Fuel Cell &
Hydrogen Energy
Association

Fuel Cell & Hydrogen Energy Association Codes and Standards Support

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June 18, 2014

Project ID # SCS022

This presentation does not contain any proprietary, confidential, or otherwise restricted information

Overview

Timeline

- Project start date: 11/2011
- Project end date: 11/2014*

* Project continuation determined annually by DOE

Budget

- FY13 DOE Funding: $200,000#
- Planned FY14 DOE Funding: $274,868
- Total DOE Project Value: $644,868

Subcontract thru NREL

Barriers

F. Enabling National and International Markets Requires Consistent RCS

H. Insufficient Synchronization of National Codes and Standards

J. Limited Participation of Business in the Code Development Process

Partners

- Interactions/ collaborations: FCHEA Members; CDOs & SDOs through NHFCCSCC and direct participation
- Project Lead -ORNL- Prime Contract

Relevance

- FCHEA project contributes directly to achievement of four of the seven objectives outlined in the Fuel Cell Technologies Office Multi-Year Research, Development and Demonstration Plan, Chapter 3.7, Hydrogen Safety, Codes, and Standards:
  - Support and facilitate development and promulgation of essential codes and standards by 2015 to enable widespread deployment and market entry of hydrogen and fuel cell technologies and completion of all essential domestic and international RCS by 2020.
  - Ensure that best safety practices underlie research, technology development, and market deployment activities supported through DOE-funded projects.
  - Conduct R&D to provide critical data and information needed to define requirements in developing codes and standards.
  - Develop and enable widespread sharing of safety-related information resources and lessons learned with first responders, authorities having jurisdiction (AHJs), and other key stakeholders.

Relevance - Objectives

- Support and facilitate development and promulgation of essential codes and standards by 2015 to enable widespread deployment and market entry of hydrogen and fuel cell technologies and completion of all essential domestic and international RCS by 2020.
  - FCHEA participates directly in key domestic and international RCS technical committees; and encourages members to participate directly in appropriate technical committees, working groups or discussions.
    - ISO/TC 197 – recent restructuring under new TC Chair and Secretariat
    - IEC/TC 105 – fuel cell requirements with efforts to harmonize with national standards and international regulations
    - CSA Fuel Cell Standards Committee
    - NFPA 2: Hydrogen Technologies
    - ICT Fuel Cell Guidance for the Telecommunications Industry Association
    - Others as needs arise

Relevance to DOE Objectives

- Ensure that best safety practices underlie research, technology development, and market deployment activities supported through DOE-funded projects.
  - FCHEA supports information-sharing of pre-competitive safety information
    - Open discussions during FCHEA Working Group and Task Force meetings
    - Identify and schedule Topical Discussions during monthly meetings of the National Hydrogen and Fuel Cell Codes & Standards Coordinating Committee (NHFCCSCC) which FCHEA administers.
    - Posting and/or linking data, workshop proceedings, and other informational resources online at www.hydrogenandfuelcellsafety.info
    - Conducts outreach activities to support deployment: Example: Secretariat to H2USA, a public-private partnership which includes automakers, government agencies, gas suppliers, and the hydrogen and fuel cell industries working together to coordinate research and identify cost-effective solutions to deploy infrastructure that can deliver affordable, clean hydrogen fuel in the United States.
      - FCHEA Technical staff also serve as H2USA Working Group liaisons to ensure close coordination between FCHEA and H2USA Working Groups

