

Bifacial factors report

Input parameters for PVsyst

PROJECT

Site	Sydney
System	single-axis tracker
Latitude	33.87° S
Longitude	151.21° E

SIMULATION

Software	SunSolve Yield 7.52.2
Method	Cell-level raytracing and SPICE solving
User name	example@pvlighthouse.com.au
Subscription	PV Lighthouse
Run date	10 Sep 2026

BIFACIAL FACTORS FOR PVSYST

REAR SHADING	TRANSMISSION	FRONT MISMATCH	REAR MISMATCH	EFFECTIVE ALBEDO
f_S	f_T	f_{MF}	f_{MR}	f_A
9.7 %	5.3 %	0.2 %	1.8 %	27.4 %

ADDITIONAL PERFORMANCE METRICS

BIFACIAL GAIN	SPECTRAL CORR.
g_B	f_{λ}
5.4 %	1.0130

Site & simulation

SITE

Name	Sydney
Latitude	33.87° S
Longitude	151.21° E
Altitude	79 m
Time zone	UTC+10

PERIOD SIMULATED

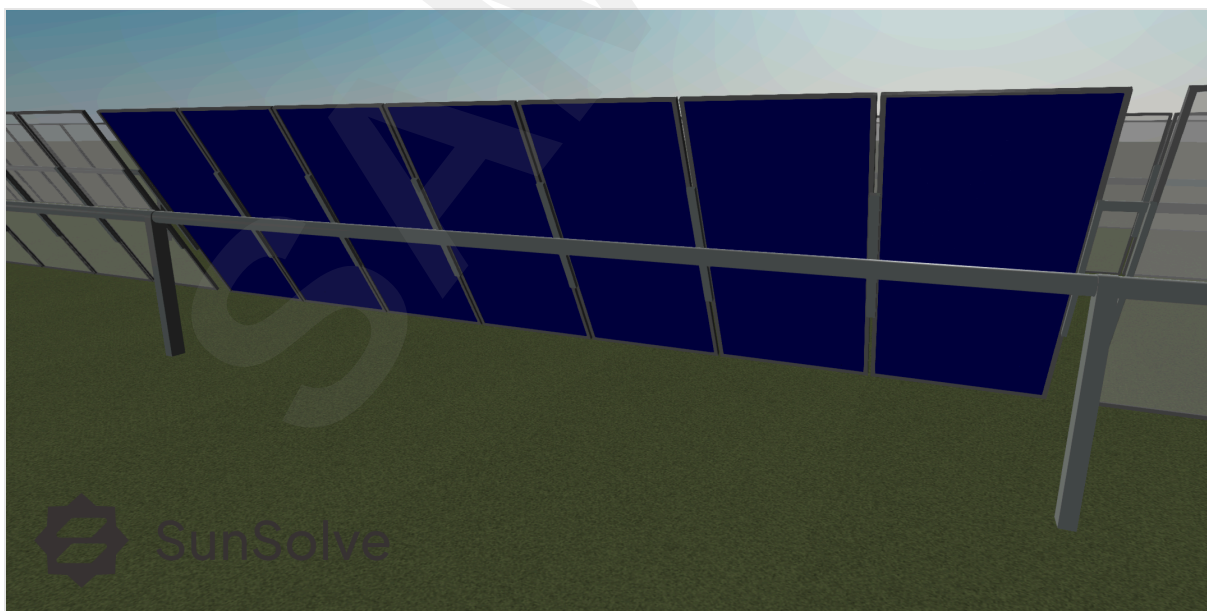
Start date	1 Jan 1990
End date	31 Dec 1990
Time steps	8760 hourly

SOFTWARE & USER

Username	example@pvlighthouse.com.au
Software	SunSolve Yield 7.52.2
Simulation timestamp	10 Sep 2026, 10:56 AM
Report version	1.0

WEATHER

Source	PVGIS
File	sydney_tmy



SunSolve unit-system · ray-tracing geometry

SINGLE-AXIS TRACKER

System

The geometry, module, structure, and tracking strategy used in the baseline simulation.

