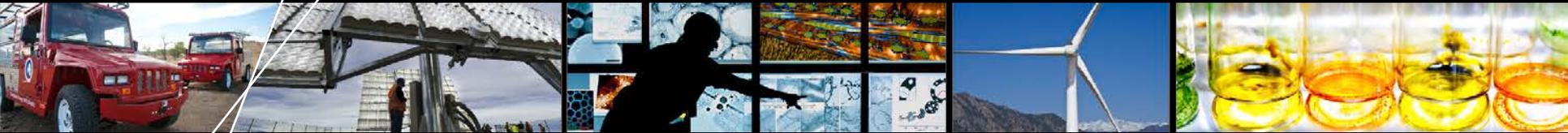


# Overview of the Hydrogen Financial Analysis Scenario Tool (H2FAST)



**H2USA Modeling Overview  
Webinar**

**Marc Melaina, Brian Bush,  
Michael Penev**

**12 May 2015**

# Presentation Outline

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- **Introduction: what is H2FAST and what questions can it answer?**
- **Review each version of H2FAST**
  - H2FAST Web Tool
  - H2FAST Excel Tool
  - H2FAST Business Case Scenario tool (beta)
- **Summary**



# What types of questions can H2FAST help to answer?



- **H2FAST: Web**

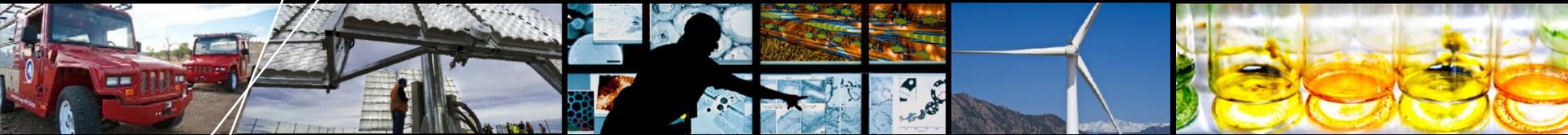
- How will a \$1 million capital incentive change the outlook for our station project?
- What if we gain \$10,000 per year (~\$30/day) in additional convenience store sales due to hydrogen customers?

- **H2FAST: Excel**

- What if our demand ramp-up rate is sluggish the first couple years, but then increases rapidly in the 4<sup>th</sup> 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 Tool

# H2FAST: A simple, user-friendly online tool

Visual results are provided instantly as inputs are changed by users

Introductory Language

Inputs

Download full financials for case

Reset Inputs

The screenshot displays the H2FAST web application interface. On the left, there are sections for 'Station Inputs' and 'Scenario Inputs', each containing various adjustable parameters with sliders and input boxes. Below these is a 'Financing Inputs' section. At the top right, there are buttons for 'Spreadsheet Version' and 'Share/Embed'. A summary box on the right lists key financial metrics: Internal Rate of Return [ % / year ]: 4.2, Break-Even Hydrogen Price [ \$ / kg H<sub>2</sub> ]: \$11.09, First Year Positive EBITD: 2018, Investor Payback Period [ years ]: 13, and NPV: \$-315,242. Below the summary are two bar charts: 'Earnings before Interest, Taxes, and Depreciation [ \$ ]' and 'Investor Cumulative Cash Flow [ \$ ]', both showing data from 2014 to 2034. At the bottom, there are buttons for 'Reset Inputs' and 'Download Results CSV'.

Link to Download Spreadsheet Version

Embed widget

Single Value Results

Graphical Outputs (1)

Graphical Outputs (2)

Change Graphical Output metrics

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

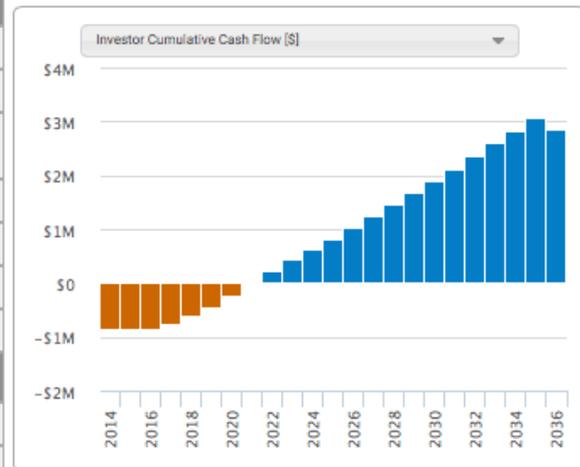
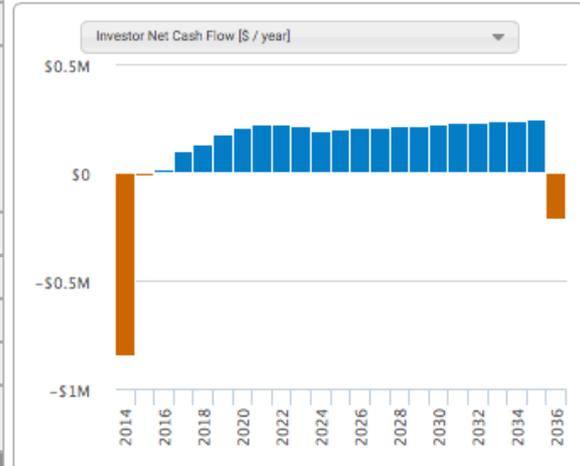
**15% IRR,  
8 yr investor payback**

- 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

### H2FAST

Station Inputs	
Installation time [months]	18
Demand ramp-up [years]	3
Station type:	Delivered Gaseous H2
Long-term station utilization [%]:	70
Vehicle refills [refills/day]:	43.75
Hydrogen per refill [kg]:	4
Total capacity [kg/day]:	250
Hydrogen price [\$ / kg]:	14
Equipment capital cost [\$]:	1031846
Total installation cost [\$]:	237325
Planned and unplanned O&M costs [\$ / yr]:	95316
Scenario Inputs	
Capital incentive [\$ / station]:	0
Initial production incentive [\$ / station]:	0
Annual decrement of production incentive [\$ / station]:	0
Incidental revenue [\$ / year]	0
Cost of delivered hydrogen [\$ / kg]	5.5
Cost of electricity [\$ / kWh]	0.12
Cost of natural gas [\$ / mmBTU]	8
Financing Inputs	
Debt interest rate [%]:	6
Minimum debt to equity ratio:	0.5

Internal Rate of Return [% / year]:	15.1
Break-Even Hydrogen Price [\$ / kg H <sub>2</sub> ):	\$12.37
First Year Positive EBITD:	2017
Investor Payback Period [years]:	8
NPV:	\$450256



