



PV Plant's Transformer Evaluation Tool: Guide Memo

This Memo will guide you through the steps necessary to input a set of data as well as explaining the embedded output options.

Input Data

Ownership Status

Initially, the correct ownership status of the PV plant should be selected. This is to perform the appropriate loss evaluation process as per the selected option. The options provided are:

1. ***Independent PV Power Producer***
2. PV Plant is considered as another source of generation in a ***Regulated Utility***

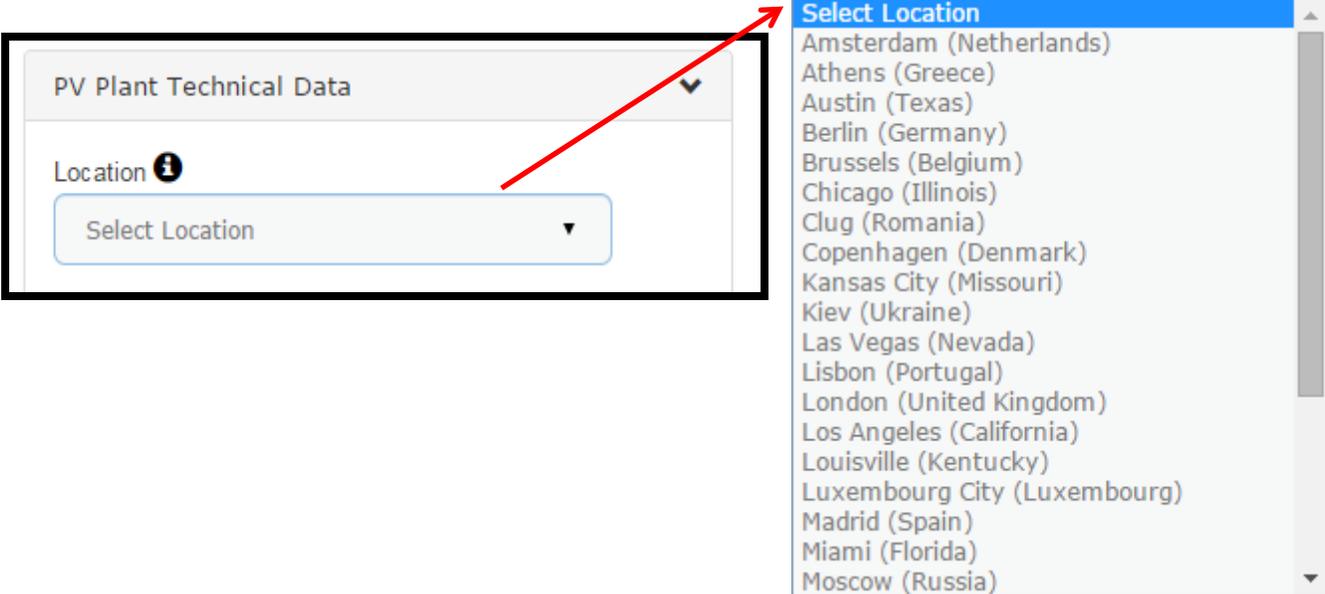
***Note:** The format of *PV Plant Technical Data* and the *PV Plant Financial Data* is identical for both options. The difference in the two options relies on *System Energy Charges*.

Independent Power Producers

Regulated Utilities

PV Plant Technical Data

On the **Location** option select an area/city. Each area/city is linked to its corresponding Solar Irradiation Profile provided by PV GIS.



The screenshot shows a form titled "PV Plant Technical Data" with a "Location" field. A red arrow points from the "Select Location" dropdown in the form to a detailed list of locations. The list includes:

- Amsterdam (Netherlands)
- Athens (Greece)
- Austin (Texas)
- Berlin (Germany)
- Brussels (Belgium)
- Chicago (Illinois)
- Cluj (Romania)
- Copenhagen (Denmark)
- Kansas City (Missouri)
- Kiev (Ukraine)
- Las Vegas (Nevada)
- Lisbon (Portugal)
- London (United Kingdom)
- Los Angeles (California)
- Louisville (Kentucky)
- Luxembourg City (Luxembourg)
- Madrid (Spain)
- Miami (Florida)
- Moscow (Russia)

For the **Size of PV Plant** option insert the peak capacity size of the PV plant in MWp. The size of the plant should be an integer number.



The screenshot shows a form titled "Size of PV plant (MWp)" with an information icon and an empty input field for entering the peak capacity size in MWp.

