Notes for Meeting 1st September 2025

After careful consideration and Simon's practical experience of convection heaters, Nick BB and myself believe we should consider revising our heating strategy to prioritise underpew heaters as the primary source of warmth during services.

Initially, our plan was to use convection heaters to take the chill off the room before each service, followed by underpew heating for seated comfort. However, given the building's size (13m × 30m × 7.5m) and the inefficiency of heating such a large air volume, convection heating could be both energy-intensive and slow to deliver meaningful comfort.

Convection Heating

Convection heaters work by warming the air, which in a tall space quickly rises above the occupied zone. In practice, this means that even after running for an extended period, the heat fails to reach the congregation effectively.

I recently used a software package – which I found by chance – which has helped me to better understand the heating requirements. For the whole church building, the theoretical minimum, in a perfectly sealed, well insulated building would be:

1. Calculate the volume of the church: 13m wide x 30m long x 7.5m tall = 2,925m^3

2. Estimate the mass of air: Air density ≈ 1.2 kg/m^3, Mass of air = 2,925 x1.2= 3,510 kg

3. Use the specific heat capacity of air: Specific heat capacity of air ≈ 1,005 J/kg·°C

4. Calculate energy required: Temperature change (ΔT) = temperature raise required – say 6°C to 16°C = 10°C, Energy = mass of air x specific heat of air x temperature change = 3,510 x 1,005 x 10 = 35,275,500 J.

5. Calculate time using power: Total power = 8 x 2000W Convection Heaters = 16,000 W or 16,000 J/s) Time= 35,275,500/16,000 = 2,205 seconds = 37 minutes.

This equates to roughly the 40 minutes time given by the Dyson Technical Team.

For the Winter Zone - 13.5m x 12m x 7.5m, with four heaters – the time would be 31 minutes

However, this is a **theoretical minimum**. In practice, it would take **much longer** due to:

- **Heat loss** through walls, windows, and roof
- **Poor insulation** typical in historic churches
- **Air stratification** (warm air rising to the ceiling)
- **Furniture and building materials** absorbing heat

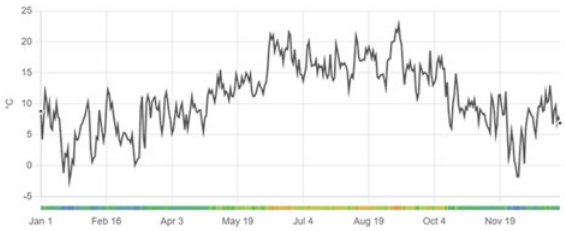
We should therefore now expect **2 to 4 hours or more** to increase the building temperature by 10°C.

For short durations, I now believe that the impact will be negligible - especially as the building has no insulation, where heat loss is high and stratification is unavoidable. Attempting to preheat the space with convection units results in high energy consumption with little perceptible benefit.

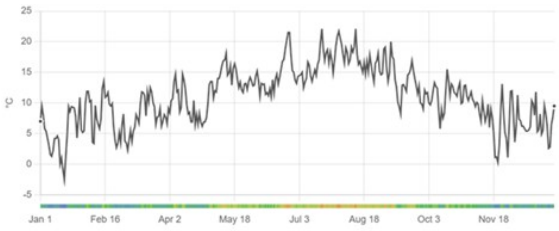
Winter Zone

The initial system was to combine convection heating with the theatre curtains to contain the heat within a specific area.

I have looked at the average daily temperatures for CV10 0LY for 2023 and 2024 – see graphs below.



2023



2024

From these graphs, we may only need to use the convection heating for ~ 6 weeks per year.

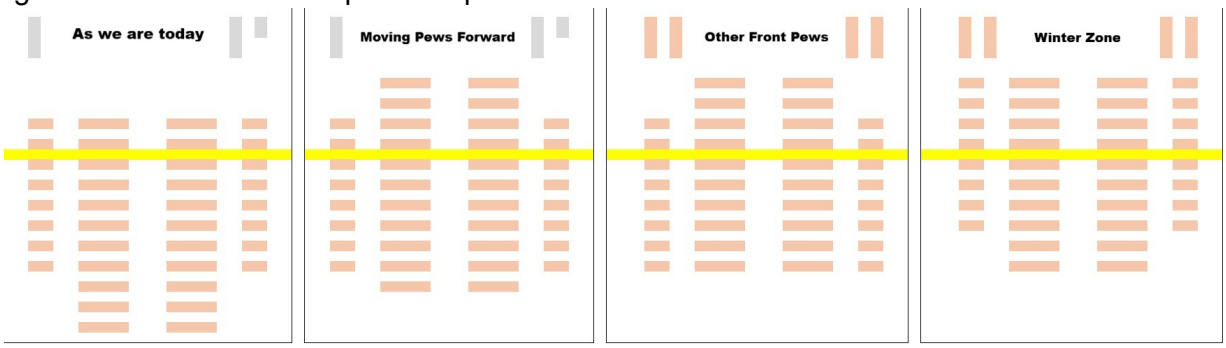
The cost for the convection heaters and curtain is ~£17,500 (note the curtain price has raised significantly from initial quote to recent quote).

