Tidal Range Power: Energy per Tide and Annual Output of a Basin

Theoretical and net energy from a single tidal basin per tide, the annual energy and average power from basin area, tidal range and efficiency.

Input parameters

Unit system: SI

Parameter	Value	Unit
Basin area	22.000	km²
Tidal range	8.5000	m
Overall conversion efficiency	33.000	%
Tides used per year (semidiurnal: about 706)	706.00	
Seawater density	1,025.0	kg/m³
Installed capacity	240.00	MW

Calculated results

Parameter	Value	Unit
Theoretical energy per tide	2,219.1	MWh
Net energy per tide	732.30	MWh
Annual energy	517.00	GWh
Average power	58.978	MW
Capacity factor	24.574	%

Notes for this case

- E = ½ρgAR² is the potential energy of a basin full to the range above low water; ebb generation, turbine head limits and the time needed to fill and empty mean only about a third is recovered.

Formula and method

$$E_{tide} = \frac{1}{2}\rho g A R^2, \quad E_{yr} = \eta n_t E_{tide}$$

Variables

A	Basin area	m²
R	Tidal range	m
η	Overall conversion efficiency	-
n_t	Tides used per year (semidiurnal: about 706)	-
ρ	Seawater density	kg/m³
P_{inst}	Installed capacity	W
E_{tide}	Theoretical energy per tide	J
E_{net}	Net energy per tide	J
E_{yr}	Annual energy	J
$\bar{P}$	Average power	W
CF	Capacity factor	-

Method and standards

Potential energy of a tidal basin.

Assumptions and limits

- Single basin, mean range; theoretical potential energy.

Report details

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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/boilers-power-plant/hydro-power/tidal-range-energy

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.