

HYBRID HEATING TRIAL 2024

1ST JANUARY – 31ST DECEMBER 2024



“

We definitely recommend this. From cost benefits and the easy to use system, to managing the heating system, it makes regulating temperature around the house easy.

-Chloe Bowman & Thomas Walker (Castlecoole Tenants)

”

CASTLECOOLE CASE STUDY 2024

Measuring the impacts of hybrid heating in Northern Ireland's retrofit market.



Castlecoole Park,
Belfast, BT8 7BE



Home Occupied
x2 Adults



Mid-Terrace House
EPC Rating C71



11.60°C Average
Outside Temperature

ABOUT THE TRIAL

PROJECT BACKGROUND

The aim of this project is to assess the impact of a hybrid heating system in Northern Ireland's retrofit market, which faces unique challenges in terms of decarbonisation solutions.

As part of the trial an Alpha E-Tec Hybrid Heat Pump was installed, including an air source heat pump, combination boiler and comprehensive monitoring system. A heat loss study was conducted on the property (1) establishing a heat loss of 4,583W with correctly sized radiators for a 62°C flow temperature, as shown in Table 1.

Property Details	
Year built	Pre 2000
Design Data	
Outside Design Temp - ODT (°C)	-4
Degree Days (DD)	2360
Mean air temp - MAT (°C)	9.4
Altitude (m)	46
Building Requirements	
Space Heating load (W)	4583
Total area of building (m ²)	82.25
Average Watts per metre square (W/m ²) heat loss	56

(Table 1 - Heat Loss Output)

Hybrid heat pumps provide a **comfortable, unique and affordable solution** within the **NI home heating** market.



No need to upgrade pipework



Operates at higher temperatures



Access to instant hot water



No need for a hot water tank



Energy security - cheapest fuel source



Backed up by combi gas boiler

CASE STUDY DESCRIPTION

This case study lays out optimal settings for a hybrid system, factoring in user comfort and cost. The system operates similarly to an air source heat pump, with a preset setback temperature. Setback temperature controls give homeowners the ability to set a minimum internal temperature during times when heating is not set to reach a preferred temperature. This helps conserve energy and support system efficiencies.

Data for this trial was recorded between 1st January and 31st December 2024 and used specific parameters, including an 18°C setback temperature, programmed with a 5 hour period at 21°C, 2 hours in the morning and 3 hours in the evening (as shown in Table 2).

On 23rd February 2024, two tenants moved into the property, allowing for the system's feasibility to be assessed while occupied. The tenants agreed to continue with a five hour period at 21°C, however modified the timings slightly during the weekends to suit their individual needs (as shown in Table 2).

Parameter	Initial Setting	Tenant Settings
<i>Programmed Heating Times</i>	Mon - Sun 0600-0800 Mon - Sun 1800-2100	Mon - Fri 0600-0800 Sat - Sun 0800-1000 Mon - Sun 1800-2100
<i>Heating Temperature</i>	21°C	21°C
<i>Setback Temperature</i>	18°C	18°C
<i>Electricity Cost</i>	£0.34 per kWh	£0.34 per kWh
<i>Gas Cost</i>	£0.115 per kWh	£0.115 per kWh (Jan - Mar) £0.0868 per kWh (Apr - Dec)

(Table 2 - Trial Parameters and System Settings)

MONITORING SYSTEM

The trial monitoring system consists of two heat meters to measure key metrics (delta T, flow rate, flow & return temperature, power, total heat energy and volume of the heating system). One meter worked to measure outputs from the air source unit, while the other measured total heating output. Current transformers measured the electrical usage of the house, air source unit and boiler. The volume of hot water used was also measured, while three thermometers recorded the outdoor, living room and bedroom temperatures.

USING THE HYBRID SYSTEM

HYBRID HEAT PUMP USED

The Alpha E-Tec Hybrid heat pump was previously selected for this trial following the heat loss study. Key features of this unit are:

- 4kW Heat Pump
- 33kW Combi Boiler
- Smartech Plus Wi-Fi Controller
- System uses energy prices (based on current tariffs) and temperature to choose the most efficient energy source.
- Checks heating flow temperature every 20 minutes to assess if boiler backup is required.
- Boiler automatically backs up after 1.5h if the house has not reached desired temperature.
- Boiler heats water instantly giving 24/7 access to hot water.

