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Administration of H-Prize Final Report

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Abstract

The Hydrogen Education Foundation (HEF) administered the H-Prize, a program authorized by Congress in 2007 to incentivize innovative technology development in the hydrogen and fuel cell sector. Under this authorization, DOE allocated \$1 million for one Prize. DOE selected HEF competitively in 2008 to administer the competition, perform fundraising activities to develop a robust prize program, and perform marketing and communications, from 2008 to 2017.

HEF administered two H-Prize competitions for DOE, the first for development of hydrogen storage materials for use on board fuel cell electric vehicles, and the second for a home or community sized hydrogen fueling system. HEF marketed the competitions through industry channels, at industry meetings, a specialized website and press releases to obtain entrants to the competitions. HEF provided assistance to the DOE for development of the judging criteria, and administered the judging and the final decision processes. In parallel, HEF sought additional prize funding from industry and foundations to expand the number of potential competitions and the amount of future prizes, consistent with the Congressional authorization of H-Prize.

The first prize sought the development of a hydrogen storage material that could meet DOE's criteria for onboard storage. This competition did not achieve any entrants that met the requirements. The second prize was for a small-scale hydrogen fueling system. The \$1 million prize was awarded to the industry consortium SimpleFuel for their home hydrogen refueling system.

HEF executed a three-pronged strategy for raising funds to expand the competitions through private (non-public) funding – corporate contributions consistent with company interests; foundation contributions consistent with their goals; and individual contributions, principally through the United Way Campaigns. For a variety of reasons, HEF did not achieve the envisioned fundraising goals, which made it difficult to achieve the excitement originally envisioned by the H-Prize Congressional authors. Originally planned as a multi-year, multi-prize competition, an expansion of H-Prize to additional competitions with potentially larger awards did not happen.

Prize competitions remain a useful way to stimulate technological innovation by researchers and product developers. Creating excitement through topic selection and harmony with important and achievable energy goals that inspire both applicants and their development work, and prize funders, is key.

Key Words

Hydrogen, Fuel Cells, Refueling System, Community Refueler, Home Refueler, Hydrogen Station, Refueling Station, Competition, Prize, Award, Department of Energy, Hydrogen Education Foundation, Hydrogen Storage, National Hydrogen Association, Technology Transition Corporation, South Carolina Research Authority, Southwest Research Institute, H-Prize, H2Refuel

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Executive Summary

In 2007, Congress authorized the H-Prize in Section 654 of the Energy Independence and Security Act of 2007, directing the Secretary of Energy to implement a robust competition with the goal of awarding large cash prizes in three categories to advance research, development and demonstration of hydrogen energy systems. The U.S. Department of Energy (DOE) selected the Hydrogen Education Foundation (HEF), a 501(c)(3) organization, to be the independent administrator of H-Prize. DOE allocated \$1 million for the first prize. DOE tasked HEF to administer the pilot award process, organize and execute a comprehensive fundraising program, deploy H-Prize funds through a fair and open competition and help focus H-Prize on critical technical challenges.

From 2008 to 2017, HEF provided the administrative leadership for the H-Prize competition, which ended in the successful completion of the second H-Prize, the H2 Refuel Competition, and award of the \$1 million H-Prize on January 19, 2017, to finalist SimpleFuel. HEF's role was to provide expert knowledge to the DOE on potential themes for the prize, help select judges, develop timelines, provide marketing and outreach to the public, raise funding, attract competitors, and provide stakeholders with regular updates and information on the progress of the competition.

The original H-Prize was launched in 2009. For the first competition, DOE focused on the development of an advanced hydrogen storage material or technology for onboard vehicle storage. DOE determined that this was the most difficult challenge in commercializing hydrogen-fueled light duty vehicles. HEF and DOE developed the Contest rules jointly. HEF used its extensive hydrogen community database and media contacts to promote the Contest after the initial announcement in the Federal Register. The goal was to seek material and technology solutions that could meet or exceed DOE requirements in key elements including material weight, volume, pressure, temperature, cost, life cycle efficiency, durability, dispensing and thermal management properties. Fourteen entities submitted at least partial applications to compete, of which HEF and DOE considered eight to be complete. Two teams submitted complete applications with material samples in 2010. The judges, recommended by DOE and assembled by HEF, determined that neither team met the minimum requirements set by H-Prize and the prize was not awarded, with the funds reserved for a future prize. Though unsuccessful in awarding the prize, the topic did draw attention to the critical parameters that a material must meet to make hydrogen fuel cell electric vehicles comparable to traditional gasoline vehicles.

In 2012, DOE and HEF began to develop a second prize. The interim search, supported by HEF among industry stakeholders, identified a competition theme focused on accurate measurement technology for hydrogen fueling dispensers. However, it was found that a company was already developing accurate metering capability, and the theme was abandoned.

DOE then developed the 2014-2016 H2 Refuel H-Prize competition, after deciding that a residential or community fueling system was an important component to complement the deployment of commercial stations in California. In 2013, HEF hosted a separate student competition on a small-scale drop-in fueling station, and was able to apply its experience to the new similarly themed H-Prize.

The competition launched in 2014 and HEF received six design submissions by the phase 1 deadline in October 2015. A panel of judges and safety experts conducted a thorough review of the entries and concluded that one submission met the criteria to advance to the finalist stage. During the second phase, the Finalist constructed in 8 months and tested a prototype system for 3 months. NREL

completed data collection in December 2016. After thorough analysis of the data, a team of judges evaluated the results and determined that the system met the competition criteria and minimum requirements necessary to win the \$1 million prize. After receiving their award in January 2017, SimpleFuel has gone on to create a business venture to create and market a commercial product around their design.

To achieve the objectives of the H-Prize legislation, which sought an expanding group of prizes with increasing awards for complex solutions, HEF initiated three fundraising strategies: direct industry solicitation, specialized foundation fundraising, and personal contributions utilizing regional Combined Federal Campaigns. HEF employed the South Carolina Research Authority (SCRA), with experience in fundraising around technical challenges, to undertake a comprehensive solicitation for HEF among industry players, as well as private and public foundations. HEF also applied and was accepted into the Combined Federal Campaign (CFC) to allow individuals to make tax-deductible contributions to HEF's H-Prize. HEF marketed this CFC opportunity to its broad database and through collaboration with regional CFC organizations.

These fundraising efforts were largely unsuccessful. HEF believes the fundraising efforts were unsuccessful due to the narrowness and specificity of the first competitive challenge, the small number of potential applicants that have the required R&D experience and resources to apply, and the difficulty in marketing a highly technical prize theme. As efforts progressed and focused on the second prize competition, fundraising was not a priority.

The selection of the original H-Prize theme, a materials solution for onboard vehicle hydrogen storage, was a critical program challenge for DOE's hydrogen program. However, HEF has concluded that it was far too ambitious for the first prize competition. Some organizations with capability were not eligible as a result of receiving DOE funding for their research. Others would need to apply significant resources to R&D with no assurance of a return on that investment. A Prize competition with a broad objective that inspires innovation by a wide variety of researchers also inspires foundation and private funding support. HEF was able to raise about \$6,000 from its participation in the Combined Federal Campaign (CFC) catalog listing in two consecutive years. This result was small for the investment HEF made in the thorough application process and auditing associated with the application for the Campaign. Fundraising from foundations and corporate sponsors did not yield positive responses, possibly because H-Prize did not achieve widespread interest with its initial, very challenging technical target. A robust multi-year corporate and foundation fundraising campaign may have produced better results, but HEF lacked the H-Prize administrative funds to continue these efforts beyond the first year, particularly in the context of the very specific topic in the first prize and the low number of participants.

1. H-Prize Creation and the Role of HEF

The U.S. Congress authorized the H-Prize in Section 654 of the Energy Independence and Security Act of 2007¹ to accelerate the development of hydrogen and fuel cell technologies by offering prizes to motivate and reward outstanding scientific and engineering achievements. Mobilizing private funding, in concert with a core of federal and other public funds, was at the heart of the H-Prize concept. The impetus for the H-Prize was based on the highly successful and renowned X-Prize. This had the potential to broaden the base of investment in dramatizing notable scientific and engineering breakthroughs, while elevating their significance with the public. The H-Prize would build on DOE's steady achievements in research, development and demonstration, leveraging federal funding to assemble a much wider resource base.

The legislation directed the Secretary of Energy to implement a robust competition that awarded cash prizes in three categories to advance research, development and demonstration of commercial application of hydrogen energy systems. It articulated three award levels with prizes between \$1 million and \$10 million.

