The Hydrogen Education Foundation's
Hydrogen Student Design Contest
2016: Development of a Hydrogen-powered Micro-Grid for Grid Support and Back-up Power
www.HydrogenContest.org

Sponsors

2016 HYDROGEN STUDENT DESIGN CONTEST

DEVELOPMENT OF A HYDROGEN POWERED MICROGRID FOR GRID SERVICES AND BACK-UP

OFFICIAL RULES AND DESIGN GUIDELINES

December 16, 2015

Any revisions will be posted at www.hydrogencontest.org.

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The Hydrogen Student Design Contest is managed by the Hydrogen Education Foundation, a 501(c)(3) charitable organization. For more information on the Hydrogen Education Foundation, go to www.hydrogeneducationfoundation.org. All donations and sponsorships are tax-deductible.

HYDROGEN EDUCATION FOUNDATION

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AT A GLANCE

REGISTRATION

Register your team via the Hydrogen Energy Foundation (HEF) Contest website at www.hydrogencontest.org/register.asp by February 10, 2016. You will be asked to provide the name of your Institution, your name and email, and your faculty advisor's name and email address.

ELIGIBILITY

The Contest is open to undergraduate and graduate students worldwide. All team members must have been enrolled in a college or university by December 15, 2015 but do not have to be enrolled full-time.

IMPORTANT DATES

8 Oct 2015	Initial Topic Announcement
17 Dec	Rules and Guidelines posted
26 Jan 2016	Webinar on Topic, Resources
10 Feb	Registration Deadline
24 Feb	Project Outline (Abstract and Approach) Due
14 Mar	Webinar on Progress, Feedback
18 Apr	Final Project Submission Deadline
16 May	Winner Notification
6-10 Jun	Winner Announcement at DOE Annual Merit Review

1. INTRODUCTION

Each year, the Hydrogen Education Foundation's Hydrogen Student Design Contest ("the Contest") challenges teams of university-level students from around the world to develop and design hydrogen applications for real-world use.

Established in 2004 by the Hydrogen Education Foundation, the Contest showcases the talents of students in many disciplines, including engineering, architecture, urban planning, marketing, and entrepreneurship. Undergraduate and graduate students worldwide are eligible to participate.

1.1. THE CHALLENGE

The theme of the 2016 Hydrogen Student Design Contest is **"Development of a Hydrogen Powered Microgrid for Grid Services and Back-up"**

The Contest will challenge undergraduate and graduate students to design a renewable hydrogen powered micro-grid capable of solely supporting a town or military base for 2 days and be able to handle at least 10% of peak demand while the macro-grid is active. The system should utilize local resources to produce and store hydrogen as well as provide hydrogen dispensing capabilities to hydrogen fuel cell vehicles (HFCEVs). The system should be optimized for as little environmental and economic impact as possible.

1.2. BACKGROUND

Developing smart, decentralized energy networks that have the capabilities of islanding for short periods of time as well as reducing overall grid strain during peak times has the potential to address a number of priorities and challenges some energy customers may be facing.

By creating a micro-grid, the system is no longer susceptible to centralized grid malfunctions and blackouts as the micro-grid will kick on once the macro-grid fails. Using on site renewable energy generation, the micro-grid will use fuel cell technology to supply a community, a military base, or any other comparable complex with the ability to produce enough electricity to supply its own needs for an extended period of time. Additionally, during peak hours the system can provide electricity to its own grid structure to reduce the demand placed on the macro-grid.

The system also becomes feasible for hydrogen fueling to occur as well. This is a complex task but will yield interesting and possibly actionable results.

1.3. ABOUT THE CONTEST

Since 2004, the HEF Hydrogen Student Design Contest has challenged multi-disciplinary teams of university students to apply their creativity and academic skills in the areas of design, engineering, economics, environmental science, business and marketing to the hydrogen and fuel cell industries.

Although the Contest designs are concepts when submitted, the Grand Prize winning teams from 2004 and 2005 each attracted the funding necessary for actual development and implementation of a new hydrogen fueling station and a hydrogen power park, respectively. The station designed in 2004 had its grand opening at Humboldt State University on September 9, 2008. The winning design in 2008, which included a back-up and portable power system powered by hydrogen for airports, has generated a great deal of attention at the Columbia International Airport in Columbia, South Carolina.

The Contest is open to undergraduate, graduate and Ph.D. students worldwide. Multiple teams from one institution are permitted, but students may not belong to more than one team, and teams must work independently. High-school students are eligible to participate.