AVERAGE TEMPERATURE

11.66°C

Average outside temperature during the trial with a low of -2°C and a high of 24.78°C.

Using Met Office data from 1991-2020 the yearly average temperature for Belfast over this period is 9.65°C (2).

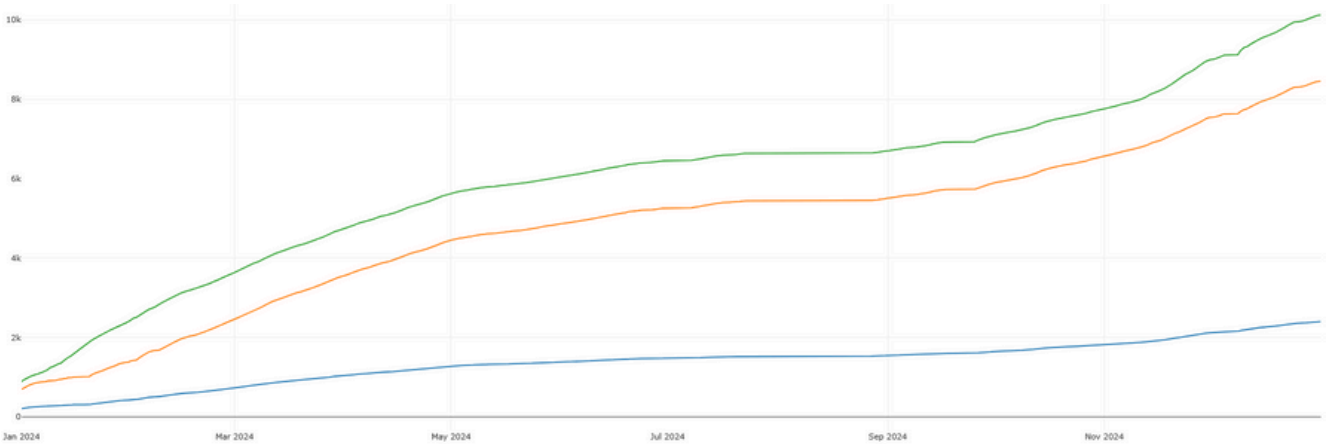
“ We have been really happy with the hybrid heat pump over the past year. We would definitely recommend this system to family and friends. ”

-Chloe Bowman & Thomas Walker (Castlecoole Tenants)

PERCENTAGE HEAT PROVIDED

Total heat output, air source heat output and electrical energy consumed is shown in Table 4. The figures show that total heat provided to the property during the trial period was 9,225 kWh.

This is broken down into 7,756 kWh from the heat pump and 1,469 kWh from the gas boiler. Therefore, 84% of heat was provided by the heat pump, while 16% was provided by the boiler.



“ The controls are really easy to use and allow us to keep our home at a comfortable temperature. ”

-Chloe Bowman & Thomas Walker (Castlecoole Tenants)

Monitoring Values	Usage	Key
ASHP Electrical Consumption (kWh)	2,191 kWh	Blue
ASHP Heat Output (kWh)	7,756 kWh	Orange
Total Heat Output (kWh)	9,225 kWh	Green

(Table 3 - Total Heat Energy Produced & Electric Consumed)

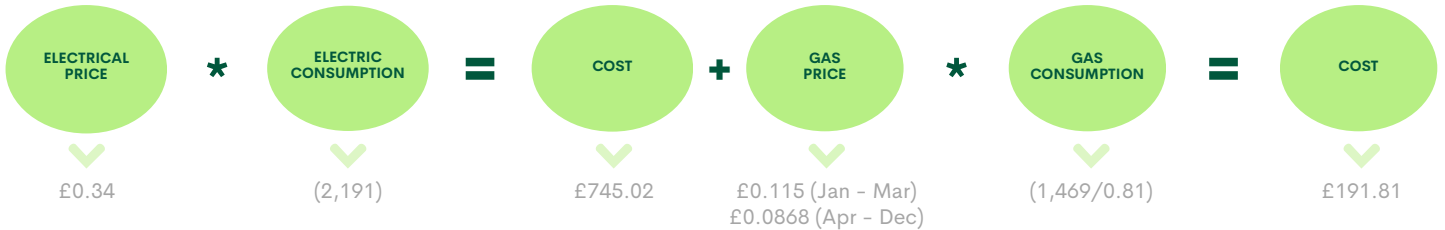
CO-EFFICIENT OF PERFORMANCE

The combination gas boiler used as part of this trial operated at 81% efficiency throughout the trial period. Heat pumps have efficiencies greater than 1, known as a COP (Co-efficient of Performance). The COP of the heat pump during this trial was 3.54, meaning that for every kW of electricity used, 3.54 kW of heat was provided.

