# Carbon Reduction Recommendations Report

for

## The Thame Museum Trust

May 2025

Carbon & energy assessment of Thame Museum

79 High Street, Thame, OX9 3AE


ENERGY SOLUTIONS OXFORDSHIRE®

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South Oxfordshire District Council
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# ORGANISATION OVERVIEW

## Report overview

Moira Dorey from EiE met Adrian Dite on 14 May 2025. Recommendations in this report are based on our site visit & information obtained; we consider finances, carbon impact, and ease of implementation. Savings and costs are estimated using data provided and from our recent work. Below is a summary of the opportunities recommended; further pages provide detail on each opportunity.

## Energy savings recommendations - summary

| Opportunity | Payback (years) | Savings current & future energy prices (£ / yr) | Estimated costs (£) | Carbon impact ($tCO_2e$ / yr) |
|---|---|---|---|---|
| 1) Document energy management procedures | - | - | 0 | - |
| 2) Match heating times to building occupancy | - | 225 | 0 | 0.77 |
| 3) Use fans for de-stratification | - | 93 | 0 | 0.37 |
| 4) Upgrade lighting to LEDs and add sensors | 6.8 | 22 | 150 to 200 | 0.02 |
| 5) Add draught proofing to external doors | 0.9 | 23 | 20 to 30 | 0.08 |
| 6) Add loft insulation | 9.8 | 135 | 1,328 to 1,432 | 0.46 |
| 7) Add solar PV panels | 13.1 | 1,066 | 13,975 to 16,125 | 0.65 |
| 8) Consider an air to water heat pump system | - | See details | See details | 3.96 |
| | TOTAL | £1,564 per year | £15,473 to £17,787 | 6.30 $tCO_2e$ per year |

## Site details

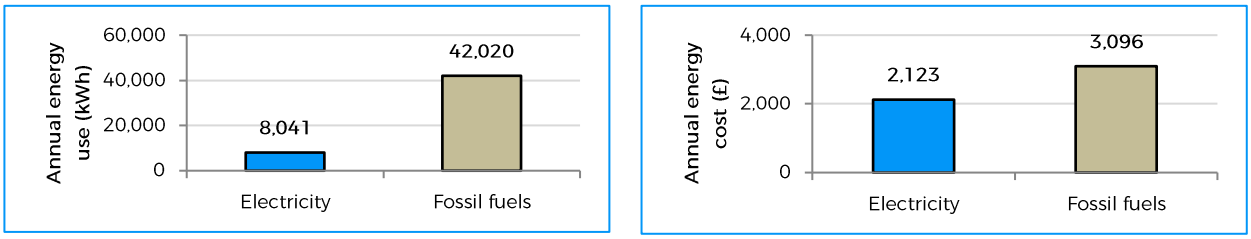
The Museum is housed in the former Thame magistrates court, which is Grade II listed and dates from 1861, with a 1980s extension. The building is owned by Thame Town Council and run by the Thame Museum Charitable Trust. It covers 345m² and includes a main gallery, 3 smaller galleries/community rooms, a reception/gallery shop, toilets and storage rooms. It is heated by a gas boiler installed in 2006 with two heating zones. Hot water is provided by two point-of-use hot water heaters. Almost all lighting is LED. There is some secondary glazing in the smaller galleries. The Museum is open four days a week, with occasional extra use for events. There is no Energy Performance Certificate (EPC) for this building.

# ENERGY PROFILE

## Energy consumption annual profile

| Fuel type | Annual Energy use (kWh) | Cost per kWh (p) | Standing charge (p/day) | Approx. annual cost (£) |
|---|---|---|---|---|
| Electricity | 8041 | 22.14 | 94 | 2,123 |
| Gas | 42,020 | 5.362 | 231 | 3,096 |

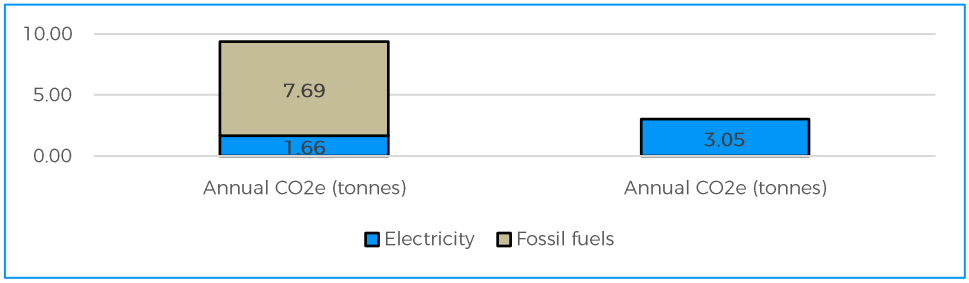
Energy profile breakdown for Thame Museum consumption (left) and costs (right)




Consumption is based on information provided.

