Thermic Fluid Against Steam Heating: Annual Running Cost

Annual fuel and power cost of a process heat load by thermic fluid heater or by steam, including boiler, distribution and water treatment losses.

Method: Energy balance and annual cost definitions

Input parameters

Unit system: SI

Parameter	Value	Unit
Process heat demand	1,000.0	kW
Operating hours per year	7,000.0	h
Fuel cost (currency per GJ) Per GJ on the same calorific basis (GCV or NCV) as the two efficiencies.	500.00	
Electricity cost (currency per kWh)	8.0000	
Thermic fluid heater efficiency	85.000	%
Thermic fluid pump power	15.000	kW
Steam boiler efficiency	82.000	%
Steam distribution, trap, flash and condensate losses	15.000	%
Water treatment and blowdown cost per GJ of steam (currency)	15.000	
Feed pump and other steam-side power	8.0000	kW

Calculated results

Parameter	Value	Unit
Annual cost, thermic fluid	1.5664e+07	
Annual cost, steam	1.8970e+07	
Saving with thermic fluid	3,306,651	
Saving as share of steam cost	17.431	%

Notes for this case

- Running cost only; capital, safety (no pressure vessel above about 300 °C) and fluid replacement are separate. Thermic fluid wins most clearly when process temperatures exceed about 200 °C, where steam pressures become high.

Formula and method

$$C_{tf} = \frac{Q t_a}{\eta_{tf}} c_f + P_{tf} t_a c_e, \quad C_{st} = \frac{Q t_a}{\eta_b (1 - f_s)} c_f + \frac{Q t_a}{1 - f_s} c_w + P_{fw} t_a c_e$$

Variables

Q	Process heat demand	W
t_a	Operating hours per year	s
c_f	Fuel cost (currency per GJ)	-
c_e	Electricity cost (currency per kWh)	-
η_{tf}	Thermic fluid heater efficiency	-
P_{tf}	Thermic fluid pump power	W
η_b	Steam boiler efficiency	-
f_s	Steam distribution, trap, flash and condensate losses	-
c_w	Water treatment and blowdown cost per GJ of steam (currency)	-
P_{fw}	Feed pump and other steam-side power	W

C_{tf}	Annual cost, thermic fluid	-
C_{st}	Annual cost, steam	-
ΔC	Saving with thermic fluid	-
$\Delta C / C_{st}$	Saving as share of steam cost	-

Method and standards

Annual cost definitions.

Assumptions and limits

- Same delivered heat.
- The steam side has a distribution, trap, flash and condensate loss share; the thermic fluid loop has no separate distribution loss input, although its pipes also lose heat. Include that loss in the thermic fluid heater efficiency, or the comparison favours thermic fluid.
- The fuel cost per GJ and both efficiencies must be on the same calorific basis (GCV or NCV).

References

- Energy balance and annual cost definitions

Report details

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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/thermic-fluid-heaters/thermic-fluid-vs-steam-cost

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.