

LOWER CARBON AND RENEWABLE ENERGY OPTIONS

BUILDINGS

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WHY?

Church buildings need energy for a number of uses such as lighting, power appliances, heating the space and heating water. Historically, heating has been provided by having a boiler powered by oil, LPG or mains gas. Electricity (e.g., for lighting) will have been bought in as mains electricity, which itself was mostly generated from oil, gas or coal, and transmitted around the country through national grid power cables. All of these sources of energy are fossil fuels and produce high levels of carbon dioxide. With macro investment in renewable energy technologies, mains electricity is increasingly being produced from low carbon sources. You can view the live mix here: <https://gridwatch.co.uk/>

HOW?

Before considering major capital expenditure of switching energy sources, it is worth reviewing our papers on 'Quick wins', 'Insulation, double glazing and draught-proofing' and 'Buying greener energy'. For example, the 'Quick wins' paper suggests that as almost all buildings use mains electricity for lighting and to power appliances, a simple solution is to purchase electricity from a supplier that provides 100% renewable energy.

Switching away from a gas, LPG or oil-fired boiler is usually complicated, giving both an opportunity and a necessity for a church to review needs and the whole approach to heating. Ask yourselves, for example, how often is the building used? Can you zone it for different heat levels? Do you need heat quickly or is a low level of background heat useful? Is the building well insulated or does it need to breathe? Do you need the same solution for both space and water heating? The Church of England has run two excellent webinars to help you think this through in more detail, regardless of your denomination or the age of your building:

1. ['To replace or not replace' your church heating and lighting, from the CofE Environment Programme](#)
2. [Choosing the best heating solution for your church, from the CofE Environment Programme](#) (starts at 6.06 minutes)



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Broadly, the options in switching to renewable energy sources are:

1. Generating electricity on site through solar panels, wind turbines or hydroelectricity. These last two may be possible as part of a community energy scheme.
2. Generating heat (but not electricity) on site through a lower carbon route, e.g., via a biomass boiler, an air source or ground source heat exchanger.
3. Generating both electricity and heat on site, e.g., by installing an air source heat pump powered by electricity from solar panels.
4. Creating a system which relies entirely on electricity for water and space heating e.g. via underfloor heating, an electric boiler, pew heaters, radiant heat or blowers. This electricity can either be generated on site or bought in as 100% renewable. With global initiatives to reduce carbon emissions, technologies in electrical heating systems are rapidly developing, so new possibilities will be arising regularly.

This resource reviews some of the key features of each approach with further detailed papers on each topic. The best option will vary from church to church to match the energy need and resources available with the most appropriate source of renewable energy. In all cases the capital investment and running costs will need to be assessed when evaluating potential options.



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Switch to greener fuel from fossil fuel mains-connected electricity or gas.

PURCHASE MAINS ELECTRICITY THAT IS 100% GENERATED FROM RENEWABLE ENERGY FROM A SERVICE PROVIDER

Initial Issues to Consider:

- When does the current contract end?
- What is the comparative price for 100% renewable energy?
- Is renewable source acceptable to you? (e.g., is it 100% renewable? Is it partially offset? Does it include nuclear?)

PURCHASE MAINS GAS FROM A SUPPLIER THAT HAS A RENEWABLE CONTENT E.G. BIOGAS

Initial Issues to Consider:

- When does the current contract end?
- Is an acceptable contract available to you? (Is it biogas or is it partially offsetting carbon from natural gas?)

GROUP BUYING OF OIL OR BOTTLED LPG GAS

Initial Issues to Consider:

- There are no easy low carbon switches for oil and bottled LPG gas. You could investigate group purchases which would reduce the carbon emissions from transport.



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Generate renewable electricity on site

ELECTRICITY GENERATED FROM ON-SITE SOLAR PHOTOVOLTAIC PANELS

Initial Issues to Consider:

- How many panels might you need? A typical panel generates 300W–400W; comparing this to your current usage will give some idea of the number.
- Is the roof large enough and strong enough to install the necessary panels?
- Can the panels be positioned to attract sufficient light for electricity generation? An unshaded south-facing roof at a 30° to 40° angle is best.
- Will there be planning limitations due to your location or the heritage of the church building?

