



Domestic Hydrogen Codes and Standards: DOE Status Report

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Outline of Presentation

- **Highlights of DOE Multi-year Plan for Codes and Standards**
- **Progress on harmonization of standards, codes, and regulations for hydrogen vehicles and fueling/service facilities**
- **Future Plans**

Codes, Standards, & Safety Focus: Facilitate the development and adoption of building codes and equipment standards; international standards, and safe practices that promote insurability.

Barriers

- Historical data are limited
- Rationale for current practice cannot be verified
- Perceptions of local government, fire marshals, and public are shaped by the past
- Creation and adoption of new codes and standards is a slow process
- Standards can be used as trade barriers





DOE Multi-Year Plan for Codes and Standards

- **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



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 must adopt/enforce model codes
- **Economic competitiveness issues and national agendas**
 - national and regional agendas not always consistent with global harmonization of standards
- **Lack of technical data**
 - standards and validation data not developed in concert



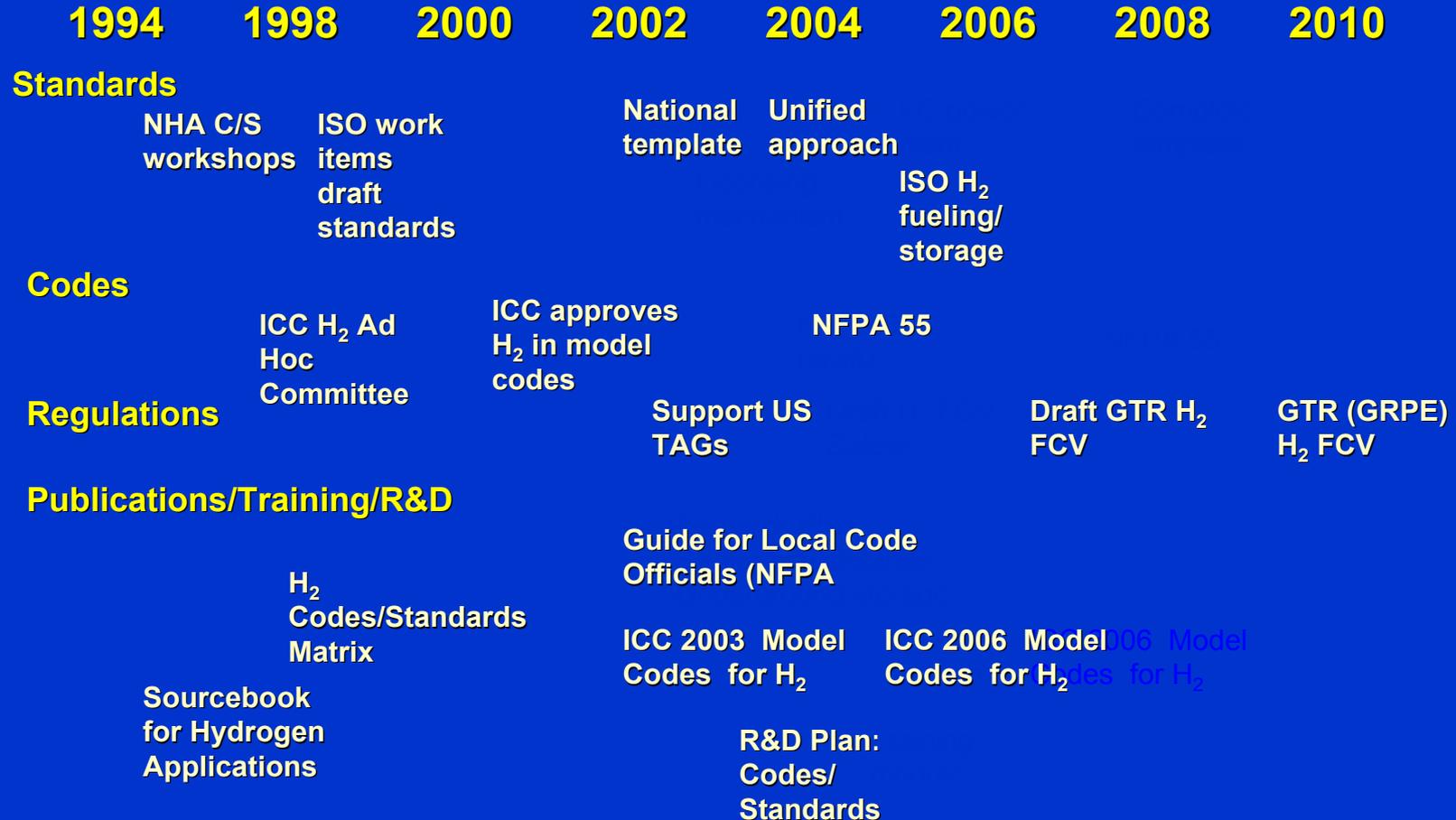
Key Technical Targets

(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, conduct workshops with ICC and NFPA
- **Economic competitiveness issues and national agendas**
 - develop unified national agenda, support consistent representation of industry and government experts at key global venues
- **Lack of technical data**
 - develop comprehensive R&D plan and program for validation of codes and standards



