

User Tutorial - Mastering SiisolTEA

Techno-Economic Assessment of Green Hydrogen Production

Explore the evaluation of green hydrogen production using solar, wind, or hybrid energy systems, focusing on both technological and economic aspects.

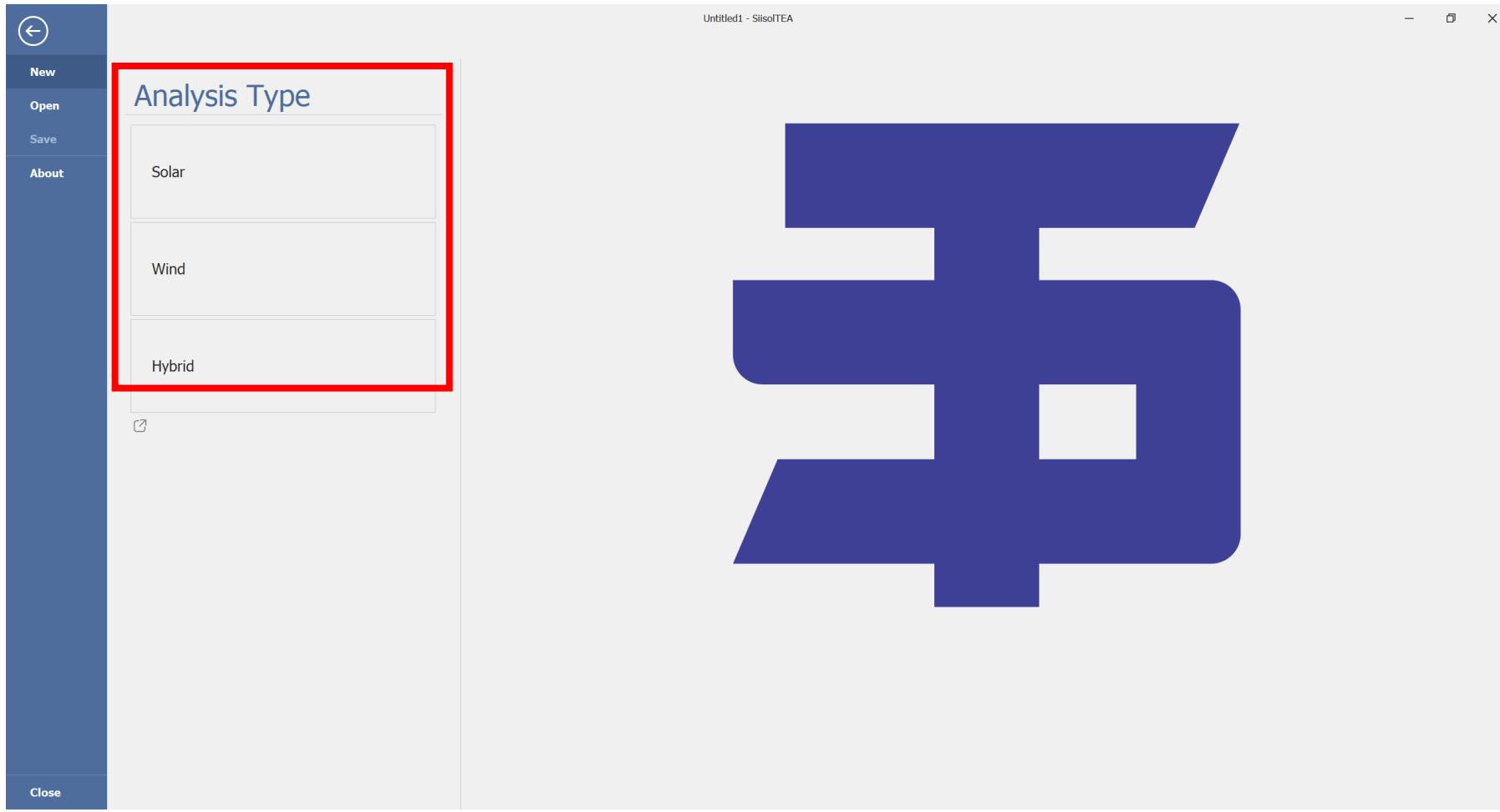
Detailed Sensitivity Analysis

Gain an understanding of how various parameters influence system performance, costs, and viability through comprehensive sensitivity studies.

System Insights and Optimization

Access detailed insights into the integration of renewable resources for hydrogen production and optimize strategies for improved efficiency and cost-effectiveness.

After launching SiisolTEA, you will be prompted to choose the type of analysis according to the renewable energy system you wish to evaluate.



Key

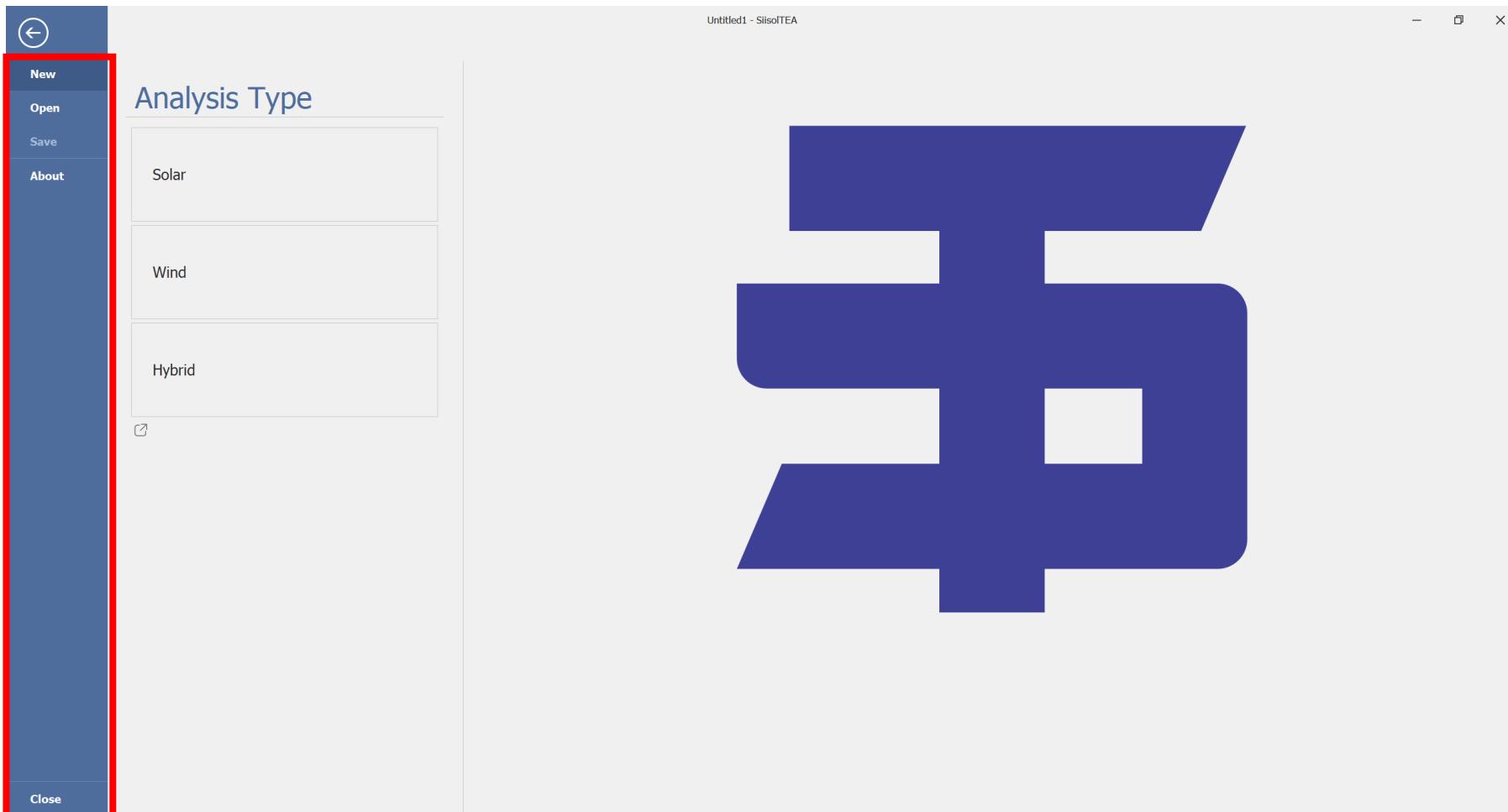
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The user can utilize the buttons on the left panel to perform general functions like opening a new window, accessing a saved analysis, saving an ongoing analysis, viewing licensing details, or closing the active window.



