17 June 2025

Heat Loss Report & System Design

Prepared for

[redacted]

Prepared by

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Summary

Your property's heat loss

Floor area	Total heat loss	Average heat load
199 m²	14.15 kW	71 W/m²

Proposed system design

HEAT PUMP

Mitsubishi Ecodan R32 Monobloc 14kW

Capacity at 45°C flow temp and -1.5 °C outdoor air temperature	15.68 kW
SCOP at 45°C	3.77

CYLINDER

200l

Capacity	200 litres

RADIATORS

16 Radiator changes

9 replaced, 7 additional, 6 retained

Performance comparison

Annual CO2 savings	Annual running cost savings
5.9 tonnes	£84 to £1,089 per year

Heat loss report

This section presents the results of our detailed heat loss calculations for your property. The overall heat loss determines how big your heating system needs to be, and the room-by-room breakdown allows us to size the emitters (radiators and underfloor heating) correctly to keep each room warm on a cold day.

Introduction

How quickly your property loses heat depends on how big it is, the materials it is made from, and how air tight it is. Our detailed heat loss survey captured all this information and we have laid it out in this report so you can understand how and why we produce our recommendations. There are several key questions that we're looking to answer as we go through this process for you:

Are the heat pump and radiators big enough?

To keep your property warm, the heat pump needs to deliver heat to the emitters (by which we just mean radiators and underfloor heating) as quickly as your property loses it, and in turn the emitters need to deliver that heat as quickly as each room loses it.

We cannot rely on the fact that your existing radiators keep your property warm with your existing heating system, because heat pumps typically work at a much lower flow temperature than fossil-fuel boilers.

Whilst heat pumps are capable of making very hot water, they work most efficiently when generating low-temperature heat, typically between 35-50C. Gas boilers have traditionally been set up to generate high-temperature heat, with water temperatures of 70-80C (although they also work more efficiently at lower temperatures!).

A lower flow temperature, while more efficient, does mean the heat output from each radiator will be reduced. We use the heat loss survey to calculate how that reduced output compares to the room's demand for heat and then determine which (if any) radiators need replacing. In this way we ensure your new system will run efficiently with a low flow temperature, while still keeping you warm on cold days.

Is the heat pump too big?

This strikes many as a funny question, but we do not want to "oversize" your heat pump. While we design your heating system to ensure it keeps your property warm on cold days, most of the time it isn't that cold! On milder days, your house loses heat more slowly so the heat pump will need to provide less heat.

Heat pumps have to be sized quite precisely, as opposed to the majority of gas or oil boilers which are typically far more powerful than is actually needed for the property. If heat pumps turn on and off all the time, it can be really inefficient and unnecessarily increase energy bills. So we want to choose a model that can keep your property warm on a cold day, but "modulate down" to keep running efficiently on milder days.

We hope this all makes sense! Please do give the report a thorough read through and let us know if you have any questions – we're more than happy to explain what bits mean in more detail if you would like!

HEAT LOSS

Calculation Conditions

When calculating the property's heat loss we design to certain conditions. This section shows the conditions used for this property.

Design outdoor air temperature For the design outdoor temperature we use the "99th percentile" temperature. That means that the outdoor temperature in the area only falls below this temperature 1% of the time.	-1.5 °C
Design ground temperature The ground temperature is used in calculating the heat loss through the floor. It's the average temperature in the surrounding area across the year, because the ground temperature stays very constant through the year.	10.6 °C
Heating degree days Heating degree days are a measure of how much heating the property needs over the whole year based on the typical temperature profile for it's location.	1835 °C days
Indoor temperature The indoor temperature set point that the system needs to be able to maintain in each room. The value used in each room is shown in the room by room breakdown section.	20 °C to 20 °C depending on the room
Intermittent heating Heating a property up from cold requires more power than just maintaining a temperature. For intermittently occupied properties like holiday homes you might slightly oversize the system to allow it to warm up more quickly when it's needed. For a property that is occupied normally this would just result in the system cycling, thus reducing efficiency.	No: assume property is occupied all winter
Exposed location Properties very exposed to the wind will lose heat more quickly than typical so we would size the system to account for this.	No: property is not in an exposed location such as on the coast
MVHR Mechanical ventilation with heat recovery systems capture heat from exhaust air and use it to pre-heat incoming air. They therefore reduce heat loss due to ventilation compared to standard mechanical ventilation systems (like bathroom fans + air vents) because they recycle some of the heat.	No: a ventilation system with heat recovery is not present

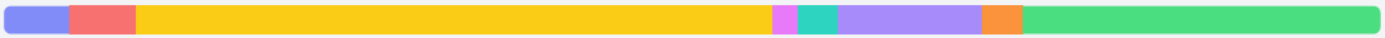
All calculations have been done in compliance with BS EN12831 (UK National Annex) and comply with the standards laid out in the Microgeneration Certification Scheme.

HEAT LOSS

Heat loss by element

This section shows the heat loss through each element in the property. They give you a sense of which parts of the property fabric lose the most heat, and may indicate areas where insulating could have a significant impact on the heat loss.

Total heat loss 14150 W



Ground Floor · Roof · External Walls · Internal Walls · Party Walls · Windows · Rooflights · Ventilation

	U-VALUE* (W/m²K)	AREA	HEAT LOSS	ANNUAL ENERGY
Ground Floor 1. Suspended floor. No insulation. 2. Solid floor. No insulation. 3. Solid floor. 75mm insulation. 4. Solid floor. 50mm insulation.	0.18 — 1.57	80.7 m²	641 W	1,312 kWh
Intermediate Floor/Ceiling 1. Intermediate floor. no insulation.	1.41 — 1.73	243.2 m²	0 W	0 kWh
Roof 1. Pitched, 200mm insulation at rafters 2. Pitched, 100mm insulation at rafters 3. Pitched, no insulation, felted	0.18 — 2.51	69.6 m²	693 W	1,420 kWh
External Wall 1. Render. Filled Cavity. Brick and Standard Block (100mm). Plaster. 2. Filled Cavity. Brick and Standard Block (100mm). Plaster 3. Filled Cavity. Brick and Brick. Plaster. 4. Timber frame 50mm insulation 5. Stone 305mm	0.44 — 2.41	179.3 m²	6,665 W	13,652 kWh
Internal Wall 1. Brick - single layer, plaster. 129mm	1.82	334.3 m²	260 W	533 kWh
Party Wall 1. New build 2012-2022. Target value. 2. MCS default party wall 3. Single glazed door	0.00 — 4.00	77.5 m²	294 W	601 kWh
Window 1. High performance windows - U value 2 W/m2K	2.00 — 3.10	38.9 m²	1,828 W	3,745 kWh

2. Double Glazed, Wood/PVC frame

	ACH**	VOLUME	HEAT LOSS	ANNUAL ENERGY
Ventilation	1	458 m³	3,281 W	6,720 kWh
Ventilation	1.5	45 m³	488 W	1,000 kWh
Total			14,150 W	28,984 kWh

*** U-Value:** the thermal conductivity of the element

****ACH:** air changes per hour

HEAT LOSS

Heat loss by room

This section shows the heat loss from each room in the property. These results are used to design the emitters (i.e. radiators or underfloor) for the new system.

Total heat loss

14151 W

Dining · Hall/Landing · Kitchen · Living/Lounge · Living/Lounge · Study · Study · Utility · Bath/Shower · Bath/Shower
Bedroom 1 · Bedroom 2 · Bedroom 3 · Hall/Landing · Bath/Shower · Bedroom 4 · Dressing · Hall/Landing · Hall/Landing

	ROOM TEMP	ACH*	FLOOR AREA	VOLUME	HEAT LOSS	HEAT LOSS PER UNIT AREA
Dining	20 °C	1	13.8 m²	36 m³	356 W	26 W/m²
Hall/Landing	20 °C	1	10.0 m²	30 m³	931 W	93 W/m²
Kitchen	20 °C	1	16.0 m²	42 m³	925 W	58 W/m²
Living/Lounge	20 °C	1.5	15.1 m²	45 m³	948 W	63 W/m²
Living/Lounge	20 °C	1	2.5 m²	8 m³	871 W	344 W/m²
Study	20 °C	1	15.9 m²	38 m³	1,094 W	69 W/m²
Study	20 °C	1	2.0 m²	6 m³	666 W	327 W/m²
Utility	20 °C	1	5.2 m²	13 m³	320 W	62 W/m²
Bath/Shower	20 °C	1	4.5 m²	13 m³	412 W	91 W/m²
Bath/Shower	20 °C	1	6.0 m²	17 m³	359 W	60 W/m²
Bedroom 1	20 °C	1	13.9 m²	40 m³	503 W	36 W/m²
Bedroom 2	20 °C	1	15.4 m²	44 m³	871 W	57 W/m²
Bedroom 3	20 °C	1	15.4 m²	44 m³	1,460 W	95 W/m²
Hall/Landing	20 °C	1	7.4 m²	21 m³	470 W	63 W/m²
Bath/Shower	20 °C	1	12.1 m²	19 m³	505 W	42 W/m²
Bedroom 4	20 °C	1	21.1 m²	35 m³	1,536 W	73 W/m²
Dressing	20 °C	1	13.7 m²	31 m³	1,080 W	79 W/m²
Hall/Landing	20 °C	1	4.1 m²	6 m³	213 W	52 W/m²
Hall/Landing	20 °C	1	4.9 m²	12 m³	631 W	129 W/m²