ELECTRICITY GENERATED FROM ON-SITE WIND GENERATOR

Initial Issues to Consider:

- Will the turbine be likely to produce the amount of electricity you need?
- Is there a safe space to install it which complies with the many planning regulations?
- Does the location have sufficient wind resources? Locations in the UK with enough uninhibited wind are rare as regular wind speeds of around 12mph are needed.
- Is there space to install a small generator?

ELECTRICITY GENERATED FROM ON-SITE SMALL-SCALE STREAM OR RIVER-WATER GENERATOR

Initial Issues to Consider:

- Is there a suitable nearby stream or river?
- Is there sufficient drop and water volume? A minimum of 2m drop at 2m³/s or a similar ratio is needed.
- Are there rights to the stream or river to generate power for the building?



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Generate low carbon heating solutions

ON-SITE AIR SOURCE HEAT PUMP SYSTEM

Initial Issues to Consider:

- Is there a suitable space for the external heat exchanger next to the church building?
- Is there a sufficient electrical supply to the building? (Usually three phases are required.)
- Are the existing radiators appropriate, despite receiving water at lower temperature than from a gas boiler?
- Do you need fairly continuous heating, making ground source a more appropriate option?
- Will you need a separate solution for water heating?

ON-SITE GROUND SOURCE HEAT PUMP

Initial Issues to Consider:

- Is there sufficient ground around the building available for either lengthy or deep pipes? (Graveyards are not suitable.)
- Are the subsurface conditions suitable for such pipes? A survey would be needed.
- Is there a sufficient electrical supply to the building? (Usually three phases are required.)
- Is there space for the heat exchangers and pipework close to the church?
- Do you need fairly continuous heating, making ground source a more appropriate option?
- Are the existing radiators appropriate, despite receiving water at lower temperature than from a gas boiler?
- Will you need a separate solution for water heating?

BIOMASS WOOD-CHIP BOILER, USING WOOD FROM SUSTAINABLE SOURCES

Initial Issues to Consider:

- Is there sufficient space for a wood-chip or pellet boiler that will be much larger than a gas or oil one?
- Is there enough space to store the fuel safely?



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- Can a consistent and sustainable supply of wood chips be guaranteed to meet heating needs?
- Do you have access to a sustainable source of wood chips or pellets?

ELECTRICAL HEATING OPTIONS (such as electric boilers, radiant or far infra-red panel heaters, oil-filled radiators, fan-assisted heaters, heated cushions, under-pew heaters or a warm air system)

Initial Issues to Consider:

- Is there a sufficient electrical supply to the building?
- Will a separate water heating solution also be needed?
- Is the building or seating suitable for the particular solution?
- Will this solution supply enough heat to the right places?
- Where should heaters be positioned?
- Will far infra-red panel heaters be powerful enough to heat the space?

HYDROGEN

Initial Issues to Consider:

- At the time of writing, hydrogen boilers are not available for installation. As gas boilers will be banned in all new-build properties from 2025, alternatives such as hydrogen are at an advanced stage of development.
- They are expected to be able to directly replace gas boilers in existing heating systems, whilst being much more efficient.
- At present the production process of hydrogen is expensive, and it is more complicated to design a system which captures carbon emissions.



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LONGER READS & OTHER RESOURCES

This is an extremely helpful booklet summarising best practice in microgeneration systems. Whilst aimed at historic buildings in Wales, the content is helpful to anyone thinking about microgeneration: https://cadw.gov.wales/sites/default/files/2019-05/Micro_gen_booklet_EN.pdf

CASE STUDIES

A number of Eco Churches are profiled on the Church of England environment website. Scroll to the management of church buildings section to see how six of our churches have reduced their carbon emissions through greener heating: <https://www.churchofengland.org/about/environment-and-climate-change/eco-church>

Many of these churches have moved towards electrical heating systems: <https://www.churchofengland.org/about/environment-and-climate-change/towards-net-zero-carbon-case-studies>

STRATEGIC DEVELOPMENT GOALS

Taking action on this topic will contribute to these UN Strategic Development Goals:

