Hydrogen Financial Analysis Scenario Tool (H2FAST)

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HTAC Meeting – April 21-22, 2015
Arlington, Virginia
Overview

- **Hydrogen Financial Analysis Simulation Tool (H2FAST)**
- H2FAST is a standard financial accounting framework applied to the DOE’s H2A cost analysis models
- There are three ways H2FAST has been implemented:
  - **H2FAST: Web**
  - **H2FAST: Excel**
    - The Excel spreadsheet is downloaded from the website, and provides more detailed inputs and capabilities for a more advanced end-user
  - **H2FAST: BCS (Business Case Scenario tool)**
    - Full supply chain results are currently being used internally by the H2USA IFWG for scenario exploration (using SERA model outputs)
    - This presentation shows one **visualization** option for BCS
Goals and Audience for H2FAST

Goals

• Inform investment decisions by providing end-users an industry-grade tool to explore the financial aspects of the following:
  – One hydrogen station or multiple hydrogen stations
  – Broader hydrogen infrastructure network developments

Audience

• Financial analysts at firms engaging in hydrogen projects
• Government agencies considering support for hydrogen stations (Governor’s offices, state energy offices, municipalities, etc.)
• Stakeholders partnering on projects with multiple parties
What does H2FAST do? How does it work?

H2FAST provides a quick and convenient in-depth financial analysis for hydrogen stations

- H2FAST builds upon the DOE H2A discounted cash flow framework, with more extensive post-processing to report on a range of financial performance metrics of interest to investors.
- H2FAST calculations conform to generally accepted accounting practices (GAAP) and use either default values or user inputs.

A business sector end-user will have less time to access relevant financial information than a typical H2A model end-user
What types of questions can H2FAST help to answer?

- **H2FAST: Web**
  - How will a $1 million capital incentive change the outlook for our station project?
  - What if we gain $10,000 per year (~$30/day) in additional convenience store sales due to hydrogen customers?

- **H2FAST: Excel**
  - What if our demand ramp-up rate is sluggish the first couple years, but then increases rapidly in the 4th year?
  - What if we put $5 million into a project with 7 stations?

- **H2FAST: BCS-Vis**
  - What kind of investments and incentives would be needed for a network of stations covering an entire metropolitan area or region?
  - How can we prioritize investments in one region or city compared to another?
H2FAST WEB

H2FAST Web
H2FAST Screenshot


- Introductory Language
- Inputs
- Download full financials for case
- Reset Inputs
- Links to Download Spreadsheet Version
- Embed widget
- Change Graphical Output metrics
- Graphical Outputs (1)
- Graphical Outputs (2)
- Single Value Results


Use the H2FAST online tool to explore how some basic financial performance metrics change by varying up to 20 user inputs. Enter your own input values or adjust the slider bars to see how the results change.

List of H2FAST Web Inputs

Many other inputs and outputs are possible. This set of inputs and outputs has been reviewed by the H2USA IFWG and other reviewers.

Station Inputs
- Utilization (%) or Vehicles Refills (per day)
- Hydrogen per Refill (kg)
- Hydrogen Price ($/kg)
- Total Capacity (kg/day)
- Total Capital Cost ($)
- Total Installation Cost ($)
- O&M Cost ($/yr)

Financing Inputs
- Debt Interest Rate (%)
- Min Debt/Equity Ratio

Scenario Inputs
- Capital Incentive ($/stn)
- Initial Production Incentive ($/stn)
- Annual Decrement of Production Incentive ($/stn)
- Incidental Revenue ($/yr)
- Cost of Delivered Hydrogen ($/kg)
- Cost of Electricity ($/kWh)

- Inputs values can be changed with cell entries or sliders
- Graphed results update automatically at right

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Example Case A: $1.2 M station, no subsidy, $14/kg price at the pump

- A nominal gaseous tank truck delivery station: 250 kg/day
- $1.2 million in capital and installation
- Hydrogen delivered for $5.50/kg and sold for $14/kg
- Top graph shows net investor cash flow; Bottom graph shows cumulative
- Result: $12.4/kg as breakeven price for a 10% IRR

15% IRR, 8 yr investor payback
Example Case B: Assume a $1.0 M Capital Incentive and $10/kg price

- Assume $1 M capital incentive in the first year
- Change pump price to $10 per kg
- Increase in IRR and investor payback period
- Result: $9.4/kg as breakeven price for a 10% IRR

19.5% IRR, 6 yr investor payback

$10/kg
$1.2M

$1.0M
$5.5/kg

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Example Case C: $1.0 M Incentive, $10/kg price, $10k incidental revenue

- $1 M capital incentive
- $10 per kg price
- Add an incidental revenue stream of $10k per year (~$30/day)
- Increase in IRR and investor payback period
- Result: $9.2/kg as breakeven price for a 10% IRR

