



Hydrogen Program Review

Hydrogen Codes and Standards

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Merit Review and Peer Evaluation

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Relevance/Objective

- Goals*
 - Facilitate creation and adoption of model building codes and equipment standards for hydrogen systems in commercial, residential, and transportation applications
 - Provide technical resources to harmonize development of international standards among ISO, IEC, and GRPE

*HFCIT R&D Plan

Relevance/Objective

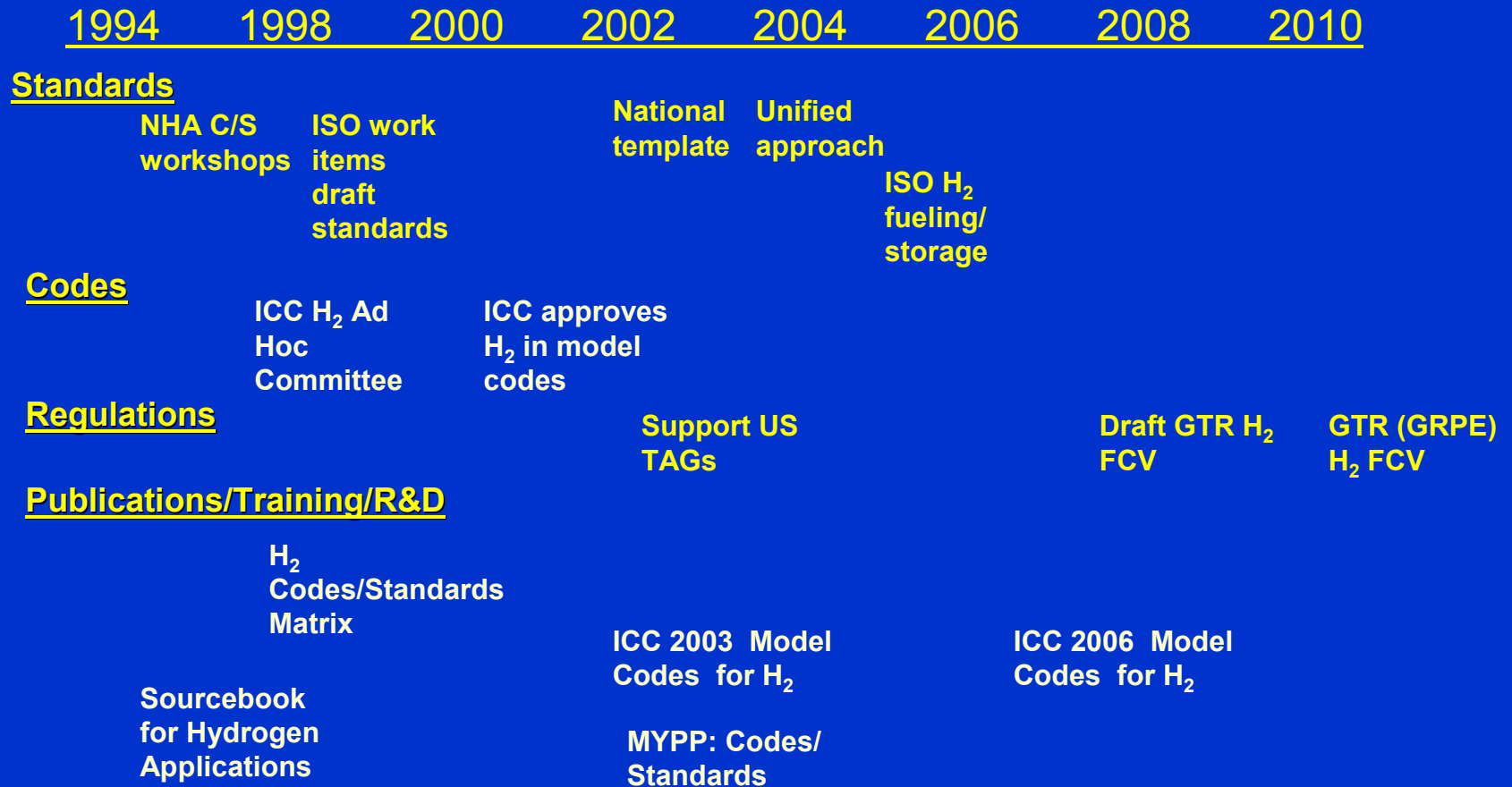
- Key Technical Barriers*
 - Limited government leadership role
 - US consensus and self-certification process limits government role to accelerate development and harmonization of standards, codes, and regulations
 - Competition among standards/code development organizations
 - Standards and codes are valuable IP and a source of revenue
 - Large, diverse number of state/local jurisdictions
 - Up to 44,000 local jurisdictions need to adopt and enforce model codes
 - Economic competitiveness issues and national agendas
 - National and regional agendas are not always consistent with global harmonization of standards
 - Lack of technical data
 - Historically, standards and validation data have not been developed in concert

