Fuel Cell & Hydrogen Energy Association Codes and Standards Support

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Fuel Cell and Hydrogen Energy Association (FCHEA)

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DOE Hydrogen Program

2024 Annual Merit Review and Peer Evaluation Meeting

AMR Project ID # SCS022

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

Project Goal

Project Goal: Facilitate wide-scale adoption of fuel cells and hydrogen energy systems through the development of consistent safety codes and standards that incorporate industry best practices.

To achieve this goal, we engage industry in the process of developing technical requirements, work to ensure requirements are consistent, and develop and enable widespread sharing of safety-related information resources and lessons learned with first responders, authorities having jurisdiction (AHJs), and other key stakeholders.

Overview

Timeline

- Project start date: 04/15/23
- Project end date: 04/14/24*

* Project continuation determined annually by DOE

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

Budget

- FY23 DOE Funding: $334,000
- FY24 Planned DOE Funding*: $412,000
- Total DOE Funds Received to Date**: $1,084,503

* Contract ends 14 April 2024. Negotiations underway for follow-on.

** Since the project started

NOTE – seeking review/feedback from ORNL

Partners

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

Potential Impact

- **This project contributes directly to the following goals of the DOE Hydrogen Program:**
  - Lower greenhouse gas emissions and criteria pollutants
  - Build clean energy infrastructure
  - best practices or state-of-the-art.
- **The project facilitates removal of the following 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

Examples:

- FCHEA keeps stakeholders engaged in the RCS activities by reporting in our Technical Working Groups, monthly RCS coordination calls, articles in our *Hydrogen and Fuel Cell Safety Report*, and RCS tracking tool, FCHEA's Regulatory Affairs Matrix. This increases participation in the RCS activities of industry, which facilitates consistency in developing RCS to reflect industry best practices.
- ASME is working to provide guidance to facilitate code-stamping of electrochemical cell stacks found in electrolyzers and fuel cells. This effort has the potential to cause significant delay and increased costs for citing these systems, without a corresponding increase in safety. FCHEA has successfully led an industry group of manufacturers and users to provide for robust industry engagement in the development of this guidance through an ASME Task Group. FCHEA staff serves as Vice Chair for this Task Group, and regularly engages stakeholders to ensure the requirements in the planned ASME mandatory appendix make sense for the technologies, recognize the system-level standards developed by industry, appropriately apply the ASME rules to electrochemical cell stacks, and educate inspectors and other stakeholders about the technologies and ANSI-approved industry standards. The purpose is to ensure consistency in the rules, broad industry participation to ensure the rules reflect best practices, and facilitate citing approvals for electrolyzer systems and fuel cell systems, which will lower greenhouse gas emissions and criteria pollutants.

Potential Impact Cont'd

- **Enabling National and International Markets Requires Consistent RCS (Barrier F)**
  - Lack of consistency limits international trade and markets.
    - FCHEA Board Priorities for our RCS efforts focuses on efforts to advocate for removal of regulatory and policy barriers; as well as efforts to harmonize codes, standards, and regulations
    - Our technical working groups engage in document review and provide input to facilitate consistent requirements
    - Conducting the monthly NHFCCSCC calls facilitates harmonization
  - FCHEA staff participates directly in the key national and international codes and standards technical committees to provide consistency – ensuring the industry is engaged and requirements are harmonized with industry best practices.
- **Insufficient Synchronization of National Codes and Standards (Barrier H)**
  - 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 facilitates the monthly meetings of the NHFCCSCC, where CDOs/SDOs can share information about timing and issues. Organizations that report out during the calls include: DOE, DOT, IEC, NFPA, ICC, CSA, CGA, ISO, SAE, ASTM, ASME, IEEE, and NIST.

Potential Impact Cont'd

- **Limited Participation of Business in the Code Development Process (Barrier J)**
  - Businesses, particularly small businesses, do not always have the resources to participate fully 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, and know when the time is right for their organization to engage directly.
      - Recent example – Outreach to WG members on new activities in ISO/TC 197/SC 1 on measurement of greenhouse gas emission methodologies led to interest from member experts to engage directly in those activities
      - Recent example – Outreach to Stationary Power Working Group members on a new revision to ASME BPVC – Boiler and Pressure Vessel Code proposal to cover requirements for electrochemical cell stacks led to interest from member experts to engage directly in those activities
    - The Hydrogen and Fuel Cell Safety Report, the FCHEA Regulatory Matrix, and the codes and standards database at H2Tools.org provide quick overview information, making it easier for organizations to track and engage in key efforts.

