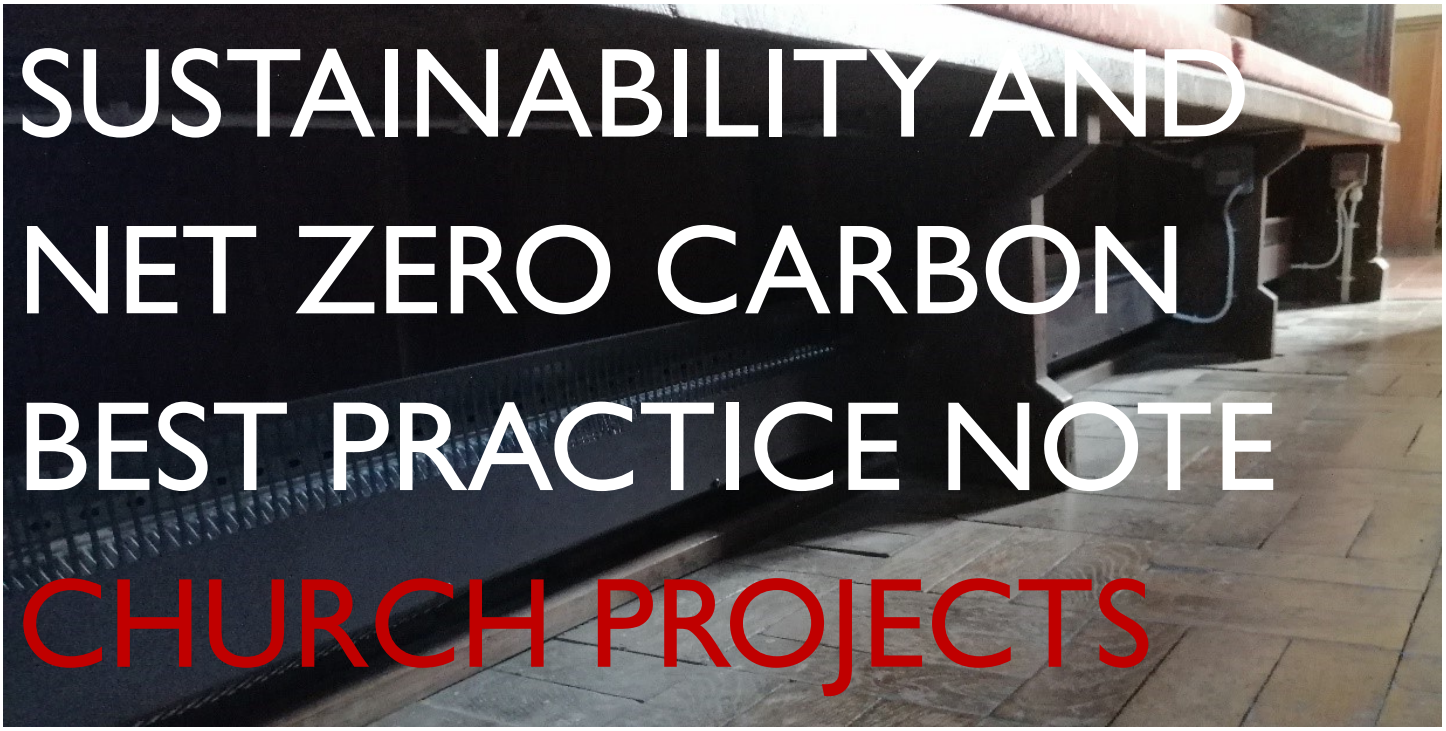

SUSTAINABILITY AND NET ZERO CARBON BEST PRACTICE NOTE

CHURCH PROJECTS

General introduction

Over recent years, many of us have become increasingly aware of the climate crisis and the urgent need to reduce our carbon footprint. In February 2020, Church of England General Synod recognised this crisis and called on all parts of the Church to plan towards 'net zero carbon' by 2030.

