HYDROGEN AND FUEL CELL TECHNICAL ADVISORY COMMITTEE

MEETING MINUTES

December 6-7, 2016

National Renewable Energy Laboratory (NREL) Conference Room: Suite 930, 901 D Street SW, Washington, DC 20585

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DAY 1 – December 6, 2016

Chairman Novachek commenced the Hydrogen and Fuel Cell Technical Advisory Committee (HTAC or Committee) meeting at 9:00 am. The meeting began with introductions of new and existing Committee members. The Committee reviewed the draft agenda and it was approved by the full Committee.

1. U.S. Department of Energy (DOE) Sustainable Transportation, Reuben Sarkar, Deputy Assistant Secretary for Sustainable Transportation, Office of Energy Efficiency and Renewable Energy (EERE), DOE

Mr. Sarkar reviewed some of his top priorities as Deputy Assistant Secretary for Sustainable Transportation, including building cross-cutting initiatives, leveraging emerging trends, developing platforms to accelerate the time from research and development (R&D) to commercialization, and conducting strategic demonstrations to help speed the transition from lab to market. He discussed the importance of innovation in transportation, including in the areas of connected vehicles, fuel substitution or diversification, low-carbon-intensity fuels, energy-efficient transportation planning, and multi-level transportation. Mr. Sarkar highlighted the efforts of the Clean Cities program to encompass more fuels, including hydrogen. He noted several other major EERE efforts supporting hydrogen, including the launch of three multi-lab consortia under the Energy Materials Network (the Electrocatalysis Consortium (ElectroCat), HydroGEN Advanced Water Splitting Materials Consortium (focused on renewable hydrogen production), and Hydrogen Materials—Advanced Research Consortium [HyMARC]) and the new Agile BioFoundry consortium, which will develop platforms for biomanufacturing. He noted major demonstrations like the SuperTruck Program and the possibility of having a fuel cell in a future SuperTruck. Mr. Sarkar discussed the role of cross-cutting research and stated that both plug-in hybrids and fuel cell electric vehicles (FCEVs) have roles to play. He identified the importance of (1) conducting rigorous, credible assessments to make sure that DOE funded research scales to market-relevant needs and applications and (2) setting stretch and breakthrough targets that are relevant to current and projected future end users and market factors. Mr. Sarkar expressed his enthusiasm for the newly formed multi-lab H2@Scale project, which builds on hydrogen's capacity to serve as an energy carrier and renewable energy storage medium for multiple sectors, including power generation, industry, and all forms of transportation. He noted that the concept is gaining attention from a number of different companies and electric utilities, as well as different DOE offices, including Fossil Energy, Nuclear Energy, and Office of Electricity and Energy Reliability. Mr. Sarkar asked the Committee for feedback on elements that are currently missing from DOE's fuel cell technology portfolio. He expressed the importance of identifying accomplishments that resonate with the public to change the narrative of fuel cell technologies.

Discussion Highlights

- Dr. Ogden suggested updates to DOE's calculations showing the cost competitiveness of fuel cell technologies and batteries. This could involve showing the effects of externalities like the volume of carbon dioxide release avoided and fuel savings over the lifetime of a vehicle. Dr. Ogden also suggested producing side cases for the cost competitiveness calculations showing how the answers may change using different assumptions.

2. **DOE Updates and Discussion, Sunita Satyapal, Director, Fuel Cell Technologies Office (FCTO), EERE, DOE**

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_01_satyapal.pdf

Dr. Satyapal provided an overview of DOE Hydrogen and Fuel Cell Program activities and accomplishments since the last HTAC meeting. Her full presentation is available at https://www.hydrogen.energy.gov/pdfs/htac_dec16_01_satyapal.pdf.

Discussion Highlights

- Mr. Kaya suggested that DOE pursue analyses that show the market potential and value of clean energy investments by the industrial sector.
- Members asked in what ways the Committee can use its expertise to help with DOE activities.
    - Dr. Satyapal stated that DOE has looked into applications in the stationary sector but would be interested in exploring specific industrial sectors, such as steel manufacturing.

