



Meeting Minutes¹

Tuesday, September 13, 2022
10:00 a.m. – 12:00 p.m.

The third meeting of the Hydrogen Study Task Force was held on September 13th, 2022.

Several participants joined in person at Nel Hydrogen. The majority of participants joined via the Teams conference call.

Task Force Members Present: Eric Annes (DEEP – Designee), Katherine Ayers (Nel Hydrogen), Digaunto Chatterjee (Eversource Energy), Julia Dumaine (PURA – Designee), Samantha Dynowski (Sierra Club), Barbara Fernandez (UCONN – Designee), Sara Harari (CT Green Bank – Designee), Anthony Leo (FuelCell Energy), Rick Mullins (Infinity – on behalf of Appointee), Mary Nuara (Dominion), Taren O'Connor (PURA – Designee), Ugur Pasaogullari (UCONN – Designee), Joel Rinebold (CCAT), Lauren Savidge (DEEP – Designee), Jennifer Schilling (Eversource), Becca Trietch (DEEP – Designee), Sarah Wall (Avangrid – on behalf of Appointee), June Wooding (Eversource – on behalf of Appointee)

Task Force Members Absent: Nikki Bruno (Eversource), Keith Brothers (AFL-CIO), Commissioner Katie Dykes (DEEP), Bryan Garcia (CT Green Bank), Chairman Marissa Gillett (PURA), Radenka Maric (UCONN), Frank Reynolds (Avangrid), Adolfo Rivera (Avangrid), William Smith (Infinity)

Others Present: Eliasid Animas, Paul Aresta, Lily Backer, Blaire Backman, Sophia Browning, Chris Capuno, Erin Childs, Donald Conley, Alexandra Daum, Brian Farnen, David Giordano, Kristin Hertz, Alex Issac, Shannon Kang, Ahmet Kusolu, Esa Laukkanen, Shannon Laun, Thomas Lefebvre, Lidia Ruppert, Tim Shea, Collin Smith, Rudy Sturk, Becca Trietch

1. Call to Order

- Sara Harari, Designee to the Chair of the Task Force, Bryan Garcia, called the meeting to order at 10:06 a.m.
- Ms. Harari noted that comments are welcome throughout the meeting via chat or just by raising your hand or speaking up. Ms. Harari noted that Bryan Garcia, Chair of the Task Force, was out of town so she would be leading in his place.

2. Welcome and Introduction by Nel

- Kathy Ayers introduced her colleagues, Chris Capuano and the COO of Nel Hydrogen, Esa Laukkanen. Mr. Laukkanen shared that his key goal is to develop hydrogen global operations and help the industry grow based on increasing demand.

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

- Ms. Ayers shared some brief background on Nel. Notably, Nel currently manufactures its PEM electrolyzers in Wallingford, CT. They delivered 3,000+ systems to date, which in total can generate about 50 megawatts of electrolyzers per year. Ms. Ayers noted that this production capacity is relatively easily scalable to 150 megawatts in the existing building, which they are actively working toward. Ms. Ayers also shared that Nel has another production plant in Herøya, Norway and an R&D facility in Notodden, Norway. The Herøya facility has fully automated production and is currently capable of producing 500 MW of alkaline water electrolyzers per year, but this is being scaled up to 1 GW/year currently, and there is space on site for up to 2 GW/year production capacity. Nel also has an automated refueling station factory in Herning, Denmark capable of delivering 300 systems per year.
- Ms. Ayers highlighted that the Nel company has over 90 years of experience working with hydrogen. She also shared that Nel has installed several 20 MW PEM and Alkaline electrolyzers to date and shared images of what these electrolyzer stacks look like on site. Nel also has a contract to install a 200 MW alkaline system to be sited in the US

3. Approval of Meeting Minutes of August 9th, 2022

- Ugur Pasaogullari moved to approve the Meeting Minutes of August 9th, 2022. This motion was seconded by Digaunto Chatterjee and Ms. Ayers.
- The Task Force members moved to approve the motion.

