastructure
- realize multi-lateral approvals and international trade
- secure technology benefits
- protect the market from unsafe products
- allow for simpler testing and certification of products

Slide 5

The Ideal Situation

Uniformity in the acceptance and application of fuel cell design, installation, operation, and use including a supportive service infrastructure

Slide 6

Technology Differences Different Codes and Standards

- Stationary fuel cell power plants
  - The fuel cell equipment
  - Integration and interaction with the built environment
- Portable fuel cells
  - The fuel cell appliance
  - Acceptance for use in the built environment
- Vehicular applications
  - The fuel cell and on-board fuel source
  - Refueling, parking, servicing, etc. infrastructure

Slide 7

Specific Activities

SUBJECT AREA	STATIONARY	PORTABLE	VEHICULAR
Terminology/definitions	IEC TC 105 WG 1 USFCC	IEC TC 105 WG 1 USFCC	IEC TC 105 WG 1 USFCC SAE Information report J 2574 (Draft), Fuel Cell Vehicle Terminology (to be mainlined directly to ISO TC 22/SC 21, IEC TC 69, JEVA and JAMA)
Fuel Cell safety	ANSI Z21.83 CSA U.S. Requirements No. 1.01, Residential Fuel Cell Power Generators IEC TC 105 WG 3 (liaison with IEC TC 31 on electrical apparatus for explosive atmospheres)	CSA Requirements No. 3.01, Portable Fuel Cell Appliances (Draft) IEC TC 105 future WG UL (considering development of a standard)	IEC TC 105 future WG 6 (liaison with ISO TC 22 SC 21 on electric road vehicles and IEC TC 29 on electric vehicles) SAE J2578 (to be mainlined directly to ISO TC 22/SC 21, IEC TC 69, JEVA and JAMA)

Slide 8

Specific Activities

SUBJECT AREA	STATIONARY	PORTABLE	VEHICULAR
Fuel cell module	IEC TC WG 2 CSA CAS No. 33	IEC TC 105 WG 2 CSA CAS No. 33	IEC TC 105 WG 2 SAE Fuel Cell Standards Committee (dialogue started to determine the direction it will pursue in this area related to I/E performance requirements by suppliers to the OEMs)
Fuel cell performance	ASME PTC 50 ANSI Z21.83 IEC TC 105 WG 4	ASME PTC 50 CSA Requirements No. 3.01, Portable Fuel Cell Appliances (Draft)	ASME PTC 50 SAE Fuel Cell Standards Committee (3 work items to be draft documents by the end of summer, 2001)

Slide 9

Specific Activities

SUBJECT AREA	STATIONARY	PORTABLE	VEHICULAR
Installation of a stationary fuel cell power plant	NFPA 853 Model Building Codes NES Fuel Cell Protocol IEC TC 105 WG 5		
Use of a stationary or portable fuel cell in, on or adjacent to buildings	NFPA 853 Model Building Codes	Model Building Codes	
Electrical components associated with the fuel cell	UL Standards are referenced in ANSI Z21.83 NFPA 70 NESC	NFPA 70	SAE

Slide 10

Specific Activities

SUBJECT AREA	STATIONARY	PORTABLE	VEHICULAR
Inverters, controllers, and controllers	UL 1741	UL 1741	UL 1741
Interconnection of the fuel cell with the grid	IEEE 1547 UL1741 (to be harmonized with IEEE 1547 when it is finished) NESC	IEEE 1547 UL1741 (to be harmonized with IEEE 1547 when it is finished) NESC	IEEE 1547 UL1741 (to be harmonized with IEEE 1547 when it is finished) NESC
Parking, servicing, locating a non-stationary fuel cell in, on or adjacent buildings		Model Building Codes NFPA Standards	Model Building Codes NFPA Standards ICC Ad Hoc Committee for Hydrogen Gas

Slide 11

Specific Activities

SUBJECT AREA	STATIONARY	PORTABLE	VEHICULAR
Hydrogen processing, storage and delivery		Model Building Codes NFPA Standards ISO TC 197	Model Building Codes NFPA Standards ISO 197
Service station hydrogen delivery components		ISO TC 197 NFPA Standards	ISO TC 197 SAE Fuel Cell Standards Committee Interface Working Group workshops bringing together vehicle manufacturers and connector suppliers addressing both hardware type and communication protocols. Draft document in process.
Hazardous fluids in fuel cell vehicles			SAE J2579

Slide 12

Status

ANSI American National Standards Institute

Stationary
Portable
Vehicular

ANSI Z 21.83-1998 "Fuel Cell Power Plants"

Packaged, self-contained or factory matched packages of integrated systems of fuel cell power plants for use with natural or LP gas and having a maximum output voltage of 600 VAC and power output of 1,000 kW operating at no less than –20F (-29C)