SITE & GEOMETRY

System type	Single-axis tracker
Module orientation	Portrait
GCR	41 %
Module height above ground (at 0° tilt)	1600 mm
Total module area	17.892 m ²
Unit-system area	45.49 m ²
Albedo type	Vegetation - Green grass
Albedo (integrated)	24.4 %

MODULE

Manufacturer	Longi Solar
Model	LR5-72 HBD 550 M Bifacial
Nominal power	550 W
Type	Standard bifacial
Bifaciality	70.0%

STRUCTURE

Clamps	Yes
Torque tube	Yes
Posts	Yes
Custom components	No

MODULE LAYOUT

Layout in unit-block	Single bay
Lateral × vertical modules	7 × 1
Lateral separation	20 mm
Vertical separation	0 mm
Edge spacing	200 mm

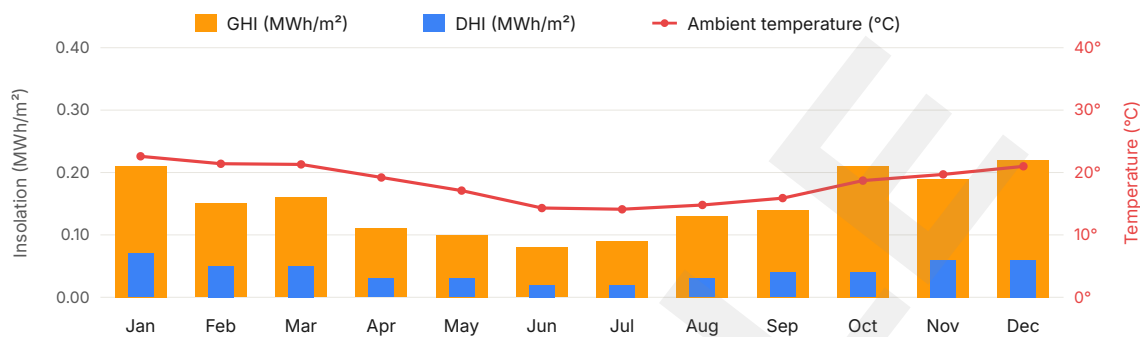
TRACKING

Tilt azimuth	90° [†]
Min tilt	-60°
Max tilt	+60°
Night stow	0°
Backtracking	Ideal
GCR used in backtracking	41 %
Axis of rotation height above ground	1487.5 mm

[†] Compass direction the module front face tilts toward (for positive tilt). 0° = N, 90° = E, 180° = S, 270° = W.

Weather

Monthly summary of the typical-year weather file used to drive the simulation.



MONTH	GHI [†] MWh/m ²	DHI [†] MWh/m ²	DIFFUSE FRACTION	T _{AMB} °C	WIND SPEED m/s
Jan	0.21	0.07	0.31	22.6	5.6
Feb	0.15	0.05	0.35	21.4	4.4
Mar	0.16	0.05	0.30	21.3	4.4
Apr	0.11	0.03	0.29	19.2	4.5
May	0.10	0.03	0.25	17.1	4.7
Jun	0.08	0.02	0.28	14.3	4.6
Jul	0.09	0.02	0.26	14.1	4.3
Aug	0.13	0.03	0.21	14.8	5.0
Sep	0.14	0.04	0.26	15.9	5.0
Oct	0.21	0.04	0.20	18.7	5.0
Nov	0.19	0.06	0.32	19.7	5.2
Dec	0.22	0.06	0.29	21.0	9.2
YEAR	1.80	0.50	0.28	18.3	5.2