Relevance to DOE Objectives – Cont'd

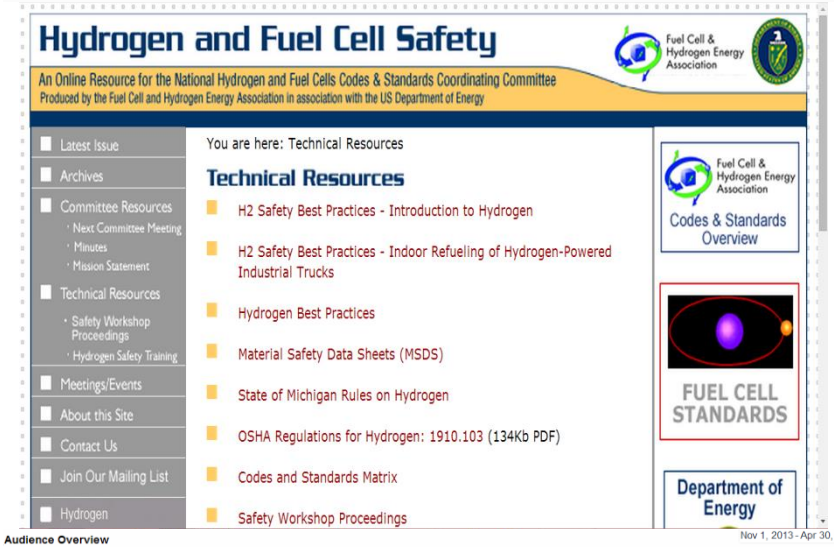
- Conduct R&D to provide critical data and information needed to define requirements in developing codes and standards.
  - FCHEA conducts forums to identify R&D needs, and engages in dialog with DOE; providing a mechanism for input and feedback into DOE R&D plans and activities.
    - FCHEA Working Groups
    - Direct participation in National CDO/SDO Technical Committees
    - Direct participation in US TAG for ISO/TC 197 and IEC/TC 105
    - Facilitations and documentation of monthly NHFCCSCC meetings
    - Monthly summary reports
    - Quarterly outreach reports
    - Strategic meetings of FCHEA Board of Directors and Executive Committee
      - DOE is invited to engage with industry in discussions of accomplishments and challenges.

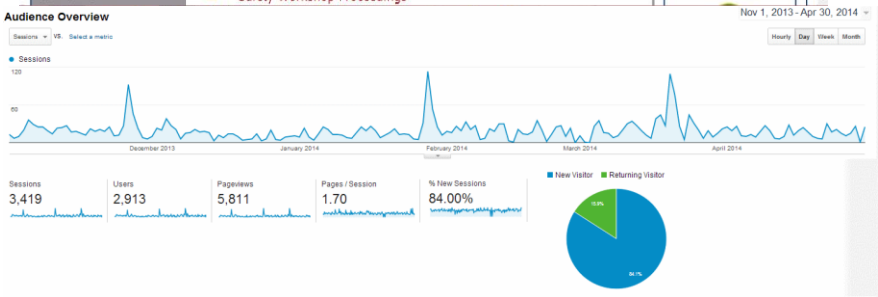
Relevance to DOE Objectives – Cont'd

- Develop and enable widespread sharing of safety-related information resources and lessons learned with first responders, authorities having jurisdiction (AHJs), and other key stakeholders.

- *The Hydrogen and Fuel Cell Safety Report* is read by thousands of interested parties all over the world. 2,200 people, including AHJs and first responders, have signed up to receive E-mail notification when new issues are posted. Many others find it through Internet searches and bookmarks.

	Country / Territory	Sessions	% Sessions
1.	United States	1,535	44.90%
2.	United Kingdom	227	6.64%
3.	Canada	187	5.47%
4.	India	148	4.33%
5.	Japan	141	4.12%
6.	Germany	105	3.07%
7.	France	96	2.81%
8.	China	80	2.34%
9.	Australia	69	2.02%
10.	Brazil	52	1.52%





Relevance - Impact

Significance

Level of Effort

- Enabling National and International Markets Requires Consistent RCS
  - Lack of consistency limits international trade and markets.
    - This is a key issue identified by our industry members, and is the reason that we work to ensure developing standards are technically consistent with published standards.
- Insufficient Synchronization of National Codes and Standards
  - The codes and standards development and revision cycles established by SDOs vary and are difficult to coordinate or synchronize even under a consensus national agenda.
    - FCHEA maintains a matrix to provide a single resource for stakeholders to see which activities are active, what the status and next steps are, and when documents are published or opened for revision.
    - FCHEA facilitates the monthly meetings of the NHFCCSCC, where CDOs/SDOs can share information about timing and issues; and where industry and researchers can engage in the discussion and provide essential linkages.
- Limited Participation of Business in the Code Development Process
  - Businesses, particularly small businesses, do not have the resources to participate in the codes and standards development process.
    - Participation in FCHEA RCS Working Groups allows these businesses opportunities to be briefed on the RCS efforts of interest; to weigh in on issues that arise; and to review documents in order to develop a FCHEA comment or position.
    - The Hydrogen and Fuel Cell Safety Report and the FCHEA Regulatory Matrix provide quick overview information

