Church Buildings Council (Jan 2020)

Review of heating guidance : Establishing principles

Introduction:

The current church heating guidance is from 2012 and is out-of-date, not least because General Synod's commitment to a low carbon future will require fundamental changes to the way we heat our buildings, so a review has begun.

(The current guidance can be found here: https://www.churchofengland.org/sites/default/files/2018-12/CCB_Choosing-the-right-heating-system.pdf.)

The way our churches are heated is a complex area, with a variety of sometimes conflicting objectives. Different people understandably put different emphasis on aspects of church heating. A common agreed set of principles from the Church Buildings Council can help guide staff, both centrally and in the dioceses, to develop guidance.

The attached ten principles have therefore been agreed by the CBC at its January 2020 meeting. The full heating guidance will come to a future CBC meeting for agreement. Appendix 1 summaries the heating approaches future guidance will cover, and Appendix 2 the different fuel sources. Appendix 3 illustrates how these factors can inter-act, and therefore why finding the right solution can be complex.

Our heating guidance needs to focus not primarily on boilers or heaters, but instead on **people,** and their activities. It is people who feel comfort or discomfort and people who are the focus of the mission of the church. A warm and welcoming building is ideal, but realistically many churches struggle to achieve this; space heating to 18^{o}C is often aimed for, but is expensive, doesn't always make people comfortable, and can be environmentally unsustainable. What is more, inappropriate heating can cause significant damage to the historic building fabric and artefacts, which can result in further considerable costs for the PCC to repair or conserve. Many churches across the country are now introducing other cost-effective ways of achieving comfort, that are also more conducive to the conservation of the fabric

As UK power stations have moved away from coal and towards renewables, the national grid has begun to 'decarbonise'. Electric heating is now cleaner than gas or oil heating, and this trend is expected to continue. Churches can go beyond this and purchase or generate 'green' renewable electricity, which further reduces the carbon footprint of electric heating.

This review exists in the current environmental context – a growing awareness of the climate emergency and its devastating effects on people worldwide. Church heating can be a somewhat dry, technical area, but decarbonizing heat is **critical** to the Church fulling its fifth mark of mission, "*To strive to safeguard the integrity of creation, and sustain and renew the life of the earth*". Currently, we burn fossil fuels in our churches to heat them; the very fossil fuels which are contributing to climate change. Therefore, finding outcomes which offer an acceptable combination of comfort, conservation, affordability, and environmental care is vital.

Principles:

The Council has agreed each of the following ten principles, which will underpin updated heating guidance:

1. **For all churches, not wasting energy and optimizing the system they already have are key places to start.** This involves, for example, maintaining gutters and roofs to avoid damp, lagging pipes, insulating lofts, draught-proofing doors, having broken windows repaired, zoning the heating, and setting the heating controls correctly. In this way, heat *loss* can be significantly reduced, reducing the demand for heat *input* from the heating system, and cutting energy use.

2. **That the approach to heating needs to find the right balance, *for each particular church,* of five things**;

    - Church users being comfortable, so the church is welcoming and usable,
    - Historic fabric and materials not being harmed,
    - Affordability (to install, maintain and run),
    - The feasibility of, and appetite for, change, and *last but certainly not least*,
    - Reducing greenhouse gas emissions.

3. **It is critical to consider how the church space is used throughout the week and throughout the year, who the users are** (e.g. children, the elderly, visitors, congregation)**, and how they use the space.**

4. **Considering the factors above, it is clear that different solutions apply to different churches; there is no "one size fits all".** Every heating solution must be designed around the individual church's use and nature. Those churches which get used for one or two services on a Sunday with the odd hour mid-week for the bell-ringers and/or choir make up a substantial number of the churches in the country. The efficient heating solution in such a church is radically different to those churches which have activities occurring in them 5 days a week for 6 to 8 hours a day. The heating advice must therefore be rooted in a clear understanding of how each individual church is used, now and in the future.

5. **However, for the majority of churches, focusing on keeping the people comfortable will be a better approach than trying to warm the whole space.** Spaces are large, ceilings high and warm air rises. Comfort can be increased through simple "soft" changes such as cushions, mats and door curtains, through temporary or permanent partitions, and through localised heating such as – potentially portable – panel heaters or pew heaters.

6. **For those churches with historic interiors that are susceptible to changes in environmental conditions, expert advice must be sought.** This is to ensure any new heating regime or changes to an existing system does not cause added harm to the historic fabric and interiors.

7. **Guidance must acknowledge where we are starting** from (oil/gas boilers, wet-system radiators, issues with electricity supply in some places, and very little funding for changes) **but also move towards where we need to be; a future where our churches are "net zero".** A net zero carbon building is highly energy efficient with all remaining energy from on-site and/or off-site renewable sources; this requires us to picture a future very different from now.

8. **Getting to this future will take time and can only move at the pace feasible for each church;** limited by the affordability of the equipment, the price of electricity vs gas, the existing supplies and electrics of the church, its listing, and many other factors. For some churches, there may currently be no feasible solution other than replacing gas-with-gas or even, in exceptional cases, oil-with-oil, but they can try to be ready for a future retro-fit when technology and the grid has progressed.

9. Therefore, in keeping with our commitment to radically reducing the Church's greenhouse gas emissions, **churches should be expected to have *at least* carefully considered the option of moving away from fossil-fuel based heating** (gas and oil boilers) towards electric-based heating (such as air- or ground-source heat pumps, pew heaters, and far-infra-red radiant panel heaters), with these being powered by 'green' electricity.

10. **That early consultation with their local DAC is invaluable and to be encouraged, as is expert advice from appropriate heating consultants,** who need to be well informed about the full range of heating options, in the context of historic buildings.