Church architects and surveyors have a pivotal role to play in advising church communities. Through the quinquennial inspection (QI) programme every church receives a QI Report, and we are also heavily involved in major change projects. We are therefore very well placed to guide and encourage church communities to make their buildings more sustainable while not compromising their heritage integrity. This guidance aims to encourage and equip inspectors to be sustainability champions.

This note is intended for building professionals. It has been approved jointly by the Church of England's Church Buildings Council and the committee of the Ecclesiastical Architects and Surveyors Association, to capture and share best practice on environmental sustainability. It has been produced by a working group comprising EASA members, representatives of the Church of England's Cathedral and Church Buildings Division (CCB) and others; a list of working group members can be found on the EASA webpage.

Your attention is drawn to the sister document on Quinquennial Inspections, and both should be read in conjunction with the CCB's Practical Path to Net Zero Carbon (PPNZC) document which provides a helpful guidance framework for churches. While this document in places refers to Church of England documents and terminology (PCC, faculty, etc.), it is hoped it will be of benefit across all denominations.

Introduction : Church projects

Church projects of course cover a very broad range of proposals; many will require faculty approval, while others may be carried out under 'List B'. What follows provides a checklist for some common application types for which sustainability plays a significant role. The aim of this guidance is to help the PCC, with their architect/surveyor's support, to choose the correct changes to make to their buildings from an environmental perspective, and then to make their case well, improving their chances of success.

The sustainability aspects of any scheme will most naturally fit within the statement of needs—far better to deal with it there than in a separate, non-statutory document. It is helpful to start with a statement of principles, referencing:

- UK government policy, including a commitment to net zero carbon by 2050;
- General Synod's ambitious target for net zero carbon by 2030;
- (if relevant) The local authority's net zero declaration, which you can check on the map of declarations;
- any specific diocesan policies (check on their website, or contact the relevant Diocesan Environment Officer); and
- the recognition that the fifth Mark of Mission—'to strive to safeguard the integrity of creation and sustain and renew the life of the earth'—is one of the 'benefits' to be balanced against 'harm' under the Duffield questions.

As with any proposals for changes to church buildings, it is essential that the local church (the PCC) owns and drives the process. This will be greatly helped if the PCC has already engaged with the CCB's PPNZC document, either through the QI process or at the outset of a project. The PPNZC provides a progressive structure of interventions which helps a PCC and their professional advisers focus on those measures that are appropriate in the particular case, and can be referenced (or included) in the statement of needs. The church may also want to commission an energy audit, to inform their decision making (see below).

Most dioceses now have a Diocesan Environmental Officer in post, who should at least be notified when planning a project, and who may be able to offer support, including on questions of ecology and biodiversity.

Principles that apply to *any* project

There are some questions you will want to consider, no matter the nature of the work you have been commissioned to do.

- **Consider the whole-life carbon of the project.** Along with any carbon savings in the running of the building, also consider the carbon cost embodied in the materials and in the energy required to carry out the project, and their removal at end of life.
- **Carry out an options appraisal.** Environmentally, which option will be best, including doing nothing? For a small project, this might be a quick back-of-the-envelope exercise; for a large project, it might be fully costed options (including the carbon impact).
- **Consider how long the work will last for, and what would be required for it to last longer.** Whether you are installing a kitchen, WC, floor, or heating system, the longer it lasts the more sustainable it will likely be, and this should be weighed against costs.
- **Consider the carbon cost of the building materials,** including their transport to site.
- **Consider how to minimise waste from the project,** through reuse or adaption in preference to demolition; plan for recycling of materials that cannot be re-used.
- **Link proposals to a broader sustainability strategy for the building** through reference to the PPNZC.
- And **don't forget the significance of the building**: the benefits of any proposed changes must, of course, be balanced against their impact on the significance of a historic building.

