

# CASE STUDY GRADE I CHURCH BECOMES NET ZERO CARBON WITH HEAT PUMPS, INSULATION AND MORE



**N.B.** This case study considers only one possible approach, which will not be suitable for every church. Always seek professional advice.

## Key Points

- The installation of air source heat pumps and underfloor heating, combined with responsive electric heating, insulation, LED lighting, and other major upgrades have transformed this church.
- A tight-budgeted rebuilding after the Blitz, followed by decades of use left this church in desperate need of a long-term plan for providing a welcoming space for parishioners.



**1** This Grade I-listed London church found feasible ways to become the first net-zero carbon church in London whilst maintaining and protecting its beautiful historic fabric.

**2** Air source heat pump technology was installed on the roof. This runs on electricity and exchanges heat from the outside air into a wet central heating system.

**3** Insulation was added in the roof, ensuring that the building was thermally efficient and that bills would be kept low.

## The context

St Andrew-by-the-Wardrobe is a Grade I-listed church in London and one of the last by Sir Christopher Wren.

It is a relatively large building, with a floor plan of over 500m<sup>2</sup>. Having been struck down in the Blitz, its rebuilding was implemented cheaply and quickly during the 1950s

In a typical week it is used on Wednesday and Sunday, as well as hosting weddings, funerals and occasionally other events. It is hoped that the completion of this work will allow greater use.

For more information visit the church's [website](#) or its entry on the [Church Heritage Record](#).

## The need for change

St Andrew's was in a poor state, without insulation or a reliable source of heating. On top of that, the electrical wiring was evidently reaching the end of its life.

The church was seeking to expand its outreach, educational offerings and liturgical activities, so a significant improvements to the building were required.

### What were the options?

- St Andrew-by-the-Wardrobe previously ran on a conventional gas boiler feeding underfloor heating pipes. However, this broke down approximately 5 years before this project began. Repairing and replacing elements of this system like-for-like was rejected because of the associated carbon emissions.
- Roof-mounted air source heat pumps were chosen as the optimal intervention.
- Linking these up to the previous underfloor heating pipes was considered, but taking up the floor would have incurred significant additional costs.
- Electric radiators and pew heaters were also chosen as a rapidly responding system for ‘topping up’ the heat, when necessary.

### Watch the case study videos

To find the case study videos of St Andrew-by-the-Wardrobe [click here](https://www.churchofengland.org/environment), or go to [www.churchofengland.org/environment](https://www.churchofengland.org/environment)

### What was done?

- Six air source heat pumps were placed on the roof of the building, linked up to radiators, which were installed inside.
- The roof was fitted with insulation to reduce heat loss in the church.
- Electrical circuits were renewed, hopefully making them more efficient as well as safer.
- Specialist LED lighting was fitted throughout for energy efficiency.
- Rapidly responding electric radiators and pew heaters were added as a supplementary source of heating.
- St Andrew’s also converted to a green electricity supplier, and with electricity the only type of energy used, the building now produces zero carbon emissions through it’s everyday use.

### How well does it work?

It is early days for measuring the success of this work, but it is expected that it will be possible to **control the building temperature** to a much greater extent.

With a greater level of efficiency, the church should see **energy use decrease** (compared to the previous gas heating system), despite **increased activity within the building**. Additionally, with the implementation of a fully electric heating system and by taking advantage of a **green energy tariff**, the church is now net-zero carbon.

### How much did it cost?

This large-scale refurbishment project came in at roughly £1.1M and included overhauls of the kitchen, WCs, office, parish room, chapel and narthex, as well as a mass upgrade to the electrical wiring, fire safety infrastructure, lighting and heating. Phase I consisted of a range of works, including delivering heating to the whole building, at a cost of approximately £650K.

*“We have made sure that the building is watertight. We’ve insulated all of the roof. We’ve introduced electrical heating, and that is in two forms. One is air source heat pump technology, and the other is rapidly responding electric radiators.”*

Bob Wilson, Project Manager