***ACH:** air changes per hour

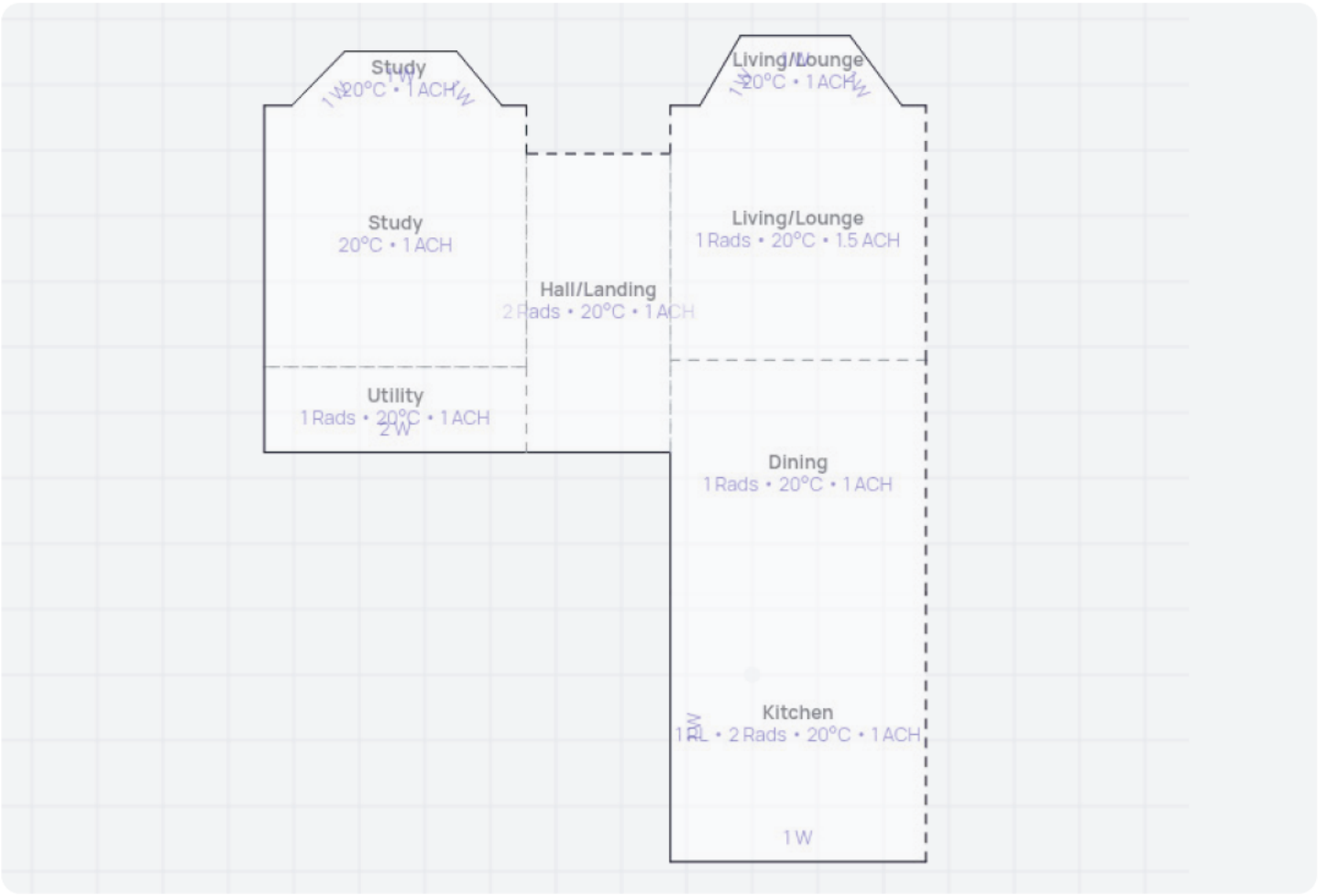
HEAT LOSS BY FLOOR

Ground floor

Heat loss by room

6111 W

Dining • Hall/Landing • Kitchen • Living/Lounge • Living/Lounge • Study • Study • Utility



Rads: number of radiators

UFH: underfloor heating in room

°C: room temperature

ACH: air changes per hour

W: number of windows

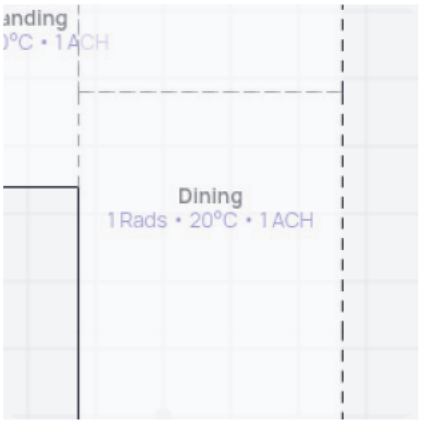
D: number of doors

HEAT LOSS BY ROOM

Dining

Total heat loss	Room temp	Air changes per hour
356 W	20 °C	1.0

Floor area	Average height	Volume
13.8 m²	2.6 m	36.3 m³



Heat loss by element

356 W

Ground Floor · External Walls · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	10.6 °C	0.31 W/m²K	13.8 m²	40 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	13.8 m²	0 W
External Walls	-1.5 °C	0.45 W/m²K	5.7 m²	55 W
Internal Walls	20.0 °C	1.82 W/m²K	24.2 m²	0 W
Party Walls	10.0 °C	0.00 W/m²K	9.3 m²	0 W
Ventilation	-1.5 °C			261 W

Heat loss per m² — 26 W/m²

Emitter performance

293% of 356 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Type 22 (K2) 600 x 1800 mm	1044 W	1044 W	356 W	293 %

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Hall/Landing

Total heat loss	Room temp	Air changes per hour
931 W	20 °C	1.0

Floor area	Average height	Volume
10.0 m²	3.0 m	30.0 m³

Heat loss by element

931 W

Ground Floor · External Walls · Party Walls · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	-1.5 °C	0.51 W/m²K	10.0 m²	109 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	10.0 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	6.6 m²	342 W
Internal Walls	20.0 °C	1.82 W/m²K	27.3 m²	0 W
Party Walls	10.0 °C	4.00 W/m²K	6.6 m²	264 W
Ventilation	-1.5 °C			215 W

Heat loss per m² — 93 W/m²

Emitter performance

82% of 931 W at 45 °C

Radiator · Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Type 21 (P+) 600 x 1100 mm	497 W	768 W	931 W	53 %
Radiator		Type 21 (P+) 600 x 600 mm	271 W	768 W	931 W	29 %

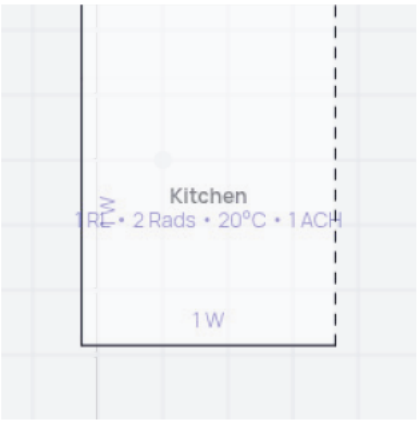
***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Kitchen

Total heat loss	Room temp	Air changes per hour
925 W	20 °C	1.0

Floor area	Average height	Volume
16.0 m²	2.7 m	42.4 m³



Heat loss by element

925 W

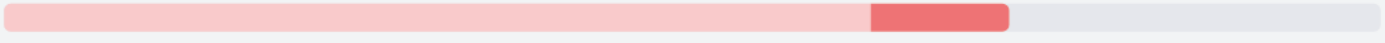
Ground Floor • Roof • External Walls • Windows • Rooflights • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	10.6 °C	0.36 W/m²K	16.0 m²	54 W
Roof	-1.5 °C	0.34 W/m²K	15.0 m²	110 W
External Walls 1	-1.5 °C	0.70 W/m²K	8.7 m²	131 W
External Walls 2	-1.5 °C	0.45 W/m²K	8.3 m²	81 W
Internal Walls	20.0 °C	1.82 W/m²K	10.3 m²	0 W
Party Walls	10.0 °C	0.00 W/m²K	10.9 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	4.2 m²	180 W
Rooflights	-1.5 °C	3.10 W/m²K	1.0 m²	67 W
Ventilation	-1.5 °C			304 W

