

---

# Case Study

---

## Edmondthorpe

---

Improving the energy  
performance of small  
homes with Ambion  
Low Carbon Heat Panels

---

ambion



# Case Study: Edmondthorpe, Melton Mowbray

Improving the energy performance of small homes  
with Ambion Low Carbon Heat Panels

“A decarbonised home [is] electrically  
heated with “enough” insulation to be  
affordable to heat comfortably”

– Hard to Decarbonise Social Homes  
Report, July 2022



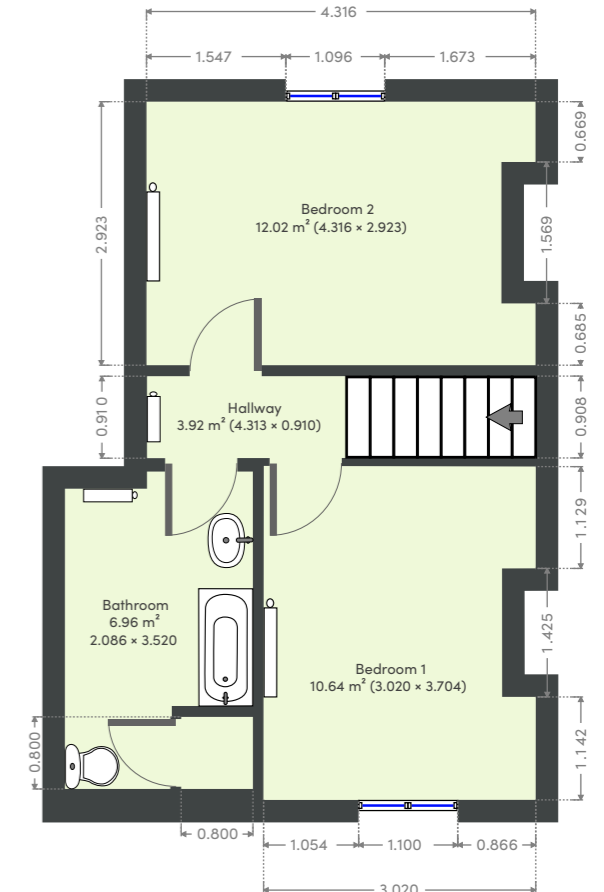
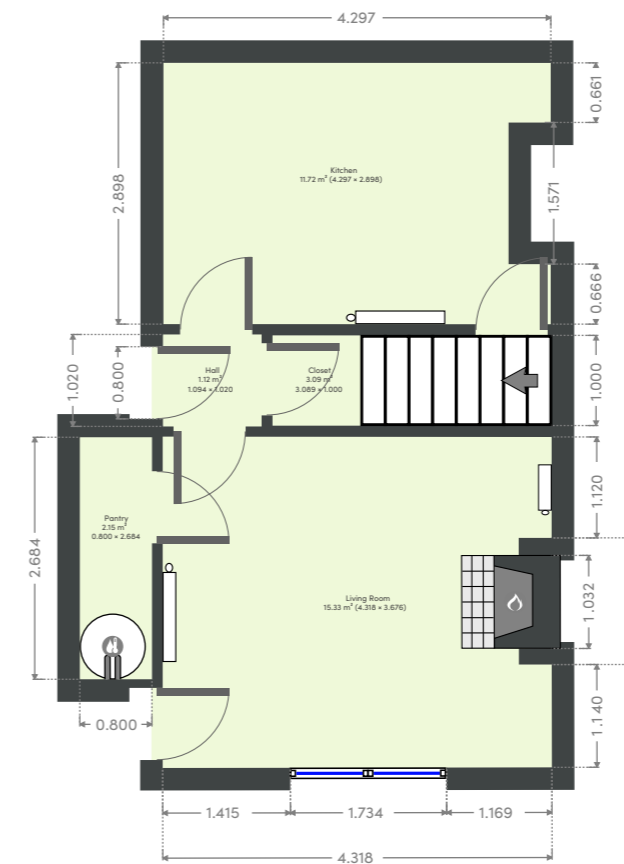
## ABOUT THE PROPERTY

The property is a two-bedroom, semi-detached house, located on the Pochin Estate, Edmondthorpe near Melton Mowbray.

