



Heating Our Churches – 1 (Heat Pumps)

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Outline

- Net Zero – What it means
- Technical Solutions Overview
 - Heat Pumps
 - Air to Air
 - Air to Water (low and high temperature)
 - Ground Source
 - Water Source
- Q&A

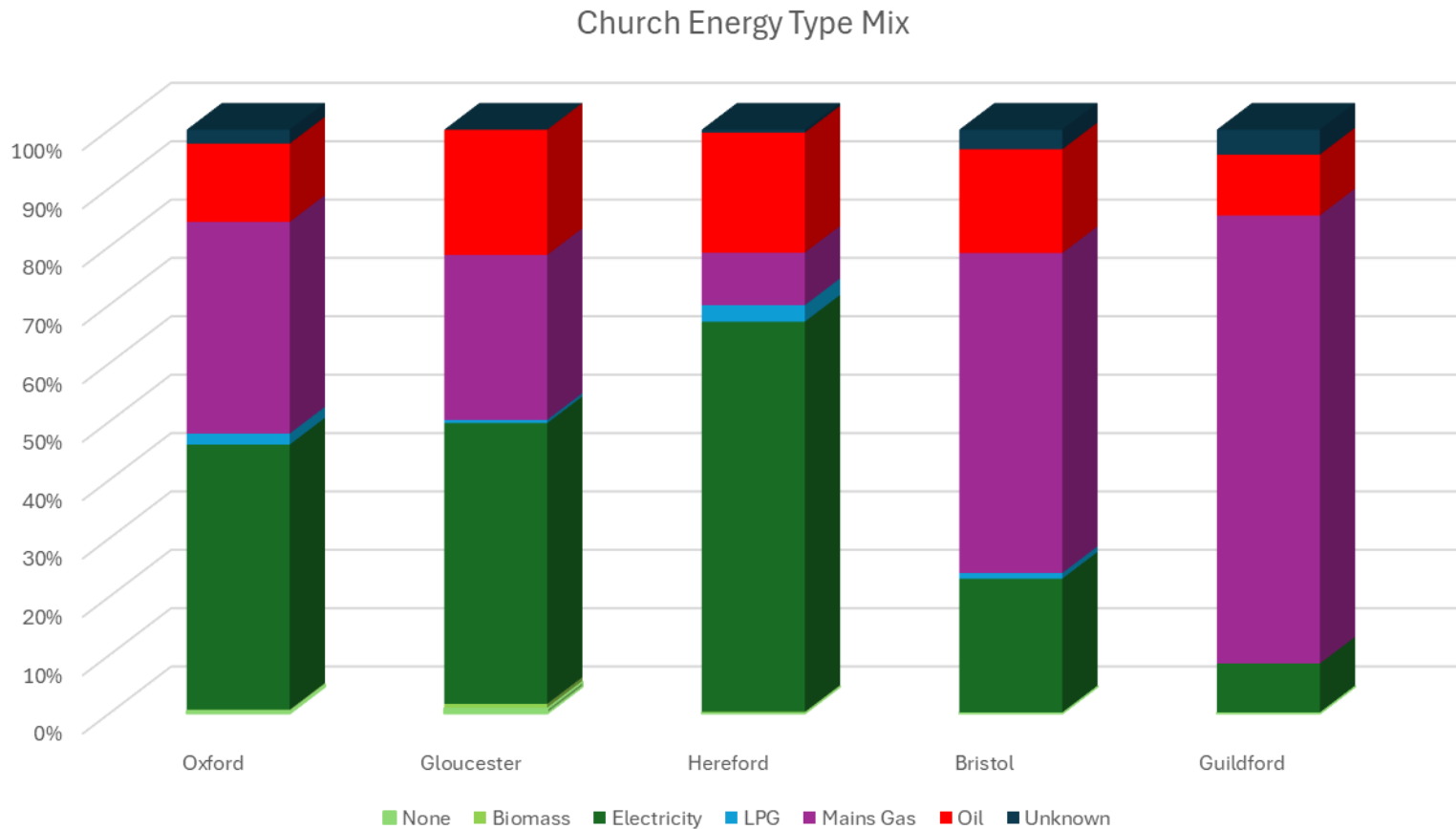


Net Zero - What this means

- No burning of fossil fuels (gas, oil, LPG, coal) to provide heat and hot water to our buildings.
- No burning of fossil fuels (petrol, diesel, LPG) in our transport.
- Efficient use of electricity
- Generation of energy on site where practical
- Electricity is clean future energy source



How big a mountain is there to climb?



This Can be Done!