Heat loss per m² — 58 W/m²

Emitter performance

73% of 925 W at 45 °C



Radiator • Secondary

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Type 22 (K2) 700 x 900 mm	582 W	674 W	925 W	63 %
Secondary		Plinth heater 10%	92 W	674 W	925 W	10 %

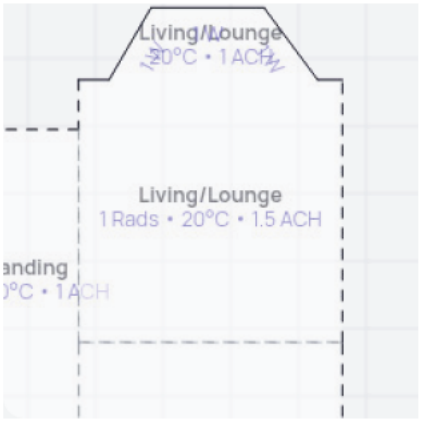
***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Living/Lounge

Total heat loss	Room temp	Air changes per hour
948 W	**20 °C**	**1.5**

Floor area	Average height	Volume
15.1 m²	**3.0 m**	**45.3 m³**



Heat loss by element

948 W

Ground Floor · External Walls · Internal Walls · Party Walls · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	-1.5 °C	0.18 W/m²K	15.1 m²	57 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	15.1 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	2.4 m²	126 W
Internal Walls	20.0 °C	1.82 W/m²K	30.6 m²	260 W
Party Walls 1	5.0 °C	0.50 W/m²K	2.2 m²	16 W
Party Walls 2	10.0 °C	0.00 W/m²K	11.6 m²	0 W
Ventilation	-1.5 °C			488 W

Heat loss per m² — 63 W/m²

Emitter performance

76% of 948 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Type 21 (P+) 600 x 1600 mm	723 W	723 W	948 W	76 %

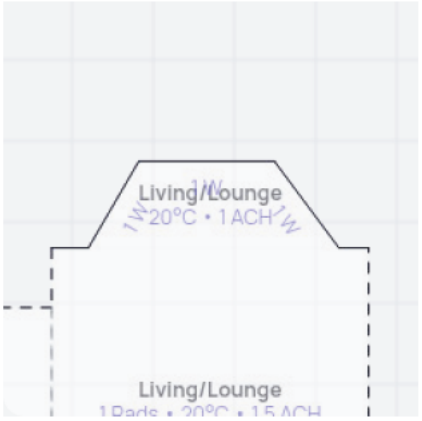
***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Living/Lounge

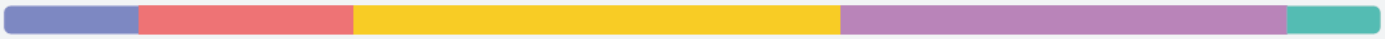
Total heat loss	Room temp	Air changes per hour
871 W	**20 °C**	**1.0**

Floor area	Average height	Volume
2.5 m²	**3.0 m**	**7.5 m³**



Heat loss by element

871 W



Ground Floor • Roof • External Walls • Windows • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	-1.5 °C	1.49 W/m²K	2.5 m²	81 W
Roof	-1.5 °C	2.51 W/m²K	2.5 m²	137 W
External Walls	-1.5 °C	2.41 W/m²K	6.0 m²	311 W
Internal Walls	20.0 °C	1.82 W/m²K	9.2 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	6.7 m²	287 W
Ventilation	-1.5 °C			54 W

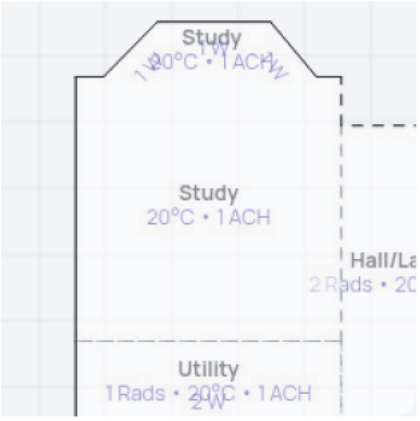
Heat loss per m² 344 W/m²

HEAT LOSS BY ROOM

Study

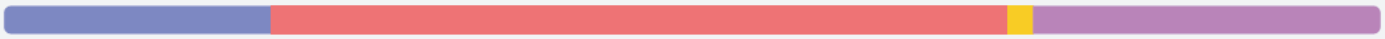
Total heat loss	Room temp	Air changes per hour
1094 W	20 °C	1.0

Floor area	Average height	Volume
15.9 m²	2.4 m	38.2 m³



Heat loss by element

1,094 W



Ground Floor · External Walls · Party Walls · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	-1.5 °C	0.62 W/m²K	15.9 m²	214 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	15.9 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	11.4 m²	593 W
Internal Walls	20.0 °C	1.82 W/m²K	25.1 m²	0 W
Party Walls	5.0 °C	0.50 W/m²K	1.8 m²	13 W
Ventilation	-1.5 °C			274 W

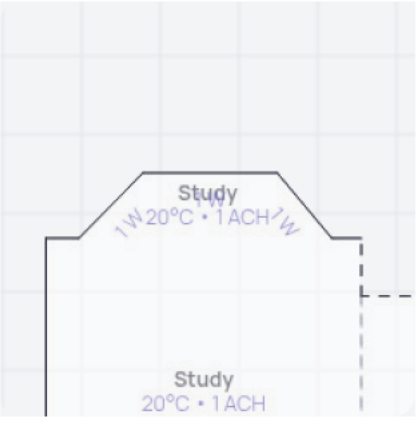
Heat loss per m² — 69 W/m²

HEAT LOSS BY ROOM

Study

Total heat loss	Room temp	Air changes per hour
666 W	20 °C	1.0

Floor area	Average height	Volume
2.0 m²	3.0 m	6.0 m³



Heat loss by element

666 W

Ground Floor · External Walls · Windows · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	-1.5 °C	1.57 W/m²K	2.0 m²	69 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	2.0 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	5.1 m²	266 W
Internal Walls	20.0 °C	1.82 W/m²K	9.6 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	6.7 m²	288 W
Ventilation	-1.5 °C			44 W

Heat loss per m² 327 W/m²

HEAT LOSS BY ROOM

Utility

Total heat loss	Room temp	Air changes per hour
320 W	20 °C	1.0

Floor area	Average height	Volume
5.2 m²	2.6 m	13.3 m³

Heat loss by element

320 W

Ground Floor · External Walls · Windows · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Ground Floor	10.6 °C	0.35 W/m²K	5.2 m²	17 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	5.2 m²	0 W
External Walls	-1.5 °C	0.56 W/m²K	12.0 m²	145 W
Internal Walls	20.0 °C	1.82 W/m²K	13.5 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	1.5 m²	63 W
Ventilation	-1.5 °C			95 W

Heat loss per m² — 62 W/m²

Emitter performance

157% of 320 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Stelrad vertical 1800 x 400 mm	502 W	502 W	320 W	157 %