1.4. JUDGING

A panel of expert judges from federal agencies, sponsors, industry and academia will be grading the student teams' submissions.

Each judge will be assigned a random set of entries. The scores from the judges' set will then be normalized using standard deviation formulas to account for individual bias. For the final entry, the top 5 entries will be reviewed a second time by a select panel of judges to identify the winning teams.

1.5. PRIZE SUMMARY

For this Contest, the Grand Prize winning team will receive a travel stipend to attend and present their design at the 2016 DOE AMR.[i] If contest sponsorship is sufficient, top teams may receive a monetary award as well.

Honorable mentions (awards depend on available funding) will receive waved conference registration, accommodations for the 2016 DOE AMR, an invitation to present the design in a poster presentation component of the event.

All winning teams' designs are also planned to be published in the International Journal for Hydrogen Energy (IJHE), a major industry publication. Sponsors may also consider students for internship positions.

For more details on contest prizes, please see Section 2.5.

2. RULES

2.1. ELIGIBILITY AND TEAM STRUCTURE

The Contest is open to undergraduate and graduate (including Ph.D.) students worldwide. Team members must be enrolled in a college or university at the time of abstract submission but do not have to be enrolled full-time. Students who are working or researching part-time in the field or a related field of the Contest topic may participate.

Students who are enrolled at a university at the time of abstract submission, but will graduate before August 31, 2016, may still participate.

Given the multi-disciplinary nature of this competition, teams are highly encouraged to include students with various expertise, including: industrial design, engineering (all types), economics, business, environmental science, policy, chemistry, marketing, education, or any other field of study relevant to the team's design. A team with students from diverse backgrounds will help address non-technical sections much better than a homogenous team.

Each team is limited to a maximum of two faculty advisors. The faculty advisors must be faculty members of a college or university. Adjunct and emeritus faculty are welcome to serve in this capacity. Faculty advisors may give guidance and suggestions but cannot perform actual design work. Faculty advisors can advise more than one team, but they must assist in ensuring that the teams work independently to maintain a fair competitive atmosphere for all participants.

Multiple teams from one institution are permitted. However, each team must work independently to keep the competition fair for other teams.

Teams are encouraged to include members from only one school. If collaboration between different schools is desired, the team leader and designated faculty advisor must request approval by submitting the team registration form with a cover letter to the address in Section 2.3 or by email to ewagner@ttcorp.com. Teams with students from more than three schools are not allowed.

A team of about 8 students is recommended, although teams with no less than 3 or up to 12 students are allowed. **Teams may not exceed 12 students at any time.** In cases where more than 12 students are interested in participating in the Contest, students are encouraged to split into two separate teams.

Please send an updated team roster to ewagner@ttcorp.com if any changes to your team roster are made during the course of the contest (i.e. additions at the beginning of a new semester).

2.2. CITATIONS AND QUESTIONS

- Teams may use any source of data or materials: journals, computers, software, references, web sites, books, etc. All sources used **MUST** be cited using common citation styles.
- Teams may contact professionals in the hydrogen and fuel cell industry as desired, and are encouraged to do so. If information from industry experts is used to develop the design, teams **MUST** cite all sources. Only open source data are allowed. No proprietary or confidential information should be included in any design or presentation.
- Teams may submit any questions about the contest by email (ewagner@ttcorp.com). Please include "HEF Student Contest" in the subject line for a timely response.

2.3. TEAM REGISTRATION AND MEMBER LIST

- Each team must register via the HEF Contest website at www.hydrogencontest.org/register.asp by February 10, 2016. Team leaders will be asked to provide the name of your Institution, your name and email, and your faculty advisor's name and email address.
- Registered teams will be made public on the contest website and may be included in contest announcements.
- Teams must submit their member roster with their abstract. The list needs to be in an Excel spreadsheet format. This list shall include the following:
    - Name and email address of Faculty Advisor(s)
    - Name and email address of Team Leader, alternative Team Leader and **all** participating students
- Teams are encouraged to submit additional information that could be shared via social media, e.g. team photos, short team description or even motivational videos. This information will be posted on the Hydrogen Student Design Contest Website and/or the HEF Facebook site (www.facebook.com/Hydrogen.Education.Foundation). Students agree that the information that the Contest receives may be shared in the ways described above (excluding name and email address).