Sample Page from Matrix

Significance

Level of Effort

Significance to Commercialization
⇦ More Critical
Highest Effort

A. Essential To or Enables Commercialization	B. Important to Commercialization	C. Supports Commercialization	
~~***ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air***: published every two years. ***2013 edition includes*** references to IEC 62282 – 6 – 100 for both carry on and checked baggage, October 2012, inclusion of A1 approved for inclusion by addendum. Publication of addendum 3 occurred June 10,2013. (micro fuel cell applications)~~ ~~**Cargo Shipping regulations of Fuel Cells, Fuel Cell Cartridges, Fuel Cell Engines and Fuel Cell Vehicles:** in force now, revised periodically. Ongoing discussions related to definitions of "articles" as well as classification test methods for Div 4.3 water-reactive substances and treatment of engine-containing fuel are ongoing.~~ ~~UN Sub-Committee of Experts (cargo shipping)~~ **US DOT Harmonization NPRM – HM215L**: **Proposed rule on Hazardous Materials: Harmonization with International Standards –** FCHEA submitted comments supporting harmonization and reiterating comments on HM215K. Both HM215L and the response to the final rule and the response to the appeal on HM215K were published in January 2013. Harmonization with IEC 62282-6-100 for both carry on and checked baggage; however DOT continues to not be harmonized with inclusion of division 2.1 and 4.3 fuel cartridges for checked baggage. (micro fuel cell applications) Recent Court of Appeals decision is expected to yield additional required activity (with DOT).	***ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air***: published every two years. ***2013 edition includes*** references to IEC 62282 – 6 – 100 for both carry on and checked baggage, October 2012, inclusion of A1 approved for inclusion by addendum. Publication of addendum 3 occurred June 10, 2013. (micro fuel cell applications) Work commencing to clarify restrictions on charging of batteries by fuel cell devices. Future work anticipated as edition 2 of IEC 62282-6-101 nears completion to more explicitly include new technologies in the regulations. **Cargo Shipping regulations of Fuel Cells, Fuel Cell Cartridges, Fuel Cell Engines and Fuel Cell Vehicles:** in force now, revised periodically. Ongoing discussions related to definitions of "articles" as well as classification test methods for Div 4.3 water-reactive substances and treatment of engine-containing fuel are ongoing. UN Sub-Committee of Experts (cargo shipping)		CARGO
~~**IEC 62282-4-100: Fuel cell systems for forklift applications – Safety requirements, environmental**~~	**UL 2267** Fuel Cell Power Systems for Installation into Industrial Trucks under revision	~~ISO TC22 / SC25 / WG5 - Fuel system components of vehicles~~	VEHICLES

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Approach: FCHEA WGs

FCHEA Working Groups provide regular opportunities to engage industry in developing RCS:

Transportation WG

- Transportation Infrastructure standards, R&D, deployment.
- Hydrogen Codes Task Force
    - Produced public code change proposals for NFPA 2

Stationary Power WG

- Supports the Telecommunications Industry Association's (TIA) focus group on fuel cells and tracks RCS relating to Stationary Power.
    - Recent topics include the TIA focus group, a call for participation in CSA Standards Development, and a discussion on the Greenhouse Gas Protocol.

Portable Power WG

- Complete regulatory framework to ship and to allow consumer transport of FCs and FC cartridges to be regulated in parity with similar technologies.
- RCS from UL, CSA, DOT, the UN, ICAO, IEC and others.
- FCHEA maintains Consultative Status at the UN Subcommittee of Experts on the Transportation of Dangerous Goods and the ICAO Dangerous Goods Panel.

Approach: Coordination and Outreach

NHFCCSCC (monthly)

- Forum for effective communication and collaboration
- Facilitates the development of the consensus-based C&S
- Identifies critical gaps and makes recommendations to address them.

