Carbon Reduction Recommendations Report

for

Thame Town Council

March 2024

Carbon & energy assessment of Thame Town Hall

High Street, Thame, Oxfordshire OX9 3DP

ENERGY SOLUTIONS OXFORDSHIRE®

ORGANISATION OVERVIEW

Report overview

Moira Dorey from EiE met Becky Reid and Andrea Oughton on 13th March 2024. Recommendations in this report are based on our site visit & information obtained; we consider finances, carbon impact, and ease of implementation. Savings & costs are estimated from our recent work and data provided. Below is a summary of the opportunities recommended; further pages provide detail on each opportunity.

Energy savings recommendations - summary

Opportunity		Savings current & future energy prices (£ / yr)	Estimated costs (£)	Carbon impact (tCO_2e / yr)
1) Upgrade lighting to LEDs	High priority	69 to 76	380 to 480	0.04
2) Insulate boiler room pipework	Medium priority	16 to 18	110 to 130	0.03
3) Match heating times to building occupancy	High priority	559 to 615	200 to 300	0.56
4) Add timer to hot water	High priority	218 to 239	230 to 300	0.15
5) Review and add loft insulation	High priority	See details	See details	0.00
6) Consider an air to air heat pump system	High priority	1,550 to 1,705	10,000 to 15,000	1.08
7) Add solar PV panels	Medium priority	1,261 to 1,387	13,440 to 16,800	0.83
	TOTAL	£3,673 to £4.040per year	£24,360 to 33,010	2.69 tCO_2e per year

Site details

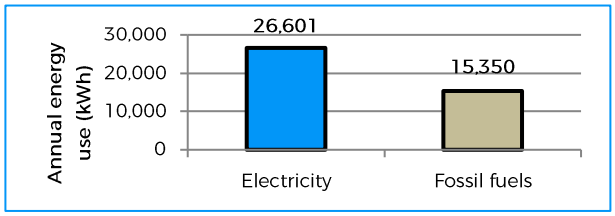
The Town Hall was built in 1871 and is a Grade II listed building. It is 431m^2 and consists of offices on the ground floor, including the tourist information office, toilets and a kitchenette. The 1st floor has the main hall, known as the Upper Chamber with a small kitchen. There is an office on the 2nd floor. The ground floor is heated by a gas boiler and wall mounted radiators, the Upper Chamber has ceramic radiant heaters, and the 2nd floor has two electric night storage heaters.

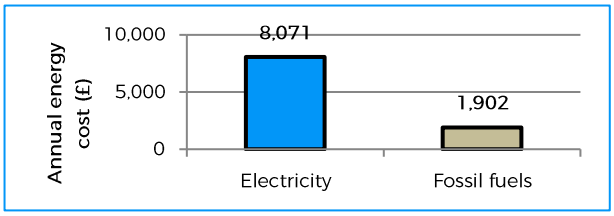
ENERGY PROFILE

Energy consumption annual profile

Fuel type	Annual Energy use (kWh)	Cost per kWh (p)	Standing charge (p/day)	Approx. annual cost (£)
Electricity	26,601	29.8	39.39	8,071
Gas	15,350	10.582	76.12	1,902

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

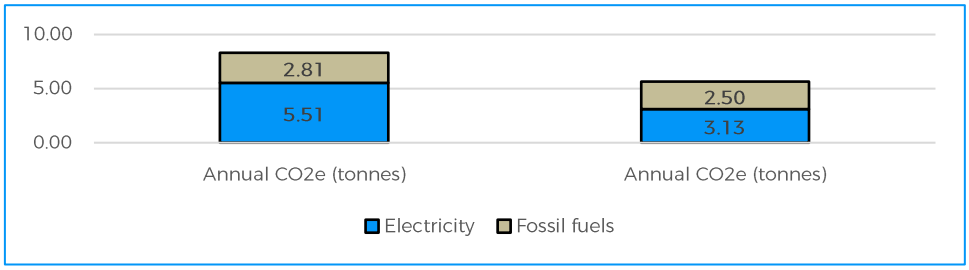




Consumption is based on information provided.