Typical Strategy

- Understand usage and heat only for conservation or comfort
- Reduce draughts (ventilation is controlled)
- Insulate where possible, appropriate and useful
- Reduce electrical demand (LED lighting, efficient appliances)
- Consider PV where possible
- Electrify Hot Water generation
- Decarbonise heating



Decarbonising Heating and Hot Water - Key Technologies

Decarbonised Heat & Hot Water

- Heat Pumps (Ground, Air-to Air and Air-to-Water Source)
- Direct electric heating
- Electric hot water (centralised or point of use)



Heat Pumps – many flavours!

	sCOP	Install Cost per kW
Air to Air	4.0	£850
Air to Water (50°C)	3.0	£1250
Air to Water (75°C)	2.0	£2,000
Ground Source	3.5	£2,500
Water Source	3.8	£2,000



Ground / Water Source



- Deep piles or long trenches to extract heat from ground – can be open or closed loop
- Units in plant room to compress heat from ground water loop and put it into building]
- Works well with underfloor or large radiators.
- sCOP of around 4
- Needs insulated building



Air to Water



- Extracts heat from outside air, compress it and puts it directly into water to circulate through heating system – around 50°C
- Need good flow rates around heating system so not suitable for small bore pipework or single pipe system
- Minimal internal plant
- sCOP around 3.5
- Need large radiators or underfloor – not suitable for most fan convectors
- Needs insulated building



High Temp Air to Water



- Air to Water system with two parts, initial air to water goes into internal unit for a second water to water cycle.
- Produces flow temps up to 75°C
- sCOP around 2.5
- Needs internal and external space
- Easier to integrate with existing radiator systems – can use existing radiators



Air to Air



- Extracts heat from air, heat is compressed and put into a refrigerant gas at the external unit
- Heated refrigerant gas run to internal units (floor, wall ceiling) and blown into room.
- sCOP of around 4.5
- Can also cool
- Rapid warm up of around 20 mins



Air to Air Internal Units

Office - FCAG100B (Compact Roundflow Cassette - Advance)



The Daikin Round Flow ceiling cassette provides 360° air discharge for optimum efficiency and comfort. It combines a stylish design with the latest energy-saving technologies and is designed to fit snugly to ceilings making it ideal in both offices and retail.

This unit has the lowest installation height in the market, making it ideal to fit into tight ceilings.

- Available in black or white
- 9.5 kW cooling
- 10.8 kW heating

Office (note multiple indoor units for this room) - FVXM35A R32 Floor Mount Flash Streamer



Attractive, floor mounted design with perfect indoor air quality. Suitable for bedrooms, living rooms or small offices.

The FVXM-A range is equipped with an infra-red remote control with a 7 day timer and can be also controlled via smart phone or tablet.

- 3.4 kW cooling
- 4.5 kW heating

Office - FTXM60-R Standard Inverter Wall Mount



Attractive, wall mounted design with perfect indoor air quality. Suitable for bedrooms, living rooms or small offices.

The FTXM range is equipped with an infra-red remote control with a 7 day timer and can be also controlled via smart phone or tablet.

- 6.0 kW cooling
- 7.0 kW heating



St Andrews by The Wardrobe, City of London



Photos kindly supplied by Dr
Paul Hamley, WCS Services



External Unit Locations



St Andrews by The Wardrobe, City of London



Photo kindly supplied by Dr Paul Hamley, WCS Services



	sCOP	Ratio gas and elec cost (old)	Ratio gas and elec cost (new)	Install Cost per kW	
Air to Air	4.5	5	3	£450	External and Internal fan units. Insulation beneficial but not critical
Air to Water (50°C)	3.5	5	3	£850	External fan unit, internal radiators. Insulation critical
Air to Water (75°C)	2.8	5	3	£1,100	External fan units, internal radiators and tank. Insulation highly advisable
Ground Source	4	5	3	£1,550	Massive external ground works, internal radiators and heat pump. Insulation critical
Water Source	4.5	5	3	£1,100	Licenced connection to near by water source, trenching, internal rads, insulation critical
Under Pew	1	N/A	N/A	£500	Need pews! Careful cable routes but low impact. Insulation not important
Overhead	1	N/A	N/A	£400-£900	Very visual, ideal 3m mounting height. Careful cable routes. Insulation not important

	Heat Up	Comfort	Pros	Cons	Most likely solution
Air to Air	Around 30mins from cool	Generally very good	Quick, efficient and cost effective	Fan noise Heat from cold, large units	Well used church but not constant use
Air to Water (50°C)	Days – needs to be on 24/7	Very good if on 24/7 with UFH – very challenging if not	Good with UFH, established	Expensive, needs to be on 24/7	Daily used church
Air to Water (75°C)	Same as boilers – 4 to 8 hours?	Depends on radiators!	Works with existing. New tech	Very expensive	Ad hoc situations (cathedrals?)
Ground Source	Days – needs to be on 24/7	Very good if on 24/7 with UFH – very challenging if not	More efficient	Very challenging ground works	Almost none!
Water Source	Days – needs to be on 24/7	Very good if on 24/7 with UFH – very challenging if not	Higher efficiency, good with UFH.	Limited applicability Licencing	Very, very, very, few!
Under Pew	20mins	Good when in pews	Minimal impact, heat where you need it	Does not heat all areas	Sunday used churches with pews
Overhead	10mins / instant	Very mixed – hot head, cold feet. Not pleasant for long time.	Can heat unpewed spaces		Sunday used churches without pews

