PV System Loss Budget, Performance Ratio and AC Energy

Performance ratio from a PV loss budget (temperature, soiling, shading, mismatch, wiring, inverter, transformer, availability) and the resulting AC energy per year.

Method: PV system loss factors and performance ratio

Input parameters

Unit system: SI

Parameter	Value	Unit
Temperature loss	8.0000	%
Soiling loss	2.0000	%
Shading loss	2.0000	%
Mismatch and nameplate tolerance loss	1.5000	%
DC wiring loss	1.5000	%
Inverter efficiency (weighted)	97.500	%
AC wiring and transformer loss	1.5000	%
Availability	99.000	%
Array rating (DC, at STC)	1,000.0	kW
Annual irradiation on the array plane	1,900.0	kWh/m²

Calculated results

Parameter	Value	Unit
Performance ratio	81.506	%
Total loss	18.494	%
Specific yield (kWh per kWp per year)	1,548.6	
Annual AC energy	1,548.6	MWh
Capacity factor (AC energy over DC rating)	17.666	%

Notes for this case

- PR is the product of the factors (1 − loss) and efficiencies; AC energy = P_DC·(H/1 kW/m²)·PR. Clipping, degradation and curtailment would add further factors.

Formula and method

$$PR = \prod_i (1 - l_i)\, \eta_{inv} A_v, \quad E_{AC} = P_{DC} \frac{H}{1\,\mathrm{kW/m^2}} PR$$

Variables

l_T	Temperature loss	-
l_s	Soiling loss	-
l_{sh}	Shading loss	-
l_m	Mismatch and nameplate tolerance loss	-
l_{dc}	DC wiring loss	-
η_{inv}	Inverter efficiency (weighted)	-
l_{ac}	AC wiring and transformer loss	-
A_v	Availability	-

P_{DC}	Array rating (DC, at STC)	W
H	Annual irradiation on the array plane	J/m²
PR	Performance ratio	-
$1 - PR$	Total loss	-
Y_f	Specific yield (kWh per kWp per year)	-
E_{AC}	Annual AC energy	J
CF	Capacity factor (AC energy over DC rating)	-

Method and standards

Loss-budget performance ratio.

Assumptions and limits

- Independent loss factors; annual averages.

References

PV system loss factors and performance ratio

Report details

Report reference	FCC-01A4-2Q3C (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/solar-pv/pv-system-derate-losses

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.