HYDROGEN AND FUEL CELL TECHNICAL ADVISORY COMMITTEE

MEETING MINUTES –June 14-15, 2011

Airport Marriott Hotel, 1890 Ridge Road West, Rochester, New York

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Day 1 – June 14, 2011

Meeting was called to order at 1:00 p.m. EST by Chairman Shaw.

1. Hydrogen and Fuel Cells Technical Advisory Committee (HTAC) Business

- **Approval of Meeting Agenda**
  Agenda for the June 14-15, 2011, HTAC meeting was approved without comment.
- **Transition of U.S. Department of Energy (DOE) Designated Federal Official (DFO)**
  Jason Marcinkoski will take over for Michael Mills as the new DFO for HTAC.
- **Selection of New Annual Report Lead**
  Peter Bond has taken over for Anthony Eggert as leader for the 2011 HTAC Annual Report.
- **Adoption of minutes from previous HTAC meeting**
  The minutes of the February 17-18, 2011, HTAC meeting were adopted without comment.

2. Public Comment Period

Dr. Sandy Thomas, Former President, H2Gen Innovations, Inc.

Dr. Thomas updated the HTAC on a project he has undertaken to raise the visibility of hydrogen in the public sphere. Dr. Thomas suggested taking out a full-page ad in the New York Times and/or contacting John Holdren, President Obama's scientific advisor and former president of the American Association for the Advancement of Science (AAAS). He welcomed feedback on this strategy and asked the group for their opinions on asking individuals on the HTAC's distribution list to send a letter to the President urging him to support hydrogen and fuel cells. Dr. Thomas also shared the results of his adaptation of the McKinsey report findings to American vehicles, stating that if every small vehicle was replaced by a battery electric vehicle (BEV), gasoline emissions would be cut by 30%. Therefore, the use of BEVs alone cannot reach the goal of reducing emissions by 50% by 2050.

Questions, answers, and comments

- Mr. Chalk asked if Dr. Thomas included the greenhouse gases associated with the production of electricity in his emissions calculations.
  - Dr. Thomas replied that upstream carbon emissions from electricity production were not accounted for; if they were, the impact of BEVs would be lower.

3. Discussion of letter from Dr. Henry Kelly, Acting Assistant Secretary and Principal Deputy Assistant Secretary for the Office of Energy Efficiency and Renewable Energy (EERE)

Chairman Shaw summarized a letter to the HTAC from Acting Assistant Secretary Dr. Henry Kelly, written in response to HTAC's letter to DOE Secretary Dr. Steven Chu. Chairman Shaw stated that while he appreciated the explained reasoning for budget cutbacks, he was disappointed that the Assistant Secretary did not address the government's perceived lack of support for hydrogen and fuel cell technology. Chairman Shaw also stated that he intended to invite Assistant Secretary Kelly to meet with the HTAC.

Questions, answers, and comments

- Dr. Ogden stated that Assistant Secretary Kelly failed to mention the significant investments that have been made in hydrogen and fuel cell technology by the private sector.

- Dr. Carlin asked how far back the budget reduction puts hydrogen and fuel cell technology in terms of years lost. He also stated that he believes the Fuel Cell Technology Program's (FCT's) Market Transformation subprogram would be best suited for leveraging the private investment.
- Mr. Rose stated that the "rebalancing" argument made by Assistant Secretary Kelly ignores the relative merits of the DOE's programs. Furthermore, the DOE's Solar Program has seen an increase in its budget even as the private sector solar industry enjoys record sales.

4. U.S. Department of Energy Presentations

4.1 Mr. Steve Chalk, DOE-EERE, Deputy Assistant Secretary of Renewable Energy

Mr. Chalk presented an update on the FCT budget, which went from $170 million in fiscal year 2010 (FY 2010) to $98 million in FY 2011. The FY 2012 request is $100 million and discussion on FY 2013 will begin soon. Mr. Chalk requested information from HTAC members for the development of the FY 2013 budget.

