Meeting Minutes[1]

Tuesday, August 9th, 2022
10:00 a.m. – 12:00 p.m.

The second meeting of the Hydrogen Study Task Force was held on August 9th, 2022.

Several participants joined in person at the University of Connecticut Innovation Partnership Building. The majority of participants joined via the Teams conference call.

Task Force Members Present: Katherine Ayers (Nel Hydrogen), Katie Dykes (DEEP), Samantha Dynowski (Sierra Club), Bryan Garcia (CT Green Bank), Marissa Gillett (PURA), Victoria Hackett (DEEP – Designee), Sara Harari (CT Green Bank – Designee), Anthony Leo (FuelCell Energy), Radenka Maric (UCONN), Taren O'Connor (PURA – Designee), Ugur Pasaogullari (UCONN – Designee), Melissa Reynolds (Eversource – on behalf of Appointee), Lauren Savidge (DEEP – Designee), Jennifer Schilling (Eversource), William Smith (Infinity), Mary Nuara (Dominion Energy), Joel Rinebold (CCAT), Ryan Wolfe (Avangrid – on behalf of Appointees)

Task Force Members Absent: Nikki Bruno (Eversource), Keith Brothers (AFL-CIO), Digaunto Chatterjee (Eversource Energy), Frank Reynolds (Avangrid), Adolfo Rivera (Avangrid)

Others Present: Jordan Ahern, Lily Backer, Blaire Backman, Sophia Browning, Erin Childs, Nicolas Connell, Evan Dantos, Raelene DeRobertis, Julia Dumaine, Susan Eastwood, Brian Farnen, Barbara Fernandez, Nathan Frohling, Joe Goodenbery, Jennifer Gorman, Alex Judd, Molly Keleher, Regan Kenney, Shannon Laun, Diane Lentakis, Jonathan Lewis, George Norfleet, Bernie Pelletier, Chris Phelps, Olivia Prieto, Lydia Ruppert, Joshua Ryor, Tim Shea, Rudy Sturk, Sarah Wall

1. **Call to Order**
   - Bryan Garcia, Chair of the Task Force called the meeting to order at 10:02 a.m.
   - Mr. Garcia thanked Professor Maric and Professor Pasaogullari for helping to coordinate in-person attendance at the University of Connecticut's Innovation Partnership Building.

2. **Approval of Meeting Minutes of July 12, 2022**
   - Kathy Ayers moved to approve the Meeting Minutes of July 12, 2022. This motion was seconded by Ms. Maric.
   - The Task Force members moved to approve the motion. Bureau Chief Vicky Hackett abstained.

3. **Task Force – New Member Introductions**

[1] For access to the meeting recording – https://ct-n.com/CTNplayer.asp?livestream=0

- Mr. Garcia noted that 11 of 16 Task Force members had been appointed to date. Mr. Garcia shared that renewable energy advocates had reached out to express concern regarding the two open positions for renewable energy advocates. Mr. Garcia explained that the Connecticut Green Bank has reached out to the Legislature to encourage the appointment of these members.
- Mr. Garcia prompted the newly appointed Task Force members to introduce themselves.
    - Ryan Wolfe, an Economic Development and Community Affairs Specialist from Avangrid introduced himself on behalf of Adolfo Rivera and Frank Reynolds. Mr. Reynolds is the President and CEO of UIL Holdings. Mr. Rivera is Avangrid's Director of Green Hydrogen.
    - Melissa Reynolds, the Director of Business Development at Eversource, introduced herself on behalf of Nikki Bruno, the Vice President of Clean Technologies at Eversource who was not in attendance.
    - Samantha Dynowski, the Connecticut State Director of the Sierra Club, noted that the Sierra Club is the nation's oldest and largest environmental organization with chapters across the country. She highlighted that her focus is on just and equitable solutions to the climate crisis.
    - Anthony Leo, the Chief Technology Officer at FuelCell Energy shared his longtime focus on fuel cells. He moved to Connecticut in 1978 to work for the Energy Research Corporation which turned into FuelCell Energy.
    - Jennifer Schilling, the Vice President of Grid Modernization at Eversource explained that her focus is on technology solutions to address climate change.
    - Mary "Weezie" Naura, the New England State Policy Director highlighted her focus on the Millstone nuclear power station
    - William Smith, the President and Founder of Proton OnSite noted his company's focus on developing fuel cells primarily for the aerospace industry but also highlighted their expansion into stationary sources.
- Mr. Garcia provided space for the Ex Officio members of the Task Force to introduce themselves.
    - Marissa Gillett, the Chair of the Public Utilities Regulatory Authority (PURA) introduced her role and noted support from Joshua Ryor, Julia Dumaine, and Taren O'Connor.
    - Joel Rinebold, the Director of Energy at the Connecticut Center for Advanced Technology (CCAT) also noted his roles as the founder of the Connecticut Hydrogen Fuel Cell Coalition and chair of the. Chair of Northeast Electrochemical Energy Storage Cluster.