HEF Selected to Administer H-Prize

HEF was awarded the Cooperative Agreement to administer the H-Prize, heading a team that included its management company (also the management company for the National Hydrogen Association), Technology Transition Corporation (TTC), and South Carolina Research Authority (SCRA), bringing to the project many years of successful management and fundraising in the service of advanced technologies. TTC had managed the competition of the Utility PhotoVoltaic Group's \$73 million "TEAM-UP" program from 1995 to 2001, the HEF's "H2 and You" Public outreach program, several HEF student design competitions and over 20 years of national and international conferences for multiple nonprofit organizations. SCRA had built two development funds totaling \$21 million with its fundraising efforts.

Work began under the cooperative agreement immediately upon execution of the award to HEF with initial consultation with DOE's Hydrogen Technology Advisory Council (HTAC) in November of 2008. The project director for H-Prize was Jeff Serfass, President of the HEF. H-Prize technical direction was initially provided by Jerry Hinkle, Geoffrey Bromaghim, Patrick Serfass, Brian Schorr, and more recently, Emanuel Wagner, now Vice President of HEF. The lead for SCRA at the time was Russ Keller.

HEF collaborated with the South Carolina Research Authority (SCRA) as a subcontractor to lead fundraising efforts, since part of the concept for H-Prize was to raise additional funds for prizes from private industry and foundations to support future prizes.

The strategic objectives of the DOE cooperative agreement with HEF was to:

- Create a pilot award process
- Organize and execute a comprehensive fund raising program
- Deploy H-Prize funds through a fair and open competition

¹ <https://www.congress.gov/bill/110th-congress/house-bill/6/text>

- Help focus H-Prize on critical technical challenges, solutions that move hydrogen and fuel cell technology closer to market implementation

2. First Prize Competition: Onboard Vehicle Storage

DOE recommended that the first H-Prize would be for advances in technologies, components or systems related to mobile, onboard hydrogen storage. The award would be \$1 million for a significant advancement in hydrogen storage materials for light duty vehicle applications. DOE's goal was to achieve at least a 300-mile range across different vehicle platforms without compromising payload, space or performance. Weight, volume, thermal management, safety and costs were all considerations.

This would be the pilot project for the H-Prize program and was titled "Breakthrough Advances in Materials for Hydrogen Storage".

The goals and technical challenges of this prize focused on:

- Material and technology solutions that would meet or exceed DOE requirements in the identified technical challenges developed by DOE and HEF, with considerable review by DOE, including legal review: Materials, with weight, volume/space, pressure, temperature and cost considerations
- Life cycle efficiency
- Durability/operability
- Charge and discharge rates
- Codes and standards requirements
- Balance of plant components
- Dispensing
- Thermal management
- Subsystem life cycle assessments

Although there had been research progress in storage materials over the years, no technology currently existed that met all of its targets.

HEF provided industry input and materials to support the development of this prize theme.

Fourteen entities submitted at least partial applications to compete in the first H-Prize, and HEF and DOE determined that eight were complete applications. However, after review of actual samples, DOE announced that the "Breakthrough Advances in Materials for Hydrogen Storage" H-Prize competition had closed with no entry meeting the criteria. The prize was not awarded and remained available for future competitions.

3. Search for the Second H-Prize Theme

Upon the unsuccessful conclusion of the first competition, DOE and HEF discussed potential topics and assessed the competition and the experiences gained in managing the first prize. With HEF now having a reduced administrative budget, DOE led the search for a new prize which included a Request for Information soliciting ideas for H-Prize topics and criteria for advancements that would help to enable

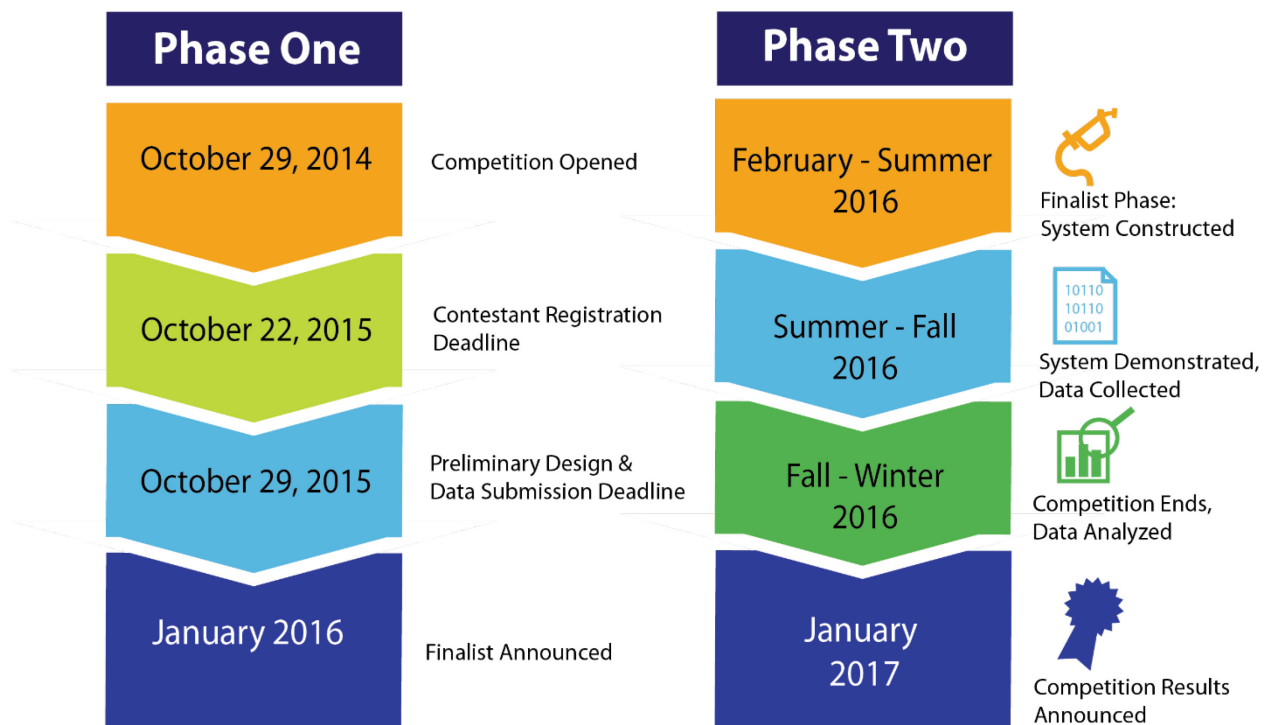
the widespread commercialization of hydrogen and fuel cell technologies. HEF promoted the RFI DE-FOA-0000680 Hydrogen Prize Topic to its industry database of 20,000+ contacts through an email announcement.

Following the RFI, DOE selected the topic of “Hydrogen Metering” because stakeholders wanted to ensure that the hydrogen dispensed at fueling stations is measured with accuracy comparable to the dispensing of gasoline. This was anticipating automakers’ plans to commence sales of fuel cell electric vehicle (FCEV) in the following years, along with the development and operation of commercial hydrogen fueling stations. DOE and HEF considered allocating the \$1 million H-Prize to the team that was able to develop the most accurate meter that met NIST measurement standards and could work in a hydrogen fueling station dispenser.

However, in early discussions with industry and stakeholders, it was found that a private entity was already developing a technology similar to what was to be requested through the H-Prize. As a result, DOE decided to abandon the idea of a prize on metering. To save the limited resources available for HEF, DOE asked HEF to cease support of H-Prize activities until a new topic was identified.

4. Second Prize Competition: H2 Refuel H-Prize

In January 2014, DOE communicated to HEF that it had drafted guidelines and criteria for a second H-Prize competition. The topic was to develop a small-scale refueler system for home or community settings. The approach was to challenge America’s engineers and entrepreneurs to develop affordable systems for small-scale, non-commercial hydrogen fueling, at homes or multi-use sites that could supplement the current development of hydrogen fueling station infrastructure.



After the initial launch of the competition on October 29, 2014, interested parties had about one year to register and complete their design submissions. On September 3, 2015, the Federal Register published an update to the Rules and Guidelines, after DOE and HEF identified several issues and provided clarification based on comments from the public.²

After the registration deadline closed on October 22, 2015, HEF and DOE review determined that six registrations for the H2 Refuel H-Prize met the registration requirements and eligibility criteria. Eight additional registrations did not meet the registration requirements and did not qualify. The qualifying registrants were:

- Katsu
- Ion Power
- Millennium Reign Energy
- Reactwell, L.L.C.
- SimpleFuel
- Washington State University

All six registrants submitted entries via the HEF-developed H-Prize website by the October 29, 2015 deadline. DOE and HEF determined that four submissions met initial review criteria necessary to warrant a complete review and consideration for phase 2. Only one submission met all the criteria and was able to advance as a Finalist, while a second submission required additional review. Due to the time needed for the additional review, DOE issued a Federal Register Notice with an updated schedule to allow the Finalist to complete the Prize in the time frame stipulated in the Rules and Guidelines. The finalist team was given six months to build its system after they received the notification that their preliminary design submission was selected for Phase 2.