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

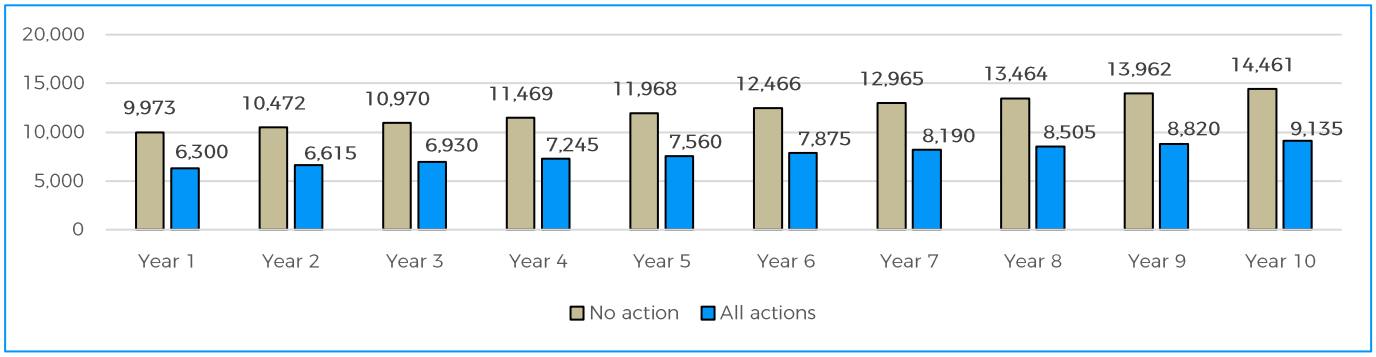
8.32 tonnes CO_2e from current annual energy consumption
5.63 tonnes CO_2e from implementing recommendations



Based on current annual CO_2e minus CO_2e implementing all actions using 2023 UK greenhouse gases coefficients.

£44,994 avoided energy over 10 years by implementing recommendations

Thame Town Hall 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) Upgrade lighting to LEDs

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
233	69 to 76	380 to 480

Although the majority of the lights have been changed to LEDs, the spot lights in the hallways on the ground and 1st floors have compact fluorescent bulbs which can be replaced with LEDs. LED lights are more energy efficient and can reduce electricity use by up to 50% compared to other lighting. Additionally LEDs last at least 50,000 hours before they need to be replaced (fluorescent lights last 15,000 hours) resulting in reduced maintenance costs. We recommend replacing the hallway lights with new LED light fixtures to reduce the cost of lighting. Additionally, consider lighting controls for these new lights as follows:

Motion sensors will switch on lighting as motion is detected and off when no movement is detected for a period of time. This will be particularly useful as users leave the 2nd floor offices to safely light the route down the stairs to the ground floor. A contractor will need to situate the motion sensor to pick up movement as the stairway door between the offices and hallway is opened. Sensors have two settings: duration before lights react to lack of movement (from seconds to 45 minutes) and sensitivity of sensor.

Light level sensors react to daylight and only turn on the lights in an occupied area when the levels of natural light is below a pre-set level. This will provide further energy saving in your two hallways that are well lit by natural light during daylight hours.

One example of a sensor that provides both motion and light level controls in one unit can be found at the link below, however, your electrician may have other suppliers:
https://www.novelenergylighting.com/cp-elec-ceiling-pir-movement-sensor-photocell-gefl.html

Finally, when selecting replacement LEDs there is also an opportunity to provide better lighting rather than using equivalent lights. When choosing the bulbs for the new lights, consider both the light quality preferred (known as colour temperature) that ranges from warm white, cool white or daylight and the level of brightness needed (measured in lumens).

Actions

- Engage your lighting contractors to provide a quote for new LED lighting for the hallways.
- Discuss motion and daylight sensors for these new hallway lights with contractors.
- Choose a preferred contractor and arrange for the lights and controls to be installed.