4.2 Dr. Sunita Satyapal, Program Manager, DOE-EERE Fuel Cell Technologies Program

Dr. Satyapal presented an overview of the DOE Fuel Cell Technologies Program, including key accomplishments and budget updates. Of note was the creation of jobs and significant number of patents that resulted directly from FCTP funding. Dr. Satyapal reiterated the funding levels stated by Mr. Chalk and highlighted several examples of cross-office collaborative successes. Furthermore, she proposed that a blue ribbon panel on hydrogen production be formed in order to provide guidance on production focus areas and coordination with other agencies. Future program work will include a focus on market penetration as well as infrastructure needs and leveraging resources for continued portfolio optimization.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_satyapal.pdf

Questions, answers, and comments

- Chairman Shaw asked about the subprograms within DOE Hydrogen Programs that have zeroed-out budgets in FY 2012 (education and market transformation).
  - Dr. Satyapal replied that the Program is trying to leverage carry-over funds but may have to completely stop some projects. Researchers may be able to coordinate with other DOE programs, such as EERE's Vehicles Technologies Program, which partners with the Hydrogen Program at the Annual Merit Review.
- Regarding the post-doctoral fellowship program, Dr. Satyapal offered to confirm whether or not applicants have to identify their own hosts, and if so, if identification had to be made before or after an award was given.
- Deputy Assistant Secretary Chalk commented that input is needed on hydrogen production and infrastructure strategy. He suggested a workshop with the financial community on localized hydrogen production.
  - Chairman Shaw responded that the Secretary of Energy would have to be present at such a meeting in order to ensure the attendance of the most senior people from the financial community. He suggested a workshop hosted jointly by Secretary Chu and U.S. Department of Transportation (DOT) Secretary Ray LaHood on hydrogen and fuel cell transportation initiatives.

- Mr. Freese stated that one of the biggest challenges to widespread implementation of hydrogen and fuel cell technologies is reaching a critical mass in a concentrated geographic area. He suggested concentrating future efforts in select geographic areas to keep things focused.
- Chairman Shaw suggested inviting Assistant Secretary Kelly and a small group to a weekend-long retreat to have a serious discussion about how to move forward with hydrogen and fuel cell technologies, specifically how to engage the financial community.

5. Work Group Updates

5.1 Stimulating the Hydrogen Infrastructure, Dr. Kathy Taylor, Chair

Dr. Taylor stated that recent work of the Stimulating Hydrogen Infrastructure Working Group has focused on assembling information on worldwide hydrogen infrastructure development. From this the group hopes to identify hydrogen infrastructure opportunities for DOE. A detailed draft report of findings was submitted to the HTAC for comment.

Questions, answers, and comments

- Chairman Shaw asked Dr. Taylor if she could suggest an initiative that could kick-start the infrastructure buildup and entice business to invest money in refueling stations.
    - Dr. Taylor responded that legislative requirements, such as fuel economy or emissions standards, are the most effective.
    - Mr. Freese added that it is important to focus on targeting specific geographic areas in order to achieve critical mass.
- Chairman Shaw asked Dr. Taylor if she believes we have accounted for all the technology and hardware required to commercialize refueling.
    - Dr. Taylor responded that the main barrier to implementing refueling infrastructure is not technological discovery, but rather improvements on current technology, codes and permitting, and financing.
- Mr. Novachek commented that the energy supply is largely a commodity and refueling stations don't necessarily have to be owned by the energy companies.
- Mr. Kaya added that several successful applications of technology have been driven by state and regional legislation. He also stated that partnerships should be made to overcome hurdles such as market penetration and deployment.
- Dr. Cardillo stated that the main point of concern should be how the HTAC can influence the federal government to promote refueling infrastructure so car companies' investment in hydrogen vehicles is not wasted. For example, install methane reforming stations in defined areas such as Hawaii or Southern California.
- Dr. Ogden suggested convening stakeholder meetings to examine progress on the regional level.
    - Mr. Rose supported this idea, but cautioned that DOE would be expected by participants to give financial support for any outcomes.
- Dr. Taylor suggested a franchise model to entice building of stations, similar to what was done in the early days of cable television.
    - Mr. Rose stated that he supported Dr. Taylor's franchising idea; however, government would have to be involved in providing patient, or long-term, capital.

- Chairman Shaw asked Dr. Taylor for a written overview of her committee's recent progress and specific challenges that need to be addressed to move forward.
- Dr. Satyapal added that one of the biggest issues her counterparts in other countries aim to address is how to incentivize the early adopters and investors. Therefore, a workshop with investors would be potentially fruitful. She also asked the working group and HTAC to aid DOE in quantifying hydrogen refueling infrastructure cost in comparison to refueling infrastructure costs for alternative vehicle technologies.
- Mr. Chalk stated it is important that critical mass be quantified on a national level.
- DOE will review the proper procedure necessary to ensure Dr. Taylor can remain as chair of the Infrastructure Working Group.