On November 9, 2016, the SimpleFuel team held an Open House event at the PDC Machines facility in Warminster, PA to provide an opportunity for the public to get a look at the system as required by the competition guidelines. Over 50 people attended, including Sunita Satyapal, Director of the Fuel Cell Technologies Office in the Office of Energy Efficiency and Renewable Energy (EERE) at the Department of Energy. The event included a ceremonial ribbon cutting and fueling demonstration. Attendees had the opportunity for a ride and drive with the FCEV used to showcase hydrogen fueling.

Achievement of Prize Goals – Product Development

The winning team of the H2 Refuel H-Prize, SimpleFuel™, brought together three companies, Ivys Energy Solutions, PDC Machines Inc. and McPhy Energy North America.

After winning the competition, the team continued its commercialization efforts, offering “The SimpleFuel™ Home Vehicle Refueling Appliance”.³ They were able to secure several contracts with customers interested in different versions of their demonstration refueler system. After the end of the

² <https://www.federalregister.gov/documents/2015/09/03/2015-21733/h2-refuel-h-prize-final-guidelines-update>

³ According to the winners, the system is a fully integrated hydrogen generation, compression, storage and dispensing system capable of delivering up to 5 kg/day of hydrogen to fuel cell vehicles at pressures up to 700 bar. More information is available at www.teamsimplefuel.com.

competition, the team continued to run their system in Warminster, PA, and conducted refueling for their FCEV on site.

The H-Prize announcement was covered in a number of website articles, including Scientific American⁴, Green Energy News⁵, GreenTech Media, Edmunds.com⁶, autoblog⁷, NewsWire⁸, TriplePundit⁹, Environmental Expert¹⁰, gasworld¹¹, and others.

The intellectual property of the design and system, and all materials submitted remained with the contestants. The submissions were reviewed by the hydrogen safety panel and judges. HEF received written guarantees by the reviewers that upon completion of the review, all documentation, written or electronic, were sent back to HEF or destroyed by the reviewer. DOE and NREL retain materials related to the contestants, including data related to the testing of the system.

5. Fundraising

HEF presented and discussed a fundraising plan on October 15, 2008, including near-term, intermediate-term and long-term goals, target audiences, and marketing and outreach strategies. In this plan, HEF pursued two strategies for raising funds for the “Breakthrough Advances in Materials for Hydrogen Storage” H-Prize competition, listed below, and eventually a third strategy also listed below:

- Sponsorship from corporations in HEF’s database including members of the National Hydrogen Association
- Funding from foundations with an interest in clean energy and environmental issues
- Individual contributions from people intrigued by the clean energy opportunities in hydrogen-fueled transportation and other energy sectors

HEF included in its proposal to DOE collaborating with the South Carolina Research Authority (SCRA), an organization well known to the National Hydrogen Association, to implement fundraising efforts for H-Prize. HEF executed a fixed price contract with SCRA on June 6, 2009 to utilize their experience in project fundraising, development of a foundation list, communications plan and announcements, as well as communications with family and corporate foundations.

Together, HEF and SCRA drafted materials for fundraising, awaiting official notification of the program in the Federal Register. SCRA and HEF developed an executive summary of the program scope and timeline for the content necessary for initial public announcements and a focused mailing to target “high net worth” individuals and organizations. SCRA developed a list of over 200 targeted contacts and organized

⁴ <https://www.scientificamerican.com/article/a-new-pathway-to-reach-totally-carbon-free-hydrogen-fuel/>

⁵ <http://www.green-energy-news.com/nwslnks/clips1014/oct14009.html>

⁶ <https://www.edmunds.com/car-news/honda-revs-up-push-for-hydrogen-fueled-vehicles.html>

⁷ <https://www.autoblog.com/2017/01/23/simplefuel-home-h2-fueling-system-refuel-h-prize/>

⁸ <https://globenewswire.com/news-release/2017/01/24/910482/0/en/H2-mobility-McPhy-Energy-North-America-and-its-SimpleFuelTM-team-members-declared-winner-of-the-1-million-H2-Refuel-H-Prize-Competition-by-the-DOE.html>

⁹ <https://www.triplepundit.com/2017/01/companies-team-hydrogen-economy/>

¹⁰ <https://www.environmental-expert.com/news/webinar-june-25-h2-refuel-h-prize-overview-and-q-a-532389>

¹¹ <https://www.gasworld.com/mcphy-to-develop-simplefuel-in-europe/2012430.article>

them into groups that can be addressed via similar strategies, though the focus was on large donors. Groups included:

- private foundations with a history of supporting the promotion of energy or environmentally related solutions;
- high net worth individuals with a history of supporting energy and environmental issues;
- large energy companies, automotive and supply chain manufacturers;
- progressive firms of all types that are dependent upon advanced technologies for growth, and see the particular energy efficiency, job creation and emissions gains from hydrogen and fuel cells;
- the broader community of hydrogen and fuel cell stakeholders; and
- the general public.

HEF developed marketing materials that provided details on the H-Prize and benefits and addressed potential misperceptions prospective funders may have about hydrogen.

A press release launched the fundraising effort, followed by direct marketing to the identified, personally developed contact at the key foundations to avoid having the first contact with potential large donors be interpreted as an unsolicited mailing. HEF then attempted to schedule personal meetings with responsive contacts in coordination with C-level individuals from the industry to provide additional perspective for the meeting. Development of contacts continued with high potential donors. HEF pitched sponsorship at industry conferences, beginning with the National Hydrogen Association's (NHA) Conference in March 2009 and the Fuel Cell Seminar in Nov 2009.

These outreach efforts included online applications, mailed materials and phone calls. SCRA and HEF identified potential donors using Hoovers, an industry directory, and the Foundation Center Directory Online, resulting in adding corporate and company foundations and venture capital firms.

HEF received a response to approximately 50% of the requests, on which HEF followed up. Many donors stated that they had already allocated their funding for 2010 or that our program fell outside of their respective organization's focus area for funding. HEF received a few comments requesting that it re-submit a request next year.

Through this period, the HEF/SCRA team members met bi-weekly to communicate progress and provide updates on outreach and fundraising efforts.

An additional strategy was to become certified to receive individual contributions through the Combined Federal Campaign (CFC). In 2010, HEF was audited, which was required to apply for the CFC and HEF staff received training. HEF was admitted to participate in the fall 2010 National CFC, to be included in all national catalogues as well as the Washington, DC catalogue.

The HEF/SCRA team implemented a marketing and outreach campaign that launched in the Fall of 2010 to coincide with the CFC. The team moved forward as follows:

- Designed and created a program flyer that was sent to local CFC offices around the country to distribute at their local events
- Launched an online ad campaign on www.Govexec.com that appeared on targeted pages such as the DOE page, Green Government, as well as a run of sites in the DC area

- Signed up for a mobile fundraising service to reach a broader audience of donors

HEF continued to receive donations from the CFC and proceeded to reapply for acceptance into the 2011 list of eligible organizations. The total contributions received over the two years was \$6,262.11, hardly enough to justify the staff time and audit expenses to obtain approval to participate in the campaigns.

The HEF/SCRA team also created a short list of prospective organizations to implement a long-term strategy, aimed to facilitate the relationship building needed to garner their support.

Except for CFC contributions from individuals, HEF did not receive any private funding for the H-Prize, a cause for concern and discussions among DOE and HEF staff, but these discussions did not lead to further actions.

For the second H-Prize competition, H2 Refuel, HEF and DOE considered the possibility for additional sponsorship from industry to expand the scope of work, but decided against allocating funding to it. HEF staff pursued sponsorship acquisition during this period on an opportunity basis, rather than as a dedicated effort, communicating with companies expected to have a direct interest in the H-Prize's success. Despite discussions with industry partners that had some interest in supporting the theme with up to \$100,000, HEF was not able to convert that interest to actual industry sponsorship. In part, the challenge to acquire significant industry sponsorship was the lack of opportunities that HEF could provide for advertisement or recognition under the H-Prize.

6. Establishing Prize Criteria

The "Breakthrough Advances in Materials for Hydrogen Storage" Prize competition focused on what was considered at the time a major barrier in the deployment of hydrogen-fueled cars, the safe onboard storage of enough hydrogen to provide for a 300 mile range or more within space, weight and other constraints. Storage as a gas or a liquid were available options but with their own limitations, so storage in a material became an important goal if all of the performance requirements were to be met.

