Guidance Note

Choosing the right heating system

ChurchCare

16,000 buildings. One resource

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One of the most important challenges facing churches today is providing sufficient comfort for the many different users of the building, from worshippers to staff to visitors. A church's heating system affects its fabric, its contents, its congregation and its mission. There is no universal solution to making a church comfortable and the key to arriving at a solution that provides reasonable comfort at a reasonable cost is to devote sufficient time and effort to understanding the particular needs of your own church. This document is intended to guide those considering upgrading an existing heating system or installing new heating through the planning and decision making processes involved.

Choosing the right heating system

In an ideal world church buildings in active use would be maintained at a carefully assessed low level of background heating all the time.

This would provide a reasonable temperature for those using the church throughout the week, and reduce the amount of warming up required for services or events. Some churches are able to do this, largely on the basis that they are used and open every day and find that continuous low-level heating is less costly than trying to warm users from scratch.

However, many church buildings are in small communities and are used too infrequently for this approach to be considered viable.

Each church will have different needs and resources but a good guiding principle is to try warm the people, not the building, so that the congregation and users feel reasonably comfortable where they are sitting rather than have the feeling of walking into a cosy space as soon as they open the door.

Avoiding pitfalls

The most common pitfall for those involved in designing a heating system for a church is to focus on heating the air. In a typical tall church building this may mean that you end up expensively heating the rafters and pulling cold air in under the door.

The first step should be to understand when and why people are uncomfortable and the different needs of different users. Simple solutions that prevent personal heat loss should definitely not be discounted (one church we know of has provided its congregation with cloaks).

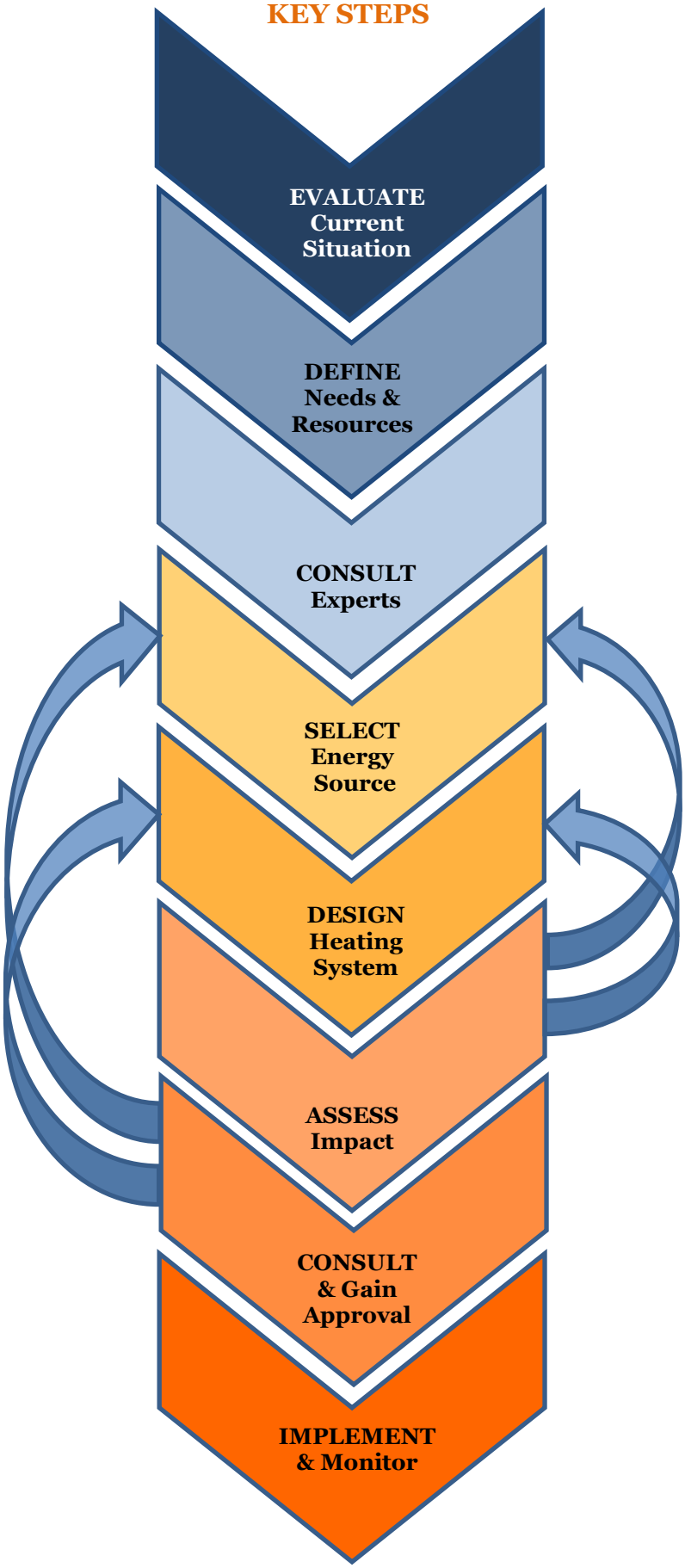
The advice of professionals with relevant experience should be sought. It is important that difficult decisions are not assigned to those who have limited experience. Plan ahead and remember that new heating will involve an on-going financial commitment for both fuel and maintenance.