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

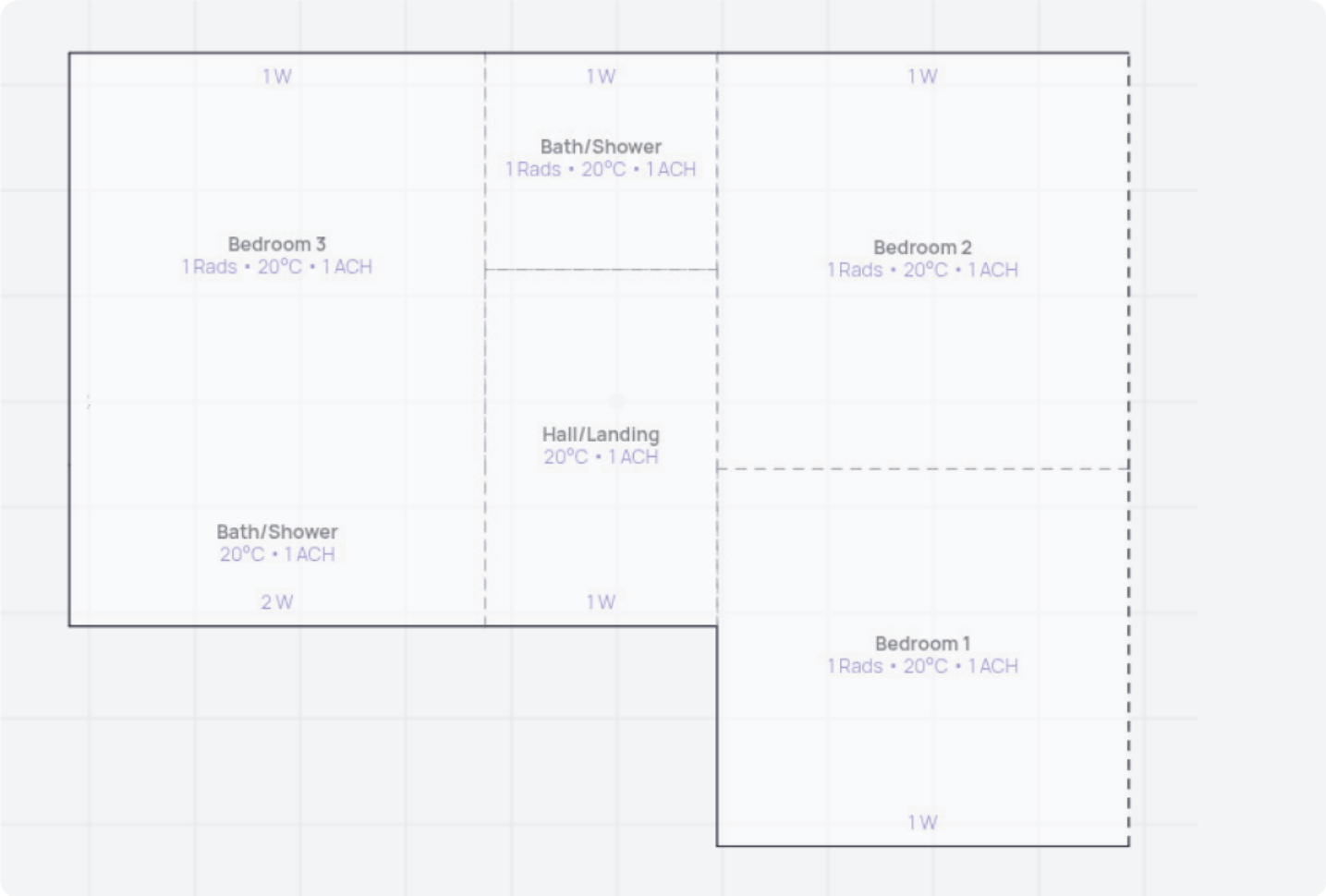
HEAT LOSS BY FLOOR

First floor

Heat loss by room

4075 W

Bath/Shower · Bath/Shower · Bedroom 1 · Bedroom 2 · Bedroom 3 · Hall/Landing



Rads: number of radiators

UFH: underfloor heating in room

°C: room temperature

ACH: air changes per hour

W: number of windows

D: number of doors

HEAT LOSS BY ROOM

Bath/Shower

Total heat loss	Room temp	Air changes per hour
412 W	20 °C	1.0

Floor area	Average height	Volume
4.5 m²	2.9 m	13.0 m³

Heat loss by element

412 W

External Walls • Windows • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	4.5 m²	0 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	4.5 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	5.1 m²	265 W
Internal Walls	20.0 °C	1.82 W/m²K	18.2 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	1.2 m²	53 W
Ventilation	-1.5 °C			93 W

Heat loss per m² — 91 W/m²

Emitter performance

46% of 412 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Type 11 (K1) 700 x 500 mm	190 W	190 W	412 W	46 %

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Bath/Shower

Total heat loss	Room temp	Air changes per hour
359 W	20 °C	1.0

Floor area	Average height	Volume
6.0 m²	2.9 m	17.3 m³

Heat loss by element

359 W

External Walls • Windows • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	6.0 m²	0 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	6.0 m²	0 W
External Walls	-1.5 °C	0.56 W/m²K	14.3 m²	173 W
Internal Walls	20.0 °C	1.82 W/m²K	15.8 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	1.4 m²	62 W
Ventilation	-1.5 °C			124 W

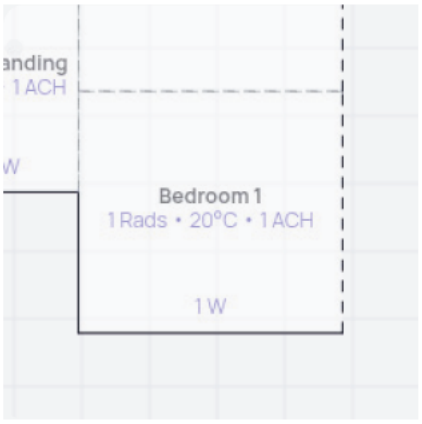
Heat loss per m² 60 W/m²

HEAT LOSS BY ROOM

Bedroom 1

Total heat loss	Room temp	Air changes per hour
503 W	20 °C	1.0

Floor area	Average height	Volume
13.9 m²	2.9 m	40.1 m³



Heat loss by element

503 W

External Walls · Windows · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	13.9 m²	0 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	13.9 m²	0 W
External Walls 1	-1.5 °C	0.44 W/m²K	9.8 m²	93 W
External Walls 2	-1.5 °C	0.45 W/m²K	6.0 m²	58 W
Internal Walls	20.0 °C	1.82 W/m²K	15.6 m²	0 W
Party Walls	10.0 °C	0.00 W/m²K	10.3 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	1.5 m²	64 W
Ventilation	-1.5 °C			288 W

Heat loss per m² — 36 W/m²

Emitter performance

100% of 503 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Type 22 (K2) 500 x 1000 mm	502 W	502 W	503 W	100 %

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Bedroom 2

Total heat loss	Room temp	Air changes per hour
871 W	20 °C	1.0

Floor area	Average height	Volume
15.4 m²	2.9 m	44.5 m³

Heat loss by element

871 W

External Walls • Windows • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	15.4 m²	0 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	15.4 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	7.8 m²	403 W
Internal Walls	20.0 °C	1.82 W/m²K	22.6 m²	0 W
Party Walls	10.0 °C	0.00 W/m²K	11.4 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	3.5 m²	150 W
Ventilation	-1.5 °C			318 W

Heat loss per m² 57 W/m²

Emitter performance

4% of 871 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		P+ 400 x 1600 mm	34 W	34 W	871 W	4 %

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Bedroom 3

Total heat loss	Room temp	Air changes per hour
1460 W	20 °C	1.0

Floor area	Average height	Volume
15.4 m²	2.9 m	44.5 m³

Heat loss by element

1,460 W

External Walls • Windows • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	15.4 m²	0 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	15.4 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	19.2 m²	993 W
Internal Walls	20.0 °C	1.82 W/m²K	22.6 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	3.5 m²	150 W
Ventilation	-1.5 °C			318 W

Heat loss per m² — 95 W/m²

Emitter performance

2% of 1460 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		P+ 400 x 1600 mm	34 W	34 W	1460 W	2 %

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Hall/Landing

Total heat loss	Room temp	Air changes per hour
470 W	20 °C	1.0

Floor area	Average height	Volume
7.4 m²	2.9 m	21.4 m³

Heat loss by element

470 W

External Walls • Windows • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	7.4 m²	0 W
Intermediate Ceiling	20.0 °C	1.73 W/m²K	7.4 m²	0 W
External Walls	-1.5 °C	2.41 W/m²K	4.9 m²	252 W
Internal Walls	20.0 °C	1.82 W/m²K	25.8 m²	0 W
Windows	-1.5 °C	2.00 W/m²K	1.5 m²	64 W
Ventilation	-1.5 °C			154 W