- CSA Fuel Cell Working Group (WG) preparing revisions
- Working Group meetings 3/14-15 and 5/24
- Seventeen (17) Task Group assignments under the WG

- Future maintenance under CSA Canvass Group and Technical Committee on Fuel Cells (FCTC)
- Meeting of FCTC late Summer 2001
- Resultant standard to be CSA FC 1 and replace ANSI Z21.83

CSA INTERNATIONAL

Slide 13

Status

CSA International
www.csainternational.org

Stationary
Portable
Vehicular

- Fuel Cell Technical Committee being formed
- First meeting Late Summer 2001
- Four CSA Canvass Groups
  - –CSA FC 1 Fuel Cell Power Plant (Z21.83 revision)
  - –CSA FC 2 Residential Fuel Cell Power Generators
  - –CSA FC 3 Portable Fuel Cell Power Generators
  - –CSA FC 4 Fuel Cell Modules

Slide 14

Status

CSA International
www.csainternational.org

Stationary
Portable
Vehicular

CSA U.S. Requirements No. 1.01
"Residential Fuel Cell Power Generator"

Packaged self-contained residential units < 50 kW for outdoor application at one- or two-family dwellings as well as light commercial

- Precursor to CSA FC 2
- Draft to be finalized June 2001
- Adapted from ANSI Z21.83 but applicable to 'residential' units
- CSA currently uses Z21.83 supplemented with CSA No. 1.01 to test and list 'residential' units

Slide 15

Status

CSA International
www.csainternational.org

Stationary
Portable
Vehicular

CSA U.S. Requirements No. 3.01
"Portable Fuel Cell Appliances"

- Precursor to ANSI/CSA FC 3
- Draft to be finalized July 2001

Slide 16

Status

CSA International
www.csainternational.org

Stationary
Portable
Vehicular

CSA Component Acceptance Service
No. 33 "PEM Fuel Cell Modules"

- Component Acceptance document because a module is not an appliance but a component
- Published in September 2000 and being used for testing and certifying such modules
- Will be used as 'seed document' for ANSI/CSA FC 4

Slide 17

Status

NFPA 853 "Standard for the Installation of Stationary Fuel Cell Power Plants"

Stationary
Portable
Vehicular

WWW.NFPA.ORG

Design, construction, and installation of stationary (non-portable) fuel cell power plants with a gross electrical generation that exceeds 50 kW; including:
(1) A singular prepackaged, self-contained power plant unit
(2) Any combination of prepackaged, self-contained power plant units
(3) Power plant units comprised of two or more factory matched modular components intended to be assembled in the field and
(4) Engineered and field-constructed power plants that employ fuel cells

- Standard approved in May 2000 and published
- Next revision to be approved May 2003
- Proposed changes due December 28, 2001
- NFPA 853 Technical Committee to meet Spring 2002

Slide 18

Status

NFPA 70
"National Electric Code"

Stationary
Portable
Vehicular

WWW.NFPA.ORG

NFPA 70 adopted by reference in the US model codes

New Article 692 "Fuel Cell Systems" received 5 comments and was considered at May 2001 Annual Meeting for final action

- –Installation
- –Circuit Requirements
- –Overcurrent protection
- –Wiring with and outside the fuel cell
- –Grounding
- –Marking
- –Connections to other systems

Slide 19

Status

NFPA 70
"National Electric Code"

Stationary
Portable
Vehicular

WWW.NFPA.ORG

NFPA 70 adopted by reference in the US model codes

Article 705 "Interconnected Electric Power Sources"

- Report on proposals came out July 2000
- Nothing further happened at May 2001 Annual Meeting
- Publication September 2001

Slide 20

Status

Underwriters Laboratories
www.ul.com

Stationary
Portable
Vehicular

UL 1741 "Static Inverters and Charge Controllers"

- Harmonized with IEEE 929
- Listed products are being accepted by many utilities
- Slated for harmonization with IEEE 1547 when published
  - –Harmonization will allow manufacturers to be evaluated once for compliance with national electrical safety and utility interconnection performance requirements

Slide 21

Status

American Society of Mechanical Engineers
www.asme.org

Stationary
Portable
Vehicular

ASME PTC 50
Performance Test Code for Fuel Cell Power System Performance

- Object and Scope Approved
- First Draft April 1999
- Compiling list of reviewers
- Meeting June 12-13 in NYC
- Targeting 2002 publication

Outline
–Object, Scope, and Measurement Uncertainty
–Definitions and Descriptions of Terms
–Guiding Principles
–Instruments and Methods of Measurement
–Calculations and Results
–Report of Results
–Uncertainty

Slide 22

Status

International Code Council
www.intlcode.org

Stationary
Portable
Vehicular

2000 *International Mechanical Code*

"924.1 General. Stationary fuel cell power plants having a power output not exceeding 1,000 kW, shall be tested in accordance with ANSI Z21.83 and shall be installed in accordance with the manufacturer's installation instructions."