Approach: Safety Planning and Culture

- A safety plan is exempted for this project, as the project focuses on the development of RCS through stakeholder engagement. The project does not involve any hardware, testing, or product development.

Approach to Resolve Technical Challenges

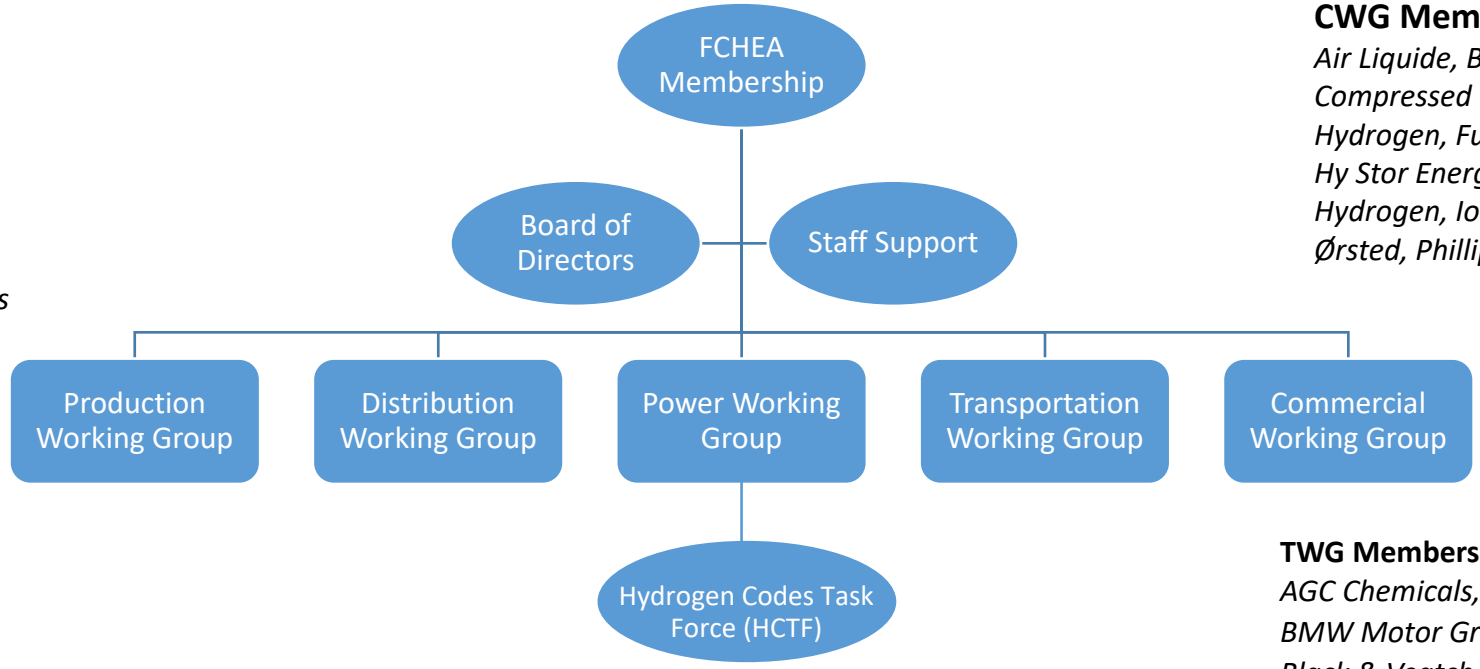
- **Challenge: Development and Harmonization of Regulations, Codes and Standards**
  - Facilitate the development of clear and comprehensive codes and standards to ensure consistency and facilitate deployment of hydrogen and fuel cell technologies
  - **APPROACH**: FCHEA Working Groups provide regular opportunities to engage industry in developing RCS, assess RCS priorities and needs, and identify opportunities to harmonize requirements. NHFCCSCC provides a forum to identify issues and discuss progress and needs in developing RCS; open dialog between CDOs/SDOs, government and research organizations, industry and users; FCHEA facilitates 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 works with stakeholders to disseminate FCV and infrastructure-deployment RCS activities. FCHEA publishes, maintains, and disseminates key safety information through the *Hydrogen and Fuel Cell Safety Report* website at www.hydrogenandfuelcellsafety.info, and www.H2Tools.org, enhancing access to codes, standards, and regulations worldwide.

- **Milestones: Quarterly summaries, bi-monthly Safety Report**
  - Aligned with the Go/No-Go Decisions in DOE's current plans. Provides regular mechanism to identify and address industry priorities.