- Ms. Dynowski noted that she tried to raise public awareness of the Task Force and encouraged the Green Bank team to increasingly publicize the activities and meetings of the Task Force to increase public attendance and representation.

4. Process – Working Group Charters

- Sara Harari noted that Working Groups would kick off after this meeting of the Task Force. Ms. Harari explained that these meetings would be published with the Secretary of State and would be recorded and publicly available.
- Ms. Maric posed a question regarding expected Working Group attendance. Ms. Maric highlighted the importance of public participation, especially regarding the need for continued education on the subject of hydrogen.

    - Ms. Harari explained that the Green Bank and Strategen are happy to reach out to any key organizations that Task Force members believe would be important for the Working Groups but noted that the Working Groups would not have appointed members.
        - Ms. Maric requested that the Green Bank reach out to Skyre and Toyota to ensure participation in the Working Groups.
- Mr. Garcia noted that a key goal of the Task Force is to engage and educate. He highlighted continued opportunities for more practical on-site learning hosted by Dominion and Proton OnSite.
- Ms. Maric proposed that the University of Connecticut could be a test bed for hydrogen demonstrations. Ms. Maric provided the example of the University of California, Irvine, which hosts several hydrogen demonstration programs and engages in leading research on the topic. Ms. Maric urged that Connecticut needs not to lag behind states such as California to stay relevant in the hydrogen space.
- Mr. Garcia highlighted the opportunity to submit concepts such as the University of Connecticut test bed proposed by Ms. Maric to the Request for Information (RFI) released by DEEP regarding the hydrogen hub application.
- Mr. Rinebold emphasized that Connecticut is a global center for the manufacturing and development of fuel cells.
- Erin Childs, a Director at Strategen Consulting, noted that her team would be helping to administer the Task Force and the Working Groups. Ms. Childs provided an overview of the proposed areas of focus for the Working Groups. Ms. Childs noted that Strategen and Green Bank would be working with Working Group co-chairs to finalize the focus areas and plans for each Working Group by the September Task Force meeting. Ms. Childs explained that Strategen would support logistics, coordination, and technical assistance including research for each Working Group.
    - Ms. Childs introduced the Hydrogen Sources Working Group. The co-chairs are Mr. Pasaogullari from the University of Connecticut and Ms. Ayers from Nel Hydrogen. This working group will investigate potential sources of clean hydrogen.
    - Ms. Childs introduced the Hydrogen Uses Working Group. The co-chairs are Mr. Rinebold from CCAT, Mr. Reynolds from Avangrid, and Mr. Chatterjee from Eversource. This Working Group will look at the potential end uses for hydrogen-fueled energy and will develop a cross-sectoral analysis of hydrogen demand.
        - Ms. Fernandez pointed out the importance of investigating hydrogen uses at the Bridgeport shipyard which services about 250 tugboats per day. Ms. Fernandez highlighted this as a significant opportunity to decarbonize an entire sector within Connecticut with hydrogen. Ms. Fernandez offered to connect the Task Force with a contact at Derektor Shipyards.
            - Mr. Rinebold seconded this recommendation.
        - Ms. Maric added the importance of hydrogen as a storage medium that can contribute to grid stability.
            - Mr. Rinebold seconded this recommendation.
    - Ms. Childs introduced the Hydrogen Infrastructure Working Group. The co-chairs are Mr. Rivera from Avangrid with additional co-chairs to be determined. This Working Group will work to understand infrastructure needs for transport and storage.