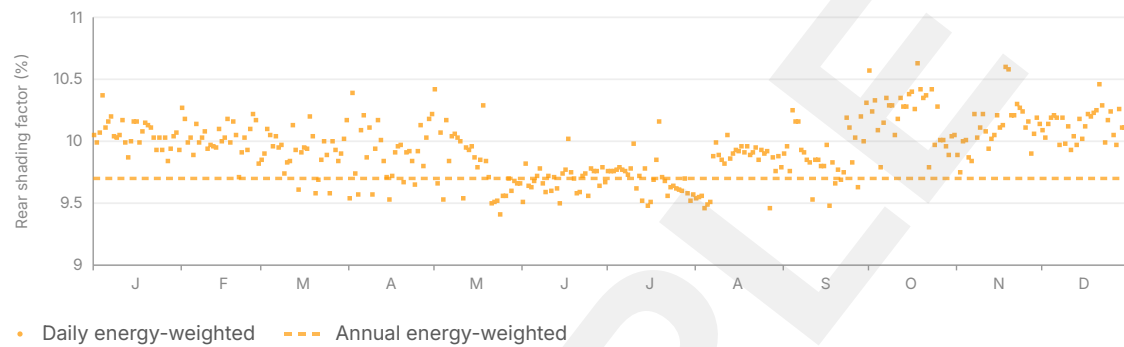
[†] GHI and DHI are period totals (MWh/m²); diffuse fraction, temperature and wind speed are means.

Rear shading factor

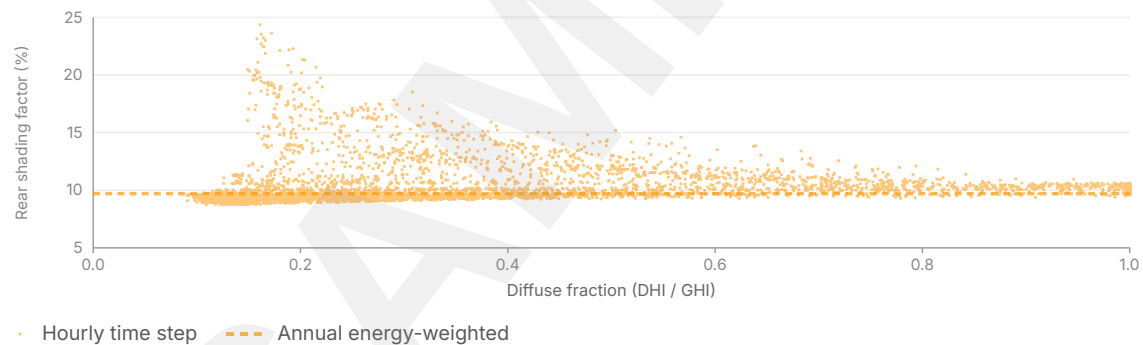
The reduction in rear irradiance caused by structural supports blocking ground-reflected light.