Approach - FCHEA RCS Working Groups

** All members are encouraged to participate in RCS activities appropriate to their business. Outside experts are invited as needed to address topics of interest to industry.*



Production WG Membership

AGC Chemicals, Anew Climate, Air Liquide, Bosal, Bosch, CF Industries, Ceres, CSA Group, Chart Industries, Clean Energy Fuels, Compressed Gas Association, Electric Hydrogen, Flexitallic, FRIEM, FuelCell Energy, Honda, GM, Hy Stor Energy, IHI Turbo, John Cockerill, Koloma Monolith, Nebraska Public Power District, Nel Hydrogen, Nikola, Neuman Esser, Phillips66, Proteum Energy, Schaeffler, StormFisher, Summit Utilities, Terrestrial Energy, and Toyota

DWG Membership

AGC Chemicals, Air Liquide, Bosch, Chart Industries, Clean Energy Fuels, Compressed Gas Association, Electric Hydrogen, FMGL, Flexitallic Forvia Faurecia, FuelCell Energy, General Motors, GKN Hydrogen, Hexagon, Honda, Hy Stor Energy, IHI Turbo, Koloma, Neuman Esser, Phillips66, Proteum Energy, Summit Utilities, and Toyota

HCTF Membership

Advent, Air Liquide, Bloom Energy, California Fuel Cell Partnership, CSA Group, Cummins, Hexagon, and HyAxiom- Doosan Fuel Cell America, Nel, Nikola, and Plug

Power WG Membership

Advent, Air Liquide, AMSC, Aris Renewable Energy, Avantus, Ballard, Bloom Energy, Bosal, Bosch, CSA Group, Ceres, Clean Energy Fuels, Compressed Gas Association, Cummins, Electric Hydrogen, Forvia Faurecia, FuelCell Energy, Flexitallic, GenCell, General Motors, Honda, Hy Stor Energy, HyAxiom –Doosan Fuel Cell America, IHI Turbo,Inc., Infinity Fuel Cell and Hydrogen, Intelligent Energy, Ionomr, John Cockerill, Kaizen Clean Energy, Nebraska Public Power District, Nel Hydrogen, Nikola, Nuvera, Parker Hannifin,Phillips66,Plug Power, PowerCell Group, Proteum Energy, Renewable Innovations, Summitt Utilities, and Toyota

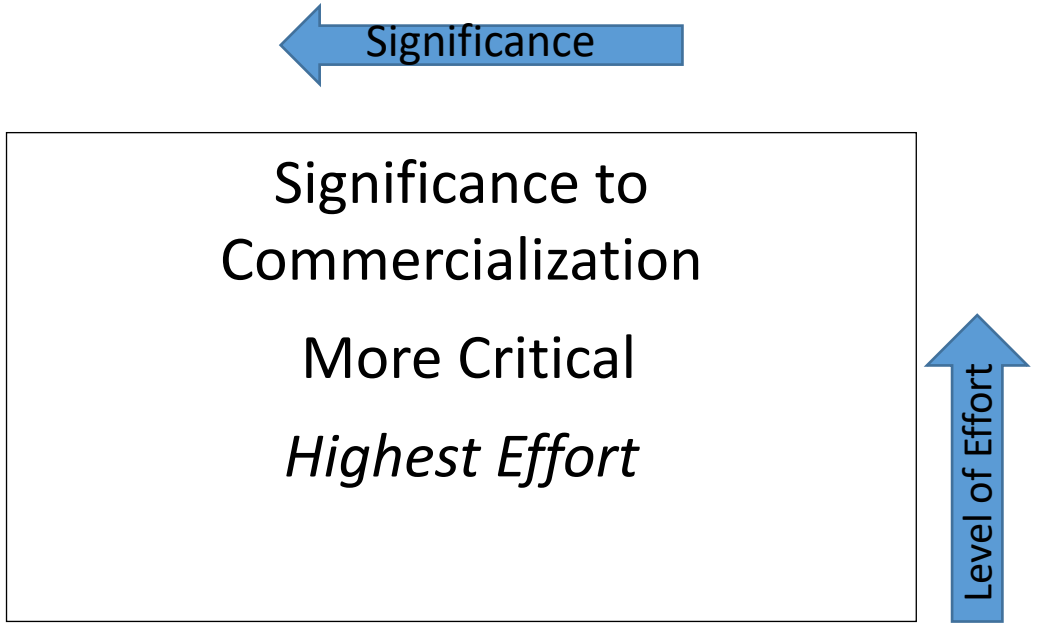
CWG Membership

Air Liquide, Bosal, Bosch, CF Industries, CSA Group, Compressed Gas Association, Cummins, ENGIE, Electric Hydrogen, FuelCell Energy, General Motors, Honeywell, Hy Stor Energy, IHI Turbo,Inc., Infinity Fuel Cell and Hydrogen, Ionomr, John Cockerill, Monolith, OCI Global, Ørsted, Phillips66, Proteum Energy, Toyota, and Twelve,