HEF requested ideas from industry and the hydrogen community about technical evaluation criteria for the initial H-Prize Contest. HEF made a presentation to the HTAC on the pilot project planning, and requested feedback on a draft list of technical evaluation criteria. HEF initiated a similar dialogue with the Hydrogen Interagency Working Group.

By January 2009, HEF's consultations with the National Science Foundation, the National Academies of Science and Engineering, and at a group meeting of DOE National Laboratories and other federal agencies were completed. The results of these meetings allowed DOE and HEF to refine plans with a broader information base.

The team continued to evolve draft criteria with the DOE Storage sub-program and the hydrogen community, including important contributions from a group of National Laboratories and their Centers of Excellence. HEF received useful advice from the Army Research Laboratory, which had successfully completed its "Wearable Power" competition in 2008.

HEF staff and DOE met as needed to discuss key decisions and to review progress and industry ideas requested from NHA members and the hydrogen community. On February 5, 2009, HEF met with DOE

to discuss the parameters of the H-Prize and HEF-supplied responses from 13 industry and laboratory organizations on the H-Prize concept. Discussion at this meeting resulted in the following decisions:

- A single prize for the pilot was the best approach, with a testable material sample required by each contestant for independent testing.
- The quantity of the sample to be tested must be sufficient to prove ability to make it and scale it to a 300-mile range, or 300 to 500 grams of material.
- The testing duration would be 15 months to maintain the momentum of the competition.
- The schedule would be to announce the rules in April 2009, to complete testing by July 2010 and to announce the winner soon after.
- The contest would follow the recommendations of the U.S. Army on focus, rules, website and updates, agency and external publicity, and testing protocols.

The storage program and the team finalized a set of criteria and basic contest parameters for inclusion in a draft Federal Register Notice that received extensive comments.

Following this first H-Prize competition, efforts were made to establish the criteria for a hydrogen measurement device suitable for fueling station use. DOE presented draft criteria to HTAC during a conference call on September 5, 2012. The conference call also served as a preliminary announcement for a second H-Prize Competition and for staff to receive feedback from HTAC committee members on the proposal to launch a second competition.

HEF and DOE assembled an expert panel in the third quarter of calendar year 2012 to prepare testing procedures (based on industry feedback), formulate evaluation criteria, and develop competition guidelines. As discussed above, the topic idea for metering was abandoned as industry was already developing the technology.

For the H2 Refuel H-Prize focused on the development and demonstration of a community or home refueler, HEF provided input on the first draft of the refueler guidelines developed by DOE. On March 21, 2014, the Federal Register published the FRN, inviting the public to provide comments on the draft Rules and Guidelines. DOE received several comments, which prompted DOE, after review by HEF, to release a new version of the Rules & Guidelines.

DOE originally planned for the Competition to launch in the Summer of 2014 and last for 24 months from the release of the FRN to the public announcement of the winning entry at the conclusion, projected to be the third quarter of 2016.

Revisions to the Rules & Guidelines and further refinement of the criteria pushed the announcement of the H2 Refuel H-Prize back to October 29, 2014, which officially started the 2-year competition.

DOE and HEF developed two sets of criteria for the H2 Refuel H-Prize. The first set was the base, initial, or minimum criteria, used to determine if the judges would consider the submissions eligible to advance to the finalist phase. Independent judges and safety experts evaluated these criteria:

- Minimum dispensing pressure: 350 bar
- Maximum dispensing time (standard fill): 10 hours for a home refueler, 60 minutes for a community refueler
- Minimum hydrogen dispensed per day: 1kg/day (home) – 5 kg/day (community)

- Hydrogen purity: Meets SAE J2719 (Hydrogen Fuel Quality for Fuel Cell Vehicles)
- Fill method: Compliant with relevant codes (for automobiles, SAE J2601 Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles) and ensures that delivered hydrogen does not exceed the pressure and temperature limits of the vehicle storage tank.
- Safety: Meets relevant safety codes and standards for installation in target location

After the judges determined that the submissions by the registered contestants had met these criteria, a second set of criteria, the “Scoring Criteria”, was used to evaluate and determine the winning entry. Criteria topics were the same for all entries, but some score targets were different for home and community scale. Because DOE considered some of the criteria more critical, the criteria had different weights, to add up to a total of 50 points.

Safety concerns were of the utmost importance during the competition, both in relation to the contestants’ designs and system construction, as well as the proper functioning and safe utilization of the deployed systems.

Safe practices for the production, storage, distribution and use of hydrogen are essential to establish public confidence and for reducing barriers to widespread acceptance of hydrogen technologies. HEF’s H-Prize website linked to relevant codes, standards and safety resources that contestants needed to address in order to provide a successful submission. Contestants were also required, as part of the design submission for finalist selection, to include a safety plan and a hazard analysis. The finalist systems needed to show approvals from local planning, zoning, fire and building officials before system operation began. Applicants needed to include required approvals in the submission information. DOE and HEF hosted a webinar to provide interested parties an overview.

HEF made several safety resources available to contestants on the H-Prize website. In addition, DOE and the Safety Panel developed safety planning and hazard analysis guidance specific to H2 Refuel H-Prize submissions in the “Safety Planning Guidance for the 2014-2016 H-Prize Competition”.

7. Outreach and Marketing

DOE and HEF issued their announcement of the “Breakthrough Advances in Materials for Hydrogen Storage” H-Prize competition on September 26, 2009, with the FRN, followed by HEF’s announcement on September 30, 2009. HEF’s launch announcement of the H-Prize competition highlighted the \$1 million cash award to the individual or team that creates the most advanced materials for hydrogen storage in vehicles. The H-Prize was open to U.S. companies, U.S. citizens and legal U.S. residents, with certain restrictions. As outlined below, a communications plan was developed with a website for announcing details of the competition, application requirements and updates to the competition, and the registration deadline.

HEF developed an “Early Communications Plan”, which included a timeline for achieving specific tasks, e.g. improving the HEF website presence, creating an H-Prize site, preparing press releases, and creating a branded image for letterhead and marketing materials. SCRA developed marketing materials to obtain sponsors from foundations, agencies and corporations. HEF staff created marketing materials for increasing interest in competing in the contest. Due to the specificity of the H-Prize theme, HEF’s approach did not include multipliers like science magazines, reporters or other media contacts. Rather,

HEF focused on tapping into the network of existing contacts from the HEF and the National Hydrogen Association to generate interest among industry and academia.

HEF encountered delays in initiating these actions, and the first announcements were made in 2009 at the National Hydrogen Association international conference in Columbia, SC. HEF presented a poster shortly thereafter at the DOE Annual Merit Review. In addition, HEF developed the H-Prize website to present the FRN, provide a place to highlight any updates in rules, a bulletin board for entrants, and the portal for submitting an official entry.

Further delays in review, rewriting and publishing the Federal Register Notice pushed the official launch date back to September 30, 2009. As part of publicizing the H-Prize, HEF made presentations and supported preparations for presentations by DOE, e.g. at Resources for the Future in Washington on December 2, 2009: The Role of Prizes in Innovation and Entrepreneurship.

Notices were also sent to professional societies to include information about H-Prize in their conference announcements, while HEF handled a steady stream of discussions with prospective contestants. The website was steadily improved, and updated with each entry filing.

H-Prize mentions in the media began in 2006 by WIRED magazine¹² and in a 2007¹³ Associated Press article, with the announcement of the congressionally backed competition. Fuel Cell Works¹⁴, Inside Energy, and Edmunds.com¹⁵ each had articles on the announcement of the first prize, in August 2009.

After the first competition ended, DOE presented at HTAC to map a path forward to create the next competition. DOE released a Request for Information “DE-FOA-0000680 – Hydrogen Prize” for ideas on a second H-Prize. HEF promoted the RFI to its industry database through an email announcement.

For the H2 Refuel H-Prize and with a limited marketing budget, HEF conducted an extended outreach effort targeting hydrogen and engineering associations, as well as media publications covering topics in the energy and engineering sectors from early 2014 to October 2015. These included 15 media partners, 24 professional organizations like ASME, SAE, NSPE, AEE, 14 scientific and popular science publications, like WIRED, Science Daily, Environmental Science and Engineering Magazine. DOE provided ideas for agencies to communicate to and lists of interest, like challenge.gov. This outreach sought to rally participation in the competition as well as public recognition of the H-Prize and hydrogen as a transportation fuel.