Heat loss per m²

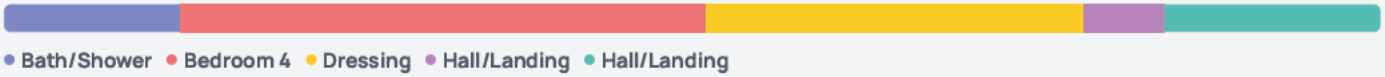
63 W/m²

HEAT LOSS BY FLOOR

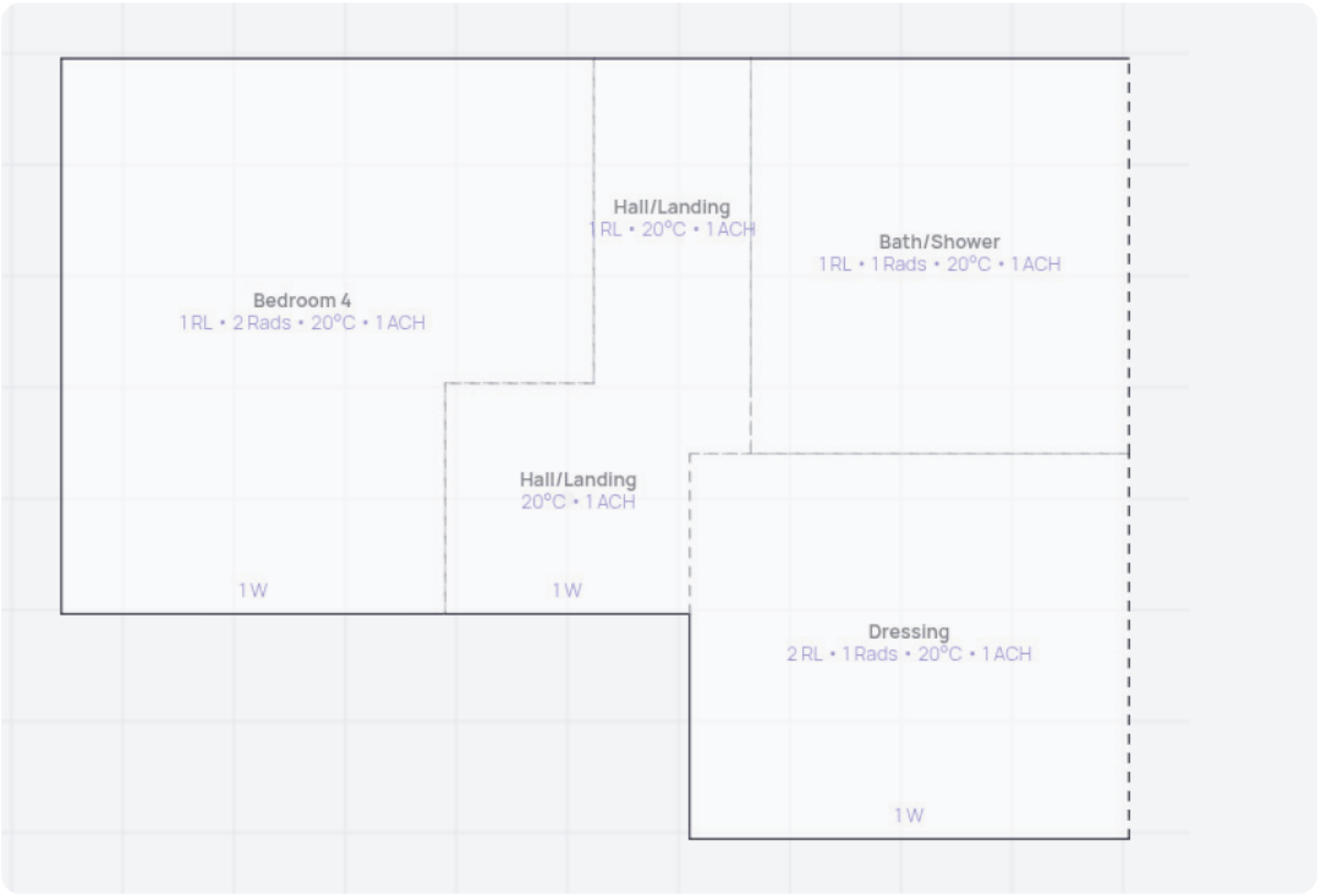
Second floor

Heat loss by room

3965 W



Bath/Shower • Bedroom 4 • Dressing • Hall/Landing • Hall/Landing



Rads: number of radiators

UFH: underfloor heating in room

°C: room temperature

ACH: air changes per hour

W: number of windows

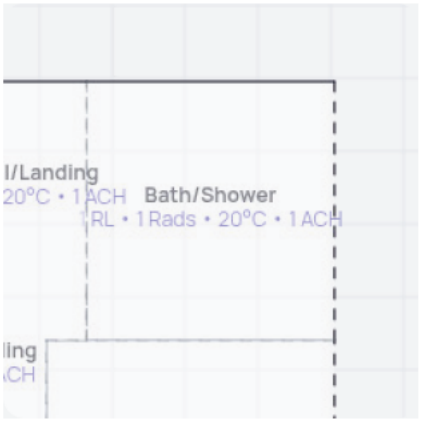
D: number of doors

HEAT LOSS BY ROOM

Bath/Shower

Total heat loss	Room temp	Air changes per hour
505 W	20 °C	1.0

Floor area	Average height	Volume
12.1 m²	1.6 m	18.8 m³



Heat loss by element

505 W

Roof • External Walls • Rooflights • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	12.1 m²	0 W
Roof	-1.5 °C	0.18 W/m²K	11.3 m²	44 W
External Walls	-1.5 °C	2.41 W/m²K	5.3 m²	273 W
Internal Walls	20.0 °C	1.82 W/m²K	10.8 m²	0 W
Party Walls	10.0 °C	0.00 W/m²K	5.5 m²	0 W
Rooflights	-1.5 °C	3.10 W/m²K	0.8 m²	54 W
Ventilation	-1.5 °C			134 W

Heat loss per m² 42 W/m²

Emitter performance

7% of 505 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Acova 3 column 600 x 800 mm	34 W	34 W	505 W	7 %

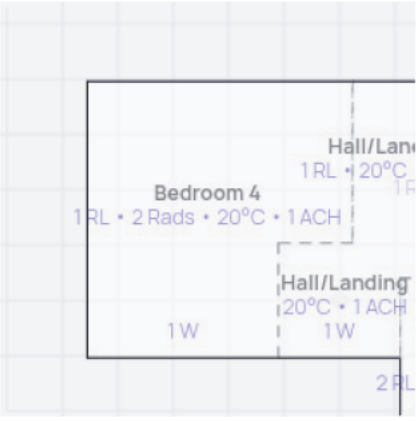
***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Bedroom 4

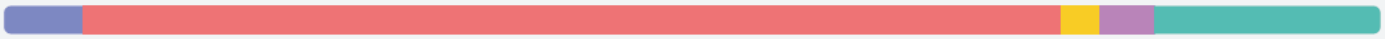
Total heat loss	Room temp	Air changes per hour
1536 W	20 °C	1.0

Floor area	Average height	Volume
21.1 m²	1.7 m	35.3 m³



Heat loss by element

1,536 W



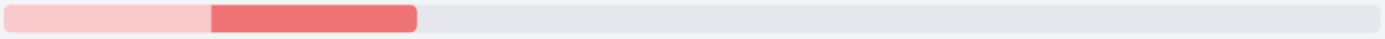
Roof • External Walls • Windows • Rooflights • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	21.1 m²	0 W
Roof	-1.5 °C	0.18 W/m²K	20.3 m²	79 W
External Walls	-1.5 °C	2.41 W/m²K	21.5 m²	1,115 W
Internal Walls	20.0 °C	1.82 W/m²K	10.6 m²	0 W
Windows	-1.5 °C	2.80 W/m²K	0.6 m²	36 W
Rooflights	-1.5 °C	3.10 W/m²K	0.8 m²	54 W
Ventilation	-1.5 °C			253 W

Heat loss per m² — 73 W/m²

Emitter performance

28% of 1536 W at 45 °C



Radiator • Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Acova 2 column 600 x 600 mm	216 W	432 W	1536 W	14 %
Radiator		Acova 2 column 600 x 600 mm	216 W	432 W	1536 W	14 %

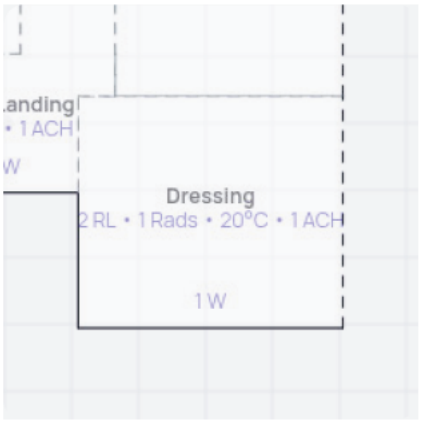
***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Dressing

Total heat loss	Room temp	Air changes per hour
1080 W	20 °C	1.0

Floor area	Average height	Volume
13.7 m²	2.3 m	31.4 m³



Heat loss by element

1,080 W

Roof • External Walls • Windows • Rooflights • Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	13.7 m²	0 W
Roof	-1.5 °C	0.18 W/m²K	12.3 m²	47 W
External Walls	-1.5 °C	2.41 W/m²K	12.9 m²	669 W
Internal Walls	20.0 °C	1.82 W/m²K	12.4 m²	0 W
Party Walls	10.0 °C	0.00 W/m²K	7.9 m²	0 W
Windows	-1.5 °C	2.80 W/m²K	0.8 m²	47 W
Rooflights	-1.5 °C	3.10 W/m²K	1.4 m²	93 W
Ventilation	-1.5 °C			224 W

Heat loss per m² — 79 W/m²

Emitter performance

46% of 1080 W at 45 °C

Radiator

EMITTER	IMAGE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Radiator		Type 22 (K2) 500 x 1000 mm	502 W	502 W	1080 W	46 %