This note outlines the different stages in the process and provides a checklist of the key actions at each stage. It also lists a number of questions that PCCs may want to ask as they move through the process.

In order to help parishes understand the various options available a summary of key facts relating to the different energy sources and heat emitters on offer has been included. This note is not intended to be exhaustive and parishes will need to conduct their own research as well: sources of further information have been given for each step in the decision making process.

CHOOSING THE RIGHT HEATING SYSTEM

KEY STEPS



This guidance is issued by the Church Buildings Council under section 55(1)(d) of the Dioceses, Mission and Pastoral Measure 2007. As it is statutory guidance, it must be considered with great care. The standards of good practice set out in the guidance should not be departed from unless the departure is justified by reasons that are spelled out clearly, logically and convincingly.

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ACTIONS & QUESTIONS

EVALUATE Current Situation

Actions

- Write a Statement of Significance for your church
- Conduct an energy use survey
- Conduct a detailed survey to understand how and why users feel uncomfortable
- Take actions that will reduce sources of discomfort and heat loss (i.e. that do not involve heating, such as repairing broken windows and draughty doors, providing insulation, door curtains, stopping air leaks, etc.)
- Monitor the temperature & humidity (to establish a baseline for your project)
- Check that the PCC holds an asbestos survey

Questions

- What is our current energy consumption and efficiency?
- What are the areas of waste in our current energy use?
- What actions can we take now to improve the current situation?
- What interim solutions are available while we decide what the right solution is?
- Do we have any special features or artefacts that could be affected (wall paintings, organs, lead roofs, even bat roosts)?
- Are there likely to be archaeological implications?
- How do comfort conditions depend on the exterior climate (for instance, is it draughtier when the wind is in a certain direction)?

DEFINE Needs & Resources

- Define the current and planned use of the building
- Talk to current and potential users about their needs
- Speak to other churches who have recently installed systems to find out about advantages and pitfalls
- Establish how you will pay for the new system
- Look at the needs of the building as a whole (for example, ventilation as well as heating)
- Unless the works are simple, draw up a Statement of Need

- Can we re-use elements of the existing system?
- Who will use the building & when?
- Do we want to heat different areas independently?
- What reference material exists to help us? (see *Further Information* below)
- What funds do we have available/ what grant aid might be on offer?
- Are we allowing enough time to get this right?

CONSULT Experts

- Involve your church architect/surveyor early on
- Seek early advice from the DAC
- Ideally, seek independent professional advice from a consulting engineer who has experience of working with church buildings
- Be aware that the thermal requirements of churches are very different from those of almost all other classes of building
- Investigate whether there are any particular insurance requirements or constraints

- What guidelines are offered by the Diocesan Advisory Committee?
- Does my diocese have a specialist heating advisor?
- Would it be appropriate to involve other experts as well? (for example, if your church is listed, or in a Conservation Area, or otherwise especially significant, it is essential to consult an expert in the environment of historic buildings, ideally one who is skilled at monitoring)