- Similar language approved in 2000 to the International Fuel Gas Code and proposed in 2001 to the International Residential Code
- Proposed changes to the IMC, IFGC and IRC to add definitions of stationary and portable fuel cell power plants approved March 2001 and will receive final action Fall 2001

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Status

National Evaluation Service
www.nateval.org

Stationary
Portable
Vehicular

Evaluation Protocol for Stationary Fuel Cell Power Plants

- Undertaken on behalf of U.S. DOE (PNNL)
- Input from FC developers, manufacturers, research & testing labs, engineers, regulators, utilities, etc.
- Basis for evaluation and assessment of stationary FC PP's intended for building applications
- Advises manufacturers of testing/documentation needed for building regulatory acceptance
- Voluntary and advisory
- Published May 2001

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Status

IEEE
www.ieee.org

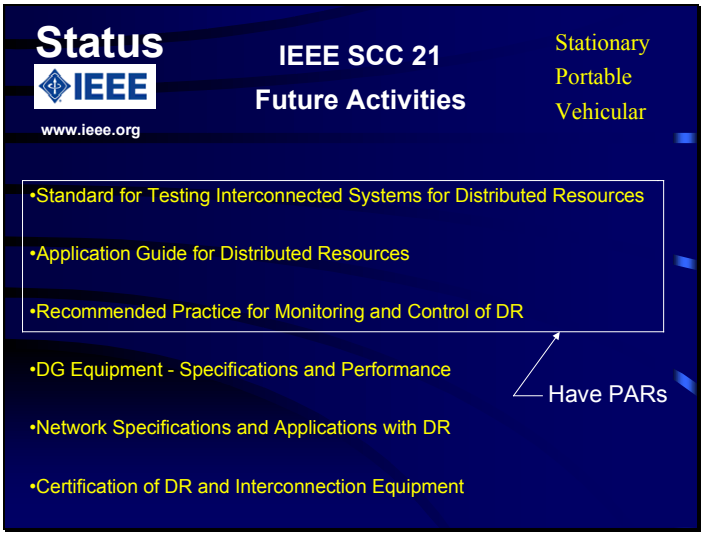
Stationary
Portable
Vehicular

P1547 Standard for Interconnecting Distributed Resources with Electric Power Systems

To provide a uniform standard for interconnection of distributed resources with electric power systems, and requirements relevant to the performance, operation, testing, safety considerations, and maintenance of the interconnection

- Being developed by IEEE Standards Coordinating Committee (SCC) 21
- Draft 7 balloted 3/28/01 and did not receive required 75% affirmative vote
- April 18-20 meeting addressed resolution of negative ballots
- Working group to meet June 5-8 to reword Draft 7 to address negatives
- Re-draft scheduled for circulation Summer 2001
- Standard slated for completion in 2001

Slide 25



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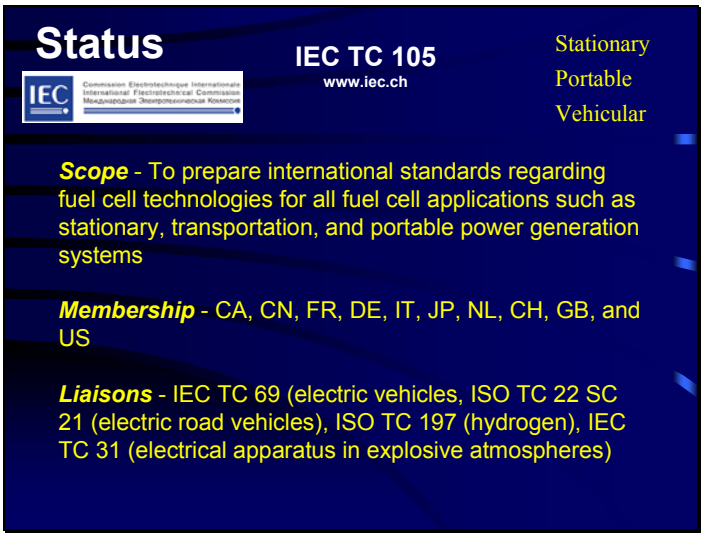