Safety Report (bi-monthly)

Central source of information on RCS activities and issues

Improves coordination of RCS activities and information transfer

Meetings of the NHFCCSCC

Summarizes key domestic and international RCS issues

List key upcoming events and issues

Outreach (quarterly report)

Distribute information on Safety and RCS to accelerate deployment

- Identify key groups and organizations
- Identify geographic areas
- Develop a detailed plan, including draft agenda, venue, logistics, and budget for holding a workshop to address information needs.

Approach to Resolve Technical Challenges

- Challenge: Development and Harmonization of Regulations, Codes and Standards
  - Facilitate the development of clear and comprehensive codes and standards to ensure consistency and facilitate deployment of hydrogen and fuel cell technologies
  - Reduce competition between individual SDOs and to minimize duplication in domestic codes and standards development. Coordinated development of international standards is also a key challenge.

  APPROACH: Technology and application-specific forums to identify issues and discuss progress and needs in developing RCS; open dialog between CDOs/SDOs, government and research organizations, industry and users; Direct Participation in RCS-development activities; and information dissemination and outreach to develop consensus requirements to ensure consistency.

- Challenge: Dissemination of Data, Safety Knowledge, and Information
  - General lack of understanding of hydrogen and fuel cell safety needs among local government officials, fire marshals, and the public. Failure to comprehensively consider the properties and behavior of hydrogen may lead to overly restrictive policies that preclude or delay deployment of hydrogen and fuel cell technologies.

  APPROACH: FCHEA publishes, maintains, and disseminates key safety information through the *Hydrogen and Fuel Cell Safety Report* website at www.hydrogenandfuelcellsafety.info; and works with stakeholders to meet the specific needs for dissemination of their FCV and infrastructure-deployment activities, internally as well as externally.

- Milestones: Monthly summaries, bi-monthly Safety Report, quarterly Outreach report
  - Aligned with the Go/No-Go Decisions in DOE's current plans: Support and facilitate development and promulgation of essential codes and standards by 2015 to enable widespread deployment and market entry of hydrogen and fuel cell technologies and completion of all essential domestic and international RCS by 2020.

Accomplishments and Progress: Portable Power

- **PPWG**: ICAO *Technical Instructions for the Safe Transport of Dangerous Goods by Air*: published every two years. 2013 edition includes references to IEC 62282 – 6 – 100 for both carry on and checked baggage, October 2012, inclusion of A1 approved for inclusion by addendum. Publication of addendum 3 occurred June 10, 2013. (micro fuel cell applications). PPWG was active in all phases to develop technical requirements, assist in international dialog, and ensure documents were available for regulators.
  - This WG met nearly every week, and exchanged papers by e-mail between meetings.
  - WG members took leadership roles in IEC WGs and drafted papers to help establish consensus.
- **Significance**: Supports Objective from MYPP - Enabling National and International Markets Requires Consistent RCS by ensuring national and international standards for micro fuel cell applications are harmonized, then adopted by International Regulations.
- **Take Home Message**: Regular dialog in FCHEA WGs and consistent messaging and participation in relevant RCS forums can result in consistent RCS.

Accomplishments and Progress: Transportation and Stationary

- **TWG**: Infrastructure RCS review. Administers Hydrogen Codes Task Force to review and develop public input for NFPA 2.
  - 11 public inputs, coordinated with other stakeholders to establish support.
  - Task Group has now developed eight inputs on the First Draft Report, one of which addresses the only open item from the first round. The public inputs all address harmonizing requirements with other industry-accepted standards and codes.
  - **Significance**: Supports Objective from MYPP – Provides consistent RCS and synchronization of national codes and standards.
  - **Take Home Message**: FCHEA WGs and TFs work collaboratively with others to effectively make changes to developing RCS

- **SPWG**: Forum for engaging in the development of RCS for stationary applications. FY 13 a new fuel cell focus group was created by the Telecommunications Industry Association (TIA). FCHEA's SPWG provides support and fuel cell experts, and assisted in populating a new draft guideline with relevant information from existing codes, standards, and guides. WG also reviewed and is developing input on issues relating to GHG emissions accounting.
  - **Significance**: Supports Objective from MYPP – Develop and enable widespread sharing of safety-related information resources and lessons learned with first responders, authorities having jurisdiction (AHJs), and other key stakeholders. Provides consistency in requirements and reduces duplication of effort.
  - **Take Home Message**: FCHEA works with other stakeholders, even where FCHEA is not leading the activity, to ensure valuable resources are shared.