To support this outreach effort, HEF and DOE agreed to relaunch the H-Prize website to a new platform to enable a more interactive and current interface for the public as well as added functionality for interaction of teams with each other, HEF, and the public. HEF staff proceeded to develop a second website to support such interactive ability, which replaced the previous website when DOE released the FRN. At that time, the website featured information about the competition including guidelines,

¹² <https://www.wired.com/2006/05/house-backs-10-million-h-prize/>

¹³ <https://www.wired.com/2007/06/house-backs-10-/>

¹⁴ <https://fuelcellsworks.com/archives/2009/08/27/doe-announces-initial-1-million-h-prize-competition-for-breakthrough-advances-in-materials-for-hydrogen-storage/>

¹⁵ <http://blogs.edmunds.com/greencaradvisor/2009/08/energy-department-launching-1-million-h-prize-for-hydrogen-storage-advances.html>

registration, and a link to the FRN. HEF developed a new logo based on the refueling theme of this competition.

Media partners would share information provided by HEF or DOE with their networks via either social media or more traditional distribution channels, like email. This allowed HEF to tap into a larger audience in return for recognition of the media partners on the H-Prize website.

At the request of DOE, HEF created and maintained a dedicated H-Prize Twitter account. After DOE approved a set of guidelines for HEF's activity on social media, HEF communicated progress updates via Twitter to the public and followers.

The H-Prize website was also designed such that the teams were able to post updates on their development efforts, share stories, blog posts, images etc. Only two contestants used this feature, and one developed a page for their entry, which HEF linked to.

HEF marketed the announcement of SimpleFuel as the Winner of the H2 Refuel H-Prize in coordination with DOE and the team. HEF also supported a webinar for the winners in which they communicated the features of their system in March 2017.

8. Judging

DOE and HEF selected five judges for the "Breakthrough Advances in Materials for Hydrogen Storage" Prize. The narrow field of technical expertise needed, combined with the legal (conflict of interest) requirements for judges limited the pool of eligible judges. Each judge signed a Certificate of Compliance with individual conflict of interest and non-disclosure acknowledgement, an HEF form developed in consultation with DOE.

HEF staff prepared and sent a detailed message to all the eligible H-Prize participants. With the November 15, 2010 deadline for receipt of materials approaching, staff reminded participants of the key contest deadlines, discussed contest procedures for testing and verification, and encouraged the participants to secure their independent testing with adequate time for meeting the November 15, 2010 deadline, should their storage material qualify.

Staff asked participants to send their independent testing results to HEF by October 29, 2010 so that HEF and DOE would have ample time for determining if any of the samples qualified for verification at the H-Prize testing facility.

Two teams submitted final applications with some technical information suggesting independent assessment of their technology. The judges determined that neither of the teams met the minimum requirements set by H-Prize, and HEF notified each team of the results. As a result, HEF did not request samples for testing.

For the H2 Refuel H-Prize, DOE proceeded to identify candidates to serve as judges. In addition, the Hydrogen Safety Panel identified a group of volunteers considered experts in hydrogen safety to review the submissions for their safety aspects. The judges had to submit Conflict of Interest and NDA forms prior to receiving any submission, and HEF managed this process. Judges who stated a Conflict of Interest recused themselves from reviewing the contestant submission in question.

After the October 29, 2015 submission deadline, DOE and HEF hosted a “Judging Tutorial Webcast” for the judges, which explained the criteria and the judging review sheet. During the following judging period, DOE and HEF hosted a review conference call for the judges, allowing them to ask questions, providing feedback on the review process, and discussing each entry briefly. The judges determined that two of the six submissions did not meet the criteria for the Finalist round and were not to be included in the detailed discussion at a follow-up in person judge meeting. The judges then proceeded to further review the four remaining submissions.

On December 7, 2015 the judges held a review meeting in Golden, Colorado, at which DOE and HEF provided support. The judges discussed the four remaining submissions in detail and determined that only one submission met the initial criteria, two submissions did not, and one required further information and clarification. After thorough review of the follow-up information, the judges decided that the submission in question did not meet the minimum criteria to move to the finalist phase of the competition. On January 30, 2016, DOE and HEF announced SimpleFuel as a Finalist for the H-Prize competition.

Over the next several months, the SimpleFuel team built and installed their system. HEF attended the installation of NREL’s data collection system (DCS) in August of 2016 to be used to collect the information necessary to assess the system with respect to the competition criteria. As required by the guidelines, at least two months’ worth of operational data had to be collected. Data collection began in September 2016 to evaluate the system based on the technical and cost criteria laid out in the guidelines. During the testing period, the system dispensed over 180 kilograms of hydrogen. NREL analyzed the data and made scoring recommendations to the judging panel, determining that the system met all the technical criteria during the testing phase.

The judging panel met in January 2017 and accepted the recommendations of NREL regarding the performance of the system within the parameters of the guidelines, and the judges made the recommendation to award the Finalist the \$1 million H2 Refuel H-Prize.

9. Lessons Learned and Conclusions

Running technology prize competitions, both with public and with private financing, helps leverage private industry innovation and investment into new and cutting-edge technology development, as the second H-Prize demonstrated. A focus on American companies and individuals helped incentivize the development of high-skilled jobs for an advanced domestic technology sector.

The success of competitions relies on a number of variables, and future competitions can benefit from improving certain factors discussed below.

Seed Funding vs. Winner-Takes-All

For both prizes, the technical requirements were aggressive, similar to those being incrementally addressed by multiple multi-year funded DOE projects. However, contrary to those efforts, H-Prize participants did not receive any financial support throughout the entire competition lasting several years, requiring investments by the participants with very uncertain payback. If competitors are expected to be large organizations, able to sustain the risk of not winning, and interested in the large public exposure that all competitors could receive, the winner-takes-all approach to the prize

competition is reasonable. But if smaller, less endowed organizations, are the likely participant audience, then seed funding availability for participants at an early stage to reduce financial risk and incentivize participation could build a larger competitive base for the H-Prize.

Marketing Needs vs. Small Promotional Budget

In negotiation of the HEF agreement with DOE, there was a need to keep administrative costs low. Even the \$300,000 allocated for the HEF's services, though small for the tasks to be accomplished, was large in comparison to the \$1 million H-Prize. Initial plans for the H-Prize assumed significant sponsorships and funds raised from foundations, which would have enabled additional Prizes and supplemented the budget available for management. The lack of success in that area limited not only the budget available to HEF for the initial prize, but also for the later prizes. The remaining funding available at the start of the second H-Prize was too low to provide even basic support for 2-year administration of the H-Prize. Although DOE did allocate additional funding, it was not approved until one year after the start of the second prize, limiting HEF support for the first year, and impeding the creation of a fully developed marketing campaign. This in turn limited HEF's ability to create more interest in the H-Prize through media, participants, large foundations and private donors. DOE also did not approve HEF's proposal to engage a professional marketing firm upon approval of the expanded budget.

Marketing and Fundraising Failure

The specificity of both prizes made fundraising from private foundations and corporate donors more difficult. H-Prize could have benefitted from an experienced big-prize marketer. The SCRA-contracted fundraising support was unsuccessful, possibly due to the limited experience of the contractor in this specific fundraising area. The contractor had raised funding support for energy projects, but not for a competition like H-Prize. However, HEF was not aware of established organizations in prize fundraising.

HEF and SCRA were not able to excite interest in the themes of the H-Prize. Despite the considerable effort to engage over 200 foundations in the clean energy and environmental field, no sponsorships or funds could be raised, aside of individual donations. HEF and SCRA may have focused too much on foundation funding, which can take years to develop, requires clear objectives and paths to achieving those, and is not a common avenue for prizes. A stronger focus on well-financed corporations and corporate foundations could have been more successful. Management of the fundraising effort and a lack of adjusting the approach after initial feedback was received may also have been factors. A potential contributing factor is that this effort took place in the aftermath of the financial crisis and recession of 2008.

Minimum Criteria Created Lack of Competition and Lack of Excitement

Marketing was hampered by the lack of competitors for the first prize, and only one finalist participant for the second prize. This lack of competition made developing exciting communications of the prize and results considerably harder.

It might be better to create guidelines that allow for more competition, rather than having difficult minimum criteria that need to be met. A more flexible evaluation system may invite greater competition in the contest.

Appendix – HEF’s Public Announcements for H-Prize



NEWS RELEASE

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H-Prize Accelerates Innovation of Hydrogen Technologies

Washington, DC – Over the next two years, the new H-Prize competition will award breakthrough innovators with the first ever cash prize intended to accelerate the research and development of hydrogen systems. The award is intended to be worth over \$1 million. In all, over \$50 million may be available for different prizes from a combination of private and public funds. The U.S. Congress authorized the H-Prize in Section 654 of the Energy Independence and Security Act of 2007 and directed the Secretary of Energy to implement six types of prizes in three categories. The U.S. Department of Energy has selected the Washington, DC-based Hydrogen Education Foundation to administer them.

