VII.8 Analysis of Business Cases with the Fuel Cell Power Model

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Objectives

The objective of this project is to revise the H2A Fuel Cell Power model to suit the analytic needs of business and financial decision makers and model end-users. To meet this objective, a Business Tab will be developed within the Fuel Cell Power excel model. It is not expected that the Business Tab will replace in-house financial models used to assess investment options, but it will extend the capability to do financial and business analysis using the model. This will prove especially valuable for tri-generation systems due to multiple stakeholders and energy product revenue streams. Understanding and fulfilling this objective will require significant stakeholder feedback on the decisions making process in question and tab design criteria.

Technical Barriers

This project addresses the following technical barriers from the 4.5 section of the Fuel Cell Technologies Program's Multi-Year Research, Development and Demonstration Plan (MYPP):

(B) Stove-piped/Siloed Analytical Capability

(D) Suite of Models and Tools

(E) Unplanned Studies and Analysis

Contribution to Achievement of DOE Systems Analysis Milestones

This project will contribute to achievement of the following DOE milestones from the Systems Analysis section of the MYPP:

- Milestone 8. Complete analysis and studies of resource/feedstock, production/delivery and existing infrastructure for technology readiness.

Accomplishments

- Reviewed H2A model structure to identify possible extensions.
- Outlined a theoretical tab format and "to-do" list of potential revisions.
- Collected feedback from internal NREL Business Review Team, including staff from the Strategic Energy Analysis, Deployment and Commercialization, and Federal Energy Management centers.
- Presented the FCPower model and proposed Business Tab design features to the California Hydrogen Business Council (CHBC), the Hydrogen Utility Group (HUG), and the California Fuel Cell Partnership (CaFCP), and collected feedback from each group on analytic capability priorities.
- Received feedback from industry representatives through an online questionnaire developed and administered in collaboration with IDC Energy Insights.
- Revised Business Case tab design accordingly.

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Introduction

Stationary fuel cell systems configured to provide heat and power to building can also be configured to provide hydrogen as a third energy product. As depicted in Figure 1, these distributed energy systems would displace power provided by the electricity grid, heat provided by burning natural gas and hydrogen produced from a pathway such as conversion of natural gas via steam methane reforming onsite at a fueling station. Installation of a tri-generation combined, heat, hydrogen and power (CHHP) fuel cell system would involve a large number of stakeholders, including building owners and operators, natural gas and electric utilities, project financiers, fleet managers, fuel cell vendors, fueling station owners and operators, and (potentially) third party developers. The successful initiation of this type of

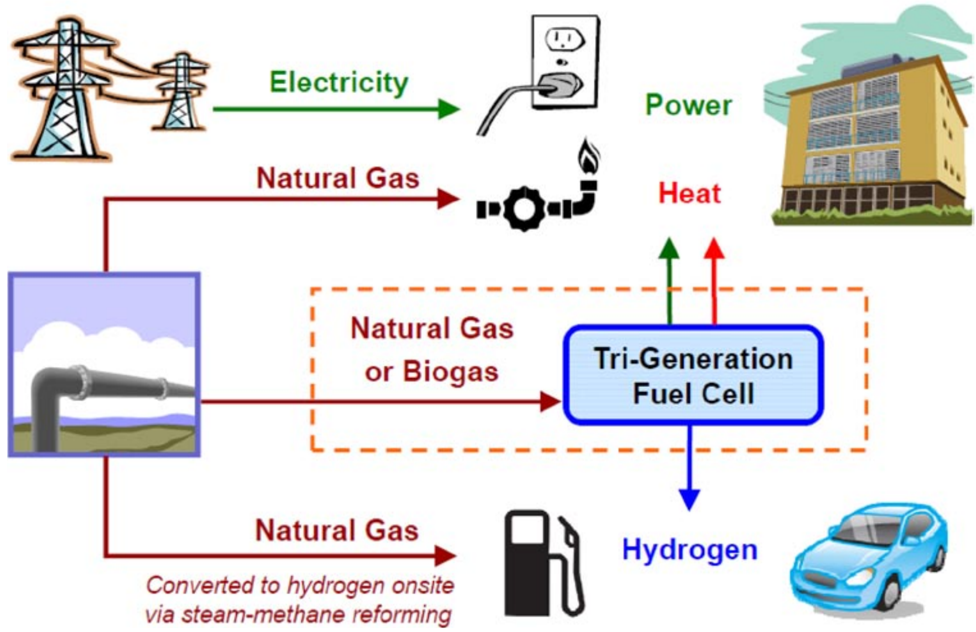

FIGURE 1. Distributed tri-generation stationary fuel cells are capable of displacing energy services provided by the electricity grid, space and water heating from burning natural gas, and the delivery of hydrogen from various pathways, including onsite steam methane reforming.