Costs and savings

Savings are based on lights being on 3,600 hours per year (10 hours per day over 360 days) at 29.8p per kWh. Savings from additional lighting controls are based on a further reduction in lighting hours of 20%. Costs are based on the current spot light being 11W bulbs and replacement 5W LED bulbs in new fittings plus 3 sensors at £25 each and one day's labour. Actual quotes from lighting suppliers will differ.

2) Insulate boiler room pipework

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
154	16 to 18	110 to 130

There are un-insulated sections of hot pipework in the boiler room. This means that heat is lost before it reaches the radiators where it can be usefully distributed to users. Un-insulated pipework, whether pipes, valves, flanges, or pumps, loses heat. Fully insulating boiler rooms can save up to 3% of heating. We recommend reviewing hot pipework and pumps in the boiler room and purchasing additional insulation as needed to reduce heat loss.

Insulation is widely available and comes in different sizes. More information is at these links:
https://product-selection.grundfos.com/uk/products/accessories-mechanical/insulation-kits?tab=models

https://www.anchorpumps.com/catalogsearch/result/?q=insulation+kit

Carbon Trust advice on pipework insulation: http://tinyurl.com/m2wcmt8

If your boiler room is cool compared to the rest of the building, there is no insulation problem.

Actions

- Review exposed pipework and measure the diameter and length of un-insulated pipes. Pipework insulation is available from most good hardware retailers.
- Check make and model of exposed pumps in the boiler room and check for suitable covers. Pump covers are available online.
- Arrange and fit pipework insulation.

Costs and savings

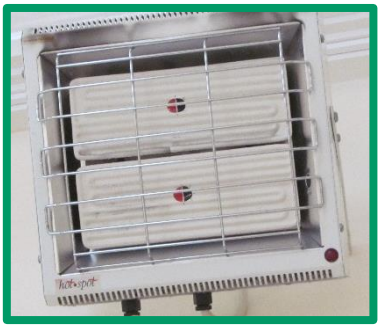
Savings are based on reducing heating demand by 1%. Costs are based on 3m of pipework insulation costing around £10 and 1 pump cover costing £100 to £120. Both these items can be installed by your maintenance contractor.

3) Match heating times to building occupancy

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
2,865	559 to 615	200 to 300

The heating is controlled mainly by manual controls. Energy can be saved, and comfort improved, by matching heating times and temperatures to building occupancy more closely as follows:

Thermostatic Radiator Valves or TRVs on the ground floor radiators were mainly set to maximum (6). Some of these radiators were generating a great deal of heat on a mild day. In the warmer days of spring and autumn consider turning down the TRV setting to 2 or 3 to reduce overheating and save energy.



The ceramic heaters in the Upper Chamber are often turned on a couple of hours in advance of the booking to warm the room. This type of heater is designed to heat objects, particularly people, rather than heating the air. Turn these on at the start of the booking to coincide when people are in the room. If you find in the winter time that the ceramic heaters take the chill off the room by heating the seats, walls and floor it may be worth turning them on a several minutes in advance of the booking however we recommend that you reduce the warm up time from 2 hours to 15 to 30 minutes.

The storage heaters in the 2nd floor offices are controlled with input and output dials. Both are set the same amount whenever they are turned on; the output is currently set to maximum. In heating shoulder months (spring and autumn) consider turning down the output to provide a lower heating level to save energy. The input control is currently set to 'late boost', which would be more common in domestic properties when heat is needed in the evening. You may also want to alter the input control to provide heat earlier in the day e.g. setting 1 or 3. The following video from Dimplex may be helpful: https://www.youtube.com/watch?v=AiJmnAMNUAM