5.2 Hydrogen Enabling Renewables Working Group, Mr. Frank Novachek, Chair

Mr. Novachek updated the group on the Hydrogen Enabling Renewables Working Group, the purpose of which is to examine the various ways in which hydrogen might serve as an enabler for high penetrations of renewable energy. The group focused on energy storage issues and recent accomplishments that include the development of a simple model for examining the basic economics of energy storage. They are now in the process of applying this model to hydrogen and other competing systems. The draft model and preliminary results were shared with the HTAC

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_renewables_wg.pdf

Questions, answers, and comments

- Mr. Chalk recommended that Mr. Novachek show the group's energy storage model to the Electric Power Research Institute (EPRI).
- Mr. Kaya stated that it is important to consider the value of energy and changing ramp rates.

6. Energy Efficiency and Renewable Energy Advisory Committee (ERAC) Update and Discussion, Dr. Arati Prabhakar, Chair

Dr. Prabhakar gave a brief overview of the ERAC and the five topics the committee has been tasked to address: (1) transportation, (2) electricity, (3) program design for impact, (4) appliance standards, and (5) EERE strategy and management. The first four topics have a subcommittee to oversee their progress; the fifth is overseen by the full committee.

Questions, answers, and comments

- Chairman Shaw urged Dr. Prabhakar to read and circulate to the ERAC the HTAC Annual Report and the accompanying letter to Secretary Chu.
- Mr. Kaya asked for more information on what the ERAC's Program Design for Impact subcommittee is trying to achieve.
    - Dr. Prabhakar responded that the subcommittee is investigating conditions that allow technologies to move to scale.
- Dr. Prabhakar asked Chairman Shaw if the committee has examined the economic viability of various hydrogen technologies.
    - Chairman Shaw responded in the affirmative.

- Mr. Freese offered to meet with Dr. Prabhakar to discuss why General Motors took a portfolio approach to investing in alternative technologies, including hydrogen fuel cell electric vehicles.

7. Fuel Cell Users Panel – Mr. Hal Koyama, Facilitator

7.1 Mr. Benny Smith, Vice President of Facilities, Price Chopper Supermarkets

Mr. Smith gave an overview of Price Chopper Supermarkets and discussed how electricity costs, the availability of incentives and grants, and its stores' continuous heat and power demands led Price Chopper to adopt fuel cells. He also detailed Price Chopper's fuel cell installation and operation processes and provided data on the company's energy use and cost. Price Chopper's initial fuel cell system is operating at 92% uptime. The company is still analyzing the payback and return on investment figures, which are generally no more than five years.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_pricechopper.pdf

Questions, answers, and comments

- Mr. Wylam asked what advice Mr. Smith would give to other grocers interested in using a fuel cell, other than to be aware of cost.
  - Mr. Smith responded that he would recommend others look for the best quality manufacturer available.

7.2 Ms. Michelle Lauterwasser, Associate, Becker and Becker

Ms. Lauterwasser presented two case studies involving fuel cell installation and use in multifamily high-rise buildings. A new building, 360 State Street in New Haven, Connecticut, uses a fuel cell system to provide electricity to all common and commercial areas, and uses waste heat for domestic hot water heating, space heating, and pool heating. Ms. Lauterwasser also highlighted The Octagon, an existing multifamily apartment development located on Roosevelt Island in New York City. The Octagon's fuel cell system provides electricity to 500 residents and common areas. The building also uses waste heat for domestic hot water heating and space heating. Ms. Lauterwasser discussed how financial incentives substantially reduced the payback period of each project.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_becker.pdf

Questions, answers, and comments

- Dr. Cardillo asked why the State of Connecticut does not allow sub-metering.
  - Ms. Lauterwasser responded that while several reasons were given, the main purpose is consumer protection—property managers could not be held to the same standards of accountability as highly-regulated utility companies.
  - Mr. Novachek asked if the rules about sub-metering apply to heat as well.
    - The answer was the rules do not apply to heat.
  - Ms. Lauterwasser reiterated that sub-metering is a huge issue for developers interested in installing fuel cells.
- Mr. Koyama asked if a fuel cell installation project would be feasible without the two-thirds cost reduction that Ms. Lauterwasser's project received.

    - Ms. Lauterwasser responded that part of the economic feasibility derived from the fact that her firm does not resell projects, but rather stays with the development for its lifetime.
    - Mr. Rose asked Ms. Lauterwasser if her company would install another fuel cell project without a subsidy.
        - Ms. Lauterwasser responded that it depends on the regulatory framework within the state in question. Probably they would not in Connecticut but would in New York. Based on one project's calculations, the payback period for one fuel cell in New York was 13 years without a subsidy.
- Mr. Novachek asked if the development company has to pay standby rates to power the building in the event that the fuel cell fails.
    - Ms. Lauterwasser responded that the developer is charged the standard commercial rate but also gets charged for the demand.
- Chairman Shaw asked if Ms. Lauterwasser's tenants are aware of the environmentally friendly components of the apartment building and whether or not they seem to care.
    - Ms. Lauterwasser said they are aware of it and probably care more about the fact that their electricity bill is significantly lower than at comparable buildings.

7.3 Mr. Kevin Kenny, Engineer, Sprint-Nextel

Mr. Kenny stated that due to the increasing presence of emissions regulations in states across the country, Sprint is now deploying fuel cells for backup power at cellphone tower sites. He discussed the various advantages of fuel cells, including their direct-current output and reliability. However, they have run into problems in urban environments where it is difficult to bring hydrogen gas tanks up to rooftops.

Questions, answers, and comments

- Chairman Shaw asked Mr. Kenny to elaborate on how Sprint uses their fuel cells.
    - Mr. Kenny stated that they are used for backup to cell towers for only minutes at a time when necessary. Of the 30,000-plus cell towers, today 243 are installed with fuel cells.
    - Chairman Shaw asked what it would take to get half the towers connected to a fuel cell.
        - Mr. Kenny stated that given the current economic environment, backup power is a luxury reserved only for the most critical towers.
    - Mr. Rose asked what the biggest challenges are in getting hydrogen to the fuel cells sites.
        - Mr. Kenny stated that even before the fuel cells are installed, detailed site investigations have to be performed. They have worked with their suppliers to modify trucks capable of reaching remote locations, although several potential locations have been deemed unreachable.
    - Dr. Cardillo asked Mr. Kenny to compare battery, diesel, and fuel cell backup methods.
        - Battery backup is not practical because the storage environment must be cooled, requiring constant maintenance. Furthermore, the regulations for battery disposal are too burdensome. Also, fuel cells are preferable to diesel because they are more reliable.

7.4 Mr. Steven Medwin, Director of Systems and Advanced Engineering, The Raymond Corporation

Mr. Medwin presented on Raymond Corporation's history and use of fuel cells in its electric forklifts. He discussed hydrogen fuel cell solutions for electric lift trucks, including a profile of an ideal customer, the value proposition for end users, and factors working against their adoption. He also mentioned several Raymond customers using fuel cells, including Sysco and BMW. Mr. Medwin stated that fuel cells are commercially available for a range of truck models, and while they are currently deployed all over North America, system costs and hydrogen infrastructure are limiting growth. He also remarked that suppliers need to drive down costs, truck manufacturers need to continue testing systems, and customers need to work with a company that will provide the best solutions for their individual needs.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_raymond.pdf

Questions, answers, and comments

- Mr. Rose asked for more information on retrofitting lift trucks versus construction of lift trucks around the fuel cell.
  - Mr. Medwin stated that all the lift trucks that use fuel cells were actually designed for lead acid batteries and have been retrofitted. Raymond did make a proof-of-concept purpose-built fuel cell lift truck with Ballard, but decided that the costs and timing are currently prohibitive unless there is more interest from the marketplace.
- Mr. Rose asked if Mr. Medwin believed fuel cell lift trucks would capture a bigger portion of the market share as the economy recovers.
  - Mr. Medwin stated that even with the poor economy, fuel cell lift truck sales were significant and will probably remain strong as the economy recovers.
- Dr. Cardillo asked about the sales trend of internal combustion forklifts.
  - Mr. Medwin responded that the internal combustion engine market is decreasing, but is still about 50% of lift truck sales.
- Mr. Kaya asked about the refueling infrastructure in place at sites that use fuel cell forklifts.
  - Mr. Medwin stated that it is dependent on the volume needed, but for 100-200 units, trucked-in liquid hydrogen is the most cost effective.
- Chairman Shaw asked whether or not Raymond encourages the use of fuel cell forklifts over their other trucks.
  - Mr. Medwin stated that many customers will specifically ask about fuel cells because their company has a sustainability initiative. For other customers, it can be a tough sell if the desire and tax incentives are not there.
- Chairman Shaw asked about the average life of a lead acid battery.
  - Mr. Medwin responded that it is usually three to four years and each truck requires three to four batteries over the course of 24 hours.