Accomplishments and Progress

- **Coordination**
  - **NHFCCSCC** – Monthly facilitated discussion of new key topics of broad interest, such as “Facilitating Deployment”. Progress in the development of RCS is reported and captured for the FCHEA Regulatory Matrix, providing an up-to-date overview of current industry priorities and recent progress in RCS.
  - **Hydrogen & Fuel Cell Safety Report** – Published every two months, keeping readers informed of the progress and issues encountered in the development of RCS. Has introduced industry to the many new WGs in ISO/TC 197 and the call for participation in US standards committees. Calendar of events aids in scheduling meetings.
- **Outreach** – New activity. Relationships are being developed with state and local government organizations, trade groups, public policy organizations, and other groups that would play key roles in the deployment of technologies.
- **Significance**: Contributes to DOE goal to develop and enable widespread sharing of safety-related information resources and lessons learned with first responders, authorities having jurisdiction (AHJs), and other key stakeholders. Increases participation of stakeholders in development of harmonized RCS.
- **Take-Home Message**: FCHEA is building relationships and working directly with stakeholders to identify and address issues in order to ensure consistency in RCS and facilitate deployment of hydrogen and fuel cell technologies.
- **Responses to Previous Year Reviewers’ Comments:** Project was not reviewed last year.

Collaborations

- FCHEA performs this work with ORNL.
- FCHEA members represent the full global supply chain, including universities, government laboratories and agencies, trade associations, fuel cell materials, components and systems manufacturers, hydrogen producers and fuel distributors, utilities and other end users. Members direct our activities, provide input to RCS through FCHEA involvement; review and prioritize our efforts.
- CDOs/SDOs through direct participation on RCS activities, participation in the NHFCCSCC, and participation in appropriate FCHEA WGs. This facilitates information-sharing and synchronization.
- FCHEA works with the full range of stakeholders, including industry, state and local officials, and others to address RCS and outreach needs and facilitate deployment.
    - Examples: State and local officials; CaFCP on RCS development and outreach tools; H2USA, a private/public partnership launched inn 2013. FCHEA holds the Secretariat and makes technical staff available to administer H2USA WGs. This assures coordination between H2USA's market-deployment activities and FCHEA WG's RCS-development activities
- FCHEA works closely with DOE to facilitate productive dialog on industry priorities, R&D needs, and deployment barriers; as well as to promulgate R&D results and information and data resources available through DOE-funded projects.

Remaining Challenges and Barriers

- The four objectives supported by this project are ongoing. Objectives are structured to be reached by 2015 to 2020.
- Further advances on US Model Codes. This includes reference to available harmonized standards. Updated Permitting Guidance is needed to aid the AHJs. Emergency Responders guidance for regions outside California.
- US harmonization with IEC 62282-6-100 for inclusion of division 2.1 and 4.3 fuel cartridges for checked baggage.
- The ICT Fuel Cell Guideline is in development. This is expected to be available as a draft by the end of 2014. User feedback will be available in 2015.
- International standards need to develop in a coordinated fashion to ensure they reflect the needs of industry and consistency with accepted practices.
  - **IEC 62282-6-400 "Fuel cell technologies – Part 6-400: Micro fuel cell power systems – Power and data interchangeability"** CDV was rejected; the votes and comments received on 105/453/CDV were circulated. The TC 105 P-member countries have been invited to consider the results and indicate their preference with regard to the next steps, which may be a 2nd CDV, an IEC Technical Specification, or put the project on hold.
  - ISO/TC 197 WGs on hydrogen fueling stations and components.