ANNUAL VALUE
9.7%
ENERGY-WEIGHTED

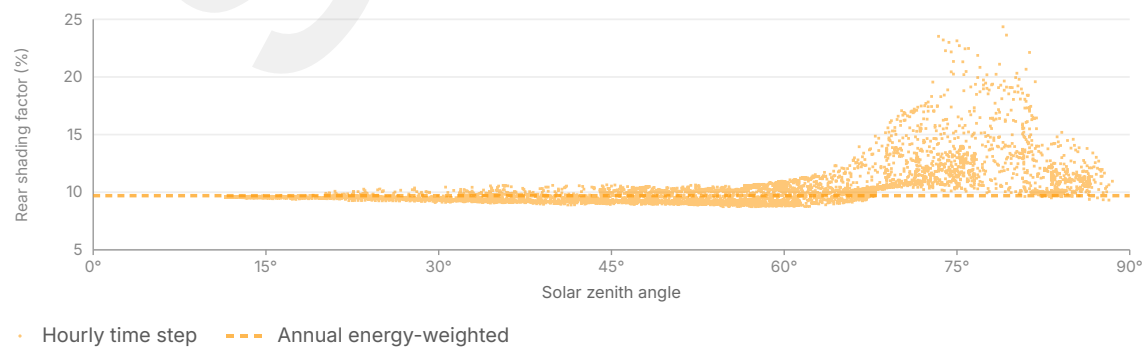
DAILY VALUES



TIME-STEP VALUES VS DIFFUSE FRACTION



TIME-STEP VALUES VS ZENITH ANGLE

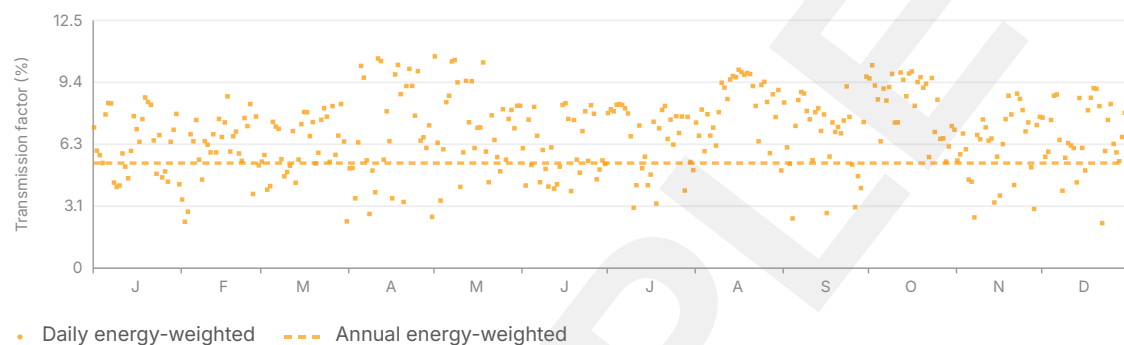


Transmission factor

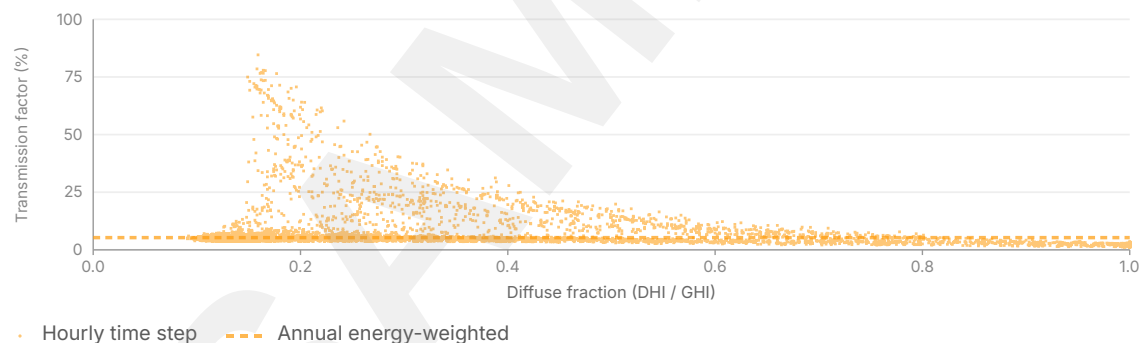
The increase in rear irradiance due to spacing between modules and bays.
SunSolve's automated routine does not include light transmitted through semi-transparent modules.