Approach

- Key Technical Targets (addressing barriers from previous slide)*
 - Limited government leadership role
 - Create “national template” to harmonize standards, codes, regulations
 - Competition among standards/code development organizations
 - Develop generic licensing agreement for web-based access to standards
 - Large, diverse number of state/local jurisdictions
 - Develop training modules and conduct workshops with ICC and NFPA
 - Economic competitiveness issues and national agendas
 - Develop unified national agenda and support consistent representation of technical experts from industry and government at key global venues
 - Lack of technical data
 - Develop comprehensive R&D plan and program for validation of codes and standards



Project Timeline





Accomplishments/Progress

- Overcame opposition by American Gas Association at final ICC public hearing, Ft. Worth, Oct. 1-4, 2002
 - all major changes proposed for IRC, IMC, and IFC approved
 - changes to minimum separation distances included in IFC
 - hydrogen recognized as a “fuel gas” in IFGC and proposed changes to IFGC to address hydrogen safety approved by floor vote
 - support by industry and hydrogen fuel cell exhibit key to success
- Hydrogen safety incorporated in 2003 edition of ICC model codes
 - all local chapters of major national code organizations contacted on proposed changes to model codes
- Guy Tomberlin, Commercial Inspections Supervisor, Fairfax Co., VA, and Chair, ICC H2 Ad Hoc Committee receives NHA Meritorious Service Award, March 6, 2003

Accomplishments/Progress

- August 19, 2002: national workshop to identify codes and standards needs and priorities for MYPP
- December 18, 2002: DOE workshop for MYPP targets/milestones for safety, codes and standards
- March 5, 2003: Larry Burns, VP, R&D & Planning, NHA Keynote Speech: “call to action” for federal government, included
 - “National template for codes and standards”
- March 7, 2003: DOE, NREL, and SDOs develop draft template for national standards, codes, and regulations for H₂ vehicles, fueling/service/parking facilities, vehicle/facility interface
 - Consensus by all key SDOs on lead and supporting roles to develop critical standards
 - DOE Hydrogen Codes and Standards Coordinating Committee manage implementation and updating of template



Accomplishments/Progress

National Template for Vehicle Systems and Refueling Facilities

Vehicles

Controlling Authority: NHTSA crashworthiness
EPA emissions

Fuel Cell Vehicle Systems
Fuel Delivery Systems
Containers
Reformers
Emissions
Recycling
Service/Repair

Interface

Fuel Specs
Wts/Measures
Fueling/Defueling
Sensors/Detectors
Connectors
Communications

Fuel Delivery/Storage

Controlling Authority: RSPA
Over-road Transport
Pipeline Safety

Composite Containers
Pipelines
Equipment
Fuel Transfer

Fueling, Service, Parking Facility

Controlling Authority: State, Local Government
Zoning, Building Permits

Storage Tanks
Piping
Dispensers
On-site H2 Production
Codes for the Built Environment



Accomplishments/Progress

DOE-NREL National Standards, Codes, & Regulations Harmonization Template

General Area	Controlling Authority	Functional Area	Lead SDO	Assisting Organizations
Vehicles	NHTSA	Crashworthiness	DOT	SAE
	EPA	Emissions	DOT	SAE
FC Vehicle Systems		Vehicles	SAE FC Standards Comm.	
		Containers	CSA	SAE
Fueling, Service, Parking facilities	State and local governments	Zoning and building permits	ICC, NFPA	DOE
		Stationary storage tanks	ASME	CSA, CGA, NFPA, API
		Piping standards	ASME	CSA, CGA, NFPA
		H2 Dispensers	CSA	UL, NFPA
		On-site H2 production	CSA	UL, CGA, API
Fuel Delivery and Storage	RSPA (DOT)	H2 pipelines and fuel delivery equipment	ASME	API, CGA, AGA
		Composite container standards	ASME	CSA, AGA, NFPA
		Fuel transfer standards	NFPA	API
Interface		Fuel specifications	SAE	ASTM, API
		Weights and Measures	NIST	ASME, API
		Fueling/defueling,	SAE	API, CSA
		Fueling connectors and communications	SAE	UL, CSA, API, IEEE
		Sensors/detectors	UL	NFPA, SAE, CSA



Accomplishments/Progress

- National Fire Protection Association (NFPA)
 - standards development
 - Member of Hydrogen Coordination Committee
 - training and education
 - *How to Permit A H₂ Refueling Facility Guide for Code Enforcement Officials*
- International Code Council (ICC)
 - Members of secretariat and technical advisory group to Hydrogen Ad Hoc Committee
- American Society of Mechanical Engineers (ASME)
 - Member of Hydrogen Steering Committee
- Underwriters Laboratory (UL)
 - Member of Standards Technical Panel UL2264: Hydrogen Generators
- CSA International
 - Member of Technical Advisory Group for on-board gaseous hydrogen container standard