Proposed Future Work

- **PPWG**: ICAO *Technical Instructions for the Safe Transport of Dangerous Goods by Air*: Work commencing to clarify restrictions on charging of batteries by fuel cell devices. Future work anticipated as edition 2 of IEC 62282-6-101 nears completion to more explicitly include new technologies in the regulations. Aid in providing data to facilitate harmonization with IEC 62282-6-100 for inclusion of division 2.1 and 4.3 fuel cartridges for checked baggage.
- **TWG**: Follow progress of FCHEA public inputs on First Revision Draft of NFPA 2 to ensure consistency of requirements between codes and with industry-accepted practices. Develop data tools to address the need for updated permitting guidance for hydrogen infrastructure deployment.
- **SPWG**: Work with TIA to complete the guideline for fuel cells in the telecommunications industry. Continue to review international standards and US regulations to ensure consistency with accepted US requirements and best practices.
- **Coordination**:
  - **NHFCCSCC** – continue to administer, identify key issues, and document discussions and outcomes. Provide industry feedback and other input to the Department of Energy (DOE) Safety and Codes and Standards Subprogram on RCS development needs and priorities; outreach needs and priorities; R&D needs and priorities to support RSC development activities.
  - **Safety Report** – continue to report on the developing RCS to improve coordination of activities and improve information transfer.
- **Outreach**: Define the safety and RCS needs of the locations identified by industry, starting with ZEV states. Engage in outreach activities in key regions to facilitate deployment.

Project Summary

- **Relevance**: FCHEA project contributes directly to achievement of four of the seven objectives outlined in the Fuel Cell Technologies Office Multi-Year Research, Development and Demonstration Plan. Project facilitates industry participation in essential codes and standards to meet DOE goals.
- **Approach**: Multi-tiered approach: forums to identify issues and discuss progress and needs in developing RCS; facilitating open dialog; participating directly in national and international RCS-development activities; information dissemination & outreach tools
- **Technical Accomplishments**: Significant progress in harmonizing national and international requirements for transportation of portable fuel cells in passenger aircraft; proposals to improve harmonization in domestic RCS; maintained central point of information for RCS activities; identified and communicated needs in RCS, R&D, and outreach.
- **Proposed Future Work**: Increased on permitting issues to facilitate deployment; continue building relationships with key stakeholders, including state and local agencies, associations such as TIA – complete ICT fuel cell guideline; develop education workshop plans to facilitate deployment of hydrogen and fuel cell technologies; ensure international standards are consistent with US practices.

Backup Slides

FCHEA Members as of April 15, 2014

Fuel Cell Vehicle Manufacturers
BMW ● Daimler ● General Motors ● Honda ● Nissan ● Toyota

Fuel Cell Manufacturers
Ballard Power Systems ● Bloom Energy ● ClearEdge Power ● Delphi ● FuelCell Energy ● Hydrogenics ● Intelligent Energy ● Lilliputian Systems ● Nuvera Fuel Cells ● Plug Power, Inc. ● LG Fuel Cell Systems Inc. ● Trulite, Inc.

Materials and Components
3M ● Gore Fuel Cell Technologies ● Johnson Matthey Fuel Cells ● PDC Machines ● TreadStone Technologies

Hydrogen Suppliers
Air Liquide ● Air Products and Chemicals ● Iwatani International Corporation ● Linde Group ● Shell Oil ● Western Hydrogen Limited

Electrolyzers and Fueling Equipment
BIC Corporation ● Hydrogenics ● ITM Power ● Nuvera Fuel Cells ● Proton Onsite ● PDC Machines ●

Laboratories, Research and Development Organizations, and Nonprofits
ARC: Hydrogen ● California Fuel Cell Partnership ● Connecticut Hydrogen Fuel Cell Coalition ● CSA America ● Fuel Cell Seminar & Energy Exposition ● Methanol Institute ● National Renewable Energy Laboratory ● Sandia National Laboratories ● Savannah River National Lab ● South Carolina Research Authority ● Taiwan Fuel Cell Partnership

Government Agencies
California Air Resources Board ● South Coast Air Quality Management District

Universities
University of North Dakota – Energy & Environmental Research Center

End users and Others
Boeing ● Nebraska Public Power District