# Heat Pump vs Fuel Boiler: Cost of Useful Heat

Annual running cost of a heat pump against a fuel-fired boiler for the same useful heat, from COP, electricity price, boiler efficiency and fuel price and CV.

**Method:** Cost = Q/COP × electricity price vs Q/(η CV) × fuel price

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Useful heat per year | 2,000.0 | MWh |
| Heat pump seasonal COP | 3.2000 | |
| Electricity price per kWh | 8.0000 | |
| Boiler efficiency (same CV basis as CV) | 88.000 | % |
| Fuel price per kg | 65.000 | |
| Fuel calorific value | 42.000 | MJ/kg |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Heat pump cost per year | 5,000,000 | |
| Boiler cost per year | 1.2662e+07 | |
| Saving with the heat pump | 7,662,338 | |
| Break-even COP | 1.2636 | |

**Notes for this case**

- Heat pumps suit low-temperature heat (below about 80 °C); COP falls as the delivery temperature rises.

## Formula and method

$$C_{HP} = \frac{Q}{3.6 \times 10^6\, COP} c_e, \quad C_B = \frac{Q}{\eta CV} p_f, \quad COP_{be} = \frac{c_e\, \eta\, CV}{3.6 \times 10^6\, p_f}$$

### Variables

| | | |
|---|---|---|
| $Q$ | Useful heat per year | J |
| $COP$ | Heat pump seasonal COP | - |
| $c_e$ | Electricity price per kWh | - |
| $\eta$ | Boiler efficiency (same CV basis as CV) | - |
| $p_f$ | Fuel price per kg | - |
| $CV$ | Fuel calorific value | J/kg |
| $C_{HP}$ | Heat pump cost per year | - |
| $C_B$ | Boiler cost per year | - |
| $\Delta C$ | Saving with the heat pump | - |
| $COP_{be}$ | Break-even COP | - |

### Method and standards

Running cost.

### Assumptions and limits

- Same useful heat.
- Boiler efficiency and CV on one basis (both GCV or both NCV).

### References

- Cost = Q/COP × electricity price vs Q/(η CV) × fuel price

## Report details

| | |
|---|---|
| Report reference | FCC-TC8K-QEGV (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/environmental/carbon-energy/heat-pump-vs-boiler-cost

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.