**H2FAST**

<table>
<thead>
<tr>
<th>Station Inputs</th>
<th></th>
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<tbody>
<tr>
<td>Installation time [months]</td>
<td>18</td>
</tr>
<tr>
<td>Demand ramp-up [years]</td>
<td>3</td>
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<tr>
<td>Station type:</td>
<td>Delivered Gaseous H2</td>
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<td>Long term station utilization [%]:</td>
<td>70</td>
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<td>Vehicle refills [refills/day]:</td>
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<tr>
<td>Hydrogen per refill [kg]:</td>
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<tr>
<td>Total capacity [kg/day]:</td>
<td>250</td>
</tr>
<tr>
<td>Hydrogen price [$/kg]:</td>
<td>10</td>
</tr>
<tr>
<td>Equipment capital cost [$]:</td>
<td>1031846</td>
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<td>Total installation cost [$]:</td>
<td>237325</td>
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<td>Planned and unplanned O&amp;M costs [$/yr]:</td>
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<table>
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<th>Scenario Inputs</th>
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<tbody>
<tr>
<td>Capital incentive [$/station]:</td>
<td>1000000</td>
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<tr>
<td>Initial production incentive [$/station]:</td>
<td>0</td>
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<tr>
<td>Annual decrement of production incentive [$/station]:</td>
<td>0</td>
</tr>
<tr>
<td>Incidental revenue [$/year]:</td>
<td>10000</td>
</tr>
<tr>
<td>Cost of delivered hydrogen [$/kg]:</td>
<td>5.5</td>
</tr>
<tr>
<td>Cost of electricity [$/kWh]:</td>
<td>0.12</td>
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<tr>
<td>Cost of natural gas [$/mmBTU]:</td>
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<table>
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<th>Financing Inputs</th>
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<tr>
<td>Debt interest rate [%]:</td>
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<tr>
<td>Minimum debt to equity ratio:</td>
<td>0.5</td>
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</table>

**Internal Rate of Return [%/year]:**

- 21.9%

- First Year Positive EBITD: $9.24
- Investor Payback Period [years]: 5
- Investor Cumulative Cash Flow [$/yr]:
  - 2014: $211520
  - 2015: $5.5/kg
  - 2016: $1.2M

**22% IRR, 5 yr investor payback**
In general the spreadsheet version allows for greater control of inputs and more elaborate exploration of outputs, within a spreadsheet environment that may be more comfortable or preferable for some end-users.

**Inputs**
- Ability to enter information for up to 10 stations, and assess finances for each individually or as a cluster of station projects.
- This allows for side-by-side comparison of station projects.
- There are two modes for users to provide inputs:
  - Basic mode: 20 parameters
  - Advanced mode: 51 parameters
- Inputs and outputs have hover-over descriptions to orient users

**Outputs**
- Detailed report tables are provided for each project year
  - Scenario parameters (e.g. volumes of sales)
  - Income statement
  - Cash flow statement
  - Balance sheet
  - Select ratio analyses
H2FAST:
BUSINESS CASE SCENARIO TOOL (BCS)
Visualizing SERA Scenario Results

The H2FAST framework can be applied across the entire hydrogen system to explore multiple market growth scenarios

- The SERA model can generate a large volume of scenario results
- For some engaged audiences, such as H2USA Working Group members, there is interest in exploring multiple sets of scenario outputs
- The SERA Visualization tool (BCS-Vis) is being developed for this type of audience

Demand and Delivery by City

Regional/State-level Subsets of Results

Vehicle Adoption Rates

- New FCVE Stock [vehicles]
- Year
- State Name
- Connecticut
- Maine
- Massachusetts
- New Hampshire
- New Jersey
- New York
- Rhode Island
- Vermont

Station Placement

Cash Flows
Launching the SERA Visualization

Select the scenario and the modeled data of interest

Slider changes the modeled year and updates the map and chart

This 4-min video demonstrates this visualization tool: [http://youtu.be/J7y51c-dldo](http://youtu.be/J7y51c-dldo)
Clicking an urban area provides a chart of all yearly values for the currently selected data parameter.