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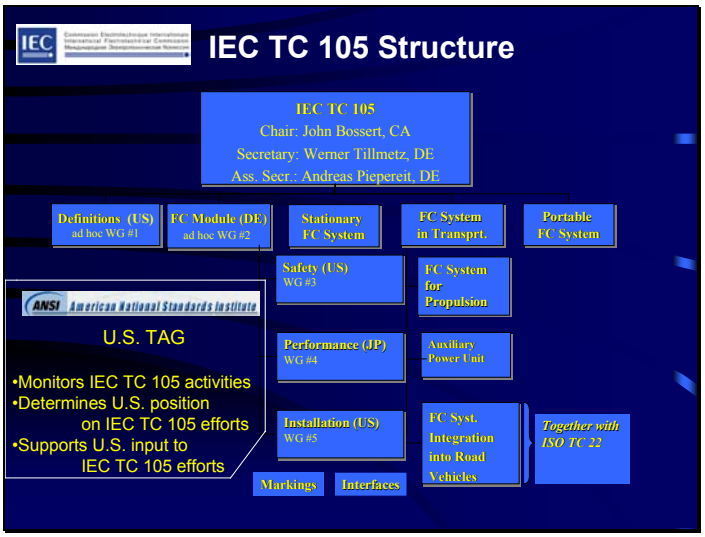

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Status

IEC TC 105
www.iec.ch

Stationary
Portable
Vehicular

- First meeting February 2000
- Second meeting scheduled September 6-7, 2001
- U.S. Technical Advisory Group, first meeting March 13, 2001
- Working Groups
  - –1 Definitions - work started using US and JP documents
  - –2 Fuel Cell Module - outline available, next meeting 9/4-5/01
  - –3 Safety for stationary fuel cell systems - using Z21.83 as a basis with next meeting 7/19-20/01
  - –4 Performance - using JP standard as basis
  - –5 Installation of stationary systems - using NFPA 853 as a basis
  - –6 Systems for propulsion - TBD

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Status

Society of Automotive Engineers
www.sae.org

Stationary
Portable
Vehicular

Fuel Cell Standards Committee

To establish standards and test procedures for fuel cell powered vehicles covering safety, performance, reliability, and recyclability of fuel cell systems in vehicles with emphasis on efficiency and environmental impact. Also to establish test procedures for uniformity in test results and define interface requirements of the systems to the vehicle.

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Status

Society of Automotive Engineers
www.sae.org

Stationary
Portable
Vehicular

Fuel Cell Standards Committee
Working Groups

Safety - J2578 on general safety and J2579 on hazardous fluid systems under development

Terminology - J2574 jointly with JAMA and JEVA (ballot process to begin in June 2001)

Performance - drafts under development on fuel cell systems, fuel processor subsystems, and fuel cell stack systems

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Status

Society of Automotive Engineers
www.sae.org

Stationary
Portable
Vehicular

Fuel Cell Standards Committee
Working Groups

Recyclability Guidelines - J2594 draft under development

Interface - focus on global harmonization for compatible refueling (design request letter May 2001, draft under development, workshop being planned)

Emissions and Fuel Economy - J2572 ballot process to begin September 2001

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Status

ISO TC 22 SC 21
Electric Road Vehicles

Stationary
Portable
Vehicular

Working Groups

Collaboration with IEC TC 105 via joint steering committee

- **Vehicle operating conditions, safety, and energy storage**
- **Definitions and performance measurement**

Projects

ISO/DIS 6469-1	Electric road vehicles -- Safety specifications -- Part 1: On-board energy storage
ISO/DIS 6469-2	Electric road vehicles -- Safety specifications -- Part 2: Functional safety means and protection against failures
ISO/DIS 6469-3	Electric road vehicles -- Safety specifications -- Part 3: Protection of persons against electric hazards
ISO/DIS 8713	Electric road vehicles -- Terminology
ISO/DIS 8714	Electric road vehicles -- Reference energy consumption and range -- Test procedures for passenger cars and light commercial vehicles
ISO 8715	Electric road vehicles -- Road operating characteristics

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Status

International Code Council
www.intlcode.org

Stationary
Portable
Vehicular

ICC Ad Hoc Committee on Hydrogen

- Purpose
  - –The development of reasonable and enforceable model health and safety requirements germane to the International Codes affecting or relating to the use of H2 in vehicular and portable applications
- Objectives
  - –Review current codes/standards; H2 storage, handling and use
  - –Determine adequacy of coverage
- Product
  - –Proposed code changes as necessary to the International Codes
  - –Identification of other standards needs and deficiencies

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Status

International Code Council
www.intlcode.org

Stationary
Portable
Vehicular

ICC Ad Hoc Committee on Hydrogen

- Next meeting June 4-5, 2001 Boulder CO
- Subcommittee Working Groups
  - –Private garages
  - –Public garages
  - –Hydrogen refueling and generating stations
  - –Portable hydrogen appliances
  - –Integrating hydrogen as a fuel into the IFGC
  - –Standards

