

CASE STUDY UNDERFLOOR HEATING



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

Key Points

- St Mary the Virgin, Willesborough is a mediaeval church used throughout the week. With this high level of regular daily usage, and the need for a flexible space, underfloor heating has proven successful; running constantly during the heating season, delivering a gentle heat.
- System maintenance costs have been low, but gas usage is relatively high, because a variety of activities are taking place in the church building consistently throughout the week. However, underfloor heating was a better option than conventional radiators or electric heating in these particular circumstances, both for greenhouse gas emissions and running costs.



1 St Mary the Virgin, Willesborough, is a mediaeval church dating from around 1075, situated in a suburban residential area around 1.5 miles from the centre of Ashford.

2 This is a busy church hosting a café, night shelter and twice-weekly services. The building is open for around 3,500 hours annually, receiving a footfall of 30,000 people.

3 The re-ordered nave offers a flexible space for activities. Underfloor heating provides low level heat throughout the week, suitable for a very well-used and flexible space such as this.

What were the options?

The church needed a heating system allowing the building to be used regularly throughout the week. They considered three options;

- **Increased use of a radiator system.** Because heat rises, this form of space heating would have delivered heat to the roof, with constant high heat losses.
- **Electric far infra red wall or ceiling mounted panels.** Electric heating has a higher cost per kWh, and with the high degree of weekly usage this church has, would have been too expensive.
- **An underfloor heating system.** This would deliver heat directly underneath people, with a gentle low level heat through the week. With the regular, high usage of this building, underfloor heating was an effective solution for St Mary's. Whilst running the underfloor heating from an **air or ground source heat pump** would have been the ideal from an environmental perspective, the capital cost was off-putting, so the church installed a new, efficient gas boiler.

What was done?

- Re-ordering was carried out in 2015 and included installing underfloor heating to the nave, with insulation underneath. The pew platforms were removed, which exposed bare soil, so a new floor was needed.
- The Jupiter underfloor heating system is powered by a Mikofill Ethos gas boiler, delivering a maximum of 130kW with the nave divided into two zones, separated by the central aisle. There are also a small number of conventional wall mounted radiators. (UFH has a limited output in terms of W/m² of 70-100 W/m² and so, for an older building like this with significant heat loss, UFH needs supplementing with another system to provide all the heat required.)

How well does it work?

The underfloor heating system runs constantly between October and April, for approximately 5000 hours.

The system allows the building to stay warm throughout the week, at all times of the year, at 19°C. The missional vision of this church means that the building is used as much as possible, and the installation of underfloor heating has enhanced this consistent use of the building.

The alternative to underfloor heating would have been to run gas central heating for many hours at greater cost and emissions, or electric heating at 4x greater cost. UFH can work well *if* the church is used daily; it then delivers fairly constant gentle heat where it is needed, rather than circulating up to the roof.

The new heating system has brought both missional and financial benefits, with the church and local community using the building daily. The church made a small net profit in 2019 as a result of increased use and income.

A sophisticated computer control system was specified using WiFi signals between the thermostat and the pump valve controls in the two operating floor pits. This was unsuccessful due to signal shielding, so the WiFi connection was replaced with hard wiring. (Earlier testing might have prevented this.)

A typical church of this size (internal area 460m²) will generally have a 70 to 150 kW boiler and use between 40,000 – 160,000kWh annually, depending on how heavily the building is used. With continual low-level heating for 5000 hours annually, St Mary's uses around 140,000kWh, so is at the highest end of this range of gas usage, reflecting the very regular usage of the building and that it is constantly warm. Using radiators to achieve the same end results would have increased gas usage further.

How much did it cost?

Installation costs of the installed services were £65,000 for the underfloor heating and £55,000 for the associated plant (gas boiler, controls and pumps). Minimal annual **maintenance costs** include annual checks and safety certification of boiler and pumps. (UFH generally requires slightly more maintenance than conventional radiators. **Operating costs** are annual gas use of around 140,000kWh at a cost of £4,600.

Guidance:

For a church building which is intended to be in use daily, a low kW underfloor system is more efficient than using radiators for space heating. Installation of UFH is only possible if the impact on the historic floor and on burials and archaeology are agreed to be acceptable, should only be considered for a very regularly used building, and generally only as part of a major reordering such as this. Ideally, it should be driven by an air- or ground-source heat pump, rather than a gas or oil boiler, as this delivers warm water at the right temperature in an energy-efficient way.

For more information on St Mary's, visit [A Church Near You](#) or its entry on the [Church Heritage Record](#).

Our new heating system has allowed us to feel warm in our church on the coldest days of the winter for the first time in hundreds of years. We are very pleased and feel we can be more welcoming to visitors and guests.

— Congregation member St Mary's Church, Willesborough