2.4. REPORT FORMAT SUBMISSION AND SCORING

- All submissions must be in English. The **metric system** must be used throughout the entry. Currency must be U.S. dollars. Where conversions are required, the exchange rate from December 31, 2015 shall be used.[ii]

PROJECT OUTLINE

- Must be submitted by **5:00 PM ET on February 24, 2016**
- The Project Outline must contain: a 4-page (maximum) abstract, a description of the major system components and rationale for the choice, and a timeline that details how the team will be approaching the design of the micro-grid system.
  - This section will require background research into how a fuel cell power plant is designed, and the safety/environmental considerations associated with such a system.
- The submissions will be reviewed by the judges and feedback will be given within two weeks.

FULL ENTRY

- Final entries must be submitted **by 5:00 PM ET, April 18, 2016**
- Late entries will be penalized.
- The entire report, including graphics and citations, should appear as a single PDF file. The electronic copy of the report must be emailed to ewagner@ttcorp.com. Please include "**Student Design Contest Entry – [Your school name]"** in the subject line of the email. Please be cautious about the file size of the document
- You may set up a Dropbox account or FTP site if the attachments exceed 5MB
- All materials must be submitted electronically. Mailings will no longer be accepted

PAGE LIMITS

The following page limits have been recommended for each section. You may distribute the pages as you see fit provided that the final report does not exceed 36 pages, not including references and citations. Report pages must include 1 inch (2.5 cm) margins and be written using a font no smaller than 11 point size, single spaced.

Section	Page Max **(Recommended)**
Cover Page	(Not included in page count)
Executive Summary	1
Table of Contents	1
Design Data and Equipment Drawings	10
Cost and Economics	4
Safety Analysis	6
Regulations, Codes and Standards	3
Siting, Operation and Maintenance	4
Environmental Analysis	4
Interface Design / Customer Education	3
References/Citations	As necessary (not included in page count)
Max. No. Pages	**36 plus references/citations**

Entries that exceed the maximum total page limit will be deducted **5 POINTS** for **each page** that exceeds the limit, excluding references and citations.

Entries that are received after the official deadline will be deducted **5 POINTS** for **each day** that it is late. However, the Hydrogen Education Foundation reserves the right not to accept late entries.

The final submission must include an executive summary that reviews the main features of the project in language that a general audience can understand. For the other sections, keep in mind that the judging panel will include both technical and non-technical experts.

Each section of the final project plan should concisely and completely fulfill the specific requirements in the design guidelines (Section 3) and provide any other relevant information.

JUDGING CRITERIA

Points	Topic
60	Design
25	Cost and Economics
35	Safety Analysis
10	Siting
10	Operation and Maintenance
20	Environmental Analysis
10	Interface Design/Customer Education
15	Accuracy, Graphics, Readability
15	Innovative Approaches
200	**TOTAL**

Teams are encouraged to copyright their submissions. By submitting a design in this contest, however, teams agree to allow their papers to be published professionally in participating media partners' publications and archived on the Contest website. The Hydrogen Education Foundation and Contest sponsors assert the right to publicize the design concepts for their own purposes. All work will be given due credit to its authors.

2.5. PRIZES

GENERAL INFORMATION

All prizes are dependent on available funding and may change accordingly throughout the Contest. One grand prize winning team and one or more honorable mention teams will be selected.

The Hydrogen Education Foundation will notify winning team on May 16, 2016. Teams are required to refrain from publicly announcing their achievements until the award ceremony. Contest winners will be announced publicly at the 2016 DOE AMR in Washington, DC June 6-10, 2016. All winning teams will receive awards at the conference. Winning designs will be published online at www.HydrogenContest.org and the IJHE, a leading industry trade publication.

For winning teams outside of the United States, passport and visa arrangements must be made by the individual team members to attend the 2016 DOE AMR. The travel stipend will not be increased for teams outside of the U.S.

Depending on opportunities provided, some of the winning teams may be invited to present their design or meet sponsors or decision makers at events not identified in the prize description.

GRAND PRIZE

The grand prize winning team will receive:

- An invitation to present their design to industry leaders in a session of the 2016 DOE AMR
- A stipend of up to $5,000 to cover airfare, meals, accommodation and incidental trip expenses (must be documented) and 2016 DOE AMR registration for up to eight team members and their faculty representative
- Publication of their design in an issue of the International Journal for Hydrogen Energy (IJHE)
- Priority consideration for summer internships at sponsor organizations
- Monetary prize (if contest funding allows)

Important Information:

The winning team must send at least one representative to present the team's design at the 2016 DOE AMR. However, the team is **strongly** encouraged to use the stipend to allow the maximum number of team members to attend and participate in the conference.