The property sits within the village Conservation Area boundary and comprises a ground floor and a first floor totalling 71 m<sup>2</sup> (764 sqft). The property is built out of traditional ironstone and dates back to the 1860's.

Heating was provided by electric storage heaters with manual controls, and had an electric instantaneous at-point-of-use water heating system.

The property had an annual heat demand of 11,928 kWh (10,198 heating and 1,730 kWh water) and an EPC rating of F25.



THE  
Pochin Estate



---

# The problem

**In England, rental properties are governed by the Minimum Energy Efficiency Standard (MEES) regulations which require the Landlord's properties to reach a minimum rating of an 'E' EPC. More recent discussions have implied that all rental properties will require an EPC rating of C or above by 2025 and Landlords will have until 2028 to comply with this.**

The Property in Edmondthorpe, as with many traditionally-built properties, is built out of traditional building materials and lacks wall insulation. This resulted in a very low thermal efficiency and an EPC rating of F25. The upcoming legislative change prompted the Estate to look at future-proofing the vacant property.

The Estate was looking to bring the EPC rating up to a D immediately with the ambition of progressing to a C. To do this, an upgrade to the fabric of the property and changing to low carbon heating technologies was required.

The Estate was also clear that the property's heating system needed to continue to be electric, as carbon emissions produced by electricity are lowering rapidly as the country builds more renewable capacity and closes the most carbon intensive power stations (e.g. coal). This presents electricity a much lower carbon intensity than gas and this widening trajectory is set to continue<sup>1</sup>.

This means that the emissions reductions due to electrification will be even more significant in the future, so 'future-proofing' the property as a low carbon home.

The challenge with electric heating is that the unit cost of electricity is some three to four times that of gas, so thermal comfort needs to be achieved using significantly fewer kWh if fuel poverty is to be avoided.

While fabric upgrades would help mitigate this by reducing energy use, the Estate was looking for a space and water heating system with levels of energy performance well ahead of conventional electric systems in order further to reduce energy consumption.

The Estate was not satisfied with the 1:1 energy performance of storage heaters (in which 1 kWh of electricity is required to satisfy 1 kWh of heat demand), nor the levels of thermal comfort produced, so this technology was definitely to be replaced. Heat pumps were not the answer because

the building is located within a conservation area, and in any event the Estate felt they were complex and unsightly. So, the Estate was looking for an alternative direct electric heating technology with an electricity-to-heat-demand ratio of more than 1:1, and if possible, close to a heat pump's 1:2.5 or 1:3 ratio. The Estate understood that conventional electric heating was already 100% efficient, so any reduction in energy use required sophisticated control systems to deliver thermal comfort using fewer kWh in a way that could not be expected of a centralised heating system (like a boiler or heat pump).

The Estate approached Ambion and DJB Installs to form a project team to cover both the fabric solutions as well as the low carbon heating and hot water solutions for the property.

---

<sup>1</sup> Hard to Decarbonise Social Homes, July 2022, Parity Projects

---

# Project targets and plan

**The team agreed that targets needed to be set in order to monitor the project and decide on appropriate measures.**

The project team decided to use **heat demand** as its metric for targeting energy efficiency measures. Heat demand (kWh) is a measure of the heat energy that a home requires to be delivered over the course of a year. It is therefore independent of the efficiency/performance ratio or fuel type of the heating system. It is also unaffected by carbon and bill assumptions, which makes it more robust to forthcoming changes to the SAP methodology, unlike the EPC score, for example. This allowed the project team to assess when the property had a high enough performance to be suitable for electrification and be affordable to heat.

This approach also meant the team was relying on standard assumptions about occupancy behaviour, such as desired room temperature, as defined in the SAP 2012 Specification. (SAP 2012 Specification, BRE. Accessed January 2022). This was felt to be appropriate for this tenanted building as the occupant could change over time.

Because of the legislative factors described above, the **EPC rating** would remain an important factor in the immediate term and needed to be reflected in the team's objectives.

It was important not to compromise on householder comfort and good **air quality** as the upgraded property needed to be attractive to tenants.