        - Ms. Ayers noted that this Working Group should consider repurposed or refurbished infrastructure.
    - Joe Goodenbery, a Senior Manager at Strategen, introduced the Policy and Workforce Development Working Group. The co-chairs are Commissioner Dykes from DEEP and Chair Gillett from PURA. This Working Group will identify policy solutions to promote the development of clean hydrogen in Connecticut based on an analysis of the Connecticut policy and framework and best practices. This Working Group will also look at potential workforce development opportunities.
        - Mr. Garcia noted that Alex Judd from Day Pitney would provide additional regulatory and policy support for this analysis, including looking at regional policies.
        - Ms. Maric noted that programs at the University of Connecticut teach policy and skills related to hydrogen. Ms. Maric highlighted that this curriculum needed to be updated to keep up with the rapidly expanding hydrogen space.
        - Ms. Fernandez explained that she connected the Connecticut Department of Insurance Commissioner with Mr. Garcia. The Commissioner has appointed a team member to attend the Policy and Workforce Development Working Group to support the conversation.
        - Mr. Rinebold noted that he has been engaging with Raytheon regarding hydrogen blending and operations for aviation.
        - Mr. Garcia flagged the opportunity to survey industry and academia representatives regarding workforce development and the need to develop a database.
            - Mrs. Maric highlighted that the required skills are highly competitive. Ms. Maric explained that the students that graduate from the University of Connecticut with such skills are in high demand.
                - Mr. Leo emphasized this point and explained that he has been struggling to hire qualified staff.
    - Lily Backer, a Manager at Strategen, introduced the Funding Working Group. The co-chairs are Commissioner Dykes from DEEP and Deputy Commissioner Daum from the Department of Economic Community Development (DECD). This Working Group will review hydrogen funding mechanisms and incentives such as the Infrastructure Investment and Jobs Act (IIJA). The Working Group will also recommend additional funding sources for developing a hydrogen ecosystem with a particular focus on the Targeted Brownfield Development Loan program.
        - Mr. Garcia noted that as concepts are developed by the Task Force, they can be submitted to DEEP via their RFI to support the state's IIJA application.
            - Ms. Savidge explained that DEEP released an RFI for concept proposals to help support the IIJA application. Ms. Savidge requested that the Task Force responds to the RFI to the best of its ability.
- Ms. Childs emphasized that Strategen is excited to kick off Working Groups following the Task Force meeting. She explained that the first step in this process would include reaching out to the Working Group co-chairs to finalize logistics.

- Ms. Harari noted that by the next Task Force, the charters including areas of focus and deliverables for each Working Group would be finalized.

5. Environmental Considerations – An Introduction with the Clean Energy Task Force

- Mr. Garcia noted that Task Force members were provided with Shalanda Baker's presentation on "Energy Justice and Justice40: Tools for an Equitable Transition."[2] Mr. Garcia also shared that a local community group, Bridgeport, would be speaking at the October Task Force meeting regarding local considerations.
- Ms. Maric expressed the importance of having a real estate developer who builds sustainable housing speak to the Task Force to explain community-based hydrogen applications.
- Ms. Childs introduced Jonathan Lewis, a Director of Transportation Decarbonization at the Clean Air Task Force, to discuss hydrogen and related environmental considerations.
    - Mr. Lewis provided background on the Clean Air Task Force (CATF) which is a United States-based NGO that works on advocating for pragmatic policy solutions to demonstrate and scale up decarbonization solutions and pushes for a suite of climate mitigation technologies. Mr. Lewis noted that the CATF is engaged in at least ten hydrogen hub efforts across the United States, Europe, and Asia. Mr. Lewis shared that the CATF began working on hydrogen over a decade ago. The CATF started the Zero Carbon Fuels Program which is focused on hydrogen. A key emergent learning from this effort was that the transportation sector is a very important potential hydrogen end user as it makes up 27% of US end-use emissions. The CATF subsequently established its transportation program. Mr. Lewis emphasized that the CATF hydrogen transportation program is focused on heavy-duty and long-haul applications as electrification are more appropriate for other transport segments.
- Ms. Childs asked Mr. Lewis to provide more detail on hydrogen-based fuels and explain how these fuels may show up as a decarbonization solution for transport and other sectors.
    - Mr. Lewis noted that about 80% of end-use energy is from molecules. Mr. Lewis explained that while several of these end uses may be electrified, there are still gaps that will require zero carbon fuels. These fuels may be clean hydrogen and ammonia. Mr. Lewis explained that ammonia could be used to transport hydrogen and is particularly well suited for marine shipping applications. He also explained that solid-oxide fuel cells can utilize ammonia. Mr. Lewis also shared that Japan is testing ammonia as a co-fired fuel for coal, which may just be a development specific to Japan as it is imperative that we ensure that the hydrogen we use can deliver climate benefits.
    - Mr. Lewis emphasized that hydrogen must have low lifecycle emissions to deliver environmental benefits. He explains that the definition of clean hydrogen may vary by context, but the CATF believes that for electrolyzers, the electricity that is clean and incremental to the electricity needed for zero carbon goals should be used. Additionally, clean hydrogen from SMR must use low carbon intensity sources for processing electricity and have very low leakage rates.

