Binary Geothermal Plant Heat, Power and Utilisation

Heat taken from geothermal brine, net power at a cycle efficiency, the ideal triangular-cycle efficiency, and the exergy utilisation of a binary (ORC) plant.

Method: Binary-cycle energy and exergy balance; ideal triangular cycle

Input parameters

Unit system: SI

Parameter	Value	Unit
Brine flow	432,000	kg/h
Brine inlet temperature	160.00	°C
Brine reinjection temperature	70.000	°C
Net cycle thermal efficiency	12.000	%
Dead-state (ambient) temperature	25.000	°C

Calculated results

Parameter	Value	Unit
Heat taken from the brine	45.907	MW
Net power	5.5088	MW
Exergy of the brine entering	12.119	MW
Utilisation efficiency	45.455	%
Ideal triangular-cycle efficiency	18.460	%
Cycle efficiency relative to the triangular ideal	65.004	%

Notes for this case

• Brine as saturated liquid (pressurised to stay liquid); ideal triangular cycle η_TRI = (T_H − T_L)/(T_H + T_L) for a source cooled to the sink temperature. Real binary plants reach about half to two-thirds of η_TRI. Water and steam properties from IAPWS-IF97.

Formula and method

$$\dot{Q} = \dot{m}(h_{in} - h_{out}), \quad \eta_u = \frac{\dot{W}}{\dot{m}\left[(h_{in} - h_0) - T_0(s_{in} - s_0)\right]}, \quad \eta_{TRI} = \frac{T_H - T_L}{T_H + T_L}$$

Variables

$\dot{m}$	Brine flow	kg/s
T_{in}	Brine inlet temperature	K
T_{out}	Brine reinjection temperature	K
η_{th}	Net cycle thermal efficiency	-
T_0	Dead-state (ambient) temperature	K
$\dot{Q}$	Heat taken from the brine	W
$\dot{W}$	Net power	W
$\dot{E}$	Exergy of the brine entering	W
η_u	Utilisation efficiency	-
η_{TRI}	Ideal triangular-cycle efficiency	-
η_{th}/η_{TRI}	Cycle efficiency relative to the triangular ideal	-

Method and standards

Binary plant energy and exergy.

Assumptions and limits

- Brine as pure water; cycle efficiency entered, not calculated.

References

Binary-cycle energy and exergy balance; ideal triangular cycle

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

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Reopens the calculator with the inputs of this report.