

User Guide for Photovoltaic (PV) Module Benefits Calculator

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Introduction

The GEC EPEAT calculator for photovoltaic (PV) modules quantifies the carbon emission savings from installing EPEAT registered PV modules that meet the [EPEAT Criteria for the Assessment of Ultra-Low Carbon Solar Modules](#)¹, compared to the average solar module on the global market. The calculator uses the capacity for electricity generation of a solar installation (in kWp) as the basis for the calculation. Results are presented as the reduction in greenhouse gas emissions (or global warming potential, GWP), measured in kilograms of carbon dioxide equivalents (kg CO_{2e}) attributed to the installation of EPEAT registered low carbon modules. The carbon savings are associated with the production of the module and its raw materials and components and demonstrate that how and where PV modules are produced can reduce the carbon impact (i.e., Scope 3 emissions) of solar installations.

****This PV calculator does not include the carbon savings associated with the generation of electricity from the solar installation as compared to the generation of electricity from other sources or impacts associated with end-of-life management of PV modules. ****

Finally, note that while EPEAT PV criteria address multiple sustainability impacts across the life cycle of PV modules, the PV calculator currently is limited in scope to the EPEAT [carbon criteria](#) that establish carbon emission limits for the production of PV modules. Calculator users can estimate carbon savings for PV modules achieving Low Carbon and Ultra-Low Carbon Solar Criteria. In addition, while EPEAT covers PV modules and inverters, at this time, the calculator only covers PV modules.

How Carbon Reductions are Calculated

The GEC PV calculator compares the carbon emissions of an EPEAT registered PV module, meeting either the Low Carbon or Ultra-Low Carbon Criteria, to the average solar module on the global market (referred to herein as “baseline module”). Carbon emissions for the baseline module are based on life cycle inventory (LCI) data published by the International Energy Agency’s Photovoltaic Power Systems Program (PVPS) Task 12 in 2020.² Global market data for PV module production was then applied to the LCI data, resulting in a weighted average for embodied carbon for PV modules on the global market (baseline module).

¹ Global Electronics Council, Criteria for the Assessment of Ultra-Low Carbon Solar Modules (EPEAT–ULCS–2023), March 17, 2023. Available at <https://globalelectronicscouncil.org/>.

² International Energy Agency, PVPS Task 12 – Life Cycle Inventories and Life Cycle Assessments of Photovoltaic Systems, and Guidelines on Life Cycle Assessment of Photovoltaic Electricity, 2020. Available at <https://iea-pvps.org/wp-content/uploads/2020/12/IEA-PVPS-LCI-report-2020.pdf>

The following values are used to calculate carbon emission savings in the GEC calculator:

- **Baseline module (global weighted market average):** embodied carbon equal to 857 kg CO₂ eq/kWp
- **EPEAT Criterion 12.1, Required – Low Carbon Solar:** embodied carbon less than or equal to 630 kg CO_{2e} per kWp
- **EPEAT Criterion 12.2, Optional – Ultra-Low Carbon Solar:** embodied carbon less than or equal to 400 kg CO_{2e} per kWp


The general formula used to calculate carbon savings for EPEAT registered PV modules compared to baseline modules is:

$$\text{Installation Capacity in kWp} * (\text{baseline module kg CO}_{2e} \text{ per kWp} - \text{EPEAT criterion maximum value kg CO}_{2e} \text{ per kWp}) = \text{kg CO}_{2e} \text{ savings}$$

More specific calculations are provided below.

How to Use the Calculator

The PV calculator allows the user to evaluate carbon savings for PV modules meeting EPEAT Criterion 12.1 (Low Carbon Solar), Criterion 4.2 (Ultra-Low Carbon Solar), or a mix. Calculations are based on the percentage of the capacity of a solar installation (in kWp) using EPEAT registered PV modules, either low carbon or ultra-low carbon modules.