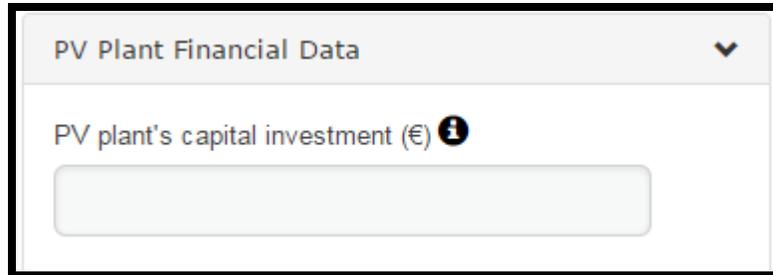
For the **Estimated Transformer Life-Time** insert the expected duration of the power transformer operation in years.



The screenshot shows a form titled "Estimated transformer life-time (years)" with a slider control. The slider is currently set to 1 year, and the range is from 0 to 50 years.

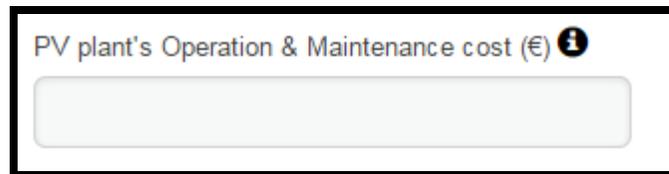
PV Plant Financial Data

On the **PV Plant's Capital Investment** option insert the initial capital expenditure for the PV plant in €.



The screenshot shows a form titled "PV Plant Financial Data" with a dropdown arrow. Below the title is the label "PV plant's capital investment (€)" followed by an information icon. A text input field is positioned below the label, currently empty.

For the **PV Plant's Operation and Maintenance Cost** option insert the annual expected expenditure for plant's operation and maintenance in €.



The screenshot shows a form with the label "PV plant's Operation & Maintenance cost (€)" followed by an information icon. A text input field is positioned below the label, currently empty.

For the **Nominal Discount Rate** option choose the interest rate (in %) that will be used in the discounted cash flow (DCF) analysis to determine the present value of future cash flows.

For the **Inflation Rate** option choose the annual expected inflation rate (in %) during the evaluation lifetime.

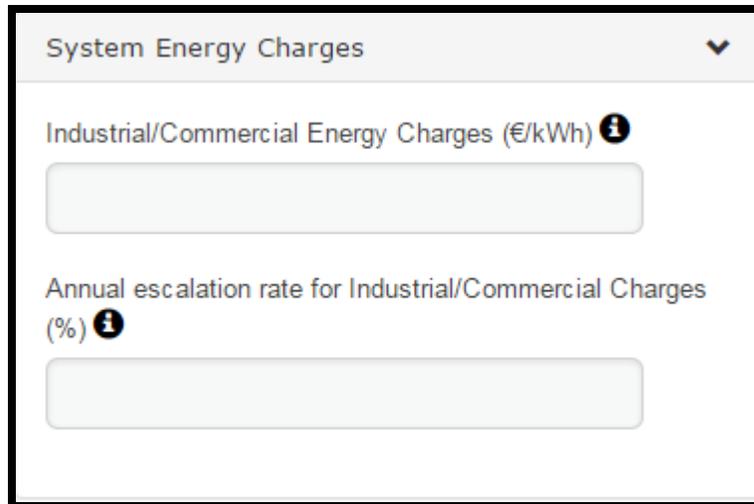


The screenshot shows two sliders. The top slider is labeled "Nominal Discount Rate (%)" with an information icon. It has a blue button showing "0%" and a scale from 0 to 25 with major ticks every 5 units. The bottom slider is labeled "Inflation Rate (%)" with an information icon. It has a blue button showing "0%" and a scale from 0 to 10 with major ticks every 2 units.

System Energy Charges

Option 1: Independent Power Producers

For the **Industrial/Commercial Energy Charges** option insert the average value of the electricity charge rate (demand + energy) that applies in current year (€/kWh). For the **Annual Escalation Rate of Industrial/Commercial Charges** option insert the estimated annual escalation rate of Industrial/Commercial charges as a percentage (%).