“Hydrogen technologies are a key part of the alternative energy portfolio needed to address today’s challenges with energy security, the environment and creating new jobs,” said [fill in with DOE Official here]. “Like other prizes before it, the H-Prize will harness American ingenuity to accelerate the R&D needed to advance these technologies.”

The H-Prize bill, which was introduced in the U.S. House of Representatives by Congressmen Bob Inglis of South Carolina and Dan Lipinski of Illinois, features a special prize, worth over \$10 million, reserved for “transformational technologies.” It has been authorized to include up to \$40 million in additional funds from non-federal sources. Transformational technologies include breakthroughs which exceed established criteria, with minimal environmental impact and a significant potential for market success.

The five other authorized prizes total \$8 million in two categories: “prototypes,” and “advancements in technologies, components or systems.” The first H-Prize award will be in Advancements, for a significant breakthrough in mobile storage for light-duty vehicles. The rules will be announced in early 2009.

“The hydrogen industry has come a long way in expanding its use beyond industrial needs. New emerging markets and products for businesses are providing real benefits today. But this is only the beginning and more effort is needed,” said Jeffrey Serfass, President of the Hydrogen Education Foundation. “The H-Prize competition has the potential to unite hundreds of researchers, universities and garage tinkerers to discover new advancements that will transform the way our society can benefit from using hydrogen.”

To find out more about the H-Prize Competition, please visit www.HydrogenEducationFoundation.org.

About the Hydrogen Education Foundation

The Hydrogen Education Foundation is the charitable, education-focused arm of the National Hydrogen Association, the largest hydrogen trade association in the world. The HEF currently administers three hallmark programs, the H2 & You outreach program, the Hydrogen Student Design Contest and the H-Prize Competition. www.HydrogenEducationFoundation.org.



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FOR IMMEDIATE RELEASE

National H-Prize Competition Offers \$1 Million for Advances in Hydrogen Storage

*Sponsors and Contestants are Encouraged to Participate
Deadline is February 15, 2010*

Washington, DC – September 30, 2009 – The Hydrogen Education Foundation (HEF) has launched the H-Prize competition, offering a \$1 million cash award to the individual or team that creates the most advanced materials for hydrogen storage in vehicles.

The H-Prize is open to U.S. companies, U.S. citizens and legal U.S. residents, with certain restrictions. Participants must register on the H-Prize website by February 15, 2010.

The U.S. Congress authorized the H-Prize in Section 654 of the Energy Independence and Security Act of 2007 and directed the Secretary of Energy to implement a robust competition that awards large cash prizes in three categories. In all, the Act could provide up to \$4 million per year and a single \$10 million cash prize in public funding over a 10-year period for the most significant innovations in hydrogen storage, production, utilization and distribution. To augment prize funds, private donors are encouraged to contribute. In a competitive solicitation in 2008, the U.S. Department of Energy (DOE) selected the National Hydrogen Association's HEF, Technology Transition Corporation and SCRA to assist in administering the initial, pilot prize competition.

"The hydrogen and fuel cell industry has come a long way in expanding the use of hydrogen from its common use as an industrial chemical in making fertilizers and cleaning gasoline. New emerging markets for materials handling and emergency power are providing real benefits – but in some technology areas innovations in materials, efficiency and cost will make those benefits even more substantial," said Jeffrey Serfass, President of the HEF. "The H-Prize has the potential to unite researchers to create new advancements that will utilize domestic resources to sharply lower greenhouse gases in transportation and distributed electricity generation."

"SCRA is pleased to be a partner in administering the H-Prize with the Hydrogen Education Foundation," said Bill Mahoney, SCRA CEO. "This not only reflects SCRA's consistent ability to achieve assured

outcomes, but it also demonstrates our excellence as a partner in deploying important alternative energy technologies.”

SCRA has managed and executed both national and regional hydrogen fuel cell programs, and is deploying fuel cell technology at Ft. Jackson, SC, to the nationally recognized Greater Columbia Fuel Cell Challenge. SCRA’s principal role within the administration team will be as fundraiser for the competition, a role which has proven successful in similar responsibilities executed by SCRA’s affiliate, SC Launch, in raising private funds to support knowledge economy initiatives within South Carolina.

The H-Prize bill was introduced in the U.S. House of Representatives by Congressmen Bob Inglis of South Carolina and Dan Lipinski of Illinois. The bill has been authorized to include up to \$40 million in additional funds from non-federal sources, including up to \$10 million in “transformational technologies.” These technologies include innovations that exceed established criteria, with minimal environmental impact and a significant potential for market success. Sponsors are needed and are encouraged to contact HEF or SCRA to support this effort.

More info about the H-Prize competition, including eligibility, the registration process and technical criteria, as published in the Federal Register, is available at www.HydrogenPrize.org.

About the Hydrogen Education Foundation: HEF is the charitable, education-focused arm of the National Hydrogen Association, the largest hydrogen trade association in the world. The HEF currently administers three hallmark programs: the H2 & You outreach program, the Hydrogen Student Design contest and the H-Prize Competition. www.HydrogenEducationFoundation.org

About SCRA: SCRA is a global leader in applied research and commercialization services with offices in South Carolina, Ohio and in the Washington, D.C. area. SCRA collaborates to advance technology, providing technology-based solutions with assured outcomes to industry, government, and research universities in SC, the US and worldwide. www.scra.org

U.S. Department of Energy Extends RFI Deadline on Hydrogen Prize

On March 20, 2012, the U.S. Department of Energy Fuel Cell Technologies (“FCT”) Program released a Request for Information (RFI) seeking ideas for topics and criteria for a potential second Hydrogen Prize (“H-Prize”) competition. The H-Prize is administered by the Hydrogen Education Foundation (“HEF”). The original deadline for interested parties to submit responses was April 20, 2012. **The HEF is pleased to announce that DOE-FCT has decided to extend the deadline until to May 31, 2012 at 5:00 pm ET!**

This special competition was established by the Energy Independence and Security Act of 2007, Sec. 654, *to competitively award cash prizes that will advance the commercial application of hydrogen energy technologies by dramatizing and incentivizing accelerated research.* The competition focuses on four key development areas, which are: Production, Distribution, Utilization, and Storage. FCT’s RFI seeks responses by industry groups for topics and criteria related to the first three of those technology development areas.

Should a second H-Prize competition be launched, a cash award of up to \$1 million is available for a qualified winning entry. For more information about the H-Prize and a link to the RFI, visit the Hydrogen Prize website at www.hydrogenprize.org.

U.S. DOE Launches \$1 Million H2 Refuel H-Prize Competition for Small-Scale Hydrogen Refueling System

America's entrepreneurs and innovators invited to compete in designing clean transportation infrastructure

October 28, 2014 – Today, the U.S. Department of Energy's (DOE) Fuel Cell Technologies Office (FCTO) and the Hydrogen Education Foundation (HEF) announced the launch of the \$1 Million H2 Refuel H-Prize. The two-year competition challenges America's engineers and entrepreneurs to develop affordable systems for small-scale, non-commercial hydrogen fueling. This H-Prize competition will assist in expanding the hydrogen infrastructure across the country to support more transportation energy options for U.S. consumers, including fuel cell electric vehicles (FCEVs).

Successful entries will install and test systems that generate hydrogen from electricity or natural gas for refueling FCEVs. The winning team will receive a \$1 million cash prize.

Hydrogen infrastructure remains the most critical barrier to the widespread adoption of FCEVs. The H2 Refuel competition aims to address this barrier through easily deployed small scale fueling systems for home and community use until widespread infrastructure development takes place.

With support from the FCTO, private industry, and the Energy Department's national laboratories, significant advances in fuel cell and hydrogen technologies have already been achieved. In the last several years, automotive fuel cell costs have been reduced by more than 50 percent, fuel cell durability has doubled, and the amount of expensive platinum needed in fuel cells has fallen by 80 percent since 2005.

The competition is planned to last two years. In the first year, teams will register for the competition, find partners, design a system, find a site to install the system, and submit data and designs to a panel of independent judges. These judges will select the top teams as finalists to advance to the testing phase. Finalist teams would then have seven months to build, install, and prepare their systems for testing. The winner would demonstrate that they can meet both the technical and cost criteria as outlined in the final guidelines. The H2 Refuel H-Prize is administered for the Department of Energy by the Hydrogen Education Foundation.

Registration to compete in the H-Prize and more information are available at <http://hydrogenprize.org>.