ANNUAL VALUE
5.3%
ENERGY-WEIGHTED

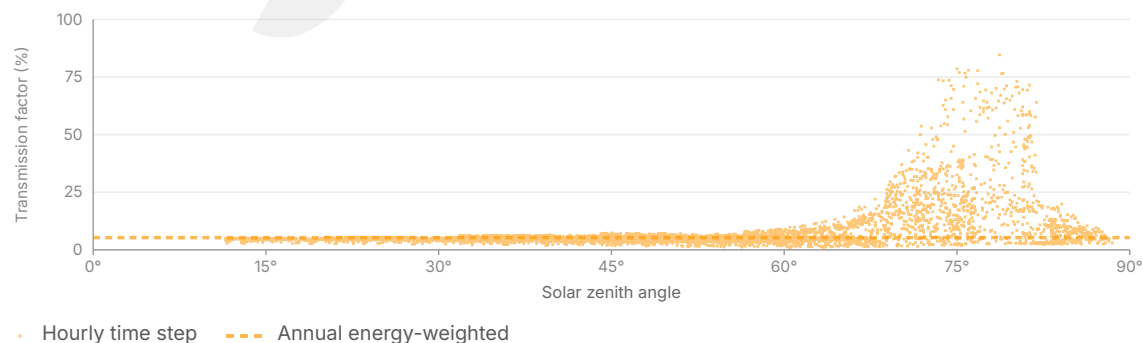
DAILY VALUES



TIME-STEP VALUES VS DIFFUSE FRACTION



TIME-STEP VALUES VS ZENITH ANGLE

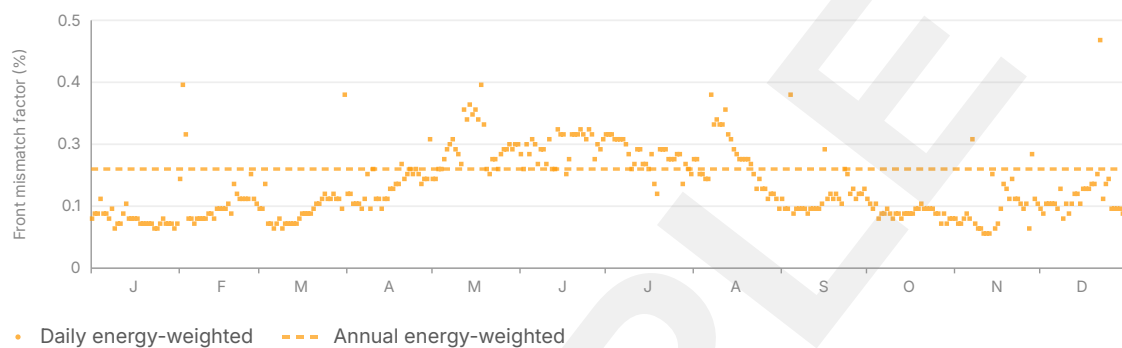


Front mismatch factor

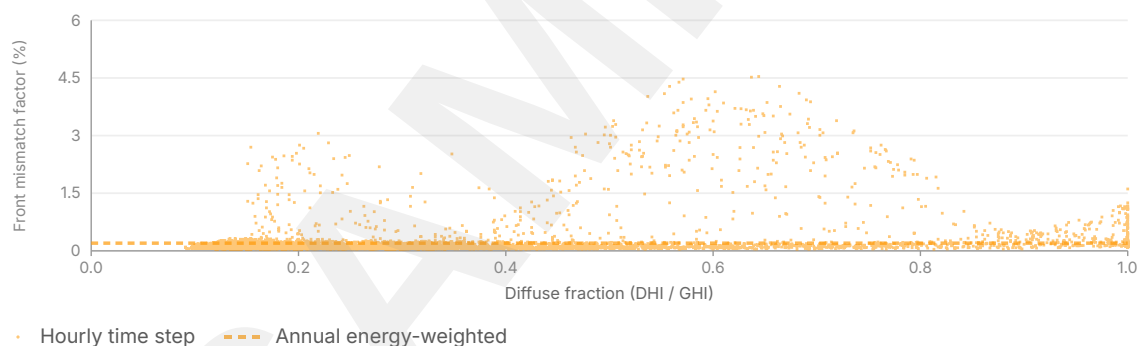
The reduction in module power from cell-to-cell electrical mismatch caused by non-uniform front irradiance.