3. **Office of Technology Transitions Initiatives, Sanjiv Malhotra, Director of the Clean Energy Investment Center (CEIC), Office of Technology Transitions, DOE**

Dr. Malhotra provided an overview of the DOE's Clean Energy Investment Center activities. He described its charge from the Secretary to work with members of the private sector and investment community to determine why investments in clean energy R&D have decreased, and then try to address the gaps. He pointed out four key challenges that investors have identified: lack of credibility, insufficient in-house resources to research and evaluate market risks, lack of patient capital, and high cost required for energy projects. To address these issues, Dr. Malhotra described how the CEIC has been working on the Technology Commercialization Fund to help fund early-stage technologies. He also described an online information portal that will be used to highlight DOE-funded technologies. To address the "lack of in-house resources" issue, Dr. Malhotra described the Lab Partnering Service, a web-based social network to connect to technology experts that can help companies conduct due diligence. Dr. Malhotra also described the programs the CEIC has set up to foster dialogue and relationships between research teams and potential investors. Before closing, Dr. Malhotra noted the importance of having an established supply chain to support the commercialization of products.

Discussion Highlights

- Topics of discussion included attracting experts to join the expert portal website, investor perceptions that fuel cells are "ahead of their time," and getting investors to understand the current maturity of fuel cell technology.

4. **EERE Updates and Discussion, David Friedman, Acting Assistant Secretary, EERE, DOE**

Mr. Friedman spoke regarding the state of fuel cells and renewable technologies in the world, noting the importance of investing sufficiently in clean energy technologies in the United States. He talked about how the role of hydrogen may change in the renewables space going forward and stated that the Committee must focus on making significant improvements in hydrogen and fuel cell technologies to solidify the role of these technologies in the renewable space. Mr. Friedman asked the Committee to

help advise DOE on getting hydrogen costs down significantly (e.g., reducing the hydrogen cost from $4 per gasoline gallon equivalent (gge) to $1–2 per gge to be competitive). He indicated that it is important for the office to assign priorities based on both increased budgets and flat budgets. Mr. Friedman made note of the Secretary of Energy's interest in H2@Scale and emphasized the importance of education and publicizing the value of hydrogen and fuel cell technologies.

Discussion Highlights

- Members asked about ways to make the argument for pursuing hydrogen and fuel cells.
    - Mr. Friedman responded that a broad approach is necessary, emphasizing energy security, climate impacts, job security, and saving money. The approach must focus on all of these areas.
- Members asked about commitments related to the Energy Policy Act's goals of having economical commercial vehicles by 2015 and widespread infrastructure by 2020.
    - Mr. Friedman encouraged the Committee to make recommendations to help H2USA. He noted that some of these questions come down to the administration's beliefs about the fundamental role of government. He asked that the Committee work to identify priorities of the new administration with which these technologies fit.

5. H2@Scale: Update for the Hydrogen Technical Advisory Committee, Mark Ruth, NREL

Mr. Ruth presented on the mult-lab developed H2@Scale concept, to enable wide-scale deployment of hydrogen as an energy carrier, energy storage medium, and manufacturing feedstock in the electricity generation, transportation, and industrial sectors. His full presentation is available at https://www.hydrogen.energy.gov/pdfs/htac_dec16_02_ruth.pdf.