Slide 35

Status

National Hydrogen Association
www.hydrogenus.com

Stationary
Portable
Vehicular

Goal - create draft standards for hydrogen systems and components where they are needed

Working Groups

–WG 1 Connectors - draft standard developed and accepted by ISO TC 197 for international development
–WG 2 Containers and hydrides - initial NHA draft standard included only materials in CNG compatible with H2 (see ISO TC 197 WG 5)
–WG 3 Refueling stations - developed a draft standard for ISO TC 197 work item
–WG 4 Use of electrolyzers - standard under development
–WG 5 Self-service refueling - work underway in conjunction with SAE
–WG 6 Coordinate with SAE on on-board issues - work underway
–WG 7 Maritime applications - report published by MHTDC

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Status

ISO TC 197 Hydrogen

www.iso.ch

Stationary
Portable
Vehicular

Developing international safety standards required to disseminate H2 technologies worldwide

Scope – Standardization in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen

Working Groups
- –WG 2 - tank containers for multimodal transport
- –WG 4 - airport refueling facilities
- –WG 5 - gaseous H2 and H2 blends: service stations
- –WG 6 - gaseous H2 and H2 blends: land and vehicle fuel tanks
- –WG 7 - basic safety considerations

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Status

www.iso.ch

ISO TC 197 Hydrogen

Stationary
Portable
Vehicular

Technical programme TC 197 print-friendly

TC 197 Hydrogen technologies

Subcommittees

Projects

ISO/DIS 13985-1	Liquid hydrogen -- Land vehicle fuel tanks -- Part 1: Design, fabrication, inspection and testing
ISO/DIS 13985-2	Liquid hydrogen -- Land vehicle fuel tanks -- Part 2: Installation and maintenance
ISO/WD TR 15594	Airport hydrogen fuelling facility
ISO/WD 15866	Gaseous hydrogen blends and hydrogen fuel -- Service stations
ISO/CD 15869	Gaseous hydrogen and hydrogen blends -- Land vehicule fuel tanks
ISO/WD 15916	Basic considerations for the safety of hydrogen systems
ISO/WD 17268	Gaseous hydrogen -- Land vehicle filling connectors

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Status

www.iso.ch

ISO TC 197 Hydrogen

Stationary
Portable
Vehicular

- Agreement of cooperation signed with ISO TC 22
- Participating in working groups of IEC TC 105
- 10th Plenary meeting to be held October 2001

–WI 15916 on basic safety - final editorial changes approved for circulation to P members until May 20, 2001
–WI 15869 on land and vehicle fuel tanks to be circulated as a draft standard for 5 months in the next month or so
–WI 17268 on land vehicle filling connectors is under development in the working group
–WI 15686 on fuel service stations is under development in the working group

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Status

EIHP

European Integrated Hydrogen Project

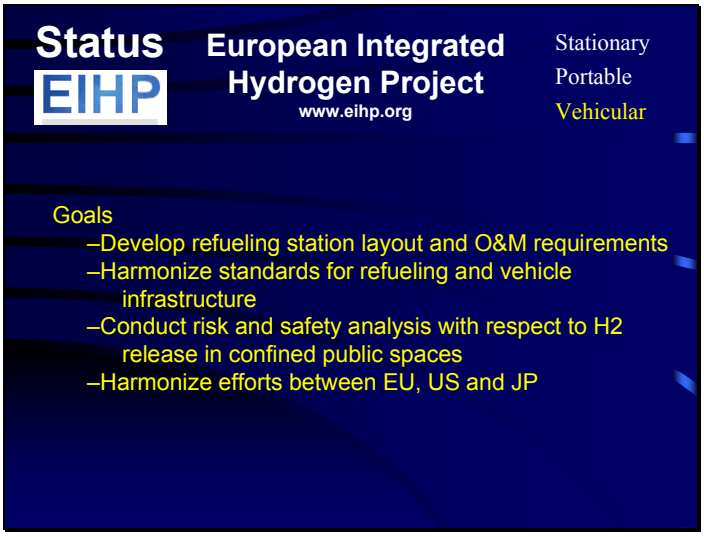
www.eihp.org

Stationary
Portable
Vehicular

Established in 1998 to address differences in national requirements throughout Europe that will affect the use of hydrogen

Objectives
–Create database of existing regulations and codes of practice
–Contact other authorities outside Europe
–Identify weak spots in current technology
–Define areas needing regulation
–Create a basis for ECE regulation for hydrogen vehicles

Slide 40



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Slide 1

Assessment of Code Officials' Needs to Accelerate Permitting Process for Fuel Cell Installations

