Meeting Minutes[1]

Tuesday, October 11th, 2022
10:00 a.m. – 12:00 p.m.

The fourth meeting of the Hydrogen Study Task Force was held on October 11th, 2022.

Several participants joined in person at FuelCell Energy. The majority of participants joined via the Teams conference call.

Task Force Members Present: Eric Annes (DEEP – Designee), Katherine Ayers (Nel Hydrogen), Keith Brothers (AFL-CIO), Enrique Bosch Naval (Avangrid), Digaunto Chatterjee (Eversource Energy), Julia Dumaine (Designee – PURA), Bryan Garcia (CT Green Bank), Sara Harari (CT Green Bank), Shannon Laun (Conservation Law Foundation), Tony Leo (FuelCell Energy), Mary Nuara (Dominion), Taren O'Connor (Designee – CT PURA), Ugur Pasogullari (Designee – UCONN), Joel Rinebold (CCAT), Lidia Ruppert (Designee – CT DEEP), Lauren Savidge (Designee – CT DEEP), William Smith (Infinity Fuel), Becca Trietch (Designee – CT DEEP)

Task Force Members Absent: Nikki Bruno (Eversource), Commissioner Katie Dykes (DEEP), Chair Marissa Gillett (PURA), Frank Reynolds (Avangrid), Adolfo Rivera (Avangrid), Jennifer Schilling (Dominion)

Other Attendees:
Tyler Anderson, Paul Aresta, Lily Backer, Blaire Backman, George Bradner, Sophia Browning, Erin Childs, Donald Conley, Liam Daley, Aziz Dehkan, Adrienne Farrar Houël, Barbara Fernandez, David Giordano, Joe Goodenbery, Jennifer Gorman, Kristin Hertz, Alex Issac, Alex Judd, Yu Lei, Jeff Litchman, Carmen Molina-Rios, George Norfleet, Tim Shea, Collin Smith, Sarah Wall

1. **Call to Order**
   - Bryan Garcia, Chair of the Task Force called the meeting to order at 10:04 a.m.
   - Mr. Garcia thanked Tony Leo, the Executive Vice President and Chief Technology Officer of FuelCell Energy, for helping to coordinate in-person attendance at FuelCell Energy's Torrington manufacturing plant.

2. **Introduction by FuelCell Energy**
   - Tony Leo provided an overview of FuelCell Energy. He noted that the purpose of FuelCell Energy is to enable a world empowered by clean energy by decarbonizing power and producing green hydrogen.
     - Mr. Leo shared that FuelCell Energy has been operating since 1969 and has over 225 MW of capacity installed around the world. They have a variety of

[1] For access to the meeting recording – https://www.ctgreenbank.com/hydrogentaskforce/

partners and customers including commercial and industrial customers, developers, and utilities.
    - Mr. Leo highlighted the local presence of FuelCell Energy with its headquarters in Danbury, Connecticut and a manufacturing lant in Torrington, Connecticut. He also shared that FuelCell Energy has additional facilities in Germany and Canada.
    - Mr. Leo shared that FuelCell Energy focuses on two advanced high temperature electrochemical platforms - carbonate and solid oxide - that can address multiple applications. Mr. Leo provided an overview of the carbonate and solid oxide power generation platforms. He noted that both technologies can produce hydrogen power and provide a platform for carbon capture. Both technologies are manufactured as individual fuel cells that can be stacked to produce higher capacity modules.
    - Mr. Leo highlighted the Toyota Tri-generation Project that FuelCell Energy is developing in collaboration with Toyota in Long Beach, California. He noted that while the carbonate system had been deployed at a demonstration scale, the Toyota project represents the first commercial development. He also noted that their carbon separation technology is commercially available while the carbon capture technology is currently under development with ExxonMobil.
    - Finally, Mr. Leo noted that solid oxide applications include power generation, electrolysis, and energy storage. He shared that FuelCell Energy is currently conducting demonstrations with this technology.

3. Approval of Meeting Minutes of September 13, 2022

- Digaunto Chatterjee moved to approve the Meeting Minutes of September 13, 2022. This motion was seconded by Eric Annes.
- The Task Force members moved to approve the motion.

