

Heating and Insulation

Heating is important for any building, if a building is a comfortable temperature then the occupants can be comfortable. If a building is too hot or cold then it can be uncomfortable. As well as this, if a building can regulate heat well then it will run more efficiently which will be a great step on the road to zero carbon.

84% of carbon emissions within the Church of England's churches originate in heating buildings. So, if we can mitigate the carbon output of heating our churches, we have gone a long way to become zero carbon.

What are the first steps?

The first step for mitigating heat carbon output is to make sure your church is in good physical condition. There are a number of factors that must be considered before moving on to more complicated methods of reducing heating carbon output:

Is there damp in the church? **A damp church is a cold church**, there are a number of factors that contribute to a cold church such as:

- Blocked and faulty rainwater goods - if a gutter or downpipe is blocked or is broken, it can cause rainwater to overflow onto the church walls and lead to damp.
- Faulty, broken and slipped roof tiles – A roof that is cracked, broken or has slipped from its original position can create a void or gap for rainwater to penetrate, if rainwater can penetrate into the interior then damp will form inside the church.
- Inappropriate materials – A large majority of churches are constructed from stone, **a breathable material**, if non-breathable mortar (concrete) or insulation is used on the church then water will get trapped in the stone and cause damp

Is the building draughtproof? While it is important that a church is well ventilated to allow it to breathe, draughts that are not designed can cause excessive heat loss which will make heat efficiency impossible. There are two main areas associated with draughts:

- Windows – windows can become loose and cracks can form where it meets the stone, regularly monitor your windows and fix anything that may arise to keep windows draughtproof.

- Doors – doors can warp, crack and rot. All of these can result in defects that let in draughts, just like with windows monitor and make sure that any problems are repair to limit the potential heat loss through draughts

If your church is well maintained it will increase heat efficiency, only then can we move on to additions to improve heat efficiency and reduce your church's carbon output.

Heat Pumps

Heat pumps can be an efficient way of heating a building more effectively than conventional heat sources. The more efficient your building is at retaining heat the smaller the heat pump you will need as well. There are three types of heat pumps available, the name of each being the source of the heat:

- *Air Source Heat Pumps* – as you can imagine Air Source Heat Pumps (ASHP) draw heat from the air. They do this by drawing outside air to heat up a liquid refrigerant that turns into a gas that is then compressed and heated further. An ASHP is cheaper than ground or water sourced Heat Pumps, but there are a number of factors to consider before choosing an ASHP.
 - Firstly, keep in mind that ASHPs use electricity to run, so if you are not on a green tariff your ASHP will not be zero carbon.
 - Secondly, the visual impact of a heat pump will need to be considered, if your church is listed then it will need to be installed in an area that is not visible to the public or alters the character of the building. This also applies for the internal portion of the unit, more designs are becoming available but remember that your ASHP has to be sympathetic to your church and the surrounding area.
- *Ground Source Heat Pumps* – Ground Source Heat Pumps (GSHP) source heat from the ground at 1.5m depth, where the temperature stays constantly between 8 and 12 degrees Celsius. The heat can be taken from the ground using pipes fill with water and antifreeze. This can be installed vertically using boreholes or horizontally using trenches. A GSHP is more environmentally friendly than an ASHP, but there are two things to consider before installing one.

- Firstly, GSHPs are much more expensive than ASHPs to install, they will require heavy machinery to excavate ground to then install pipes, it is costly, long and intrusive work that requires space that may not be available for a church.
 - Secondly, as stated the work is intrusive, and may disturb or damage archaeological remains on site. Even if there is no record of burials, you will need to have an archaeologist undertake a watching brief to make sure no archaeology or burials are damaged in the GSHP installation process.
- GSHP are effective, but they are also expensive.
- *Water Source Heat Pumps* – Water Source Heat Pumps (WSHP) work in the same way as GSHPs but pump water and antifreeze around lakes, rivers, canals or the sea. Water temperature sits higher than air in winter and a WSHP can increase the temperature by four times. This can be cheaper to install than a GSHP and may not require archaeological intervention, however there are a couple of things to consider before installing a WSHP.
 - Firstly, your church needs to be close enough to a body of water so it can effectively heat the building through a WSHP, the body of water needs to be large enough to cater for a WSHP as well. If either of these factors are insufficient it will reduce the efficiency of a WSHP and therefore the heat efficiency of your church.
 - An ecological survey will need to be carried out to make sure the WSHP does not affect marine life and other species that rely on the water body. Whilst it is less likely to need archaeological intervention this may also still be necessary depending on your church surroundings.
 - While less expensive than a GSHP, a WSHP is still very expensive, time consuming and intrusive.

Consider if you need a heat pump before installing one, it may only be necessary if you are a large church that is open frequently. If you are on a green electricity tariff an ASHP may be enough to heat a build efficiently and be net zero. Heat pumps are not an all cure elixir for heat efficiency and you should carefully weigh up all your options before installing one. Consult with DAC on the matter before going ahead with any plans.

All heat pump installations will require a full faculty application.

Insulation

Insulation can be useful when increasing heat efficiency in your church. Insulation does need to be appropriate and installed correctly however to improve the thermal performance of your church. You can install insulation in the walls and the roof of your church.

Walls

Insulation and its appropriateness may depend on the type of wall your church has. There are two types of wall that your church may have.

- *Solid Wall* – The vast majority of churches will have a solid wall, a solid wall is a wall built with no cavity, all buildings pre-1919 are built with a solid wall. So, the chances are that your church will have a solid wall. Insulation therefore has to be either on the external face of the wall or the internal face of the wall. With churches an external wall will be inappropriate, especially with listed churches as it will affect the character of the church. Internal insulation will be what you will use for a solid wall insulation. Many churches will have decorations and adornments that may make internal insulation inappropriate as well. Solid walls are also built from breathable materials such as stone and lime-based mortars. So an insulation will also need to be breathable to prevent problems such as damp which will decrease heat efficiency. For a solid wall insulation may not be appropriate with a church.
- *Cavity Wall* – cavity walls are walls built with a cavity in between an external and internal wall, they are the standard building practice post-1919. While there are not many churches built post-1919 if yours is then cavity insulation will be the ideal option as it will not affect the visual character of the church. Cavity walls can be built from non-breathable materials but it is important to know before installing insulation so appropriate material is used.

Roofs

Insulation in roofs can increase heat efficiency in churches and be an effective alternative to wall insulation. Most church roofs fall into two material categories that will affect the approach to insulation in roofs.

- *Slate and Tile* – slate and tile roofs are common on churches, with slate being more common. These roof materials are suitable for insulation but it is important to use appropriate materials to insulate. As well as this, insulating roofs can be hard in churches due to many not having ceilings, this means that internal or external scaffolding will be needed to insulate. This makes the process expensive and intrusive, and may not be very effective due to high ceilings. If you wish to insulate the roof it is best to do so when other roof repairs are happening to keep scaffold costs and disruption to a minimum.
- *Lead and Other Metals* – Lead and metal roofs are also very common for church roofing material. Insulation for these roofs is not appropriate and can cause more damage than good to your church. So if you have a metal roof, do not insulate.

Insulation is expensive and intrusive for your church and can disrupt service and congregation. Any insulation installation will require a full faculty application. Consult with the DAC so it can be decided if insulation is right for your church.