Key

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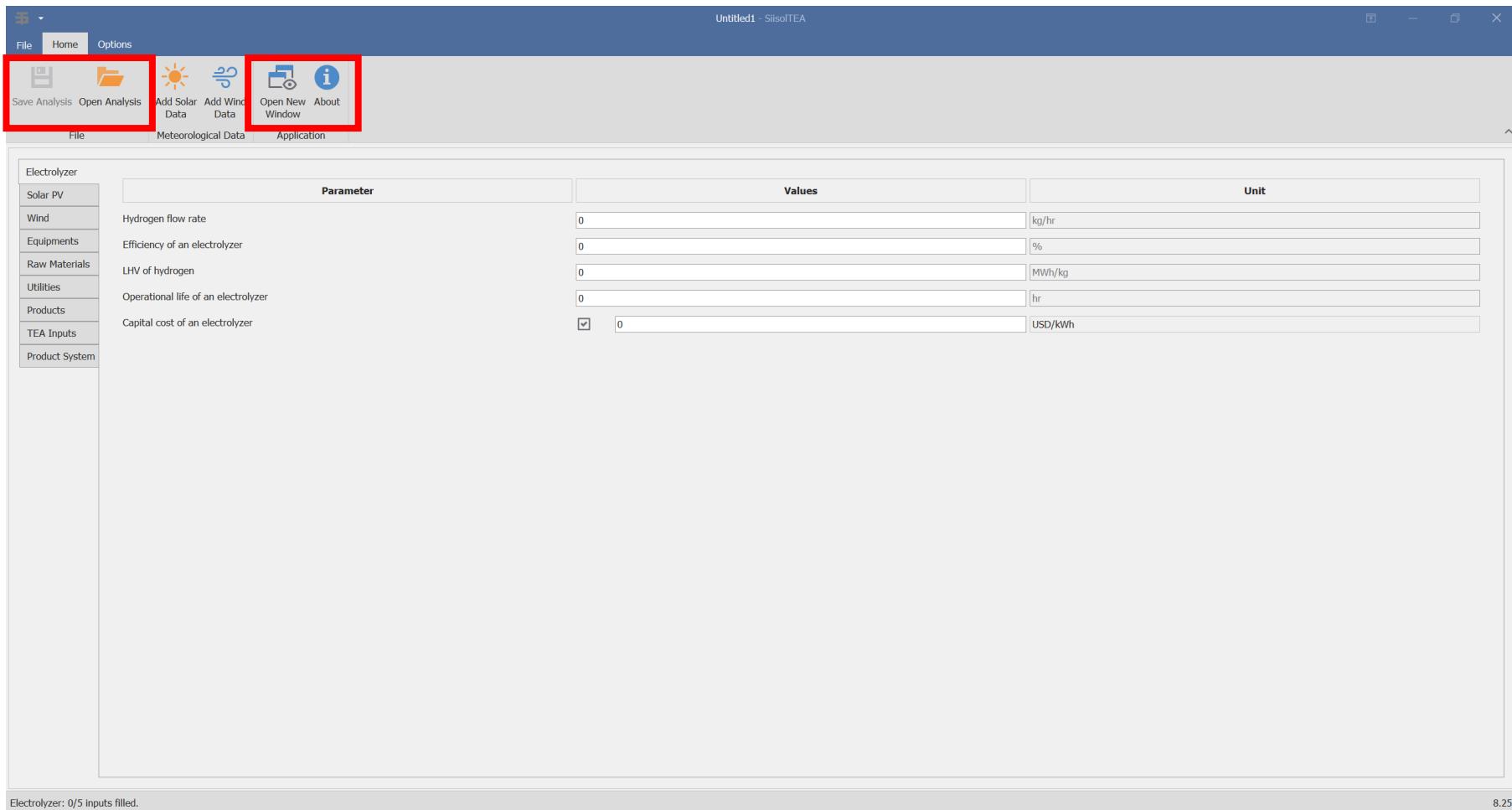
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Users can utilize the highlighted buttons on the ribbon to access common functions like saving the current analysis, opening a previously saved analysis, launching a new window, and viewing licensing details.



Key

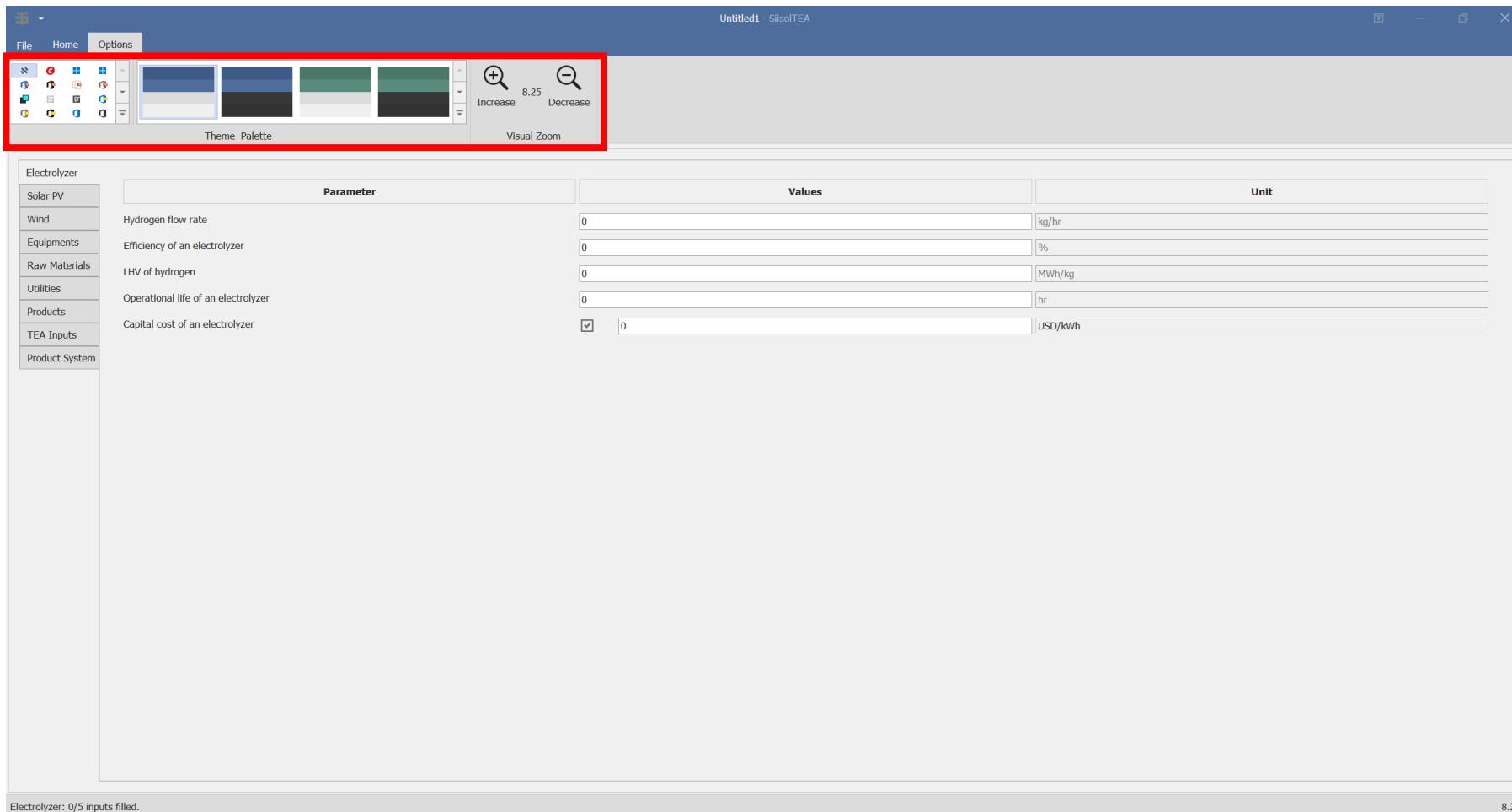
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Users can utilize the Options ribbon to modify the application's appearance, such as adjusting the theme, color scheme, and font size of the user interface.



Key

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The user will navigate sequentially through the tabs on the left panel to provide all necessary inputs in their respective units for the analysis.

Untitled1 - SisoltEA

File Home Options

Save Analysis Open Analysis Add Solar Data Add Wind Data Open New Window About Application

File Meteorological Data Application

Electrolyzer

Solar PV

Wind

Equipments

Raw Materials

Utilities

Products

TEA Inputs

Product System

Parameter	Values	Unit
Hydrogen flow rate	0	kg/hr
Efficiency of an electrolyzer	0	%
LHV of hydrogen	0	MWh/kg
Operational life of an electrolyzer	0	hr
Capital cost of an electrolyzer	<input checked="" type="checkbox"/> 0	USD/kWh

Electrolyzer: 0/5 inputs filled.

