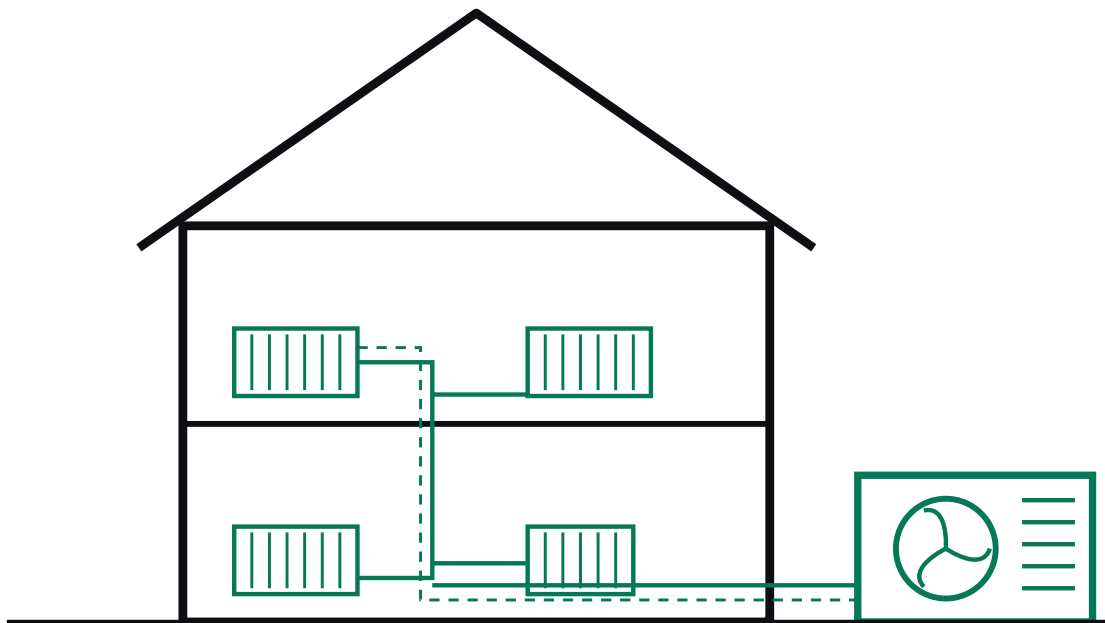


HEAT PUMP · ENERGY EFFICIENCY ANALYSIS

Heat pump sizing

153 m² · 13 rooms · heat loss from the room-by-room calculation



Demand
4.6 kW

Supply
45 °C

Area
153 m²

Heat pump sizing

The HP-6kW pump covers the building's **4.57 kW** at -20 °C.

Recommendation: V1: No changes, supply 45 °C.

4.57 kW

Building load

5.47 kW

Required pump power

45 °C

Supply temperature

20,295 PLN

Investment (radiators + pump)

Recommended option V1: No changes

Pump	HP-6kW	SCOP	4.1
Annual electricity	2,993 kWh	Radiator replacements	0
Power headroom	TIGHT SIZING +0.16 kW		

Key warnings

- ❗ Distribution set to underfloor heating - radiator retrofit check skipped.
- ❗ Selected pump (HP-6kW) has limited headroom. Consider checking the next pump size up.

Basis and assumptions

Load source	Heat load calculation [1]		
Indicator per m ²	29.8 W/m ²	Usable floor area	153 m ²
Indoor temperature	21 °C	Design outdoor temperature	-20 °C
Distribution type	Underfloor heating		

The heat load was carried over verbatim from the heat load calculation for this project - it was not rescaled by insulation class or by fuel consumption history. This report is indicative and does not replace a full energy audit.

[1] EN 12831-1:2017 - the design heat load, each room with the wind on its own side.

Options to choose from

Recommendation: V1 for 20,295 PLN.