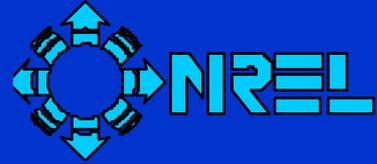
Program Timeline





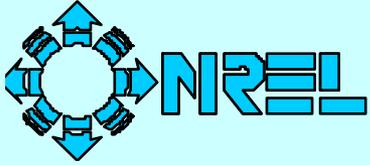
Progress

- **Hydrogen safety incorporated in 2003 edition of ICC model codes**
 - all major changes proposed for IRC, IMC, and IFC approved
 - hydrogen recognized as a “fuel gas” in IFGC and proposed changes to IFGC approved by floor vote
 - support by industry, hydrogen fuel cell exhibit key to success
 - AGA is new member of ICC H2 Ad hoc Committee, CGA is participant
- **ICC approves H2 Ad Hoc Committee for 2006 code cycle**
 - footprint of fueling/service facilities is key concern
 - new data for quantity-separation distance requirements
 - underground liquid, canopy, and metal hydride storage
- **Guy Tomberlin, Commercial Inspections Supervisor, Fairfax Co., VA, and Chair, ICC H2 Ad Hoc Committee receives NHA Meritorious Service Award, March 6, 2003**



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, GM in 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**



Progress

Vehicles

Controlling Authority : NH TSA
 (crashworthiness)
EPA (emissions)

Fuel Cell Vehicle Systems: SAE
Fuel Delivery Systems: SAE,
Containers: CSA
Reformers: SAE
Emissions: SAE
Recycling SAE
Service/ Repair: SAE

Fuel Delivery, Storage

Controlling Authority : RSPA
 Over-road Transport
 Pipeline Safety

Composite Containers ASME
 CSA, CGA, NFPA
Pipe lines ASME, API, CGA, AGA
Equipment ASME, API, CGA, AGA
Fuel Transfer NFPA, API

Fuel Specs: SAE
 ASTM, API
Wt/ Measures: NIST,
 API, ASME
Fueling/Defueling: SAE
Sensors/Detectors: UL,
 NFPA, SAE, CSA
Connectors: SAE, API,
 CSA
Communications : SAE
 UL, CSA, API, IEEE

[lead SDO underlined]

Fueling, Service

Parking Facility

Controlling Authority : State, Local Govt.
 Zoning, Building Permits

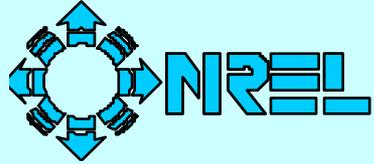
Storage Tanks : ASME, CSA, CGA, NFPA,
 API

Piping ASME, CSA, CGA, NFPA

Dispensers CSA, UL, NFPA,

On-site H2 Production: CSA, UL, CGA, API

Codes for the Built Environment: ICC, NFPA



Progress

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

General Area	Controlling Authority	Functional Area	Lead SD O	Assisting Organizations
Vehicles	NHTSA	Crashworthiness	DOT	SAE
	EPA	Emissions	DOT	SAE
FC Vehicle Systems		Vehicles	SAE FCS 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



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)**
 - secretariat and technical advisory group to Hydrogen Ad Hoc Committee
- **American Society of Mechanical Engineers (ASME)**
 - Hydrogen Steering Committee
- **Underwriters Laboratory (UL)**
 - Standards Technical Panel UL2264: Hydrogen Generators
- **CSA International**
 - Technical Advisory Group for on-board gaseous hydrogen container standard



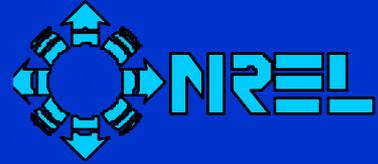
Progress

- **California Fuel Cell Partnership**
 - Codes and Standards Working Group
 - brief Steering Committee annually on codes and standards
 - Working Group on Emergency Response Guide for FC Buses
- **US Fuel Cell Council**
 - 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
 - Denver, Boston, Chicago, Philadelphia, Atlanta (Orlando)
 - safety, codes and standards discussed



Coordination

- **DOE H₂ Codes/Standards Coordinating Committee**
 - DOE Office of Hydrogen, Fuel Cells, and Infrastructure Technologies Program
 - NREL, PNNL
 - DOT, NIST, NASA, US Navy, EPA
 - ANSI, API, ASME, ASTM, CGA, CSA, ICC, NFPA, NGVC, NHA, IEEE, IHIG, SAE, UL
 - Will coordinate and manage national templates for DOE
 - Open to all participants
 - Contact Russ Hewett (russell_hewett@nrel.gov)



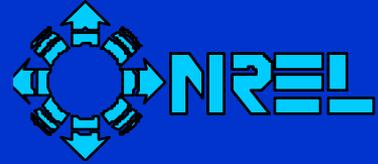
Future Plans

- **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**



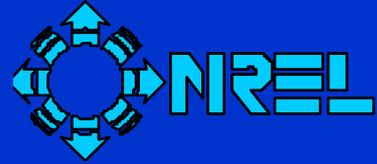
Future Plans

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.
Mass-Flow Measurement	Defines methods to quantify hydrogen mass flow rate to determine appliance efficiency
Transport	Review and modification of existing piping standards and underground storage



Industry Support

- **Energy companies must support domestic and international developments**
 - Refueling station standard for ISO TC 197
 - Underground storage
 - Piping for transmission and distribution
- **Auto companies must support the same developments**
 - Communication between dispenser and vehicle
 - Connector
 - Hydrogen in exhaust
- **Provide technology data to DOE for database**
- **Encourage “dedicated” SDO activities to ensure cooperative effort**



Conclusion

- **Significant progress on domestic codes and standards**
 - **National template for hydrogen vehicles and fueling facilities**
 - consensus and collaboration among primary standard and code development organizations
 - next steps include “synchronized” work plans
 - other templates will be prepared
- **Industry support is growing**
 - support at ICC hearings were critical for success
 - IHIG emphasizing importance of codes and standards
- **Discussions on comprehensive R&D plan for validation of standards begun**
- **Cooperation between NFPA and ICC is crucial**
- **Annual safety, codes, and standards summit meeting**
 - “Report Card” for DOE program
- **Thank you for your help and support**