PV Self-Consumption and Self-Sufficiency with a Battery

Daily PV self-consumption, self-sufficiency, battery use and grid import and export of a home or building from PV energy, day and night loads and battery size.

Method: Daily energy balance of PV with storage

Input parameters

Unit system: SI

Parameter	Value	Unit
PV energy per day	25.000	kWh
Load during PV hours per day	10.000	kWh
Load outside PV hours per day	12.000	kWh
Usable battery capacity	10.000	kWh
Battery round-trip efficiency	90.000	%

Calculated results

Parameter	Value	Unit
PV used directly	10.000	kWh
PV stored in the battery	10.541	kWh
Energy from the battery	9.4868	kWh
PV exported	4.4591	kWh
Grid import	2.5132	kWh
Self-consumption ratio	82.164	%
Self-sufficiency	88.577	%

Notes for this case

• Daily energy balance: PV first serves the coincident load, the surplus charges the battery (only as much as the evening load can use), the rest is exported. Usable capacity is split as √η on charge and discharge. Hourly profiles and cloudy days lower real self-sufficiency.

Formula and method

$$E_{direct} = \min(E_{PV}, E_{day}), \quad E_{bat,out} = \min\left(\eta E_{bat,in}, E_{night}\right), \quad SS = \frac{E_{direct} + E_{bat,out}}{E_{day} + E_{night}}$$

Variables

E_{PV}	PV energy per day	J
E_{day}	Load during PV hours per day	J
E_{night}	Load outside PV hours per day	J
C	Usable battery capacity	J
η	Battery round-trip efficiency	-
E_{direct}	PV used directly	J
$E_{bat,in}$	PV stored in the battery	J
$E_{bat,out}$	Energy from the battery	J
E_{export}	PV exported	J
E_{import}	Grid import	J
SC	Self-consumption ratio	-

SS	Self-sufficiency	-

Method and standards

PV-battery energy balance.

Assumptions and limits

- One representative day; battery empty at sunrise.

References

Daily energy balance of PV with storage

Report details

Report reference	FCC-4WQA-BCYS (the same inputs always give the same reference)
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Calculator	PV Self-Consumption and Self-Sufficiency with a Battery
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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-battery-self-consumption

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.