Questions, answers, and comments for the entire group

- Dr. Satyapal asked for advice in making the most of federal tax credit 1603 in its few remaining months.
  - Mr. Kenny stated that for his company, cash in lieu of credits is the best option. Furthermore, competitive solicitation selection process was too lengthy.

- Ms. Lauterwasser stated that it was almost impossible for her to find an accounting firm that had the knowledge required to apply for a fuel cell tax credit, because the process is complicated and unique. Furthermore, the credits should be more tailored to the systems available on the market.

8. DOE's Quadrennial Technical Review (QTR) Discussion, Mr. Bob Rose

Mr. Rose gave a brief overview of the QTR, initiated by the President's Council of Advisors on Science and Technology to review the current DOE energy technology activities. A draft report, published to elicit dialogue across the spectrum of interested parties, focuses on transportation and power generation, but does not include any mention of hydrogen or fuel cell technologies.

Questions, answers, and discussion

Mr. Freese, having attended the QTR hearings, noted that concerns about the absence of hydrogen from the review process were vocalized.

- Chairman Shaw encouraged the committee members to attend the final meeting of the QTR hearings on July 13, 2011 in Washington, D.C.

Day 2 – June 15, 2011

9. European Hydrogen and Fuel Cell Activities, Dr. Sara Cerri, Independent Consultant, Naval International Cooperative Opportunities in Science & Technology Program (NICOP)

Dr. Cerri gave an overview of European energy policy objectives, initiatives, and research activities. She identified the key energy policy objectives for the European Union as enhancing the security of the energy supply, mitigating climate change, addressing local air pollution, and developing a sustainable market. Dr. Cerri also discussed The Fuel Cells and Hydrogen Joint Technology Initiative, which is a public-private partnership for fuel cell and hydrogen research and technological development initiatives. The partnership holds open and competitive calls for project proposals annually, and awards selected proposals with funds on a cost-shared basis. Dr. Cerri also listed European hydrogen and fuel cell associations as well as research activities.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_cerri.pdf

Questions, answers, and comments

- Chairman Shaw asked how it was possible to reach a consensus with 55 members in the Joint Undertaking (JU).
  - Decisions are made and voted on by the 12-member governing board.
- Dr. Carlin asked Dr. Cerri to comment on the attitude toward hydrogen and fuel cells among researchers and industry members throughout Europe.
  - Dr. Cerri stated that the attitude is positive. Every nation in Europe has some hydrogen and fuel cell activities over and above the JU's Multi-Annual Implementation Plan (MAIP).
- Mr. Koyama asked about the level of planning and discussion happening between DOE and the European Union.
  - The International Partnership for the Hydrogen and Fuel Cell Economy (IPHE), of which the United States and many European nations are members, provides the framework for this type of collaboration.
    - Mr. Mills added that Dr. Satyapal meets regularly with her counterpart in the European Commission (EC). There has also been an attempt to align activities between the United States and the EC.

10. Small and Medium Enterprise Presentations

10.1 Mr. Christian Böhm, President, SFC Energy AG

Mr. Böhm discussed how SFC Energy's business model, which features product readiness, liquid fuel infrastructure, and market traction, leads to sustainable fuel cell growth. He also detailed SFC Energy's hybrid power concept, which comprises fuel cell, power management, solar, and battery components, and noted how this approach combines advanced energy density with the required power density. Mr. Böhm mentioned how SFC Energy products have applications in numerous markets, such as leisure, remote industry, defense, mobility, and e-mobility. He also discussed the battery-power gap, in terms of both capacity limitations and thermal issues.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_sfc.pdf

Questions, answers, and comments

- Dr. Cardillo asked how many companies provide component pieces for SFC Energy's fuel cells.
  - Mr. Böhm said there are about five companies that provide essential products.
- Dr. Taylor asked for more information on the technology behind their fuel cells.
  - Mr. Böhm responded that they are direct methanol fuel cells (DMFC). He offered to send Dr. Taylor more information about the chemical reaction.
- Mr. Koyama asked if SCF Energy takes advantage of biomethanol.
  - Mr. Böhm stated that because they outsource the production of the fuel cartridges, they do not know whether or not the methanol is bio-based.
- Mr. Koyama asked about the durability of the fuel cell stack.
  - Mr. Böhm stated that the fuel cells are sold to individuals with a three-year warranty. Industrial systems have a 3,000-hour warranty.
- Mr. Rose asked about the percentage of methanol in the fuel.
  - The fuel is pure, undiluted methanol.
- Mr. Rose asked Mr. Böhm to speak to the challenges of refueling infrastructure.
  - Mr. Böhm stated that they use existing distribution channels for the fuel, including the United Parcel Service and FedEx. Individual customers can also purchase fuel from local dealers.