## 63.04 tonnes avoided $CO_2e$ over 10 years by implementing recommendations (based on tonnes of $CO_2e$ per year)

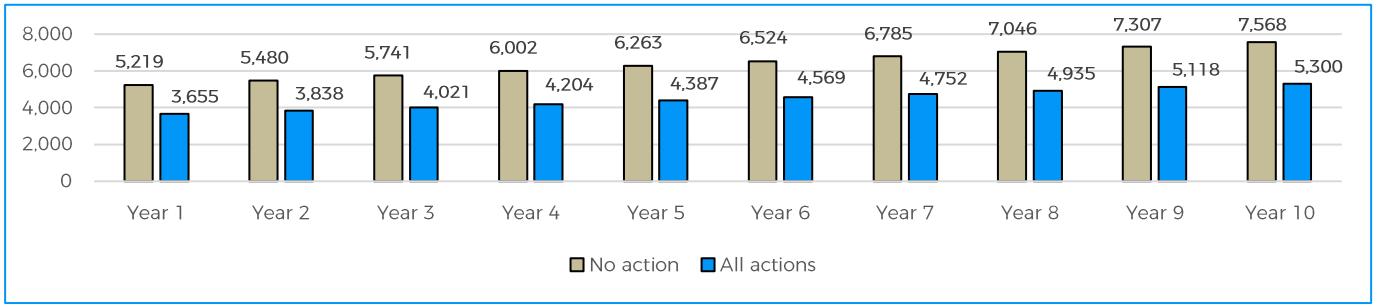
9.35 tonnes $CO_2e$ from current annual energy consumption
3.05 tonnes $CO_2e$ from implementing recommendations




Based on current annual $CO_2e$ minus $CO_2e$ implementing all actions using 2024 UK greenhouse gases coefficients.

## £19,153 avoided energy over 10 years by implementing recommendations

Thame Museum energy spend in the next 10 years




Savings are 'no action' minus 'all actions' using Laser mid-range predicted UK electricity price rises.

# ENERGY SAVINGS RECOMMENDATIONS

## 1) Document energy management procedures

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| See details | See details | 0 |

There are no written heating management policies and procedures for your museum. Currently staff members hold all the knowledge about managing energy; this is not documented. Energy management is the process of monitoring, controlling, and conserving energy in a building or organisation. Having structured, co-ordinated and documented energy management procedures maximises the benefits for energy saving and helps identify cost effective opportunities. The documents can also be used to capture knowledge that may be lost when staff leave or retire. Formal procedures will make employees aware of the importance of saving energy, both for the charity and for their own working conditions. We recommend arranging for energy policies and procedures to be documented to help capture currently successful energy management practices.

Energy procedures are based on management of items that use energy throughout the building, their maintenance, control, and any monitoring. There were several areas that were identified during the site visit where written records would be useful:

- There appeared to be two heating zones, one controls a radiator that was hot during the May site visit. To avoid wasted energy, document the areas each zone covers and what the policy is on heating each zone (see Recommendation 2).
- Levels of insulation in the loft were not known, although a member of staff reported that there was very little insulation (see Recommendation 6). Having a record of insulation would inform future energy efficiency decisions.
- Other areas to record would include information on lighting and hot water heating – both what energy using equipment is installed and the policy for what times this is switched on and off.

### Actions

- Make an inventory of the energy using technology in the building. Record how each item of technology is managed, including settings, maintenance and replacement schedule.
- Establish how improvements are decided and implemented and how staff can be involved in this process, e.g. suggesting improvements to shut-down procedures or an over-heating problem. Staff input into current approaches will help create draft procedures.
- Establish a list of competent, recommended contractors who are available to help support repairs or further implementation.

