Boiler Energy Balance (Losses and Efficiency)

Boiler efficiency by the heat-loss method from the individual losses and credits, with each loss in kW for the heat input: the boiler's energy balance sheet.

Method: ASME PTC 4-2013 Fired Steam Generators §5.14 (losses) and §5.15 (credits); BIS IS 8753 (boiler efficiency)

Input parameters

Unit system: SI

Parameter	Value	Unit
Heat input from fuel (on GCV)	80.000	MW
Dry flue gas loss	5.5000	%
Loss from water formed from hydrogen	4.0000	%
Loss from moisture in the fuel	3.5000	%
Loss from moisture in the air	0.20000	%
Loss from CO (incomplete combustion)	0.20000	%
Loss from unburned carbon in ash	1.2000	%
Sensible heat in ash	0.30000	%
Surface radiation and convection loss	1.0000	%
Unaccounted and manufacturer's margin	1.0000	%
Heat credits (entering air and fuel above the reference, steam air heater, mill power)	0.50000	%

Calculated results

Parameter	Value	Unit
Boiler efficiency (on GCV)	83.600	%
Total losses	16.900	%
Heat to steam	66.880	MW
Total heat lost	13.520	MW
Heat lost in dry flue gas	4.4000	MW
Heat lost in water vapour (hydrogen, fuel and air moisture)	6.1600	MW

Formula and method

$$\Sigma L = L_{dg} + L_H + L_m + L_{am} + L_{CO} + L_C + L_{ash} + L_r + L_u \qquad \eta = 1 - \Sigma L + B$$

$$\dot{Q}_{out} = \eta \dot{Q}_{in} \qquad \dot{Q}_L = \Sigma L \, \dot{Q}_{in} \qquad \dot{Q}_{dg} = L_{dg} \, \dot{Q}_{in} \qquad \dot{Q}_w = (L_H + L_m + L_{am}) \, \dot{Q}_{in}$$

Variables

$\dot{Q}_{in}$	heat input from fuel, on GCV	W
L_{dg}	dry flue gas loss	–
L_H	loss from water formed from hydrogen	–
L_m	loss from moisture in the fuel	–
L_{am}	loss from moisture in the air	–
L_{CO}	loss from CO	–
L_C	unburned carbon loss	–
L_{ash}	sensible heat in ash	–
L_r	surface radiation and convection loss	–

L_u	unaccounted loss and margin	–
B	heat credits as a share of input	–
η	boiler efficiency on GCV	–
ΣL	total losses	–
$\dot{Q}_{out}$	heat to steam	W
$\dot{Q}_L$	total heat lost	W
$\dot{Q}_{dg}$	heat lost in dry flue gas	W
$\dot{Q}_w$	heat lost in water vapour	W

Method and standards

Efficiency by the energy-balance (heat-loss) method of ASME PTC 4 §5: efficiency is 100 % less losses plus credits, all as fractions of the fuel input on the gross calorific value. Indian practice (IS 8753, BEE audit guides) uses the same list of losses.

Assumptions and limits

- Each loss is entered as a fraction of the heat input on GCV; this page does not compute the losses themselves.
- Credits are entered as one combined fraction: entering air and fuel above the reference temperature, a steam air heater, mill power.
- All losses and credits must be referred to the same reference temperature (25 °C in ASME PTC 4; the ambient air temperature in BS 845 and IS 8753, which then has no air credit).
- A warning appears above 95 % efficiency on GCV.

References

• ASME PTC 4-2013 Fired Steam Generators §5.14 (losses) and §5.15 (credits)
• BIS IS 8753 (boiler efficiency)

Report details

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Calculator	Boiler Energy Balance (Losses and Efficiency)
Method last reviewed	10 November 2026
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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

https://calc.firecad.com/boilers-power-plant/boilers/boiler-energy-balance

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Reopens the calculator with the inputs of this report.