---

Against this background, the project team set **four key objectives**:

1. To achieve an **EPC rating D**, up from the existing F25, with a plan for a second phase of improvements to achieve C.
2. To **reduce energy consumption** from 11,928 kWh to at least 3,400 kWh, a saving of 8,528 kWh or 71%. This target would be within 10% of the kWh required to make the property no more expensive to run than if it had been on gas (currently the cheapest form of energy), and would deliver a significant reduction in carbon footprint.
3. To achieve a **payback period of maximum ten years** – defined as (1) upfront cost of measures taken (fabric and heating systems); divided by (2) energy saving compared with original fabric and conventional space and water heating.
4. To ensure **good air quality and householder experience**, ensuring none of the above objectives were secured at the expense of an affordably warm home with good air quality.

These objectives would be achieved through a judicious combination of fabric upgrades and new low carbon heating measures for space and water heating.

Where possible, funding support would be secured to lower the effective upfront cost and reduce the actual payback period to the Estate.

# The solution

Working together as a project team, The Estate, Ambion and DJB Installs developed the following approach:

## REDUCTION IN HEAT DEMAND - FABRIC:

DJB Installs advised on using SWIP 95mm internal wall insulation with u-value of 0.30 to upgrade the existing solid external walls on the ground floor as this gave a cost-effective solution with a relatively modest increase in wall thickness. This was to be finished using a plaster skim.

The first floor with its sloping ceilings was to be insulated to room-in-roof standards, with 0.30 u-value for walls and sloping ceilings, and u-value 0.17 for flat ceilings. This is in line with current new-build standards.

This means the annual space heating demand for the property would reduce from the pre-existing 10,198 kWh, to 6,730 kWh (97 kWh/m<sup>2</sup>) based on standard SAP calculations resulting in **a saving of 3,468 kWh** or 34%.

## DECARBONISING HEAT SOURCE - SPACE HEATING

In order to achieve the objective of 3,400 kWh total energy usage, there needed to be a further reduction in the annual energy usage of the property for space heating.

Ambion Low Carbon Heat Panels were the ideal solution for the client's needs. In semi-detached houses, the Ambion system has a Performance Ratio of 2.41<sup>2</sup> (defined as the EPC predicted annual space heating demand divided by the actual electricity consumption of the Ambion system) meaning occupants can expect to use nearly 60% less electricity when compared to conventional systems, which also equates to a near 60% reduction in carbon emissions. This means the annual energy requirement for the space heating of the property would reduce from 6,730 kWh (after the fabric measures described above) to 2,793 kWh, a saving of 3,937 kWh or 59%.

<sup>2</sup> Ambion Low Carbon Heat Panel System, Technology and Operational Performance Review, Fichtner Consulting Engineers Limited, 16 August 2022

The Ambion system was also ideal because it delivers optimum energy performance when working 24 hours a day. This means savings occur even when the property is occupied extensively during the 24-hour period, so catering for a wide range of potential tenants, including the elderly, young families and people working from home, who would get 24-hour comfort as standard.

The Ambion Low Carbon Heat Panel system also appealed to the Estate because it requires no external heat pump and takes up a minimal amount of space, which was ideal for the size and location of the building.

As an electric system with no moving parts, it also requires no annual maintenance and has a 10-year warranty with a further 10-year top up available. This protects the Estate from costly maintenance and servicing costs.

Ambion advised on the exact specification of the system, as summarised in the table below and as set out on the floorplans on page 3.

Space heating	No.	Power (kWh)
Large panel	4	0.82
Small panel	2	0.43
Large panel IP	1	0.82
Small panel IP	-	0.43
Total panels	7	
Control panel	1	
<b>Total space heating</b>		<b>4.96</b>
Total per m <sup>2</sup>		0.07