Discussion Highlights

- Dr. Ogden suggested looking at the conceptual H2@Scale analysis from a regional perspective, e.g., the structure of the electric grid in different regions (where is renewable and baseload power generation being curtailed; where are grid bottlenecks?) and what kinds of policies would encourage uptake of renewables into the grid.
- Ms. Oge suggested that the project emphasize the benefits of hydrogen beyond decarbonization and consider how expansion of hydrogen could increase and improve infrastructure.
- Dr. Thompson recommended that Mr. Ruth interact with DOE's Energy Policy and Systems Analysis group, other offices in EERE, and the Energy Information Administration to get a better understanding of the market opportunities for H2@Scale. He suggested analysis on how hydrogen offers unique features vs biomass.
- Dr. Satyapal stated that the H2@Scale team will engage in a series of workshops and sessions to gather feedback on near-, mid-, and long-term strategies and gather input for an RD&D roadmap. She suggested that HTAC members provide feedback on the roadmap.
- Ms. Ratcliff suggested that hydrogen offers unique features of resiliency and national security that some other fueling options don't have.

6. Grid Modernization Initiative, Kevin Lynn, Director of Grid Integration, EERE

Mr. Lynn provided an overview of DOE's Grid Modernization and other grid cross-cut activities, including the recent go/no-go peer review meeting which evaluated 29 projects, Hi full presentation may be found at https://www.hydrogen.energy.gov/pdfs/htac_dec16_03_lynn.pdf.

Discussion Highlights

- Committee members asked questions about the challenges of working with small firms' proprietary grid modernization technologies, the impact and perspective of the Federal Energy Regulatory Commission towards these grid modernization initiatives, how to facilitate the transfer of information from grid modernization projects, and the role of distributed generation in grid modernization efforts.

7. HTAC Business, Frank Novachek, HTAC Chair

Chairman Novachek opened the floor for discussion by the Committee, including reactions to David Friedman's talk from earlier in the day.

- Ms. Dunwoody made the point that the Committee should emphasize the importance of DOE and on-the-ground support for enabling deployment of hydrogen stations, noting that the demonstration of stations in real world environments will be important to the goal of achieving low cost hydrogen. She stated that it needs to be normal to build a hydrogen station with people who are familiar with how to build it.
    - Dr. Powell agreed that demonstrations are vital to build credibility.
- Dr. Satyapal noted the importance of reducing the cost of hydrogen and asked the Committee for feedback on DOE's R&D portfolio.
    - Members indicated the need to demonstrate how technologies build on each other and the need for real world projects to establish credibility.
- Dr. Lipman asked the Committee for suggestions on how to communicate, to Congress and others, the results of the 2015 (and 2016) HTAC Annual Reports.
    - Members supported continuing efforts to brief congressmen and staff at briefings and caucuses.
    - Ms. Dunwoody suggested reaching out to think tanks.
- Dr. Satyapal stated that she would circulate the report, State of the States: Fuel Cells in America 2015 (https://energy.gov/sites/prod/files/2015/12/f28/fcto_state_of_states_2015.pdf), to the Committee.
- Dr. Satyapal requested that the Committee provide feedback on the draft Infrastructure Strategy Roadmap that DOE is preparing, which responds to HTAC's recommendation for an action plan to get to the 2020 goals set forth in the Energy Policy Act of 2005.
- Dr. Satyapal also asked for HTAC feedback on making H2USA more effective in transferring the successes in California to match hydrogen infrastructure buildout with vehicle commitments from OEMs.
    - Ms. Gobin replied that without matching federal funds, it will be difficult for many states to step up.
- Dr. Lipman asked whether the 2015 HTAC Annual Report has been delivered to Congress.
    - Mr. Markowitz replied that FCHEA will make sure it is distributed at the next House and Senate caucus meetings.

Development of the 2016 HTAC Annual Report was discussed.

