Thermostat Setback Heating Savings

Heating energy saved by lowering the thermostat for part of each day, by the degree-hour method with an effectiveness factor for the building's cool-down lag.

Method: Degree-hour estimate of setback savings

Input parameters

Unit system: SI

Parameter	Value	Unit
Normal setpoint	21.000	°C
Setback	5.0000	K
Setback hours per day	8.0000	h
Mean outdoor temperature in the heating season	5.0000	°C
Setback effectiveness (cool-down lag)	70.000	%
Annual heating energy without setback	15,000	kWh

Calculated results

Parameter	Value	Unit
Share of heating energy saved	7.2917	%
Annual energy saved	1,093.8	kWh
Degree-hours avoided per day	40.000	°C·h

Notes for this case

• Heat loss is roughly proportional to the inside–outside temperature difference, so lowering the setpoint by ΔT for h hours a day cuts the season's degree-hours by about ΔT·h/[24(T_i − T̄_o)]. The building cools gradually and must be reheated, so only part of the setback is realised; the effectiveness factor (about 0.5–0.8, lower for heavy buildings and heat pumps with electric backup) accounts for that. The often-quoted rule is about 1 % saving per °F of 8-hour setback.

Formula and method

$$f = \varepsilon \frac{\Delta T \cdot h/24}{T_i - \bar{T}_o}, \quad \Delta E = fE$$

Variables

T_i	Normal setpoint	K
ΔT	Setback	K
h	Setback hours per day	s
$\bar{T}_o$	Mean outdoor temperature in the heating season	K
ε	Setback effectiveness (cool-down lag)	-
E	Annual heating energy without setback	J
f	Share of heating energy saved	-
ΔE	Annual energy saved	J
$\Delta T \cdot h$	Degree-hours avoided per day	K·s

Method and standards

Setback savings.

Assumptions and limits

- Heat loss proportional to temperature difference; constant internal gains.

References

Degree-hour estimate of setback savings

Report details

Report reference	FCC-47TD-TZRF (the same inputs always give the same reference)
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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/hvac/loads/thermostat-setback-savings

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.