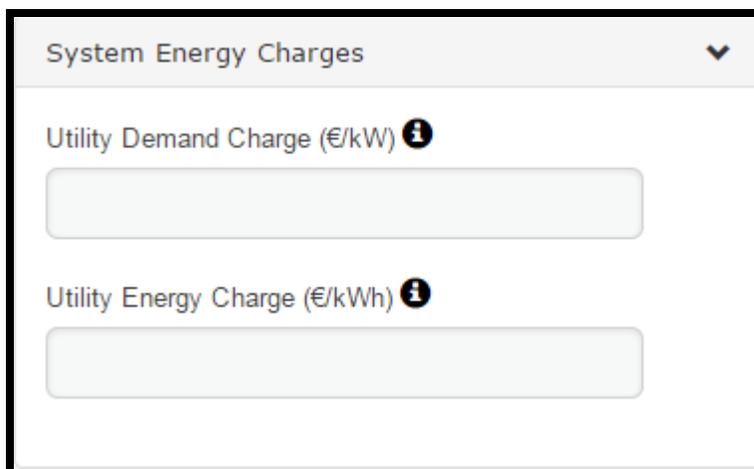


The screenshot shows a form titled "System Energy Charges" with a dropdown arrow. It contains two input fields: "Industrial/Commercial Energy Charges (€/kWh)" and "Annual escalation rate for Industrial/Commercial Charges (%)". Both fields have an information icon (i) to their right.

Option 2: Regulated Utilities

For the **Utility Demand Charge** option insert the present utility's specific demand charge (fixed component – capacity dependent) in €/kW.

For the **Utility Energy Charge** option insert the present utility's specific energy charge (variable component – energy dependent) in €/kWh.



The screenshot shows a form titled "System Energy Charges" with a dropdown arrow. It contains two input fields: "Utility Demand Charge (€/kW)" and "Utility Energy Charge (€/kWh)". Both fields have an information icon (i) to their right.

****Optional: Transformer Total Ownership Cost***

If you wish to calculate the ***Total Ownership Cost (TOC)*** of candidate transformers you should select the displayed option. If this is the case, the required number of transformers to be compared should be selected. The tool provides the ability to compare up to three transformers.

Life-cycle costing of losses and Total Ownership Cost of transformers
Select the number of transformers to compare :

	Transformer A	Transformer B
Purchase Price (€) ⓘ	<input type="text"/>	<input type="text"/>
No-Load Losses (kW) ⓘ	<input type="text"/>	<input type="text"/>
Load Losses (kW) ⓘ	<input type="text"/>	<input type="text"/>
Auxiliary Losses (kW) ⓘ	<input type="text"/>	<input type="text"/>
Total Ownership Cost (€) ⓘ	<input type="text"/>	<input type="text"/>

You should then insert the data provided by the manufacturers. The data should be inserted as follows:

For the ***Purchase Price*** option insert the required capital expenditure to buy the transformer in €, as provided by the manufacturer.

For the ***No-Load Losses*** option insert the guaranteed fixed transformer losses due to core energisation, in kW. This is provided by the transformers' manufacturer.

For the ***Load Losses*** option insert the guaranteed variable transformer losses due to the loading of transformer, in kW. This is provided by the transformers' manufacturer.

For the ***Auxiliary Losses*** option insert the guaranteed transformer losses due to power lost by the operation of the transformers' cooling units, in kW. This is provided by the transformers' manufacturer.

The ***Total Ownership Cost*** is an output result, providing the sum of the transformer's purchase price and it's Total Value of Losses (TVL). This figure is expressed in €.

Output Results

The output results are displayed in a table format. The Table provides the calculated loss cost rates for transformer no-load, load and auxiliary losses. In addition, the PV plant specific Levelized Cost of Electricity of the PV plant is illustrated.

No-Load Losses Cost Rate (€/kW): Factor that capitalizes or converts no-load loss costs to present value. This is dependent on the industrial/commercial energy prices and the PV plant's Levelized Cost of Electricity

Load Loss Cost Rate (€/kW): Factor that capitalizes or converts load loss costs to present value. This is dependent on the PV plant's Levelized Cost of Electricity.

Auxiliary Loss Cost Rate (€/kW): Factor that capitalizes or converts auxiliary load loss costs to present value. This is dependent on the PV plant's Levelized Cost of Electricity

Levelized Cost of Electricity (€/kWh): It is an economic assessment, in per kWh cost, to build and operate a power-generating asset over its lifetime divided by the total power output of the asset over that lifetime.

Output Data	
No-Load Loss Cost Rate (€/kW) ⓘ	<input type="text"/>
Load Loss Cost Rate (€/kW) ⓘ	<input type="text"/>
Auxiliary Loss Cost Rate (€/kW) ⓘ	<input type="text"/>
Levelized Cost of Electricity (€/kWh) ⓘ	<input type="text"/>

For Further Details:

<http://digital-library.theiet.org/content/journals/10.1049/iet-gtd.2014.0465>