



2012 Hydrogen Student Design Contest Q&A

This document contains answers to common questions participants have submitted. The newest batch of questions and answers are below.

Update One

Q: How fast can the DFC stop and start?

A: The DFC can go from no load to full load in a few hours. **However, it is not meant to cycle. The DFC and fuel supply system should be designed and operated so the DFC can stay on continuous load**, although while on load the fuel may be changed from Biogas to Natural Gas and back to Biogas within a matter of minutes.

Q: Can I control the power output by controlling the fuel flow rate?

A: No, as specified above the DFC system is not meant to cycle. The hydrogen by-product can however be used in a PEMFC peaking system in order to meet variations in the electrical loads.

Q: What is the simple cycle efficiency of the DFC?

A: This is the conversion efficiency of the DFC which has been discounted for all DFC internal parasitic loads. Please note the simple cycle efficiency is not discounted for hydrogen purification loads. For phase II **all teams should use a simple cycle efficiency of 45%**.

Q: What is fuel utilization in regards to the DFC?

A: Fuel utilization is the amount of fuel consumed at the anode of the DFC system. For phase II **all teams should assume a fuel utilization rate of 65%**. For the actual DFC-CHHP system this number varies between 65-68 % in order to help balance the plants heat loads. For this analysis it is acceptable to assume the 65% in order to be consistent with the anode exhaust data provided.

Q: Where can I find anode exhaust data?

A: Please refer to slide 11 of the FuelCell Energy slides located at <http://www.hydrogencontest.org/rules.asp>.

Q: Is the H₂ separator an internal part of the DFC?

A: No, the hydrogen separator is not internal. You will need to design or spec out this system on your own.

Q: Where can I find power and heat production information for the DFC systems?

A: Please refer to the product brochures, which can be found at:

For the 300 - <http://www.fuelcellenergy.com/dfc300ma.php>

For the 1500 - <http://www.fuelcellenergy.com/dfc1500ma.php>

For the 3000 - <http://www.fuelcellenergy.com/dfc3000.php>

Q: How does the methane content of a biogas or syngas affect the DFC efficiency?

A: With Biogas, methane is diluted in carbon dioxide, and there is no impact on efficiency within the fuel specification (up to 40% CO₂ in methane). Syngas from steam reforming of coal creates a mixture too rich in hydrogen, too lean in methane, under normal process conditions to enter into the DFC. It should be methanated or converted so that the methane content is at least 50% on a dry basis (50% CH₄ in H₂ and CO₂). If there is too much hydrogen the effect is not on efficiency, but rather DFC output may be limited due to reduced cooling from internal fuel reforming.

Q: Can you clarify FuelCell Energy Slide 13 (entitled Hydrogen Energy Station - Fountain Valley, California - these slides can be found at <http://www.hydrogencontest.org/rules.asp>)?

A: The co-product numbers refers to the amount of heat, hydrogen and power the plants produce for that specific site. **Please do not use any of this data in your analysis, as it is specific to the complete CHHP system in Fountain Valley.** The peaker capacity refers to a PEMFC peaking system which runs eight hours per day on the co-produced H₂ from the DFC system. The refuelling capacity is # of cars that can be refuelled per day based on the assumption that said vehicles consume .5 kg/day.

Q: Should we use the metric or imperial measurement system?

A: Please use the metric system.

Original Q+A

Q: Do we get participation certificates?

A: We are currently working on developing possible certificates for participation. You should have received your participation certificate in the last few weeks.

Q: What is electrochemical hydrogen separator?

A: It separates the hydrogen from the waste stream so that it can be used, for example, in a fuel cell vehicle.

Q: If I have questions about the DFC system who can I contact?

A: There is no official FuelCell Energy contact. Please send all questions to the Hydrogen Education Foundations. That said, we encourage you to reach out to industry experts for inspiration.

Q: What kind of input fuel the DFC able to use?

A: A variety of hydrocarbon fuels, which includes propane, natural gas and biogas. More specific data on input fuel quality is being compiled and we will pass that data along to the participants once it is received.

Q: Is FuelCell Energy going to provide the teams with the cost of the three systems?

A: We are in the process of getting more precise cost data and that data will be passed along to students as soon as we receive it.

Q: Is there a page limit for Phase 1 report? Will it be judged?

A: There is a two page limit. Both phase one and two will be judged. The impact, phase one has on the final grading is minimal compared to phase two. However, a strong phase one report is an important stepping stone to strong phase two and overall report.

Q: What is the gas pressure before the H2 purification in DFC?

A: This information will be passed along to students as soon as it is received from FuelCell Energy.

Q: What is the difference between the net power and gross power in the DFC (in kW)?

A: Net power is equal to the gross power minus parasitic loads. Thus the difference for the entire process will vary depending highly on the power demands of your purification system. An example can be found in the slideshow found at www.hydrogencontest.org. Furthermore, we are currently waiting on specific data on the gross and net power of the DFC system alone (be careful this data does not include loads caused by purification) and this data will be sent to students once it is received.

Q: In the DFC, what happens to the remaining CH4 at the anode exhaust?

A: It will either be burnt in the anode gas oxidizer or recycled to the cathode.

Q: For financial analysis, can we work in local currency, or must we use USD?

A: So that there is consistency between reports final submissions must be in USD. However, please feel free work in local currency as well.

Q: What is expected to be included in the abstract? Should we strictly adhere to the abstract for the final design?

A: Expectations for the abstract can be found in the project guidelines. You do not have to strictly adhere to your abstract for the final report.

Q: Are we encouraged to use facilities unique to our campus, or would a design with a more general applicability score better?

A: The design should be for your campus or a renewable feedstock nearby your university. One of the main goals of the project is to create a **feasible** design that could be constructed on your campus in the near future.

Q: Does the abstract due on Nov. 15th affect our teams score?

A: The abstract does not affect the team score.

Q: Is the total 200 points or 300 points?

A: The total is 200 points.

Q: Can we download recording of the webinar?

A: Yes, at www.hydrogencontest.org.

Q: Is hydrocarbon fuel required or can I directly feed hydrogen instead of hydrocarbons based fuel?

A: The DFC is a molten carbonate fuel cell (MCFC). Methane-rich biogas or syngas, natural gas, or propane must be used as fuel. Hydrogen can not be used, because the DFC depends on its internal reformation process in order to keep the proper heat balance.

Q: Would it be possible to post an updated rules and guidelines document?

A: An update was posted on November 1st and a further update will be posted by November 14th. The new update will address specific questions and concerns which have been sent to the Hydrogen Education Foundation.

Q: Are we limited to one type of unit?

A: You may use any combination of the 300, 1500, 3000 so long your system is sized to handle the amount and rate at which your feedstock is produced.

Q: What does HEX stand for?

A: Heat Exchanger.

Q: What maintenance does the DFC system require?

A: We are currently collecting more in depth information on this topic. A short summary of FuelCell Energy service can be found at <http://www.fuelcellenergy.com/service.php>.