[2] A link to this recording may be found here: https://www.youtube.com/watch?v=C5MLqjctYyI&t=3640s

    - Mr. Lewis also emphasized the need for investment in pipelines, fueling infrastructure, and hydrogen production pathways. Mr. Lewis also pointed out the need for particular focus on end-use demand and applications
- Ms. Childs prompted Mr. Lewis to discuss the end-use applications for hydrogen and specifically asked what applications are ready to be first movers.
    - Mr. Lewis explained that the CATF is focused on several key hydrogen applications including transoceanic marine shipping, heavy-duty trucking, heavy industry, aviation, and power system load balancing. Mr. Lewis shared that marine shipping is a challenging industry to advocate in but the hydrogen application is straightforward because marine engines are some of the most flexible internal combustion engines. Mr. Lewis noted that regarding marine end-uses, the primary challenge with hydrogen use is transporting ammonia to the ports. He recommended that investment should be focused on a small number of ports with existing ammonia bunkering or significant marine traffic such as LA, Singapore, and Rotterdam then expanded. Mr. Lewis explained that for near-shore marine applications such as tugboats, hydrogen fuel cells are promising.
    - Mr. Lewis noted that aviation will be the most challenging hydrogen end-use as we need to develop aircraft that can use hydrogen as fuel. He highlighted the example of Airbus, a company that is making progress in this arena. Mr. Lewis also shared that synthetic fuels, or synfuels, developed from clean hydrogen and CO2 from direct air capture may be used in existing jet engines.
- Ms. Childs inquired about the key steps needed to enable hydrogen deployment.
    - Mr. Lewis noted that three key factors are needed which include 1) commercial demonstration of core production technologies; 2) public finance to reduce the cost differential between incumbent fuels and clean hydrogen; and 3) clear, rigorous, and widely accepted protocols to certify the carbon intensity of hydrogen and hydrogen-based fuels.
    - Mr. Lewis noted promising progress on the first two factors emerging from the IIJA and pointed out that the most work is needed regarding certifying hydrogen.
- Mr. Garcia highlighted local heroes like Brooke Suter who launched a campaign to retire coal plants and Roger Smith who has led community-based clean energy efforts.
    - Mr. Lewis noted that Ms. Suter is a former CATF colleague and an outstanding advocate. Mr. Lewis emphasized that the clean energy transition has multiple facets and is a significant multi-stated transition that will require many solutions. He emphasized the use of zero-carbon fuels for end uses that cannot be electrified. Mr. Lewis also highlighted that hydrogen is scalable, does not have land use issues like those associated with biofuels, and is a complimentary solution alongside electrification to achieve decarbonization goals.
        - Need zero carbon fuels for non-electrification applications
        - H2 is massively scalable, doesn't have land use issues like biofuels, H2 is a promising fuel and ties in with the ability to decarbonize the electric sector
- Ms. Childs inquired whether Mr. Lewis had any closing remarks.
    - Mr. Lewis remarked a key piece of a hydrogen hub must be offtakers. He shared that the greatest uncertainty that hydrogen producers have expressed is whether there will be sufficient demand for clean hydrogen. Mr. Lewis noted that potential federal funding is supposed to be flexible and encouraged Connecticut to keep the end user value chain in mind. Mr. Lewis also remarked that investment will be key for applications such as long-haul heavy-duty trucking which is relevant as Connecticut is a busy transportation corridor. He noted that the conversion of

trucks from diesel would deliver enormous health and environmental benefits. Mr. Lewis shared that CATF analysis found that Connecticut ranks 12th out of the 50 states in terms of cancer risk from emissions associated with trucking.[3]