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45 °C

HEAT LOSS BY ROOM

Hall/Landing

Total heat loss	Room temp	Air changes per hour
213 W	20 °C	1.0

Floor area	Average height	Volume
4.1 m²	1.4 m	5.8 m³

Heat loss by element

213 W

Roof · External Walls · Rooflights · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	4.1 m²	0 W
Roof	-1.5 °C	0.18 W/m²K	3.3 m²	13 W
External Walls	-1.5 °C	2.41 W/m²K	2.0 m²	104 W
Internal Walls	20.0 °C	1.82 W/m²K	12.1 m²	0 W
Rooflights	-1.5 °C	3.10 W/m²K	0.8 m²	54 W
Ventilation	-1.5 °C			42 W

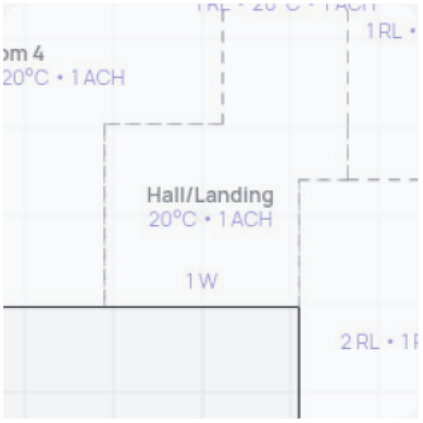
Heat loss per m² 52 W/m²

HEAT LOSS BY ROOM

Hall/Landing

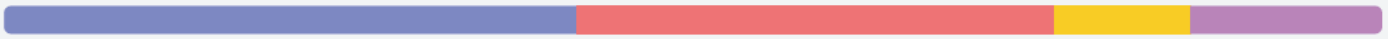
Total heat loss	Room temp	Air changes per hour
631 W	20 °C	1.0

Floor area	Average height	Volume
4.9 m²	2.4 m	11.8 m³



Heat loss by element

631 W



Roof · External Walls · Windows · Ventilation

	OTHER SIDE TEMPERATURE	U-VALUE	AREA	HEAT LOSS
Intermediate Floor	20.0 °C	1.41 W/m²K	4.9 m²	0 W
Roof	-1.5 °C	2.51 W/m²K	4.9 m²	264 W
External Walls	-1.5 °C	2.41 W/m²K	4.2 m²	219 W
Internal Walls	20.0 °C	1.82 W/m²K	17.9 m²	0 W
Windows	-1.5 °C	2.80 W/m²K	1.0 m²	63 W
Ventilation	-1.5 °C			84 W

Heat loss per m² 129 W/m²

System design

This section presents our proposed system design for the property. The design is based on the detailed room by room calculations in the previous section.

Proposed heat pump

Based on the property's design heat loss of **14.1 kW** and on all the attributes of the property that we recorded during our site survey, we would suggest the following heat pump.

Mitsubishi Ecodan R32 Monobloc 14kW	
Capacity at 45 °C (-1.5 °C)	15.68 kW
SCOP at 45 °C	3.77
Flow temperature	45 °C

This heat pump covers **111 %** of the heating requirement at and above the design temperature of **-1.5 °C**. The heat pump will be run on weather compensation so the efficiency will be higher when the weather is milder.

MCS certificate number
037-0035-20-01, 037-0035-20-02

Refrigerant
R-32

Model number
PUZ-HWM140VHA(-BS)

Sound power
67 dB(A)

Width
1020 mm

Height
1350 mm

Depth
360 mm

Weight
132 kg

Capacity (kW)

OUTSIDE TEMP	35°C	40°C	45°C	50°C	55°C
-7°C	15.9	15.7	15.5	14.7	14
2°C	16.3	16	15.8	15.1	14.3
7°C	16.6	16.4	16.1	15.4	14.6

Seasonal Coefficient of Performance (SCOP)

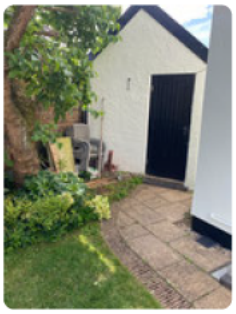
SCOP is the average coefficient of performance over the heating season, accounting for the variation in outdoor temperature. Manufacturers have to test their equipment in standard conditions and report their SCOP performance data to be eligible for certification.

	35°	40°	45°	50°	55°
SCOP	4.33	4.05	3.77	3.51	3.26

Location

Ground works, digging under path for heating pipes, tree 1.5m away

- Mounting location: Ground
- Base to be built by: Installer
- Condensate drain: Soak away to be dug



SYSTEM DESIGN

Emitters

Emitters (i.e., radiators/fan coils/underfloor heating) are a vital part of the heating system. They take the heat produced by the heat source and distribute that heat around the property.

Based on the room by room heat loss results, we propose the following emitter design for the property. This design will ensure each room can be heated to its set point when it's -1.5 °C outside whilst maintaining high system efficiency.

Design conditions

- Flow temperature = 45 °C
- Temperature drop across the radiator (delta T) = 5 °C
- Mean radiator temperature = 42.5 °C

Emitter replacements

We propose replacing or adding emitters in the following rooms:

1. Hall/Landing
2. Living/Lounge
3. Study
4. Bath/Shower
5. Bedroom 2
6. Bedroom 3
7. Bedroom 4
8. Dressing

SYSTEM DESIGN

Current emitters in the property

ROOM	IMAGE	TYPE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Dining + Kitchen		Radiator	Type 22 (K2) 600 x 1800 mm	1044 W	1718 W	1281 W	134 %
		Radiator	Type 22 (K2) 700 x 900 mm	582 W			
		Secondary	Plinth heater 10%	92 W			
Hall/Landing		Radiator	Type 21 (P+) 600 x 1100 mm	497 W	768 W	931 W	82 %
		Radiator	Type 21 (P+) 600 x 600 mm	271 W			
Living/Lounge + Living/Lounge		Radiator	Type 21 (P+) 600 x 1600 mm	723 W	723 W	1819 W	40 %
		-		0 W			
Study + Study		-		0 W	0 W	1760 W	0 %
		-		0 W			
Utility		Radiator	Stelrad vertical 1800 x 400 mm	502 W	502 W	320 W	157 %
Bath/Shower		Radiator	Type 11 (K1) 700 x 500 mm	190 W	190 W	412 W	46 %
Bath/Shower + Bedroom 3		-		0 W	34 W	1819 W	2 %
		Radiator	P+ 400 x 1600 mm	34 W			
Bedroom 1		Radiator	Type 22 (K2) 500 x 1000 mm	502 W	502 W	503 W	100 %
Bedroom 2		Radiator	P+ 400 x 1600 mm	34 W	34 W	871 W	4 %
Hall/Landing		-		0 W	0 W	470 W	0 %
Bath/Shower		Radiator	Acova 3 column 600 x 800 mm	34 W	34 W	505 W	7 %

ROOM	IMAGE	TYPE	DETAILS	EMITTER OUTPUT	ROOM OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Bedroom 4		Radiator	Acova 2 column 600 x 600 mm	216 W	432 W	1536 W	28 %
		Radiator	Acova 2 column 600 x 600 mm	216 W			
Dressing		Radiator	Type 22 (K2) 500 x 1000 mm	502 W	502 W	1080 W	46 %
Hall/Landing + Hall/Landing		–		0 W	0 W	844 W	0 %
		–		0 W			

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45.0 °C

SYSTEM DESIGN

Proposed emitter changes

ROOM	STATUS	IMAGE	TYPE	DETAILS	EMITTER OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Dining + Kitchen	Keep		Radiator	Type 22 (K2) 600 x 1800 mm	1044 W	1281 W	134 %
	Keep		Radiator	Type 22 (K2) 700 x 900 mm	582 W		
	Keep		Secondary	Plinth heater 10%	92 W		
Hall/Landing	Replacement		Radiator	Type 22 (K2) 700 x 1100 mm	711 W	931 W	105 %
	Keep		Radiator	Type 21 (P+) 600 x 600 mm	271 W		
Living/Lounge + Living/Lounge	Replacement		Radiator	Type 22 (K2) 700 x 2000 mm	1291 W	1819 W	103 %
	New		Radiator	Type 22 (K2) 600 x 1000 mm	580 W		
			-		0 W		
Study + Study	New		Radiator	Type 33 (K3) 700 x 1200 mm	1072 W	1760 W	101 %
	New		Radiator	Type 22 (K2) 700 x 1100 mm	711 W		
			-		0 W		
Utility	Keep		Radiator	Stelrad vertical 1800 x 400 mm	502 W	320 W	157 %
Bath/Shower	Replacement		Radiator	Type 22 (K2) 700 x 700 mm	452 W	412 W	110 %
Bath/Shower + Bedroom 3	New		Radiator	Towel rail - Straight white 1744 x 600 mm	333 W	1819 W	100 %
	Replacement		Radiator	Type 33 (K3) 300 x 2000 mm	910 W		
	New		Radiator	Type 22 (K2) 600 x 1000 mm	580 W		
Bedroom 1	Keep		Radiator	Type 22 (K2) 500 x 1000 mm	502 W	503 W	100 %**
Bedroom 2	Replacement		Radiator	Type 33 (K3) 300 x 2000 mm	910 W	871 W	104 %