4. Task Force – New Member Introductions

- Ms. Harari acknowledged that five outstanding appointments still remained for the Task Force. Ms. Harari noted that, though it is not in the Green Bank's responsibilities nor power to make appointments, the Green Bank wants all voices represented around the table that were identified within Special Act 22-8, and has been working to increase public awareness and transparency related to the Task Force.
- Ms. Harari introduced Alexandra Daum, the Deputy Commissioner and Chief Investment Officer at the Connecticut Department of Economic and Community Development. While not an official appointee or designee, Ms. Daum will be serving as the co-chair of the Hydrogen Funding Working Group alongside Commissioner Dykes.

5. Update from DEEP on Northeast Hub Coordination

- Ms. Harari introduced Eric Annes from the Department of Energy and Environmental Protection to provide an update on Connecticut's hydrogen hub efforts related to the Infrastructure Investment and Jobs Act (IIJA).
- Mr. Annes noted that DEEP has its ongoing Comprehensive Energy Strategy (CES) technical sessions which will include topics related to the hydrogen ecosystem and related policy. He shared that it is the intention of DEEP to incorporate Task Force outcomes and recommendations into the CES process. He emphasized that coordination and efficiency are key within these efforts.
 - Mr. Annes shared that the New York State Energy Research and Development Authority (NYSERDA) has been leading a multi-state coalition, including Connecticut, with the intent to develop a joint IIJA hydrogen hub application. Mr. Annes noted that there are multiple non-disclosure agreements in place between participants so he would only be able to share high-level details on this process.
 - Mr. Annes described that NYSERDA has set up a series of working groups to determine out the best way to develop and coordinate a multi-state

- application for the IIJA Funding Opportunity Announcement (FOA). He shared that the FOA is expected to be released within the next few weeks, but the timelines for the application process were still unknown, although some guidance was provided in the Department of Energy's IIJA Notice of Intent (NOI).
- Mr. Annes noted that Connecticut has also been processing in parallel, led by DEEP, to ensure that the state agencies involved in the coalition led by NYSERDA are appropriately representing the interests of Connecticut and promoting potential projects within the State. Mr. Annes referred to the DEEP Request for Information and noted that they had received several hydrogen deployment concepts, which have been shared with NYSERDA, and DEEP has been working to meet with these applicants to best understand the key details of the proposed projects.
 - Mr. Annes highlighted the Task Force and the CES process as key opportunities for public engagement. He also noted the importance of efficiency and information sharing especially with several parallel, related processes related to hydrogen.
 - Samantha Dynowski requested public facing information regarding the process with NYSERDA and relating to the DEEP RFI.
 - Mr. Annes noted that there is not yet a public facing docket for the RFI, but he offered to share this information via email with Ms. Dynowski. He noted that the RFI responses and participants would remain confidential due to competitive business interests.
 - Ms. Dynowski inquired whether other Connecticut state entities have been involved in the NYSERDA hydrogen working groups.
 - Mr. Annes shared that the DECD and governor's office had been involved, and DEEP intended to reach out to the Department of Transportation especially as proposals related to hydrogen for transportation came up. He noted that PURA and the Office of Consumer Council have not had significant involvement to date as the degree to which regulatory entities will need to be involved in implementation is unknown.
 - Ms. Harari noted that the Connecticut Green Bank has also been involved in the NYSERDA process.
 - Mr. Chatterjee inquired how the Task Force was intended to complement the NYSERDA process as it was expected that the Task Force would likely results in recommendations regarding statewide legislation or incentive development.
 - Mr. Annes clarified that the Task Force is broader than the hub effort, and unlike the hub effort, is only occurring on the Connecticut state level. Mr. Annes noted the rapid pace of the DOE IIJA implementation and described the Task Force's efforts as a key method to inform updates to Connecticut's policy framework to appropriately support the hydrogen economy.
 - Erin Childs asked for further information on where the overall hydrogen hub application process was at and expectations regarding near-term milestones.
 - Mr. Annes explained that the DOE FOA was expected within the next few weeks, and it was generally expected that the first round of applications would be due within 45-60 days of the FOA release. Mr. Annes clarified that the initial applications would be less detailed and would inform a go/no go decision from the DOE to develop a more detailed application. He noted that the IIJA application process was in parallel with the Task Force activities.