- Ms. Dynowski shared her appreciation of Mr. Lewis' emphasis on hard-to-electrify end uses. She added that the health impacts of air pollution are often concentrated in low-income and disadvantaged communities. Ms. Dynowski explained that there is a growing body of research from environmental organizations such as EDF and RMI focusing on the specific sources, end uses, and issues that need to be addressed to achieve decarbonization goals. Ms. Dynowski also remarked that when considering the carbon intensity of hydrogen, quantifying upstream methane emissions is a key challenge, but also pointed out the importance of this factor as methane is a critical accelerant of the climate crisis.
- Diane Lentakis noted that Sierra Club was very instrumental in getting a commitment from PSEG to retire the Bridgeport Coal Plant.

6. Areas of Discussion – defining Clean vs. Green Hydrogen

- Ms. Childs introduced Nicholas Connell, the Policy Director at Strategen, and the Director of the Western Green Hydrogen initiative to provide background on clean versus green hydrogen and provide a proposed clean hydrogen definition.
- Mr. Connell noted that there has been a movement away from referring to hydrogen in terms of colors to a more quantifiable carbon intensity basis. Mr. Connell identified that when defining hydrogen key considerations include maintaining feedstock diversity, determining hydrogen production CO2e threshold, identifying certification mechanisms, understanding lifecycle impacts, and aligning with policy.
- Mr. Connell proposed the following definition of clean hydrogen: Clean hydrogen is hydrogen that is produced using non-fossil fuel feedstocks and produces zero or de minimis emissions on a well-to-gate lifecycle basis**.** 'De minimis emissions' is defined as 2kg CO2e/kg H2 which aligns with the IIJA definition. A 'well-to-gate' lifecycle assessment evaluates the lifecycle emissions from feedstock through the point of production.
- Mr. Connell shared that the biggest flaw with the IIJA definition of clean hydrogen is the lack of consideration of lifecycle impacts.
- Ms. Maric noted that emissions from other greenhouse gases, not just CO2, are important from an environmental perspective. Ms. Maric also expressed the importance of considering how emissions from hydrogen production will change over time.
    - Mr. Connell agreed that transition planning is key but also cautioned about the risk of stranded assets when considering hydrogen production with carbon capture as this method does not produce zero emissions of hydrogen.
- Mr. Leo questioned where the 2kg of CO2e would come from if we are not considering hydrogen produced from fossil fuels.
    - Mr. Connell explained that emissions could come from ancillary equipment. Mr. Connell also shared data from Argonne national lab illustrating that the well-to-gate emissions of hydrogen produced from biomass gasification and nuclear, which are not fossil fuels, are under 2kg CO2e/kg H2, but not necessarily zero.
- Mr. Connell emphasized that when developing a clean hydrogen definition, it is critical to align with state policy and federal policy, align with international standards

[3] CATF's 2022 diesel emissions study: https://www.catf.us/deathsbydiesel/

if considering exports, support technology neutrality, and ensure that the definition is based on a quantifiable methodology.
    - Ms. Dynowski noted that on the Connecticut state policy front there are parallel processes such as the Comprehensive Energy Strategy and Connecticut's participation in a regional hub which should inform a specific definition of clean hydrogen.
- Mr. Connell highlighted that comments have been submitted to the Department of Energy regarding the need for a well-to-gate methodology when defining clean hydrogen.
- Mr. Garcia noted that the Policy and Workforce Development Working Group and Sources Working Group would work together to develop a clean hydrogen definition.

7. Public Comment

- Shannon Laun, an attorney and Connecticut State Director at the Conservation and Law Foundation noted her appreciation of Mr. Garcia acknowledging the need to fill the Task Force seats allocated to renewable energy advocates. Ms. Laun encouraged the Task Force to proactively reach out to environmental advocates as it is key that diverse participants can participate in all of the Task Force meetings. Ms. Laun also highlighted the need for additional public notice and stakeholder outreach to increase public participation. Ms. Laun noted that it is critical to focus investment on clean hydrogen in hard-to-electrify sectors and cautioned against the development of incentives that support fossil fuel infrastructure.

8. Adjourn

- The Hydrogen Study Task Force meeting was adjourned by Mr. Garcia at 11:55 a.m.

9. Tours of Building

- In-person attendees went on a tour of the University of Connecticut Innovation Partnership Building.