TWG Membership

AGC Chemicals, Air Liquide, Amazon, Anglo American, BMW Motor Group, Ballard Power Systems, BayoTech, Black & Veatch, Bosch, CSA Group, California Fuel Cell Partnership, Ceres Clean Energy Fuels, Compressed Gas Association, Cummins, ENGIE North America, First Element Fuel, First Mode, Forvia Faurecia, FuelCell Energy, FuelCell Energy, Garrett Advancing Motion, General Motors, HORIBA, Hexagon, Honda, Hy Stor Energy, Hyundai, Hyzon Motors, IHI Turbo America, Inc., Infinity Fuel and Hydrogen, Intelligent Energy, Ionomr, John Cockerill, Kaizen Clean Energy, Luxfer, Nel Hydrogen, Nikola Motor Company, Nuvera, PDC Machines, Phillips66, Plug Power, PowerCell Group, Proteum Energy, Schaeffler, Toyota, and ZeroAvia

Approach - FCHEA Regulatory Matrix updated Quarterly



Through the use of “Track Changes” software, users can quickly identify what has changed during the past quarter. The “track changes” version is reviewed by our WGs and the NHFCCSCC, and provided to ORNL each quarter. Clean copies are available upon request and archived, and form the basis of the next quarters mark-up.

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 RCS information
- Improves coordination and information transfer
- Meetings of the NHFCCSCC
- Summarizes key domestic and international RCS issues
- List key upcoming events and issues

Note – this is NOT an incident report

H2Tools.org (monthly)
- Database of Regulations, Codes and Standards
- Ability to drill for detailed information
- Central source of RCS information
- Improves coordination and information transfer

FCHEA
Fuel Cell & Hydrogen Energy Association

Regulatory Affairs Matrix
December 31, 2023 Version

FCHEA's Regulatory Affairs Matrix is a tool designed to report progress in the development of codes, standards, and regulations of interest to our members. Redline/strike-out markings depict changes over the past quarter. In addition to status updates on each document, position of items within the matrix provides information regarding application, activity level, and importance of the effort to commercialization.

The matrix is divided into clusters based upon application, such as infrastructure, portable power, stationary, etc. Applications are depicted in the far-right column. Level of activity is represented vertically, with items with the highest level of activity appearing towards the top of the matrix. Position within the columns represent the importance of the effort to industry commercialization timeframes.

The matrix is updated on a quarterly basis and reviewed with members during our technical working group meetings. Feedback is used to evaluate importance to commercialization and identify new efforts for future tracking.

For questions or updates regarding this matrix, please contact Karen Quackenbush by email at kquackenbush@fchea.org.

Significance to Commercialization
More Critical ⇦
Highest Effort

A. Essential To or Enables Commercialization	B. Important to Commercialization	C. Supports Commercialization	
	ISO 19880-2: Gaseous hydrogen filling station dispensers Comments from DIS are being resolved. Next stage is FDIS. **ISO 17268 Gaseous Hydrogen Land Vehicle Refuelling Connection Devices:** ISO/TC 197	**NFPA 55: Compressed Gases and Cryogenic Fluids Code:** 2023 edition has been published. The 2026 edition is now open for input until January 4, 2024. o A task group is working to resolve any hydrogen	INFRASTRUCTURE Transportation WG (all)

Accomplishments and Progress: Working Groups

- **Transportation WG**: All applications of hydrogen and fuel cells in transportation across land, sea, and air. Administers Hydrogen Codes Task Force to review and develop public input for NFPA 2 and the I-Codes. Continued participation in NFPA to develop and track code change proposals and decisions taken in revision cycle for 2026 editions of NFPA 2 and NFPA 55 model codes. Engaged in SAE/EuroCAE efforts to develop standards for use of hydrogen and fuel cells in the aviation sector.
    - Serve in task group to review AS6858 Installation of Fuel Cell Systems in Large Civil Aircraft.
    - Hydrogen Codes Task Force developed a harmonized public input for the 2026 edition of the NFPA 2 model code to harmonize with ISO and North American standards for hydrogen refueling dispenser breakaway valves. Public inputs and feedback were solicited from business and experts with operational experience and focus on harmonizing requirements with other industry-accepted standards and codes.

