Salt-Gradient Solar Pond Efficiency and Heat Output

Collection efficiency and useful heat of a salt-gradient solar pond from transmission to the storage zone, loss coefficient and storage and air temperatures.

Method: Solar pond collection efficiency

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean solar irradiance on the pond	0.23000	kW/m²
Fraction of light reaching the storage zone	40.000	%
Overall heat loss coefficient of the storage zone	0.80000	W/(m²·K)
Storage zone temperature	70.000	°C
Ambient (surface) temperature	20.000	°C
Pond area	3,000.0	m²

Calculated results

Parameter	Value	Unit
Collection efficiency	22.609	%
Useful heat	156.00	kW
Useful heat per year	1,367.5	MWh
Stagnation temperature (no extraction)	135.00	°C

Notes for this case

• η = τ − U(T_s − T_a)/G̃; the gradient layer acts as transparent insulation. Ponds store heat seasonally and deliver 60–90 °C; annual efficiencies of 15–25 % are typical.

Formula and method

$$\eta = \tau - \frac{U(T_s - T_a)}{\bar{G}}, \quad T_{stag} = T_a + \frac{\tau \bar{G}}{U}$$

Variables

$\bar{G}$	Mean solar irradiance on the pond	W/m²
τ	Fraction of light reaching the storage zone	-
U	Overall heat loss coefficient of the storage zone	W/(m²·K)
T_s	Storage zone temperature	K
T_a	Ambient (surface) temperature	K
A	Pond area	m²
η	Collection efficiency	-
$\dot{Q}$	Useful heat	W
Q_a	Useful heat per year	J
T_{stag}	Stagnation temperature (no extraction)	K

Method and standards

Solar pond balance.

Assumptions and limits

- Steady annual average; well-maintained gradient.

References

Solar pond collection efficiency

Report details

Report reference	FCC-S7QW-9NN1 (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/environmental/solar-thermal/solar-pond-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.