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Electric Vehicle Infrastructure Financial Analysis Scenario Tool (EVI-FAST): Spreadsheet Tool User's Manual

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List of Acronyms

DSCR	debt service coverage ratio
EBITD	earnings before interest, taxes, and depreciation
EV	battery-electric vehicle
EVI-FAST	EV Infrastructure Financial Analysis Scenario Tool
IRR	internal rate of return
IRS	Internal Revenue Service
ITC	investment tax credit
kWh	kilowatt hours
kW	kilowatt
LCFS	low-carbon fuel standard
MACRS	Modified Accelerated Cost Recovery System
NPV	net present value
NREL	National Renewable Energy Laboratory
PP&E	plant, property, and equipment
PTC	production tax credit

Table of Contents

1 Introduction

The Electric Vehicle Infrastructure Financial Analysis Scenario Tool (EVI-FAST) provides a quick and convenient in-depth financial analysis for electric vehicle charging infrastructure. It is meant to facilitate investments in charging infrastructure and improve policy-design decisions to support deployment. Intended users include policy and government decision makers, infrastructure operators, equity investors, strategic investors, and lenders.

This manual describes how to use the spreadsheet version of EVI-FAST, which was developed by the National Renewable Energy Laboratory (NREL). The model conforms to Generally Accepted Accounting Principles (GAAP) and is compatible with analysis for International Financial Reporting Standards (IFRS) (FASAB 2014, Investopedia 2014).

As this manual illustrates, the EVI-FAST spreadsheet offers basic and advanced user interface modes for parallel modelling of multiple charging scenarios. It provides users with detailed annual finance projections in the form of income statements, cash flow statements, and balance sheets; graphical presentation of financial performance parameters for numerous common metrics; life-cycle cost breakdown for each analysis scenario; and common ratio analysis results such as debt/equity position, return on equity, and debt service coverage ratio. It also enables risk analysis based on user-defined distributions of input values.

2 Getting Started

After the EVI-FAST Excel file is downloaded to a computer (free of charge), users must enable macros when the file is opened. To revert to the default settings and values, the model can simply be downloaded again. This tool is designed for use with Microsoft Excel 2010 and newer Excel versions on a PC platform; full functionality is not guaranteed with the use of older Excel versions or an Apple computer.

The spreadsheet opens on the Interface worksheet (Figure 1). This is the primary worksheet for inputting values and viewing results. Three other worksheets are accessible by clicking the tabs at the bottom of the screen. The Description worksheet provides basic information about the tool. The Report Tables worksheet shows detailed technical and financial outputs in tabular form. The Overrides worksheet enables customized inputs for various parameters.

Active cells in each worksheet are color coded: yellow for user inputs, blue for calculated values, and green for key results. Although equations in the blue cells can be modified, only expert users should attempt this, because it can cause the model to malfunction or produce inaccurate results. The green cells should never be modified.

For many of the cells, descriptive information pops up when the cell is clicked. In addition, some blocks of inputs are collapsible and can be expanded by clicking the triangle next to the section heading.

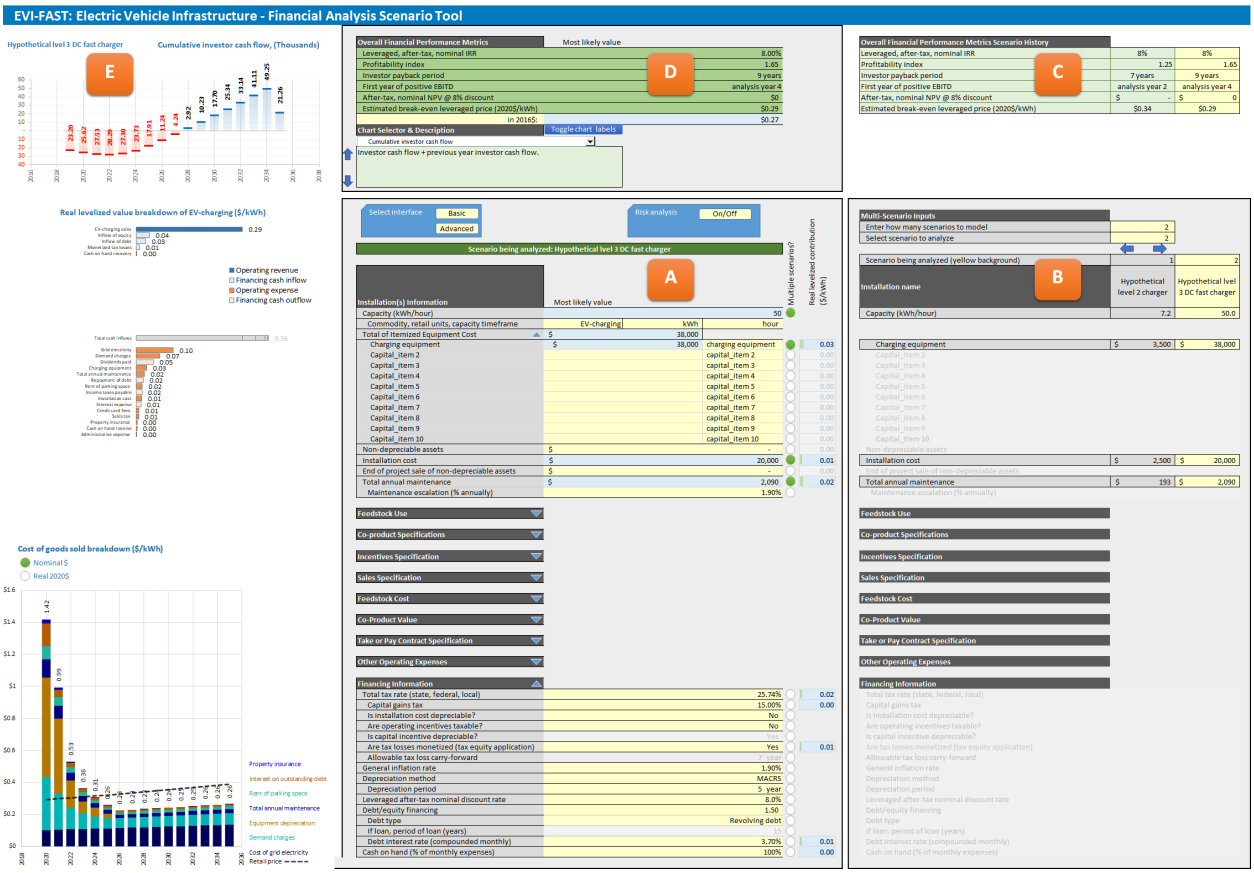


Figure 1. Interface worksheet layout, basic mode. Layout is denoted by **A**: inputs pane for individual installation currently analyzed by financial model. **B**: inputs pane for items differentiated by selecting "●Multiple Scenarios" line items in the A pane. Users can select scenario being analyzed by clicking the left and right arrows at the top of this pane, which highlights the currently selected scenario with yellow. **C:** key results from individual scenarios selected in section B. Note that user has to cycle through the scenarios for the values to be updated in this section (by clicking arrows on top of section B). **D:** key results of the currently selected scenario. **E:** Graphical display of key results. Note: top graphic can be changed by selecting drop-down menu items on the bottom of pane D.

2.1 Inputs

Users input information within the Interface worksheet. Clicking the "Basic" or "Advanced" button above the Installation(s) Information table selects the interface type. Basic is the default and enables a relatively small number of input fields. In this mode, the default values can simply be accepted, or new values can be entered into the yellow cells.

The advanced mode enables additional input fields, and it gives the option of analyzing up to 300 side by side installation analysis by clicking the circles to the right of each field to turn them green. For analyzing only one installation, the default values can simply be accepted, or new values can be entered into the yellow cells for all sections under the Installation(s) Information table. Clicking the down-arrows expand each input section (Figure 2). Default labels, units, and values are provided for some fields, but these can be overwritten, and/or customized entries can be created using the numerous fields available for that purpose. For example, in Figure 2, the default feedstock type (grid electricity) is specified in terms of kilowatt hours of grid electricity per kilowatt hour of electricity sold to an EV. In this scenario, more than 1 kWh of grid electricity is specified by default to account for efficiency losses and charger auxiliary power consumption. Additional feedstocks can be specified on per-unit of energy of charging. This is allowed by user discretion (e.g. to break out transmission and distribution charges, or other variable operating expenses). In any case, it is important that the default numbers are replaced with installation-specific values. The default values are meant to approximate a typical charger, but they do not represent actual or predicted values that would be applicable to a broader set of charging stations or locations.