ROOM	STATUS	IMAGE	TYPE	DETAILS	EMITTER OUTPUT	ROOM DEMAND	% HEAT DEMAND MET*
Hall/Landing	New		Radiator	Type 22 (K2) 600 x 900 mm	522 W	470 W	111 %
Bath/Shower	Replacement		Radiator	Type 22 (K2) 700 x 800 mm	517 W	505 W	102 %
Bedroom 4	Replacement		Radiator	Type 33 (K3) 700 x 900 mm	804 W	1536 W	105 %
	Replacement		Radiator	Type 33 (K3) 700 x 900 mm	804 W		
Dressing	Replacement		Radiator	Type 33 (K3) 500 x 1600 mm	1101 W	1080 W	102 %
Hall/Landing + Hall/Landing			-		0 W	844 W	107 %
	New		Radiator	Type 22 (K2) 700 x 1400 mm	905 W		

***% Heat demand met:** This is calculated for a day when the outdoor temperature is -1.5 °C and the flow temperature is 45.0 °C

****** Accepting undersized emitters**

Please note that the emitters do not meet the room heat demand in all cases. This means that the following rooms will not reach their set point temperature at the design flow temperature. If you choose to go ahead, you are acknowledging that you are happy with the above. If that doesn't sound right please contact us before proceeding with the install.

Bedroom 1 1 Watt!

SYSTEM DESIGN

Hot water

The heat pump will provide 100% of the hot water requirement. Heat pumps cannot create heat as quickly as combi boilers, so they can't heat up hot water instantaneously when you need it. Instead we install a cylinder which stores hot water so it's always ready when you need it.

Proposed cylinder model

We've selected the following hot water cylinder based on the number of bedrooms in the property.

200l

Capacity	200 litres

Cylinder location

Boiler cupboard, utility

Hot water demand

The calculation below shows how much electricity we expect the heat pump to use for providing hot water, based on our assumptions about how much hot water people typically use in a year.

Total electricity per year for hot water — 756 kWh

Normal operation	670 kWh
Electricity per day	1.83 kWh
Heat energy per day	5.98 kWh
Volume per day	90 litres/day
Assumed mains water temp	10 °C
Storage temp	50 °C
Distribution efficiency	70 %
Heat pump sCOP (55 °C flow)	326 %

Legionella cycles	86 kWh
Electricity per cycle	3.32 kWh
Heat energy per cycle	3.32 kWh
Volume per cycle	200 litres
Tank starting temperature	50 °C
Legionella set point	60 °C
Distribution efficiency	70 %
Legionella cycle efficiency	100 %
Cycles per year	26

Reheat time — 0 h 39 min

Once depleted, it will take the cylinder **0 h 39 min** to fully reheat based on the following inputs:

Cylinder volume	200 litres
Mains water temp	10 °C
Hot water storage temp	50 °C
Heating power	14.18 kW

Sound assessment

Pass

To class as "permitted development" the heat pump design must comply with regulations regarding the sound level at a neighbour's nearest window/door. This section presents the results of the sound assessment we've conducted for the proposed heat pump and location, as set out in MCS 020a v1.0

This assessment accounts for:

- The sound level of the heat pump itself
- The influence of the space that it is in
- Any barriers between the heat pump and the assessment position

Assessment position:

Sound pressure level

Sound power level Mitsubishi Ecodan R32 Monobloc 14kW PUZ-HWM140VHA(-BS)	67 dB(A)
Reduction due to distance Reflective surfaces: three reflecting surfaces (Q=8) Distance (heat pump to assessment position): 12 m	23.5 dB(A)
Reduction due to barriers No line of sight, Solid brick/masonry wall or fence more than 18mm thick	10 dB(A)
Total	**33.5 dB(A)**

Result

Pass

Maximum allowed value	37 dB(A)
Final result at assessment position	**33.5 dB(A)**

Performance estimate

Predicting running costs with a heat pump is hard as it depends on a lot of factors, many of which are outside our control. But it's clearly really important that you're able to make an informed decision. So in this section we give you our best estimate of what the running costs and carbon savings will look like for the property if and when you switch to a heat pump.

We then provide an in-depth description of how we've calculated these figures in case you want to dig into the details. Please do ask us if anything doesn't make sense!

Summary

Bills

Current	£2,343
Proposed system	£1,254 to £2,259
Savings	£84 to £1,089

Carbon

Current	7.0 tonnes CO_2
Proposed system	1.1 tonnes CO_2
Savings	84%

PERFORMANCE ESTIMATE

Detailed results

The running costs and carbon emissions of a heating system depends on a few key factors, all of which are explained in (even) more detail further down this report:

1. **Your property's heating and hot water demand**
   This is how much heat your property needs for heating and hot water in the year irrespective of what heating system is used to provide it. It's surprisingly hard to put a definitive number on this because it depends on how often you have the heating on and at what temperature, how much hot water you use, and the weather outside.
   - **Heating Degree Days** – Based on the heat loss calculations we have done combined with "heating degree day" data which represents the typical annual weather pattern in the area.

   We would usually also provide an estimate based on the EPC but we can't do that in this case because a representative EPC cannot be obtained for this property because of planned building work.

2. **The efficiency of your system**
   The efficiency of your system describes how much heat your system makes from what you pay for (electricity/gas/oil), both in heating and when making hot water. This depends on the system design, install quality, and how you run the system. We've included two sets of numbers here. One using fixed efficiencies from MCS and another using the Manufacturer's tested values.

   The MCS estimate uses standard efficiency values, which are the same for all heat pumps and only depend on the flow temperature the system is designed at. They tend to be more conservative. Manufacturer's efficiencies use their test data at standard conditions. We've included both to give you a fair picture of what to expect.

3. **Energy prices**
   Heat pump running costs depend on the price of electricity, and the comparison with your old system depends on the price of mains gas. We've included numbers both at the price cap and with a heat pump tariff, to show the range of what you might pay depending on the tariff you are on. We've included more info on heat pump tariffs further down.

4. **Emission factors**
   Emission factors show how much carbon dioxide is emitted per unit of energy provided by a fuel. They are a measure of how "clean" a fuel is.

PERFORMANCE ESTIMATE

MCS031 Performance estimate

The table below shows a performance estimate in MCS's required table layout following the methodology laid out in MCS 031 Issue 4.0.

Heat Pump System Performance Estimate	
Your energy requirements	
Energy required for heating	**28,984** kWh
Demand to be supplied by the heat pump	**28,984** kWh
Energy required for hot water	**2,183** kWh
Demand to be supplied by the heat pump	**2,183** kWh
Your property	
Your postcode prefix	**BS**
Total property floorspace (not property footprint)	**199** m^2
Average watts per square metre	**71** W/m^2
Note: W/m2 is a measure of your property's thermal efficiency. 0-30W/m2 is very low heat loss and 120-150W/m2 is very high heat loss.	
Proposed system	
Heat pump capacity	**15.7** kW
Heat pump type	**ASHP**
Your system is proposed to provide:	**Space heat and hot water**
Your proposed heating system will be (select one):	**Upgraded radiators**
The proposed flow temperature will be	**45** °C
Performance	
The Seasonal Performance Factor is calculated to be:	**3.4**
Estimate of energy consumption of the proposed heat pump (or combined system where Hybrid).	**High: 10,790** kW → **Low: 8,828** kW
Note: you can convert these figures to approximate running costs.	
Important Note: This is not a detailed system design. It offers a reasonable estimate of likely performance and a description of the likely design.	
This estimate is based on a full heat loss survey and design.	

PERFORMANCE ESTIMATE

Results table - Manufacturer's efficiencies

The table below shows running cost and carbon savings estimates based on efficiencies from manufacturer's test data, which often shows higher efficiencies than MCS's fixed values.