- Chairman Novachek stated that he would send out an email to the Committee asking for input on the report content, themes, and key messages, and asked for 1–2 iterations of review of a draft complete in April, before the next HTAC meeting.
- HTAC Report writing subcommittee members: Morry Markowitz (Chair), Levi Thompson, Charlie Freese, Joan Ogden, Kathy Ayers, and Frank Novachek.
- Ms. Dunwoody suggested making use of infographics in the next report to capture the theme of progress in hydrogen and fuel cell technology development and deployment.
- The following ideas for the content of the 2016 report were offered by Committee members:
    - Commissioner Scott suggested including metrics on patents and jobs produced from hydrogen and fuel cell technologies presented by Dr. Satyapal in the FCTO update presentation.
    - Mr. Freese suggested showing the pathway for reaching the "endgame" for hydrogen and fuel cell technologies, with comparisons to what other countries are doing, and benchmarks and milestones required to reach this point.
    - Dr. Thompson suggested that technology benchmarking in the report include other technologies, such as biomass, for comparison. He suggested that HTAC collaborate with the technical advisory committee for biomass.
    - Ms. Dunwoody suggested focusing on the theme that, though the commercial market for hydrogen and fuel cell technologies has started, there are still challenges that need to be addressed. She noted that it is important to continue support for the demonstration of technology, to validate it and show that this is real-world technology, working today. She also suggested using infographic(s) to capture theme of progress and commercial opportunities today.
    - Chairman Novachek suggested using the figures in Mark Ruth's presentation on H2@Scale showing the market opportunities for hydrogen and the resources required.

8. External Communications Subcommittee, Charles Freese

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_11_freese.pdf

Mr. Freese reviewed the charter and the subcommittee's goal to produce a consolidated website for tools to help provide accurate, vetted information and inform the public about hydrogen and fuel cells. Mr. Freese presented a draft version of the HTAC communications website, and asked for feedback from the Committee.

Discussion Highlights

- Members discussed water that is produced from stationary fuel cell stations and whether making use of that water could be highlighted as a benefit in some stationary fuel cell scenarios.
- Members agreed that the messaging on this website must be complementary to what is on the DOE website regarding hydrogen and fuel cells.
- Chairman Novachek asked that some information about how hydrogen fuel cells compare to batteries be included.
- Ms. Dunwoody noted that the material is very transportation focused.
- Dr. Satyapal recommended highlighting hydrogen technology success stories such as the Hexagon Lincoln tube-trailer tank project. She also suggested linking to the Alternative Fuels Data Center website, allowing users to find nearby stations based on zip code; adding a jobs and

economic potential tab (DOE is updating some of its data now); including some videos; and making sure that other organizations' websites include links to the site.

- Commissioner Scott suggested that the website highlight hydrogen and fuel cell activities occurring in individual states.
- Dr. Ogden suggested showing the many different applications of fuel cells in the imagery used on the website.
- Dr. Thompson suggested the use of more common examples, such as fuel cells providing backup power during a storm power outage).
- Ms. Oge suggested having the site beta tested by someone who knows nothing about hydrogen,
- Mr. Freese asked if someone from DOE could be added to the team to review the content.

9. Hydrogen Safety Subcommittee, Catherine Dunwoody

Ms. Dunwoody presented on the subcommittee's draft Hydrogen Safety and Event Response Report, and asked for feedback from the Committee. She identified four recommendations to DOE made in the report regarding hydrogen safety and event response:

(1) Maximize the Role of the Hydrogen Safety Panel: DOE should develop a strategic plan that positions the HSP as a trusted resource on hydrogen safety, invests in marketing to make the HSP more visible, and provides resources to enable the HSP to develop relationships with safety officials at the local, state, and national levels.
(2) Leverage the Capabilities of Public–Private Partnerships, Including Clean Cities Coalitions and Other Regional Partnerships
(3) Take Steps to Support Reopening Hydrogen Stations in a Timely Fashion after a Safety-Related Incident
(4) Identify and Support Other Federal and State Agencies that Need to Incorporate Hydrogen into Their Programs.

Discussion Highlights

- Chairman Novachek asked the Committee to review and provide comments on the Hydrogen Safety and Event Response Draft Report. He asked that these be submitted by the end of the first week of January.
- Dr. Satyapal stated that DOE will update the Committee on its hydrogen safety and risk assessment activities at a future meeting and provide links to relevant reports and resources.
- Ms. Dunwoody clarified that the intent of recommendation #1 is not to say that DOE should *provide* funding; but that DOE could help with collaboration and finding funding sources.