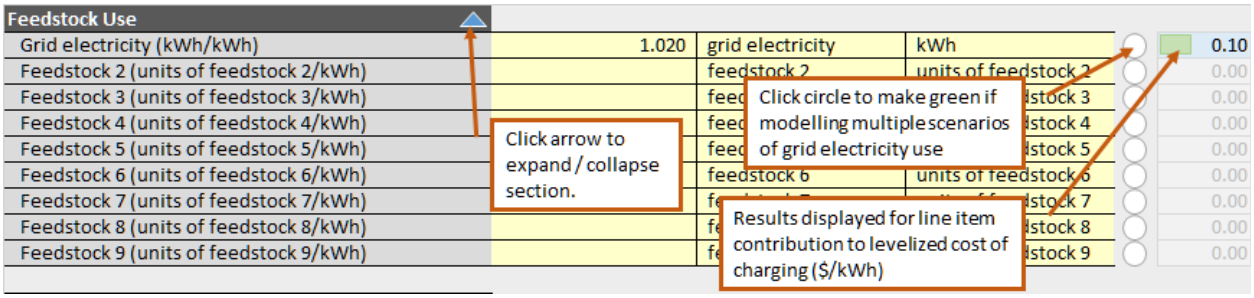


Figure 2. Example expanded and unexpanded sections under the Installation(s) Information table

For analyzing multiple installations, one or more circles (under the heading "Multiple scenarios?") can be clicked next to an input value that will be different for different installations. This turns the cell to the left of the circle blue, making it a calculation cell that should not be modified directly—its value can be changed via the Multi-Scenario Inputs table, which appears immediately to the right of the Installation(s) Information table when the circle is clicked. In the Multi-Scenario Inputs table, the number of scenarios to model can be set (from 1 to 300), and then inputs can be entered for all relevant fields. In the example shown in Figure 3, clicking the circles next to the "Capacity (kWh/hour)", "Charging equipment", "Installation cost" and "Total annual maintenance" input fields has brought up the Multi-Scenario Inputs table, where the user has selected scenarios to model, named two corresponding charger types, and entered corresponding values for each scenario. The scenario values for the selected scenario (highlighted in yellow) appear in the corresponding fields in "Installation(s) Information" table

on the left. Values in any input field in the Installation(s) Information table for which the circle is not clicked are applied to all installations defined in the Multi-Scenario Inputs table.

Note that EVI-FAST is not a cost estimation model. The tool is intended to be flexible so that users can input charging infrastructure cost assumptions for a wide variety of systems. Guidance for installation costs should be obtained by vendor quotes or literature review to suit the analysts' needs. The populated chargers are supplied as hypothetical inputs and should only be used as an example of how to use the model.

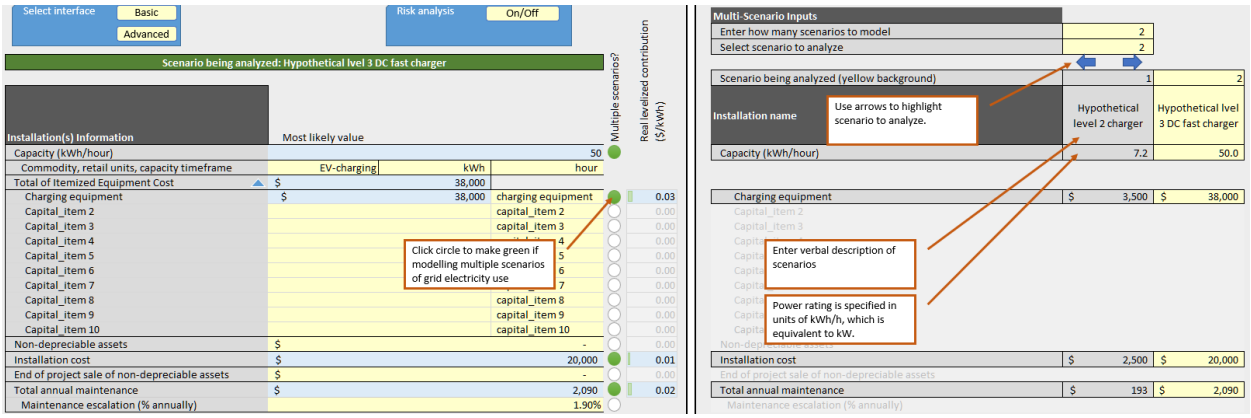


Figure 3. Example of the linkage of values between the Installation(s) Information table (top) and Multi-Scenario Inputs table (bottom)

Appendix A has descriptions of all input values. Furthermore, each row heading has pop-up information when selected, with description of the input parameter.

2.2 Results

Results can be viewed for each installation by clicking the blue arrows at the top of the Multi-Scenario Inputs table. The selected installation is highlighted in yellow; for example, in Figure 3 above, the "Hypothetical level 3 DC fast charger" installation is selected. For the installation selected, results are presented in five areas in the Interface worksheet. The Overall Financial Performance Metrics table at the top shows values for leveraged, after-tax, nominal IRR (internal rate of return); profitability index; investor payback period; first year of positive EBITD (earnings before interest, taxes, and depreciation); after-tax, nominal NPV (net present value) at the selected discount rate; and estimated break-even leveraged price (Figure 5). Clicking on each metric title shows a definition of the metric (Appendix B has descriptions of all outputs).

Overall Financial Performance Metrics	Most likely value
Leveraged, after-tax, nominal IRR	8.00%
Profitability index	1.65
Investor payback period	9 years
First year of positive EBITD	analysis year 4
After-tax, nominal NPV @ 8% discount	$0
Estimated break-even leveraged price (2020$/kWh)	$0.29
in 2016$:	$0.27

Chart Selector & Description | Toggle chart labels

Cumulative investor cash flow

Investor cash flow + previous year investor cash flow.

Figure 4. Interface worksheet, Overall Financial Performance Metrics table

The IRR is the discount rate at which a project's NPV is equal to zero. The IRR calculations can exhibit complex behavior (Miller 2008). In simple cases where investor cash flow is negative in the first year and positive in each subsequent year, the IRR can have only one value. However, if investor cash flow switches between positive and negative more than once during the project period, multiple solutions for the IRR will exist. EVI-FAST uses Excel's native IRR calculation. In cases with multiple IRR solutions, it typically displays the smallest positive solution. In contrast, the *Profitability index*—the present value of future equity investor cash flows divided by the initial equity investment—is a robust financial performance metric that always returns a single, valid result.

NPV and break-even price are linked to the value entered for "Leveraged after-tax nominal discount rate" in the Financing Information table (using the advanced interface). The NPV is calculated using that discount rate. The break-even price is the price at which an installation would need to sell a commodity to receive an IRR equal to the discount rate specified. If the actual price (e.g., "Price of EV charging at project onset ($/kWh)" (row 80), in the Sales Specification table) is set exactly equal to the break-even price (row 11), the IRR received will equal the discount rate entered, and the NPV will be zero (Figure 6). The values can be matched exactly using an Excel calculation: typing an equal sign in the cell next to "Price of EV charging at project onset ($/kWh)", selecting the cell next to "Estimated break-even leveraged price ($/kWh)," and then pressing "Enter" on the keyboard.