6. Fuel Cell Applications Presented by LBNL

- Ms. Harari shared that part of the Green Bank's goal has been to elevate the knowledge level of the Task Force to appropriately inform the group's recommendations.
- Ms. Childs introduced Ahmet Kusoglu from the Lawrence Berkeley National Lab. Mr. Kusoglu is a Scientist in the Energy Conversion Group at Berkeley Lab, working on polymeric and functional materials for hydrogen and clean energy applications. His research focuses on the characterization of ion-conductive polymers and solid-electrolyte interfaces for energy conversion and storage devices and exploration of related electro-chemical-mechanical phenomena.
- Mr. Kusoglu noted that he is also the Communications Officer of the DOE M2FCT initiative. Mr. Kusoglu shared that his presentation would discuss the importance of fuel cells to promote decarbonization of the mobility sector and reaffirm why hydrogen and fuel cells will play a key role in future of the heavy duty transit industry.
 - Mr. Kusoglu shared that fuel cells are increasingly being examined in the heavy duty vehicle (HDV) space where there is a strong need for lowering emissions without sacrificing in terms of weight. He noted that hydrogen is particularly well suited for HDVs and even ships and aircraft applications as they benefit from separation of energy storage and power output, which is an inherent strength of fuel cells. He shared that CAPEX (performance at low cost) is key for light duty vehicles (LDVs) but durability and efficiency is key for HDVs.
 - Mr. Kusoglu highlighted the end-use category of HDV trucks and noted their importance as a fuel cell user because per vehicle mileage is higher for HDV trucks, HDV trucks consume significantly more fuel despite comprising a smaller fraction of the US fleet, and the decarbonization of HDV will have a stronger impact on a per vehicle and mile basis. He also mentioned that freight activity from diesel powered trucks is projected to continue to grow, posing air quality risks and representing an increasing share of emissions as time progresses. By 2040, medium and heavy duty vehicles are expected to be the largest fraction of transport sector emissions. Mr. Kusoglu added that electrification of passenger vehicles will reduce emissions, but the same progress is not projected for freight vehicles.
 - Mr. Kusoglu shared that diesel exhaust, which creates airborne particulate matter (PM) composed of SO₂ and NO_x, leads to a significant proportion of adverse health effects, and this impacts disadvantaged communities disproportionately.
 - Mr. Kusoglu noted that available and announced zero emissions fuel cell truck models have maximum driving ranges between 90-250 miles, but trucks with longer ranges are expected to reach the market in the near future.
 - Mr. Kusoglu highlighted that the M2FCT will focus on heavy duty fuel cell trucks as they demand a greater emphasis on system efficiency and longer lifetimes. This change in focus from light to heavy duty applications highlights the importance of durability and efficiency. Additionally, Mr. Kusoglu noted that the DOE has set cost, efficiency, and system lifetime targets for fuel cell vehicles to hit by 2030 and 2050.
 - Mr. Kusoglu shared that multiple studies have evaluated scenarios that achieve carbon neutrality. He noted, that in a study performed specifically for California, zero emissions vehicles (ZEVs) reach 40-75% of medium and heavy duty truck sales by 2035 and 100% of transit buses by 2029. Based on

the US Hydrogen Roadmap, several million metric tons of hydrogen are projected to be demanded by the transport sector by 2030, which only increases by 2050.