10.2 Mr. Taras Wankewycz, Executive Director, Horizon Fuel Cell Technologies Pte. Ltd.

Mr. Wankewycz presented an overview of Horizon Fuel Cell Technologies, a global developer and marketer of hydrogen fuel cells and integrated products, and its pursuit of fuel cell portable power devices. Mr. Wankewycz stated that portable power presents an immediate opportunity for the introduction of fuel cell products, and represents a much larger market opportunity than forklift or backup power. He also detailed many of Horizon's products, including a pocket-sized, portable electronics charger that combines fuel cell and solid-state hydrogen cartridge systems. Mr. Wankewycz also described Horizon's automatic hydride charging system, off-grid portable fuel cell power unit, and fuel cell generator.

Questions, answers, and comments

- Mr. Novachek asked how Mr. Wankewycz felt about use of sodium borohydride technology in larger-scale applications.

- Mr. Wankewycz replied that his company believes sodium borohydride is too complicated for larger applications.
- Mr. Koyama asked about the energy storage capacity of the Hydrostick.
  - The Hydrostick holds 11 watt hours of energy.

10.3 Dr. Paul Osenar, President and Chief Executive Officer, Protonex Technology Corporation

Dr. Osenar gave an overview of Protonex and its products. Protonex is focused on 100–1,000 watt high-performance portable and remote power solutions, and specializes in both proton-exchange membrane and solid-oxide fuel cell technology. Its targeted applications include military battery charging, unmanned aerial vehicle power, auxiliary power unit, and general portable power products. Dr. Osenar detailed Protonex's suite of military portable power units, which range from single battery chargers to current tactical generators for high-powered equipment. He also described the company's unmanned aerial vehicle power systems.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_protonex.pdf

Questions, answers, and comments

- Mr. Koyama asked about the pressures under which the stacks operate.
  - Dr. Osenar replied that the systems run at less than 10% parasitic power.
- Dr. Ogden asked if Protonex has considered applying their 500- and 600-Watt systems to electronic bikes.
  - Dr. Osenar replied that finding a refueling system is still a challenge. Furthermore, polymer electrolyte membrane (PEM) bike systems have not proven to be cost effective.

Questions, answers, and comments posed to the panel

- Chairman Shaw asked the presenters about their biggest challenges in convincing investors that theirs is a viable business opportunity.
  - Mr. Böhm and Mr. Wankewycz both stated that the best way to attract capital is to project confidence. This involves being creative as well as having a commercialized, marketable product early on.
  - Dr. Osenar stated that while his company initially received venture capital funds and was listed on the AIM market in London, they have since turned inward and are no longer publically traded because they felt there was not enough public interest in fuel cells.
- Dr. Odgen asked the presenters to comment on whether or not they think there is a clear transitional path from current hydrogen-based portable power technology toward larger applications (such as vehicles and stationary power).
  - Mr. Wankewycz stated that his company has had this as a goal from day one; their commercialized smaller-scale applications are funding the research and development (R&D) for larger applications.
  - Mr. Böhm stated that his company's success with shipping fuel proves that there needs to be a greater willingness to try a novel approach.
  - Dr. Osenar added that he likes the idea of small, regionally-focused zones of refueling infrastructure, such as in Hawaii.

11. New York State Initiative Presentation, Mr. Matt Fronk and associates

Mr. Fronk discussed plans to support fuel cell vehicle commercialization and build hydrogen infrastructure in the state of New York. He detailed a public-private partnership developed by State Assemblyman Joseph Morelle that is working to generate a commercialization plan for fuel cell

vehicles in the state of New York, using New York State Energy Research and Development Authority's (NYSERDA's) "NY Hydrogen Highway" as a foundation. Mr. Fronk also cited a 2011 DOE study that projects the fuel cell and hydrogen industries to create between 360,000 and 675,000 jobs nationwide.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_nyserda.pdf