8.25

Key

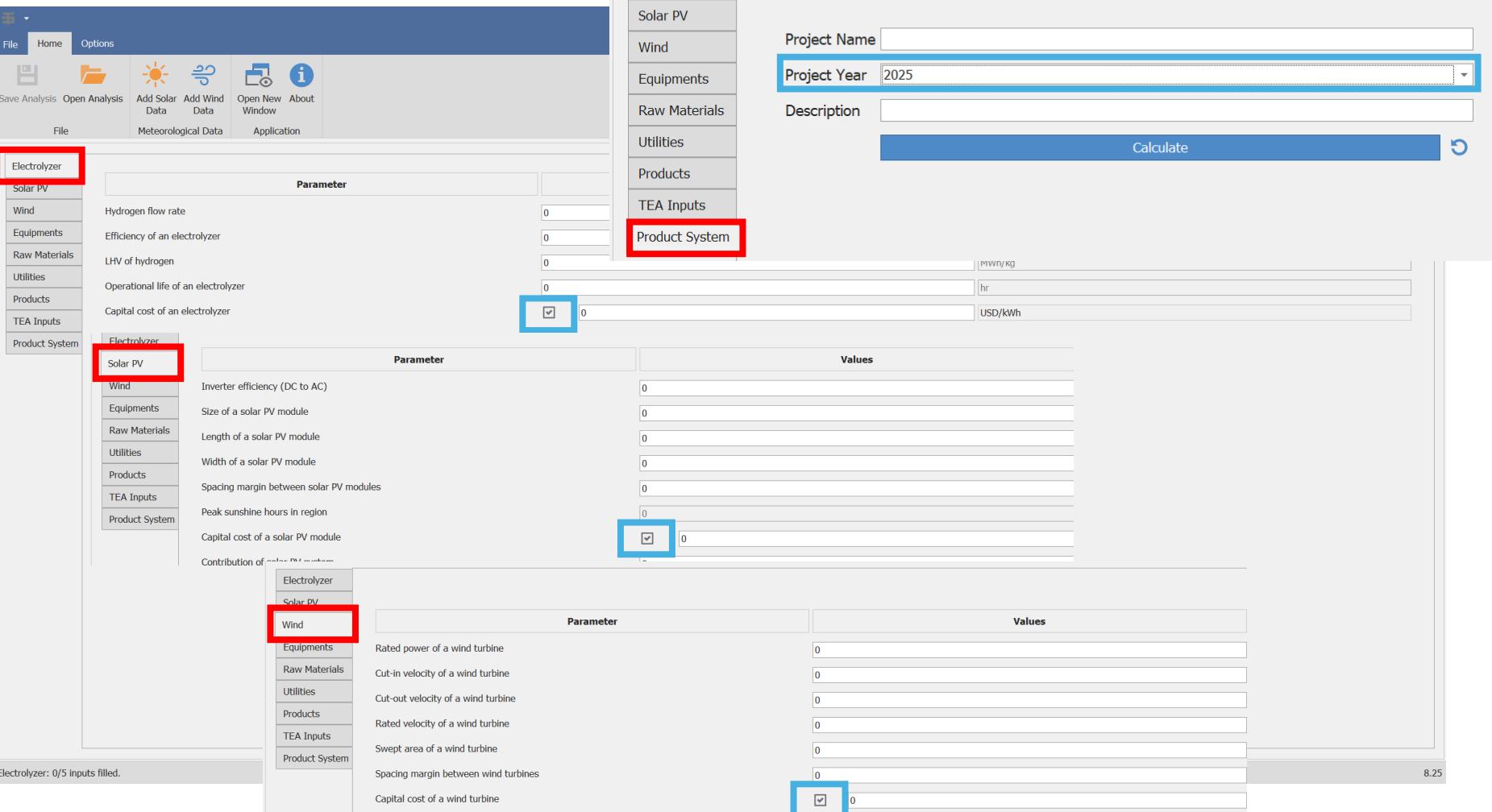
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SiisolTEA includes an integrated database containing renewable energy and AWE electrolyzer cost projections for the years 2025 to 2050, based on data from IEA and IRENA. To utilize this feature, please deselect the boxes next to the capital costs for solar, wind, and electrolyzers.



Electrolyzer

Project Name

Project Year 2025

Description

Calculate

Product System

Electrolyzer

Parameter Values

Hydrogen flow rate 0

Efficiency of an electrolyzer 0

LHV of hydrogen 0

Operational life of an electrolyzer 0

Capital cost of an electrolyzer 0

0

Solar PV

Parameter Values

Inverter efficiency (DC to AC) 0

Size of a solar PV module 0

Length of a solar PV module 0

Width of a solar PV module 0

Spacing margin between solar PV modules 0

Peak sunshine hours in region 0

Capital cost of a solar PV module 0

0

Wind

Parameter Values

Rated power of a wind turbine 0

Cut-in velocity of a wind turbine 0

Cut-out velocity of a wind turbine 0

Rated velocity of a wind turbine 0

Swept area of a wind turbine 0

Spacing margin between wind turbines 0

Capital cost of a wind turbine 0

0

Electrolyzer: 0/5 inputs filled.

Key

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Users must supply solar meteorological data when evaluating solar-based infrastructure. This data can be obtained and exported directly through the built-in NASA Power Access feature or entered manually. Additionally, users can reset the input fields at any time by clicking the reset button located in the top right corner of the Solar Data pop-up.

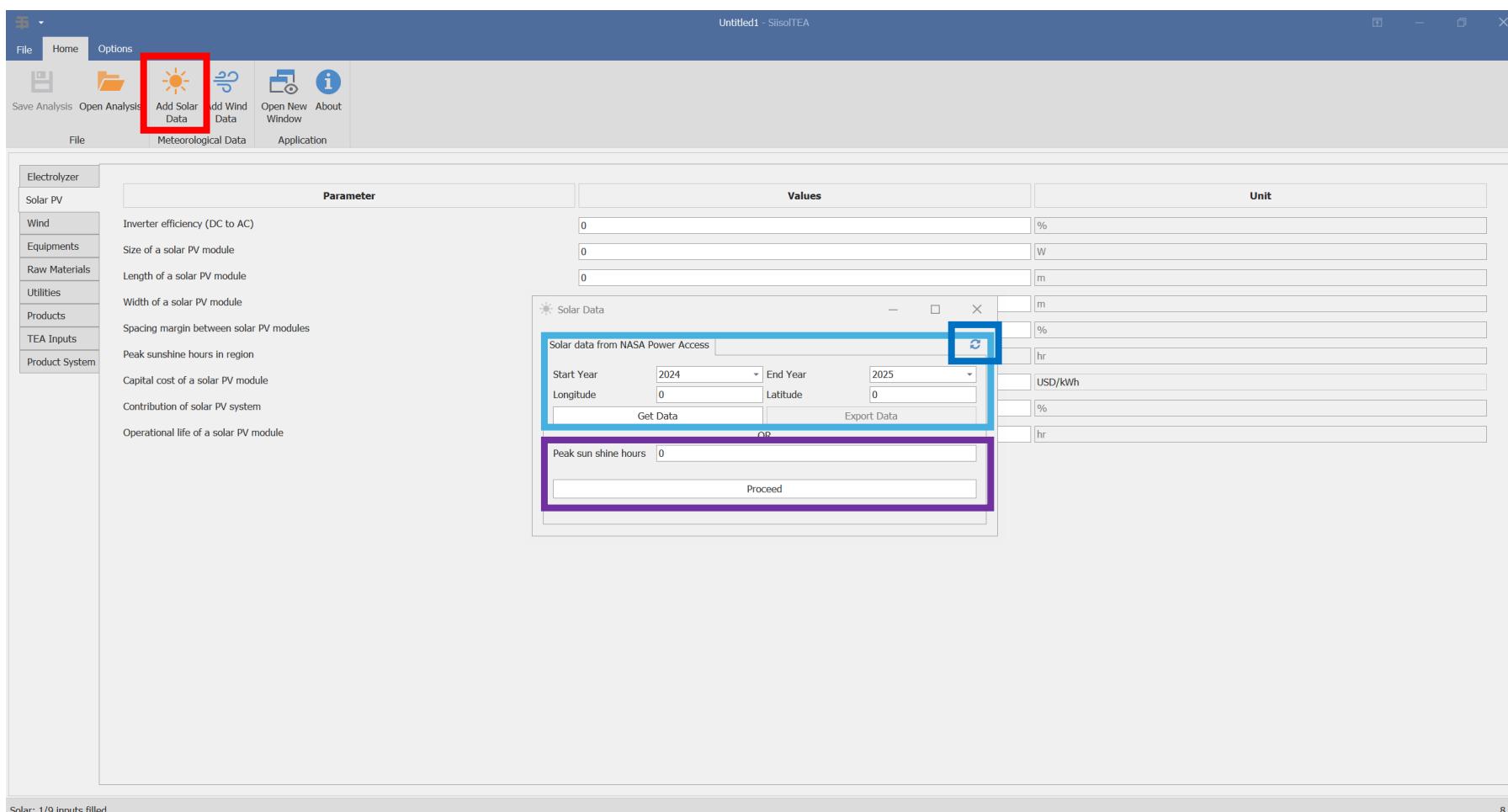
Key

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When analyzing wind-based infrastructure, users must supply wind meteorological data. This data can be obtained and exported directly through the built-in NASA Power Access feature or entered manually. Additionally, users can reset the data at any time by clicking the reset button located in the top right corner of the Wind Data pop-up.