END.

APPENDIX 1 : Different approaches to heating

Space heating	• Aims to warm the air of the church, so that the whole space is warm • Can be either gas, oil, or electric, and can use radiators, fan convectors, trench heaters, or underfloor heating. Most commonly, a gas- or oil-fired boiler, driving a wet radiator system. Underfloor heating can be fed by boilers or heat-pumps, or can be electric. • For an intensively used church running the heating for enough hours, everything eventually reaches the same temperature. A church in frequent daily use, every day of the week, can be maintained at a comfortable temperature where heat input = heat loss. • Pros: simple and well-understood technology, relatively inexpensive to maintain. People can move around within the space and remain warm. • Cons: often very inefficient (and therefore expensive to run) because the warm air rises and so heating has to run for many hours; a particular problem with wet radiator and fan convector heating. Many churches utilise their space heating irregularly, with long heat up times in winter (typically 8-12 hours). High greenhouse gas emissions. Can damage fabric through cycles of warming and cooling, including through condensation etc. • Underfloor heating can be an efficient solution for well-used buildings, since the heat is delivered closer to the people, with much less heat wasted at high level. Underfloor heating combined with air or ground source heat pumps can be even more efficient.
Background / Setback Heating	• Like space heating, this aims to warm the air of the church, so that the whole space is warm, but in a smoother way. Background heating maintains a church at a minimum temperature (10-12^{o}C) at all times which is boosted when required. • This retains some heat in the large thermal mass of a stone church. It may be useful, for example, if the church receives a lot of visitors during the week, so it is comfortable to walk around wearing a coat. • It is compatible with underfloor heating and/or heat pumps, both of which work efficiently when delivering constant, low grade heat from warm water (rather than hot water supplied by a boiler). • The “boost” can be provided by a traditional wet central heating or by under pew / overhead radiant systems. • Pros – uses the thermal mass of the church to our advantage; avoids the significant energy demands of heating the church from a very low temperature in winter. • Cons – the cost and energy used to maintain the background temperature for long periods when the church is not occupied. As for space heating, there is wasted energy, because you are heating air that rises.

People heating	• Aims to keep people comfortable, where they are • Heating is installed near to where the people sit, which may include under pew, portable, and/or overhead far-infra-red radiant heating panels. • Heating is typically zoned so that all of it does not have to be switched on at once - this allows for different occupancy patterns and different seasons and weather. Separate rooms (e.g. meeting rooms, side chapels, vestries, tower rooms, etc) are heated separately. • Pros: energy efficient and therefore (potentially) inexpensive to run, due to much shorter warm up times and heat directed where it is needed. With radiant heating, surfaces are warmed not air, so heat does not rise. A 'people heating' approach is easier to combine with electric heating and 'green' electricity, radically cutting green-house gas emissions. • Cons: A new system is likely to cost more to install than replacing like-with-like. Currently, electricity is more expensive per unit than gas, so the new system needs to be much more efficient, or operating costs will rise. (However, see the pros: if well-designed, it *will* be much more efficient.) In a poorly designed system, if people move away from the heated areas they will be cold (for example, children running around).
Conservation Heating	• Aims at preserving historic interiors susceptible to damage through environmental changes. This is similar to background heating, but controlled by a humidistat, keeping the humidity within a defined range to prevent condensation and damaging swings in relative humidity. • Historic buildings housing vulnerable collections such as National Trust properties are often heated this way, but their occupancy is very different - visitors will be walking through, usually with their coats on if it is winter. • Heating can be programmed for comfort heating when needed, e.g. with boosts for services, which provides some flexibility. • Pros – can help to preserve historic interiors • Cons – as for background heating there is considerable energy usage, and it doesn't work well in large spaces
Frost prevention	• A heating system aiming to prevent water freezing in the pipes and frost damage within the building, which is set to come on (normally) when the thermostat reaches 5°C. • Pros – prevents the frost damage, low cost to run • Cons – building is not warm and welcoming in winter

"Winter church"	• Aiming to create a space within the church which can be kept warm enough to use during winter, without needing to warm the whole space. This can be a chapel, aisle, or transept. The space is partitioned off in some way, and heated, whist the rest of the space is left unheated or on frost prevention. • Pros – reduces energy usage and costs, by creating a smaller, usable space. Can allow churches to be used all year, which might otherwise be unusable in winter. • Cons – if there are historic interiors in the zones left unheated, then they may deteriorate. There is reduced usage of the main church space during winter.
No heating	• Some churches, particularly in isolated rural locations, have no functioning heating, and generally very little winter use. Some, generally medieval churches, were designed without heating. In these churches, the use of "soft" changes such as blankets and door curtains, and reducing draughts, may increase comfort somewhat. • Pros - no energy use, no cost. • Cons – not warm and welcoming, risk of deterioration to historic interiors. Potentially unusable in winter.

APPENDX 2 : Different energy sources

- Gas (mains and LPG)
- Oil
- Electricity
- Biomass
- Coal/coke
- 'Green' electricity purchased from renewable sources
- 'Green gas' where a proportion is gas produced from anerobic digestion
- Heat pumps (generally air-source and ground-source, occasionally water-source)
- Solar PV (=electricity) & solar thermal (=hot water)
- Occasionally, wind turbines or small-scale hydro
- (In the future?) Hydrogen

- On site energy generation can be combined with battery storage, so electricity is "time shifted" from the time in the day it is generated to the time it is needed.

APPENDIX 3 –DIFFERENT HEATING APPROACHES AND ENERGY SOURCES ACHIEVE DIFFERENT OUTCOMES