This 4-min video demonstrates this visualization tool: [http://youtu.be/J7y51c-dldo](http://youtu.be/J7y51c-dldo)
Summary

• The H2FAST Web and Spreadsheet tools are an effective means of informing investment decisions on hydrogen station projects
  – Developed for end-users requiring a simple, first-cut analysis (web version) as well as more detailed and elaborate analyses (spreadsheet version)

• The H2FAST framework can also be applied to the entire hydrogen fuel supply chain to evaluate the financial implications of infrastructure development at the city, region, or national levels
  – This framework is currently being used internally to inform H2USA IFWG members in scenario exploration
  – A beta version of a visualization tool has been developed to allow access to these multivariate results to a broader audience
QUESTIONS?
BACKUP SLIDES
Example Toggles

H2FAST Excel

Basic Interface
1 station
station 1 analysis

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Example Toggles

H2FAST Excel

Advanced Interface
1 station
station 1 analysis

Real levelized costs ($/kg H₂)

<table>
<thead>
<tr>
<th>Item</th>
<th>1 station</th>
<th>Cumulative levelized cost ($/kg H₂)</th>
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<tbody>
<tr>
<td>Direct cost</td>
<td>$1.50</td>
<td>$5.50</td>
</tr>
<tr>
<td>Indirect cost</td>
<td>$1.30</td>
<td>$4.80</td>
</tr>
<tr>
<td>Total cost</td>
<td>$2.80</td>
<td>$10.30</td>
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<tr>
<td>Profit before taxes</td>
<td>$1.00</td>
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<tr>
<td>Taxes</td>
<td>$0.50</td>
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</tr>
<tr>
<td>Net cash flow</td>
<td>$0.50</td>
<td>$2.30</td>
</tr>
</tbody>
</table>

Other operating expenses:
- Fuel and chemicals ($/kg H₂)
- Labor ($/kg H₂)
- Maintenance ($/kg H₂)
- Depreciation ($/kg H₂)
- Property taxes ($/kg H₂)
- Insurance ($/kg H₂)
- Other ($/kg H₂)

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Basic Interface

1 station
station 1 analysis

Example Toggles
Example Toggles

**Basic Interface**

2 stations

Station 1 analysis

**H2FAST Excel**
### Example Toggles

**H2FAST: Hydrogen Fueling Financial Analysis Scenario Tool**

**Summary:**

- **Net Present Value (NPV):** $1,125,000
- **Internal Rate of Return (IRR):** 7.5%
- **Profitability Index (PI):** 1.12

**Key Metrics:**

- **Investor Contribution:** $9,414,000
- **Initial Investment:** $1,125,000
- **Average Annual Maintenance:** $5,414
- **Annual Capital Expenditure:** $1,021,000

**Station 1 Analysis:**

- **Total Install Capital Cost:** $1,125,000
- **Annual Operating Expenses:** $5,414

**Realized Savings (US$/kg H₂):**

- **Month 1:** $5.16
- **Month 2:** $12.10

**Operating Costs:**

- **Hydrogen:** $6.00
- **Electricity:** $5.96
- **Maintenance:** $1.06
- **Property Insurance:** $0.00
- **Taxes:** $0.00

**Financial Metrics:**

- **Net Present Value (NPV):** $1,125,000
- **Internal Rate of Return (IRR):** 7.5%
- **Profitability Index (PI):** 1.12

**Important Notes:**

- **Investor Contribution:** $9,414,000
- **Initial Investment:** $1,125,000
- **Average Annual Maintenance:** $5,414
- **Annual Capital Expenditure:** $1,021,000

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Example Toggles

H2FAST: Hydrogen Fueling Financial Analysis Scenario Tool

Basic Interface
4 stations
station 1 analysis

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### H2FAST: Hydrogen Fueling Financial Analysis Scenario Tool

#### Basic Interface

**4 stations**

Station 2 analysis

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**Example Toggles**

**H2FAST Excel**

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Example Toggles

H2FAST Excel

Basic Interface
4 stations
station 3 analysis

H2FAST: Hydrogen Fueling Financial Analysis Scenario Tool

Station 3

Cumulative investor cost flows (Millions)

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Example Toggles
Example Toggles

H2FAST: Hydrogen Fueling Financial Analysis Scenario Tool

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### General Information

#### Revenue (sales and related)
<table>
<thead>
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<th>Year</th>
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<th>2015</th>
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<td>180</td>
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<td>4</td>
<td>210</td>
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#### Marketing and sales

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<td>700</td>
<td>600</td>
</tr>
<tr>
<td>4</td>
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#### Research and Development

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### Income Statements

#### Operating expenses

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<tr>
<td>1</td>
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<td>4</td>
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#### Net income

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</tr>
<tr>
<td>4</td>
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### Balance Sheets

#### Total assets

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#### Total liabilities

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<th>2015</th>
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<tr>
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### Cash Flow Statements

#### Cash flows from operating activities

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<td>400</td>
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<tr>
<td>4</td>
<td>400</td>
<td>500</td>
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#### Cash flows from investing activities

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<td>200</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>250</td>
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</table>

#### Cash flows from financing activities

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<th>2015</th>
</tr>
</thead>
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</tr>
<tr>
<td>4</td>
<td>300</td>
<td>350</td>
</tr>
</tbody>
</table>
Time Series Examples

**All 4 stations:**

Cumulative investor cash flow, (Millions)

- User can select from 65 common reportable time series.
- Labels can be turned on and off to show numeric values