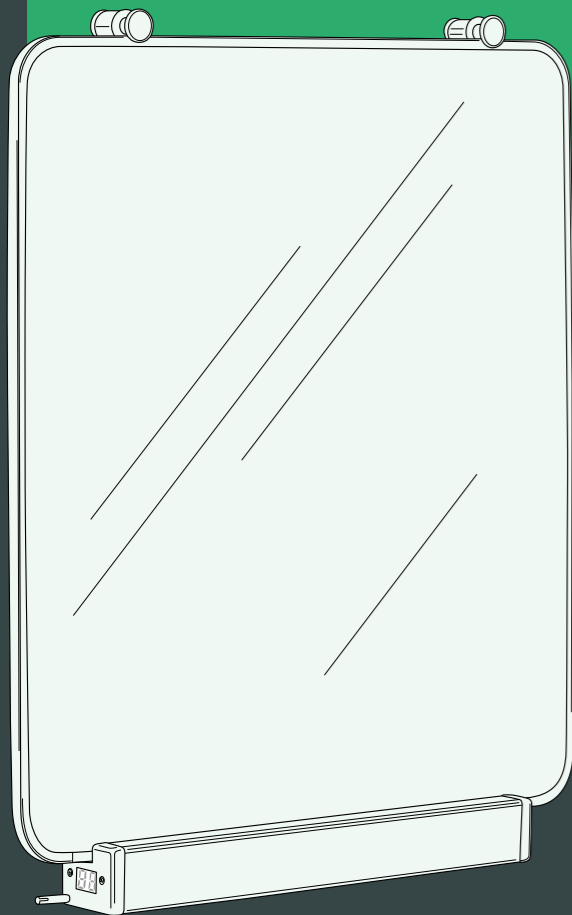
## ABOUT AMBION LOW CARBON HEAT PANELS

Ambion Low Carbon Heat Panels have a unique control system which uses constant dynamic pulsing to reduce energy use, rather than a 'zoning' on/off approach used by other direct heating systems.

The system uses infrared heat panels because building materials absorb and store infrared, releasing it between pulses, making it the perfect partner for the pulsing approach.

This combination dramatically reduces energy usage and the system has an average Performance Ratio of 2.69, an energy saving of 63%. The Performance Ratio varies by house type. The system delivers optimum energy performance when working 24 hours a day.

The system is controlled by the householder using the Ambion Control Panel, which provides timer settings, room temperature control and surface temperature control. The Control Panel also provides a host of data including actual temperature, energy usage and cost.



## DECARBONISING HEAT SOURCE - WATER HEATING:

A KERS hot water system was also recommended for use in tandem with Low Carbon Heat Panels for a complete heating solution.

KERS is an indoor heat pump and works by recycling the warm air generated inside a home, such as air in the kitchen and bathroom, to produce hot water. The unit can achieve temperatures of up to 65°C without an electric immersion heater.

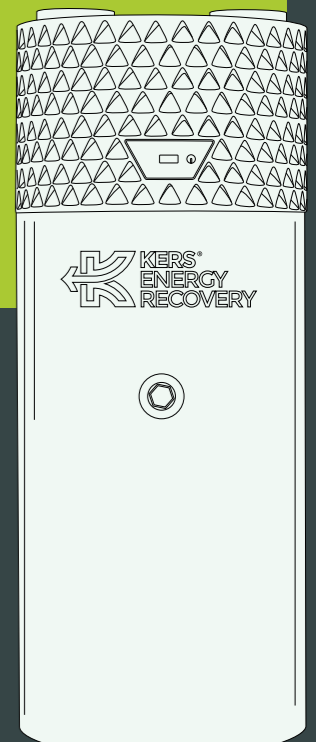
The system has a SCOP of 3.1 (310% efficiency) in SAP, meaning occupants can expect to use nearly 70% less electricity when compared to conventional systems.

This means the annual energy requirement for the water heating of the property would reduce from 1,730 kWh to 558 kWh, **a saving of 1,172 kWh** or 68%.

## ABOUT THE KERS WATER HEATER

The KERS MVHR range is a combined hot water, heat recovery and MEV system with storage cylinder. It converts waste heat energy from bathrooms and kitchens into low-cost renewable hot water.

This all-in-one design can replace mechanical ventilation and heat recovery with only one external penetration. SAP registered, it helps achieve building regulations part L and F and has a COP value of 3.3.



## IMPROVED AIR QUALITY

The Estate wanted to ensure the property had good air quality, free from condensation and dust.

The UK Building Research Establishment (BRE) has identified a trade-off between airtightness and levels of ventilation as highly airtight buildings are more energy efficient but less well ventilated. The BRE is concerned that simply increasing the airtightness of buildings to improve energy efficiency will reduce ventilation levels which may have an adverse impact on indoor air quality. Poor ventilation has led to increasing problems with dampness and mould and prompted new designs for homes that combine energy efficiency with high levels of ventilation. Mechanical Extract Ventilation (MEV) is commonly used to reduce moisture and condensation. Both the Ambion space heating and KERS water heating systems contribute to improved air quality.