- **Power WG**: The confluence of hydrogen, fuel cells, and power markets both as a production vector and end-use market. Reviewed and provided feedback on draft documents, including New Work Item Proposals and National Deviations for International Standards. Activities include domestic and international standards development, with a focus on ensuring consistency of requirements.
    - Completed revision of three standards in IEC/TC 105 on micro fuel cell power safety WG 402 (formerly WG 8). These documents are now in final publication.
    - Coordinate with ASME on activity to provide mandatory language for cell stack assemblies.
    - Participate in revision of IEEE 1547 for grid interconnection.

Significance: Overcomes Barriers F. Enabling National and International Markets Requires Consistent RCS; H. Insufficient Synchronization of National Codes and Standards; and J Limited Participation of Business in the Code Development Process

Take Home Message: FCHEA WGs and TFs work collaboratively with others to effectively make changes to developing RCS

Accomplishments and Progress: Working Groups, Cont'd.

- **Production WG:** The diversity of clean hydrogen production pathways, both from traditional and renewable sources. Recent activity includes direct participation in the myriad efforts on electrolyzers to ensure harmonized requirements. Serve as Vice-Chair for ASME BPVC Section VIII Electrochemical Cell Stack Task Group, and coordinate industry participation and feedback on developing mandatory appendix. Also briefed WG on new ISO/TC 197 SC1 activities to develop standard methodologies to measure GHG emissions in hydrogen production technologies, resulting in direct engagement by industry.

- **Distribution WG:** The spectrum of infrastructure including distribution, compression, storage and dispensing. Recent activity includes regular reporting on CGA and other RCS development efforts to facilitate harmonization.

- **Commercial WG:** The intersection of hydrogen and emerging markets for commercial processes like steel and cement production, use of hydrogen as a chemical feedstock such as ammonia, hydrogen for heating, and other uses. Our newest WG is bringing stakeholders who are new to hydrogen energy to the table to discuss priorities and novel applications.

- Significance: Supports Objective from MYRDD - Enabling National and International Markets Requires Consistent RCS by ensuring national and international standards are harmonized, then adopted in appropriate codes and Regulations.

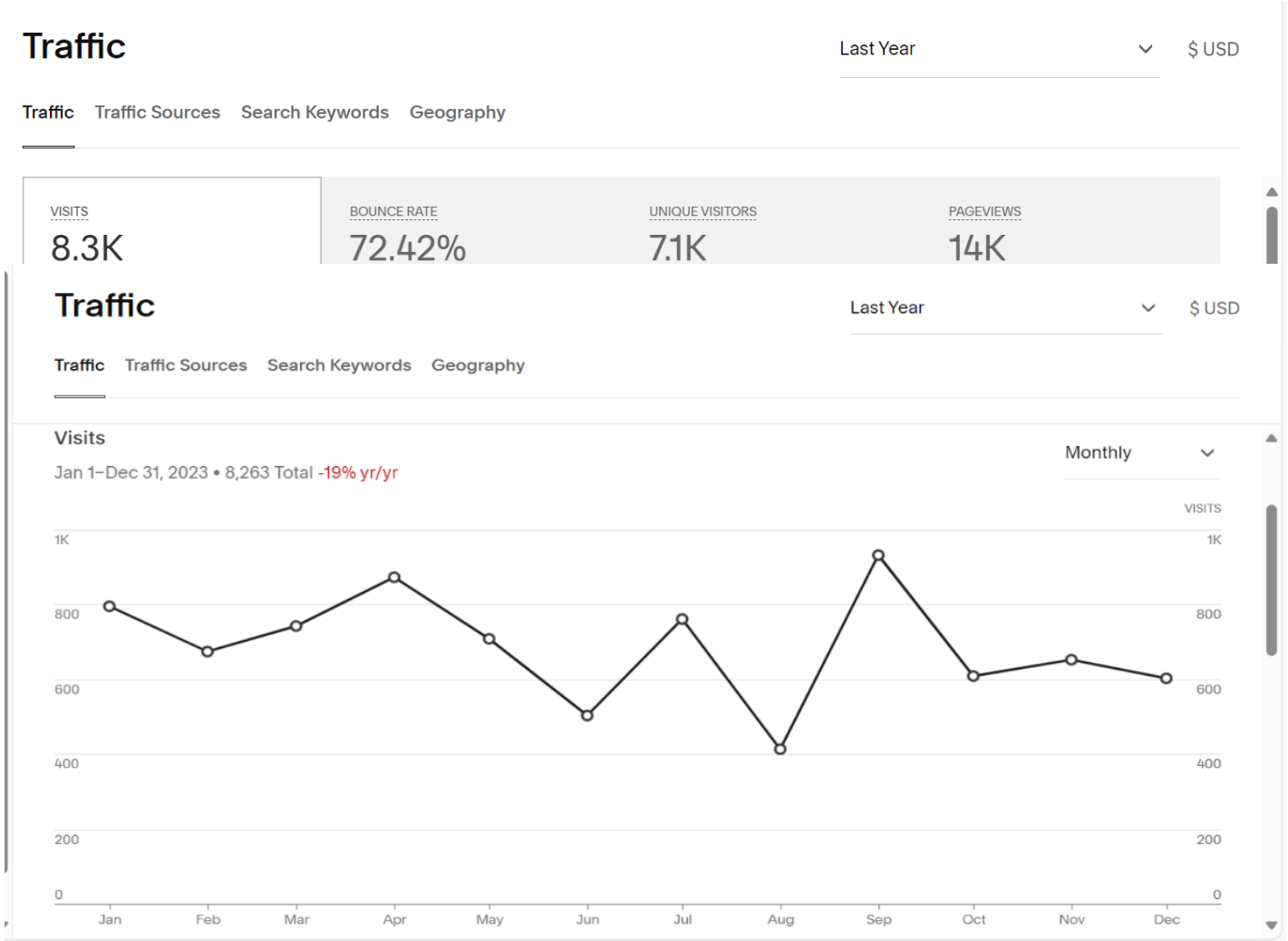
    - **Take Home Message: Regular dialog in FCHEA WGs and consistent messaging and participation in relevant RCS forums can result in consistent RCS**.