# Example Case B: Assume a \$1.0 M Capital Incentive and \$10/kg price

**19.5% IRR,  
6 yr investor payback**

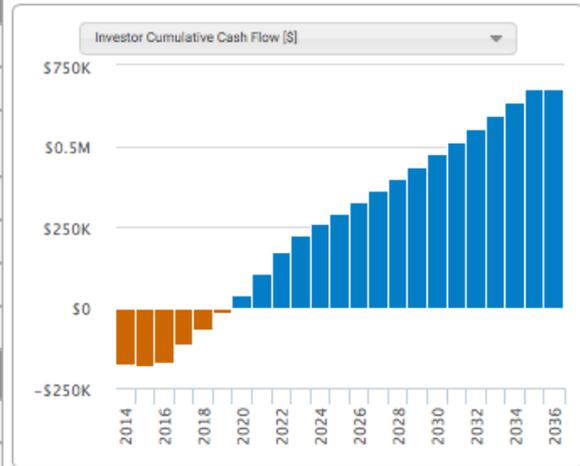
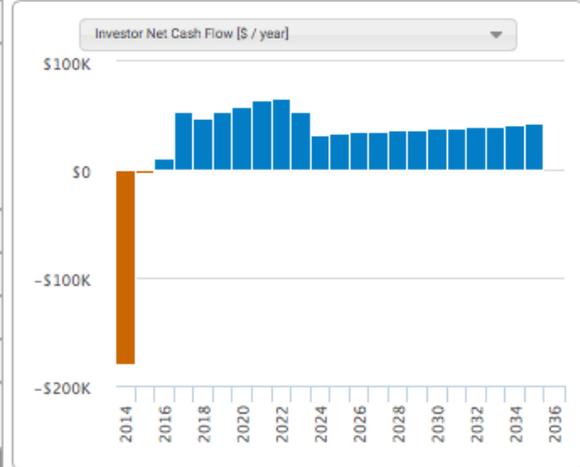
- Assume \$1 M capital incentive in the first year
- Change pump price to \$10 per kg
- Increase in IRR and investor payback period
- Result: \$9.4/kg as breakeven price for a 10% IRR

**H2FAST provides rapid assessments of the influence of incentives**

### H2FAST

Station Inputs	
Installation time [months]	18
Demand ramp-up [years]	3
Station type:	Delivered Gaseous H2
Long-term station utilization [%]:	70
Vehicle refills [refills/day]:	43.75
Hydrogen per refill [kg]:	4
Total capacity [kg/day]:	250
Hydrogen price [\$ / kg]:	10
Equipment capital cost [\$]:	1031846
Total installation cost [\$]:	237325
Planned and unplanned O&M costs [\$ / yr]:	95316
Scenario Inputs	
Capital incentive [\$ / station]:	1000000
Initial production incentive [\$ / station]:	0
Annual decrement of production incentive [\$ / station]:	0
Incidental revenue [\$ / year]	0
Cost of delivered hydrogen [\$ / kg]	5.5
Cost of electricity [\$ / kWh]	0.12
Cost of natural gas [\$ / mmBTU]	8
Financing Inputs	
Debt interest rate [%]:	6
Minimum debt to equity ratio:	0.5

Internal Rate of Return [% / year]: 19.5  
 Break-Even Hydrogen Price [\$ / kg H<sub>2</sub>]: \$9.43  
 First Year Positive EBITD: 2019  
 Investor Payback Period [years]: 6  
 NPV: \$158696



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

**22% IRR,  
5 yr investor payback**

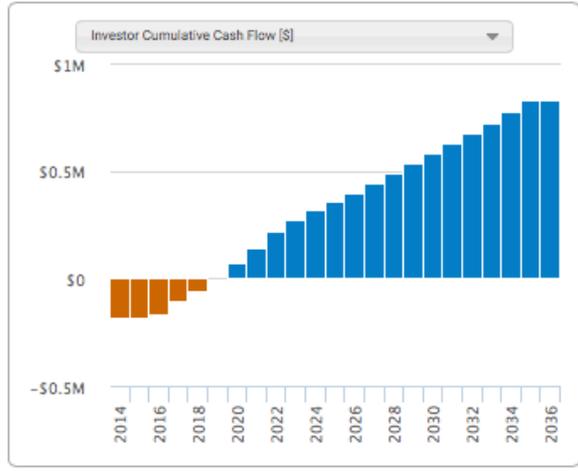
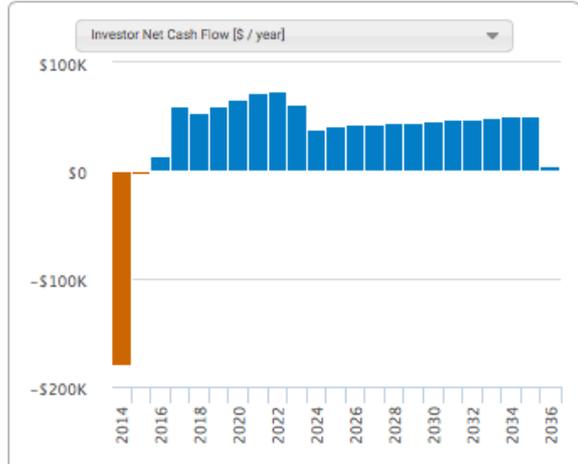
- \$1 M capital incentive
- \$10 per kg price
- Add an incidental revenue stream of \$10k per year (~\$30/day)
- Increase in IRR and investor payback period
- Result: \$9.2/kg as breakeven price for a 10% IRR

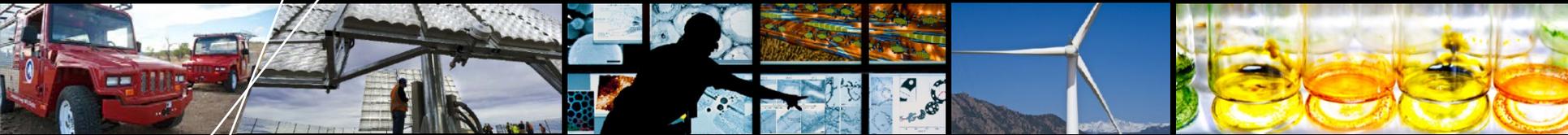
**Many financing options can be explored quickly**

### H2FAST

Station Inputs	
Installation time [months]	18
Demand ramp-up [years]	3
Station type:	Delivered Gaseous H2
Long-term station utilization [%]:	70
Vehicle refills [refills/day]:	43.75
Hydrogen per refill [kg]:	4
Total capacity [kg/day]:	250
Hydrogen price [\$ / kg]:	10
Equipment capital cost [\$]:	1031846
Total installation cost [\$]:	237325
Planned and unplanned O&M costs [\$ / yr]:	95316
Scenario Inputs	
Capital incentive [\$ / station]:	1000000
Initial production incentive [\$ / station]:	0
Annual decrement of production incentive [\$ / station]:	0
Incidental revenue [\$ / year]	10000
Cost of delivered hydrogen [\$ / kg]	5.5
Cost of electricity [\$ / kWh]	0.12
Cost of natural gas [\$ / mmBTU]	8
Financing Inputs	
Debt interest rate [%]:	6
Minimum debt to equity ratio:	0.5

Internal Rate of Return [% / year]: 21.9  
 Break-Even Hydrogen Price [\$ / kg H<sub>2</sub>]: \$9.24  
 First Year Positive EBITD: 2019  
 Investor Payback Period [years]: 5  
 NPV: \$211520