Timothy Hillman
Pacific Northwest National Laboratory

Slide 2

Introduction

- Background of Tri-Cities
- Assessment design
- Study findings
- How to proceed

Slide 3

Slide 4

Demographics

The Tri-Cities, WA

- Kennewick – 50,390
- Richland – 36,860
- Pasco – 26,090

Total Population of Tri-Cities Area ~150,000

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Slide 5

Code Official Structure

- 5 Jurisdictions
  - 3 cities, 2 counties (Benton & Franklin)
- Code Officials
  - Building Officials (Building, Mechanical, Plumbing)
  - Fire Marshals
  - Electrical Inspectors (Dept. Labor & Industries)

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Slide 6

Study Structure

- Questionnaire
  - Background info on Washington State codes & code officials
  - Access their current knowledge of fuel cells
- Group Interview
  - Identify major issues relating to a fuel cell installation
  - What would aid the plan review process
  - Determine most effective training tools

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Slide 7

Study Findings

- Current knowledge of fuel cells = Very little to none!
- Many issues were identified; three of most concern were:
  - Fuel supply and storage systems
  - Utility interconnect
  - Fire fighter intervention

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Fuel Supply and Storage

- What type of fuel is used
  - Storing liquid hydrogen was NOT a greater concern than other fuels
- Automatic shut-off valves
- Clearances around storage tank
- Appropriate signage

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Slide 9

Utility Interconnect

- Local utilities may have different requirements
- "Islanding"

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Slide 10

Fire Fighter Intervention

Major concern:
Entering a building being powered by a fuel cell.

- Appropriate signs/labels warning fire fighters
  - Location of emergency shut-off valves
  - Type of fuel used
  - Of fuel cell location

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Slide 11

Aiding the Plan Review Process

- Manufacturer installation requirements
  - Is there a licensed installer besides manufacturer?
- A complete wiring schematic
- All necessary clearances

* Potentially over design to reconcile inconsistencies between different jurisdictional requirements.

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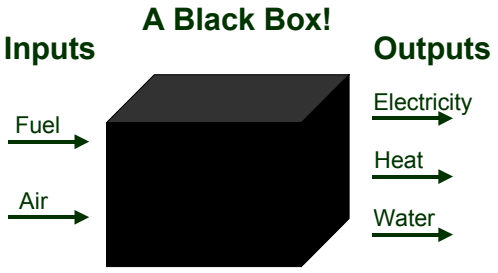
Slide 12

Code Officials' View of a Fuel Cell



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Slide 13

Training Tools

- Conferences
- Field Guides
- Manufacture's Rep.
- Videos
- Mobile Training Platform
- Training with MCA's
- Articles in Periodicals
- Adoption by Model Codes
- Flyers
- CD Rom
- Internet

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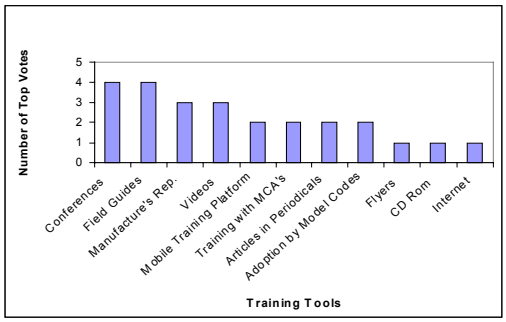
Training Tools



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Next Steps

An education program for code officials should consider:

- What information you want them to receive?
- What is the most effective way to get that information to them?

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Slide 16

Training Tools

Things to consider while developing training tools:

- Who is our audience?
- What is their level of background?

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Training Tools

What might a tool incorporate?

- Brief description of the technology
- Listing of all relevant codes
- Common installation requirements

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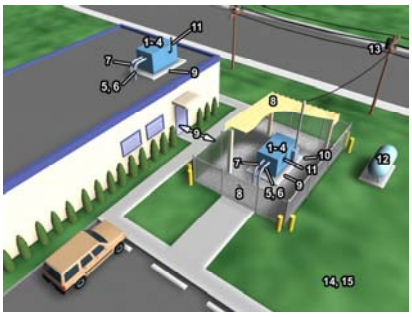
Slide 18

Installation Requirements



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Summary

- Very little to NO previous knowledge of fuel cells
- Three major concerns
  - Fuel supply and storage systems
  - Utility interconnect
  - Fire fighter intervention

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Slide 20

Summary

- Aids for plan review process
  - Manufacturer installation requirements
  - Consider over design to meet different jurisdictional requirements
- Training Tools
  - Speaking at conferences
    - Field guides
    - Videos
    - Manufacturer's representatives

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Slide 21

Summary

Code officials see a black box!