### Costs and savings

Savings are possible from actions resulting in documenting energy procedures as well as other benefits mentioned above. There is no cost to this action.

## 2) Match heating times to building occupancy

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| 4,202 | 225 | 0 |


The heating is controlled by a Honeywell programmer with two zones. Set temperatures were reported to be 21˚C with a setback temperature of 18˚C. The heating on 7 days a week and running from 5am to 1am daily. If heating times do not match building occupancy, energy is wasted. Matching heating times to occupancy will reduce energy usage and costs. We recommend reviewing settings to reduce unnecessary heating as soon as possible.

Several factors that may affect heating settings. These include your museum displays, which require controlled humidity and is affected by temperature. Additionally, as this is an old stone building, it takes a long time to heat up and therefore may need to be maintained at a setback temperature throughout the heating season. Taking this into account, we recommend reviewing set times and temperatures. According to the Carbon Trust, reducing heating temperatures by just 1°C can cut fuel consumption by 8%. Factors to consider include:

- Could the museum open temperature be set at 20˚C instead of 21˚C?
- Could the setback temperature be reduced by 2 or 3˚C when the museum is closed without compromising the required humidity levels?
- Do both heating zones need to be set at this setback temperature? It may be possible to lower the temperature further for the zone that only operates a couple of radiators.
- What time does the heating need to be programmed to increase to 21˚C to bring the Museum temperature to a comfortable level for staff and visitors on days when the museum is open?
- It was reported that the heating is off between 1am and 5am nightly – is this at the setback temperature or frost setting?

Museum Galleries Scotland suggests that the recommended temperature for museum objects is 16 to 20˚C and that temperatures that fluctuate between 10 and 20˚C are unlikely to adversely affect museum objects. For further reading on this and other energy saving opportunities in museums see:

https://www.museumsgalleriesscotland.org.uk/advice-article/temperature-and-humidity-in-museums/

https://www.nationalmuseums.org.uk/what-we-do/climate-crisis/uk-museum-cop-report/museum-decarbonisation-case-studies/
https://museumsnorthumberland.org.uk/about-us/our-environmental-commitment/reduce-energy-consumption/

Once a review has been carried out of heating times and temperatures and adjustments made, ensure that this is recorded for future staff and volunteers (see Recommendation 1).

Instructions for heating controls can often be found on-line either via the manufacturer's website or a manual library. See: https://manuall.co.uk/home-decoration/thermostats/honeywell-thermostats/

Actions

- Re-programme your heating to reflect building use.
- Taking into account the special requirements for your exhibits, programme the heating to maximise efficiency by reviewing the setback temperature and heat up times.
- Make a record of settings.

Costs and savings

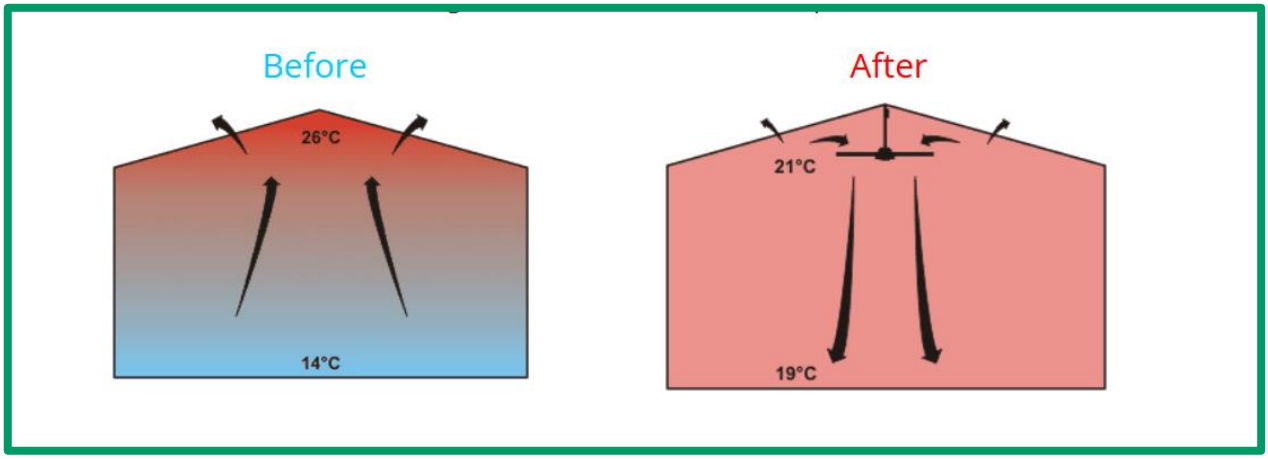
Savings are based on reducing heating by 10%. There is no cost to this action.