The infrared emitted by the Ambion heat panels produces a dry heat and warms the fabric of the home, which reduces condensation at source. The KERS indoor heat pump doubles as an MEV system, further reducing moisture in the air by extracting (and recycling) warm, damp air from the kitchen and bathroom by way of simple ducting installed as part of the overall fabric upgrade.

This approach to MEV appealed to the Estate as it meant there was no need for a stand-alone MEV system, delivering a saving in upfront costs of some £1,500.

3 UK Indoor Air Quality, November 2010, POST  
(an office of both Houses of Parliament)

## FUNDING

DJB Installs are specialists in securing ECO funding for eligible properties and tenants, working directly with EON. They advised the Estate that ECO funding might be available for this project and it was decided to

proceed with an application. This was successful in securing 100% cover for the fabric and installation works. This ECO funding enables the Estate to fund further works elsewhere which might otherwise have taken longer to resource.



# Project appraisal

## measuring results against objectives

The project was highly successful, achieving all objectives as set out below.

### OBJECTIVE 1 – TO IMPROVE EPC RATING FROM F25 TO D

The property's EPC jumped from F25 to D56 (SAP 10), demonstrating the immediate impact of the measures installed. A further uplift to a C rating is within reach.



### OBJECTIVE 2 - TO REDUCE ENERGY CONSUMPTION FROM 11,928 KWH TO AT LEAST 3,400 KWH

As a result of the project improvements, the total annual energy usage of the property more than meets the target of 3,400 kWh, reducing from 12,376kWh to just 3,351kWh, a saving of 8,577 kWh or 72%.

This drives annual heating costs down from £4,056 pa (pre-measures) to £1,139 pa, a saving of £2,916, which is £53.60 (or 5%) cheaper than it would have been to run a high-carbon gas system in the property before any measures were taken .

Furthermore, annual carbon emissions reduce from 2.5 tonnes pa to just 0.7 tonnes, a saving of 1.8 tonnes or 72%.

The energy-saving contribution of the various measures are summarised in the table:

	BEFORE	UPGRADE				
	Electric	Fabric upgrade	Saving	Ambion	Saving	Total saving
<b>Energy performance</b>						
Performance Ratio - space	1.0			2.41		
Performance Ratio - water	1.0			3.10		
<b>Energy used (kWh)</b>						
Space	10,198	6,730	3,468	2,793	3,937	7,405
Water	1,730	1,730	0	558	1,172	1,172
<b>Total</b>	<b>11,928</b>	<b>8,460</b>	<b>3,468</b>	<b>3,351</b>	<b>5,109</b>	<b>8,577</b>
<i>Saving</i>			29%		60%	72%
Space heat demand (kWh/m <sup>2</sup> )	147.16	97.11	50.04			
<b>Energy costs (£)</b>						
Space	£ 3,467	£ 2,288	£ 1,179	£ 949	£ 1,339	£ 2,518
Water	£ 588	£ 588	£ -	£ 190	£ 398	£ 398
<b>Total</b>	<b>£ 4,056</b>	<b>£ 2,876</b>	<b>£ 1,179</b>	<b>£ 1,139</b>	<b>£ 1,737</b>	<b>£ 2,916</b>
<i>Saving</i>			29%		60%	72%
<b>Carbon emissions (Tonnes)</b>						
Space	2.2	1.4	0.7	0.6	0.8	1.6
Water	0.4	0.4	0.0	0.1	0.2	0.2
<b>Total</b>	<b>2.5</b>	<b>1.8</b>	<b>0.7</b>	<b>0.7</b>	<b>1.1</b>	<b>1.8</b>
<i>Saving</i>			29%		60%	72%

For illustration only. Based on Energy Price Guarantee, 1 October 2022. 0.34p/kWh



### OBJECTIVE 3 - TO ACHIEVE A PAYBACK PERIOD OF MAXIMUM TEN YEARS

The pay-back periods of the various measures are summarised in the table below:

Payback analysis	Fabric upgrade	Water heater	Ambion	Total (unfunded)		Total saving
<b>Upfront costs</b>						
<b>Total</b>	£ 14,555	£ 3,555	£ 4,565	£ 22,675		£ 4,565
Cost per m <sup>2</sup>	£ 210		£ 66		Funding %	80%
<b>Annual savings</b>						
<b>Total</b>	£ 1,179	£ 398	£ 1,339	£ 2,916		£ 2,916
% of total savings	40%	14%	46%			
<b>Payback in years</b>						
<b>Total</b>	12.3	8.9	3.4	7.8		1.6

For illustration only. Based on Energy Price Guarantee, 1 October 2022. 0.34p/kWh

From these results, the following has been achieved:

- The fabric measures cost £14,555 and save £1,179 in energy costs per annum, a payback of 12.3 years.
- The Ambion space heating system cost £4,565 and saves £1,339 in energy costs per annum, a payback of 3.4 years.
- The KERS water heating system cost £3,555 and saves £398 in energy costs per annum, a payback of 8.9 years. This payback is calculated before the saving in upfront costs of c.£1,500 associated with a stand-alone MEV system, which would reduce the payback to 5.2 years.
- Excluding funding, the total project cost £22,675 and saves £2,916 in energy costs per annum, an underlying payback of 7.8 years. This more than meets the target payback period of ten years.
- Including funding, the total project cost £8,120 and saves £2,916 in energy costs per annum, an underlying payback of just 2.8 years. This is an impressive outcome.

## OBJECTIVE 4 – GOOD AIR QUALITY AND HOUSEHOLDER EXPERIENCE

The ambience of the property has been transformed into a warm, comfortable home with affordable 24-hour heating across the house as standard, with plentiful cheap hot water. With the infrared heating and in-built MEV system to the kitchen and bathroom, the air quality certainly meets the Estate's objectives.

The Estate feels sure it has created a comfortable, desirable property which will be attractive to tenants for years to come.



## Next steps

The next steps are to install further measures to improve the property's EPC rating to a C. These may include further insulation measures, or solar PV fitted either on the building or in adjoining fields.

# Comments

THE  
Pochin Estate

### Mr Pochin of The Pochin Estate:

"The Estate needed to move quickly to greatly improve the environmental performance of the property and to also create a desirable and comfortable property for a new tenant. Choosing to use new technology on the Estate was something we felt could work in a property such as 13 Main Street. We're really impressed with the results so far and will be considering this approach for the other properties on the Estate, as and when they require upgrading."



### Lilly Hives at Fisher German comments:

"One of the key issues we are facing with rural properties is reaching EPC standards and improving the properties without damaging their character, and doing so within budget for the client. Working with the team at DJB Installs and Ambion, we were able to advise the client and hope to have future proofed this property, whilst keeping running costs low for the occupant which is an important factor when letting houses."



### Danny Buckley, Director of DJB Installs, comments:

"One of the key challenges with this property – and many similar older, traditional buildings – is its very low thermal efficiency. Where the property and tenant qualify, this is a great example of how ECO funding can be used to upgrade the building fabric in the most cost-effective way, improving the thermal efficiency and helping reduce overall energy demand and carbon emissions."

### Oliver Baker, CEO at Ambion Heating, adds:

"We know that our Low Carbon Heat Panels can achieve impressive results for landlords, and it was great to work with Fisher German and DJB Installs to improve the EPC rating of the property using our space heating solution as well as the new KERS water heater and the improved insulation."

"This project shows how competitive Ambion Low Carbon Heat Panels are in terms of upfront costs and payback periods, compared with other low-carbon systems. As well as reducing emissions, the tenant will benefit from all-day thermal comfort, with running costs significantly below the old storage heating system."

We are pleased to have worked with the Estate, Fisher German and DJB Installs on this interesting project, and to know that this property is now a really comfortable home which will serve well the Estate and tenants for years to come."

---

# About Ambion Low Carbon Heat Panels

Ambion Low Carbon Heat Panels offer the best low-carbon heating system for smaller homes and multi-occupancy buildings, providing the most cost-effective way to meet decarbonisation objectives and ensure households stay out of fuel poverty. This is achieved through unique heat panel technology, which uses constant dynamic pulsing to keep homes warm and energy costs low.

With over 1,000 installed systems to date, Ambion has established itself as a leader in low-carbon heating.

For more information, contact us at [sales@ambionheating.com](mailto:sales@ambionheating.com)

