Fuel Saving from a Boiler Efficiency Improvement

Fuel saved per hour and per year and the cost saving when boiler efficiency rises from one value to another at the same steam output.

Method: Same useful heat: ṁ_f2 = ṁ_f1 η₁/η₂

Input parameters

Unit system: SI

Parameter	Value	Unit
Fuel rate now	5.0000	t/h
Efficiency now	78.000	%
Efficiency after improvement	82.000	%
Operating hours per year	8,000.0	h
Fuel price per tonne	9,000.0	

Calculated results

Parameter	Value	Unit
Fuel rate after	4.7561	t/h
Fuel saved	0.24390	t/h
Fuel saved per year	1,951.2	t
Cost saving per year	1.7561e+07	
Fuel saving	4.8780	%

Notes for this case

- A rise of one point from 78 to 79 % saves about 1.3 % of fuel, not 1 %: the saving is 1 − η₁/η₂.

Formula and method

$$\dot{m}_{f,2} = \dot{m}_f \frac{\eta_1}{\eta_2}, \quad \frac{\Delta \dot{m}_f}{\dot{m}_f} = 1 - \frac{\eta_1}{\eta_2}$$

Variables

$\dot{m}_f$	Fuel rate now	kg/s
η_1	Efficiency now	-
η_2	Efficiency after improvement	-
t	Operating hours per year	s
C	Fuel price per tonne	-
$\dot{m}_{f,2}$	Fuel rate after	kg/s
$\Delta \dot{m}_f$	Fuel saved	kg/s
ΔM	Fuel saved per year	kg
ΔC	Cost saving per year	-
$\Delta \dot{m}_f / \dot{m}_f$	Fuel saving	-

Method and standards

Heat balance.

Assumptions and limits

- Same output and fuel. If the efficiency after is lower, the result is negative: extra fuel, with a note.

References

- Same useful heat: $\dot{m}_{f2} = \dot{m}_{f1}\,\eta_1/\eta_2$

Report details

Report reference	FCC-PKDY-HM9K (the same inputs always give the same reference)
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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/boilers-power-plant/plant-performance/efficiency-improvement-fuel-saving

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.