## 3) Use fans for de-stratification

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| 2,011 | 93 | 0 |

Heat in the main gallery rises toward the roof, away from users. You already have ceiling fans in this room (see image) to create a draught in hot weather, although they are rarely used. Ceiling fans can also be useful in winter; they work by churning the air as they rotate anti-clockwise, forcing the warm air at the ceiling level downwards back to the ground level, where its required. This will improve comfort and reduce demand for heating.

To push the heat back down into the room, fans need to turn in the opposite direction from their cooling mode. Check with your installer or the manufacturer that this is possible with your existing fans and controls. We recommend using the fans when heating to reduce heating costs and improve comfort.




Example of de-stratification using fans: https://www.flexiheatuk.com/product/destratification-fans

**Actions**

- Engage a contractor for advice on the suitability of existing fans to provide heat de-stratification.
- Ensure staff members are trained in using fan controls for warm and cold weather.

**Costs and savings**

Savings are based on the assumption that the main gallery uses 50% of the heating requirement and that adding de-stratification could reduce this by 10%. There would be some increase in electricity use to power the fans, estimated at £20 a year.

## 4) Upgrade lighting to LEDs and add motion sensors

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| 100 | 22 | 150 to 200 |

Whilst most of the lighting is LED, there are non-LED bulkhead lights installed in the two toilets that can be replaced with LEDs to reduce energy use and maintenance as well as providing improved lighting quality. This will reduce the electricity use by up to 50% compared to current lighting. Additionally LEDs last at least 50,000 hours before they need to be replaced, resulting in reduced maintenance costs. We recommend replacing toilet lights with new LED light fixtures to reduce the cost of lighting.

Lights regularly get left on in these toilets. When replacing the lights, consider additional lighting controls, such as motion detectors, that will switch off lighting when no movement is detected for a period of time. When replacing bulkhead lighting, the additional cost to add built in motion sensors is low (£10 to £12 per light). For an example see: https://www.tlc-direct.co.uk/Products/LTPMSW.html

Motion sensors can be set for duration that the lights are left on; for toilets this would normally be 5 to 10 minutes.

### Actions

- Engage an electrician to replace the lights in the two toilets with LED fixtures and built-in motion detection.
- Agree with the electrician the duration the lights will remain on before turning off automatically.

### Costs and savings

Savings are based on replacing the two bulk heads lights in the toilets (28W each) with LED fixtures (14W each) and reducing the time they are switched on from 40 hours a week to 4 hours per week saving a total of 100 kWh a year. Costs are based on £50 for two lights plus £100 to £150 installation cost.

## 5) Add draught proofing to external doors

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| 420 | 23 | 20 to 30 |

There is a draught from a gap at your exterior door (see image). There is an opportunity to reduce heat loss. Any gaps around the doors will let in cold air and draughts; blocking gaps with draught proofing will greatly reduce this. We recommend reviewing all external doors and adding draught proofing to reduce discomfort during colder months.

Examples of draught stripping can be found online here:
https://www.screwfix.com/p/stormguard-self-adhesive-brush-pile-weatherstrip-white-5m-3-pack/30322

https://www.screwfix.com/p/stormguard-epdm-rubber-p-strip-white-20m/33145

The best way to determine if draught proofing is required on a door is to feel around the door when the heating is on and it is cold outside. Draughts will be very evident and remedial action can be taken.

### Actions

- Add draught stripping to the door or door frame. If draught stripping is not suitable to attach (e.g. if the gap is not uniform), consider engaging a contractor to suggest improvements to the door frame.