The team must send a 15-minute PowerPoint presentation (maximum of 15 slides) with highlights of the project plan, to be given by the team representative(s) during a session of the 2016 DOE AMR. Presentation is due via email to ewagner@ttcorp.com by **one week prior to the submission deadline for the 2016 DOE AMR**.

HONORABLE MENTIONS

The honorable mention teams will receive:

- A stipend of up to $2,000 to cover airfare, meals, accommodation and incidental trip expenses (must be documented) and 2016 DOE AMR registration for up to eight team members and their faculty representative
- An invitation to give a poster presentation or short presentation at the 2016 DOE AMR
- Conference registration for up to four team members and their faculty representative 2016 DOE AMR
- Publication of their design in an issue of the International Journal for Hydrogen Energy (IJHE)
- Priority consideration for summer internships at participating sponsor organizations

2.6. CONTEST SCHEDULE

8-Oct 2015	*Initial Topic Announcement*
16-Dec	*Rules and Guidelines posted*
26-Jan 2016	*Webinar on Topic, Resources*
10-Feb	*Registration Deadline*
24-Feb	*Project Outline (Abstract and Approach) Due*
14-Mar	*Webinar on Progress, Feedback*
18-Apr	*Final Project Submission Deadline,*
16-May	*Winner Notification*

2.7. TIPS

TIME MANAGEMENT

It is important for your team to start Contest work early to be able to adhere to the deadlines of the Contest. Previous teams found the most challenging part of the Contest to finish on time. Connect with researchers and industry from the start; they can help you to refine your approach and ideas and help save time. Be aware that many companies may not give you all the information you may desire.

LEARN FROM SUCCESSFUL TEAMS

Review previous winning entries and see how they approached the contest. All winning entries are archived on the Contest website.

3. GUIDELINES

For this year's Contest, student teams are challenged to plan and design a renewable hydrogen powered micro-grid that will fulfill all of the electricity requirements for a town, military base or equivalent institution for 2 days and provide at least 10% of the peak energy requirements of that location. The system should be able to store large quantities of hydrogen produced from renewable sources or natural gas via energy input from renewable energy sources (wind, solar, hydro, geothermal, etc.)

Student teams should strive to create a model for reliable, convenient and reasonably priced electricity for the potential customers of this technology

The technologies and systems participating teams select for their design must be commercially available and feasible to implement for practical, real-world use by November 15, 2015. Participants should clearly state any assumptions used in their entries.

3.1. PROJECT OUTLINE

All teams **are required** to develop an up to 4-page project outline for review and commentary by the judges. This entry will **NOT** be graded, but rather provides participating teams with the feedback needed to either continue to pursue their design or to amend their design and incorporate the judges' comments. To improve the feedback from judges, teams should strive to provide a detailed submission.

Submissions must include:

- Abstract – Narrative of the team's approach to their micro-grid, outlining the key challenges and solutions for their system design.
- Timeline of how the team plans to finish the project
- Description of major system components with specifications and rationale for their choice.

3.2. FULL ENTRY

For the full entry, the teams must submit a complete design based on the following criteria.

3.2.1. COVER SHEET, EXECUTIVE SUMMARY & TABLE OF CONTENT

The submission needs to feature a cover sheet, including the title of their proposal, list the members of the team and contact information.

Teams are required to provide a one-page executive summary outlining the key components, challenges and solutions included in their design.

The submission needs to include a Table of Content with page numbers for easy reference. If submitted in electronic form, a linked TOC to the specific sections is highly recommended.

3.2.2. DESIGN DATA AND EQUIPMENT DRAWINGS

In this section, all components of the system need to be described in detail, including their interconnection, supported by detailed high-resolution schematics. A blueprint and schematics of the entire systems with specs on key data, including footprint, weight, and interconnection requirements needs to be included.

KEY COMPONENTS

HYDROGEN PRODUCTION

There are two ways to provide hydrogen: On-site production and delivery. However, teams should strive to produce and store all of the necessary hydrogen on-site for at least a two day scenario where the system needs to provide full back-up power.

Hydrogen can be produced by many methods, but teams should place priority on hydrogen produced from renewable sources (such as MSW, electrolysis[iii] powered by solar, wind, or hydropower, reformation of syngas (may overlap with use of MSW).

Teams should attempt to design systems that can produce hydrogen independent from the macro-grid. This means that teams should design the system around another green technology (e.g. solar, wind, etc.). However, in order to increase the amount of H_2 in reserve, teams may rely on the macro-grid as a secondary source of electricity, if desired.