Accomplishments and Progress: Coordination

- **Coordination** (Note: The following tools are open and available to any interested party.)
  - **NHFCCSCC** – Monthly facilitated discussion of key topics of broad interest, such as “Facilitating Deployment”, and “Legal Metrology Standards Hydrogen Fuel”. 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 U.S. standards committees. Calendar of events aids in planning and scheduling.
  - **H2Tools.org Codes & Standards Database** - This website tracks the world-wide development of about 500 hydrogen and fuel cell standards, and its matrix can be searched. FCHEA works closely with PNNL to make information available for H2Tools in a format more appropriate for policy-makers and decision-makers. Content transfer from www.FuelCellStandards.com was completed in late 2021. Current efforts are focused on keeping the information up to date and identifying ways to improve functionality to meet user needs.
- **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 makes useful, informative resources available to all interested stakeholders in order to ensure consistency in RCS and facilitate deployment of hydrogen and fuel cell technologies.**

Accomplishments and Progress:
Hydrogen and Fuel Cell Safety Report

- 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.
- Over 8,000 people, including AHJs and first responders, visited the website in 2023.
- Top geographies of our visitors in 2023 are from the United States, Canada, Germany, United Kingdom, India, and France.



Accomplishments and Progress– Cont'd
Codes and Standards database in H2Tools

- FCHEA updates the codes and standards database on H2Tools.org, managed by PNNL. This database tracks the world-wide development of hundreds of industry standards.
- Launched in October 2021 to facilitate integration of the data previously maintained on www.FuelCellStandards.com into the toolset at H2Tools.
- The site receives more than 2,000 unique visitors to the site every month.
- In 2023, the database was viewed in five continents: Africa, Americas, Asia, Europe, and Oceania.
- The site is maintained by FCHEA, ensuring newly published RCS are added, and entries are updated when the documents are reaffirmed, revised, or withdrawn.
- Current year efforts are also focused on improving the user experience through filtering options.