COST & CARBON SAVINGS

AVERAGE HYBRID RUNNING COSTS

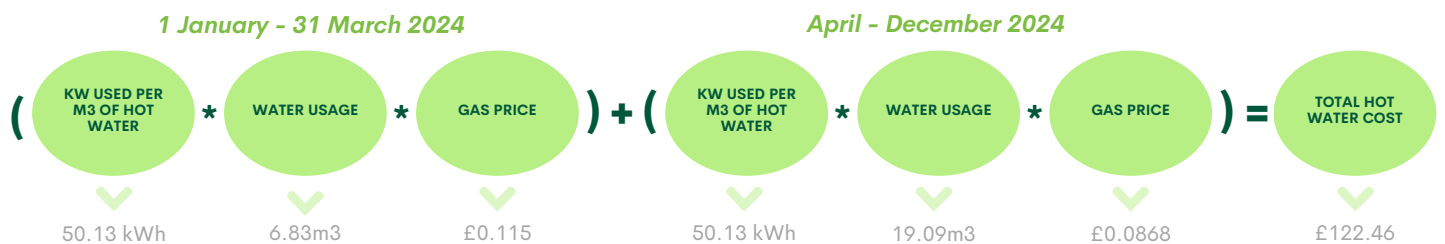
During the study, we compared electricity and gas consumption before and after the trial to calculate heating usage and cost. Throughout the trial, the **total cost for heating (not including DHW) was £936.83**, averaging **£2.56 per day**. If the same amount of heat was provided by a gas-only system, fuel costs would have totaled £1,082.53, or £2.96 per day based on gas prices for the trial period. According to the total heat output (as shown in Table 3), divided by boiler efficiency (81%), multiplied by gas price (3), **the hybrid system proved £0.40 cheaper per day compared to heating costs of a traditional gas heating system (5)**.



If the same heat was provided by an air source heat pump with a COP of 2.8 (6), the annual fuel cost would have totaled £1,120.18 or £3.06 per day. The hybrid heating system would therefore save £0.50 per day.

HOT WATER COSTS

During the initial trial hot water was tested for one hour, including gas meter readings. During this time 16.794kWh of gas was used to produce 0.335m3 of hot water, equating to 50.13kWh of gas used per m3. To determine the total hot water cost during this trial the below calculation was used. An average domestic hot water value was taken from March to December and applied to both January & February.



During the trial, hot water costs totaled £122.46 equating to £0.33 per day (4).

CARBON INTENSITY & CARBON SAVINGS

Figures taken from SEAI (7) and shown in Table 4 outline the carbon intensity of gas, kerosene and electric. This enables us to calculate the carbon savings of a hybrid heating system when compared to both a kerosene only and gas only system. Based on the trial data, a kerosene oil-only system would have emitted 3,220kg of carbon, while a gas-only system would have emitted 2,556kg. On the other hand, the hybrid system emitted just 1,287kg of carbon.

Fuel Type	Carbon Intensity
Gas	204g Co2/kWh
Kerosene Oil	257g Co2/kWh
Electric	255g Co2/kWh

(Table 4 - SEAI Carbon Intensity of Fuel Types)

Over the course of the year, switching from oil to hybrid would save 2.25 tonnes of carbon.



REFERENCES:

(1) Joshua Rowe (October 2023), 20 Castlecoole Heat Loss Study. (2) Belfast Newforge (County Antrim) UK climate averages (no date) Met Office. (3) SSE Gas Price 1st January - 30th September 2024. (4) Hot water demand retrospectively added to January & February by applying average hot water use during 6 months of tenant occupancy. (5) Consultation on support for low carbon heating in residential buildings. (6) Electrification of Heat Demonstration Project Summary Report. (7) Conversion factors (2022) Sustainable Energy Authority Of Ireland.