Questions, answers, and comments

- *Chairman Shaw asked* about the size of the fleet that the program is intended to support.
  - Mr. Fronk replied that in a given city such as Rochester, they would install eight to 10 stations to service 3,000–4,000 vehicles. There are 100 stations that could support up to 50,000 vehicles.
- Dr. Ogden asked if Mr. Fronk and his group are working with any industrial gas suppliers.
  - Mr. Fronk stated that the station cost estimates do include synthesized data from hydrogen gas suppliers.
- Mr. Freese asked about the assumptions for hydrogen throughput for a single station.
  - Mr. Fronk replied that his group is still discussing throughput levels.
- Mr. Freese asked if Mr. Fronk is considering on-site reforming of natural gas or off-site centralized reforming.
  - Mr. Fronk stated that they are still in the process of discussing all of the options with various suppliers, including Hess, Praxair, Air Products, Hydrogenics, Linde, and Proton, and have not yet settled on the most cost-effective technology.
- Mr. Rose suggested Mr. Fronk consult with Dr. Ogden as she has overseen a similar project in California. He also offered to speak further with Mr. Fronk.
- Chairman Shaw suggested Mr. Fronk contact Air Liquide regarding their commercially available small-scale steam-methane reformer.
- Chairman Shaw suggested Mr. Fronk reach out to New York Governor Andrew M. Cuomo for support in attempting to engage U.S. President Barack Obama.

12. HTAC Evaluation Matrix Discussion, Mr. Frank Novacheck

Mr. Novachek presented a draft of a proposed "scorecard" or evaluation matrix that HTAC could include in its 2011 Annual Report as a pictorial of status/progress.

>>see full presentation at http://www.hydrogen.energy.gov/pdfs/htac_june2011_scorecard.pdf

Questions, answers, and comments

- Mr. Novachek added that he foresees the matrix used as a framework for presenting results in the HTAC Annual Report.
  - Chairman Shaw agreed with using the matrix.
- Dr. Carlin suggested that Mr. Novachek represent the impact of budget cuts in the matrix, including whether current funding levels are sufficient.
- Mr. Rose suggested adding national security to the performance criteria.
  - Mr. Rose commented that the performance metrics are confusing. He asked if they are measures of progress, status or potential? (e.g., with environmental side, it's more of a potential impact than a status.) For each performance criteria, what does HTAC want to show? Current progress? Where we stand? How long to get to end game? All of the above?

    - Mr. Freese suggested adding a numerical measurement for each criterion to indicate whether work is progressing forward. He also suggested that there be some measure of whether any policy measures have been put in place to incentivize the industry to act.
- Dr. Bond noted that the color red in a matrix will always draw a reader's attention.
- The Policy and Planning Committee, led by Mr. Rose, will work with Mr. Novachek to revise the matrix and will send a revised draft to HTAC members for comment before the next meeting.

13. Suggestions for Upcoming Meeting Agenda

- State Presentations: Hawaii, South Carolina, Ohio, and Florida are all options.
    - Mr. Kaya will put together a list of potential speakers from Hawaii for Chairman Shaw by midsummer. Mr. Freese volunteered GM for a presentation on the Hawaii Initiative, and Dr. Carlin said that the U.S. Department of Defense (DOD) could also present.
    - If Hawaii does not work out as a topic, South Carolina would be the second choice.
    - Dr. Wyman suggested Indiana and the "Energy Systems Network" (ESE) as a potential topic. The ESE includes chief executive officers from Allison Transmission, Delphi, Cummins, Duke Energy, American Electric Power, Purdue, and more. Dr. Wyman added that he may be able to convince Paul Mitchell to speak.
        - Dr. Wyman will email Chairman Shaw more information on the ESE and potential topics.
- Entrepreneur Presentations:
    - Focus on hydrogen production
        - Mr. Novachek suggested Al Weimer from the University of Colorado speak about his solar reactor project.
        - Chairman Shaw suggested Dave Edlund speak about small scale methanol reforming.
        - Mr. Rose suggested hydrogen reforming as a topic. He also proposed discussing small-scale electrolyzers that use renewables.
        - Chairman Shaw suggested that an entire meeting devoted to hydrogen production could be an ideal way to jump-start the Blue Ribbon Panel that Dr. Satyapal has proposed.
- Regulatory Constraints to Adoption of Distributed Generation
    - Mr. Novachek suggested they invite regulators and utility executives, for example Kim Rogers.
- Solid Oxide Fuel Cell (SOFC) Developments
    - Mr. Rose suggested inviting a DOE technology development manager as well as technology developers and system integrators.
- Batteries
    - Chairman Shaw suggested inviting Dave Howell from the EERE Vehicle Technologies Program to discuss established battery companies as well as innovative/entrepreneurial companies.
    - Chairman Shaw also suggested inviting Pat Davis.
    - Dr. Ogden suggested a presentation on battery technology analyses.
- Update on ARPA-E (if different from the February 2011 presentation)
    - Chairman Shaw suggested a presentation from ARPA-E regarding advanced technology.
- 2011Annual Report on the State of the Industry

- Chairman Shaw stated that a discussion of the HTAC's 2011Annual Report must be included in the November agenda.

