Cost of Steam per Tonne

Cost of producing one tonne of steam from fuel, water, chemicals and power, with the fuel per tonne from the steam conditions, efficiency and calorific value.

Method: IAPWS R7-97(2012) IF97; first law heat balance

Input parameters

Unit system: SI

Parameter	Value	Unit
Steam pressure (absolute)	10.500	bar
Steam condition	Dry saturated	
Steam temperature (superheated only)	250.00	°C
Feedwater temperature	105.00	°C
Boiler efficiency (on GCV)	78.000	%
Gross calorific value of the fuel, as fired	18,600	kJ/kg
Fuel price per tonne	7,000.0	
Make-up water, tonnes per tonne of steam	0.40000	
Treated water price per tonne (m³)	60.000	
Chemicals per tonne of steam	20.000	
Auxiliary power, kWh per tonne of steam	25.000	
Electricity price per kWh	8.0000	

Calculated results

Parameter	Value	Unit
Cost of steam per tonne (your currency)	1,372.1	
Of which fuel	1,128.1	
Of which water	24.000	
Of which power	200.00	
Fuel per tonne of steam	161.16	kg
Heat added per kg of steam	2,338.1	kJ/kg

Formula and method

$$m_f = \frac{1000\,(h_s - h_{fw})}{\eta_1\, GCV} \qquad C_f = \frac{m_f}{1000}\, c_f \qquad C_w = x_{mu}\, c_w \qquad C_e = e\, c_e$$

$$C = C_f + C_w + c_c + C_e$$

Variables

p	steam pressure, absolute	Pa
state	saturated or superheated steam	–
T_s	steam temperature (superheated)	K
T_{fw}	feedwater temperature	K
η_1	boiler efficiency on GCV	–
GCV	gross calorific value	J/kg
c_f	fuel price per tonne	–

x_{mu}	make-up water, tonnes per tonne of steam	–
c_w	treated water price per tonne	–
c_c	chemicals per tonne of steam	–
e	auxiliary power, kWh per tonne of steam	–
c_e	electricity price per kWh	–
C	cost of steam per tonne	–
C_f	fuel cost per tonne of steam	–
C_w	water cost per tonne of steam	–
C_e	power cost per tonne of steam	–
m_f	fuel per tonne of steam	kg
$h_s - h_{fw}$	heat added per kg of steam	J/kg

Method and standards

Fuel per tonne from the heat added per kg of steam (FireCAD's IAPWS-IF97 enthalpies) and the boiler efficiency on GCV; the other items as entered. All prices in one currency of your choice.

Assumptions and limits

- Variable cost only; no capital, labour or maintenance.
- One fuel; efficiency on GCV.
- The fuel per tonne covers the heat from feedwater to steam only. Heat lost in the blowdown and the heating of cold make-up water before the feedwater temperature are not added; include them in the efficiency or in the feedwater temperature you enter.
- Water price per tonne and per m³ are taken as equal.

References

- IAPWS R7-97(2012) IF97
- first law heat balance

Report details

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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/steam-cost

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.