# H2FAST Excel Tool

# H2FAST Spreadsheet: Summary of Capabilities

The spreadsheet version allows for greater control of inputs and more elaborate exploration of outputs

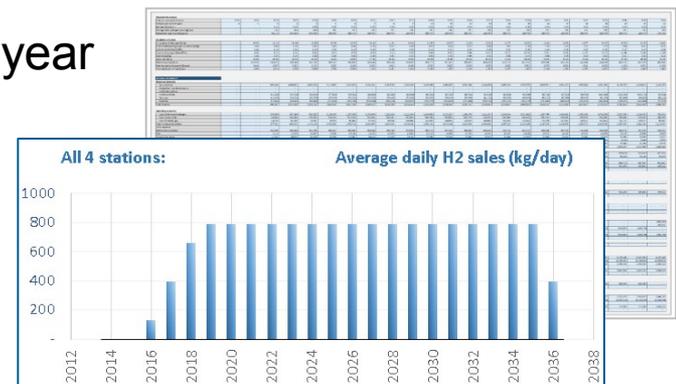
## Inputs and User Interface

- Enter information for up to 10 stations and assess finances individually or as a cluster
- 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



# User Interface Overview

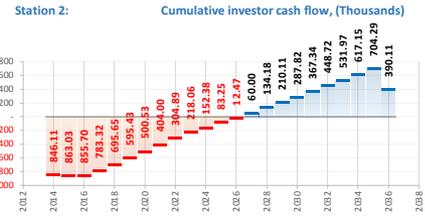
Color coding facilitates navigation

- Basic user inputs
- Advanced user inputs
- Calculated values
- Key results

Overall Financial Performance Metrics	Restore defaults
Leveraged, after-tax, nominal IRR	4.22%
Investor payback period	13 years
First year of positive EBITD	analysis year 4
After-tax, nominal NPV @ 10% discount	\$ (315,239)
Estimated break-even leveraged price (\$/kg)	\$ 11.09

Chart Selector & Description	Toggle chart labels
Cumulative investor cash flow	<input type="checkbox"/>
Investor contribution + previous year investor contribution	<input type="checkbox"/>



Station(s) Information	Basic	Advanced
Select interface type	<input checked="" type="radio"/>	<input type="radio"/>
Enter number of stations to model		3

Total dispensing capacity (kg/day)	250
Equipment capital cost	1,031,846
Installation cost	237,325
Planned & unplanned maintenance (\$/year)	95,316
Maintenance escalation (% annually)	1.9%

Incentives Information		
One time capital incentives (grant or ITC)	\$ -	
Annual operating incentives (grant or PTC)	\$ -	
Operating incentives decay rate (%/year)	10%	
Operating incentives sunset (years)	10	
Incidental revenue	\$ -	
Incidental revenue escalation rate (%/year)	1.9%	

Multi-Station Inputs	1	2	3
Select station(s) to analyze	2		
Station being analyzed (yellow background)	1	2	3
Station type	Delivered gas	Delivered gas	Delivered gas
Total dispensing capacity (kg/day)	100	250	500
Equipment capital cost	\$ 930,156	\$ 1,031,846	\$ 1,659,916
Installation cost	\$ 213,936	\$ 237,325	\$ 381,781
Planned & unplanned maintenance (\$/year)	\$ 82,852	\$ 95,316	\$ 141,412

One time capital incentives (grant or ITC)	\$ -	\$ -	\$ -
Annual operating incentives (grant or PTC)	\$ -	\$ -	\$ -

Annual incidental revenue	\$ -	\$ -	\$ -
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Demand Projection	
Price of hydrogen at project onset (\$/kg)	10.00
Project start year	2015
Price escalation rate (% annually)	1.90%
Installation time (months)	18
Demand ramp-up (years)	2.0
Long-term nominal utilization (%)	70%

Feedstock Information	
Cost of delivered hydrogen (\$/kg)	\$ 5.50
Escalation rate of hydrogen cost (% annually)	1.9%

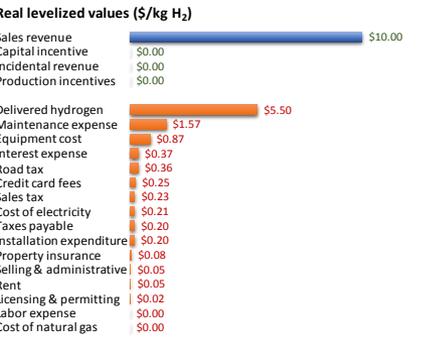
  

Price of electricity (\$/kWh)	\$ 0.120
Escalation rate of electricity cost (% annually)	1.9%

Price of natural gas (\$/mmBTU)	\$ 8.00
Escalation rate of natural gas cost (% annually)	1.9%

Other operating expenses	
Credit card fees (% of sales)	2.50%
Sales tax (% of sales)	2.25%
Road tax (\$/kg)	\$ 0.36
Road tax escalation rate (%/year)	1.90%
Staffing labor hours (h/year-station)	-
Labor rate (\$/h)	\$ 40
Labor escalation rate (% annually)	1.9%
Licensing & permitting (\$/year-station)	\$ 1,000
Licensing & permitting escalation rate (%/year)	1.9%
Rent of land (\$/station-year)	\$ 3,000
Rent escalation (% annually)	1.9%
Property insurance (% of dep capital)	1.5%
Selling & administrative expense (% of sales)	0.5%

Financing Information	
Project operational life (years)	20
Total tax rate (state, federal, local)	38.50%
Is installation cost depreciable?	No
Are operating incentives taxable?	No
Is capital incentive depreciable?	Yes
Are tax losses monetized (tax equity application)	Yes
Allowable tax loss carry-forward	7 years
General inflation rate	1.90%
Depreciation (MACRS)	7 year
Leveraged after-tax nominal discount rate	10.0%
Debt/equity financing	0.5
Debt type	Revolving debt
If loan, period of loan (years)	20
Debt interest rate (compounded monthly)	6.00%
Cash on hand (% of monthly expenses)	100%



# User Interface Overview

**i**

**Multi-Station Inputs** ← →

Select station(s) to analyze	2		
Station being analyzed (yellow background)	1	2	3
Station type	Delivered gas	Delivered gas	Delivered gas
Total dispensing capacity (kg/day)	100	250	500
Equipment capital cost	\$ 930,156	\$ 1,031,846	\$ 1,659,916
Installation cost	\$ 213,936	\$ 237,325	\$ 381,781
Planned & unplanned maintenance (\$/year)	\$ 82,852	\$ 95,316	\$ 141,412

One time capital incentives (grant or ITC)	\$ -	\$ -	\$ -
Annual operating incentives (grant or PTC)	\$ -	\$ -	\$ -

Annual incidental revenue	\$ -	\$ -	\$ -
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## Cost specifications can be entered for multiple stations