### Costs and savings

Savings are difficult to calculate but are based on reducing gas use by 1% by reducing draughts. Costs for draught stripping is estimated at £20 to £30, attached by a volunteer.

## 6) Add loft insulation

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| 2,521 | 135 | 1,328 to 1,432 |

It was reported during the site visit that there was very little loft insulation above the ceilings. Accessible lofts where insulation could be added are potentially all areas other than the main gallery. Up to 25% of your building's heat is lost through the roof if it is un-insulated. We recommend increasing insulation to 300mm. This will minimise heat losses in winter, reduce heat gains in summer, improve comfort levels for users, and reduce annual energy bills by reducing heating requirements.

Loft insulation is widely available and mainly comes as glass or mineral wool. For examples see: https://www.diy.com/building-supplies/insulation/insulation-rolls.cat

300mm of loft insulation will improve U-value, which is a measure of the insulation properties of the material (the lower the U-value, the greater the insulating properties). Check the U-value or ask a contractor if a U-value of 0.16 W per $m^2k$ can be achieved.

Ensure that insulation is laid evenly over the whole loft, including right to the edges, to avoid cold spots where heat can escape.

As some of the lofts are in older buildings, ensure you discuss issues around insulation and moisture with a qualified contractor.

Insulation can potentially be added to the main gallery roof, possible via the exterior, when re-roofing; consider asking a contractor about this when appropriate.

**Actions**

- Install loft insulation to a recommended level of 300mm to maximise heat retention in the building. Discuss any moisture issues with contractor.
- Ideally obtain quotes from three contractors.
- Engage a qualified contractor for this work.

**Costs and savings**

Savings are based on reducing heating by 20% in 30% of the building. Costs are based on 300mm of loft insulation covering 115$m^2$ at £7 to £8 per $m^2$ plus £600 installation costs.

## 7) Add solar PV panels

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| 3,151 | 1,066 | 13,975 to 16,125 |

There is sufficient space to install south east / south west facing solar PV panels on the roof to generate electricity from sunlight, which will reduce the amount drawn from the National Grid saving you energy costs and carbon.

Although obtaining planning permission for solar panels on Grade II listed buildings is often difficult, you have a parapet over the main gallery which would effectively hide the panels and could be an ideal spot to add solar. Planning permission would need to be obtained.

Based on 50m² of suitable roof space, we recommend, subject to survey, a 10.75 kWp solar array of 25 panels generating an estimated 10,503 kWh of electricity per year. For every kWh generated from solar panels that you use on site you will save 22.14p (your day time electricity rate). Surplus solar electricity is exported back to the National Grid and you will receive at least 5p per kWh from the Smart Export Guarantee (SEG), paid through your electricity supplier. The SEG amount per kWh varies by supplier; it is worth shopping around to obtain the best rate. We anticipate 30% of electricity generated will be used on site. If battery storage is added, this may increase to 50%.

Find an MCS certified installer at this link: https://mcscertified.com/find-an-installer

In addition to installing an array of solar PV panels on the roof, an inverter is installed indoors to make the electricity compatible with your building's electricity demand. While the sun shines every day, the amount generated is affected by temperature and cloud cover; weather data is used to estimate performance.

### Actions

- Engage the local historic buildings advisor to discuss permission for solar panels on this site.
- Engage a solar PV contractor to design a solution for your premises. They will assess feasibility of the project, considering obstructions. Speak to the designer about batteries for storing electricity that would have been exported. You can then engage a number of contractors with the design for quotes on installation.
- Contact at least three solar panel contractors to obtain quotes. Installation quotes need to include a structural assessment of the roof to determine if it can bear additional weight.

### Costs and savings

Savings are based on using UK solar data to estimate generation from 430W solar PV panels. Costs are based on £1,300 to £1,500 per kWp. Prices from contractors will differ.

## 8) Consider an air to water heat pump system

| Energy saving (kWh) | Cost saving (£) | Cost of action (£) |
|---|---|---|
| 22,943 | See details | Subject to quote |

The current gas heating system was installed in 2006 and will probably need to be replaced in the next 5 to 10 years. One option is an air source heating system (ASHP) that uses electricity but will deliver 3 units of heating from 1 unit of energy, making it over 300% more efficient than current heating. Inertia in the air is increased via compression through the heat pump and transferred to a wet heating system and radiators. We recommend investigating an air source heating system as a potentially efficient and low cost heating solution.