Accomplishments/Progress

- International Hydrogen Infrastructure Group
 - Member Codes and Standards Working Group (GM, BP, Shell Hydrogen, Air Products, Praxair, ExxonMobil, DOE/NREL)
 - Working meetings with high-level managers of auto and energy industries (GM, Ford, DC, BMW, Shell, BP, ExxonMobil, ChevronTexaco, PhillipsConoco)
- California Fuel Cell Partnership
 - Member of Codes and Standards Working Group
 - Brief Steering Committee annually on codes and standards
 - Member of Working Group on Emergency Response Guide for FC Buses
- US Fuel Cell Council
 - Member of Codes and Standards Working Group
- Regional Hydrogen Infrastructure Forums
 - Co-sponsored by DOE Regional Offices and key stakeholders
 - forums held in 5 of the 6 DOE regions; 6th forum planned for Fall 03



Accomplishments/Progress

- Draft performance-based regulations for compressed and liquid hydrogen storage for vehicles completed by UN-ECE/GRPE informal group on Hydrogen/Fuel Cell Vehicles
 - Drafts will be submitted to GRPE in May 2003 under 1958 agreement (US not a signatory)
 - Depending on outcome of May meeting, signatories to 1958 and/or 1998 agreement (includes US) may pursue development of Global Technical Regulations for compressed and liquid hydrogen storage for vehicles
 - No further action expected until October 2003
- Partnership to Accelerate the Transition to Hydrogen (PATH) underway
 - Link mutual codes and standards interests of key Pacific Rim countries, (US, Canada, Japan, Argentina, Mexico, China, Korea)
 - Organizational meetings held, Board of Directors, organizational agreements in place



Accomplishments/Progress

- Option year subcontract in place with National Hydrogen Association to continue codes and standards workshops and US industry coordination
 - Monthly electronic hydrogen safety newsletter
 - Hydrogen codes and standards matrix on website
- Option year subcontract in place with Robert Mauro to chair ISO/TC197 TAG and to organize and manage Partnership to Accelerate the Transition to Hydrogen (PATH)
- Subcontract in place with LCC, Ltd., to continue technical support with ICC, NFPA, IEC TC105, CSA International, USFCC
- Subcontract in place with Ron Sims to continue chairing SAE Fuel Cell Electric Vehicle Standards Committee



Interactions/Collaborations

- **DOE H₂ Codes/Standards Coordinating Committee**
 - DOE Office of Hydrogen, Fuel Cells, and Infrastructure Technologies Program (Neil Rossmeissl, Technology Program Manager)
 - DOT, NIST, NASA, US Navy, EPA
 - ANSI, API, ASME, ASTM, CGA, CSA, ICC, NFPA, NGVC, NHA, IEEE, IHIG, SAE, UL
- **Industry**
 - International Hydrogen Infrastructure Group
 - California Fuel Cell Partnership
- **International**
 - Working Party on Pollution and Energy (GRPE)
 - European Integrated Hydrogen Project (EIHP)
 - Partnership to Accelerate the Transition to Hydrogen (PATH)



Plans, Future Milestones

- Refine overall codes and standards coordination program
 - create centralized, publicly accessible web-based data center
 - DOE license from primary standard and code development organizations
 - draft generic licensing agreement under review by DOE, NREL, and key “early adopters”
 - directory of primary contacts for information and technical assistance
 - one-stop technical assistance for hydrogen projects
- Annual safety, codes, and standards summit meeting
- Initiate comprehensive R&D plan for validation of standards
- Develop hydrogen safety training packages for local code officials with NFPA and ICC
 - Handbook of Representative Hydrogen Fueling Station Projects



Plans, Future Milestones

Standard	Content
Piping	Hydrogen specific piping design, installation, training, and certification. Replaces B31.3 reference in ICC Family of Codes
Storage	Hydrogen storage tank for portable and stationary service. Standard will be independent of adsorbent. New standard for vehicular transport of high-pressure hydrogen up to pressures of 10,000 psi. Includes supporting R&D program funded by DOE.
Materials Guide	Ensures public safety, health, and general welfare through proper selection of materials for hydrogen service. Reference for existing design and installation standards
Hydrogen Quality	Ensures safety by defining testing methods to determine the quality of the fuel independent of production technique.
MassFlow Measurement	Defines methods to quantify hydrogen mass flow rate to determine appliance efficiency
Transport	Review and modification of existing piping standards and underground storage

Plans/Future Milestones

- Leadership in development of quantifiably safe systems
 - Identify and fund appropriate experts to fully participate in development of Global Technical Regulations for on-board storage and other hydrogen-related regulations under development
 - performance requirements often set with little or no statistical data or modeling results to quantify the safety of component or system
 - only Germany provided technical expertise through TUV (German safety and vehicle certification organization)
 - opportunity for US to assert technical expertise in developing draft regulations for compressed and liquid hydrogen storage
- Global Technical Regulations for hydrogen fuel cell vehicles
 - Harmonized regulations for on-board hydrogen storage
 - Technical draft for vehicular safety standards
 - Harmonized with US Federal Motor Vehicle Safety Standards
- Harmonized standards for fuel cell power plants