Double-Flash Geothermal Power Plant Output

High- and low-pressure steam flows, turbine outputs and total electrical power of a double-flash geothermal plant with Baumann-rule turbine efficiencies.

Method: Double-flash cycle with Baumann wet-turbine rule

Input parameters

Unit system: SI

Parameter	Value	Unit
Reservoir temperature (saturated liquid)	250.00	°C
High-pressure separator temperature	180.00	°C
Low-pressure flash temperature	120.00	°C
Condenser temperature	50.000	°C
Total geofluid flow	360,000	kg/h
Dry turbine efficiency	85.000	%
Generator efficiency	98.000	%
Dead-state temperature	25.000	°C

Calculated results

Parameter	Value	Unit
High-pressure steam flow	57,645	kg/h
Low-pressure flashed steam flow	35,616	kg/h
HP turbine power	3.7433	MW
LP turbine power	8.1031	MW
Total electrical power	11.609	MW
Electrical output per kg of geofluid	116.09	kJ/kg
Utilisation efficiency	45.086	%
LP turbine inlet quality	95.439	%

Notes for this case

• HP steam expands to the LP pressure, mixes with steam flashed from the HP separator brine and expands to the condenser; Baumann rule η_tw = η_td(x_in + x_out)/2 for each turbine. Parasitic loads not deducted. Water and steam properties from IAPWS-IF97.

Formula and method

$$\dot{m}_{LP} = (1 - x_2)\dot{m}\frac{h_f(T_1) - h_f(T_2)}{h_{fg}(T_2)}, \quad \dot{W}_e = \eta_g\left[\dot{m}_{HP}(h_{g,1} - h_{HP,out}) + (\dot{m}_{HP} + \dot{m}_{LP})(h_{mix} - h_{LP,out})\right]$$

Variables

T_{res}	Reservoir temperature (saturated liquid)	K
T_1	High-pressure separator temperature	K
T_2	Low-pressure flash temperature	K
T_{cond}	Condenser temperature	K
$\dot{m}$	Total geofluid flow	kg/s
η_{td}	Dry turbine efficiency	-
η_g	Generator efficiency	-

T_0	Dead-state temperature	K
$\dot{m}_{HP}$	High-pressure steam flow	kg/s
$\dot{m}_{LP}$	Low-pressure flashed steam flow	kg/s
$\dot{W}_{HP}$	HP turbine power	W
$\dot{W}_{LP}$	LP turbine power	W
$\dot{W}_e$	Total electrical power	W
w	Electrical output per kg of geofluid	J/kg
η_u	Utilisation efficiency	-
x_{mix}	LP turbine inlet quality	-

Method and standards

Double-flash cycle.

Assumptions and limits

- Saturated-liquid reservoir; ideal separators; no gases or pipe losses.

References

Double-flash cycle with Baumann wet-turbine rule

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

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