Hydro Potential from Catchment Rainfall: Flow, Power and Energy

Mean river flow from catchment area, rainfall and runoff coefficient, and the mean power, annual energy and capacity factor of a hydro plant using it.

Input parameters

Unit system: SI

Parameter	Value	Unit
Catchment area	500.00	km²
Mean annual rainfall	1,200.0	mm
Runoff coefficient (share reaching the river)	60.000	%
Share of the runoff used by the plant	80.000	%
Net head	80.000	m
Overall efficiency	85.000	%
Installed capacity	80.000	MW
Water density	1,000.0	kg/m³

Calculated results

Parameter	Value	Unit
Annual runoff	3.6000e+08	m³
Mean flow used	9.1262	m³/s
Mean power	6.0858	MW
Annual energy	53.348	GWh
Capacity factor	7.6073	%

Notes for this case

- A yearly average; seasonal flow and the flow-duration curve decide how much of it a plant of given size can actually use without storage.

Formula and method

$$V = ARC, \quad \bar{Q} = \frac{Vf_u}{t_{yr}}, \quad \bar{P} = \rho g \bar{Q} H \eta_o, \quad E = \bar{P} t_{yr}$$

Variables

A	Catchment area	m²
R	Mean annual rainfall	m
C	Runoff coefficient (share reaching the river)	-
f_u	Share of the runoff used by the plant	-
H	Net head	m
η_o	Overall efficiency	-
P_{inst}	Installed capacity	W
ρ	Water density	kg/m³
V	Annual runoff	m³
$\bar{Q}$	Mean flow used	m³/s
$\bar{P}$	Mean power	W

E	Annual energy	J
CF	Capacity factor	-

Method and standards

Annual water balance of a catchment.

Assumptions and limits

- Annual averages; no evaporation from reservoirs beyond the runoff coefficient.

Report details

Report reference	FCC-Y3SP-H7MD (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/boilers-power-plant/hydro-power/hydro-catchment-energy

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.