About the Hydrogen Education Foundation

The Hydrogen Education Foundation, a 501(c)(3) organization, promotes clean hydrogen energy technologies through innovative national competitions and educational programs to encourage environmental stewardship, improve energy security, and create green jobs. www.HydrogenEducationFoundation.org

Hydrogen Education Foundation Publishes H2 Refuel H-Prize Technical Data Collection Requirements

Webinar on specification announced for May 14, 1 PM

April 2, 2015, Washington D.C. – Today, the Hydrogen Education Foundation has announced that the [technical testing specifications](#) for the Department of Energy’s Fuel Cell Technologies Office’s \$1 million H₂ Refuel H-Prize competition are now available on the H-Prize website at www.hydrogenprize.org. Participating teams are encouraged to review these specifications in detail prior to submitting their designs, which are due on October 29, 2015.

The H-Prize is a two-year competition challenging America’s engineers to develop the equivalent of home or community electric charging stations, but for hydrogen fuel cell electric vehicles (FCEVs). FCEVs are zero-emission electric vehicles, but have much greater range than pure battery electric vehicles and can be refueled in less than 5 minutes.

Finalist entries to the competition will be evaluated on both technical and financial criteria to determine the winner of the \$1 million prize. To evaluate the system performance against the technical criteria, the National Renewable Energy Laboratory will collect data from the finalists’ systems. The testing specification documents are intended to inform potential contestants about:

- the type of data that will be collected; and
- the requirements for compatibility with the data collection system.

On May 14, 2015 at 1 p.m. ET, H-Prize will host a webinar which will cover the specifications and testing plans and answer questions. Anyone interested in the competition are encouraged to attend, and the webinar will be recorded and posted at the H-Prize website, www.hydrogenprize.org.

Register for the webinar at <https://attendee.gotowebinar.com/register/1877656163529152513>. For more information on the H2 Refuel Competition, visit www.hydrogenprize.org.

H2 Refuel H-Prize Webinar May 14, 1 PM – Your Questions, Answered

Register for webinar and send in questions by May 8, 2015 at HPrize@ee.doe.gov

“What does it take to win \$1 million for an ingenious technology system?” and other questions related to the H2 Refuel H-Prize will be answered on May 14, 2015 at 1 PM ET; 10 AM PT, during a webinar hosted by the Energy Department’s Fuel Cell Technologies Office. Anyone interested in the competition is encouraged to participate in the presentation provided by DOE and submit questions, either ahead of time or live.

The H2 Refuel H-Prize has been launched late last year, and the guidelines and [technical testing specifications](#) for this \$1 million competition have been made available. Now is the time to ask questions regarding the H-Prize, the requirements, guidelines, and other aspects of the competition. For detailed answers, interested parties are encouraged to submit questions by to HPrize@ee.doe.gov or via twitter by including their twitter handle @H2Refuel in their tweet. Submitted questions will likely be answered during the event or afterwards as part of a [FAQ update](#) if the answer is too technical in nature.

The webinar will be recorded and posted at the H-Prize website, www.hydrogenprize.org.

Contestants are encouraged to review all specifications in detail prior to submitting their designs, which are due on October 29, 2015. Contestants may also use the H-Prize website to promote their activities or find collaborators

Registration for the webinar is available at

<https://attendee.gotowebinar.com/register/1877656163529152513>. For more information on the H2 Refuel Competition, visit www.hydrogenprize.org.

About the H-Prize

The H-Prize is a two-year competition challenging America's engineers to develop the equivalent of home or community electric charging stations, but for hydrogen fuel cell electric vehicles (FCEVs). FCEVs are zero-emission electric vehicles, but have much greater range than pure battery electric vehicles and can be refueled in less than 5 minutes.

“Safety First” Webinar for \$1M H2 Refuel H-Prize Scheduled for Aug 6, 1PM ET

August 6th webinar covers safety plans and hazard analysis competition requirements for a home or community hydrogen refueling system

Washington, D.C., July 24, 2015 – The Hydrogen Education Foundation (HEF) has announced a webinar on August 6th, at 1PM ET to discuss safety issues for the \$1 million H2 Refuel H-Prize competition. The U.S. Department of Energy's (DOE's) Fuel Cell Technologies Office will host the webinar, which will provide detailed information on the safety aspects of the competition including safety submissions and requirements. In order to be eligible for finalist selection, contestants must submit a safety plan and hazard analysis with their design. Anyone interested in the prize should register for the webinar [here >>](#).

The DOE's Hydrogen Safety Panel, represented by Nick Barilo and Don Frikken, will discuss safety planning and what information should be included in the required safety plan document. There will also be a general discussion on codes and standards and the need for local fire/building approval requirements.

As noted on the [H2 Refuel Safety Planning page](#), “safe practices in the production, storage, distribution, and use of hydrogen are essential for the widespread acceptance of hydrogen and fuel cell technologies.”

The [guidelines](#) and potentially relevant [safety information](#) for the H2 Refuel H-Prize competition are available online; designs are due by October 29, 2015. Registration for the H2 Refuel H-Prize closes one week before, on October 22, 2015.

Questions can be submitted ahead of time by sending an email to HPrize@ee.doe.gov or a tweet to [@H2Refuel](https://twitter.com/H2Refuel). Previously asked questions are available in the H2 Refuel H-Prize [FAQs](#). Registration for the webinar is available [here >>](#). The webinar will be recorded and posted on the H-Prize website, www.hydrogenprize.org.

Updated H2 Refuel H-Prize Safety Guidelines Available

Safety Guidelines Cover Safety Submission Requirements for the H2 Refuel H-Prize Competition

Washington, D.C., August 24, 2015 – The Hydrogen Education Foundation has posted updated [Safety Guidelines](#) developed by the Hydrogen Safety Panel for the \$1 million H2 Refuel H-Prize competition. The safety guidelines provide detailed information on the safety aspects of the competition, including safety submissions and requirements. In order to be eligible for finalist selection, contestants must submit a safety plan and hazard analysis with their design.

Those interested in competing in the H2 Refuel H-Prize competition should read over the Safety Guidelines. Further information on safety is available from the August 6th [Safety Webinar slides](#) and [webinar recording](#).

The [rules and guidelines](#) for the H2 Refuel H-Prize competition are available online; designs are due by October 29, 2015. Registration for the H2 Refuel H-Prize closes one week before, on October 22, 2015.

Rules & Guidelines for H2 Refuel H-Prize Updated

Changes reflect Comments and Questions Submitted to HEF and DOE

Washington, D.C., September 3, 2015 – The [Rules and Guidelines](#) for the \$1 million H2 Refuel H-Prize have been updated with clarifications, corrections, and additional information based on questions and other feedback received from the public.

The updates include:

Alternative scoring process: New information and comments received by the Fuel Cell Technologies Office and the Hydrogen Education Foundation, indicate that the minimum score targets for two criteria may not be achievable in the competition timeframe. If any entry receives at least the minimum score for all scoring criteria, the winner will be determined as described in the original guidelines. In the event that no entry receives at least the minimum score for all scoring criteria, the alternative process will be implemented to relax targets as necessary for availability and/or total installed system cost.

Clarifications: Added clarifications to reduce confusion. The most significant clarifications emphasize that cost criteria are based on actual costs of the H2 Refuel system entry, not projected future costs.

Added information: Expanded the tie resolution process, and laid out communication expectations for the finalists.

Typographical error: Corrected a typo in the dispensing time criteria table.

Scoring criteria evaluation updates: As indicated in the guidelines, additional criteria and testing information have been and will continue to be provided on the H-Prize website. The guideline update includes additional information on Tested Availability, Direct User Costs, and Total Installed System Costs.

H2 Refuel H-Prize Finalist Announced

Competition outcome expected to be announced in December of 2016

Washington, D.C., February 1, 2016 – Today, the Hydrogen Education Foundation (HEF) officially announced SimpleFuel as the finalist for the \$1 million H2 Refuel H-Prize competition after careful review of six submissions.

The six submissions were received in October of 2015, and a panel of judges and safety experts conducted a thorough review to determine if the designs have the potential to meet the basic criteria for a safe home or community refueling system. Based on this evaluation, only one submission, SimpleFuel's, was determined to meet the criteria for advancing to the finalist stage.

The contestant describes their SimpleFuel™ Home Vehicle Refueling Appliance as a fully integrated hydrogen generation, compression, storage and dispensing system capable of delivering up to 5 kg/day of hydrogen to vehicles at pressures up to 700 bar. SimpleFuel states that their system could also provide fleet automobile and material handling markets with dependable, on-site hydrogen solutions that have the potential to reduce GHG emissions significantly.

The SimpleFuel team will have until this summer to construct their prototype, and then testing and analysis will follow to determine if the system meets the six different technical and cost criteria, found in the rules and guidelines. After rigorous evaluation of the data is complete, it will be determined whether or not SimpleFuel's system meets the competition criteria and minimum requirements and wins the \$1 million prize. The outcome of the competition is expected to be announced in December of 2016.