4. Task Force – New Member Introductions and Logistics Update

- Mr. Garcia noted that 14 of 16 Task Force members had been appointed to date, three of which are new appointees of the President Pro Tempore.
- Mr. Garcia prompted the newly appointed Task Force members to introduce themselves.
    - Enrique Bosch, the Director of Innovation at Avangrid, introduced Avangrid and provided an overview of his position.
    - Shannon Laun, the Connecticut State Director of the Conservation Law Foundation, noted her excitement to participate as an official Task Force member.
    - Mr. Garcia noted that Sridhar Kanuri will be joining from HyAxiom, formerly Doosan, to provide a manufacturer perspective.
- Mr. Garcia noted that the Task Force has two empty seats still to be appointed by the Minority Leader of the Senate.
- Mr. Garcia emphasized that only three Task Force meetings are remaining prior to the January 15, 2023 legislative report deadline noted in Special Act 22-8. He provided a brief overview of upcoming meeting topics noting a continued discussion of environmental justice and equity.

5. Hydrogen Safety Presented by Sandia National Laboratory

- Erin Childs introduced Kristin Hertz, a Hydrogen Program Manager at Sandia National Laboratory.

- Ms. Hertz noted that in her role, she focuses on overseeing and communicating the breadth and depth of work that Sandia performs related to hydrogen.
    - Ms. Hertz shared that the national lab typically partners with universities and other labs to perform research and development. She noted that federally funded national labs cannot compete with industry, but they make a point to partner with industry to support market development and make resources publicly available.
    - Ms. Hertz emphasized that Sandia provides deep, quantitative understanding and a scientific basis for hydrogen materials for hydrogen production, storage, delivery, and utilization and safety to inform risk analysis and the creation of risk-informed standards.
    - Ms. Hertz noted that it is well-understood It is well known that hydrogen effects the physical and mechanical properties of metals and other materials. She explained that in order to understand this impact, it is important to understand the relationship between the environment, materials, and mechanics.
    - Ms. Hertz explained that to understand material fatigue and fracture, they need to be tested within hydrogen environments that are similar to real-world conditions. Ms. Hertz illustrated that Sandia has a well-known hydrogen laboratory that can be used to perform these tests.
    - Ms. Hertz noted ASME Boiler and Pressure Vessel Code CC2938 that Sandia helped to define. Based on Sandia's research, this code is now based on fatigue crack growth rate curves for pressure vessel steels, rather than the number of fill cycles. The use of these design curves enables approximately three times longer design life of typical hydrogen storage vessels compared to the previous design basis.
    - Ms. Hertz explained that Sandia is currently working to test and understand pipeline materials based on samples sent to them from the field.
    - Further, Sandia is interested in understanding how hydrogen behaves when it is released. Ms. Hertz explained that Sania assesses this risk via Behavior R&D which focuses on predicting hazards and harm from releases, Risk R&D to understand risks of leakage, and a combination of these methods to assess real problems. To perform this analysis, Sandia has developed and maintained HyRAM+. Ms. Hertz noted that Sandia has conducted hydrogen behavior experiments to validate the models that HyRAM+ utilizes. She explained that Sandia's vent-stack experiments have demonstrated that hydrogen is concurrent with the visible plume.
    - Ms. Hertz noted that Sandia has also wanted to understand hydrogen ignition and jet flame characteristics. She explained that in order to do this, Sandia has utilized a laser to heat a hydrogen plume and used this data as an input to their risk assessment code.
    - Ms. Hertz explained that Sandia has also mapped out the hydrogen regulatory agencies involved in the hydrogen ecosystem. Ms. Hertz noted that this regulatory map is extensive and highlights the need for vast collaboration to enable a hydrogen ecosystem.
    - Ms. Hertz provided several examples of how Sandia is influencing current hydrogen standards.
        - Ms. Hertz noted that the current separation distances for liquid hydrogen systems are based on consensus without a documented scientific analysis. She explained that based on Sandia research, this standard has been updated for the 2023 edition, leading to a 40% footprint reduction.

        - Ms. Hertz also explained work that Sandia performed to understand hydrogen flows within a tunnel and risk on behalf of Massachusetts to enable tunnel access for fuel cell vehicles in the state.
    - Ms. Hertz noted that Sandia has also impacted the hydrogen end use ecosystem.
        - Ms. Hertz explained that Sandia collaborated with the National Renewable Energy Lab and Powertech Labs to develop a standardized certification process for hydrogen refueling stations. She noted that this group worked together to develop a portable certification device to measure the performance for hydrogen dispensers with respect to the required fueling protocol standard. This technology is currently being used in California.
        - Ms. Hertz also explained that Sandia has been working with the Scripps Institution of Oceanography to design a hydrogen fuel cell ocean vessel and understand safety and risk associated with the vessel design. She noted that vessel is currently being produced with funding from the California government.
        - Finally, Ms. Hertz noted that Sandia is participating in a project to demonstrate the feasibility and viability of hydrogen production, storage, and fueling in a maritime context. They are working to stimulate and develop a sustainable green hydrogen ecosystem in the San Fransisco Bay Area.
    - Ms. Childs noted that Ms. Hertz would follow up with questions via the chat or via email.[2]