Chairman Novachek adjourned the meeting at 5:39 EST.

DAY 2 – December 7, 2016

Chairman Novachek began the meeting at 9:10 am EST.

10. Overview of H2USA Activities, Connor Dolan and Karen Quackenbush, Fuel Cell & Hydrogen Energy Association (FCHEA)

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_06_dolan.pdf

H2USA is a public-private collaboration of hydrogen and fuel cell technology companies, automotive manufacturers, state energy organizations, and national labs. Mr. Dolan provided a briefing that identified some of H2USA's partners, summarized the activities of the Locations Roadmap Working Group, and highlighted the investor outreach activities of the Investment and Finance Working Group. Ms. Quackenbush provided updates on Market Support and Acceleration Working Group activities, Hydrogen Fueling Station Working Group activities, and Hydrogen Fueling Infrastructure Research and Station Technology (H2FIRST).

Discussion Highlights

- Dr. Satyapal noted that Ms. Gobin helped to identify a problem that has now been addressed through the work of DOE and its partners, i.e., an outdated regulation that required FCEVs parking underground to obtain and display a hazardous placard. She noted that this is a success for HTAC, since DOE was able to mobilize resources to update this regulation to reflect current code and safety science.

11. Fuel Cell Electric Vehicle (FCEV) Education and Outreach, Eric Hoffman and David Leavitt, Weber-Shandwick

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_07_dolan.pdf

Mr. Hoffman provided an overview of Weber Shandwick's work for FCHEA's campaign to raise awareness and accelerate support for FCEVs.

Discussion Highlights

- Ms. Gobin suggested targeting state procurement of FCEVs and making it clear to states the value of investing in FCEVs for their state fleets.
- Dr. Ayers suggested focusing on locations in the United States where oil and gas has more influence, such as in the Midwest.
- Commissioner Scott suggested that peer-to-peer distribution and communication of the messaging would have the most impact.

12. Hydrogen Fuel Cell NEXUS: The Hydrogen and Fuel Cell Directory, Alleyn Harned, Virginia Clean Cities

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_08_harned.pdf

Mr. Harned presented on a DOE-funded project to develop a web-based business-to-business directory that helps suppliers connect with buyers. He demonstrated the draft website being created, called Hydrogen Fuel Cell Nexus (http://hfcnexus.com/).

Discussion Highlights

- Committee members asked questions about how data on different types of organizations will be populated in the database.
- Dr. Satyapal showed the Committee a sample of DetecTape™, a tape that changes color in the presence of hydrogen, as one example of DOE/national lab impact and partnership with small

business. She stated that Hydrogen Fuel Cell Nexus helps promote visibility for the hydrogen product supply chain and commercial products like this.

13. U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis, Patrick Fullenkamp, Global Wind Network (GLWN)

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_09_fullenkamp.pdf

Mr. Fullenkamp presented on the progress and findings to date of a DOE funded project to conduct (1) a global competitiveness analysis of hydrogen and fuel cell systems and components and (2) analysis to assess the status of global hydrogen and fuel cell markets. He noted that the outcome of the studies will identify global cost leaders, best global manufacturing processes, key factors determining competitiveness, and opportunities for cost reduction.

Discussion Highlights

- Committee members discussed GLWN's observations of the technologies highlighted in the presentation and the market's readiness to manufacture products at different vehicle production levels.

14. Northeast States Update, Joel Rinebold, Connecticut Center for Advanced Technology (CCAT)

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_10_rinebold.pdf

Mr. Rinebold provided an overview of hydrogen ad fuel cell activities in Northeastern states, including roadmap market planning, economic analysis, market analysis/target identification, policy initiatives, manufacturing/business development, and supply chain management. Mr. Rinebold emphasized the importance of working with automotive original equipment manufacturers and the need to coordinate hydrogen refueling infrastructure with the rate of new vehicle deployment. He specified the need to put out information in a way that policymakers can understand it, the importance of collaboration within the industry, and the value in keeping companies based in the United States.