CHOOSING THE RIGHT HEATING SYSTEM

ACTIONS & QUESTIONS

	Actions	Questions
SELECT Energy Source	• Familiarise yourself with *Shrinking the Footprint* (the Church of England's national environmental campaign aimed at helping churches reduce their carbon footprint) • Understand what alternatives are available (for example, you may not have access to natural gas or the space for a biomass boiler) • Check what electricity capacity is available (a three phase supply will be required for an electric heating system) • Carefully weigh up the pros and cons of the available alternatives (see *Energy Sources: Key Facts* below) • Check eligibility for government incentive schemes (for example, not all air source systems are eligible)	• What are the relative carbon values of the different options? • What potential is there for reducing our carbon footprint? • Have we considered the carbon footprint of a heat source in the round i.e. including the fabrication of the system? • What are the relative capital and maintenance costs of the different options? • What is the relative efficiency of the different options? • Is the building accessible for fuel deliveries? • What space do we have available for equipment and storage (internally and externally)? • Is the local planning authority likely to object to the siting of equipment externally?
DESIGN Heating System	• Aim to increase efficiency and comfort and reduce running costs • Carefully weigh up the pros and cons of the different heating systems available (see *Heat Emitters: Key Facts* below) • Unless the works are simple, use an independent consultant, architect or surveyor to draw up a specification • If this is not possible, ask at least three contractors (with experience of church work) for detailed proposals and quotations • Ask for estimates of energy use and efficiency for the proposed systems • Compare these with your current situation • Ascertain the *lifetime* cost of the system (i.e. purchasing, running and servicing) • Ensure you have specified colour requirements (avoid white heaters under dark pews or against panelling, for example) • Understand the maintenance requirements	• Can any previous features of earlier heating systems be reused? (for example flues, pits, trenches in the church etc.) • What system will best meet the usage needs we have defined? • Is the system flexible enough to be refined/adjusted over time? • What potential is there for reducing energy consumption? • What will the visual impact be? • How does the cost of keeping the heating on all the time at a low level (boosting when required) compare to that of a fast responding system? • What are the regulations concerning the siting and routing of flues? • Will the controls be easy to understand and operate? • Will they be both accessible and tamper proof? • Are the quotes we have received for similar work? • Have we received quotations or estimates and what is the difference? • Who will assume responsibility for the operation and maintenance of the system?

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ACTIONS & QUESTIONS

	Actions	Questions
ASSESS Impact	• Understand what physical changes will be required in order to install the system • Understand how the archaeology, fabric, contents and setting of your church will be impacted by your proposals • Be aware that rapid heating and cooling of historic buildings can have an adverse impact on the fabric (the moisture generated by fast responding systems can be particularly problematic) • Ask your church architect to help you in assessing impact • **Review your proposals in light of your impact assessment and rework as necessary**	• What damage will there be to the fabric of the building both internally and externally? • In particular, what will be the impact of proposed service runs? • How will we mitigate any impact on the significance of the building? • Is the new system likely to generate humidity and/or condensation? • How will we mitigate the impact of this? • How will any significant artefacts be affected and how will we protect them? • Will there be any archaeological disturbance?
CONSULT & Gain Approval	• Submit your proposal to the DAC • For major works, consult with the amenity societies, English Heritage and the Church Buildings Council • **Review your proposals in light of consultees advice and rework as necessary** • Apply for a faculty to carry out the works • Apply for planning permission if necessary	• Have we included Statements of Significance and Need and a clear rationale for our choice of system? • Does the Statement of Significance include an assessment of the impact of the proposed works and proposals for mitigating this? • Have we included a ground plan of the church, photos and technical details?
IMPLEMENT & Monitor	• Ideally, provide your chosen contractor with a performance specification written by a professional (be aware that without some level of specification contractors **will** quote for the cheapest possible scheme in order to get a job) • At a minimum, define contractor targets (temperature, efficiency, etc.) & include in the contract • Ensure you meet formal Health & Safety requirements, including Risk Assessment • Make the installer responsible for all the maintenance in the first year • Before the contractor leaves, ensure they demonstrate the system controls and hand over all relevant paperwork • Continue the energy use survey • Refine the system as needed	• Are our temperature targets robust and achievable? (This is an area of great potential conflict, with intermittent heating of old heavyweight buildings temperatures can vary widely; • what is needed is for the congregation to feel comfortable) • Are the contractors Gas Safe registered or MCS certified (for renewable technology installations) and NICEIC or ECA approved? • Does the contract include the cost of all associated work (like redecoration)? • Does the paperwork supplied by the contractor include details of the design, the work carried out, and the long-term management requirements? • How has our energy consumption and efficiency changed?