- Mr. Kusoglu highlighted the importance of the Advanced Clean Trucks (ACT) regulation in spurring the adoption of zero emissions vehicles. The ACT regulation is a manufacturers ZEV sales requirement and one-time reporting requirement for large entities or fleets. Additionally, the multi state medium and heavy duty zero emission vehicle memorandum of understanding recognizes the role of HDVs in GHG emissions and acknowledges it as an environmental justice problem with disproportionate impacts. Many states have signed this memorandum of understanding to agree to work together to foster a self-sustaining market for zero emissions medium and heavy duty vehicles through the ZEV Task Force.
- Mr. Kusoglu shared that a technology-neutral analysis of key insights and critical trends for clean vehicle technologies published by the State of Sustainable Fleets determined that a fundamental shift away from gasoline powered transportation has begun. This report highlighted California as a market starter, but noted that clean transportation funding and policy was spreading nationwide.
- Ms. Harari inquired how close the nation is to meeting the M2FCT's objective of a one million mile fuel cell durability target.
 - Mr. Kusoglu shared that most fuel cell truck demonstrations are still nascent, so this target has not been hit yet. He also noted that several demonstrations have been operating in port areas, so accumulation of miles was not a key factor. Mr. Kusoglu highlighted the AC Transit ZEV Bus Demo which reached over 100,000 miles for its fleet, which is some of the highest publicly reported.
- Mr. Chatterjee noted that one of the key successes of battery vehicles was charger deployment along highways. He noted that there are key highways along which HDV fleets are concentrated. Mr. Chatterjee inquired about the best approach to scaling up hydrogen fueling.
 - Mr. Kusoglu noted that availability of refueling stations has been a key challenge but included that ideally ongoing efforts related to hydrogen hubs could answer some of these infrastructure development questions. He noted that the hydrogen transportation industry would not require the same degree of fueling stations as electric vehicles due to increased range so initial stations could be strategically deployed based on transport corridors along key highways. Mr. Kusoglu highlighted that California and Europe have been working on the concept of a hydrogen corridor.
- Mr. Annes cited the chicken and egg problem with infrastructure and vehicle demand. He noted that this conundrum will be a key challenge for hydrogen transportation and noted the importance of federal funding to solve this. Mr. Annes inquired whether there was any current federal funding focused on hydrogen fueling station deployment.
 - Mr. Chatterjee proposed that an interstate study performed by a national lab or the DOE could inform an investment plan for a future administration.
 - Ms. Ayers also noted that funding will not only be driven by the DOE. She highlighted the importance of private funding and development from trucking companies to promote a public-private approach.
 - Mr. Chatterjee noted challenges with charging station deployment such as the lack of universal access for chargers deployed by specific vehicle manufacturers.

- Ms. Ayers responded that hydrogen dispensing is more universal.
 - Mr. Annes questioned on a policy front whether universal fueling station access should be required.
 - Ms. Ayers noted that in California, the government helped to fund the deployment of many hydrogen fueling stations to date, and these stations are required to have public access due to the government investment.
- Ms. Childs thanked Mr. Kusoglu for his educational and insightful presentation.

7. Working Group Update

- Ms. Childs shared that the Task Force would be conducting five Working Groups. These Working Groups will be coordinated and supported by Strategen with leadership from co-chairs from the Task Force. Ms. Childs shared that Working Group co-chair positions are still open.
 - Ms. Harari noted that while these Working Groups do have co-chairs, attendance at Working Group meetings will be open to Task Force members and members of the public. Information on Working Group scheduling can be found on the Green Bank's website.²
- Professor Pasaogullari, the co-chair of the Hydrogen Sources Working Group, shared that the Working Group will develop a proposed definition of clean hydrogen (in collaboration with the Policy and Workforce Development Working Group), identify total production potential of clean hydrogen within Connecticut, developed across at least 3 scenarios (e.g. High, Medium, Low), determine the impact on local manufacturing potential and industry in each of the hydrogen production scenarios identified above (in collaboration with the Policy and Workforce Development Working Group), perform a comparison of Connecticut's hydrogen production potential to other Northeast states in the Regional Clean Hydrogen Hub, and develop scenario-based production curves for clean hydrogen, identifying the amount of hydrogen that could be produced at different price points based on cost of underlying energy feedstocks.
- Mr. Chatterjee, the co-chair of the Hydrogen Uses Working Group, shared that this Working Group will develop a structured framework to prioritize hydrogen end use applications relevant for Connecticut, determine the total demand size of priority hydrogen end uses identified through the framework, developed across at least 3 scenarios (e.g. High, Medium, Low), and develop scenario-based demand curves for each hydrogen end use, identifying price points at which hydrogen would become competitive for different end uses and expected demand at those price points.
 - Ms. Dynowski noted the importance of developing a comparison between other decarbonization options for end uses.
 - Mr. Chatterjee clarified that an assessment of hydrogen competitiveness by end use is included in the Uses Working Group charter.
 - Mr. Capuno inquired whether hydrogen cost competitiveness would be forecast.
 - Mr. Chatterjee affirmed that this would be the case.
- Mr. Capuno, the co-chair of the Hydrogen Infrastructure Working Group, shared that this Working Group will develop a geographic analysis detailing the locations of existing infrastructure and proximity to hydrogen production and offtake sites, provide a high-level assessment of needed infrastructure and associated costs, and identify

² <https://www.ctgreenbank.com/hydrogentaskforce/>

priority areas for hydrogen infrastructure development, taking into account environmental justice and economic development objectives.