ASHPs run at 40 to 60˚C, whereas conventional boilers run at 60 to 80˚C, so require slightly longer heat up times and some maintaining of background temperature throughout most of the heating season. ASHPs qualify for a government rebate, claimed through installers, helping reduce the payback period of investment.

For further details see: https://www.thegreenage.co.uk/tech/air-source-heat-pumps

Some older radiators are not suitable for ASHPs as they lack sufficient surface area to emit enough heat. Your heat pump designer can review radiators to see if any need to be replaced.

Solar PV panels can supplement electricity costs for heat pumps for further savings.

Ensure there is sufficient back-up heating available in case of extremely cold temperatures to maintain the correct humidity in the galleries. The requirement for such a system will depend on what system is eventually selected; installers of systems will suggest various options.

**Actions**

- Engage a qualified contractor to determine a feasible design for an ASHP system on site with drawings and specifications.
- Request quotes from three competent and qualified suppliers, prior to failure of the current boiler.
- Choose a preferred supplier and arrange for the system to be installed when the current boiler reaches end of life.

**Costs and savings**

At the current rates for your electricity and gas, changing to an electrically based heating system will cost more to run. However, we anticipate the differential of these rates to reduce in coming years. This action will save 3.96 tonnes of $CO_2e$ per year. Costs are subject to quote when the system is installed.

# RESOURCES & NEXT STEPS

## Funding

Possible sources of funding for the recommendations in this report:

**ESOx Green Fund** (https://www.energysolutionsoxfordshire.org/get-match-funding-with-our-green-fund/) 25% match grant funding for recommendation in this report. First round is open until 13th June 2025.

Opportunities can be found in the **South & Vale Business Support** newsletter: https://campaign.emailblaster.cloud/MTE1MTQ/504.html

**The Oxfordshire Local Enterprise Partnership (OxLEP)** may also have funding opportunities for businesses from time to time. Check here: https://www.oxfordshirelep.com/funding-grants

## Technical advice - solutions fit for the future

This report recommends installing new electrical products. We recommend discussing some technical considerations with your contractors. While UK electricals must comply with safety standards, there is currently no requirement that items are able to communicate with other electrical systems to maximise operating efficiency both on site and within the National electricity grid. For example, heat pumps use electricity and are best operated in tandem with solar PV panels and batteries to minimise use of more expensive grid electricity. As electricity networks make more use of data sharing, **ensure contractors consider compatibility when installing** the items below to help avoid later upgrades:

**Solar PV panels** – Ensure inverters, which convert DC power generated to AC power compatible with your site, have **'modbus'** interface. This enables communication with other devices, including batteries.

**Heat pumps** – Ensure these include **OpenADR** (automated demand response), which allows better electricity management, particularly in areas where sub-stations have grid constraints.

# RESOURCES & NEXT STEPS

## Your action progress update

Our report recommendations may help you choose what actions your organisation would like to act on. After a number of months, we will ask for an update on your progress. Some actions will be completed, some in progress, and others not yet started. Below is an example of how you can indicate your progress (tick one box per row). There is no expected completion date for any action, however your information is extremely important for helping us track project improvements.

| Opportunity | Action completed | Action in progress | Not begun but intending to | Not begun, not intending to | Not applicable |
|---|---|---|---|---|---|
| 1) Document energy management procedures | ◯ | ◯ | ◯ | ◯ | ◯ |
| 2) Match heating times to building occupancy | ◯ | ◯ | ◯ | ◯ | ◯ |
| 3) Use fans for de-stratification | ◯ | ◯ | ◯ | ◯ | ◯ |
| 4) Upgrade lighting to LEDs and add sensors | ◯ | ◯ | ◯ | ◯ | ◯ |
| 5) Add draught proofing to external doors | ◯ | ◯ | ◯ | ◯ | ◯ |
| 6) Add loft insulation | ◯ | ◯ | ◯ | ◯ | ◯ |
| 7) Add solar PV panels | ◯ | ◯ | ◯ | ◯ | ◯ |
| 8) Consider an air to water heat pump system | ◯ | ◯ | ◯ | ◯ | ◯ |