6. Environmental Justice and Equity – A Discussion with Bridgeport

- Mr. Garcia noted the importance of Justice40 which will be a significant scoring component for the DOE's Clean Hydrogen Hubs RFP. Mr. Garcia shared that the concept of environmental justice and community engagement has been emphasized by state governments as they work to provide potential match funding.
- Ms. Childs introduced Adrienne Farrar Houël. Ms. Childs prompted Ms. Houël to provide a brief introduction and explain why environmental justice has been a critical topic in Bridgeport.
    - Ms. Houël shared that she runs a nonprofit in the Bridgeport community. She noted that this nonprofit has been working specifically on zero waste and weatherization topics. Notably, they have been working on mattress recycling, an initiative which has created jobs for several second chance citizens.
    - Ms. Houël shared that Bridgeport has a long history with environmental issues. She noted that Bridgeport is an old industrial city and has experienced several challenges associated with this industrial history. She explained that Bridgeport is an environmental justice and disadvantaged community as designated by the state of Connecticut.
- Ms. Childs inquired about Ms. Houël's nonprofit, the Bridgeport Regional Energy Partnership (BREP).
    - Ms. Houël noted that BREP was started only a year ago. She explained that the nonprofit was founded in response to potential financing for energy projects on the national and state level. Ms. Houël noted that Operation Fuel, the Green Bank, and the city and regional business councils had provided initial guidance

[2] Questions and responses will be posted to the Green Bank Hydrogen Power Task Force website separately from the meeting minutes.

and resources during the inception of BREP. Ms. Houël explained that about 42 organizations are involved in BREP.
    - Ms. Houël noted that about 20% of households in Bridgeport are below the poverty line, leading to significant energy burdens.
    - Ms. Houël explained that BREP sought to answer the US DOE's request for proposals for the development of an energy plan through the Local Energy Action Program (LEAP). Ms. Houël noted that Bridgeport was one of 24 communities awarded a LEAP grant which provides technical assistance to develop an energy plan.
- Ms. Childs inquired further about the LEAP grant, specifically seeking Ms. Houël's insights regarding workforce development and focus areas.
    - Ms. Houël explained that the DOE asked BREP to consider seven pathways, of which BREP chose to focus on three- clean energy development, renewable energy development focused on buildings, and economic development. Ms. Houël noted that BREP has its members divided across three committees to reflect these focuses.
    - Ms. Houël noted that the economic development committee brings together the education board and the manufacturing community. She noted the importance of creating a supportive community atmosphere to encourage local job growth.
    - Ms. Houël cited research performed by Joel Rinebold which demonstrated that over 6,600 jobs will be created by the hydrogen economy. In response to this significant job growth, Ms. Houël noted that currently, those looking for workers are struggling, so it will be critical to engage with individuals on the community level to get them interested and involved in this emerging industry.
- Ms. Childs asked Ms. Houël to speak to the concept of community benefit agreements.
    - Ms. Houël explained that BREP is aiming to developing its own community benefit agreement. Ms. Houël noted that a community benefit agreement should be developed before a plan is implemented to ensure general buy-in and consensus and ensure that community members are appropriately included in the development process. Ms. Houël explained that BREP is currently developing an outreach plan and determining methods and cadence for community outreach to develop a community benefit agreement.
- Ms. Childs inquired about the gaps in community outreach and engagement that Ms. Houël had observed.
    - Ms. Houël noted that on the community level, the average citizen has no idea what is going on in terms of hydrogen. She shared that a key challenge is communicating the hydrogen value proposition in layman's terms for community members.
    - Ms. Houël explained that often the Hindenberg explosion is the main perception of hydrogen, so in terms of communication, the hydrogen economy is starting from ground zero.
- Ms. Childs asked Ms. Houël how the Task Force and the Northeast regional hydrogen hub should be thinking about environmental justice and community engagement. Ms. Childs also noted that the Task Force is preparing to submit a report to the legislature, and inquired whether Ms. Houël had any specific recommendations for inclusion.
    - Ms. Houël noted that communities in Connecticut understand their energy burden but need support in developing a comprehensive plan to address these burdens.
    - Ms. Houël explained that as a first step, criteria to identify community impact must be developed. She also emphasized the need to provide funding for

community outreach. Ms. Houël noted that this outreach will require a diverse skill set and messaging support.
    - Ms. Houël noted the importance of community participation in conversations and development of a comprehensive plan to enable this engagement, leveraging groups that are already engaged at the community level.
    - Ms. Houël also emphasized that best practices from neighboring states should be leveraged considering that many states are currently navigating similar issues.
- In closing, Ms. Houël shared that the idea of a community benefits agreement will be key and highlighted the importance of learning from each other, noting the power in the diverse perspectives involved in the Task Force.
- Kathy Ayers noted that in her experience, seeing is believing. She emphasized the importance of showing people hydrogen vehicles and stations and demonstrating how similar they look to traditional equivalents to begin to change public perspectives.
- Ms. Childs noted that Ms. Houël would follow up with questions via the chat or via email.[3]