ANNUAL VALUE
0.2%
ENERGY-WEIGHTED

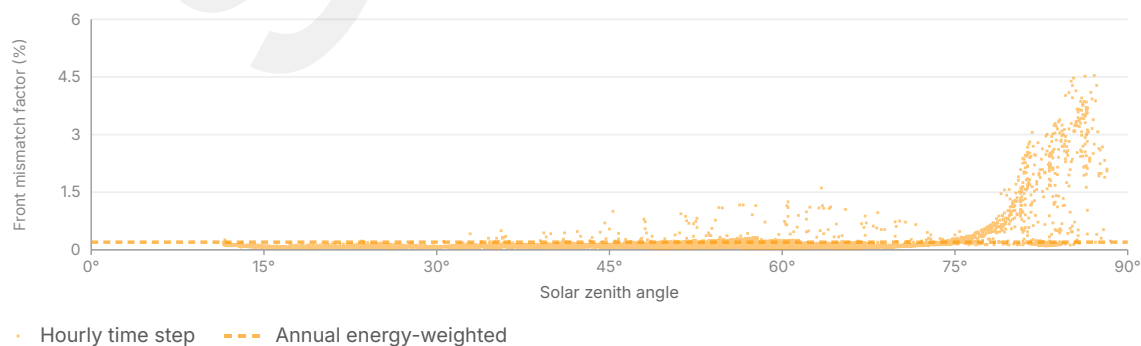
DAILY VALUES



TIME-STEP VALUES VS DIFFUSE FRACTION



TIME-STEP VALUES VS ZENITH ANGLE

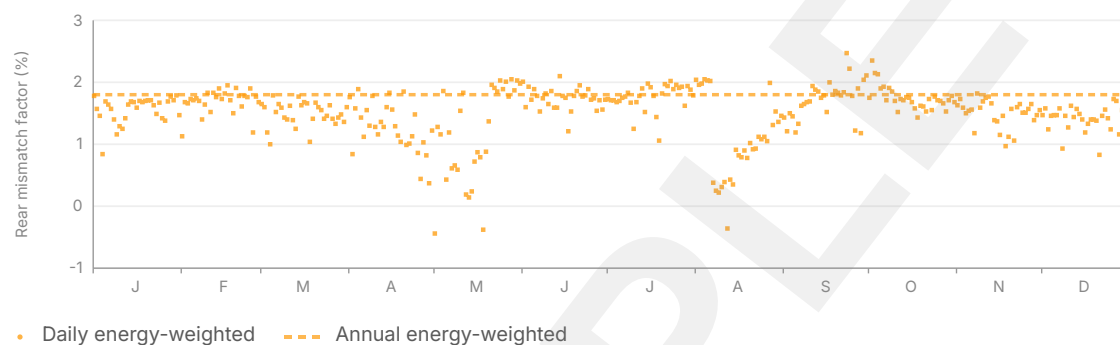


Rear mismatch factor

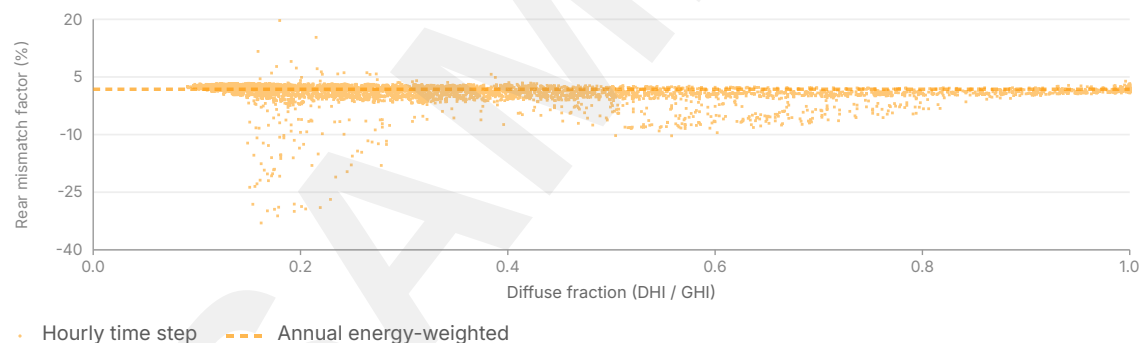
The reduction to the bifacial gain in power caused by non-uniform rear irradiance. May be negative when rear non-uniformity counteracts the front non-uniformity.