Principles that apply to *specific types* of project

Heating renewal

The upgrade or replacement of a heating system provides a key opportunity to improve the sustainability of a church building, and is very much in line with government targets to move away from fossil fuels. Principles are set out in the heating guidance on the Church of England website. Applications should consider:

- Existing and foreseeable future patterns of building usage.
- Heat source—to reduce our carbon footprint the clear consensus is that we should transition away from fossil fuels to renewable systems, typically electrically powered with electricity purchased from 100%-renewable sources.

(See also under 'Heat pumps' below.) In some situations a biomass boiler may be appropriate; consider the sustainability of the fuel source, together with space requirements for the boiler and fuel store.

- Heat delivery—heating of the people, or of the space? Appraisal of the options including, for example, high-level infrared heating panels. Justification both for the basic strategy, and the specific proposal.
- The use of zoning, controls and insulation of pipework to reduce the energy required.
- Data on temperature and relative humidity, valuable for responsible design and for making the case for that design.
- Where underfloor heating is proposed, what is known about existing floor construction/archaeology? In historic churches: proposals for any ledger stones (and whether they are likely still to relate to burials), and proposals for secondary heat delivery. Where change of floor level is proposed, impact on any pier bases etc.
- Principal service routes, and any impact on existing fabric.
- Where possible and appropriate, the adaptation and re-use of existing heating components, to reduce the embodied carbon cost of the proposals.

Roof replacement

Roofs typically offer the greatest potential for improving the insulation value of the building elements. Clearly, this needs to be done with great care to avoid condensation and other issues, particularly in historic buildings. Work to roofs also presents an ideal opportunity to consider the installation of solar panels (see below).

- Metal roofs: with historic buildings, the question of insulation often arises in conjunction with lead theft (and its possible replacement with alternative forms of metal roofing). Where insulation lifts the plane of the roof, local authority planning permission will be required (or confirmation received that this is not required).
- Pitched roofs (with or without roof space): justification for warm or cold roof design, and ventilation strategy if required.
- Sustainability of insulation materials themselves—for example, wood-fibre insulation products are preferable to closed-cell materials in this respect.
- Demonstration of how condensation is to be avoided. Consideration of breathability of materials; vapour-diffuse products that allow moisture through them and hydroscopic insulation products (wood fibre, sheep wool etc.) that absorb and release moisture to suit ambient humidity levels are preferable to impermeable materials. Include reference to how the building is heated and its pattern of use.
- Consider impact of materials on any protected species that may be present, particularly bats.

Other building improvements

There are other forms of alteration that improve the energy performance of buildings which may arise in conjunction with re-orderings and other larger projects, or perhaps in their own right:

- Insulation of floors: consider breathability strategy, whether for solid floor construction or ventilation of suspended timber floor voids.
- Insulation of walls, especially in ancillary spaces and/or in modern construction (e.g. cavity insulation).
- Insulation of roofs; see roof replacement above.
- Double- or secondary-glazing to suitable windows in well-used areas such offices, vestries and halls.
- Reintroduction of ceilings which may once have been present: nature of the historical precedent; ventilation of roof void; possible (positive?) impact on bats and other protected species.
- Formation of draught lobbies: any impact externally (and whether this needs planning permission); impact on accessibility and level access; consider automatic door openers; impact on the process of welcoming.

Solar panels

While solar panels may not be appropriate on every historic building, appropriateness is a cultural question which is already shifting rapidly in some quarters. Justification for a solar panel installation should include:

- Visual impact, which will typically be required for the planning application. If the panels are visible, and the building listed or in a conservation area, then a clear case should be made for the public and missional benefit of the visible section. Photographs of the roof from different angles in the surrounding area, marked up with an impression of the panels, help greatly here.
- Condition and projected life of the existing roof covering; reference to latest QI report.
- Structural capacity of the roof to take the additional loading.
- Proposed fixing method and assessment of potential impact on existing roof covering; consider weighted frame. Demonstrate ease of future dismantling and reconstruction.
- Assessment of potential overshadowing (including any trees, parapets, etc.) and projected impact of this on system generation capacity.
- Cabling: entry point into and routing within the building.
- Demonstration either of significant levels of daytime electricity usage well matched to the size of the panels or a clear plan for the use of the spare electricity—export to the grid on a missional basis, or perhaps battery storage.
- Battery storage is expected to become more financially feasible in the near future; consider whether to plan for a future battery, and where these batteries would be located, since this may affect cable routes.
- Demonstration that the panels are part of a package of measures including tackling heat loss and making the building more energy efficient. Installation should not be undertaken in isolation without setting in context of the building system as a whole.