ELECTRICITY PRODUCTION

There are many types of fuel cells – all with their own pros and cons. It is up to the teams to decide what type and/or combination of fuel cells will be used to convert hydrogen into electricity. The system must be able to support 90% of the usual peak demand during times of macro-grid outage. The system must be able to follow an electricity production model that fits the data for the site. The system must be able to support this demand for at least two days. It is recommended that hydrogen production still occur during times of electricity production.

Since hydrogen may be produced from sources such as solar or wind power (which will operate on a relative continuous basis), it is recommended that these sources be utilized when the system is providing back-up power to the site. The sources should produce hydrogen during non-peak times, and produce mostly electricity during peak demand times.

COMPRESSION

Hydrogen gas has much lower energy density by volume than fossil-fuel based sources of energy. As a result, compression of the gas to improve its energy density is a commonplace practice. For this section, include all details on your hydrogen compression equipment and rationale for your choice.

STORAGE

While hydrogen needs to be stored, the amount needed for storage may differ depending on the ability to produce additional hydrogen on-site. Be sure to explain in detail all major characteristics of the storage unit(s).

On-site hydrogen storage in concert with continued on-site production should be tailored to accommodate at least a two day full back-up power scenario.

DISPENSING

There are many factors to consider when optimizing the hydrogen dispensing system. Your system shall be designed to safely dispense gaseous hydrogen to a vehicle with SAE J2601 (2013) compliant connections and tank systems as described in Appendix A of SAE TIR J2601.As, hydrogen dispensing is not the primary role of this system, the system must meet a **10 minute refueling target**, from pulling the fueling trigger to full, assuming a 5 kg fill to 700 bar. The hydrogen may be required to be pre-cooled prior to dispensing, and thus a pre-cooling component may need to be integrated in the system design.

COMMUNICATIONS

In this section teams need to describe how the system will communicate key information, e.g. electrical outage, error messaging, user feedback, etc. This includes system internal as well as external communication. For example, the storage system needs to be able to send a signal to the refueler and production systems when it is running low on hydrogen, or signal to the production equipment if its storage has reached maximum, thus shutting off production until further demand is signaled again.

Since a wired connection cannot be guaranteed, a wireless communication system that data to a third party needs to be incorporated in the design. The communications system also needs to be able to allow the user to verbally communicate with the remote operator and via video, thus must support transfers of large amounts of data.

SAFETY EQUIPMENT

In case of severe failure, the system needs to feature a fire suppression system and emergency communications protocol. A breaker to cut off the electrical interconnection is also required. Acoustical warning sounds as well as warning lights must be featured as well. The station needs to provide artificial lighting for activities after sunset as well as video recording equipment.

3.2.3. COST AND ECONOMIC ANALYSIS

In this section, the teams will determine the costs of their proposed hydrogen micro-grid system. Using a line-itemization chart, this comprehensive analysis should include all fixed costs associated with the team's design. Furthermore, the teams need to estimate the operating costs of the system as well as estimate costs for replacements of parts.

The analysis should include:

- **Capital costs** for all equipment, including installation costs.
- **Operating costs** of all resources necessary for operation (i.e., water for electrolysis, electricity for compressors and controls, costs for delivery of hydrogen[iv]). Justify costs for water and electricity (when needed) using average U.S. utility prices.[v]
- **Maintenance requirements and costs**.

To allow for a fair comparison, the price for delivered hydrogen is fixed.[vi] Additionally, students will need to develop a matrix for the price of hydrogen ($/kg) and electricity ($/kWh) for sale. This will be based on the cost of the system and different estimates for demand. With those results, a return on investment analysis needs to be developed with a payback period no longer than 10 years.[vii] In general, students should consider different approaches in order to reduce costs, e.g. off-peak hydrogen production using real-time pricing for electricity or developing additional value streams for the system or its products. See "Optional Features" section for details.

3.2.4. SAFETY ANALYSIS

In this section, teams must show how their system design will operate safely and maintain the safety of the surrounding environment. Teams shall describe how safety concerns and applicable codes and standards have been addressed for their fueling system. Safety equipment and operational safety, as well as public perception of safety, are included.

Judges will score the design according to how well they think safety has been addressed. Teams must address the following minimum requirements:

- Perform a Failure Mode and Effects Analysis (FMEA) by identifying the most significant safety risks in the design. In determining the failure modes that need to be addressed, teams should consider both the magnitude of potential damage and frequency.
- Describe how their design mitigates the risk of any identified issues.
- List applicable codes and standards, show how the design is compliant, and describe how code requirements were used to ensure safety (visit www.fuelcellstandards.com for information on different relevant codes) The majority of hydrogen codes and standards are safety related, such as National Fire Protection Association (NFPA) codes 2 and 55, as well as the Society of Automotive Engineers (SAE) codes relating to connections between dispenser nozzles and fuel cell electric vehicles. However, not all codes, standards and regulations relate to safety, e.g. standards relating to hydrogen fuel quality[viii].