Discussion Highlights

- Mr. Novachek noted that fuel cells that can load follow could provide a very important and reliable function in microgrids.
- Mr. Markowitz noted that station siting needs to be informed by more than maps; information should be gathered from locals who really drive the areas and know what routes commuters take. Ms. Gobin noted that state air programs also have a lot of data on where cars really go.
- Vice Chairman Freese and Dr. Satyapal noted the follow-up action for the H2USA Locations Committee to look into ways to make use of traffic data from sources like OnStar.
- Dr. Powell suggested being proactive in looking at where wind and solar resources are being sites, and work with them to include hydrogen energy storage as part of their build out plan.

15. Other HTAC Business, Frank Novachek, HTAC Chair

Chairman Novachek continued with the HTAC business discussion from the previous day, beginning with presentations from Hal Koyama and Joan Ogden on the infrastructure-related subcommittees.

He noted that the work of these two committees may be merged, depending on the recommendations of HTAC members.

a. Outline of Fueling Options, HTAC Near-Term Fueling Infrastructure Subcommittee, Hal Koyama

>>see full presentation at https://www.hydrogen.energy.gov/pdfs/htac_dec16_04_koyama.pdf

Mr. Koyama described the scope of the subcommittee's work element as "provide a first order assessment of a range of fuel cell vehicle fueling alternatives to determine: 1) a rough comparison of costs and financial risks, 2) technical and regulatory challenges, and 3) potential for facilitating consumer adoption of FCVs. The four methods explored were central, portable, delivery, and home. He reviewed initial findings and asked for feedback on whether further work is merited to develop more detailed analysis and recommendations.

b. Status Update for HTAC Infrastructure Report, HTAC Infrastructure Subcommittee, Joan Ogden

Dr. Ogden reviewed the work of the first HTAC Infrastructure Subcommittee, which published its report in the Fall of 2015. Since then, she noted there has been interest in producing a follow-up report to focus on technical advances and new developments in hydrogen infrastructure technologies. She provided an overview of several possible focus areas for the report, including central hydrogen stations (replacing gasoline stations), personal hydrogen delivery systems, tracking vehicle and station deployment, compiling funding estimates from public/private partnerships, tracking worldwide progress, and developing recommendations for fueling infrastructure based on the information collected.

Discussion Highlights

- Dr. Satyapal stated that DOE has information that may be useful for the HTAC infrastructure work from their H2FIRST, mobile refueling, H-Prize, and International Partnership for Hydrogen and Fuel Cells in the Economy projects.
- Mr. Koyama noted that the only detailed analyses so far have been on central fueling and suggested targeting home fueling stations.
- Mr. Fred Joseck spoke on FCTO's efforts considering the business case for home refuelers; Chairman Novachek suggested that this may be a good presentation topic for the next HTAC meeting.
- Dr. Satyapal suggested a follow-up call with Mr. Koyama and Dr. Ogden to discuss what materials FCTO may have that could be relevant to the next infrastructure report or reviewed by the Infrastructure Subcommittee.

16. Closing HTAC Business

- 2017 HTAC Chair and Vice Chair succession and selection process:
    - Mr. Freese presented a formalized process for transitioning the roles of Vice Chair to Chair and for nominating and electing members for these positions using a Leadership Selection Subcommittee.

