Christ Church

Low Carbon Energy Consultation

The environmental team at Christ Church are investigating potential low carbon energy sources for heating and power and are starting a consultation on the topic. We hope that you will find this information useful and contribute with feedback so that the church are able to make a decision on whether to pursue. The timeline for the activities is as follows:

November 2023

November 2023

Consultation – Provide Information

Consultation – Provide Information

December 2023

December 2023

Consultation – Feedback via Questionnaire

Consultation – Feedback via Questionnaire

Summer 2024

Summer 2024

PCC decide whether to pursue low carbon energy installation. If yes, PCC will obtain further cost estimates and quotes before final authorisation

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Spring 2024

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Environmental team review feedback and make recommendation to PCC

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Solar Power

How does solar power work?

Solar power works by converting energy from the sun into power. There are two forms of energy generated from the sun for our use – electricity and heat.

Both are generated through the use of solar panels, which range in size from residential rooftops to 'solar farms' stretching over acres of rural land.

Is solar power a clean energy source?

Yes, solar power is a renewable and infinite energy source that creates no harmful **greenhouse gas emissions** – as long as the sun continues to shine, energy will be released.

The carbon footprint of solar panels is already quite small, as they last for over 25 years. Plus, the materials used in the panels are increasingly recycled, so the carbon footprint will continue to shrink.

How exactly is electricity from solar energy produced?

Solar panels are usually made from silicon, or another semiconductor material installed in a metal panel frame with a glass casing. When this material is exposed to photons of sunlight (very small packets of energy) it releases electrons and produces an electric charge.

This PV charge creates an electric current (specifically, direct current or DC), which is captured by the wiring in solar panels. This DC electricity is then converted to alternating current (AC) by an inverter. AC is the type of electrical current used when you plug appliances into normal wall sockets.

Costs

The average domestic solar PV system is 3.5kWp and costs around £7,000. Typical cost savings from a system of this size are shown below:

[source: energysavingtrust.org.uk]

Carbon Saving:

Solar electricity is low carbon, renewable energy. **A typical home solar PV system could save around one tonne of carbon per year**, depending on where you live in the UK.
Solar PV systems need little maintenance. Keep an eye on nearby trees to ensure they don't begin to overshadow your system.
Once fitted, your installer should leave written details of any maintenance checks that you should carry out to ensure everything is working properly. This should include details of the main inverter fault signals and key troubleshooting guidance. Ideally, your installer should demonstrate this to you once the system has been installed.

Keeping a close eye on your system and the amount of electricity it's generating (alongside the weather conditions) will help you understand what to expect and alert you to when something might be wrong.
The panels should last 25 years or more, but the inverter is likely to need replacing sometime during this period, at a cost of around £800 (depending on system size and the manufacturer). Some inverters have online monitoring functions and can warn you by email if the system fails.

Potential Problems with Solar PV

Delamination and internal corrosion

If moisture finds its way into the panel, it can cause internal corrosion.

Electrical issues

Faulty wiring prevents your solar panels from performing well. Loose connections, corrosion, and oxidation may interfere with electricity production.

Micro-cracks

These are tiny cracks on the panel and are hard to notice with your naked eyes. But with time and significant weather changes, the cracks can grow. The cracks mostly occur due to PV module production and thermal and seasonal conditions.

Hot spots

Hot spots are among the most common issues with solar or PV systems.
They can degrade the function of your solar panels and even render them irreparable. Hot spots occur when panels get too warm and overload. They are caused by several things, including the accumulation of dirt on the panels. This problem can lower the performance and lifespan of the solar panels.

Potential Induced Degradation.

It can occur due to the voltage difference between the earthing and the solar panel. When this happens, the primary power circuit ends up producing partial voltage discharge. PID effect may degrade the efficiency and performance of the panels and lower their lifespan.

Birds

Those lovely little birdies tweeting overhead can wreak havoc on solar systems. They can nest beneath the panels and keep the system from doing its job properly. Thus, if you notice birds gathering on your roof, consider bird roofing solutions like spikes, mesh wire, and more.

Roof issues

The solar system should not affect the integrity of your roof. Conversely, it can serve as a nice layer of protection for the roof materials below. However, in some cases, the installation can hurt your roof in some way. Make sure that you inspect your roof from time to time, and call your PV system installers if it seems to be compromised in any way.

Inverter problems

Solar panels use an inverter to convert direct current from the sun to alternative current that you now use in your home. An inverter is like a box that is usually installed in the upper floor. Most solar panels can last up to 20 years, but inverters aren't quite that durable. Solar users report having to change their inverters an average of every 10 to 15 years.

How would these work at Christ Church?

We use around 5000 kWh per year in the centre, and 2,800 kWh per year in the church. This is similar to a large house, so a domestic sized system of somewhere around 12-16 panels would probably be suitable, with suitable batteries for local storage. Based on the average domestic costs quoted above, we'd expect a large domestic system to be in the region of £10,000.
Panels could be fitted on the South side of the centre roof, shown in yellow in this overhead view:

We are not aware of any Planning or Church of England restrictions that would limit us.
We won't know the precise costs or be able to get more accurate estimates until we ask for quotations. Its possible that we may receive a grant from the Church of England and are investigating this with the diocese.