Concerns:

- Inputs
- Outputs
- Connections

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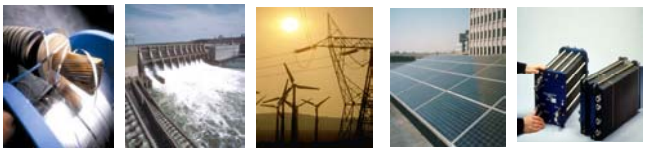
Slide 1

Office of Power Technologies

FUEL CELLS SUMMIT V

Distributed Generation in the Office of Power Technologies

William Parks
Associate Deputy Assistant Secretary
Office of Power Technologies
May 30, 2001
Adelphi, Maryland

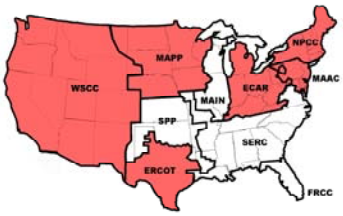


Slide 2

Electric Power Constraints

"If the energy infrastructure of this country is inadequate or in some way excessively costly, it will undermine economic growth, and is therefore a major issue that must be addressed." *Alan Greenspan*, *January 26, 2001*

2009 Projections



Areas with Capacity Margins < 10 percent

ECAR- East Central Area Reliability Coordination Agreement
ERCOT- Electric Reliability Council of Texas
FRCC- Florida Reliability Coordinating Council
MAAC- Mid-Atlantic Area Council
MAIN- Mid-America Interconnected Network
MAPP- Mid-Continent Area Power Pool
NPCC- Northeast Power Coordinating Council
SERC- Southeastern Electric Reliability Council
SPP- Southwest Power Pool
WSCC- Western Systems Coordinating Council

Source: North American Electricity Reliability Council, 2000

Slide 3

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Renewable Energy

- Biopower
- Solar Technologies
- Wind
- Geothermal
- Hydrogen
- Hydropower

Distributed Energy Resources

- Natural Gas Turbines, Fuel Cells & Engines
- Interconnection Standards
- Thermally Activated Technologies
- Natural Gas-Renewable Hybrids

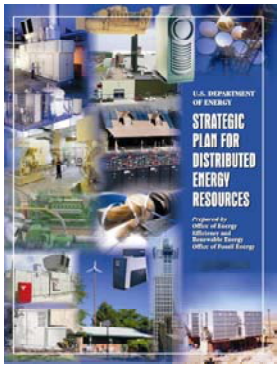
Reliability/ Power Quality

- Power Delivery
- Superconductivity
- Transmission Reliability
- Energy Storage
- Smart Controls

Slide 4

DER Strategic Plan

- **Vision 2020:** *The U.S. will have the cleanest and most efficient and reliable energy system in the world by maximizing the use of affordable DER.*
- **Goal 2012:** *DER will achieve 20%+ of new capacity additions.*



Slide 5

Federal Role

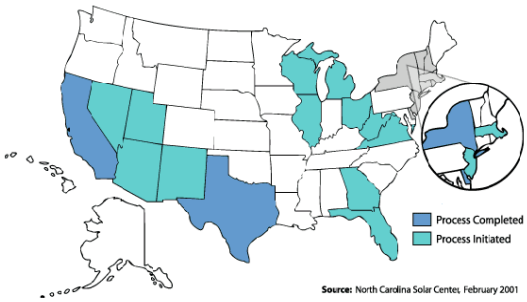
Federal government role in the development and deployment of distributed energy resources is twofold:

- Continue to support RD&D to raise efficiency and performance, and lower cost and emissions of advanced distributed energy technologies; and
- Address technical, regulatory, and institutional barriers and enable distributed energy resources to compete on an equal and consistent basis for supplying energy and ancillary services in competitive electricity and natural gas markets.

Slide 6

State Patchwork of Regulation

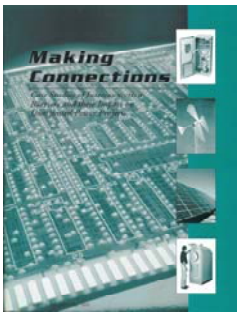
Status of State Distributed Resource Regulatory Activity



Slide 7

Activities Addressing Utility Interconnection

- "Making Connections" Report
  - 10 pt action plan for removing barriers to interconnection
- IEEE Process
- Solicitation awards focused on interconnection issues, 8-10 awards to be negotiated
- Workshops
  - RAP
  - NCSL
  - RTO/ISO