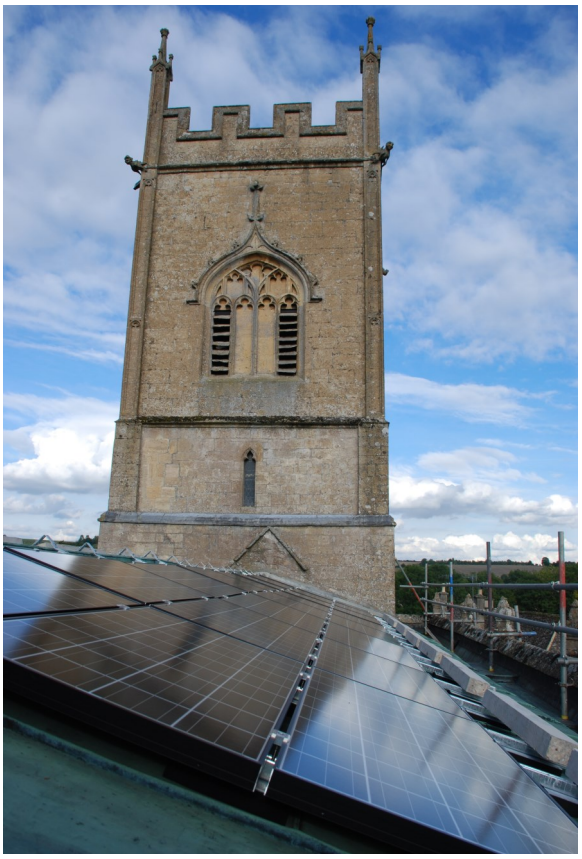

Photo: **St Michael and All Saints, Withington; Matt Fulford**

Heat pumps

Heat pumps, of course, dramatically improve the output from each kilowatt hour of electricity consumed, with typical efficiencies of 300%-400%. The capital cost will likely only be justifiable within well -used buildings.

- Existing and foreseeable patterns of building usage.
- Air source: Number, location and size of units; screening if any; distance from and anticipated impact on neighbours (if any—presumably required at planning).
- Ground source: horizontal (coil) or vertical (borehole) installation; confirmation of suitable geology; impact on

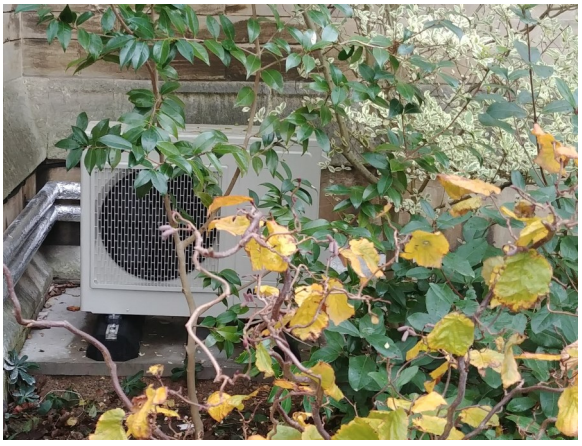

Photo: **Richard Crooks**

archaeology, burials and/or the root protection areas of any trees—vertical boreholes involve disruption to ground due to links back to heat pump.

- Location/size of plant e.g. buffer vessel, if required.
- Service routes and associated builder's work.
- Cost projections for return on investment with and without solar panels (where proposed).