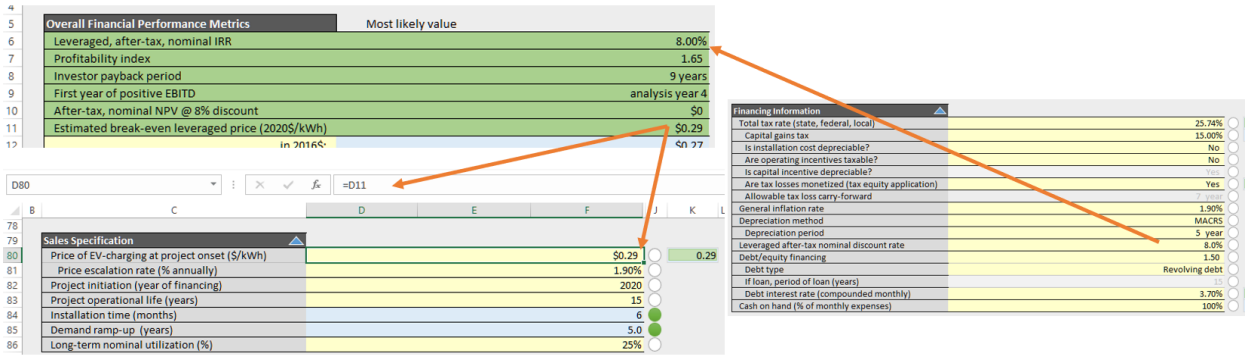
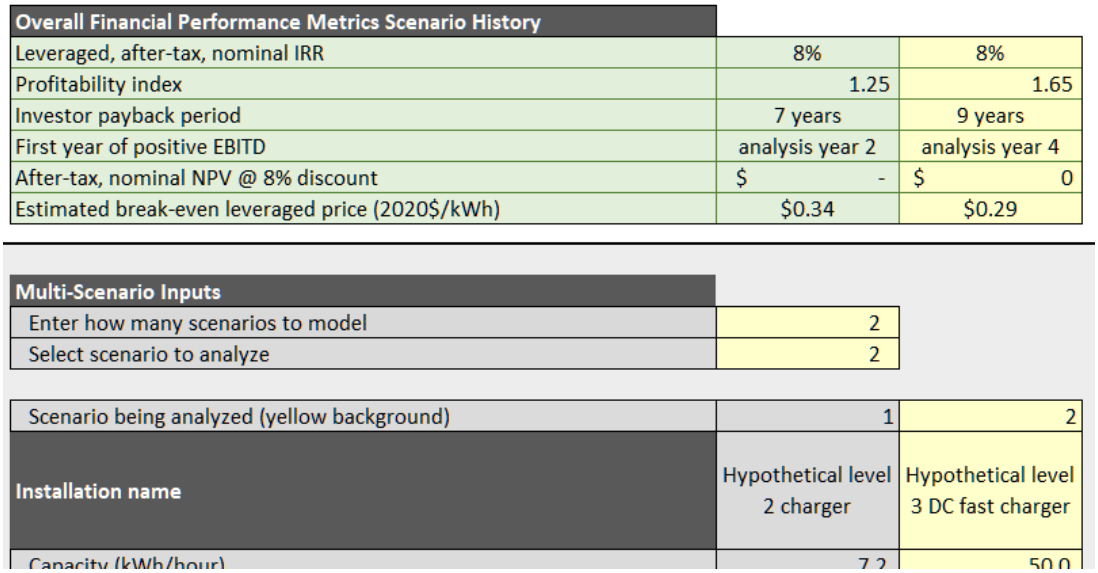


Figure 5. Model can be set to solve for price of first year charging cost ($/kWh) by setting cell D80 = D11. This makes the model compute a price of charging which yields an NPV of $0 at the specified leveraged

discount rate. Alternatively, the model can be given a price of charging and will compute the corresponding IRR and NPV for the specified discount rate.

When multiple installations are analyzed, the basic financial results for all scenarios will be displayed in the Overall Financial Performance Metrics Scenario History table. In the example shown in Figure 7, the results for two installations are shown, and the results for the "Hypothetical level 3 DC fast charger" installation are highlighted. After any values are changed in the model, each station must be highlighted using the blue arrows in the Multi-Scenario Inputs table to "refresh" the results in the Overall Financial Performance Metrics Scenario History table so they reflect the changes.



Overall Financial Performance Metrics Scenario History		
Leveraged, after-tax, nominal IRR	8%	8%
Profitability index	1.25	1.65
Investor payback period	7 years	9 years
First year of positive EBITD	analysis year 2	analysis year 4
After-tax, nominal NPV @ 8% discount	$ -	$ 0
Estimated break-even leveraged price (2020$/kWh)	$0.34	$0.29

Multi-Scenario Inputs	
Enter how many scenarios to model	2
Select scenario to analyze	2

Scenario being analyzed (yellow background)	1	2
Installation name	Hypothetical level 2 charger	Hypothetical level 3 DC fast charger
Capacity (kWh/hour)	7.2	50.0

Figure 6. Overall Financial Performance Metrics Scenario History table (top), with results for the "Hypothetical level 3 DC fast charger" installation highlighted via the Multi-Scenario Inputs table (bottom)

Various results also can be displayed within the Interface worksheet's chart field. Selecting a chart from the drop-down menu under Chart Selector & Description displays the selected chart (Figure 8). The text field below the menu describes the active chart. Clicking the blue up and down arrows to the right of the text field scrolls through the various charts. The "Toggle chart labels" button turns the chart labels on and off.

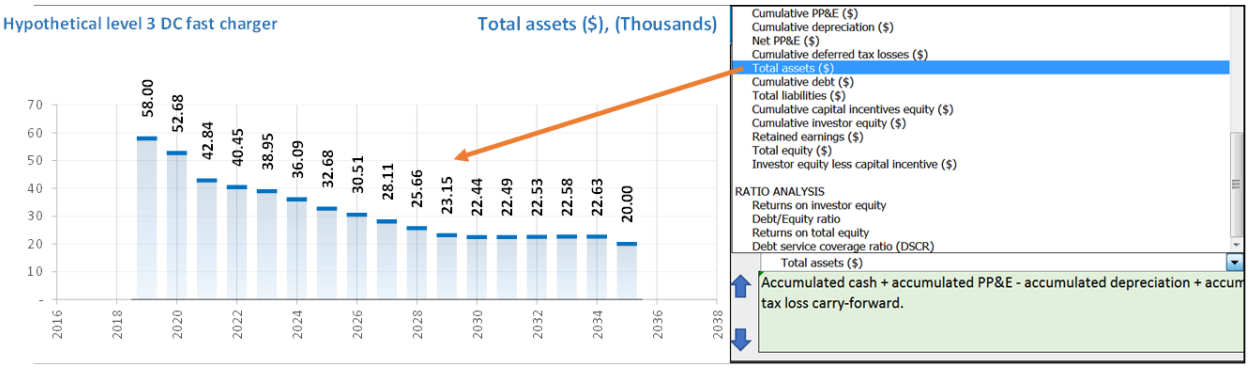


Figure 7. Interface worksheet, Chart Selector & Description, showing chart options

Below the rotating chart area is another chart with bars and values representing levelized (dollars per kWh sold) cash inflows and outflows for the selected installation (Figure 9). Below that chart is the final results output within the Interface worksheet, the cost of goods sold chart. The example in Figure 10 highlights the effects of accelerated capital depreciation (5-year MACRS) on equipment costs. It also shows costs dipping below the charging price after year 5 of the project.