7. Working Group Progress Updates

- Ms. Childs noted that the Task Force Working Groups kicked off in September and will continue on a monthly cadence.
- Ms. Childs shared that these efforts will be culminating into a legislative report. This report is envisioned to include an executive summary, background and motivation, process, findings, and recommendations.
    - Ms. Fernandez inquired what type of recommendations related to incentives would be included.
        - Ms. Childs noted that these recommendations would come from the Funding Working Group to enable the recommendations from the Uses, Sources, and Infrastructure Working Groups. She shared that the next Policy and Workforce Development Working Group would discuss best practices related to hydrogen incentives.
- Joe Goodenbery introduced the Policy and Workforce Development Working Group Policy Guiding Principles. He explained that the guiding principles are intended to provide clarity for Working Group chairs regarding alignment of recommendations and to align the Policy and Workforce Development Working Group's recommendations with the intent of existing state policy as well as the trajectory of hydrogen policy.
    - The proposed Policy Guiding Principles state that all final recommendations from Working Groups should: 1) be in compliance with relevant state statutes and regulations, or identify changes that would enable compliance; 2) align with state policy and active regulatory proceedings; 3) identify any fundamental underlying policy or regulatory challenges or potential enablers; 4) identify expected impacts to active policy proceedings; and 5) identify or recommend relevant regulatory stakeholder proceedings that could be used to allow for additional review and vetting, or identify the need for new procedural avenues.
    - Mr. Goodenbery provided examples of existing Connecticut policy that provides general ecosystem support for the development of clean hydrogen, such as ozone regulations, decarbonization targets, and zero emissions vehicle targets.

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    - Mr. Goodenbery highlighted that discussion in the first Policy and Workforce Development Working Group was intended to identify any gaps in the Proposed Guiding Principles.
- Collin Smith provided an updated on the Uses Working Group.
    - Mr. Smith noted that there are a variety of potential hydrogen end uses due to the diversity of hydrogen fuel, but these end uses are not all created equally.
    - Mr. Smith noted that an evaluation framework composed of eight evaluation criteria had been developed to prioritize end uses. These evaluation criteria include cost effectiveness, greenhouse gas reduction potential, technological maturity, infrastructure requirements, environmental justice, workforce development, resilience benefits, and safety. Mr. Smith noted that all end-uses will be ranked numerically on a three-part scale.
    - Mr. Smith provided more detail regarding the cost effectiveness criterion. He noted that given the importance of cost effectiveness for scaled adoption and efficient infrastructure deployment, this will be treated as a gating criteria such that any end use that does not score above the minimum will be excluded from further analysis.
    - Mr. Smith provided more detail regarding the environmental justice criterion. He noted that the environmental justice analysis will consider impacts to frontline communities associate with hydrogen usage.

8. Public Comment

- Mr. Garcia provided an opportunity for public comments.
    - Lily Backer highlighted the Green Hydrogen Coalition's upcoming event, CatalystH2, from November 14-16, 2022.[4] This event will include sessions on green ports and maritime shipping, seasonal renewable energy storage, hydrogen transportation and storage, and hydrogen for backup applications. There will also be an opportunity to tour Fenix Marine Services at the Port of Los Angeles to see the potential of green hydrogen to decarbonize port operations. The Green Hydrogen Coalition has funding available for environmental justice, labor, tribal, or environmental organizations to attend free of charge.
    - Samantha Dynowski from the Sierra Club noted that the New York Power Authority's Brentwood power station was testing hydrogen blending with fossil gas and released an associated report. This report demonstrated that as the hydrogen concentration in the power plant's blend increased, NOx emissions also increased.[5]

9. Adjourn

- The Hydrogen Study Task Force meeting was adjourned by Mr. Garcia at 11:54 a.m.

10. Tours of Building

- In-person attendees went on a tour of the FuelCell Energy Torrington manufacturing plant.

[4] See additional information: https://catalysth2-hydrogen.com/
[5] Access the report: https://www.epri.com/research/products/000000003002025166