Power Plant Heat Rate and Efficiency

Gross and net heat rate and efficiency of a power plant from fuel flow and calorific value, from efficiency or from heat rate, with auxiliary power and specific fuel consumption.

Method: ASME PTC 46 (terms); CEA India (station heat rate reporting); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Heat input from	Fuel flow and GCV	
Gross generator output	30.000	MW
Auxiliary power consumption	2.7000	MW
Fuel flow	20,000	kg/h
Gross calorific value of the fuel Also used to give the fuel flow when the heat input comes from efficiency or heat rate.	18,600	kJ/kg
Gross efficiency	30.000	%
Gross heat rate	12,000	kJ/kWh

Calculated results

Parameter	Value	Unit
Gross heat rate	12,400	kJ/kWh
Net heat rate	13,626	kJ/kWh
Gross efficiency	29.032	%
Net efficiency	26.419	%
Heat input from fuel (on GCV)	103.33	MW
Net output	27.300	MW
Auxiliary consumption	9.0000	%
Fuel flow	20,000	kg/h
Specific fuel consumption (gross)	0.66667	kg/kWh

Formula and method

$$\dot{Q}_{in} = \dot{m}_f GCV \quad \text{or} \quad \dot{Q}_{in} = \frac{P_g}{\eta_{g,in}} \quad \text{or} \quad \dot{Q}_{in} = HR_{g,in} P_g$$

$$HR_g = \frac{\dot{Q}_{in}}{P_g} \qquad HR_n = \frac{\dot{Q}_{in}}{P_n} \qquad \eta_g = \frac{1}{HR_g} \qquad \eta_n = \frac{1}{HR_n} \qquad P_n = P_g - P_{aux}$$

$$\dot{m}_{f,out} = \frac{\dot{Q}_{in}}{GCV} \qquad SFC = \frac{\dot{m}_{f,out}}{P_g}$$

Variables

basis	heat input from fuel flow, efficiency or heat rate	–
P_g	gross generator output	W
P_{aux}	auxiliary power consumption	W

$\dot{m}_f$	fuel flow, entered	kg/s
GCV	gross calorific value of the fuel	J/kg
$\eta_{g,in}$	gross efficiency, entered	–
$HR_{g,in}$	gross heat rate, entered	J/J
HR_g	gross heat rate	J/J
HR_n	net heat rate	J/J
η_g	gross efficiency	–
η_n	net efficiency	–
$\dot{Q}_{in}$	heat input from fuel, on GCV	W
P_n	net output	W
P_{aux}/P_g	auxiliary consumption as a share of gross output	–
$\dot{m}_{f,out}$	fuel flow	kg/s
SFC	specific fuel consumption, gross	kg/J

Method and standards

Definitions of heat rate and thermal efficiency as used in ASME PTC 46 and in the station heat rate reporting of India's Central Electricity Authority: heat input on the gross calorific value divided by electrical output. Unit factors from NIST SP 811 (1 kWh = 3.6 MJ, 1 kcal_IT = 4.1868 kJ, 1 Btu_IT = 1.055 056 kJ).

Assumptions and limits

- Heat input on GCV. European figures are often on NCV and are 4–10 % lower in heat rate; do not mix the two.
- Steady load over the period; for a period average use the energy generated and the fuel burnt in the period.
- Heat in fuel only; heat credits from process steam export (cogeneration) are not deducted.

References

• ASME PTC 46 (terms)
• CEA India (station heat rate reporting)
• NIST SP 811 (unit factors)

Report details

Report reference	FCC-WSN3-7RVK (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	Power Plant Heat Rate and Efficiency
Method last reviewed	10 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/plant-performance/plant-heat-rate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.