- Ms. Dynowski inquired whether environmental impacts would be included in the analysis of infrastructure needs and development.
 - Mr. Capuno clarified that novel analysis on this topic would not be performed, but noted that there is an existing suite of research hydrogen leakage that has already been done by other groups and will be cited.
- Ms. Dumaine, a Designee on behalf of the co-chair of the Policy and Workforce Development Working Group, Chairman Gillett, shared proposed deliverables including a set of policy guiding principles that can be used by stakeholders and other workgroup chairs to align their research and recommendations with existing state policy and processes on clean hydrogen, a hydrogen policy readiness assessment that will identify the current status of hydrogen policy, regulation, and oversight in Connecticut, a hydrogen policy best practices assessment, potentially including flags of specific hydrogen policies that could be most relevant for Connecticut's regulatory framework, and an assessment of hydrogen job creation opportunities, based on existing literature, Connecticut-specific opportunities, and best practices on workforce development and transition.
- Ms. Trietch, a Designee on behalf of the co-chair of the Funding Working Group, Commissioner Dykes, shared proposed deliverables for the Working Group including recommended actions for the state to position itself competitively for funding opportunities, an assessment of regions and resources that can utilize the funding available through the Targeted Brownfield Development Loan Program and make recommendations for tax advantaged opportunities, and a potential toolkit of incentives or other compensation mechanisms to advance the development of hydrogen infrastructure and use in Connecticut.
 - Mr. Chatterjee clarified whether the conclusions Funding Working Group would be informed by the needs identified by the Sources and Uses Working Groups. He also clarified whether the funding recommendations would include options outside of pre-existing opportunities.
 - Ms. Trietch affirmed that this Working Group would be aligned with the Sources and Uses Working Groups. She also noted that the Working Group would be doing a gaps analysis to recommend additional funding opportunities but would also be focusing on how to capture existing opportunities.
- Ms. Laun noted her appreciation that the Working Groups and co-chairs are now included on the Task Force website, along with meeting information. Ms. Laun inquired whether the members of each Working Group could also be posted for public awareness.
 - Ms. Childs noted that attendees at Working Group meetings would be reported in the formal meeting minutes.
 - Ms. Harari clarified that there are not official members of the Working Group meetings and these meetings are open to the public. Ms. Harari noted that the Green Bank had circulated a flyer to Task Force members to communicate this information publicly.
- Sara Harari asked the Task Force to move to formalize the Working Group Charters.
 - Professor Pasaogullari moved to approve the Working Group Charters. This motion was seconded by Mr. Chatterjee.
 - The Task Force members moved to approve the motion.

- Ms. Childs showed the Working Group schedule of meetings and noted that the meeting information could be found on the Green Bank’s website.

8. Public Comment

- Ms. Harari acknowledged that the Green Bank received a letter from a group of environmental, environmental justice, and social justice organizations on the definition of clean hydrogen.³
- Shannon Laun, the Connecticut State Director of the Conservation Law Foundation followed up on prior meeting comments related to transparency. Ms. Laun additionally inquired whether the Working Group charters would be posted, and whether Working Group meetings would be recorded and posted. Ms. Laun recommended that the Working Group meeting minutes include differentiation between Task Force members, consultant, and general members for transparency. Ms. Laun also noted that regarding public outreach, it would be most useful to have folks be able to sign up for a mailing list and also recommended outreach to DEEP’s CES mailing list.
 - Ms. Harari responded that Working Group charters would be posted and meeting minutes and recordings for Working Groups would be shared. Ms. Harari thanks Ms. Laun for her recommendations.
 - Ms. Dynowski added that outreach could also be sent to DEEP’s EJ mailing list to ensure that all relevant feedback is being sought.

9. Adjourn

- Ms. Harari announced that the next Task Force meeting would be held on October 11th, 2022. She shared that representatives from Bridgeport would be presenting on topics related to local environmental justice.
- The Hydrogen Power Study Task Force meeting was adjourned by Ms. Harari at 11:54 a.m.

10. Tours of Building

- In-person attendees went on a tour of the Nel Hydrogen building.

³ <https://www.ctgreenbank.com/wp-content/uploads/2022/09/ENGO-letter-Defining-Clean-Hydrogen-2.pdf>