Accomplishments and Progress - Responses to Previous Year Reviewers' Comments

- Related Reviewer Comments:
  1. The approach to the Development and Harmonization of Regulations, Codes and Standards is not clearly articulated in the poster, and it is unclear how the project will make an impact on barriers.
  2. The monthly discussions are an important activity, and FCHEA pulls together a large number of participants—this is commendable. However, this accomplishment is diluted by vagueness about what is being achieved and by whom.
- Responses:
  - Ensuring stakeholders are aware of, and engaged through FCHEA's technical activities on related documents helps ensure harmonization. The project engages stakeholders throughout the hydrogen energy and fuel cell space through direct engagement in working group meetings, articles in the Hydrogen and Fuel Cell Safety Report, and direct calls and emails. This ensures stakeholders are informed of codes and standards in development, and provides assistance in getting stakeholders engaged directly with the work, or access to review draft documents and provide comments through FCHEA's direct involvement. Many of these stakeholders are not already directly engaged in the codes and standards process (see slide 6). Some industry participants in FCHEA's technical working groups only monitor certain activities of primary interest to their business. This provides them an opportunity to contribute to developing codes and standards without the need to participate directly.
  - The project includes conducting monthly meetings of stakeholders, including industry, researchers, AHJs, and the codes and standards development organizations. The NHFCCSCC is a forum to announce progress, barriers, and planned new activities. Participants address any questions or concerns regarding possible duplication of effort and opportunities to ensure harmonization of technical requirements with other published documents.
  - The project includes serving as Convenor for International working groups to ensure that developing standards reflect best practices and published requirements. This leads to identification and resolution of draft requirements that may differ from published national requirements. Example – in late 2023, FCHEA staff led a joint meeting of stakeholders in conjunction with the ISO/TC 197 plenary meeting, to address discrepancies in requirements for hose breakaway force in hydrogen refueling dispenser hoses. The group agreed on what the minimum requirements should be, and identified the documents and revision proposal process to submit a public input to address the discrepancies. This led to the sole public input from FCHEA to NFPA 2, which is currently in revision.

Accomplishments and Progress - Responses to Previous Year Reviewers' Comments – Cont'd

- Related Reviewer Comments:
  3. While there are a number of useful tools managed by the project, it is not clear whether there would be a discernable impact if this project went away. For example, the six proposals to National Fire Protection Association (NFPA) 2 would have still happened; they would just have been submitted by someone else. It is not clear that FCHEA was a driving force behind important changes that otherwise would have not moved forward.
  4. There is a lack of excitement or specific new activity to sustain the project long-term. Comments are made about participating in numerous activities, but just participation and monitoring is not enough to make a difference in many of these forums. Being a consensus organization of numerous parties who are already participating in the codes and standards process does not lend itself to effectiveness
- Responses:
  - FCHEA's leadership in reviewing documents such as NFPA 2 each cycle and discussions with stakeholders leads to consensus proposals for revisions consistent with industry best practices. Neither the six proposals in the 2023 revision, nor the single public input in the current revision cycle, would have been submitted by someone else.
  - FCHEA isn't looking to "sustain the project long-term", per se. Harmonization is very much an ongoing process. *Project Goal: Facilitate wide-scale adoption of fuel cells and hydrogen energy systems through the development of consistent safety codes and standards that incorporate industry best practices.* This project aims to work with all stakeholders to address the mutual goals of DOE and industry to identify and remove the barriers addressed in this presentation. As new hydrogen applications and technologies are under constant development, this naturally leads to activities to support these new endeavors.
  - This project specifically aims, and succeeds, in engaging industry experts who are NOT already participating in the codes and standards process (see Slide #6)

Collaboration and Coordination

- FCHEA performs this work under subcontract to ORNL. Quarterly reports highlight activities and needs.
- 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 in RCS development; review and prioritize our efforts.
- FCHEA works with CDOs/SDOs through direct participation on RCS activities, participation in the NHFCCSCC, and participation in appropriate FCHEA Working Groups and Task Forces. This facilitates information-sharing and synchronization.
  - Reporting organizations include ASME, ASTM, NIST, SAE, CSA Group, CGA, NFPA, and others.
- 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.
  - Non-SDOs engaged in the NHFCCSCC include the Center for Hydrogen Safety, and the California Fuel Cell Partnership.
- FCHEA works closely with PNNL to make RCS data available for H2Tools and The Center for Hydrogen Safety.
- 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.

DEIA/Community Benefits Plans and Activities

- Our project does not have a CBP or DEIA plan, however, the Hydrogen and Fuel Cell Safety Report, as well as minutes of the NHFCCSCC meetings, are freely available to the public at www.HydrogenandFuelCellSafety.info.