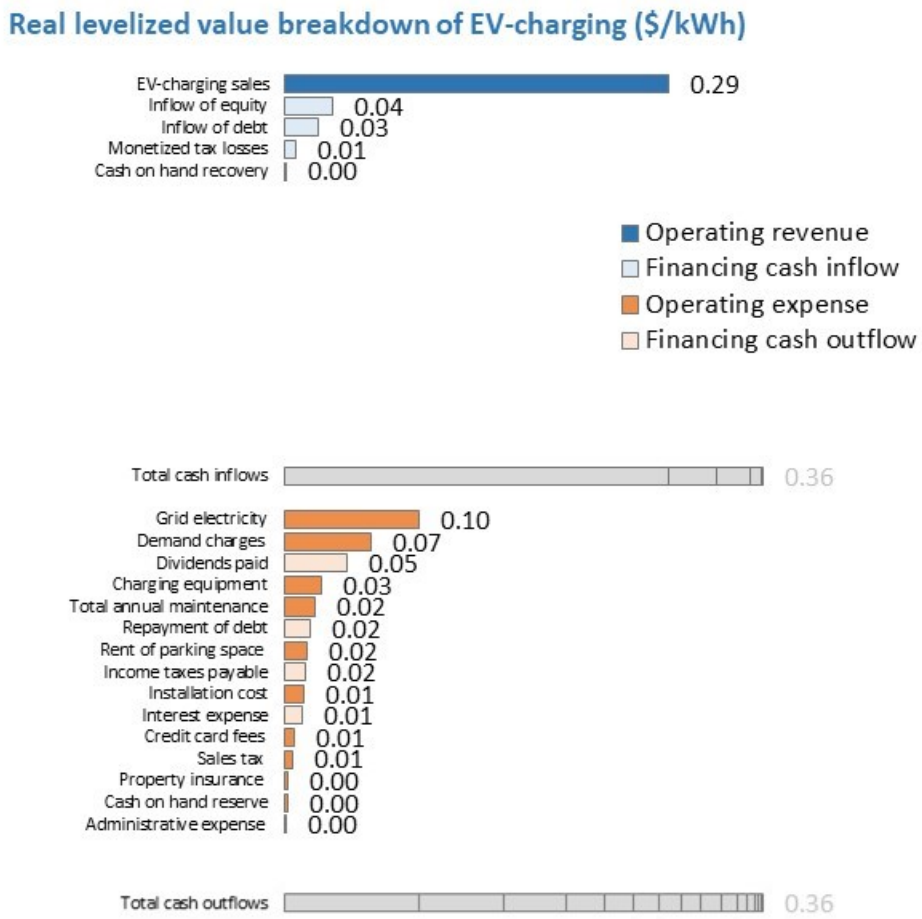


Figure 8. Interface worksheet, levelized value breakdown results

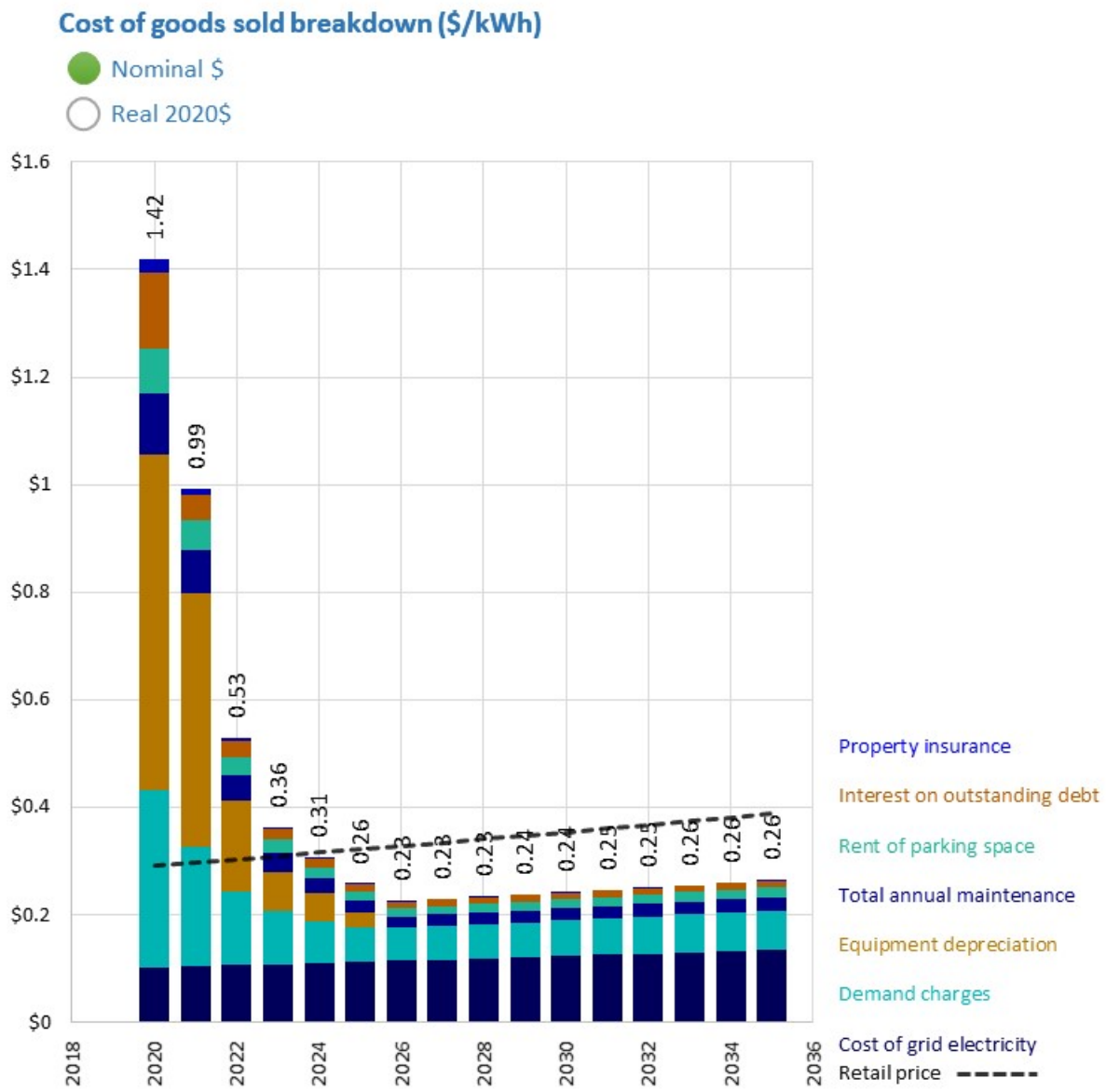


Figure 9. Interface worksheet, cost of goods sold results

Tabular results for each year of the project's life are available within the Report Tables worksheet (Figure 11). These results include annual projections for the income statement, cash flow statement, balance sheets, key prices and parameters, and financial ratios.

INCOME STATEMENT					
Revenues (annual)					
EV-charging sales	$ -	$ 2,671	$ 8,164	$ 13,865	$
Credit card fees	$ -	$ (67)	$ (204)	$ (347)	$
Sales tax	$ -	$ (60)	$ (184)	$ (312)	$
Total revenue	$ -	$ 2,544	$ 7,776	$ 13,207	$
Operating expenses					
Cost of grid electricity	$ -	$ 931	$ 2,846	$ 4,834	$
Total feedstock & utilities	$ -	$ 931	$ 2,846	$ 4,834	$
Total annual maintenance	$ -	$ 1,045	$ 2,130	$ 2,170	$
Rent of parking space	$ -	$ 750	$ 1,529	$ 1,558	$
Property insurance	$ -	$ 235	$ 354	$ 285	$
Administrative expense	$ -	$ 13	$ 41	$ 69	$
Demand charges	$ -	$ 3,000	$ 6,114	$ 6,230	$
Total operating expenses	$ -	$ 5,975	$ 13,014	$ 15,146	$
Earnings before interest, taxes and depreciation (EBITD)	$ -	$ (3,431)	$ (5,238)	$ (1,939)	$
Interest on outstanding debt	$ -	$ 1,288	$ 1,288	$ 1,288	$
Equipment depreciation	$ -	$ 5,700	$ 12,920	$ 7,752	$
Taxable income	$ -	$ (10,419)	$ (19,445)	$ (10,979)	$
Calculated current year taxes before deferrement	$ -	$ (2,682)	$ (5,005)	$ (2,826)	$
Remaining deferred taxes from 1 years ago	$ -	$ -	$ (2,682)	$ (5,005)	$
Remaining deferred taxes from 2 years ago	$ -	$ -	$ -	$ (2,682)	$
Remaining deferred taxes from 3 years ago	$ -	$ -	$ -	$ -	$
Remaining deferred taxes from 4 years ago	$ -	$ -	$ -	$ -	$
Remaining deferred taxes from 5 years ago	$ -	$ -	$ -	$ -	$
Remaining deferred taxes from 6 years ago	$ -	$ -	$ -	$ -	$
Income taxes payable	$ -	$ (2,682)	$ (5,005)	$ (2,826)	$
Income before extraordinary items	$ -	$ (7,737)	$ (14,440)	$ (8,153)	$
CASH FLOW STATEMENT					
Net Income	$ -	$ (7,737)	$ (14,440)	$ (8,153)	$
Adjustments to reconcile net income to net cash					
Depreciation	$ -	$ 5,700	$ 12,920	$ 7,752	$
Net Cash	$ -	$ (2,037)	$ (1,520)	$ (401)	$
Cash Flows From Investing Activities					
Capital expenditure for Charging equipment	$ (38,000)	$ -	$ -	$ -	$
Capital expenditures for equipment installation	$ (20,000)	$ -	$ -	$ -	$
Net Cash Provided by (Used in) Investing Activities	$ (58,000)	$ -	$ -	$ -	$

Figure 10. Report Tables worksheet showing tabular results

3 Advanced Functions

Several advanced functions within EVI-FAST enable further customization of the analysis: overrides, risk analysis, and built-in Excel analytic tools. These are described below.