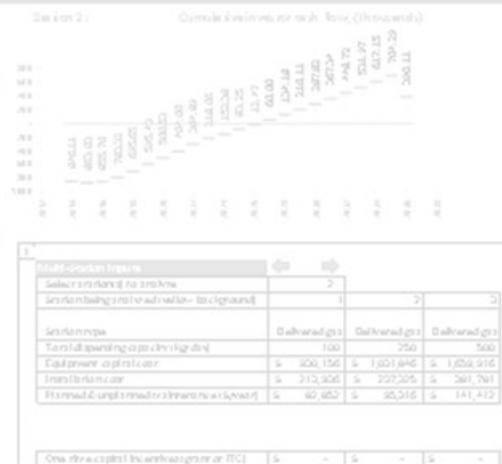
- Users can select individual or all stations
- Users can specify different station types
- Costs should be changed by the user
- Pre-populated values are derived from HRSAM

# User Interface Overview

Station(s) Information	Basic	Advanced
Select interface type	Basic	Advanced
Enter number of stations to model		3

Multi-Station Inputs	1	2	3
Select station(s) to analyze		2	
Station being analyzed (yellow background)		1	2



**Users can switch between model modes and stations to be analyzed**

- Up to 10 stations can be modeled
- All stations can be modeled as a cluster

# User Interface Overview

Demand Projection		
Price of hydrogen at project onset (\$/kg)		10.00
Project start year		2015
Price escalation rate (% annually)		1.90%
Installation time (months)		18
Demand ramp-up (years)		2.0
Long-term nominal utilization (%)		70%

Feedstock Information		
Cost of delivered hydrogen (\$/kg)	\$	5.50
Escalation rate of hydrogen cost (% annually)		1.9%

Price of electricity (\$/kWh)	\$	0.120
Escalation rate of electricity cost (% annually)		1.9%

Price of natural gas (\$/mmBTU)	\$	8.00
Escalation rate of natural gas cost (% annually)		1.9%

Other operating expenses		
Credit card fees (% of sales)		2.50%
Sales tax (% of sales)		2.25%
Road tax (\$/kg)	\$	0.36
Road tax escalation rate (%/year)		1.90%
Staffing labor hours (h/year-station)		-
Labor rate (\$/h)	\$	40
Labor escalation rate (% annually)		1.9%
Licensing & permitting (\$/year-station)	\$	1,000
Licensing & permitting escalation rate (%/year)		1.9%
Rent of land (\$/station-year)	\$	3,000
Rent escalation (% annually)		1.9%
Property insurance (% of dep capital)		1.5%
Selling & administrative expense (% of sales)		0.5%

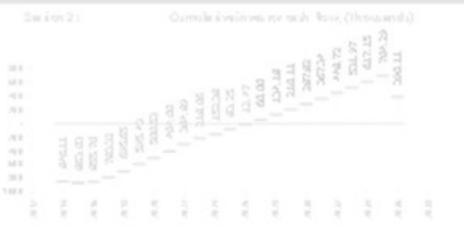
Financing Information		
Project operational life (years)		20
Total tax rate (state, federal, local)		38.50%
Is installation cost depreciable?		No
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Are tax losses monetized (tax equity application)		Yes
Allowable tax loss carry-forward		7 year
General inflation rate		1.90%
Depreciation (MACRS)		7 year
Leveraged after-tax nominal discount rate		10.0%
Debt/equity financing		0.5
Debt type		Revolving debt
If loan, period of loan (years)		20
Debt interest rate (compounded monthly)		6.00%
Cash on hand (% of monthly expenses)		100%

## Users can specify all financial parameters

- Projected demand
- Feedstock & utility costs
- Other operating expenses
- Capital structure
- Taxes

# User Interface Overview

Overall Financial Performance Metrics	Restore defaults
Leveraged, after-tax, nominal IRR	4.22%
Investor payback period	13 years
First year of positive EBITD	analysis year 4
After-tax, nominal NPV @ 10% discount	\$ (315,239)
Estimated break-even leveraged price (\$/kg)	\$ 11.09



Operating Parameters	Value
Target operating capacity (kg/day)	250
Equipment capital cost	1,001,646
Interest rate	207,205

Operating Parameters	Value
Target operating capacity (kg/day)	250
Equipment capital cost	\$ 1,001,646
Interest rate	\$ 207,205

Overall Financial Performance Metrics	Restore defaults
Leveraged, after-tax, nominal IRR	4.22%
Investor payback period	13 years
First year of positive EBITD	analysis year 4
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Operating Parameters	Value
Cost of delivered hydrogen (\$/kg)	\$ 5.50
Discount rate of hydrogen user's market	1.9%

Operating Parameters	Value
Cost of delivered hydrogen (\$/kg)	\$ 5.50
Discount rate of hydrogen user's market	1.9%

Operating Parameters	Value
Price of delivered hydrogen (\$/kg)	\$ 6.170
Discount rate of delivered hydrogen user's market	1.9%

Operating Parameters	Value
Price of delivered hydrogen (\$/kg)	\$ 6.170
Discount rate of delivered hydrogen user's market	1.9%

Operating Parameters	Value
Target operating capacity (kg/day)	250
Equipment capital cost	26,5025

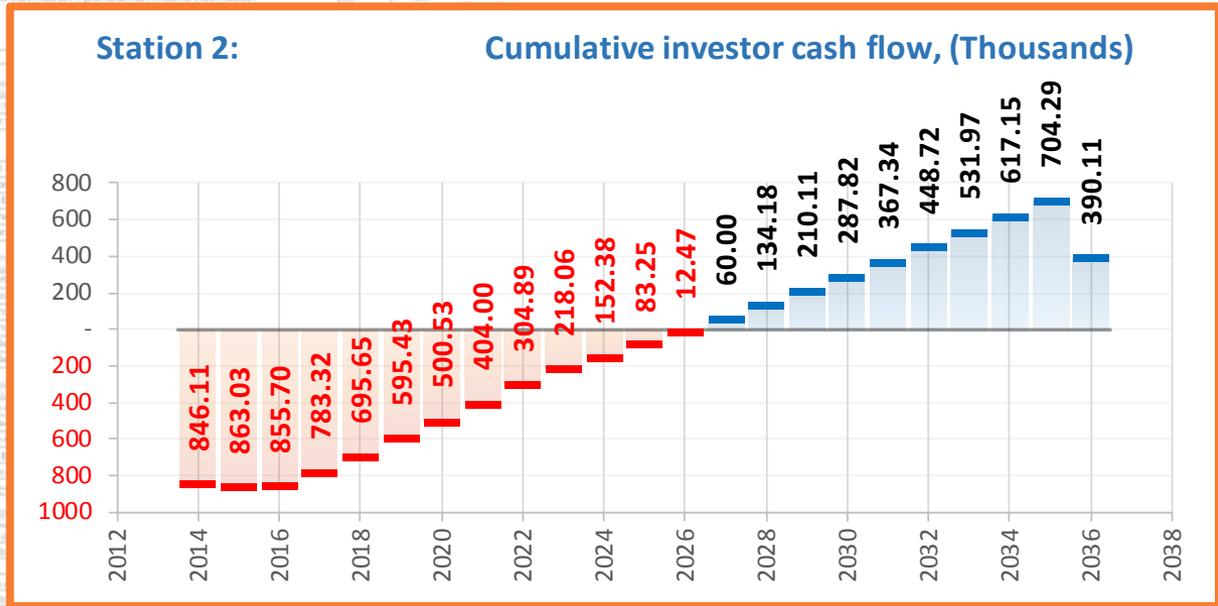
Operating Parameters	Value
Target operating capacity (kg/day)	250
Equipment capital cost	26,5025

## Key outputs are highly visible

- IRR
- Payback
- Year of positive earnings
- NPV
- Break-even price of hydrogen

Note: values are leveraged, based on equity investors cash flow.