project will depend upon rapid identification of benefits to each of the involved stakeholders. The Fuel Cell Power model (FCPower), developed by the National Renewable Energy Laboratory for the Department of Energy, is an analytic tool that can facilitate this process by providing a first-cut estimate of project costs and benefits [1]. The FCPower model is a publically available, financial model, programmed in Excel™, that can be tailored to a particular building application by importing site-specific information such as hourly building energy demands, feedstock costs, fuel cell system costs and operating characteristics, and various financial assumptions.

The goal of this project is to design a Business Tab within the FCPower model that caters to the analytic needs of a business decision maker. The Business Tab consolidates all the key questions and analytic capabilities pertinent to a business end user in one location within the model. The FCPower model is based upon the discounted cash flow framework of the DOE H2A Models, which were originally designed for a technical rather than business end-user [2]. With addition of the Business Tab, it is anticipated that an interested stakeholder, such as a building owner/operator, would rely upon technical personal to set up and calibrate the model to represent a proposed fuel cell project, and then the model would be passed on to a financial analyst within the same organization to explore strategic business "what-if" questions and financial metrics. Versions of the FCPower model tailored to a specific combined heat and power (CHP) or CHHP building project can also be circulated among multiple project stakeholders to communicate and reach agreement on basic project assumptions. Designing a Business Tab for a new end user required collection of information on the decision making processes most likely to be involved in this early project screening phase. The following sections describe the process undertaken to collect this input from key stakeholders as well as some of the resulting design criteria.

Approach

The approach to designing the Business Tab involved collecting input from experts internal and external to NREL. Internal input was received from a Business Review Team consisting of NREL staff in the Strategic Energy Analysis, Deployment and Commercialization, and Federal Energy Management centers. Key external stakeholders included staff from the CaFCP, the HUG and the CHBC. Short multi-choice forms were circulated at these meetings to gauge priority or emphasize placed upon different financial metrics (see examples). Additional input was provided from external stakeholders on an ad hoc basis through hydrogen and fuel cell meetings and conferences. Based upon preliminary suggestions and design criteria provided by these internal and external experts, a questionnaire was developed and administered in collaboration with IDC Energy Insights (www.idc-ei.com) and administered to 100 stakeholders from pertinent organizations, including utilities, accounting or financial, hospitals, hotels, big box stores, car dealers, hotels, convention centers, government facilities, transportation and warehousing, etc. Sections of the questionnaire inquired into the decision making process of the particular organization, and asked focused questions on the types of financial metrics typically relied upon to reach decisions about large capital investments. A typical list of potential metrics is shown below.

a. Net Present Value (NPV)
b. Internal Rate of Return (IRR)
c. Payback Period
d. Total Capital Cost
e. Maintenance Cost/Savings
f. Energy Cost/Savings
g. Revenue Opportunity
h. Vendor Brand Name Recognition
i. Vendor Financial Stability
j. Efficiency/energy improvements for Corporate Social Responsibility or Sustainability Goals
k–m. Other (please specify)

These and other proposed enhancements to the FCPower model are based upon a review of the model capabilities and possible extensions to the discounted cash flow calculations. In most cases only minor modifications are required to enable these capabilities due to the detailed existing H2A financial framework. In addition to identifying priority decision metrics, specific analytic capabilities were discussed, such as the capability to specify hydrogen, heat or electricity price and subsequently calculating IRR (a new capability not included in the original H2A models).

Results

Feedback received through the process described above was compiled, organized by type, prioritized, and associated with specific Tab designs and analytic capabilities. Examples of some of these suggestions are listed in the following, including Big Picture suggestions and Detailed Suggestions.

Big Picture Suggestions

- Make costs and benefits prominent. To keep stakeholders engaged in the project as additional information is collected and analyzed, a clear line of sight is needed to keep potential benefits prominent. This prominence provides motivation to endure transaction costs during the formative screening stage of the project.
- Provide access to technological information. Stakeholders can often be at a disadvantage due to an information imbalance among multiple parties, especially with adoption of new technologies. Providing links to information resources can help even out this imbalance and build confidence for key decision makers.