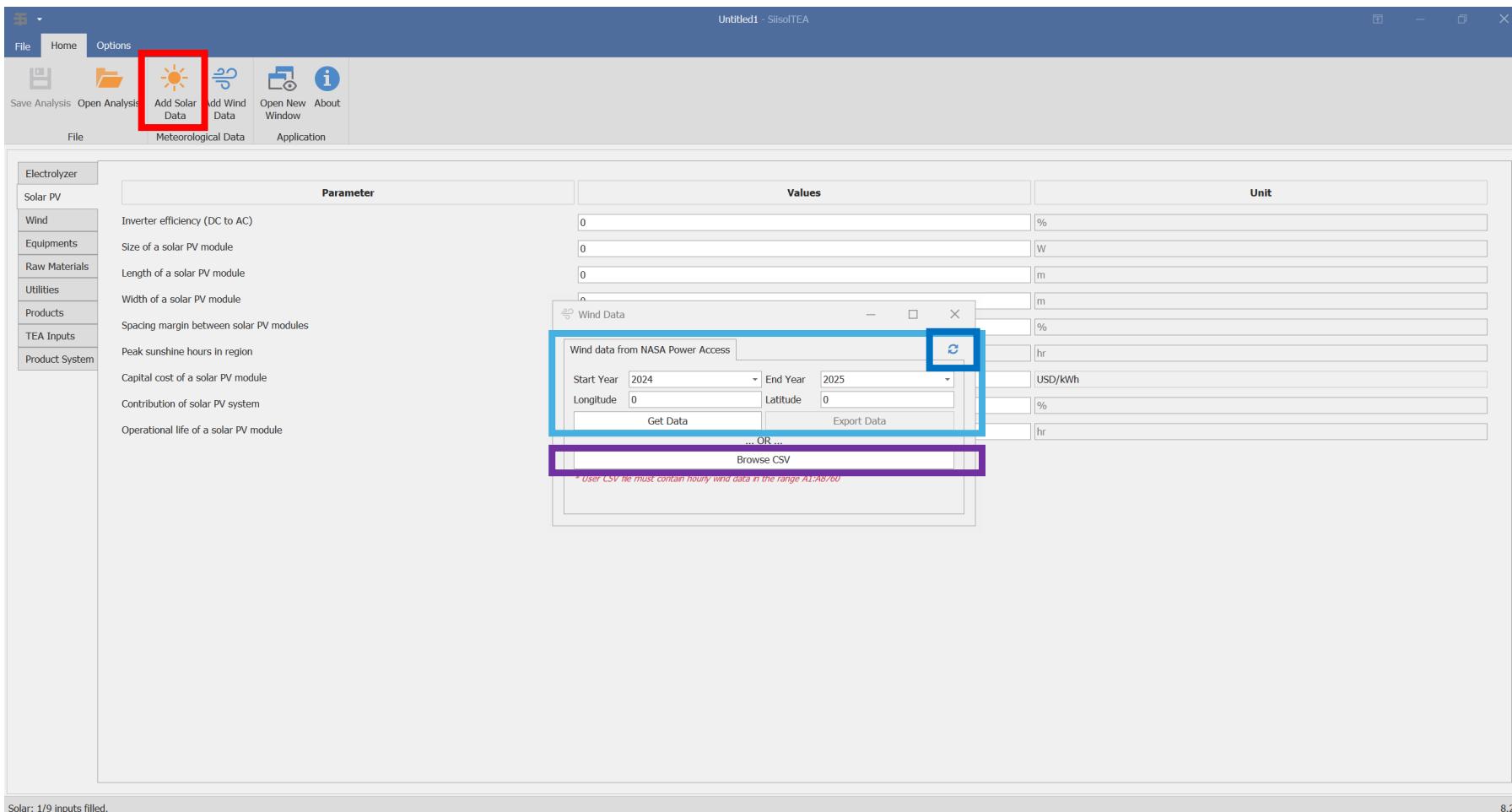
Key

1

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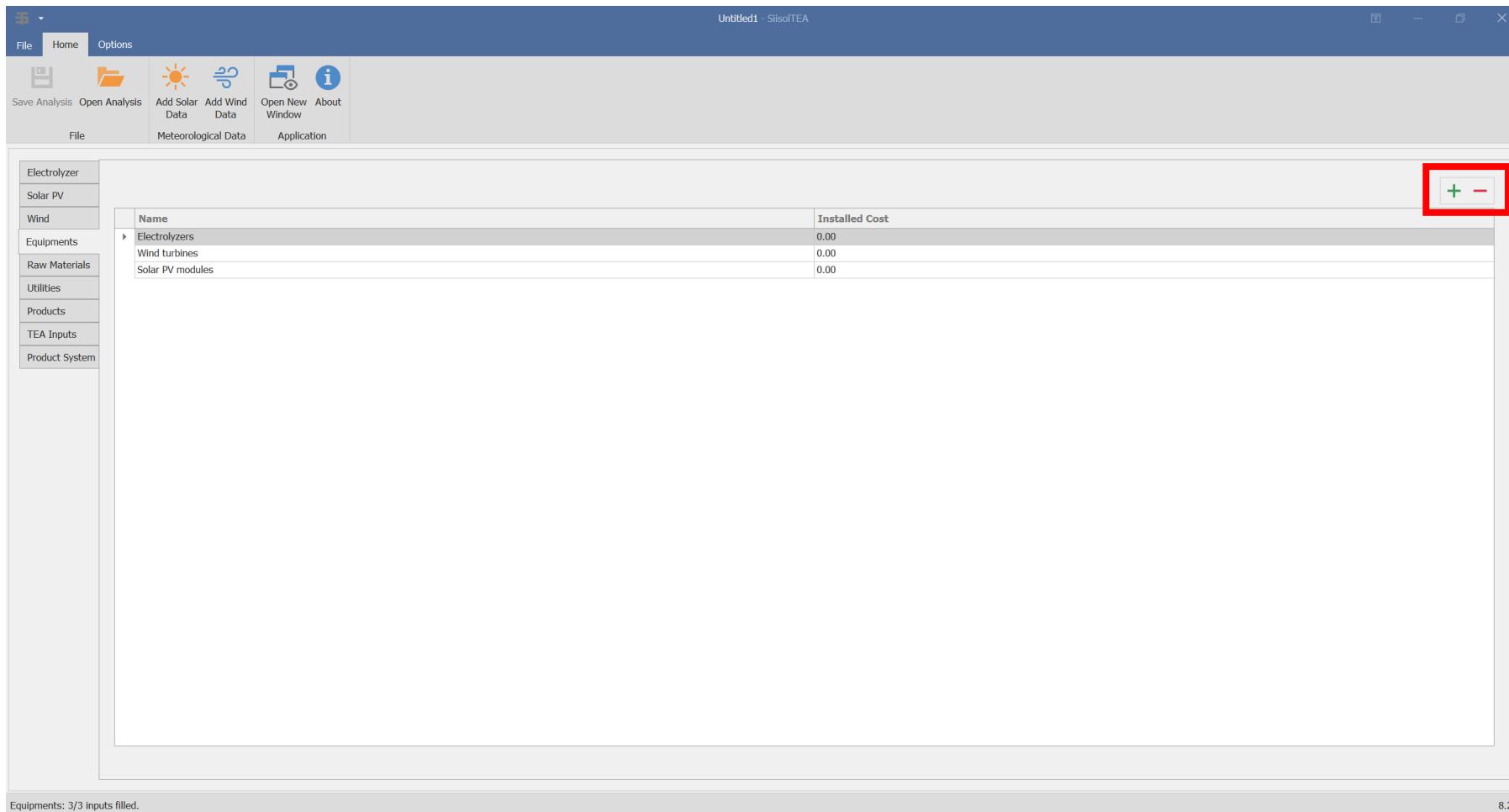
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SiisolTEA includes default entries for the equipment needed for the analysis, with no cost inputs required for these items. However, users have the option to add or remove equipment using the + and – buttons in the top right corner. Any equipment added by the user will require associated cost inputs.



Key

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SiisolTEA initially includes entries for the raw materials needed for the analysis. However, users have the option to add or remove items as necessary by using the + and - buttons located in the top right corner. All quantity and cost fields must be completed.

Raw Material Name	Quantity [unit/hr]	Cost [USD/unit]
Deionized water	0	0
KOH/NaOH	0	0
Steam	0	0
Nitrogen	0	0

Raw Materials: 0/4 inputs filled. 8.25

Key

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Like raw materials, users can add or remove utilities as needed by using the + and - buttons located in the top right corner. All quantity and cost fields must be filled in.

Untitled1 - SisoltEA

File Home Options

Save Analysis Open Analysis Add Solar Data Add Wind Data Open New Window About

File Meteorological Data Application

Electrolyzer Solar PV Wind Equipments Raw Materials Utilities Products TEA Inputs Product System

Utility Name Quantity [unit/hr] Cost [USD/unit]

Add utilities first 8.25

Key

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SiisolTEA includes default entries for the products obtained for the analysis. Users have the option to add or remove items as necessary using the + and - buttons located in the top right corner. The software calculates the quantities of hydrogen and oxygen based on the previously defined hydrogen demand, requiring only cost inputs for these products.

The screenshot shows the SiisolTEA software interface. The main window has a title bar 'Untitled1 - SiisolTEA' and a menu bar with 'File', 'Home', and 'Options'. The 'File' menu includes 'Save Analysis', 'Open Analysis', 'Add Solar Data', 'Add Wind Data', 'Open New Window', and 'About'. The 'Home' menu includes 'Electrolyzer', 'Solar PV', 'Wind', 'Equipments', 'Raw Materials', 'Utilities', 'Products', 'TEA Inputs', and 'Product System'. The 'Options' menu is currently selected. A central table displays products: 'Hydrogen' and 'Oxygen'. The table has columns for 'Product Name', 'Quantity [unit/hr]', and 'Selling Price [USD/unit]'. The 'Selling Price' column for Hydrogen and Oxygen is highlighted with a blue box. A red box highlights the '+' and '-' buttons in the top right corner of the table. The status bar at the bottom left says 'Products: 0/2 inputs filled.' and the bottom right says '8.25'.