# User Interface Overview



**Visualization of time series results**

# User Interface Overview

Account	Balance	Debit	Credit
Invested 1st year	4,200		
Invested 2nd year	12,000		
Invested 3rd year	12,000		
Invested 4th year	12,000		
Invested 5th year	12,000		
Invested 6th year	12,000		
Invested 7th year	12,000		
Invested 8th year	12,000		
Invested 9th year	12,000		
Invested 10th year	12,000		
Invested 11th year	12,000		
Invested 12th year	12,000		
Invested 13th year	12,000		
Invested 14th year	12,000		
Invested 15th year	12,000		
Invested 16th year	12,000		
Invested 17th year	12,000		
Invested 18th year	12,000		
Invested 19th year	12,000		
Invested 20th year	12,000		
Invested 21st year	12,000		
Invested 22nd year	12,000		
Invested 23rd year	12,000		
Invested 24th year	12,000		
Invested 25th year	12,000		
Invested 26th year	12,000		
Invested 27th year	12,000		
Invested 28th year	12,000		
Invested 29th year	12,000		
Invested 30th year	12,000		
Invested 31st year	12,000		
Invested 32nd year	12,000		
Invested 33rd year	12,000		
Invested 34th year	12,000		
Invested 35th year	12,000		
Invested 36th year	12,000		
Invested 37th year	12,000		
Invested 38th year	12,000		
Invested 39th year	12,000		
Invested 40th year	12,000		
Invested 41st year	12,000		
Invested 42nd year	12,000		
Invested 43rd year	12,000		
Invested 44th year	12,000		
Invested 45th year	12,000		
Invested 46th year	12,000		
Invested 47th year	12,000		
Invested 48th year	12,000		
Invested 49th year	12,000		
Invested 50th year	12,000		
Invested 51st year	12,000		
Invested 52nd year	12,000		
Invested 53rd year	12,000		
Invested 54th year	12,000		
Invested 55th year	12,000		
Invested 56th year	12,000		
Invested 57th year	12,000		
Invested 58th year	12,000		
Invested 59th year	12,000		
Invested 60th year	12,000		
Invested 61st year	12,000		
Invested 62nd year	12,000		
Invested 63rd year	12,000		
Invested 64th year	12,000		
Invested 65th year	12,000		

**Chart Selector & Description** Toggle chart labels

Cumulative investor cash flow ▼

Investor contribution + previous year investor contribution ▲

- Cumulative investor cash flow
  - Investor cash flow
  - Monetized tax losses
  - Gross margin
  - Cost of goods sold (\$/year)
  - Cost of goods sold (\$/kg)
  - Average station utilization (%)
  - Average daily H2 sales (kg/day)
  - Retail price of H2 (\$/kg)
  - Cost of delivered H2 to station (\$/kg)
  - Cost of electricity (\$/kWh)
  - Cost of natural gas (\$/mmBTU)
- INCOME STATEMENT VALUES**
- Sales revenue
  - Production incentive revenue
  - Incidental revenue
  - Credit card fees
  - Sales tax
  - Road tax
  - Total revenue
  - Annual cost of delivered H2
  - Annual cost of electricity
  - Annual cost of natural gas
  - Total feedstock & utilities cost
  - Labor expense
  - Maintenance expense
  - Rent expense
  - Property insurance
  - Licensing & permitting

**Users can select from 65 different metrics**

- Green window provides parameter descriptions

# User Interface Overview

## Real levelized values (\$/kg H<sub>2</sub>)



**Users are provided with a detailed breakdown of revenues and expenses**

- Values are reported on per-kilogram of hydrogen sold

# Report Tables

All typical US GAAP report values are displayed for each analysis year

General parameters

General information	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Calendar year end of year	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31
Analysis year end of analysis	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31	12/31
Reporting currency (USD)	USD																		
Average exchange rate (USD)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Accounting method (US GAAP)	US GAAP																		

Income statements

Income Statement	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Revenues (total)	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Cost of sales	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Gross profit	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Operating expenses	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
Operating income	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000

Cash flow statements

Cash Flow Statement	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Net income	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Depreciation	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Change in working capital	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Cash flow from operating activities	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000

Balance sheets

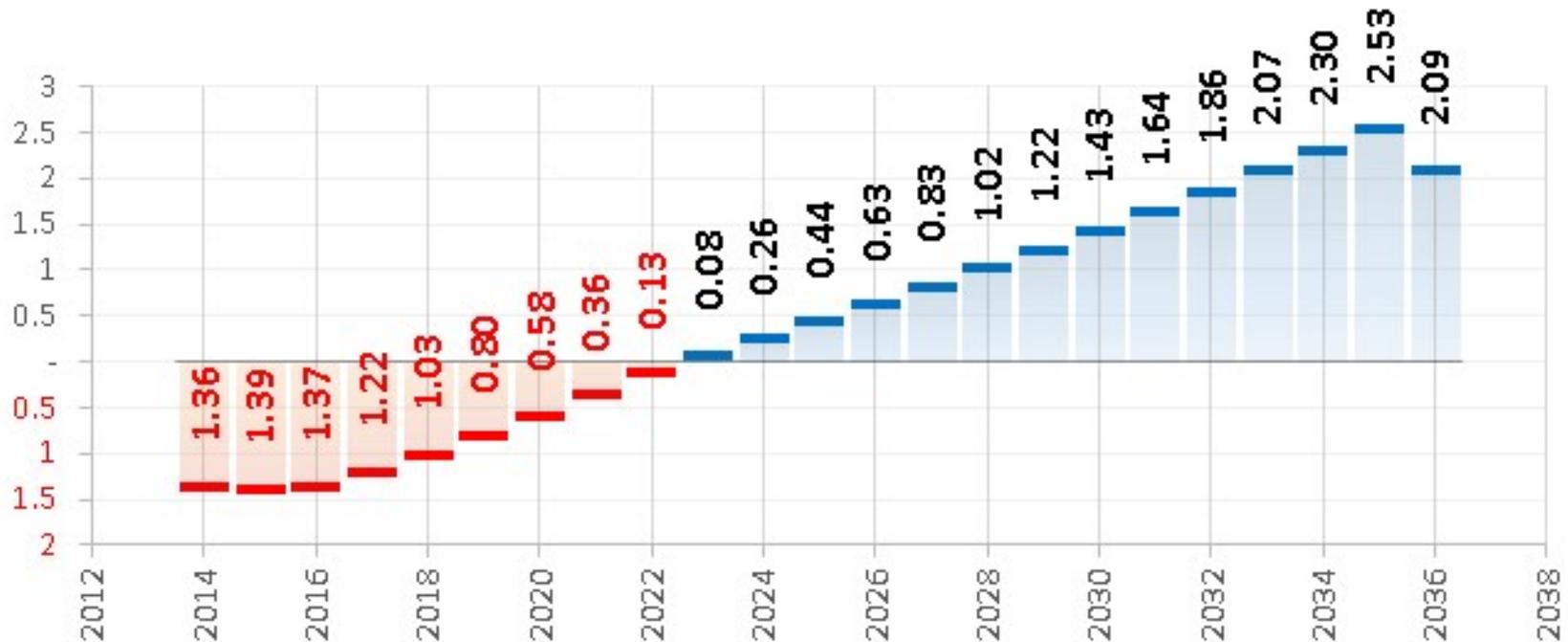
Balance Sheet	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Assets	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Current assets	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Non-current assets	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Liabilities	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Current liabilities	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
Non-current liabilities	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Equity	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Common stock	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Retained earnings	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000