Slide 8

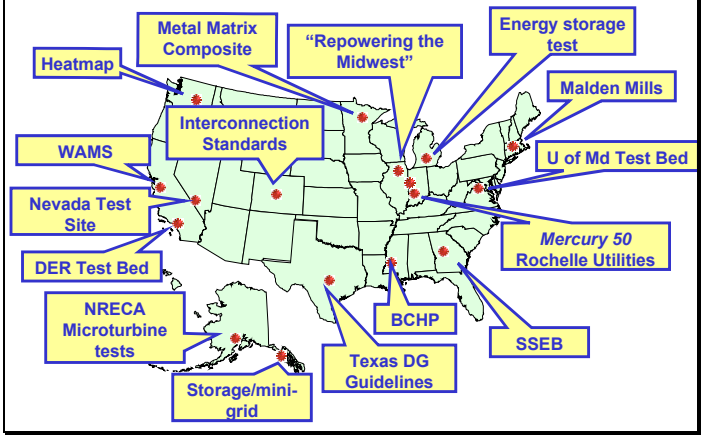
OPT Initiatives

OPT Initiatives Include:

- CHP Challenge
- Building Codes and Standards
- Environmental Siting and Permitting

Slide 9

Activities



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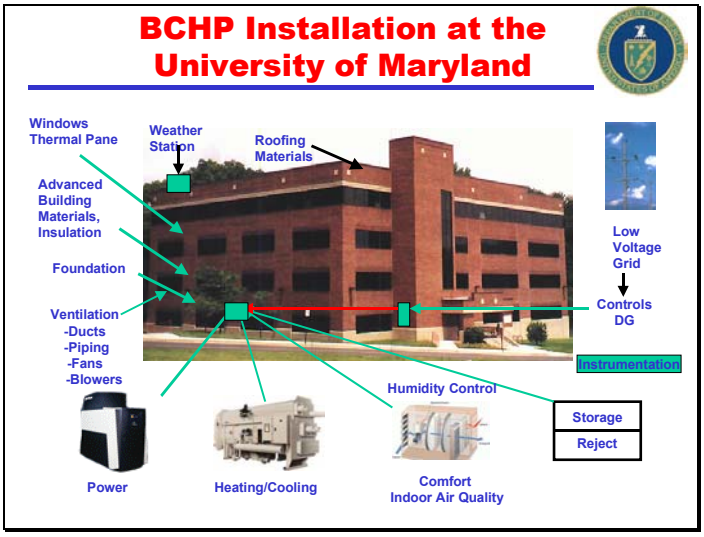

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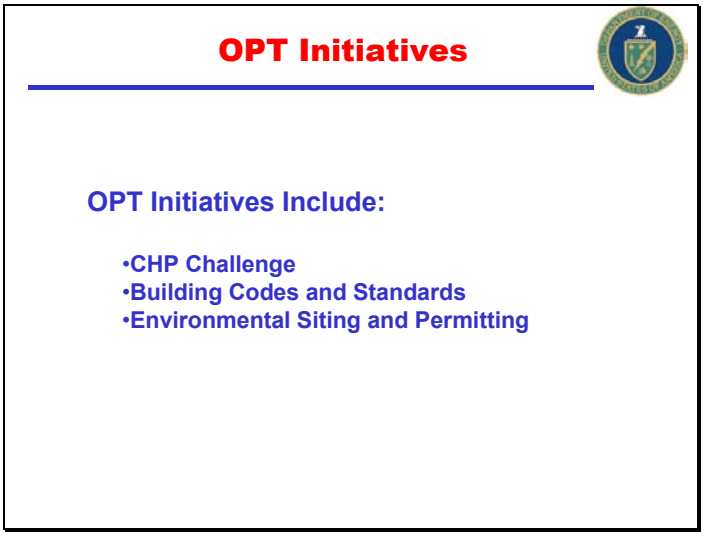
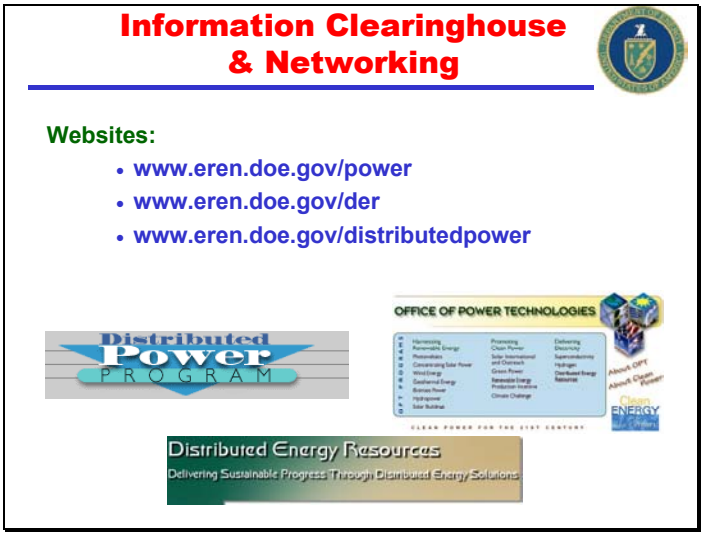
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