3.1 Overrides

The Overrides worksheet is used to create customized inputs. Various EVI-FAST inputs have a single value applied to each year in the project period. For example, under Sales Specification, a "Long-term nominal utilization (%)" of 25% would apply 25% utilization to every year after demand has ramped up fully. Other inputs couple an initial value with an escalation rate to produce a set of values over time. For example, under Feedstock Cost, a "Cost of grid electricity ($/kWh)"of $0.10 and an "Escalation rate of cost (% annually)" of 1.90% would yield a grid energy cost of $0.1000/kWh in the first year, $0.1019/kWh ($0.1000/kWh × 101.9%) in the second year, and so forth.

A time series of inputs can be customized by entering values in the corresponding rows within the Overrides worksheet. Figure 12 shows a customized series of utilization inputs for 10 years of a project's life. For overridden items, cells for all years of the analysis period (highlighted in yellow) must be populated with values, and populating cells beyond the highlighted years enables analysis of sensitivities to project length, installation time, or year of commissioning. Here the values entered within the Overrides worksheet replace the values for demand ramp-up and long-term utilization in the Interface worksheet, which are now grayed out, as shown in Figure 12. Deleting all values from the Overrides worksheet removes the override and returns the model to using the inputs from the Interface worksheet. Any monetary values input in the Overrides worksheet should be entered in nominal dollars. For example, the U.S. Energy Information Administration's *Annual Energy Outlook* might be used to develop custom values for electricity price in nominal dollars.

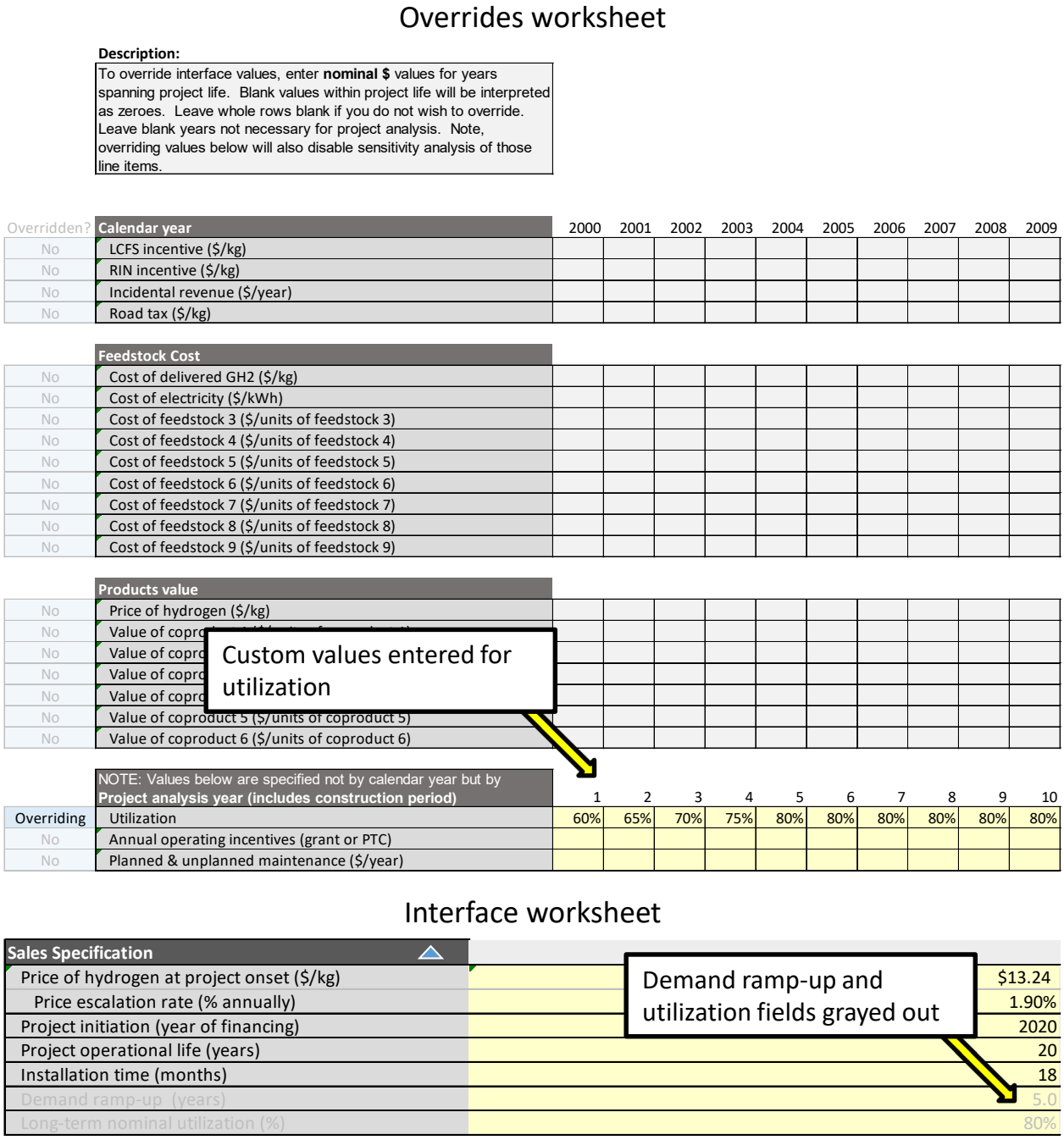


Figure 11. Using Overrides worksheet to input custom utilization values

3.2 Risk Analysis

Risk analysis accounts for the effects of uncertain input parameters on the financial performance of modeled installations. This capability is accessed by activating the advanced user interface and then clicking the "On/Off" button in the "Risk analysis field."[1] Clicking this button reveals three fields for most input parameters: a most likely value, a "% less" value, and a "% more" value (Figure 13). The % less and more values are calculated with respect to the most likely

[1] Note that overriding values, as described in Section 3.1, will disable risk analysis for the overridden items.

value; for example, if the most likely value is $100,000, then entering -20% in the % less field assigns a value of $80,000 to that field. These three values define a triangular distribution used for Monte Carlo analysis. As the default setting, all three values are the same for each parameter, and the uncertainty values are grayed out. When an uncertainty value is changed, it turns black and becomes active for subsequent analyses. The % less value must be less than or equal to zero, and the % more value must be greater than or equal to zero. Once the uncertainty distributions are defined for one or more input parameters, clicking the "Evaluate uncertainty (1,000 runs)" button in the "Risk analysis" field initiates the analysis. EVI-FAST takes 1,000 random samples from each of the defined input distributions to calculate probability distributions for input parameters and financial results. The analysis usually takes a few minutes to run. The elapsed time and percentage of the analysis complete are displayed at the bottom left of the screen.