# Time Series Examples

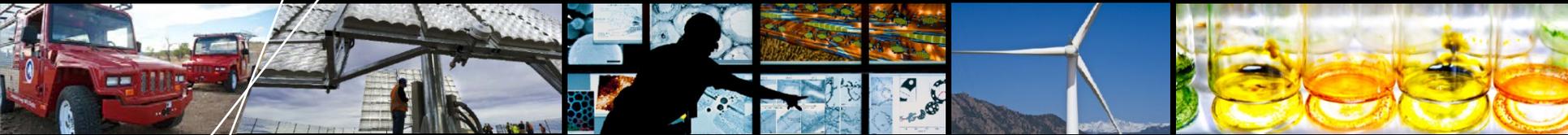
Range of tables satisfied  
most end user inquiries

## Station 3:

## Cumulative investor cash flow, (Millions)



- User can select from 65 common reportable time series
- Detailed description is available for each time series
- Labels can be turned on and off to show numeric values



# H2FAST Business Case Scenario – Visualization Tool

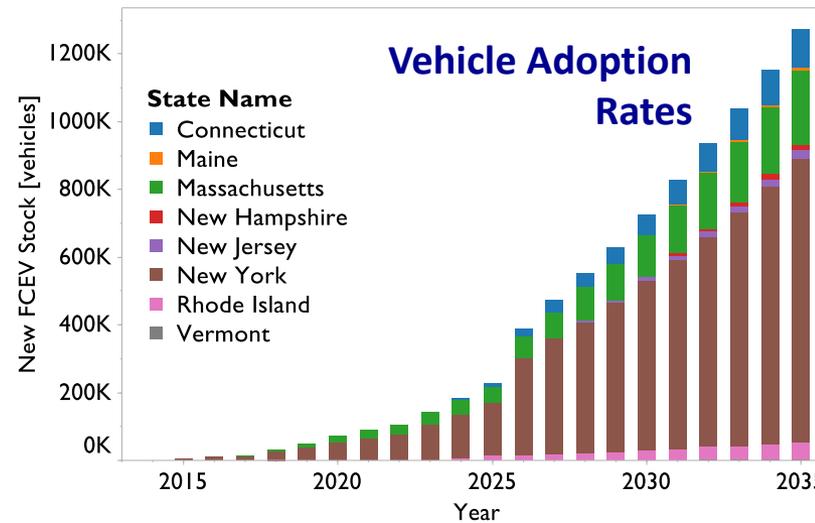
# Multivariate visualization provides access to large scenario data results

- The SERA model can generate a large volume of scenario results
- The H2FAST framework can be applied across the entire hydrogen supply chain system and a broad range of scenario parameters
- Some engaged audiences, such as H2USA WG members, are interested in exploring ranges of inputs assumptions and multiple sets of scenario outputs