Remaining Challenges and Barriers

- The four objectives supported by this project are ongoing and tied to DOE Goals.
- International standards need to develop in a coordinated fashion to ensure they reflect the needs of industry and consistency with accepted practices.
- Significant progress: ISO/TC 197 WGs on hydrogen fueling stations and components.
    - ISO 19880-5 (hoses and hose assemblies) completed the Committee Draft phase, and is addressing comments received. The next step is registration of the Draft International Standard (DIS). Remaining challenges include addressing stated desires to include requirements for heavy-duty vehicles and fast-fill applications. The WG is seeking experts in these areas to ensure such requirements can be included in the DIS, if available. Otherwise, these requirements will be deferred until the next revision.
    - ISO 19880-6 (Fittings) has passed the Committee Draft stage. Comments received from this consultation are being addressed.
    - ISO 19880-4 (Compressors) is currently paused due to source material issues from the seed documents and time constraints
    - Once published, efforts to harmonize with U.S. standards on similar topics will get underway.
- Published standards being updated to reflect advances and learnings. Ex: National and International standards on electrolyzers are being revised to reflect the state-of-the art technologies. In addition, revision work on national standards for electrolyzers and fuel cells are taking recent ASME decisions into account to address electrochemical cell stacks in a consistent way.
- Ensuring hydrogen experts contribute to development of RCS in new areas. Example: Hydrogen and fuel cell experts are briefed and provided many opportunities to contribute to standards for newer applications for hydrogen and fuel cells. EUROCAE/SAE is developing standards for gaseous and liquid hydrogen fueled aircraft. FCHEA is helping to bring hydrogen experts to the table. Similar challenges in areas such as railway, maritime, etc.
- U.S. adoption (with national deviations) for published International Standards. FCHEA participates in current efforts to ensure technical harmonization between national and international requirements for fuel cells, electrolyzers, and hydrogen infrastructure technologies that reflect industry best practices and lessons learned. As standards are published, FCHEA will continue to coordinate member participation and input to ensure technical consistency.
- Codes and standards are modified every 3-5 years. FCHEA works to keep members informed of technical issues and provides opportunities to contribute to ensure harmonization of technical requirements.

Proposed Future Work

- **Power WG**: Continue to coordinate with ASME on activity to provide mandatory language for electrochemical cell stacks. Participate in revision of IEEE 1547 for grid interconnection.
- **Transportation WG**: Continue to address RCS and R&D needs for medium/heavy-duty vehicles, aircraft, railway applications, maritime applications, and others.
- **Production WG**: Continue to review international standards and U.S. as well as state regulations to ensure consistency with accepted U.S. requirements and best practices. Engage stakeholders in the myriad efforts of updating requirements for electrolyzers. Track and engage in RCS efforts for standard methodologies to determine GHG emissions in hydrogen production.
- **Distribution WG:** Work with ICC to ensure infrastructure requirement harmonization with NFPA 2, particularly proposals relating to hydrogen/natural gas blends for buildings.
- **Commercial WG:** Identify RCS needs and priorities for commercial applications.
- **Hydrogen Codes Task Force**: Lead FCHEA member participation in reviewing public inputs for the 2026 edition of NFPA 2. Participate as a voting member to track and inform stakeholders throughout the current development cycle. Lead FCHEA member participation in the International Code Council's hydrogen activities, which will be updating all the I-codes for hydrogen technologies for the 2027 edition.
- **Coordination**
  - **NHFCCSCC** – continue to administer, identify key issues, and document discussions and outcomes.
  - **Safety Report** – continue to report on the developing RCS to improve coordination of activities and improve information transfer to facilitate industry engagement in RCS.
  - Maintain data and improve functionality of **H2Tools.org** – continue to ensure data on all relevant codes and standards is current and readily available to stakeholders.

Any proposed future work is subject to change based on funding levels.

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 to address industry needs; information dissemination & outreach tools.

Technical Accomplishments:

- Significant progress in conducting information exchange and data transfer to improve harmonization in domestic and international RCS; maintained central point of information for RCS activities; identified and communicated needs in RCS, R&D, and outreach.
- Completed IEC/TC 105 Convenor duties for micro fuel cell power safety WG 402 (formerly WG 8). These documents are now in final publication.
- Success in engaging industry to participate in codes and standards development process. Some participate directly, while others take the opportunity to review draft codes and standards when out for review. FCHEA staff then represents these comments and concerns on the Technical Committees of CSA, SAE, ISO/TC 197, IEC/TC 105, ICC, IEEE, NFPA, and others as appropriate.
- Helped form, and now serve as Vice-Chair for ASME BPVC Section VIII Electrochemical Cell Stacks Task Group, ensuring access to the development of a planned mandatory appendix for manufacturers and users of electrolyzers and fuel cells.

Proposed Future Work:

- Complete drafting of documents where FCHEA staff holds convenorship and facilitate national adoption (ISO/TC 197 WG 21, 22, 23). Continued focus on harmonization of requirements to facilitate deployment; ensure international standards are consistent with U.S. practices; continue building relationships with key stakeholders, including outside associations; continue dialog with industry to facilitate deployment of hydrogen vehicles infrastructure; track model code inputs for the current code revision cycles (I-Codes, NFPA 2). Lead industry engagement in ASME BPVC Section VIII activities. Continue to address new and emerging energy applications.