Underpew and Stadium Heating Pads

Underpew heaters, combined with the personal stadium heated pads, by contrast, offer targeted warmth directly to seated individuals. By increasing the number of units, we can ensure consistent comfort throughout the service while maintaining a low background temperature elsewhere. This approach is more efficient, conservation-friendly, and better aligned with the practical needs of our congregation.

Additional Underpew Heaters (40 rather than 20)

The diagram below shows some potential pew orientations



If we were to go to 40 underpew heaters, and have no more than half of the larger pews heated, then the following options could be used.

If we were to go to 40 underpew heaters, with no restrictions on location, then the following options could be also be used.

Single Phase Electrical Supply

I believe that we concluded that we are not currently considering changing to three-phase, and that we are looking at single phase only. In settings like ours, where the focus is on targeted heating (e.g. underpew units) and low-power lighting, single-phase is more than sufficient—and far easier to manage.

Our single-phase supply will give up to 24 kW at 100 amps.
So, I have assumed that we should get 23kW most of the time.

I have split the electrical consumption into several discrete areas – which are:

Always On: These are items that will always need to be available. These include**;** heating control panel, router for internet, photocopier, Internal lights, external lights, altar lights, vestry lights, library lights, heaters & computers. These add up to a maximum of **4.93kW.**

Winter Zone: These include; wireless radio mike system, electric keyboard, sound system, blue tooth speakers, infrared heaters, projectors, 20 underpew heaters. These add up to a maximum of **10.54kW**

Pew Zone. Additional to the Winter Zone equipment, the Pew Zone items would include 20 additional pew heaters, with a maximum of **6kW**

'School Room' (the new room with external access): This includes the combined heating and light units plus additional items, with a maximum of **1.84kW**

'Church Room' (the other room which could be used for Sunday School and Prayer Group)**:** This includes the combined heating and light units plus additional items, with a maximum of **1.84kW**

Other: This would include the stadium heater charging area and items for the heritage zone, with a maximum of **2.8kW**

Typical Electrical Consumptions

'Standard' Service = Always on + Winter Zone + 'School Room' = 4.93 + 10.54 + 1.84 = **17.31kW**

Larger Service = 'Standard' Service + Pew Zone = 17.31 + 6 = **23.31kW**

This is slightly above the 23kW limit we have set. However, part of the 23.31kW includes the photocopier (0.8kW), external lights (0.1kW), vestry lights (0.2kW) and Library (2kW).

It is unlikely that all these items – 3.1kW – will be on at the same time. We could ensure that the photocopier is not used during the large service – which alone will reduce our total consumption to drop to less than 23kW.

Things to be considered

1. If we adopt an approach that relies solely on underpew heaters or heated stadium-style seating during services, we must acknowledge that the overall ambient temperature of the church may feel

cooler - particularly when people are moving around. However, the seating areas themselves will offer a warm and comfortable experience, precisely where it matters most. This strategy prioritises direct personal comfort while significantly reducing energy consumption and avoiding the inefficiencies of trying to heat a vast, high-ceilinged space. It's a practical and thoughtful solution that balances the realities of our building with the needs of our congregation.

2. If we move forward with using only underpew heaters or heated stadium-style seating during services, we need to consider whether the curtain option remains necessary or effective. With warmth now being delivered directly to seated individuals, the role of curtains in retaining ambient heat may be significantly reduced, potentially making them redundant in this revised approach.

3. If we transition to using only underpew heaters or heated stadium-style seating during services, we need to consider the implications for larger gatherings such as Christingle, Remembrance Sunday, large weddings and funerals. These events typically draw a full congregation, with attendees occupying not just the main seating area but also the rear of the church. Since underpew heating provides targeted warmth to seated individuals, areas without designated seating - particularly at the back - may feel noticeably cooler. This raises the question of whether supplementary heating or alternative arrangements will be needed to ensure comfort for those standing or seated in overflow areas during major services.

4. If we remove convection heating from our overall strategy, we need to carefully consider the impact this will have on the heritage zone during the winter months, particularly as this area will no longer benefit from any form of direct heating. Without convection heat to raise the ambient temperature, the heritage zone may become noticeably colder, potentially affecting its usability for visitors, volunteers, or any planned activities. While underpew or seat-based heating will provide comfort in the main worship areas, the absence of background warmth in the heritage zone could limit its appeal and accessibility during colder periods. This shift calls for a reassessment of how the space is used seasonally and whether alternative low-level heating or conservation measures might be needed to maintain its function and protect the building fabric.