	BASED ON HEAT LOSS CALCULATIONS AND HEATING DEGREE DAYS		BASED ON EPC	BASED ON LAST YEARS CONSUMPTION
Demand			Unavailable	Unavailable
Heating	28,984 kWh			
Hot Water	2,183 kWh			
Total	31,167 kWh			
Efficiency	Existing (Mains gas)	Heat pump (Electricity)	Unavailable	Unavailable
Heating	93 %	377 %		
Hot water	93 %	326 %		
Consumption	Existing (Mains gas)	Heat pump (Electricity)	Unavailable	Unavailable
Heating	31,166 kWh	7,688 kWh		
Hot Water	2,348 kWh	670 kWh		
Total	33,513 kWh	8,358 kWh		
Bills	Existing (Mains gas)	Heat pump (Electricity)	Unavailable	Unavailable
Price cap (27.03 p/kWh)	£2,343	£2,259 £84		
OVO Heat Pump Plus (15 p/kWh)	£2,343	£1,254 £1,089		

Octopus Cosy (22.13 p/kWh)	£2,343	£1,850 **£493**		

Carbon	Existing (Mains gas)	Heat pump (Electricity)	Unavailable	Unavailable
Totals	7,038 kg	1,137 kg **5,901 kg**		

PERFORMANCE ESTIMATE

Inputs and assumptions

In each of the following sections, we break down how we've calculated the numbers that appear in the results table.

Heat energy required

To work out how much energy the property needs to keep it warm, we first have to work out how much heat is required. That might sound strange, but because different heating sources have wildly different efficiencies, this heat energy number will need to be divided by the system efficiency (see next section) to calculate the actual energy required.

	BASED ON HEAT LOSS CALCULATIONS AND HEATING DEGREE DAYS	BASED ON EPC	BASED ON LAST YEARS CONSUMPTION
	1835 degree days, 658 W/°C	Unavailable	Unavailable
Heating	28,984 kWh		
Hot water	2,183 kWh		
Total	31,167 kWh		

System efficiency

The efficiency of a heating system describes how much useful output (heat) you get per unit of what you pay for (electricity/gas/oil). A system's efficiency will often be different when it is doing space heating vs. when it's making hot water because the temperature that the system is heating the water to is often hotter in water heating cycles. We have used the following inputs when modelling the system.

Existing heating system

Existing heating system fuel:	Mains gas
Efficiency - space heating:	93%
Efficiency - hot water:	93%

Heat pump system

Type of system:	Air source heat pump
Model:	Mitsubishi Ecodan R32 Monobloc 14kW
MCS certificate numbers:	037-0035-20-01, 037-0035-20-02
Flow temperature - space heating:	45°C
Flow temperature - hot water:	55°C

	MCS SPF	MANUFACTURERS SCOP
Heating efficiency	340 %	377 %
Hot water efficiency	170 %	326 %

Energy prices

As the last few years have shown, energy prices are very hard to predict. In modelling bills we have used the current energy price cap and also shown you a few different heat pump tariff options.

There are an increasing number of heat pump tariffs that give you access to cheaper electricity. These fall into two categories: **type of use** and **time of use**.

Type of use heat pump tariffs detect how much electricity the heat pump is using, and charge you a lower rate for that electricity.

Time of use tariffs charge you different amounts depending on when you use the electricity. So you can set the hot water heating schedule (and to a lesser extent the space heating schedule) to make use of lower prices.

If you have solar (or are planning to install it), the electricity prices will also be lower because the heat pump will use some of the electricity that the solar is generating. This is especially true for hot water consumption because you can schedule the hot water to run in the middle of the day.

Mains gas	Unit price
Price cap	6.99 p/kWh

Electricity	Unit price
Price cap	27.03 p/kWh
OVO Heat Pump Plus*	15 p/kWh
Octopus Cosy**	22.13 p/kWh

*Currently only available for Vaillant, Viessmann and Mitsubishi heat pumps
**Based on Octopus's expectations of customer consumption patterns on the cosy octopus tariff as of April 2025

You may want to check out some of these heat pump tariffs (we haven't vetted these):

Type of use:

- OVO heat pump plus: 15p/kWh. Vaillant, Viessmann and Mitsubishi heat pumps only currently.

Time of use:

- EDF: 10p/kWh off from 4-7am and from 1-4pm
- Octopus Cosy: Cheaper pricing 4am-7am and 1-4pm. Peak pricing 4pm -7pm
- Octopus Agile: Half-hourly pricing which tracks the wholesale price. Goes both very high and negative.

Emission factors

We've used the emission factors from the government's SAP 2010 methodology. For gas this value is fixed but for electricity it is falling over time as the grid decarbonises. This means the system will get cleaner and cleaner. The value used here is based on a projected continued reduction in grid carbon intensity.

Gas	Electricity
210 gCO2/kWh	136 gCO2/kWh

Dependence of performance on flow temperature

How much electricity the heat pump will use to provide heating depends on the flow temperature that the system runs at. We have designed the system to run at 45°C when it's -1.5°C outside and we'll set it up to use weather compensation so it runs more efficiently at milder temperatures.

To demonstrate the importance of flow temperature, the table below shows how much electricity the system would consume to provide heating at a range of flow temperatures. This graph is based on the heat loss calculations and heating degree days based estimate, but the pattern would be similar for any of the inputs.

	35°	40°	45°	50°	55°
SCOP	4.33	4.05	3.77	3.51	3.26
Electricity consumed (kWh/year)	7198	7696	8267	8879	9560

PERFORMANCE ESTIMATE

MCS Key facts - Energy Performance Estimate

Predicting the heat demand of a building, and therefore the performance and running costs of heating systems, is difficult to predict with certainty due to the variables discussed here. These variables apply to all types of heating systems, although the efficiency of heat pumps is more sensitive to good system design and installation. For these reasons your estimate is given as guidance only and should not be considered as a guarantee.

Seasonal Coefficient of Performance:

MCS Seasonal Coefficient of Performance (SCoP) is derived from the EU ErP labelling requirements, and is a theoretical indication of the anticipated efficiency of a heat pump over a whole year using standard (i.e. not local) climate data for 3 locations in Europe. It is used to compare the relative performance of heat pumps under fixed conditions and indicates the units of total heat energy generated (output) for each unit of electricity consumed (input). As a guide, a heat pump with a MCS SCoP of 3 indicates that 3 kWh of heat energy would be generated for every 1 kWh of electrical energy it consumes over a 'standard' annual cycle.

Energy Performance Estimate

An Energy Performance Certificate (EPC) is produced in accordance with a methodology approved by the government. As with all such calculations, it relies on the accuracy of the information input. Some of this information, such as the insulating and air tightness properties of the building may have to be assumed and this can affect the final figures significantly leading to uncertainty especially with irregular or unusual buildings.

Identifying the uncertainties of energy predictions for heating systems

We have identified 3 key types of factor that can affect how much energy a heating system will consume and how much energy it will deliver into a property. These are 'Fixed', 'Variable' and 'Random'. Most factors are common to ALL heating systems regardless of the type (e.g oil, gas, solid fuel, heat pump etc.) although the degree of effect varies between different types of heating system as given in the following table.

The combined effect of these factors on energy consumption and the running costs makes overall predictions difficult however an accuracy + 25-30% would not be unreasonable in many instances. Under some conditions even this could be exceeded (e.g. considerable opening of windows). Therefore it is advised that when making choices based on mainly financial criteria (e.g. payback based on capital cost versus net benefits such as fuel savings and financial incentives) this variability is taken into account as it could extend paybacks well beyond the period of any incentives received, intended occupancy period, finance agreement period etc.

'Fixed' which include:

Factor	Impact
Equipment Selection Performance figures (SCoP) from ErP data	System Efficiency
Energy Assessment via the EPC (e.g. assumptions as to fabric construction and levels of insulation; the variation in knowledge and experience of Energy Assessors)	Energy Required

'Variable' which are affected by the system design and include:

Factor	Impact
Accuracy of sizing of heat pump-i.e. closeness of unit output selection (kW) to demand heat requirement (kW)	System Efficiency
Design space and ambient (external) temperatures	Energy Required
Design flow / return water temperatures and weather compensation	System Efficiency
Type of Heat emitter (e.g. Under-floor; natural convector (e.g. radiator), fan convector etc.)	System Efficiency

'Random' which cannot be anticipated and include:

Factor	Impact
User behaviour:	
• Room temperature settings	Energy Required
• Hot water usage and temperature settings	Energy Required
• Occupancy patterns/times	Energy Required
• Changing the design HP flow temperatures	System Efficiency
• Ventilation (i.e. opening windows)	Energy Required
Annual climatic variations (i.e. warmer and colder years than average)	Energy Required

Key

The statement at the end of each item indicates the major factor affected as follows:

Energy Required: the heat energy output requirement of the system which directly impacts on running costs. This requirement exists regardless of the heating system chosen as it is the heat required to keep the space comfortable. Opening windows or increasing room temperatures will demand more heat output, which means more energy input but this would NOT directly affect the efficiency. Thus increased energy demand does NOT automatically mean reduced efficiency.

System Efficiency: the efficiency of the system has been directly affected and will therefore demand more input energy to achieve the same heat output thus increasing running costs. However, increased energy input does NOT necessarily mean lower system efficiency (see above).