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ENERGY SOURCES: KEY FACTS*

ENERGY SOURCE	Renewable yes/no	Carbon Emissions zero/low/ med/high**	Capital cost £	Running cost £	Efficiency *	Other comments
Oil	no	med	££	££	*	○ requires on site storage & delivery ○ must be stored inside a bund to prevent leaks from the storage tank
Electricity	some sources	high (unless from renewable sources	£	£££	***	○ can be appropriate for occasional or local heating ○ can be the most efficient solution for churches under 300 m² ○ can be expensive when used to run a boiler, unless rated at less than 35kW
Natural gas	no	med	£	££	**	○ requires a mains supply nearby
LPG	no	med	£	£££	**	○ requires on site storage & deliveries ○ sometimes used when natural gas is not available ○ must be compliant with the Pressure ○ Systems Safety Regulations
Biomass	yes (but ensure you are using sustainably source wood pellets)	low	££	£-££	***	○ requires on site storage & delivery ○ needs attention every other day; not recommended for weekend only use ○ wood pellet stoves can be used in small areas like chapels ○ may be eligible for the renewable heat incentive (RHI)
Ground source heat pumps	yes	low (powered by electricity so not carbon neutral)	£££	£-££	**	○ requires extensive digging ○ may need to be on for long periods in cold weather ○ perform better with underfloor or warm air heating than radiators ○ works best in combination with insulation and draught proofing ○ can be used to provide hot water but this reduces efficiency ○ may be eligible for the RHI
Air source heat pumps	yes	low (powered by electricity so not carbon neutral)	££	£-££ (£££ in very cold weather)	** (lower in very cold weather)	○ works with outside temperatures to -5° but effectiveness decreases with temperature ○ may need to be on for long periods in cold weather ○ can be noisy ○ performs better with underfloor or warm air heating than radiators ○ work best in combination with insulation and draught proofing ○ can be used to provide hot water but this reduces efficiency ○ may be eligible for the RHI (not air-to-air systems) ○ vandalism is a risk
Solar thermal panels	yes	zero	£	0-£	*	○ used to provide hot water ○ in winter will need to be supplemented by other water heating equipment ○ may be eligible for government incentives ○ may require planning consent ○ may be eligible for the RHI
Solar photovoltaic panels	yes	zero	££ (panels) £££ (tiles)	0-£	**	○ used to generate cheap electricity but unlikely to generate all you need ○ can be sited on outbuildings ○ may require planning consent ○ may be eligible for the Feed-In Tariffs scheme

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HEAT EMITTERS: KEY FACTS

HEAT EMITTER	What is heated?	Suitable for occasional use?	Impact on the building	Other comments
Underfloor heating Energy sources: oil, gas, biomass, ground source, air source (as part of a wet system) electricity (mains connection or as part of a wet system)	the floor and the air immediately above	no, requires continuous use to be effective	○ can be beneficial if used to provide ambient background heat ○ installation necessitates removal of pews and replacement of existing floor ○ installation necessitates digging below floor level (and archaeological costs will be high as a result)	○ uses hot water pipes or electrical heating elements ○ may need to be supplemented with other types of emitter ○ if concrete floors are poorly designed may drive moisture up adjacent walls and columns: limecrete floors can avoid this ○ can be difficult to access for repairs
Radiators (fixed) Energy sources: oil, gas, biomass, air source, ground source (as part of wet system) oil (oil filled) electricity (mains connection or as part of a wet system)	the ambient air	electric panels only	○ can be beneficial if used to provide ambient background heat	○ in certain locations may need to be fitted with protective guards to avoid burning ○ low surface temperature radiators are available ○ perform poorly with air & ground source heat pump systems ○ oil filled radiators can be very small and can be painted
Heated pipes Energy sources: oil, gas, biomass, air source, ground source (as part of a wet system)	the ambient air	no, requires continuous use to be effective	○ heat can have an adverse effect on woodwork if pipes are near pews ○ old damaged grilles can be remade	○ often part of an old installation and can sometimes be reused for background heating (may crack if heated rapidly)
Convectors (forced and fan) Energy sources: oil, biomass (as part of a wet system) electricity, gas (mains connection, direct fired, or as part of a wet system) air source (as part of an air-to-air system)	the air – but can result in a cold floor and a warm ceiling	yes	○ gas fired convectors need an external flue for each unit which can be unsightly and damage the building ○ heat up and cool down rapidly which can have a negative effect on the fabric of the building ○ wall hung units used in conjunction with some air & ground source systems can be unsightly, floor standing units are preferable	○ rapid warm up time for occasional use ○ there are dangers associated with moisture with fast responding systems. These can pose a threat to the fabric ○ can be noisy; avoid industrial equipment ○ maintenance costs can be high ○ may need to be fitted with protective guards to avoid burning ○ can be easy to install and control
Electric radiant (quartz ray) heaters Energy sources: electricity	warm individuals, not the air	yes	○ can be installed with little damage to the fabric of the building but can be visually intrusive ○ radiation can have a negative impact on fabric, fixtures and fittings if poorly positioned	○ can be incorporated into chandeliers ○ users can experience discomfort ○ air temperature still needs to be maintained at an acceptable level so supplementary heating may be necessary