## Demand and Delivery by City



## Regional/State-level Subsets of Results

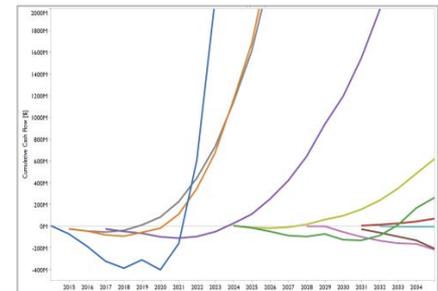


*Stand-alone reports cannot capture the full range of possible outputs*

## Station Placement

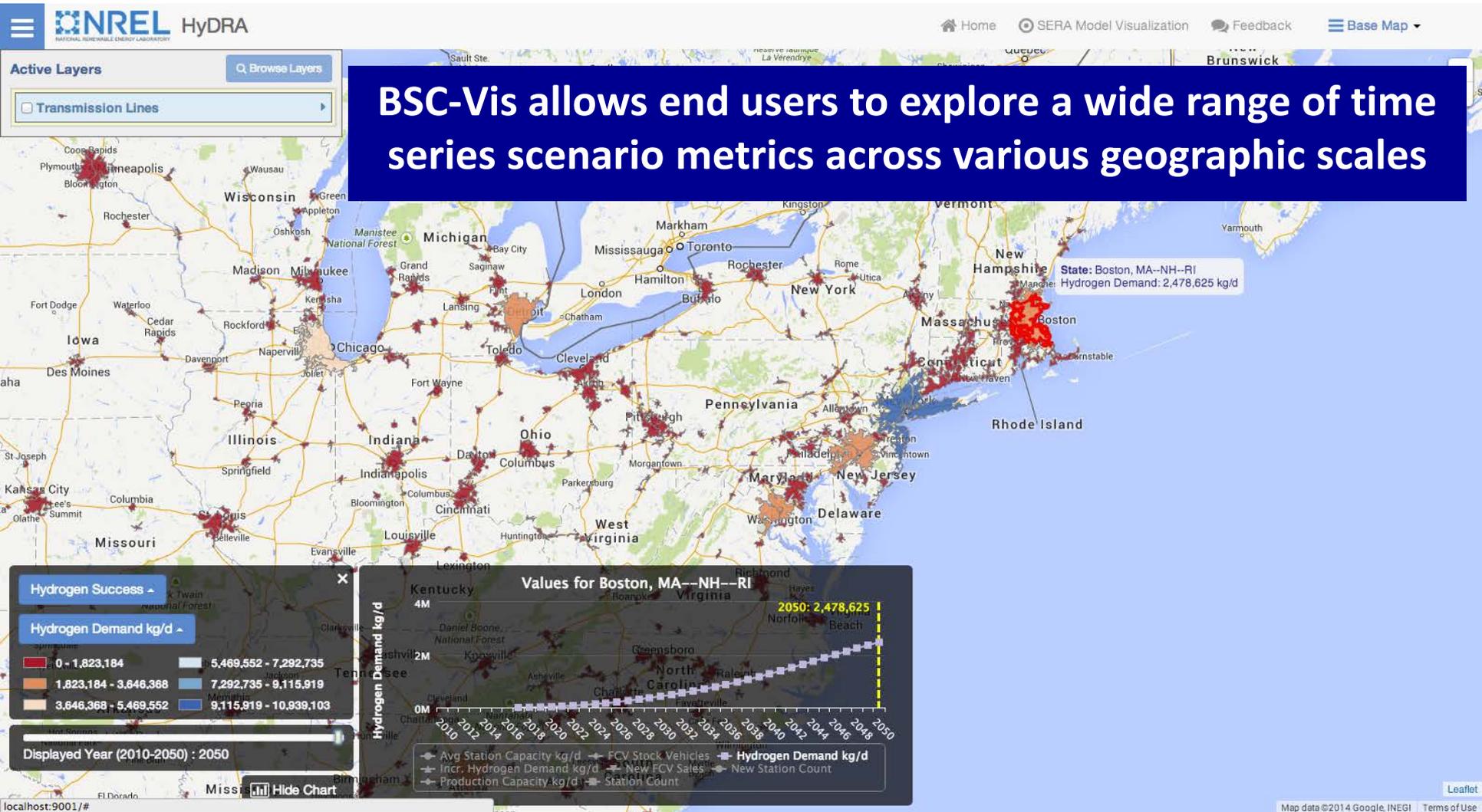


## Cash Flows



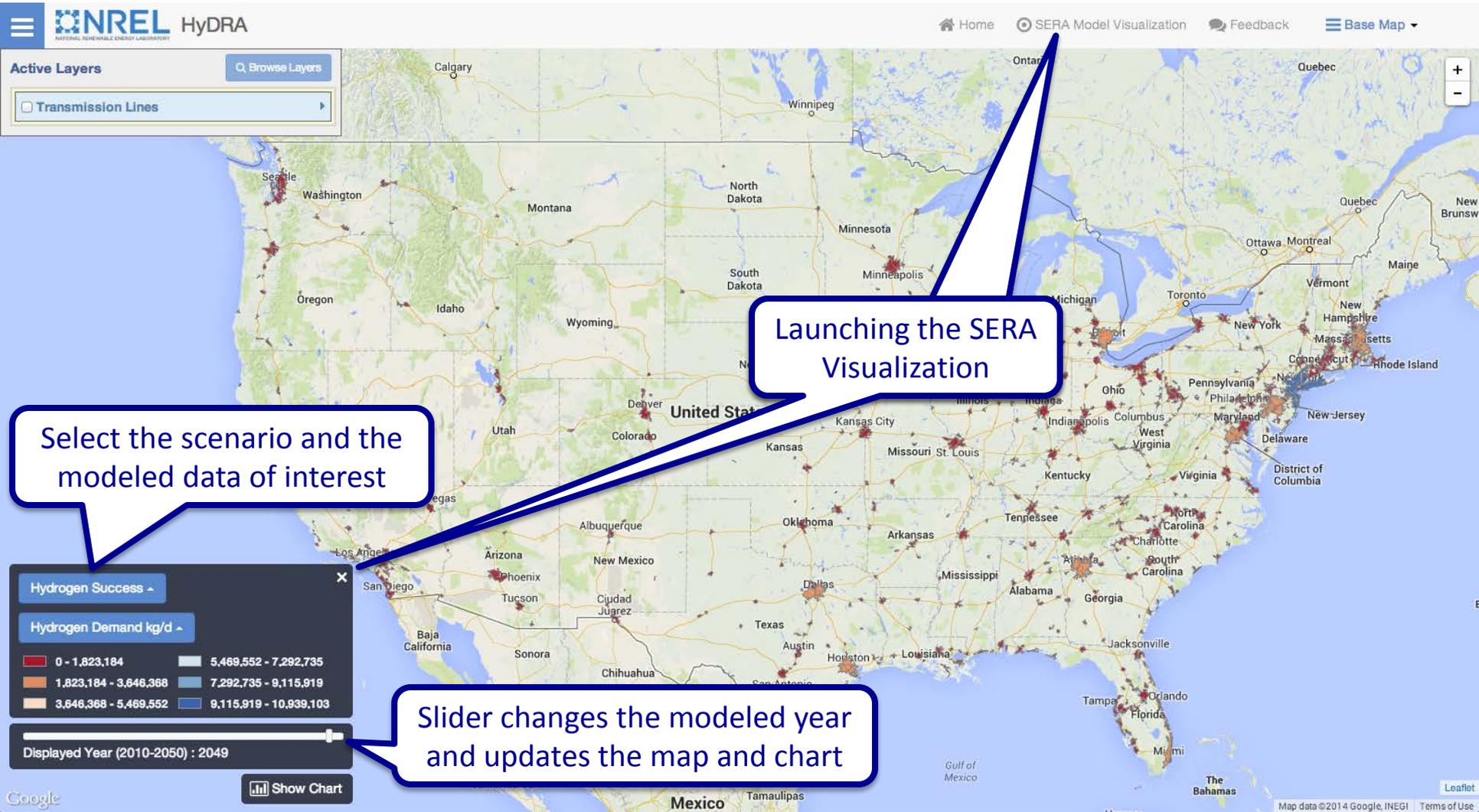
**The Business Case Scenario Visualization tool (BCS-Vis) is being developed to allow end-users to explore a wide range of inputs and outputs**

# Business Case Scenario tool explores the full range of SERA outputs

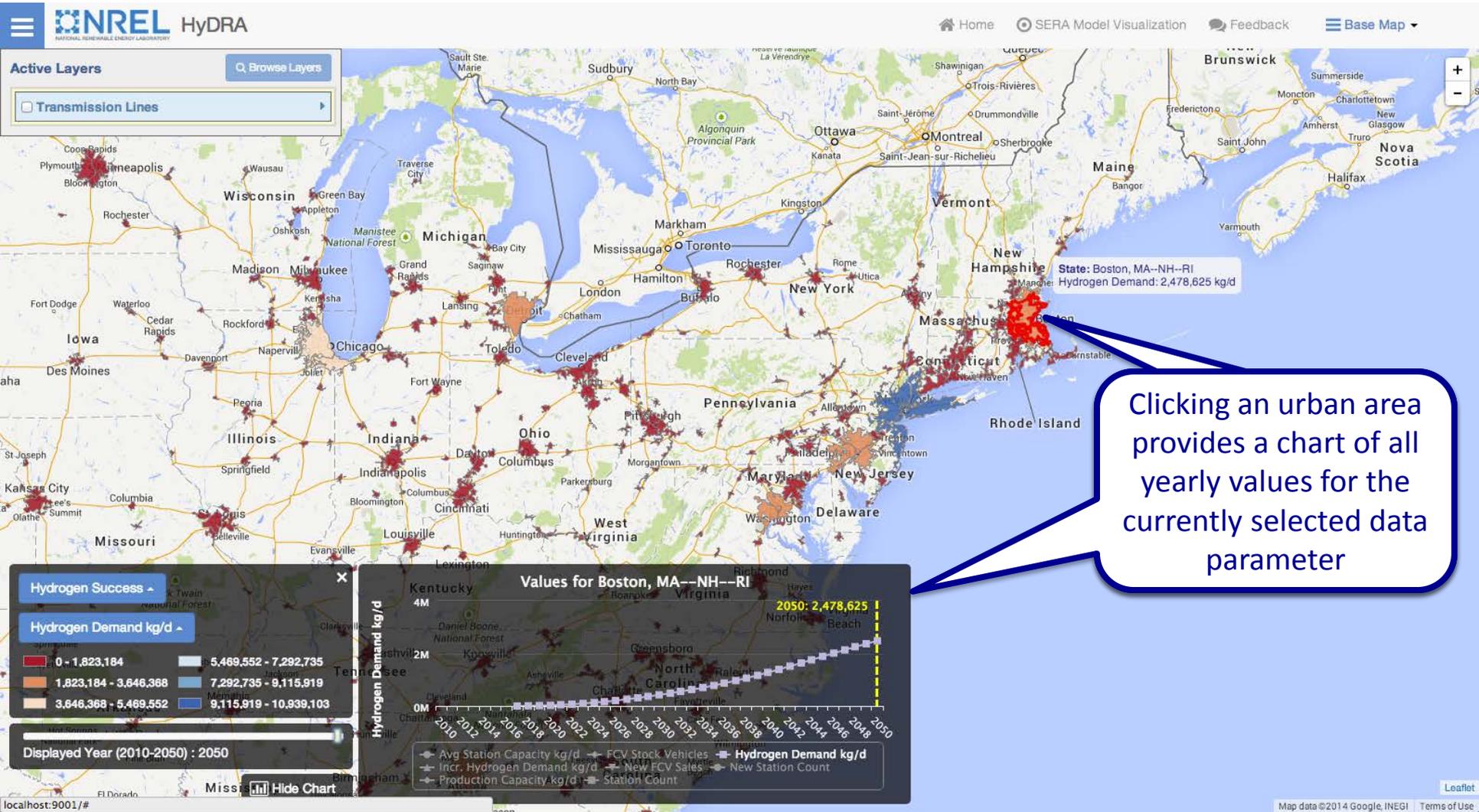


4-min video demonstrates the multivariate visualization tool: <http://youtu.be/J7y51c-dldo>

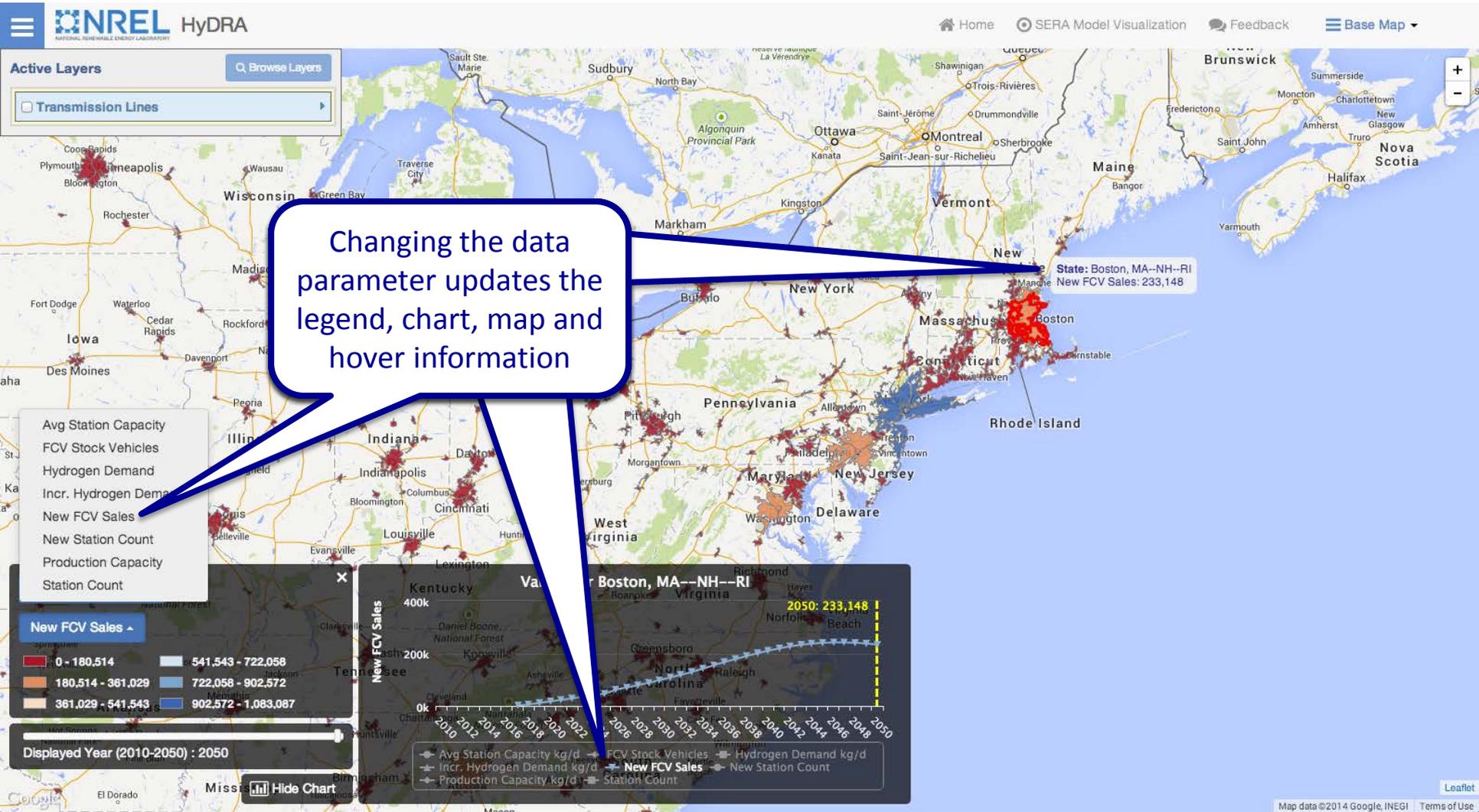
# Selection of years



# Selection of urban areas



# Selection of metrics and output variables

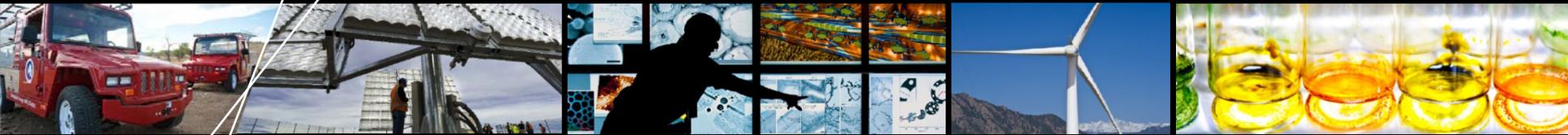


# Summary

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- **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?



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