SimpleFuel™ World Premiere System Design Unveiling at ACT Expo a Great Success

On May 3, 2016 the Hydrogen Education Foundation witnessed the unveiling of the system design of the H2 Refuel H-Prize Finalist: SimpleFuel™. Taking place at the Alternative Clean Transportation (ACT) Expo 2016 in Long Beach, CA, the ceremony attracted many interested spectators from the showroom floor and press to observe the first public showing of the team's system. The SimpleFuel booth was located adjacent to four fuel cell electric vehicles (FCEVs) from major automakers, highlighting a number of very real options for fuel cell mobility.



Darryl Pollica of Ivys, Inc. and Kareem Afzal of PDC Machines, two of the three companies who make up the SimpleFuel team, unveiled the system, while Prabhu Rao of McPhy Energy North America, the third team member, guided the attendees through the capabilities and design of the system.

Their home refueler features a sleek white, curved design, a footprint of 80" x 42", and a maximum height of 82". That's a smaller footprint than an economy car. The system is designed to be easily deployable, requiring standard utility hookups for electricity and water. The refueler is planned to be certified by a third-party approvals body which the team expects will be a major advantage from a permitting perspective.

This design provided the very first glimpse of what the operational system will likely look and feel like. The final functioning system will be publically shown later in the summer during the "Open House". During the unveiling, Darryl Pollica explained that commercially-available components like the dispenser featured in this design will be used in the final system. That system, currently under construction, will be tested to determine if it meets the technical and cost criteria to win the \$1 million H-Prize, and is expected to be able to provide five fills of one kg each per day, at a dispensing pressure of up to 700 bar.



In discussions about future plans beyond the H-Prize competition, the team projected that the initial launch of their product line, which would be able to deliver 5-10 one kg fills per day at five minutes per fill, will cost \$200,000 or less, depending on the rate of hydrogen production, dispense pressure and manufacturing volume. Such a small scale and low cost refueling option may allow for very interesting applications and could provide an additional pathway for expanding the delivery and dispensing infrastructure for FCEVs.



The team attracted quite an audience during the three-day Expo, and reported some very real interest in their design from potential customers. With that positive feedback, SimpleFuel returns to the East Coast to continue constructing their system, which will be put online for data collection near the end of the summer. HEF wishes them the best of luck for their next steps.

Demonstration Phase of H2 Refuel H-Prize Commences with Start of Data Collection of Finalist System

On September 21, 2016, the H2 Refuel H-Prize Finalist, SimpleFuel™, officially moved from the construction to the demonstration phase of the competition. Over the next few months, an array

of [technical data on the system will be collected](#), which includes dispensing pressure, dispensing time, amount of hydrogen dispensed, ambient temperature, gas temperature, and availability.

On Friday, September 16, prior to the start of the demonstration phase, representatives from the National Renewable Energy Laboratory (NREL), the U.S. Department of Energy's Fuel Cell Technologies Office, and the Hydrogen Education Foundation visited the site of PDC Machines in Warminster, PA, where the demonstration system is located, for the installation of the data collection system (DCS). The DCS, provided by NREL, is designed to provide impartial measurements of the Finalist system's performance to the H-Prize judges.

The final shakedown testing was completed in the following days. The team conducted a test fill to confirm successful communication between the two devices, while also proving the system's ability to produce and dispense hydrogen. During the demonstration phase, the team will conduct regular fills to show successful operation of their system. They also have arranged to use a fuel cell electric vehicle for some of the fills. The vehicle will be driven by members of the team, and relies entirely on their system for hydrogen refueling.

During the demonstration phase, the Finalist team has to submit cost information and at least two months' worth of operational data needs to be collected. At the end of the demonstration phase, the data will be analyzed to determine if the system can meet the [six technical and cost criteria targets](#) found in the [Guidelines](#) that are required to win the \$1 million prize. The results will be announced early 2017.



SIMPLEFUEL TEAM MEMBER CHRIS O'BRIEN IS CONDUCTING A TEST FUELING IN PREPARATION OF THE DEMONSTRATION PHASE

Consortium SimpleFuel Wins \$1 Million in U.S. Department of Energy's H-Prize

SimpleFuel receives Award of H2 Refuel H-Prize Competition for Small-Scale Hydrogen Refueling System

January 23, 2017 – Washington, DC – The U.S. Department of Energy's (DOE) Fuel Cell Technologies Office (FCTO) and the Hydrogen Education Foundation (HEF) recently announced the competition finalist [SimpleFuel](#) as the winner of the \$1 Million H2 Refuel H-Prize. This success can support economic growth, jobs, and domestic leadership in cutting edge energy technology.

The SimpleFuel™ team, a consortium made up of [Ivys Energy Solutions](#), [McPhy Energy North America](#) and [PDC Machines](#), designed their system to be a safe, small-scale hydrogen-refueling appliance capable of delivering up to 5 kg/day of hydrogen to vehicles at pressures up to 700 bar (10,000 psi). 5 kg is enough to fully fuel one fuel cell electric vehicle (FCEV) for 300-360 miles.

"In 2007 Congress established this competition, with bipartisan support, to inspire creative approaches and advances for hydrogen energy technologies," stated Jeff Serfass, President of the Hydrogen

Education Foundation. “The development of the hydrogen infrastructure became the target of this competition, and I am pleased that DOE and HEF together have delivered on the objective for the H-Prize with SimpleFuel’s grand achievement,” Serfass concluded.

Phase 1 of the competition was launched in 2014, when America’s engineers and entrepreneurs were invited to answer the call to design and build an affordable system for small-scale, non-commercial hydrogen fueling. After receiving and evaluating nine design submissions in 2015, one team – SimpleFuel– was selected by an independent panel of judges as the Finalist, to advance to Phase 2.

SimpleFuel constructed their system in 2016 in Warminster, Pennsylvania, followed by a 3-month data collection period, which ended in December 2016. During that time, an open house event was held, which was attend by DOE FCTO Director Sunita Satyapal, at which the team demonstrated their system by conducting a fueling of a Hyundai Tucson FCEV.

The National Renewable Energy Laboratory (NREL) analyzed the data collected during that testing period, and the cost information provided by the team was also independently reviewed. The H-Prize panel of judges deemed that the data collected showed that SimpleFuel’s system met both the technical and cost criteria as outlined in the final competition guidelines, thereby unanimously declaring them the winner of the H2 Refuel H-Prize.

Hydrogen infrastructure remains a critical barrier to the widespread adoption of FCEVs. The future of FCEVs in a consumer environment is dependent upon a widely available network of fueling stations. At the current early stage of market introduction, there will be a need for small-scale refueling to serve communities and residences far from the commercial hydrogen fueling station network. The H2 Refuel competition was designed to help address this barrier through easily deployed small scale fueling systems for home and community use to bridge the gap while widespread infrastructure development takes place.

WE HAVE A WINNER

On January 19, 2017 the U.S. Department of Energy’s (DOE) Fuel Cell Technologies Office (FCTO) and the Hydrogen Education Foundation (HEF) announced the competition finalist [SimpleFuel](#) as the winner of the \$1 Million H2 Refuel H-Prize. This success can support economic growth, jobs, and domestic leadership in cutting edge energy technology. For more information on the winner, please contact the team at www.ivysinc.com/simplefuel-main-page.

The H2 Refuel H-Prize challenged America’s innovators to deploy an on-site hydrogen generation system, using electricity or natural gas, to fuel hydrogen vehicles, that can be used in homes, community centers, small businesses, or similar locations.

DOE Hosts Webinar with \$1M H-Prize Winner SimpleFuel, Focus on Design & Data of System

Webinar will take place on March 16, 12 PM ET, 9 AM PT

On Thursday, March 16, at 12 PM ET, the U.S. Department of Energy’s (DOE) Fuel Cell Technologies Office (FCTO) will host a live webinar titled “DOE-FCTO H-Prize Competition Drives Innovation with

SimpleFuel™". On this webinar, attendees will be able to hear directly from Ivys Energy Solutions as they describe the role of competition-based innovation in the launch of the award-winning SimpleFuel Hydrogen Refueling Appliance.

In January, DOE and the Hydrogen Education Foundation (HEF) announced the competition finalist [SimpleFuel](#) as the winner of the \$1 Million H2 Refuel H-Prize. The SimpleFuel™ team, a consortium made up of [Ivys Energy Solutions](#), [McPhy Energy North America](#) and [PDC Machines](#), designed their system to be a safe, small-scale hydrogen-refueling appliance capable of delivering up to 5 kg/day of hydrogen to vehicles at pressures up to 700 bar (10,000 psi).