Product Name	Quantity [unit/hr]	Selling Price [USD/unit]
Hydrogen	0	0
Oxygen	0	0

Key

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SiisoltEA enables users to evaluate the system based on profit margins. Just select the highlighted checkbox, choose the desired product, and enter the margin percentage.

Untitled1 - SiisoltEA

Parameter	Values	Unit
Annual operating hours	0	hr
Tax rate	0	%
Discount rate	0	%
Profit margin	<input type="checkbox"/>	0 %
Depreciation years	0	yr
Salvage value	0	USD
Project life	0	yr
Plant start-up year	0	YR
Capital cost approach for equipments	Lowest	-

Parameter	Values
Annual operating hours	0
Tax rate	0
Discount rate	0
Profit margin	<input checked="" type="checkbox"/> Hydrogen
Depreciation years	<input type="checkbox"/> 0
Salvage value	0
Project life	0
Plant start-up year	0
Capital cost approach for equipments	Lowest

TEA Inputs: 4/8 inputs filled. 8.25

Key

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SiisolTEA enables users to analyze the system using either straight-line depreciation or accelerated depreciation. By default, the software applies the straight-line depreciation method; to switch to accelerated depreciation, simply select the highlighted checkbox.

Untitled1 - SiisolTEA

File Home Options

Save Analysis Open Analysis Add Solar Data Add Wind Data Open New Window About

File Meteorological Data Application

Parameter	Values	Unit
Annual operating hours	0	hr
Tax rate	0	%
Discount rate	0	%
Profit margin	0	%
Depreciation years	<input type="checkbox"/>	Yr
Salvage value	0	USD
Project life	0	Yr
Plant start-up year	0	Yr
Capital cost approach for equipments	Lowest	

TEA Inputs: 4/8 inputs filled.

Key

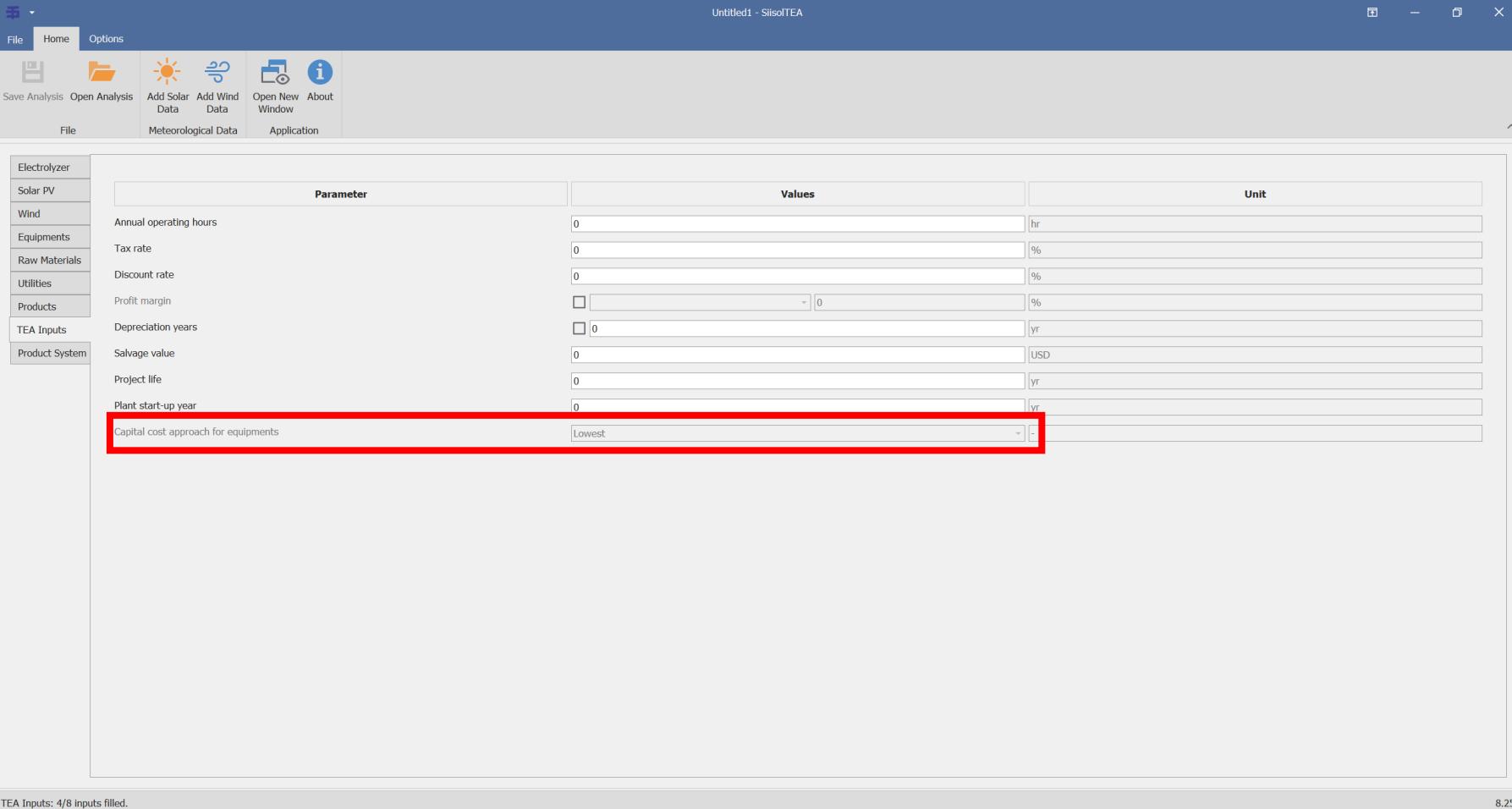
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If the user selects the capital cost for solar, wind, or electrolyzer from the software database, this field will request the cost methodology, based on the ranges specified by IEA and IRENA.



The screenshot shows the SiisolTEA software interface with a table of parameters. The table has three columns: Parameter, Value, and Unit. The 'Parameter' column lists various financial and operational inputs. The 'Value' column contains input fields, and the 'Unit' column specifies the unit for each value. The 'Capital cost approach for equipments' row is highlighted with a red box. The software interface includes a top menu bar with File, Home, Options, and various icons for saving, opening, and adding data. On the left, a sidebar lists categories like Electrolyzer, Solar PV, Wind, Equipments, Raw Materials, Utilities, Products, TEA Inputs, and Product System. The bottom of the interface shows a status bar with 'TEA Inputs: 4/8 inputs filled.' and a version number '8.25'.

Parameter	Value	Unit
Annual operating hours	0	hr
Tax rate	0	%
Discount rate	0	%
Profit margin	<input type="text"/> 0	%
Depreciation years	<input type="text"/> 0	yr
Salvage value	0	USD
Project life	0	yr
Plant start-up year	0	yr
Capital cost approach for equipments	Lowest	

Key

1

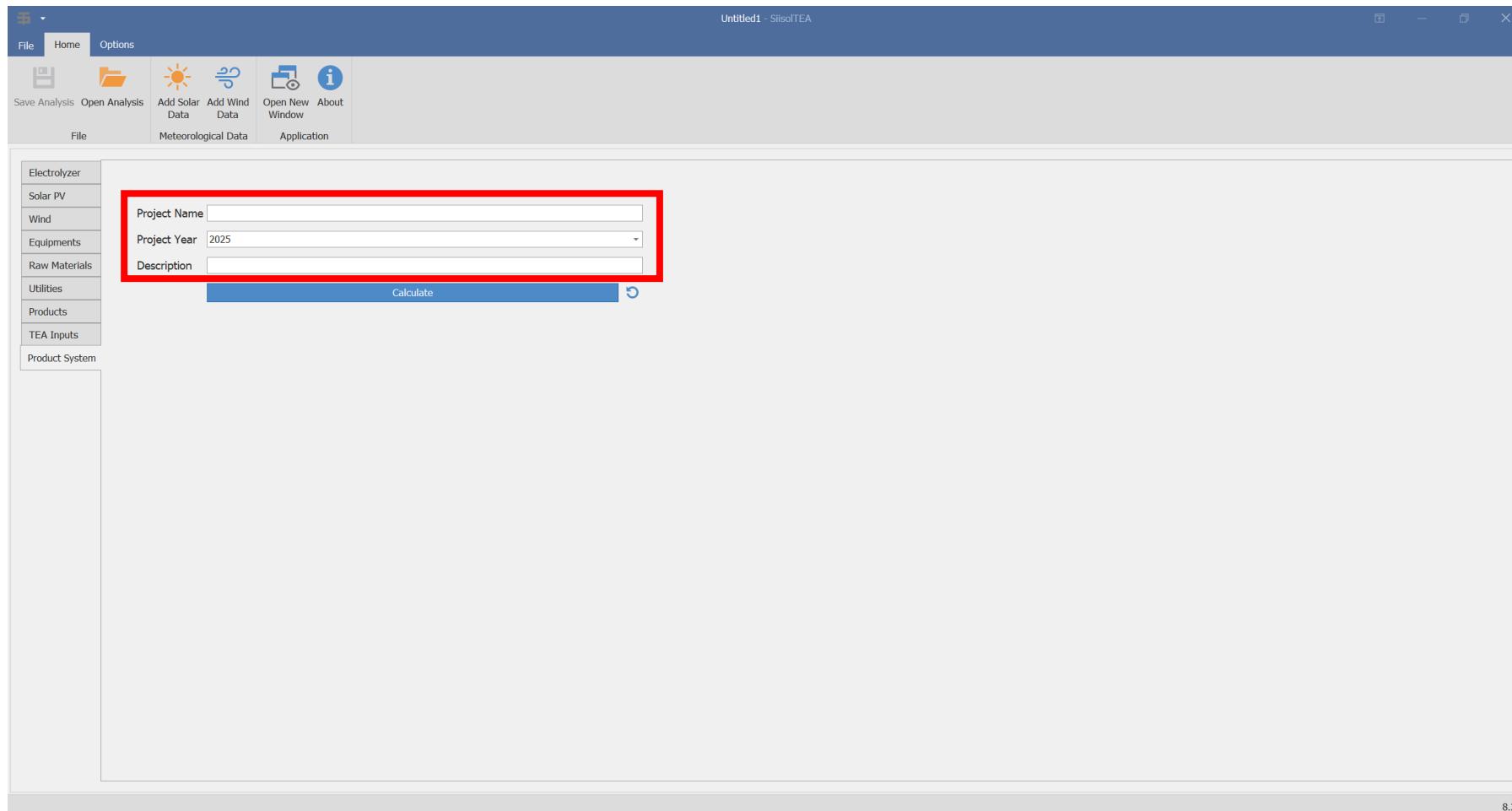
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Users have the ability to assign unique project names to each analysis and utilize the description box for comprehensive notes. Selecting the appropriate Project Year is essential when capital costs for solar, wind, or electrolyzer are sourced from the software's database.