Car charging points

As increasing numbers of people switch to driving electric vehicles, where churches provide parking an expectation will grow for one or more charging points. Principles are set out in the the Church of England's electric vehicle charging guidance. Faculty is required, and planning approval may be needed. Applications should consider:

- Who has access to the charging point, and whether/how charging is billed.
- Connection type(s) and charging speed.
- Whether the church's existing electrical installation is adequate to take the increased electrical load.
- Cable routes into and within the building.

Reordering and other projects

When proposing other works such as a re-ordering, the following should also be considered :

- Airtightness greatly helps the thermal performance of buildings, yet many historic buildings rely on plentiful ventilation to maintain a balance of moisture. Understanding the existing moisture performance of the building, based on temperature and humidity data, is critical (see 'Other Matters' below).
- Where relevant, consider repairs to leaded glass, draught-proofing of doors and tower floors, etc.
- Include any other obvious wins such as LED lighting and other unaddressed items from the PPNZC.

Other matters: monitoring and data gathering

The following are three key ways in which data can be gathered to inform decisions around sustainability measures for the long-term health of our church buildings:

- PCCs should be encouraged to complete the Church of England Energy Footprint Tool as part of the Online Parish Returns System. Some churches may want to continue on to calculate their complete carbon footprint using the 360°Carbon carbon footprint calculator, which also covers travel, water, food, waste, and purchases.
- Design of appropriate interventions is made much easier if we have records of temperature and relative humidity within the building; the key is to start gathering the information. Data loggers that record temperature and humidity data for download via USB are easily available for under £50. In order to provide a baseline for future interventions, every church should be encouraged to install one now. The data can be further enriched when combined with a small external weather station, which then allows comparison of external and internal temperatures, how wind speed affects performance, etc. These start below £100.
- Churches can commission an energy audit, to inform and justify the options they pursue.

A sample of useful links and resources

- Historic England has multiple publications on energy efficiency, heat pumps, photovoltaics, etc. A good place to start is their guide to saving energy in the home.
- RIBA Sustainable Outcomes Guide.
- SPAB Energy Efficiency and Old Buildings and the SPAB Energy efficiency in old buildings briefing document (2014).
- EASA: https://easa.org.uk/index.php/resources/sustainability-net-zero-carbon
- Churchcare net zero carbon case studies and Net Zero Carbon landing page
- Churchcare guidance (practical path to net zero carbon, heating, energy efficiency, QIs etc.)
- The Online Faculty System renewables map, which searches for churches by diocese, listing grade and specific technology.
- Church Buildings Council & CFCE joint statement on the environment.
- General Synod declaration.
- Parish buying (energy audits, 100% renewable electricity).
- Find your local Diocesan Environment Officer.

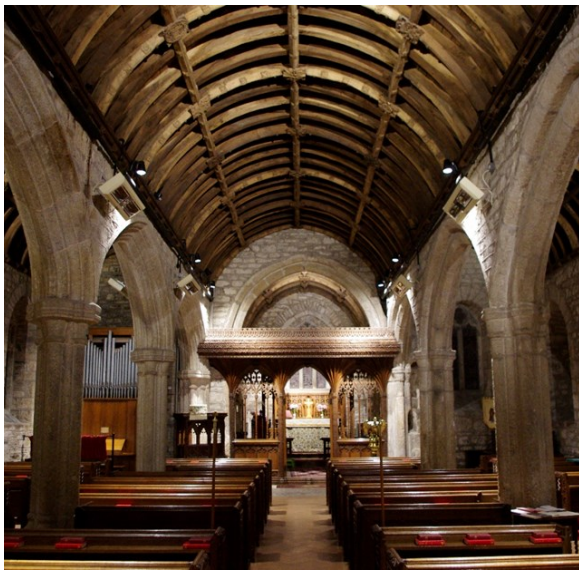

Photo: **St Petroc, Lydford; Chadburn Conservation Architect**

This guidance is issued by the Church Buildings Council pursuant to its powers under section 55(1)(d) of the Dioceses, Mission and Pastoral Measure 2007, jointly with the Ecclesiastical Architects and Surveyors Association. 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.