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HEAT EMITTER	What is heated?	Suitable for occasional use?	Impact on the building	Other comments
Portable heaters Energy sources: gas (LPG), electricity	the ambient air	yes, but should only be used when there is no alternative	○ heating appliances using LPG create large ○ amounts of water vapour in the atmosphere ○ this can seriously damage the fabric of the building ○ and lead to rot in timber	○ Should be sited well clear of woodwork and should not be left unattended ○ paraffin and oil fired heaters and others designed for use in industrial, agricultural ○ or commercial buildings ○ should never be considered ○ for use in church, even as a temporary measure ○ be aware of the safety risks associated with the use of portable electric radiant ○ heaters in a public building ○ the Electricity at Work Regulations require the ○ inspection of electrical equipment having a lead/cable and a plug and which can be ○ easily moved from place to place (see the ChurchCare Guidance note on Electric Wiring Installations in Churches for further details)
Storage heaters Energy sources: electricity	the ambient air	yes	○ minimal - if significant furnishings and ○ monuments are not ○ disturbed	○ may be suitable for rural churches ○ difficult to control use effectively
Electric local heating Energy sources: electricity	individuals and the pews	yes	○ heat can have an adverse ○ effect on woodwork if ○ poorly positioned or protected	○ under pew tubes, panel pew ○ heaters or heated cushions ○ may be suitable for rural churches ○ not favoured by some ○ insurers so consult first
Heated curtains Energy sources: electricity	disrupt the air flow	yes	○ do not stop air & moisture passing through, consider a real curtain instead	○ expensive to run ○ have a short life

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Further information

EVALUATE Current Situation	Guidance on writing a Statement of Significance can be found at http://www.churchcare.co.uk/images/Guidance_on_statements_of_significance_and_needs.pdf An online tool for monitoring your building's energy usage is available at www.shrinkingthefootprint.smeasure.com The Revd Ruth Lampard, Associate Vicar at St Mary the Boltons, shows how regular meter reading can lead to energy saving initiatives with significant long-term benefits at http://www.youtube.com/watch?v=MdDk2icT7tQ This presentation by Matt Fulford of Sustain looks at what churches can do to improve their energy efficiency without making major changes, as well as other topics http://www.sustain.co.uk/images/files/Heating-without-Hot-Air-Conference.pdf
DEFINE Needs & Resources	Guidance on writing a Statement of Need can be found at http://www.churchcare.co.uk/images/Guidance_on_statements_of_significance_and_needs.pdf
CONSULT Experts	Contact details for your DAC can be found at http://www.churchcare.co.uk/churches/church-buildings-council/who-s-who/dacs The CIBSE website at http://www.cibse.org/index.cfm?go=page.view&item=213 provides information on specialists in the heating of religious buildings Ecclesiastical Insurance publishes guidance on fire risk which contains a section on heating https://www.ecclesiastical.com/ChurchMatters/Images/PDF%20-%20church%20insurance%20guidance%20notes%20-%20fire.pdf
DESIGN Heating System	**Other sources:** ○ *New Work in Historic Places of Worship,* Historic England https://www.historicengland.org.uk/images-books/publications/new-work-in-historic-places-of-worship/ ○ *Conservation of cultural property. Indoor climate. Guidelines for heating churches, chapels and other places of worship* BS EN 15759-1:2011 (British Standards Institute: 2011) ISBN 978-0-580-60908-4 ○ Presentations from the CCB Heating Conference held in 2012 can be found here: http://www.churchcare.co.uk/about-us/past-events/575-heating-event-2012