Key

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After entering all the required inputs, click the Calculate button to obtain the results. Once the results are displayed, users will no longer be able to modify any inputs unless they click the reset button located to the right of the Calculate button.



Key

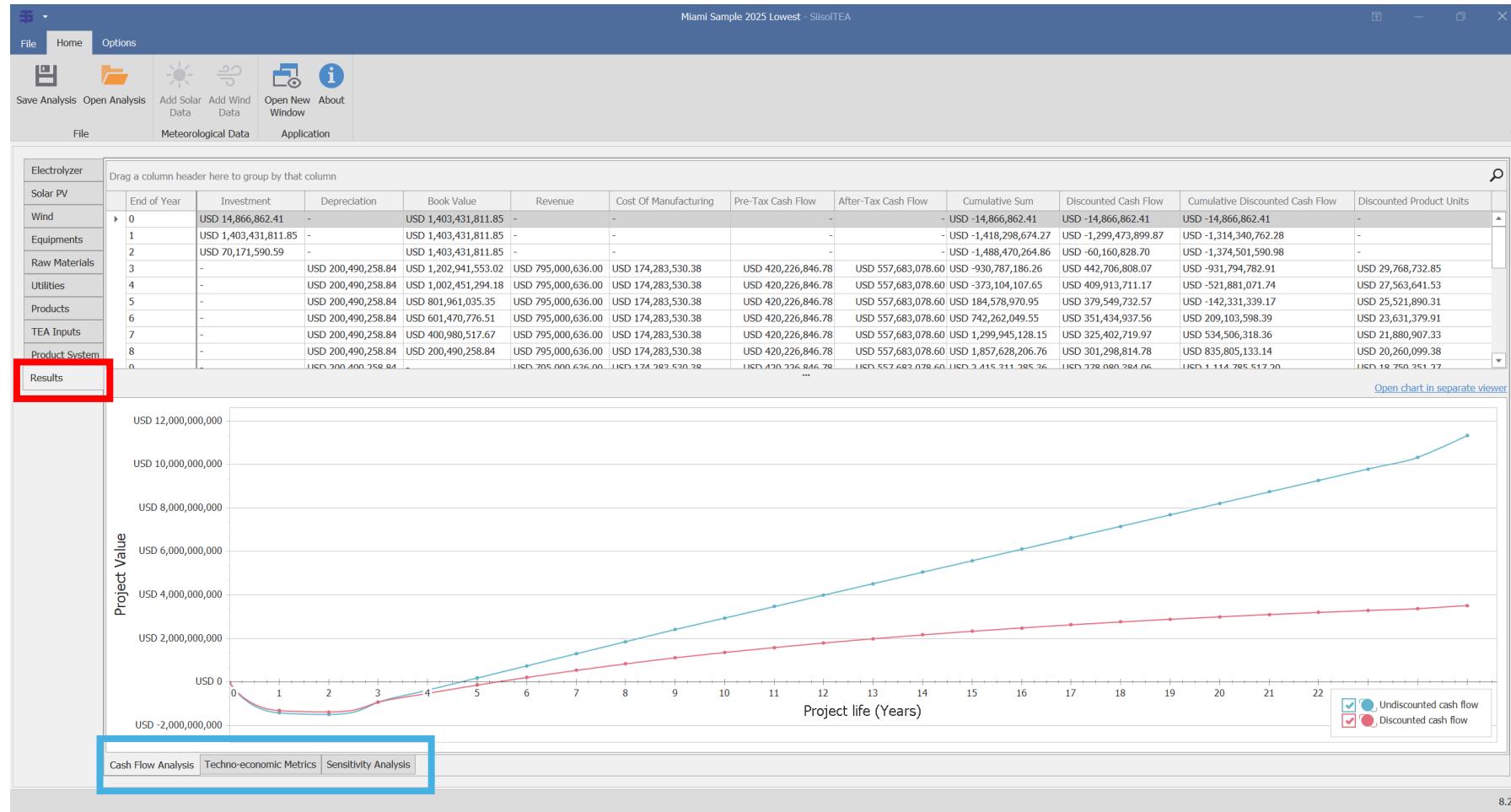
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After the results are generated, a new Results tab will appear in the left panel. Within this tab, three additional tabs will be displayed just above the status bar.



Key

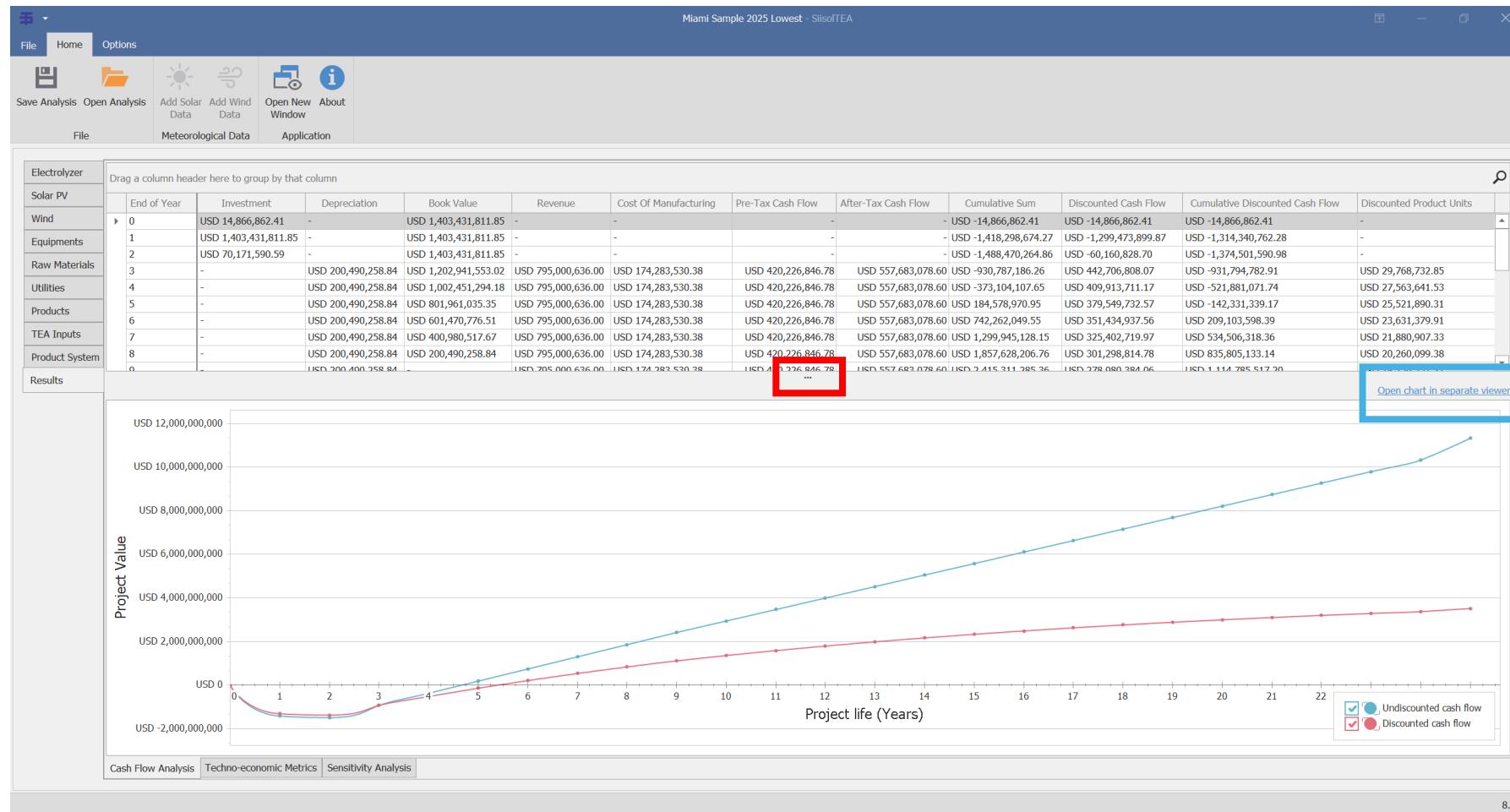
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Users can drag the separator vertically to adjust the size of each panel (highlighted in red). Additionally, hovering over the graph displays the values at each data point. Users also have the option to open the chart in a separate viewer for a more detailed view.