    - The Committee approved the new process, approved Dr. Lipman and Mr. Koyama as members of the subcommittee, and agreed that Erika Gupta (as the HTAC Designated Federal Officer) would be the DOE representative on the subcommittee.
    - The Committee approved Charlie Freese as next HTAC Chair (beginning July 2017).
- Closing remarks from Sunita Satyapal:
    - Dr. Satyapal repeated Reuben Sarkar's and David Friedman's requests for the Committee to provide feedback on activities to help DOE achieve low-cost, low-carbon hydrogen.
        - Chairman Novachek suggested that a presentation from Proton OnSite, or other electrolyzer manufacturer, at a future HTAC meeting on the issues associated with getting hydrogen production costs down.
    - Dr. Satyapal discussed FCTO's progress with the H-Prize winner (SimpleFuel) and their plans to reach out to the investment community and have more public visibility for the project.
    - She mentioned several upcoming events, including the 2017 Annual Peer Review, an H2@Scale workshop to be held in the April-May timeframe in Texas, a truck applications workshop to be held in spring 2017 in California, and a webinar on HydroGEN.
- Updated meeting minutes process:
    - Chairman Novachek asked for the Committee's input on the decision to shorten the format of the HTAC meeting minutes. The Committee approved the shortened format.
- Dates 2017 HTAC meetings:
    - The Committee agreed to poll members for dates during the weeks of April 17, 2017 (tentative location Washington, DC) and October 23, 2017 (tentative location Hartford, CT).

Chairman Novachek adjourned the meeting at 1:23 pm EST.

TWENTY-EIGHTH MEETING OF THE

HYDROGEN AND FUEL CELL TECHNICAL ADVISORY COMMITTEE (HTAC)

PARTICIPANT LIST

December 6-7, 2016

HTAC Members Present

- Kathy Ayers
- Kathryn Clay
- Catherine Dunwoody
- Charles Freese
- Anne Gobin
- Maurice Kaya
- Harol Koyama
- Timothy Lipman
- Morry Markowitz
- Frank Novachek
- Joan Ogden
- Margo Oge
- Joseph Powell
- Adele Ratcliff
- Janea Scott
- Levi Thompson

HTAC Members Not Present

- Inez Azevedo
- Anthony Eggert
- Drew Kodjak
- Paul Leggett

U.S. Department of Energy Staff

Office of Energy Efficiency and Renewable Energy

- Rick Farmer
- David Friedman (Speaker)
- Nancy Garland
- Erika Gupta (DFO)
- Fred Joseck
- Kevin Lynn (Speaker)
- Shawna McQueen
- Reuben Sarkar (Speaker)

- Sunita Satyapal (Speaker)

Office of Technology Transitions

- Randy Abreu
- Sanjiv Malhotra
- Marlin Martes

Members of the Public in Attendance

- Leland Cogliani—Lewis-Burke Associates, LLC
- Sandra Curtin—Fuel Cell and Hydrogen Energy Association
- Connor Dolan—Fuel Cell and Hydrogen Energy Association (Speaker)
- Kathy Martin—Alliance Technical Services, Inc.
- Patrick Fullenkamp—Global Wind Network (Speaker)
- John German—International Council on Clean Transportation
- Leo Grassilli—Office of Naval Research
- Alleyn Harned—Virginia Clean Cities (Speaker)
- Joseph Hartvigsen—Ceramatech
- Eric Hoffman—Weber-Shandwick (Speaker)
- David Leavitt—Weber-Shandwick (Speaker)
- Randy Petri—FuelCell Energy
- Karen Quackenbush—Fuel Cell and Hydrogen Energy Association (Speaker, remote)
- Joel Rinebold—Connecticut Center for Advanced Technology, Inc. (Speaker)
- Mark Ruth—National Renewable Energy Laboratory (Speaker)
- Herie Soto—Shell Global
- Danny Terlip—National Renewable Energy Association
- Sandy Thomas—no affiliation

Support Staff

- Judi Abraham—Alliance Technical Services, Inc.
- Dottie Bunn—Bunn & Associates
- Rachel Davenport—Alliance Technical Services, Inc.
- Lilia Murphy—Alliance Technical Services, Inc.
- Neil Popovich—National Renewable Energy Laboratory
- Amit Talapatra—Energetics Incorporated
- Thomas Timbario—Alliance Technical Services, Inc.