Resources for hydrogen related codes and standards are:

- Hydrogen and Fuel Cell Safety - http://www.hydrogenandfuelcellsafety.info/
- Fuel Cell Standards - http://www.fuelcellstandards.com/
- National Fire Protection Association - http://www.nfpa.org/
- International Code Council - http://www.iccsafe.org/

Other good resources include the HEF H-Prize website[ix], DOE Hydrogen Permitting website[x], SAE hydrogen standards, and the corresponding regulatory agencies for the states and counties in which the students plan to construct hydrogen sourcing and refueling stations.

Final submissions for this section must include:

Show that the team's design addresses the issues identified in FMEA and provides solutions, and meets all the necessary codes, standards and regulations. Ensuring these codes, standards and regulations are met will demonstrate a high level of reliability, safety and quality of the design. Teams must document their sources as necessary.

3.2.5. OPERATION AND MAINTENANCE

The system should be capable of operating nearly autonomously with at most a single team of system operators at the system location at any one time. The system thus needs to be able to collect performance data on all key system components.

The system shall be designed to facilitate rapid and easy replacement of most parts to minimize potential downtime. Teams are required to identify the ability to conduct repairs and maintenance of the system, e.g. accessibility of key systems.

Consideration should be given to minimum operational levels of equipment when usage is low and to the cycling of systems as concerns peak hour output. Teams should also provide information of life expectancy of the components used.

3.2.6. ENVIRONMENTAL ANALYSIS

The impact of the system on the surrounding is a key component in siting a station. Teams must provide a narrative of the environmental impacts of the design. This should include considerations of how residents may be impacted, e.g. if the compressors are going to be excessively loud, pollutants, etc.

RESOURCE ANALYSIS

The resource analysis needs to address all required fuels and resources the system needs to operate. That needs to include an **energy balance** for all major components (production, compression, storage etc.) of the system. It needs to include an **efficiency factor** determining the efficiency of converting the feedstock to dispensed or stored hydrogen. Other resources could include water use if the design produces hydrogen through electrolysis. Overall, it should be considered how to minimize energy needs and losses throughout the system.

3.2.7. OPTIONAL FEATURES

Teams may think about additional features for their system that may increase the profitability and usability of the system. Teams are encouraged to reach out to the HEF staff to confirm if an optional feature is appropriate for inclusion.

3.2.8. MARKETING VIDEO

Teams are to support their entry by developing a video of no more than 5 minutes, which will attempt to “sell” their design to the judges. The intent of this video is to display all the major characteristics of the system so that the judges may have an easier time evaluating systems, and so that the teams gain valuable marketing experience. This portion of the contest will be a bonus section, worth at most 10 points. However, **failure to include** this portion of the contest will result in a **10 point penalty** and cannot be submitted after other materials are submitted.

4. ADDITIONAL RESOURCES

For links to informative websites, presentations, and publications that may help with your project, please visit our website: www.hydrogencontest.org/resources.asp. We will update this page throughout the course of the Contest.

5. LIABILITY

The Hydrogen Student Design Contest, the Hydrogen Education Foundation and any sponsoring or supporting organization assume no liability or responsibility for accidents or injury related to the Contest.

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[i] Prizes are subject to change and depend on number of sponsors.

[ii] Students shall use www.xe.com for currency conversions.

[iii] Electrolysis need not be performed solely on fresh water, but other system considerations may be necessary for use of salt-water

[iv] For comparison, use http://www.ttcorp.com/pdf/marketReport.pdf, page 11 for costs of delivered hydrogen in the U.S. Note that these prices do not include sales tax. Do not calculate the distance from the production facility.

[v] For electricity, use 10.58ct/kWh (http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a)

[vi] Teams should assume a cost of $7/kg for delivered gaseous H2.

[vii] Useful information on station cost can be gleaned from this NREL Paper: http://www.nrel.gov/docs/fy13osti/56412.pdf

[viii] Ensuring fuel quality is of particularly high importance to the reliability of PEMFC technology.

[ix] http://www.hydrogenprize.org

[x] http://www.hydrogen.energy.gov/permitting/index.cfm