Fuel Saving from Higher Feedwater Temperature

Fuel saved when the feedwater enters the boiler hotter (economiser, condensate return, feed heater), from the steam conditions and IAPWS-IF97 enthalpies.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Steam flow	10,000	kg/h
Steam pressure (absolute)	10.500	bar
Steam condition	Dry saturated	
Steam temperature (superheated only)	250.00	°C
Feedwater temperature now	80.000	°C
Feedwater temperature after	105.00	°C
Boiler efficiency (on GCV)	80.000	%
Gross calorific value of the fuel, as fired	18,600	kJ/kg

Calculated results

Parameter	Value	Unit
Fuel saved, share	4.3039	%
Fuel saved	70.668	kg/h
Fuel now	1,641.9	kg/h
Fuel after	1,571.3	kg/h

Formula and method

$$\dot{m}_{f,1} = \frac{\dot{m}_s\,(h_s - h_{fw,1})}{\eta_1\,GCV} \qquad \dot{m}_{f,2} = \frac{\dot{m}_s\,(h_s - h_{fw,2})}{\eta_1\,GCV}$$

$$\Delta\dot{m}_f = \dot{m}_{f,1} - \dot{m}_{f,2} \qquad s = 1 - \frac{\dot{m}_{f,2}}{\dot{m}_{f,1}}$$

Variables

$\dot{m}_s$	steam flow	kg/s
p	steam pressure, absolute	Pa
state	saturated or superheated steam	–
T_s	steam temperature (superheated)	K
$T_{fw,1}$	feedwater temperature now	K
$T_{fw,2}$	feedwater temperature after	K
η_1	boiler efficiency on GCV	–
GCV	gross calorific value	J/kg
s	fuel saved, share	–
$\Delta\dot{m}_f$	fuel saved	kg/s
$\dot{m}_{f,1}$	fuel now	kg/s
$\dot{m}_{f,2}$	fuel after	kg/s
h_s	steam enthalpy	J/kg

$h_{fw,1}\$, \$h_{fw,2}$	feedwater enthalpies now and after	J/kg

Method and standards

Fuel for the same steam output before and after, from the heat added per kg of steam with enthalpies from FireCAD's IAPWS-IF97 and the same boiler efficiency.

Assumptions and limits

- Same steam flow, conditions and boiler efficiency before and after.
- Feedwater liquid at boiler pressure.
- With an economiser, hotter feedwater lowers the economiser's recovery, so the saving here is an upper bound when the extra heat comes from the economiser itself.
- A colder feedwater after gives a negative saving, with a note.

References

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

Report details

Report reference	FCC-6RDS-V9VM (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Fuel Saving from Higher Feedwater Temperature
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/boilers/feedwater-temperature-saving

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.