 **Information icons (on the data entry and results screens) provide helpful information for using the calculator.**

Data Entry

The user enters the following data in the PV calculator to calculate the carbon emission (GWP) savings:

1. The electricity generation capacity for the solar installation (in kWp). If the solar installation includes a mix of EPEAT registered and non-EPEAT registered modules, the user inputs only the EPEAT registered PV module capacity.
2. Do the EPEAT registered modules meet Optional Criterion 12.2 (Ultra-Low Carbon Solar)?
 - If “yes” is selected, an Optional Data Entry section appears where the user can enter the percentage of capacity attributed to EPEAT registered modules meeting Optional Criterion 12.2 (“Optional %”).
 - If the user leaves the Optional % section blank or enters 100, the calculator assumes that all PV modules meet Optional Criterion 12.2, and carbon savings are calculated as:

$$\text{Installation Capacity in kWp} * (857 \text{ kg CO}_{2e} \text{ per kWp} - 400 \text{ kg CO}_{2e} \text{ per kWp}) = \text{kg CO}_{2e} \text{ savings}$$

- If the user enters a value between 1 and 100 for Optional %, the carbon savings are calculated as:
$$\text{Installation Capacity in kWp} * (\text{Optional \%} * [(857 \text{ kg CO}_{2e} \text{ per kWp} - 400 \text{ kg CO}_{2e} \text{ per kWp}) + (1 - \text{Optional \%}) * (857 \text{ kg CO}_{2e} \text{ per kWp} - 630 \text{ kg CO}_{2e} \text{ per kWp})] = \text{kg CO}_{2e} \text{ savings}$$
- If “no” is selected, all Installation Capacity is calculated using the maximum carbon threshold for Criterion 12.1 (Low Carbon Solar), as follows:

$$\text{Installation Capacity in kWp} * (857 \text{ kg CO}_{2e} \text{ per kWp} - 630 \text{ kg CO}_{2e} \text{ per kWp}) = \text{kg CO}_{2e} \text{ savings}$$

- If the user does not know whether the EPEAT registered PV module capacity meets Optional Criterion 12.2, the user is encouraged to go to the EPEAT Registry (www.epeat.net), click on “Product Finder” on the top menu bar, then click on “Photovoltaics Modules and Inverters” on the left side menu, and search for the PV module by name or brand. After finding the specific PV module, click on the product name to view additional information. On this screen, click on the “+” button for “12. Ultra Low Carbon Solar” to see if the PV module meets Optional Criteria 12.2.
- Alternatively, select the “don’t know” option, and the calculator will assume that Optional Criterion 12.2 is not met, and carbon emissions savings are calculated using the maximum carbon threshold value for Criterion 12.1:

$$\text{Installation Capacity in kWp} * (857 \text{ kg CO}_{2e} \text{ per kWp} - 630 \text{ kg CO}_{2e} \text{ per kWp}) = \text{kg CO}_2 \text{ eq savings}$$

Results

After completing the above data entry, click the “Get Results” button. The results are displayed in the column labeled, “Greenhouse gas emission reduction, expressed as global warming potential (kg CO₂ eq).” If the user entered data for multiple products, these results are displayed along with savings for other product types. As noted previously, only carbon reduction (GWP) results are calculated for EPEAT registered PV modules. For this reason, the columns for other environmental impacts are blank for PV modules.

When calculating the reduction in environmental impacts for multiple products, the carbon reductions attributed to PV modules can be viewed by scrolling down and clicking “By Product Category,” then “Photovoltaic Modules.” Clicking “By Product Life Cycle Phase (All Products)” shows the carbon savings attributed to conformance with EPEAT’s Low and Ultra-Low Carbon Criteria in the “Raw Materials Extraction, Product Manufacturing and Transport” line. Other life cycle stage results for PV modules are blank because the scope of the EPEAT Low and Ultra-Low Carbon Solar Criteria is limited to the production of PV modules and its raw materials and components and does not include the use phase or end of life for PV modules.

Finally, expanding the “Equivalencies” drop down will provide an estimate of the number of passenger cars of the road per year that are equivalent to the reduction in greenhouse gas reductions. Since the PV module calculator only estimated greenhouse gas savings, all other metrics will be recorded as the default of <0.01, unless the user entered data for other EPEAT product categories.

For assistance with the PV benefits calculator, please contact Info@GEC.org.