Detailed Suggestions

- Provide one-sheet printout for executive reading.
- Enable IRR as output and as function of various "what if" assumptions.
- Allow solving for hurdle rates, as stakeholders will know their own hurdle rates.
- Facilitate spot checking of basic financial assumptions.
- Include significant flexibility on treatment of tax credits.
- Allow exploration of alternative future feedstock prices (e.g., natural gas).
- Include a visual display of how hourly and peak demand would be offset.

The general structure of the Business Case Tab, developed in response to these and other suggestions, is indicated in Figure 2. The sections of the worksheet shown are accessible by scrolling down the worksheet. Upon opening the Business Tab, an end user will first see the key results and variables associated with the costs and benefits of the stationary fuel cell CHP or CHHP installation. Scrolling down to the next section, an end user would find a number of commonly used "what if" financial questions. These have been identified as typical inquiries of a business-oriented end user through the outreach activities described previously. Users will also find a section with links to external resources providing additional information on the core technology, fuel cells, in order to familiarize them with the technology and therefore reduce any information imbalances among stakeholders. Subsequent sections include results and input cells associated with taxes and incentives, a detailed balance sheet and cash flows, system performance, utility and feedstock assumptions, and additional advanced or less-common analytic capabilities.

Conclusions and Future Direction

A first-cut analysis of the costs and benefits of installing a stationary fuel cell system in CHP or CHHP configuration at a building can provide key decision makers with project screening criteria. The FCPower model, based upon the detailed H2A discounted cash flow framework, is cable of providing these criteria after being calibrated to a particular facility installation. However, the H2A models were originally designed with a technical end user in mind. A Business Tab has therefore been developed to make the FCPower model

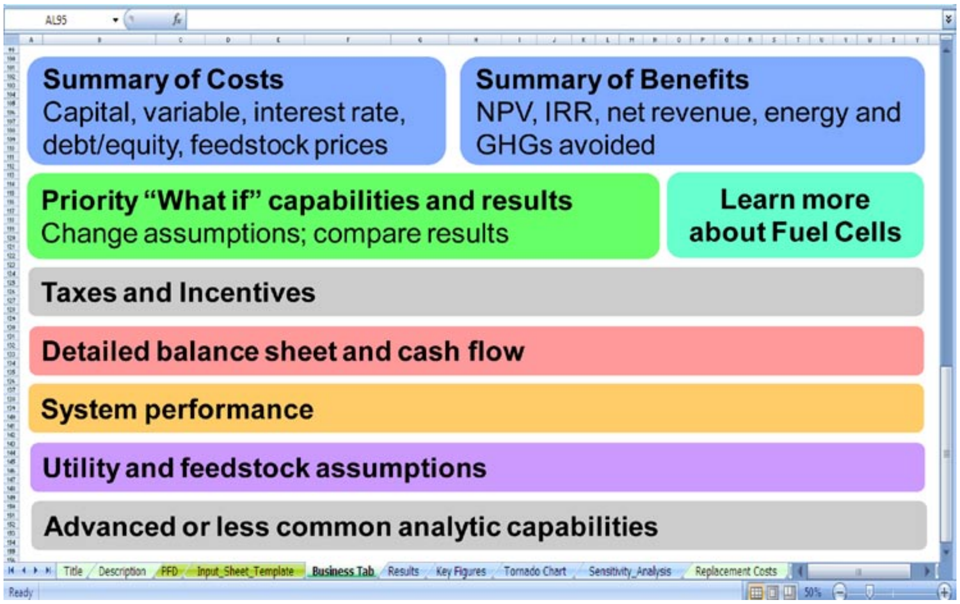

FIGURE 2. General Structure of the Business Tab

more useful for a business-oriented end user. Extensive input was collected, both internal and external to NREL, to determine design criteria and priority analysis capabilities for the Business Tab. Having collected and categorized these criteria and design suggestions, the Business Tab will be included in the next release of the FCPower model. If deemed appropriate, similar tabs will be integrated into future versions of some H2A production and delivery models, especially those focused on infrastructure components subject to financial scrutiny by multiple stakeholders, such as onsite steam methane reforming or electrolysis systems.

References

1. Department of Energy, Fuel Cell Power Analysis (FCPower) website, <http://www.hydrogen.energy.gov/fc_power_analysis.html>. Accessed July 10, 2010.

2. Department of Energy, Hydrogen Analysis (H2A) website, <http://www.hydrogen.energy.gov/h2a_analysis.html>. Accessed July 10, 2010.