ANNUAL VALUE
1.8%
ENERGY-WEIGHTED

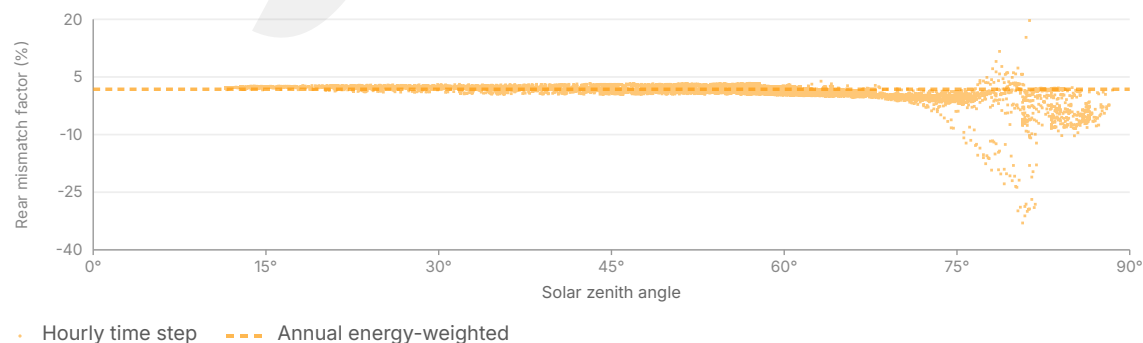
DAILY VALUES



TIME-STEP VALUES VS DIFFUSE FRACTION



TIME-STEP VALUES VS ZENITH ANGLE



Bifacial factors in PVsyst

PVsyst calculates the rear-side performance of a PV power plant in two steps. First it determines an **ideal rear irradiance** using a view-factor model. Second, it applies correction factors to account for rear shading f_s , transmission between and through modules f_T , and the electrical mismatch caused by non-uniform irradiance f_{MR} .

PVsyst requires the user to provide these correction factors, where each factor is a **single number** that represents all simulation time steps over the year.

These factors are very difficult to measure but can be determined by SunSolve. It applies advanced physics-based algorithms for optical and electrical modelling, resolving the irradiance on every cell of every module at every time step, accounting for shading and reflections from structural components, wavelength-dependent optical effects, and non-uniform irradiance.

This report provides the resulting bifacial factors. The values are **energy-weighted annual averages**, in the form PVsyst expects.

SunSolve can also calculate two further factors that can be entered directly into PVsyst: the effective albedo f_A and the front mismatch loss f_{MF} . The effective albedo determines the equivalent wavelength-independent albedo that reproduces the response obtained when using the wavelength-dependent albedo.

In addition, SunSolve reports two performance metrics that characterise the system but are not entered into PVsyst: the bifacial gain g_B , which is the percentage increase in energy yield due to rear-side illumination, and the spectral correction factor f_{λ} , which quantifies how the real solar spectrum shifts module performance relative to the AM1.5g reference.

TWO-STAGE PVSYST REAR-SIDE MODEL

STEP 1

ideal view factor

Compute the **ideal rear irradiance** assuming uniform reflection from the ground and no obstructions.

STEP 2

correction

Apply correction factors f_s, f_T, f_A, f_{MR} entered by the user. **This report supplies them for the simulated system.**

PVsyst accepts a single annual value for each factor, but as the graphs above demonstrate, the underlying factor varies at every time step. The scatter plots give a visual indication of the magnitude and trends of that variation for this specific simulation.

Mapping to PVsyst

Where to find the correction factors in the PVsyst user interface and yield report. All factors are entered under **System** > **Bifacial system** > **General Simulation Parameters**.

SUNSOLVE FACTOR	PVSYST USER INTERFACE	PVSYST REPORT
f_s · Rear shading factor	Reflected irradiance on back-side ▶ Structure shading factor	Bifacial model definitions ▶ Rear shading factor
f_T · Transmission factor	Incident irradiance on the ground ▶ Shed transparent fraction	Bifacial model definitions ▶ Shed transparent fraction
f_{MR} · Rear mismatch factor	PV Array behaviour ▶ Mismatch loss factor	Bifacial model definitions ▶ Rear mismatch loss
f_A · Effective albedo	Incident irradiance on the ground ▶ Ground albedo	Bifacial model definitions ▶ Ground albedo

Procedure

SunSolve isolates each physical mechanism by running paired simulations and comparing module current and power. A subset of these simulations may have been calculated for this report.