Key

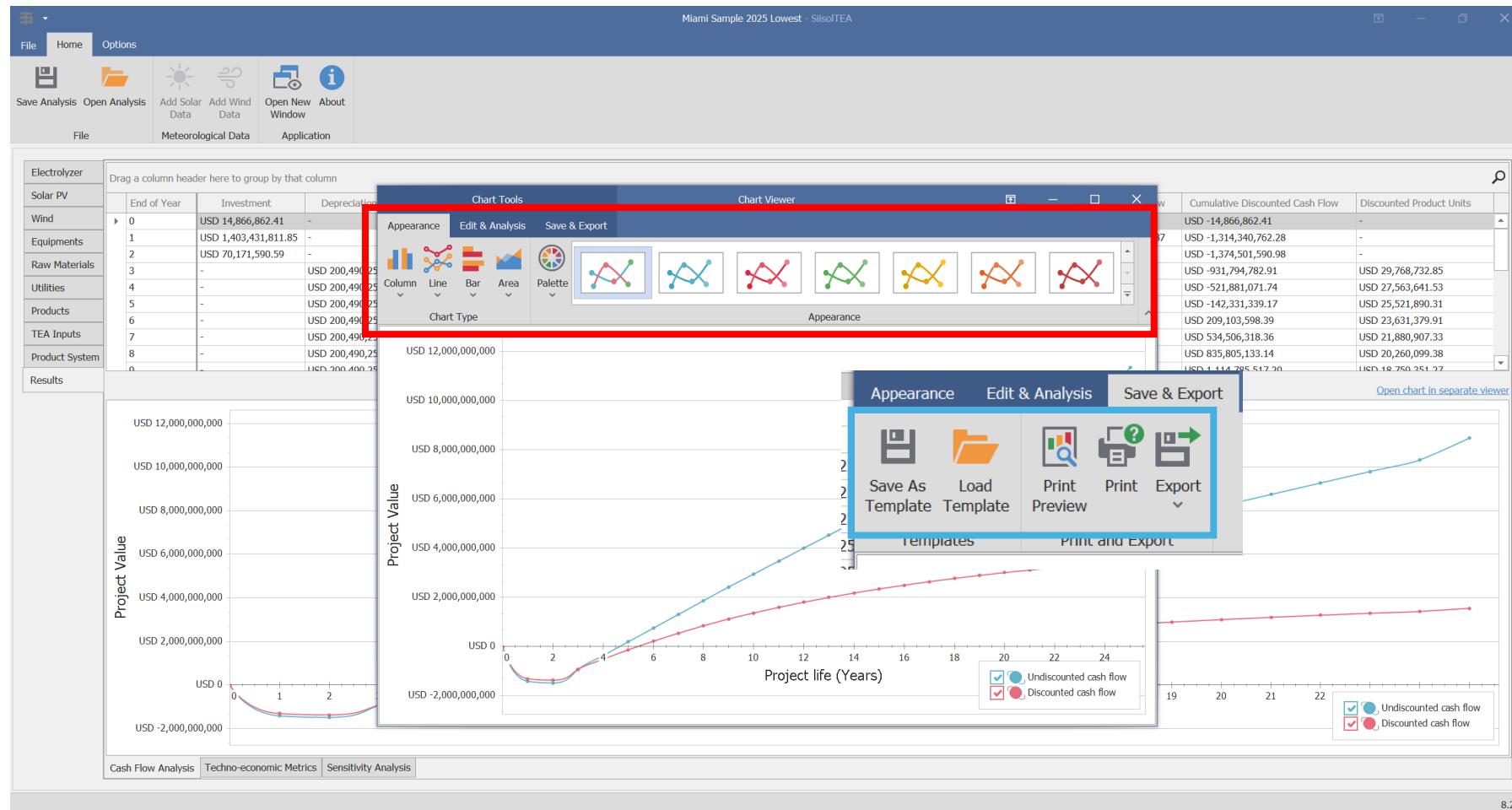
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The chart viewer enables users to personalize charts by selecting the type and adjusting the appearance. Additionally, users can export charts in high-quality formats like SVG, ensuring they remain sharp and clear when included in presentations or documentation.



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The findings encompass comprehensive techno-economic indicators can be found in the Techno-economic Metrics tab..

Miami Sample 2025 Lowest - SisoltEA

File Home Options

Save Analysis Open Analysis Add Solar Data Add Wind Data Open New Window About

File Meteorological Data Application

Technical Metrics

Drag a column header here to group by that column

Parameter Name	Value	Unit
Size of electrolyzer	261.90	MW
Size of solar PV farm	176.60	MW
Number of solar PV modules	318,196.00	-
Area of solar PV farm	0.98	km ²
Size of wind farm	235.71	MW
Number of wind turbines	66.00	-
Area of wind farm	0.89	km ²
Total area for hybrid farm	1.87	km ²

Economical Metrics

Drag a column header here to group by that column

Parameter Name	Value	Unit
Net present value (NPV)	4,221,556,121.56	USD
Total capital investment (TCI)	1,488,470,264.86	USD
Net annual profit before taxes	620,717,105.62	USD
Net annual profit after taxes	527,609,539.78	USD
Payback period	5.41	yr
Return on investment (ROI)	35.45	%
Internal rate of return (IRR)	28.95	%
Net present value per unit capital investment	2.84	USD
Discounted lifecycle cost	2,487,517,968.87	USD
Discounted lifecycle production	333,431,945.83	kg
Levelized cost	7.46	USD/kg

Cash Flow Analysis Techno-economic Metrics Sensitivity Analysis

8.25

Key

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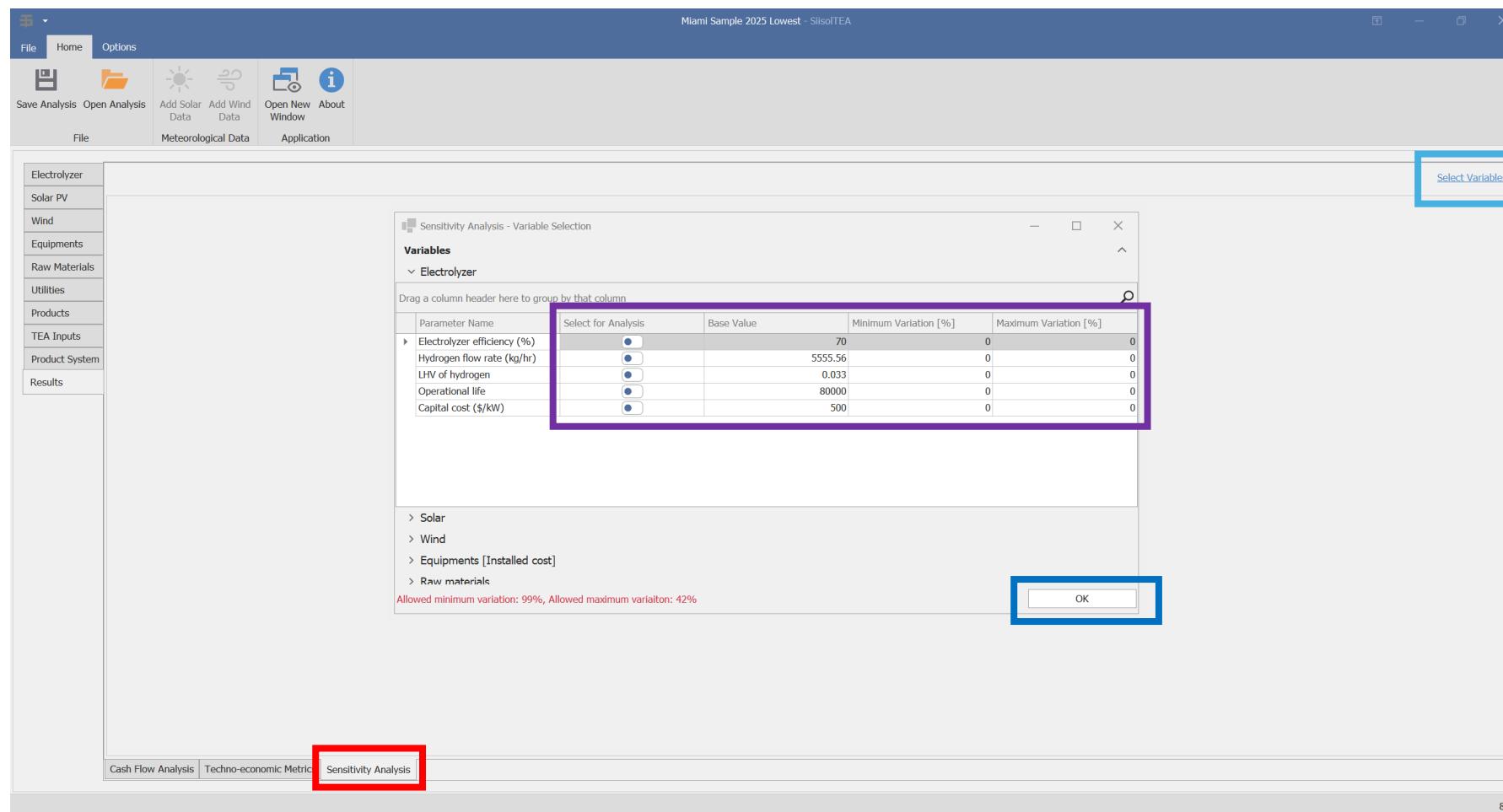
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In addition to comprehensive techno-economic and cash flow evaluations, SiisolTEA offers an in-depth sensitivity analysis feature. Users can access this by navigating to the Sensitivity Analysis tab within the Results section, where they can choose variables and specify percentage variations.