Parameter	RECOMMENDED		
	V1: No changes	V2: Minimal changes	V3: Best efficiency
Pump			
Supply temperature °C	45	45	45
Pump	HP-6kW	HP-6kW	HP-6kW
Nominal power kW	6.1	6.1	6.1
Power at supply temp. kW	5.6	5.6	5.6
Sizing status	! TIGHT SIZING	! TIGHT SIZING	! TIGHT SIZING
SCOP (estimated)	4.1	4.1	4.1
Annual electricity kWh	2,993	2,993	2,993
Cost			
Radiator replacements pcs	0	0	0
Radiator cost PLN	0	0	0
Pump cost PLN	20,295	20,295	20,295
Total investment PLN	20,295	20,295	20,295

V1 - No changes:

Existing radiators without retrofit.
Minimum cost, but often requires high supply temperature.

V2 - Minimal changes:

Up to 3 radiator replacements.
Compromise between cost and efficiency.

V3 - Best efficiency:

Up to 10 replacements. Lowest supply temperature = best SCOP.

Recommendation: the cheapest feasible option (radiators + pump). The sizing status is about the pump's capacity margin, not its price.

Room analysis

With the existing radiators, Porch needs a **43 °C** supply. Every room stays within 45 °C.

Room coverage	100%	Audit status	PARTIAL_AUDIT
Modelled heat loss	5.06 kW	Unmodelled heat loss	0.00 kW

Required supply temperature Supply temperature needed for existing radiators to cover room load

REQUIRED SUPPLY, EXISTING RADIATORS

Room	Load W	Current heating	°C
Porch	170	UFH 150 mm / Ceramic tiles	43
Study	354	UFH 150 mm / Wood / laminate	37
Bathroom	305	UFH 150 mm / Ceramic tiles	36
Utility room	314	UFH 150 mm / Ceramic tiles	35
Living room	793	UFH 150 mm / Wood / laminate	35
WC	120	UFH 150 mm / Ceramic tiles	34
Guest room	464	UFH 150 mm / Wood / laminate	34
Kitchen-diner	563	UFH 150 mm / Ceramic tiles	33
Main bedroom	553	UFH 150 mm / Wood / laminate	33
Bedroom	496	UFH 150 mm / Wood / laminate	33
Children's room	409	UFH 150 mm / Wood / laminate	32
Landing	252	UFH 150 mm / Wood / laminate	32
Hall	267	UFH 150 mm / Ceramic tiles	31

 required supply | 45 °C - the pump's efficient range

Heat loss per room

The rooms lose **5,061 W** together at -20 °C. The most: Living room, 793 W.

Room	LOSSES				GAINS	RESULT
	Transm.	Vent.	Bridges	Heat-up	Internal	Total (W)
Living room	581	161	51	0	0	793
Kitchen-diner	482	32	49	0	0	563
Main bedroom	360	114	79	0	0	553
Bedroom	333	91	72	0	0	496
Guest room	338	87	40	0	0	464
Children's room	251	89	69	0	0	409
Study	229	80	46	0	0	354
Utility room	257	21	36	0	0	314
Bathroom	267	11	28	0	0	305
Hall	74	193	0	0	0	267
Landing	63	164	25	0	0	252
Porch	114	47	9	0	0	170
WC	111	6	4	0	0	120
TOTAL	3,459	1,096	506	0	0	5,061

Breakdown of the design heat load [W]

$$\Phi = \Phi_T + \Phi_V + \Phi_{TB} + \Phi_{hu} - \Phi_{gain}$$

This project's room-by-room calculation, EN 12831-1

Total = transmission + ventilation + thermal bridges + heating-up power - internal gains. Values come from the heat load calculation for this project.

Heat pump

HP-6kW gives **5.6 kW** at -20 °C and a 45 °C supply - **0.16 kW** more than the sizing needs.

Sizing chain	Value
Building load	4.57 kW
+ Safety margin	12%
+ Hot water (day / 24 h)	+0.35 kW
= Required heating power	5.47 kW
Required power headroom	0.55 kW
Selected pump V1: No changes	HP-6kW
Nominal power (A7)	6.1 kW
Derated output (-20 °C, supply 45 °C)	5.6 kW
Power headroom · TIGHT SIZING	+0.16 kW

! Pump power headroom is below the recommended level. Consider the next pump size class.

