Absorption Chilling from Exhaust or Hot Water

Cooling from waste heat in a single- or double-effect absorption chiller, heat to the cooling tower, and the electric chiller power and cost it avoids.

Method: Energy balances (definitions); 1 ton of refrigeration = 3.516 853 kW

Input parameters

Unit system: SI

Parameter	Value	Unit
Driving heat delivered to the chiller	1,000.0	kW
Absorption chiller COP	Single-effect (0.7)	
Electric chiller COP (for comparison)	5.5000	
Electricity price per kWh	8.0000	
Absorption plant's own electricity (pumps, extra tower fans and pumps) Leave 0 to ignore; it is subtracted from the electricity the absorption chiller saves.	0	kW
Hours per year	6,000.0	h

Calculated results

Parameter	Value	Unit
Cooling capacity	700.00	kW
Cooling capacity in tons of refrigeration	199.04	
Heat to the cooling tower	1,700.0	kW
Electric chiller power avoided	127.27	kW
Annual electricity saving	6,109,091	

Notes for this case

- Absorption chillers reject the driving heat as well as the cooling: the cooling tower duty is about 2.1 times that of an electric chiller here.
- The absorption plant's own pumps and the larger cooling tower's fans and pumps are not deducted; enter them to get the net saving.

Formula and method

$$Q_c = COP \cdot Q_h, \quad Q_r = Q_h + Q_c, \quad P_{el} = \frac{Q_c}{COP_e}, \quad S = (P_{el} - P_{aux})\, t\, c_e$$

Variables

Q_h	Driving heat delivered to the chiller	W
COP	Absorption chiller COP	-
COP_e	Electric chiller COP (for comparison)	-
c_e	Electricity price per kWh	-
t	Hours per year	s
Q_c	Cooling capacity	W
Q_r	Heat to the cooling tower	W
P_{el}	Electric chiller power avoided	W
P_{aux}	absorption plant's own electricity (pumps, extra tower fans and pumps)	W
S	Annual electricity saving	-

Method and standards

Chiller energy balance.

Assumptions and limits

- Rated COPs; part load differs. The COP choices are typical rated values for single- and double-effect machines; use the maker's figure for a real machine.
- The saving is net of the absorption plant's own electricity only when that is entered.

References

- Energy balances (definitions); 1 ton of refrigeration = 3.516 853 kW

Report details

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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/hrsg-waste-heat/exhaust-absorption-chiller

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.