Heat Pumps

What is an air source heat pump?

An air source heat pump, sometimes referred to as an air-to-water source heat pump, transfers heat from the outside air to water, which heats your rooms via radiators or underfloor heating. It can also heat water stored in a hot water cylinder for your hot taps, showers and baths. **It is a carbon-efficient alternative to a gas boiler.**
Heat from the air is absorbed into a fluid. This fluid then passes through a heat exchanger into the heat pump, which raises the temperature and then transfers that heat to water.

There are two types of air source heat pumps: monobloc and split systems. A monobloc system has all the components in a single outdoor unit, with pipes carrying water to the central heating system and a hot water cylinder inside your home. A split system separates the components between indoor and outdoor units. Whether a monobloc or split system is right for you will depend on your budget and the space available.

How much does an air source heat pump cost?

The price of an air source heat pump can vary between £3,500 and £8,900 depending on several factors, such as how powerful the unit is, the brand, government grants and installation costs. [Source EdF]

Will installing a heat pump help save money on my heating bills?

. The amount of heat energy moved versus the amount of electrical energy used depends on the source temperature and the output temperature, so it varies constantly throughout the year as outside temperatures change.

How this will affect your energy bill will depend on several factors, including:

- What fuel you are replacing and how much it costs.
- Your electricity tariff.
- Which type of heat pump you install and how efficient it is.
- The design of your central heating system.
- Your location and its average air or ground temperatures throughout the year.

For people using gas boilers (not LPG or oil boilers), heat pumps are likely to be slightly more expensive to run. However, as utility prices fluctuate over time, we expect that heat pumps will become the cheapest as well as the lowest carbon form of heating available.

How efficient are heat pumps?

Heat pumps are more efficient than other heating systems because the amount of heat they produce is more than the amount of electricity they use. The amount of heat produced for every unit of electricity used is known as the Coefficient of Performance (CoP). So, if a heat pump has a CoP of 3.0, then it will give out three units of heat for every unit of electricity consumed.

Hot Water

A standard air-to-water or ground-to-water heat pump needs to be able to store hot water for when you need it. The size of hot water cylinder required will depend on the volume of hot water that you need, but often it can be fitted inside a cupboard measuring 80x80cm. A hot water cylinder allows the heat pump to gradually heat the water, with the cylinder storing the hot water for when you need it.

Radiators

Conventional fossil fuel boilers were typically designed to deliver water to your radiators at 75°C – though modern condensing boilers should ideally run at lower temperatures to run as efficiently as possible. In comparison, a heat pump would ideally circulate hot water to the radiators or underfloor heating at temperatures between 35°C and 45°C, depending on the outside temperature. This is when the heat pump will work most efficiently with the lowest running costs.

You may opt to install a heat pump and continue using existing radiators or install radiators with greater surface area to provide enough heat using lower water temperatures.

Insulation

Your heat pump installer will calculate the energy required to heat your home by considering its size and the level of insulation and draught-proofing it has. Improving the insulation of your home makes your home more comfortable and reduces your heating costs.

Can a heat pump save you money on your energy bills?

- If you’re replacing an older, G-rated gas boiler for a well-designed heat pump, you could save around £295 a year on your energy bills under current energy prices (A).
- Do remember that not everyone who installs a heat pump will see savings straight

> away. Electricity is more expensive than gas right now so if you're replacing a much newer, more efficient gas boiler for a heat pump your energy bills aren't likely to reduce in this scenario just yet.

Energy costs based on gas and electricity prices set by Ofgem's price cap running from 1 October to the end of December 2023 (an electricity price of 27.4p/kWh and a gas price of 6.9p/kWh).

What carbon savings can we expect?

A semi-detached home with an old, G-rated gas boiler would save **around 2,900kg of carbon dioxide emissions a year** by switching to an air source heat pump

How would these work at Christ Church?

The main church building needs heating only for short, intense periods, and is unheated for most of the week. A heat pump would not be able to provide this concentrated energy and would not be suitable to replace the church boiler. However, the centre buildings are heated continuously in cool weather by the current centre gas boiler, and this mode of heating could work well with an air source heat pump.
The outdoor heat pump equipment could be located to the West of the main hall, behind the current boiler cupboard and adjacent to the kitchen.

The centre is different to domestic properties, with an individual radiator system that may not be suitable, and large expanses of glass. We don't know if an Air Source system would be suitable without further expert advice from a supplier or energy assessor.

Comparison of Air Source Heat Pumps vs Solar Panels

These are basic estimates only, based on assuming a well-working large domestic system is suitable at Christchurch:

	Heat Pump	**Solar Panel**
Principle:	Replaces gas boiler with hyper-efficient electric system	Generates electricity used immediately or stored in batteries
Initial Cost	£8,000 - £10,000 Risk that radiators and insulation need upgrading	£10,000
Change to energy bills per year	Somewhere between costing an extra £200 to saving £300	£400 to £800
Cost impact over 15 years	Low: £4,500 cost High: £12,000 cost	Low: £2,000 saving High: £4,000 cost
Carbon impact over 15 years	40-50 tonne saving	20-25 tonne saving

Confidence	Low	High