$$P = \Phi_{HL} \cdot (1 + m) + Q_{DHW,d} / 24 h$$

HeatAlgo's sizing model, not a standard

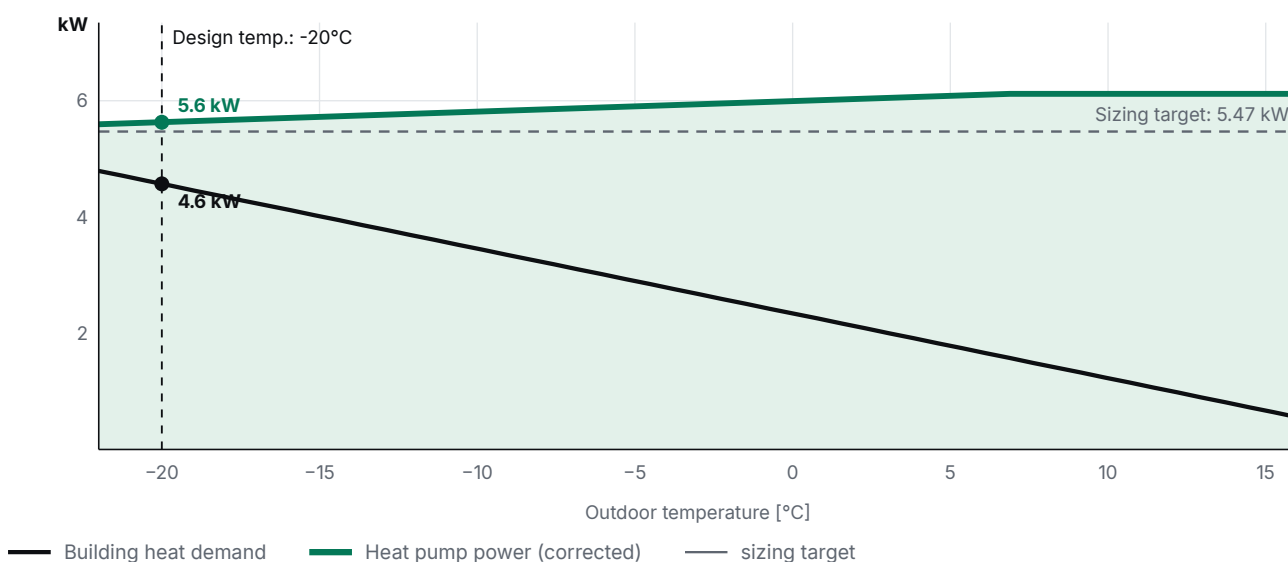
m - the safety margin. In a bivalent sizing Φ_{HL} is the heat loss at the bivalent point. Hot water only when the pump heats the cylinder.

$$P_{\text{pump}} - P \geq \max(0.30 \text{ kW}; 0.10 \cdot P)$$

Met - optimal, below - tight, < 0 - too small

P_{pump} - the class output derated for outdoor and supply temperature (EN 14511 / 14825, averaged data).

Heat demand vs pump power



Black line - building heat demand (4.57 kW at -20°C). Green line - pump power HP-6kW (6.1 kW nominal) accounting for derating at low temperatures. When the green line falls below the black (bivalent point) - the pump cannot cover 100% of demand and auxiliary heating is needed.

Model confidence: HIGH - input data sufficient for reliable sizing.

Energy and cost

The house uses about **12,195 kWh** of heat a year.

Component	Energy (kWh/yr)
Central heating (CH)	9,140
Domestic hot water (DHW)	3,056
Total	12,195

Suggested DHW tank: **240 litres**

$$Q_{SH} = \Phi_{HL} \cdot 2,000 \text{ h}$$

full-load hours - an indicator, not an hourly simulation (#08)

$$Q_{DHW} = n \cdot 40 \text{ l} \cdot c_w \cdot (55 - 10) \text{ K} \cdot 365$$

hot water per person per day

$n = 4$ residents, $c_w = 4.186 \text{ kJ/(kg} \cdot \text{K)}$

$$E_{el} = Q / SCOP; C = Q / \eta \cdot p$$

SCOP linear between W35 and W55 (#08)

η - the efficiency or COP in the table, p - the price per kWh of fuel.

Annual heating cost comparison

Estimated annual costs for the heat demand 12,195 kWh/year

Heat source	FUEL		ANNUAL COST	
	Efficiency/COP	Cost per kWh of heat PLN		PLN
Electricity	1.00	0.85		10,366
Heating oil	0.85	0.46		5,596
Coal (old boiler)	0.55	0.45		5,543
Gas (atmospheric)	0.80	0.41		5,031
Pellet	0.85	0.39		4,735
Gas (condensing)	0.95	0.35		4,236
Coal	0.85	0.29		3,587
Firewood	0.70	0.26		3,136
Heat pump (V1)	4.08	0.21		2,541
Heat pump (V2)	4.08	0.21		2,541
Heat pump (V3)	4.08	0.21		2,541

heat pump other source

* Fuel prices are indicative (Polish market estimates for Q1 2026, in PLN) and may vary by region, supplier, and tariff. Costs exclude fixed charges. The electricity price for heat pumps assumes the Polish G12 off-peak tariff (weighted average ~0.85 PLN/kWh); electric heating (immersion heaters) the flat G11 tariff (~1.03 PLN/kWh).

Limitations and assumptions

The limits of this sizing in 11 points. The heat loss comes from the room-by-room calculation - the estimator's limits (fuel calibration, the 2-30 kW range) do not apply to this report.

- 01 The heat load for this project was calculated room by room in accordance with EN 12831-1 (with EN ISO 6946 for envelopes and EN ISO 13370 for ground heat transfer). Transmission, ventilation and thermal bridges are included. The remaining disclaimers concern the pump selection model, not the heat load.
- 02 This report is intended solely for preliminary estimation and client discussion. It does not constitute a basis for claims, performance warranties, or commitments regarding specific temperatures or operating costs.
- 03 This report does not meet the documentation requirements of subsidy programmes (in Poland, Czyste Powietrze - the Clean Air programme). A full energy audit is required for subsidy purposes.
- 04 Annual energy cost estimates are an approximate proxy (fixed full-load hours = 2,000 h/yr), not an hourly simulation. Actual consumption depends on weather conditions, user behaviour, and installation quality.
- 05 The SCOP model is linear (proxy) and depends only on supply temperature. Actual SCOP depends on many additional factors.
- 06 If a pump class lacks complete manufacturer data at 55°C supply temperature, SCOP is estimated as 74% of the SCOP at 35°C. Actual values depend on the specific pump model.
- 07 Pumps in the catalogue are size classes (5/7/9/12/16 kW), not specific products. Performance curves are based on averaged EN 14825/14511 data from 9 manufacturers. Power is derated for performance drop at the design outdoor temperature.
- 08 No hydraulic modelling: flows, resistances, valve settings. Underfloor heating (UFH): if pipe spacing and floor type were provided, the algorithm verifies UFH power (EN 1264 model). Without this data it assumes the UFH will cover the required load. Loop lengths and hydraulic resistances are not modelled.
- 09 If not all rooms were described, the analysis covers only a proportional part of the building (coverage). The remaining load is included in pump sizing but is not subject to emitter optimisation. The more rooms described, the more accurate the recommendation.
- 10 Rooms without emitters (indirect heating) - the model assumes heat transfer from adjacent rooms, but reaching the target temperature is not guaranteed.
- 11 Radiator and pump costs are approximate and may differ from market prices.

See the method: a reference house calculated in full: heatalgo.com/en/compliance

Glossary of terms

SCOP - Seasonal coefficient of performance - kWh of heat delivered per kWh of electricity consumed (seasonal average).

Bivalent - Fraction of design load covered by the heat pump (remainder: electric heater/boiler).

Existing - Radiator left unchanged.

Power headroom - Surplus pump power above the required minimum - safety buffer.

Coverage - Percentage of building area included in the detailed room-by-room analysis.

Replacement - Proposed radiator retrofit - new type/size.

What **this report** rests on

EN 12831-1	The design heat loss of the building and its rooms - from the heat load module (#02, #05).
EN ISO 6946 · 13370	Building elements and heat transfer to the ground in the heat load calculation.
EN 14511 · EN 14825	Output and SCOP of the pump classes - averaged maker data, output derated for temperature (#03, #06).
EN 1264	Underfloor heating output, when the pipe spacing and floor covering are given.

Limitations: page #08.