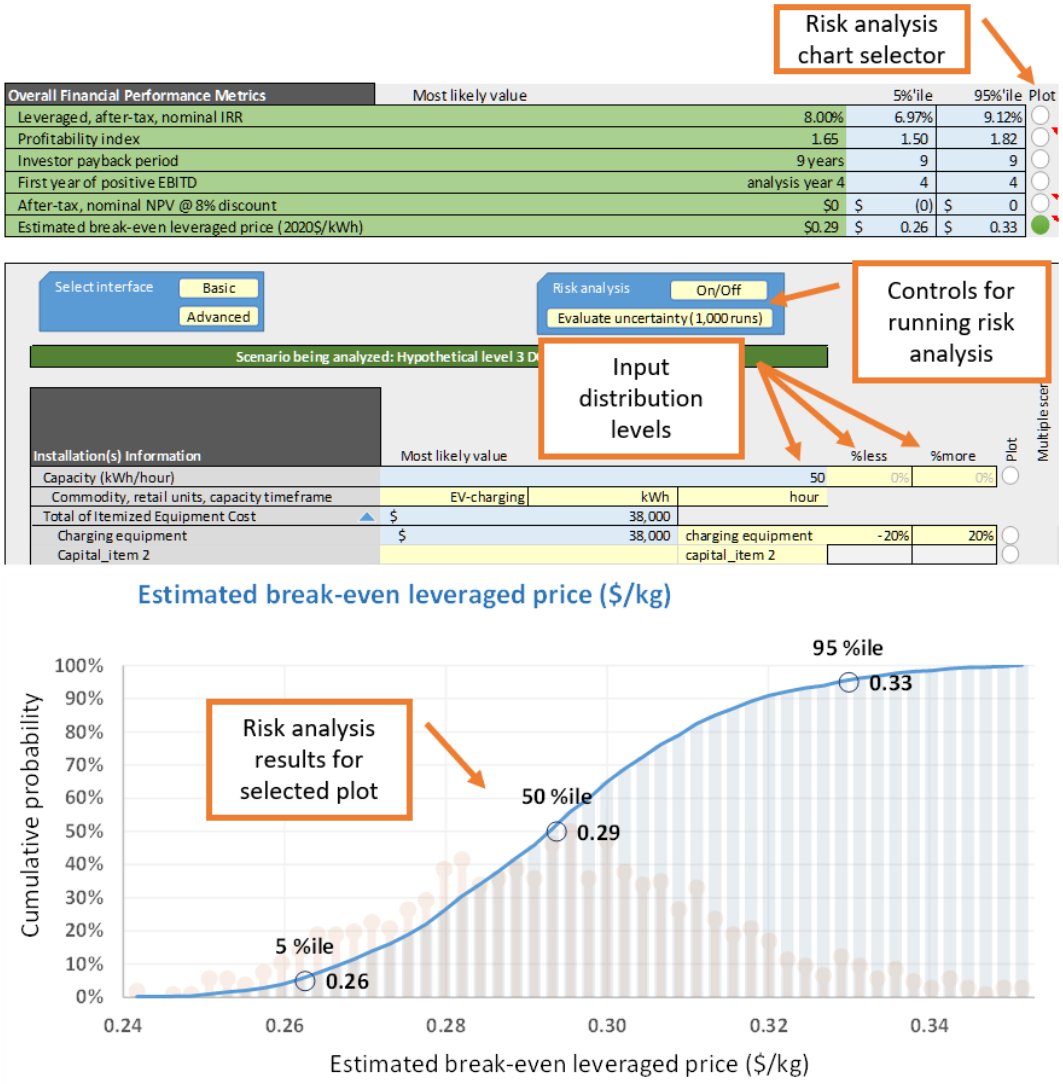


Figure 12. EVI-FAST risk analysis functions

Once the analysis is 100% complete, the updated results are shown in the Overall Financial Performance Metrics table, which provides most likely, 5th percentile, and 95th percentile values for each metric. The probability distributions for each of these metrics can be plotted by clicking

the adjacent circle under the heading "Plot." The resulting risk analysis chart appears below the cost of goods sold chart. In a similar fashion, the probability distributions for the relevant input parameters can be plotted. As the risk analysis is being used, a message on the risk analysis chart might appear stating, "Inputs have changed. Rerun model before examining statistical results." This message appears when the risk analysis function is first activated and when input values are changed. If this message is present, the risk analysis must be run again—by clicking the "Evaluate uncertainty (1,000 runs)" button—to produce valid results.

Additional analyses can be viewed for three of the financial performance metrics: profitability index, after-tax nominal NPV, and estimated break-even leveraged price. Clicking the plot circle adjacent to one of these metrics and then scrolling down below the financial performance and risk analysis charts reveals tornado and waterfall charts. The tornado chart plots the sensitivity of the selected metric to the user-defined variations in input parameters; if more than 10 input distributions are defined, the tornado chart plots the 10 that have the most impact on the metric. Figure 14 is an example tornado chart, showing the sensitivity of first year charging price. The most influential parameter is listed on top, for example, utilization of 30% yields $0.26/kWh price, 25% (baseline) yields $0.29/kWh and $20% utilization yields $0.34/kWh. The sensitivity to the other parameters can be read in a similar manner.

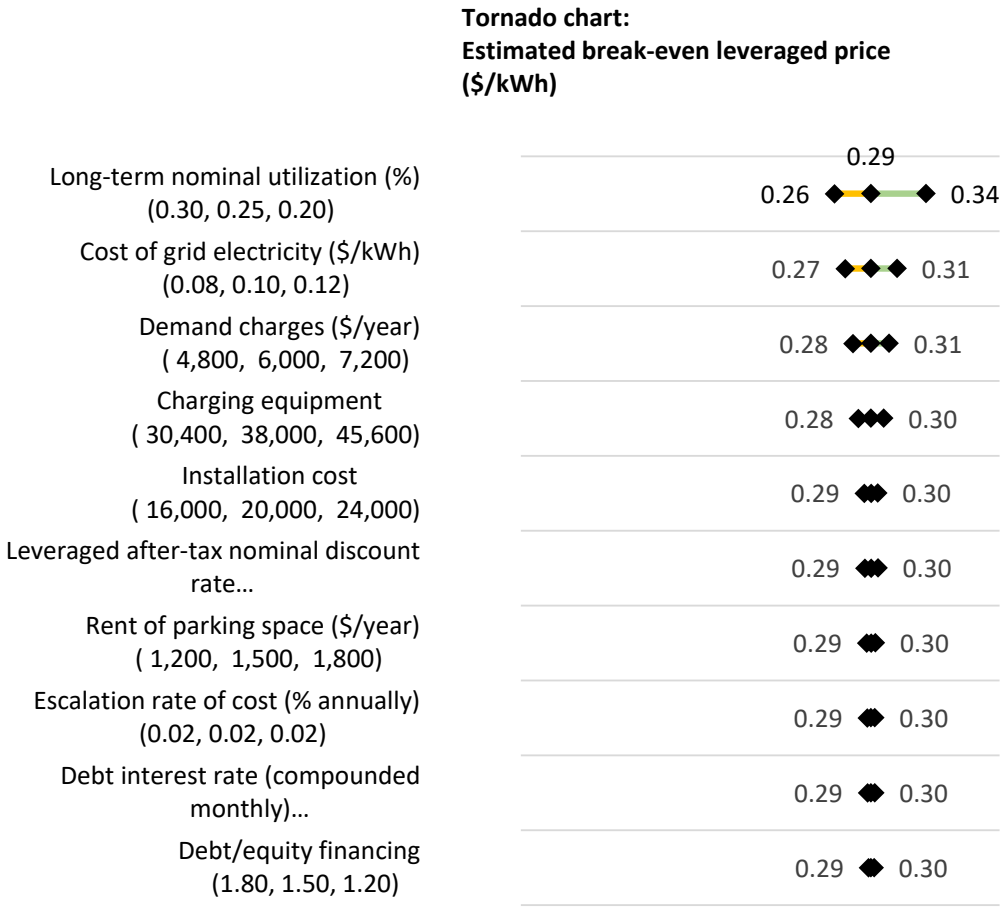


Figure 13. Tornado chart showing sensitivity of first year price to ten specified uncertainty parameters.

3.3 Built-in Excel Analytic Tools

Excel's built-in analytic tools, including Goal Seek and Solver, can be used to solve for conditional inputs. For example, a user can specify a desired price of charging into Goal Seek, and use a capital incentive as a solver input to achieve this price. The model will use the built-in Excel function to vary the capital incentive until the desired first year price is achieved. Similarly, the built-in function of "Solver" can be used to allow users to solve for more complex analysis scenarios.

4 Technical Support

If you have questions or comments about the spreadsheet version of EVI-FAST, please contact:

Michael Penev
Phone: 303-275-3880
Email: Michael.Penev@nrel.gov

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Appendix A: Model Inputs and Default Values

Installation Information[a]	
Input	**Description**
Select interface	Advanced mode allows access to detailed model assumptions.
Enter number of installations to model	Input information for up to 300 installations.
Capacity (kWh/h)	This value defines maximum charging capacity. The unit of kWh/h equates to kW of charging power.
Equipment capital cost	Cost of equipment only (not including engineering cost, permitting, and installation). Note: model assumes that salvage value equals decommissioning costs.
Non-depreciable assets (e.g., land)	Cost of assets, such as land, that are not subject to depreciation.
Installation cost	This cost should include costs associated with installation, such as engineering, permitting, and lot and utility upgrades.
End of project sale of non-depreciable assets	Net recovered value at end of life (salvage value – demolition expense), in nominal dollars. This should include non-depreciable fixed assets such as land.
Planned & unplanned maintenance ($/year)	Levelized annual maintenance expenses for planned and unplanned equipment servicing and overhauls. Expenses are assumed to be non-depreciable.
Maintenance escalation (% annually)	Each year expenses may escalate due to higher cost of technician labor or material expenses.

[a] These values are entered in the Installation(s) Information and Multi-Scenario Inputs tables.

Co-Product Specifications and Feedstock Use[a]	
Input	**Description**
Grid electricity (kWh/kWh)	Yearly average amount of grid energy purchases per kWh of charging.
User defined feedstock (units/unit)	Yearly average amount of user-defined feedstock used per number of retail units sold. This can be used to model custom variable operating expenses.
User defined co-product (units/unit)	Yearly average co-product generated per yearly average product sold. This can be used to model possible value streams for example grid services such as possible load shedding.

[a] These values are entered in the Co-product Specifications and Feedstock Use tables.

Incentives Specifications	
Input	**Description**
One time capital incentives (grant or ITC)	Incentive is provided at the beginning of the project (accounted on Dec. 31, the year before construction begins). The credit can be a grant or an investment tax credit (ITC).
Annual operating incentives (grant or PTC)	Production-based incentives commence the month of charging station commissioning. This can be a grant or a production tax credit (PTC). If PTC, specify as non-taxable (row 157).
Operating incentives linear decay (% of initial/year)	Annual operating incentives may be reduced each year. This input allows this revenue stream to be ramped down to zero by a fixed annual percentage.
Operating incentives sunset (years)	Number of years in which operating incentives are available. This input can simulate early termination of incentives before an annual ramp-down is complete.
LCFS incentive ($/kWh)	Incentive issued per retail unit sold. Example: low-carbon fuel standard (LCFS) credit.
LCFS incentive decay rate (%/year)	Annual incentive decay rate per year as % of the initial quantity. Note: escalation can be specified by entering a negative number.
LCFS incentive sunset (years)	Number of years in which incentive is available. This input can simulate early termination of incentive before an annual ramp-down is complete.
RIN incentive ($/kWh)	Incentive issued per retail unit sold. Example: Renewable Identification Number (RIN) credit.
RIN incentive decay rate (%/year)	Annual incentive decay rate per year as % of the initial quantity. Note: escalation can be specified by entering a negative number.
RIN incentive sunset (year)	Number of years in which incentives are available. This input can simulate early termination of incentives before an annual ramp-down is complete.
Incidental revenue	Miscellaneous revenue enhancements derived from charging services. Value should be expressed as (marginal revenue − marginal expenses). This item could cover items such as enhanced profits from associated convenience store.
Incidental revenue escalation rate (%/year)	Rate of annual escalation for incidental revenue.

Sales Specification	
Input	**Description**
Price of electricity at project onset ($/kWh)	This is the total cost to the end customer and includes all transaction costs such as credit card fees and sales taxes. Specified price is for the beginning of the project.
Price escalation rate (% annually)	Rate of annual escalation.
Project initiation (year of financing)	Year in which the project starts (Jan. 1). Note: financial reporting occurs Dec. 31, and investments into the project will be reported as of Dec. 31 of the prior year.
Project operational life (years)	Operating life of the project. Enter a value between 5 and 60. Note: project operational life plus installation time must be less than 100 years.
Installation time (months)	Months between investment in a charging station and its first sale.
Demand ramp-up (years)	Number of years to achieve long-term average utilization. This value imposes a straight-line ramp-up in charging station utilization.
Long-term nominal utilization (%)	Infrastructure utilization relative to theoretical maximum energy of charging if the unit operates 24/7 at its rated power.

Feedstock Cost and Coproduct Value[a]	
Input	**Description**
Cost of grid electricity ($/kWh)	Chargers purchase grid electricity. Price is defined at the start of the project (not at start of operation). Note this parameter is for the energy portion of grid costs and the model takes in demand charges separately as demand charges are more appropriately modeled as a fixed cost.
Escalation rate of cost (% annually)	Rate of annual escalation.
Cost of user defined feedstock ($/unit)	Blended user-defined feedstock price.
Escalation rate of cost (% annually)	Rate of annual escalation.
Value of user-defined co-product ($/unit)	Value of user-defined co-product.
Escalation rate of value (% annually)	Rate of annual escalation.

[a] These values are entered in the Feedstock Cost and Co-Product Value tables.

Take or Pay Contract Specification		
Input	**Default Value**	**Description**
Price of unsold charging potential ($/kWh)		Price paid for unused capacity up to supported level. Price point at the year of start of sales. Note: price is in nominal dollars.
Price decay (% annually)		Annual decay rate of take-or-pay contract price. Note: decay is based on first-year total cost.
Contract sunset (years)		Years of consideration for take-or-pay contract.
Utilization supported up to (% of capacity)		Ceiling of equipment utilization covered under take-or-pay contract.

Other Operating Expenses	
Input	**Description**
Credit card fees (% of sales)	This is a flow-through expense for credit card fees.
Sales tax (% of sales)	This is a flow-through expense for sales taxes.
Road tax ($/kWh)	This is a flow-through expense for road taxes.
Road tax escalation rate (%/year)	Rate of annual escalation.
Staffing labor hours (h/year-station)	This value allows allocation for any on-site labor attributed to dispensing. As stations are typically fully automatic, this value is usually zero.
Labor rate ($/h)	Fully burdened rate of labor. Note that this is for on-site labor, if any, and should not factor in labor rates for maintenance.
Labor escalation rate (% annually)	Rate of annual escalation.
Licensing & permitting ($/year-station)	All licensing and permitting expenses. Do not include licensing and permitting during station installation (those are accounted for in the installation expense).
Licensing & permitting escalation rate (%/year)	Rate of annual escalation.
Rent of land ($/station-year)	Rent is paid annually for the footprint of any charging equipment. Rent expenses prior to operation should be rolled into installation cost.
Rent escalation (% annually)	Rate of annual escalation.
Property insurance (% of dep capital)	Annual expense as percentage of the depreciated equipment value. Insurance covering installation should be rolled into installation costs.
Selling & administrative expense (% of sales)	Use this value to assign any overhead expenses, such as administrative and management costs, as a percentage of the sales revenue stream.
Electric demand & service charges ($/year)	Fixed operating expense in $/year. Demand charges should be computed exogenously to this model and should consider use profile and desired utility rate structure.
Electric demand & service escalation (% annually)	Rate of annual escalation.
User-defined charges	Fixed operating expense in $/year.
User-defined charges escalation (% annually)	Rate of annual escalation.

Financing Information	
Input	**Description**
Total tax rate (state, federal, local)	Specify the total tax rate, which may include federal, state, county, and city taxes.
Capital gains tax	Specify the total tax rate, which may include federal, state, county, and city taxes.
Is installation cost depreciable?	Specify whether costs associated with construction and permitting are depreciable.
Are operating incentives taxable?	Specify whether operating incentives are treated as income (taxable) or whether they are tax exempt.
Is capital incentive depreciable?	Specify whether incentives received for capital are taxable or tax exempt.
Are tax losses monetized (tax equity application)	Can tax losses be monetized by offsetting coupled business tax liabilities?
Allowable tax loss carry-forward	IRS allows carry-forward of tax losses usually for 7 years. Note: this is not used if tax losses are monetized (tax equity application).
General inflation rate	This value specifies a general inflation rate and is used in calculation of levelized costs.
Depreciation method	Specify depreciation method: Modified Accelerated Cost Recovery System (MACRS) or linear.
Depreciation period	Value should be less than or equal to the project life. If MACRS is used, it should also be one of the allowed schedules (use drop down).
Leveraged after-tax nominal discount rate	Specify a discount rate for reporting of net present value. Note that this rate should include consideration of inflation.
Debt/equity financing	This factor guides the initial financing capital structure (ratio of debt financing to equity financing).
Debt type	Specify the type of debt financing (loan or revolving debt). In case of revolving debt, a fixed amount of debt is issued.
If loan, period of loan (years)	Enter repayment period for loan (if loan debt is used). This value should not exceed the equipment life.
Debt interest rate (compounded monthly)	Enter interest rate on debt—used for both loan and revolving debt calculations.
Cash on hand (% of monthly expenses)	This is cash retained by the business for purposes of liquidity and includes operating expenses, taxes, and interest.