SIM 1 baseline The actual system as built — full optics, full electrical model.	SIM 2 Sim 1 with rear irradiance blocked.	SIM 3 Sim 1 with structural components rendered optically transparent.
SIM 4 Sim 3 with lateral spacing between modules, bays and rows removed.	SIM 5 Sim 4 with a fixed, wavelength-independent albedo of 0.3.	SIM 6 Sim 4 with a fixed, wavelength-independent albedo of 0.2.

HOW FACTORS ARE DERIVED

Factors are computed at every simulation time step from the comparisons below. Daily and annual values are then obtained as **energy-weighted averages** of the time-step results.

Rear shading factor f_s — the relative decrease in rear current caused by structural shading; determined with Sim 1, Sim 3 and Eq. (1).

Transmission factor f_T — the relative change in rear current due to lateral spacing between modules, bays and rows, accounting for the change in ground area that can reflect light onto modules; determined with Sim 3, Sim 4 and Eq. (2). Light transmitted through semi-transparent modules is *not* included automatically.

Effective albedo f_A — the equivalent wavelength-independent albedo that best emulates the simulated wavelength-dependent albedo; determined with Sim 4, Sim 5, Sim 6 and Eq (3).

Total mismatch f_M — the relative decrease in module power caused by cell-to-cell electrical mismatch arising from non-uniform irradiance on the front and rear surfaces; determined with Sim 1 and Eq. (4).

Front mismatch factor f_{MF} — the relative decrease in module power caused by cell-to-cell electrical mismatch arising from non-uniform irradiance on the front surface only; determined with Sim 2 and Eq. (5).

Rear mismatch factor f_{MR} — the relative decrease in the bifacial gain caused by electrical mismatch arising from non-uniform irradiance on the rear surface; determined with Sim 1, Sim 2 and Eq 6.

Bifacial gain g_B — the percentage increase in energy yield attributable to rear-side illumination; determined with Sim 1, Sim 2 and Eq. (7).

Spectral correction f_λ — the relative change in output current (or yield) due to spectral effects. The spectral correction is solved with Sim 1 and Eq 8, where the current (or yield) is computed at every time step when (i) the direct and diffuse spectra are computed from atmospheric effects, like the air mass, precipitable water vapour (PWV) and aerosol optical depth (AOD); and (ii) the spectrum is assumed equal to the AM1.5g spectrum.

Equations & references

Each factor is calculated at every time step using the equations below. I_{Rn} denotes the rear-current contribution from Sim n ; P_n the module power; $P_{noM,n}$ the same with no cell-level mismatch; $I_{sc,1}$ the short-circuit current from Sim 1; Y_1 the energy yield from Sim 1; AM1.5g denotes the equivalent quantity under the standard reference spectrum.

$$f_S = (I_{R3} - I_{R1}) / I_{R3} \quad (1)$$

$$f_T = (I_{R3} - I_{R4}) / I_{R4} \quad (2)$$

$$f_A = 0.2 + (I_{R4} - I_{R6}) \times (0.3 - 0.2) / (I_{R5} - I_{R6}) \quad (3)$$

$$f_M = (P_{noM,1} - P_1) / P_{noM,1} \quad (4)$$

$$f_{MF} = (P_{noM,2} - P_2) / P_{noM,2} \quad (5)$$

$$f_{MR} = (f_M - f_{MF}) \times (1 + I_{F1} / I_{R1}) \quad (6)$$

$$g_B = (P_1 - P_2) / P_2 \quad (7)$$

$$f_\lambda = I_{sc,1} / I_{sc,1,AM1.5g} \text{ or } Y_1 / Y_{1,AM1.5g} \quad (8)$$

REFERENCES

White paper · *Extracting PVsyst inputs with SunSolve* — derivations and assumptions.

Field validation study, Array Technologies & CFV Solar — concluded the methodology represents a "bankable, real-world modelling best practice for bifacial power plants."

Cited in > 100 academic papers; SunSolve Yield is benchmarked against field data and other simulation programs.