- Working Group Updates
  - Dr. Taylor suggested a status report on existing industrial infrastructure
    - Dr. Taylor will follow up with Chairman Shaw on suggestions for who could be invited to make this presentation.
- Whole Foods Site Visit
  - Mr. Rose stated that Whole Foods has 61 fuel cell lift trucks in warehouse in the Washington, D.C., area, so a site visit there could be included at a future Washington-based meeting.
- Infrastructure Cost
  - Mr. Freese suggested a comparison of the costs of battery charging infrastructure and hydrogen fueling infrastructure.
  - There was discussion on forming a panel about infrastructure.
- Natural Gas
  - Mr. Freese suggested a discussion on the connections between hydrogen and natural gas.
  - It was suggested that natural gas players such as pipeline owners, gas companies, etc. be invited.
- Federal Government Partnerships (DOE, DOD, DOT, etc.)
  - What activities currently exist and how can HTAC help with further coordination?
  - It was noted that DOT Secretary LaHood visited the California Fuel Cell Partnership and suggested he be invited to the HTAC.
- ERAC
  - Continue coordination with ERAC; perhaps periodic briefings/updates. Coordinate with ERAC on future correspondence to Secretary Chu to present a cohesive message.
- New HTAC Working Group on H2 Production
  - Chairman Shaw will discuss this further with Dr. Satyapal, specifically whether an HTAC working group is needed, the concept of a blue ribbon panel outside of HTAC, how HTAC would advise the panel, etc.
- Chairman Shaw asked that all HTAC members send him any further suggestions for speakers for the above topics and/or suggestions for other agenda topics.

14. Adjourn 12:27 p.m. EST.

FIFTEENTH MEETING OF THE

HYDROGEN AND FUEL CELL TECHNICAL ADVISORY COMMITTEE

PARTICIPANT LIST

JUNE 13-14, 2011

HTAC Members Present

- Peter Bond
- Mark Cardillo
- Richard Carlin
- Charles Freese
- Maurice Kaya
- Harol Koyama
- Frank Novachek
- Joan Ogden
- Geraldine Richmond
- Bob Rose
- Bob Shaw
- Kathleen Taylor
- Bill Wylam

HTAC Members Not Present

- Anthony Eggert
- John Hofmeister
- Alan Lloyd
- Levi Thompson
- Jan van Dokkum

Members of the Energy Efficiency and Renewable Energy Advisory Committee in Attendance

- Arati Prabhakar (via teleconference)

U.S. Department of Energy Staff

Office of Energy Efficiency and Renewable Energy

- Steve Chalk
- Jason Marcinkoski
- Michael Mills
- Sunita Satyapal

Members of the Public in Attendance

- Christian Böehm – SFC Energy, Inc.
- Sara Cerri – Consultant
- Matt Fronk – Matt Fronk & Associates
- Leo Grassilli – D&L Energy Consulting

- Dan Hennessy – Delphi
- Kevin Kenny – Sprint
- Michelle Lauterwasser – Becker and Becker
- John Love – New York State Energy Research and Development Authority
- Steven Medwin – The Raymond Corporation
- Paul Osenar – Protonex Technology Corporation
- Bryan Pivovar – National Renewable Energy Laboratory
- Michael Resner – Office of Naval Research / Syntek
- John Saintcross – New York State Energy Research and Development Authority
- David Seeley – New York State
- Benny Smith – Golub Corporation
- Sandy Thomas – Consultant
- Taras Wankewycz – Horizon Fuel Cell Technologies
- David Wetter – David Wetter Consulting

Support Staff

- Judi Abraham – Conference Management Associates, Inc.
- Kristine Babick – Energetics Incorporated
- Dottie Bunn – Bunn & Associates
- Melissa Laffen – Alliance Technical Services, Inc.
- Shawna McQueen – Energetics Incorporated
- Kristen Nawoj – SRA International