PV Lifetime Energy with Annual Degradation

Output in the final year, total and average lifetime energy and discounted energy of a PV plant whose output falls by a fixed rate each year after first-year losses.

Method: Geometric degradation of PV output

Input parameters

Unit system: SI

Parameter	Value	Unit
Energy in the first year (before first-year degradation)	1,600.0	MWh
First-year (light-induced) degradation	2.0000	%
Annual degradation rate after year 1	0.50000	%
Plant life (years)	25.000	
Discount rate (for discounted energy)	7.0000	%

Calculated results

Parameter	Value	Unit
Energy in the final year	1,390.3	MWh
Final-year output relative to year 1 before losses	86.892	%
Lifetime energy	36,936	MWh
Average annual energy	1,477.4	MWh
Discounted lifetime energy	17,508	MWh

Notes for this case

• Year k output $E_1(1 - l_1)(1 - d)^{k-1}$. Warranties typically promise 80–87 % of nameplate after 25–30 years; measured rates for crystalline silicon are about 0.5 % per year.

Formula and method

$$E_k = E_1(1-l_1)(1-d)^{k-1}, \quad \sum_{k=1}^{N} E_k, \quad \sum_{k=1}^{N} \frac{E_k}{(1+r)^k}$$

Variables

E_1	Energy in the first year (before first-year degradation)	J
l_1	First-year (light-induced) degradation	-
d	Annual degradation rate after year 1	-
N	Plant life (years)	-
r	Discount rate (for discounted energy)	-
E_N	Energy in the final year	J
E_N/E_1	Final-year output relative to year 1 before losses	-
$\sum E$	Lifetime energy	J
$\bar{E}$	Average annual energy	J
$\sum E/(1+r)^n$	Discounted lifetime energy	J

Method and standards

Degradation and discounting.

Assumptions and limits

- Constant degradation rate; no repowering.

References

Geometric degradation of PV output

Report details

Report reference	FCC-AK3W-TAJV (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-lifetime-energy-degradation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.