CHP: Overall Efficiency and Primary Energy Saving

Overall efficiency of a combined heat and power plant and its primary energy saving against separate heat and power, using reference efficiencies (EU method).

Method: PES = 1 − 1/(η_H/η_ref,H + η_E/η_ref,E) (EU Directive 2012/27/EU, Annex II)

Input parameters

Unit system: SI

Parameter	Value	Unit
Fuel input per year	300,000	GJ
Electricity produced per year	105,000	GJ
Useful heat per year	135,000	GJ
Reference efficiency for separate power From the harmonised reference values of your regulator for the fuel and year.	52.500	%
Reference efficiency for separate heat	90.000	%

Calculated results

Parameter	Value	Unit
Electrical efficiency	35.000	%
Heat efficiency	45.000	%
Overall efficiency	80.000	%
Primary energy saving	14.286	%

Notes for this case

- High-efficiency cogeneration needs PES above the threshold your regulation sets.

Formula and method

$$PES = 1 - \frac{1}{\frac{\eta_H}{\eta_{ref,H}} + \frac{\eta_E}{\eta_{ref,E}}}$$

Variables

F	Fuel input per year	J
E	Electricity produced per year	J
H	Useful heat per year	J
$\eta_{ref,E}$	Reference efficiency for separate power	-
$\eta_{ref,H}$	Reference efficiency for separate heat	-
η_E	Electrical efficiency	-
η_H	Heat efficiency	-
η_o	Overall efficiency	-
PES	Primary energy saving	-

Method and standards

EU method.

Assumptions and limits

- Annual totals.
- The regulatory calculation applies correction factors to η_ref,E (average climate, avoided grid losses) and puts all efficiencies on the net calorific value of the fuel; enter the corrected reference values and NCV-based energies, or the PES here may differ from the regulatory one.

References

- PES = 1 − 1/(η_H/η_ref,H + η_E/η_ref,E) (EU Directive 2012/27/EU, Annex II)

Report details

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Release checks	2 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/environmental/carbon-energy/chp-primary-energy-saving

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.