

# St Mary's March Heat Pump

## A case study

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# Background

- ▶ Church badly damaged by arson in 2010 leaving just the shell
- ▶ Rebuilt 2012 as church for the 21<sup>st</sup> Century by Archimage of Wilburton
- ▶ No mains gas supply
- ▶ Consultants examined several types of heating based on assumption that it would also be used for community activities several times a week
- ▶ They recommended an Air Source Heat Pump



# System Description

- ▶ Combination of underfloor and radiators fed by a 32kW ASHP
- ▶ Underfloor would run 24/7 to hold the ambient temperature at 12 C
- ▶ Radiators would boost to 21 C when occupied
- ▶ Building was divided into seven zones with a very sophisticated control system
- ▶ An 800 litre buffer tank was included
- ▶ Original plan proposed a 45/38 flow/return but this was changed to 50/43 when double glazing was omitted

# Operational History 1

- ▶ Difficult to obtain due to total lack of local records, conflicting information and departure of previous incumbents
- ▶ M&E contractor was unhelpful due to past history with client
- ▶ Several undocumented changes have been made to control system
- ▶ It soon became obvious that the hoped for community use did not materialise and the church was only being used for about one hour per week on Sundays and the occasional funeral

# Operational History 2

- ▶ It seems to have worked well initially though there was some dissatisfaction with temperatures reported in 2014
- ▶ Modifications (undocumented) are said to have been made to the stat (sic) and the timer by a local plumber who had no knowledge of heat pumps
- ▶ System was serviced by the M&E contractor in 2015
- ▶ There is then a complete gap in the history

# Mechanical Problems 1

- ▶ Problems started to appear with the compressor around 2019
- ▶ Several attempts were made by the M&E contractor to rectify the fault culminating in a complete compressor replacement with costs running into several thousand pounds
- ▶ At no point did the church seek external advice or contact the original heat pump supplier but accepted without question the finding of the M&E service technician
- ▶ There were also frequent trips requiring re-set which made the system unreliable

# Mechanical Problems 2

- ▶ An analysis of what little information there is available now point not to a plant failure but problems with the local electricity supply
- ▶ It was apparently well known locally that due to the large amount of agricultural product processing in the area that there were significant voltage fluctuations which could well have explained the symptoms as the unit had a very complex protection system
- ▶ UK Power Networks admitted they had problems though never reported by the church
- ▶ They say it is now rectified

# Recent History

- ▶ At some point (not documented or on whose advice) a decision was made to isolated the underfloor system and use only the radiators
- ▶ The system was shut down during COVID
- ▶ The system failed in February 2022 again on compressor overload
- ▶ The M&E Contractor was called out but they sent a heating technician who know nothing about heat pumps
- ▶ It was left idle from that time

# Investigation

- ▶ The original heat pump supplier agreed to examine the unit with a view to deciding on further action
- ▶ The system was run up and the sound indicated compressor damage
- ▶ It could have been due to loss of refrigerant or could have been more serious
- ▶ There was also a possibility of condenser heat exchanger blockage which could have led to compressor damage
- ▶ It was noted the water treatment system had never been used

# Investigation conclusions

- ▶ Whilst the system could have been re-charged though this was a problem as it used a now obsolete refrigerant, it could not be guaranteed that a new compressor may be needed.
- ▶ It would also be necessary to strip down and clean the main condenser
- ▶ Recharging alone would have cost about £2000
- ▶ In view of the potential costs with no guarantee of success and the very limited use of the church it was reluctantly agreed to install a simple electric heating system

# Lessons learned

1. Heat pumps should only be installed if the justified by usage, they are not suitable for Sunday only churches
2. They are intended for continuous operation and have significant thermal inertia so heat up and cool down time is slow
3. They need a reliable power supply
4. There should be someone with at least a basic understanding of how they work or if not have access to technical advice
5. Basic operating instructions must be observed including dosing the water
6. They should only be serviced by competent heat pump technicians, not the local plumber
7. Good records and logs should be kept to aid investigation

# Final Conclusions

- ▶ There was nothing wrong with the installation
- ▶ The designers were given the wrong brief re usage
- ▶ It was not correctly maintained, and modifications were made which gave rise to problems
- ▶ No external advice was sought and too much reliance put on technicians who did not have the necessary skills or experience
- ▶ This is an isolated case which in no way invalidates the use of heat pumps in churches