Appendix B: Model Outputs

Global Scenario Outputs

Overall Financial Performance Metrics	
Output	**Description**
Leveraged, after-tax, nominal IRR	Rate of return based on investor cash flow (investments and withdrawals).
Profitability index	(Present value of future equity investor cash flows)/(initial equity investment)
Investor payback period	Number of years before cumulative investor cash flow first becomes greater than zero.
First year of positive EBITD	First year in which earnings before interest, tax, and depreciation are greater than zero.
After-tax, nominal NPV	Net present value of investor net cash flow (investments and withdrawals).
Estimated break-even leveraged price ($/kWh)	Price of charging that would yield specified leveraged, after-tax, nominal IRR.

User-Selectable Graphs

Overall Metrics	
Output	**Description**
Cumulative investor cash flow	Investor cash flow + previous year investor cash flow.
Investor cash flow	Investor withdrawals − investor contributions.
Monetized tax losses	Tax loss credits could be applied when majority equity holder has tax liabilities in excess of any credits.
Gross margin	(Total revenue − cost of goods sold) / total revenue.
Cost of goods sold ($/year)	Total operating expenses + depreciation + interest − selling and administrative.
Cost of goods sold ($/kWh)	Cost of goods sold / annual charging electricity sales (kWh).
Average utilization (%)	Infrastructure utilization relative to theoretical maximum energy of charging if the unit operates 24/7 at its rated power.
Daily sales (kWh/day)	Total annual energy sales / 365.
Capacity covered by take or pay contract (kWh/day)	Daily average charging capacity qualifying for any take-or-pay contract payments.
Charging price ($/kWh)	Price of charging to the end customers ($/kWh).
Value of user-defined coproduct ($/unit)	Price of user-defined coproduct to the end customers ($/unit).
Cost of grid electricity ($/kWh)	Amount paid for energy from the grid ($/kWh). Note, demand charges are accounted for separately.
Cost of user-defined feedstock ($/unit)	Amount paid for supply of user-defined feedstock to installation ($/unit).

Income Statement Values	
Output	**Description**
Charging sales ($/year)	Annual revenue derived from sales of charging electricity. Does not include revenue from incentives.
User-defined co-product sales ($/year)	Annual revenue from user-defined co-product.

LCFS ($/year)	Annual revenue from LCFS.
RIN ($/year)	Annual revenue from RIN.
Take or pay revenue ($/year)	Revenue from take or pay contract
Annual operating incentives (grant or PTC) ($/year)	Annual revenue derived from production incentives (nominal $).
Incidental revenue ($/year)	Other business revenue enhancements from presence of charging infrastructure. This value should be expressed as (marginal revenue − marginal expenses).
Credit card fees ($/year)	Reduction in total revenue based on credit card fees (flow-through expense).
Sales tax ($/year)	Reduction in total revenue based on sales tax expense (flow-through expense).
Road tax ($/year)	Reduction in total revenue based on road tax expense (flow-through expense).
Total revenue	Sales revenue + incentive revenue − credit card fees − sales tax − road tax (annual basis).
Cost of grid electricity ($/year)	Annual expense for grid energy use.
Cost of user-defined feedstock ($/year)	Annual expense for use of user-defined feedstock.
Total feedstock & utilities cost ($/year)	Annual expense for all feedstock and utilities use. Note: this does not include fixed operating expenses.
Labor ($/year)	Annual labor expense.
Planned & unplanned maintenance ($/year)	Annual expenses for maintenance.
Rent of land ($/year)	Annual expense attribution for equipment real estate rent.
Property insurance ($/year)	Annual insurance expense associated with value of equipment. Note: insurance is proportional to the depreciated equipment value.
Licensing & permitting ($/year)	Annual expenses associated with licensing and permitting.
Selling & administrative ($/year)	Annual expenses associated with selling and administrative activities (management overhead).
Demand & service charges ($/year)	Annual expenses associated with grid rate structure demand charges and service charges.
User-defined charges ($/year)	Annual expenses associated with user-defined charges.
Total operating expenses ($/year)	Annual total operating expenses. Does not include depreciation, taxes, and interest.
EBITD ($/year)	Total annual revenue − total operating expenses. Earnings before interest, taxes, and depreciation (EBITD).
Interest on outstanding debt ($/year)	Annual interest on outstanding debt. Note: in case of loan debt, interest is accrued monthly.
Equipment depreciation ($/year)	Depreciation expense for equipment, calculated based on quarter of equipment commissioning. Note: this is a tax-accounting metric and not a cash expenditure.
Taxable income ($/year)	Income subject to taxation, before consideration of tax loss carry-forward.
Remaining available deferred carry-forward tax losses ($/year)	Tax loss carry-forward remaining after annual taxes payable calculations.
Income taxes payable ($/year)	Taxes payable for the year.
Income before extraordinary items ($/year)	Income after interest, ordinary income taxes.
Sale of non-depreciable assets ($/year)	Sale of non-depreciable fixed assets such as land.
Net capital gains or loss ($/year)	Sale of non-depreciable fixed assets less cost basis.

Capital gains taxes payable ($/year)	Capital gains taxes payable on sale of non-depreciable assets gains.
Net income ($/year)	Revenues − operating expenses − interest expense − taxes payable − depreciation expense.

Cash Flow Statement Values	
Output	**Description**
Net annual operating cash flow	Net income + dividends.
Capital expenditure for equipment	Cash flow for initial equipment purchases.
Capital expenditure for user-defined item	Cash flow for initial purchase of user-defined capital item.
Expenditure for non-depreciable fixed assets	Expenditure for the purchase of non-depreciable fixed assets such as land.
Capital expenditures for equipment installation	Cash flow for initial installation, permitting, and commissioning expenses.
Total capital expenditure	Total cash flow for initial equipment and installation expenses.
Incurrence of debt	Cash flow associated with acquisition of debt financing.
Repayment of debt	Cash flow associated with repayment of debt. Note: in the case of revolving debt, repayment is done in full at the end of the analysis period.
Inflow of equity	Cash flow associated with equity investment.
Dividends paid	Cash flow to equity investors (dividends or owner withdrawals).
One-time capital incentive	Cash flow from receipt of capital incentive and/or grants.
Net cash for financing activities	Incurrence of debt − repayment of debt + inflow of equity − dividends paid + receipt of capital incentives.
Net change of cash	Annual change in cash position.

Balance Sheet Values	
Output	**Description**
Cumulative cash	Previous year cash position + current year net cash.
Cumulative PP&E	Total undepreciated plant, property, and equipment (PP&E).
Cumulative depreciation	Accumulated depreciation: previous year depreciation expense + current year depreciation expense.
Net PP&E	Depreciated value of plant, property, and equipment (PP&E): cumulative PP&E − cumulative depreciation.
Cumulative deferred tax losses	Tax loss carry-forward usable to offset future year tax liabilities.
Total assets	Accumulated cash + accumulated PP&E − accumulated depreciation + accumulated tax loss carry-forward.
Cumulative debt	Outstanding debt.
Total liabilities	Outstanding debt. Note: accounting is performed on annual basis (assumes accounts payable = accounts receivable, and maintains cash on hand for liquidity).
Cumulative capital incentives equity	Accumulated equity from one-time receipt of capital incentives.
Cumulative investor equity	Accumulated equity from investor contributions.
Retained earnings	Previous year retained earnings + current year net income − current year paid dividends.
Total equity	Accumulated equity from capital incentives + accumulated equity from investor contributions + retained earnings + accumulated tax loss carry-forward. Note: value can be negative in highly leveraged scenarios.
Investor equity less capital incentive	Total equity − capital incentive.

Ratio Analysis	
Output	**Description**
Returns on investor equity	Net income / investor equity. Note: investor equity = total equity − capital incentive.
Debt/equity ratio	Total debt / total equity.
Returns on total equity	Net income / total equity. Note: total equity = investor equity + capital incentive.
Debt service coverage ratio (DSCR)	EBITD / interest. EBITD: earnings before interest, taxes, and depreciation.