Key

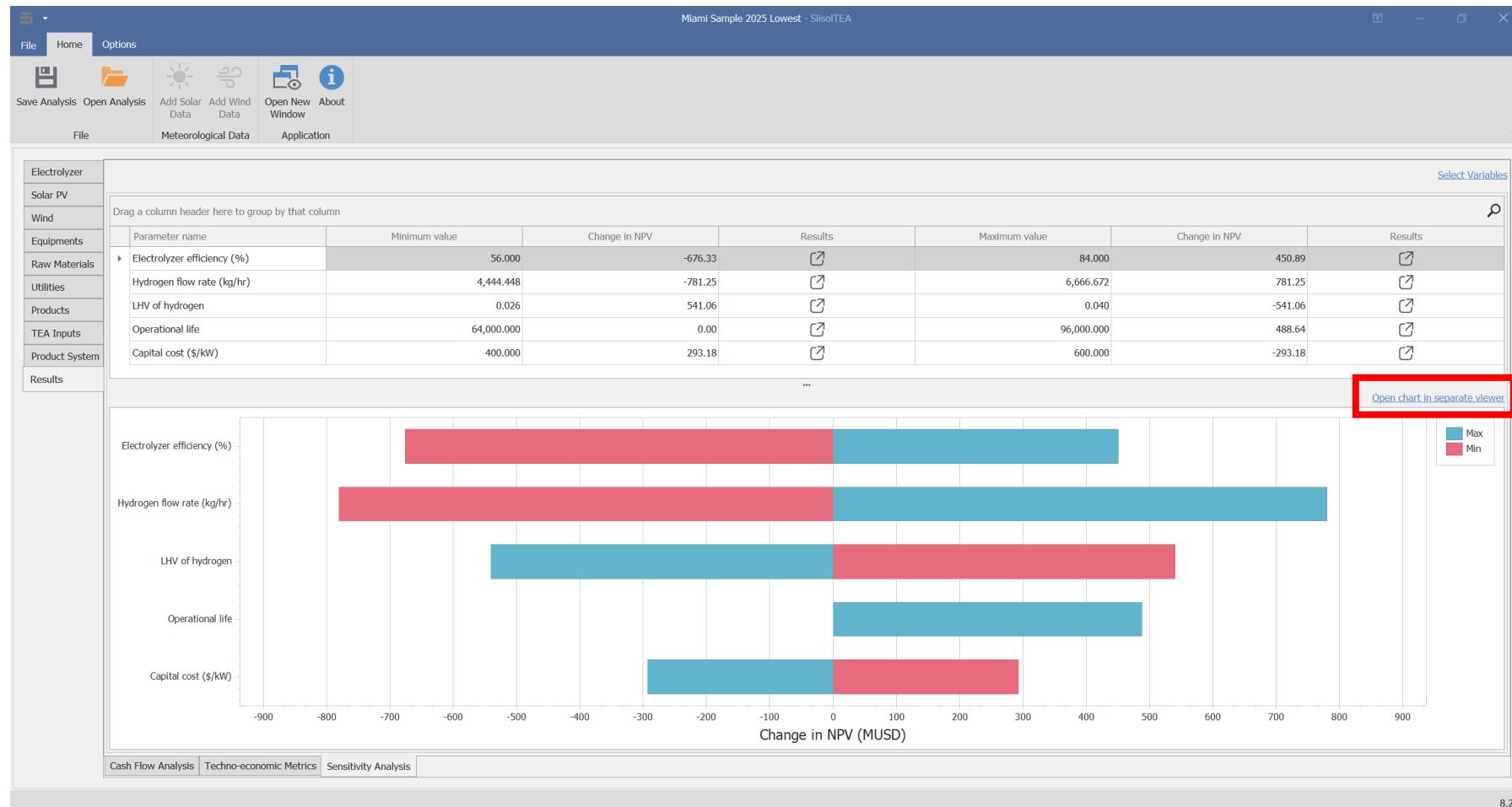
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After the results are produced, the user can view the impact of the change as the Change in NPV of the project, presented both numerically and graphically. The chart, similar to cashflow chart, is customizable and exportable using the Chart Viewer.



Key

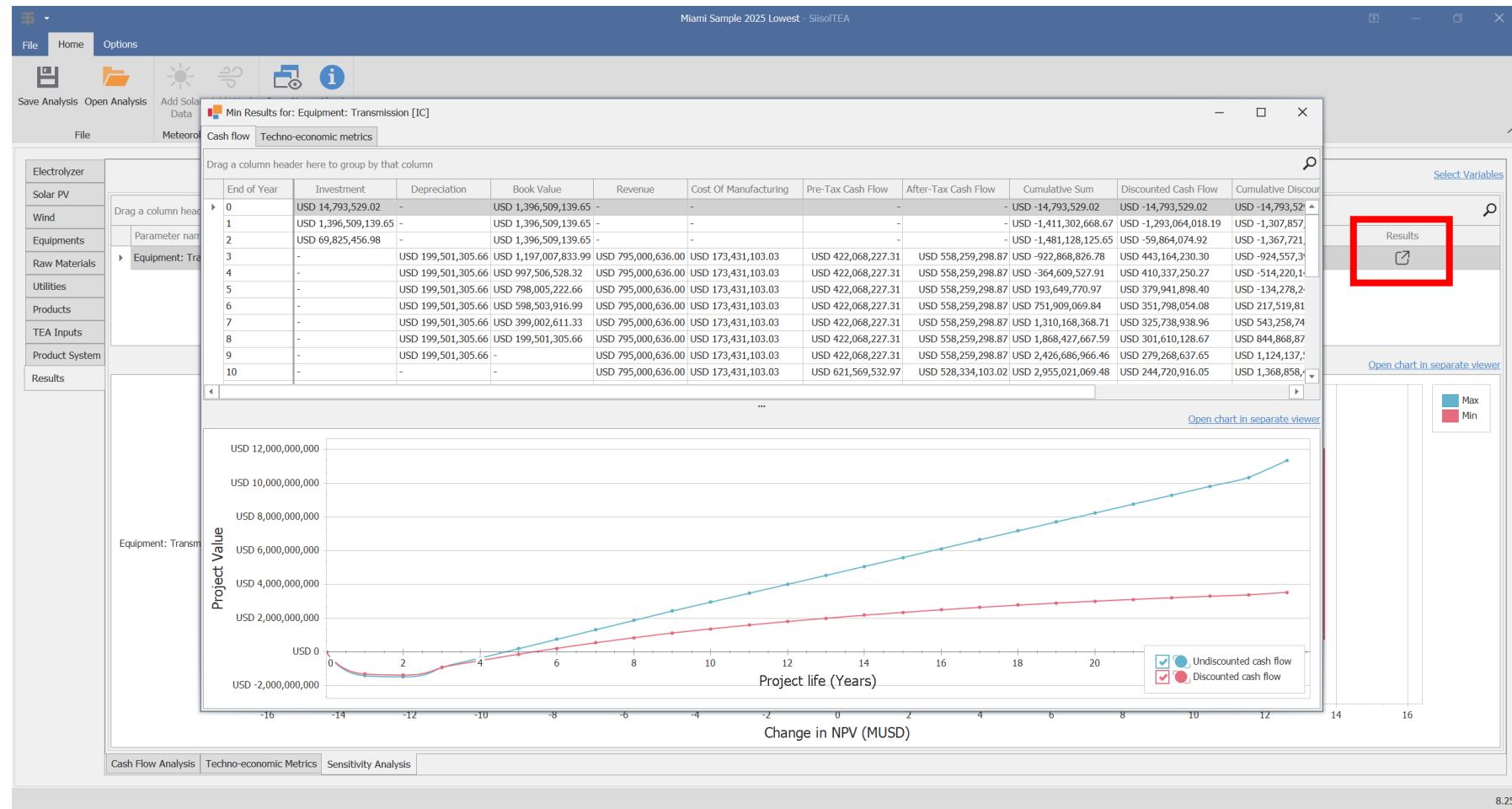
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In addition to estimating the change in the system's NPV, the Sensitivity Analysis provides comprehensive techno-economic and cash flow details for each variation. Simply click the links in the results column to open a new window displaying the detailed results.



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The End

Thank you!