The heating for the ground floor offices is currently controlled by staff turning the thermostat up during the day (set to 23°C during the assessment visit) and turning it down at night to around 15°C. Although this manual system has worked well in the past, energy efficiency could be improved by having a programmable timer. There are 2 options for this. Firstly, there is a heating programmer in the boiler cupboard that could be used to restrict heating times. For ease of programming you may want this moved to the offices. Settings are is currently set to 'Continuous heating' but could be used as a timer to programme the heating to be on only when the offices are occupied. If controls are relocated to the offices, the 'Boost' function would allow staff to override the setting on a temporary basis when working outside of standard hours, e.g. weekends. This programmer would work in tandem with the existing thermostat, which could be set to 21 to 22°C without the need to turn it up and down as the programmer will control times. If there is a concern about the building getting too cold overnight the heating can be programmed to come on a couple of hours before staff arrive to pre-warm the building. Programming instructions can be found here: https://www.corgi-direct.com/link/1/c003570_20434_t.pdf

If you prefer to install a programmer (see image) that will control both time and temperature, and can therefore set different temperatures for different times of day, there are several programmers that can fulfil this function. If so, we recommend selecting a 7-day programmer for flexibility. For example see:
https://www.screwfix.com/p/honeywell-home-t3-1-channel-wired-programmable-thermostat/901kt#product_additional_details_container

Actions

- Set your heating to reflect building use using the above details.
- Consider purchasing and installing a new 7-day heating programmer that can be set for both time and temperature.
- Locate this where staff are not able to alter settings regularly but will have access to 'Boost' out of hours if necessary.

Costs and savings

Savings are based on reduce gas heating by 10% and electric heating by 10% (assuming that heating accounts for 50% of electricity use). If a 7-day replacement programmer is selected it would cost around £100 plus installation. There would also be a cost involved with moving the existing timer.

4) Add timer to hot water

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
730	218 to 239	230 to 300

Your 4 electric hot water heaters are permanently switched on and heating water 24 hours a day 365 days a year. Each hot water heater is rated at approximately 3 kW and will use about 1 kW a day to heat the water. Arrange for a timer to be installed to control heating times. Energy will be saved by only heating the water when staff and hirers are in the building. We recommend arranging to install a 7-day programmable timer to control times of each hot water heater to save energy.

An example of timer is here:
http://www.screwfix.com/p/lap-7-day-digital-immersion-timer/1804r

Electric hot water heaters store low amounts of water and represent low Legionella risk if they are on for 15 minutes at 60°C prior to use.

Actions

- Arrange for an electrician to install a 7-day timer on each hot water heater and set it to turn off when not needed (for example 7pm every night).
- Programme the timer to turn on 30 minutes before hot water is required and off when the building is unoccupied.

Costs and savings

Savings are based on hot water heaters being turned off an average of 12 hours in every 24 hour period. When users book the kitchen and toilets for evening use hot water may need to be programmed on for that period therefore ensure that the programmers are reasonably accessible. We recommend carrying out a review of use of each heater to determine reasonable turn off times before setting the timers. As the hot water heater is hard-wired you will need to get a qualified electrician to wire in a timer which will cost around £20 to £25 each plus half a day's labour.

5) Review and add loft insulation

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
See details	See details	See details

Levels of loft insulation above the Upper Chamber are not known, however a recent building inspection is thought to have checked this; you are awaiting the outcome of that inspection. There may be mineral wool insulation above the ceiling or the insulation may have been added during re-roofing in the past.

Up to 25% of your building's heat is lost through the roof if it is un-insulated. We recommend increasing insulation to 300mm or equivalent if possible. 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 however as this is a difficult space to insulate a specialist will be required who may recommend an alternative method of insulation. Insulation should be laid evenly over the whole loft, including right to the edges, to avoid cold spots where heat can escape.

Actions

- Once you have received the building survey report, confirm if more insulation is needed above the ceiling in the Upper Chamber. If so, engage a contractor to discuss insulation options. Aim for a recommended level of 300mm loft insulation or equivalent to maximise heat retention in the building. U-value is a measure of the insulation properties of an insulation material (the lower the U-value, the greater the insulating properties). Aim for a U-value of 0.16/m^{2}K, however a contractor can advise on what will be possible in the constrained space above the ceiling.
- Select a qualified contractor for this work. Ideally obtain quotes from three contractors.
- Ensure that insulation is laid evenly over the whole loft.

Costs and savings

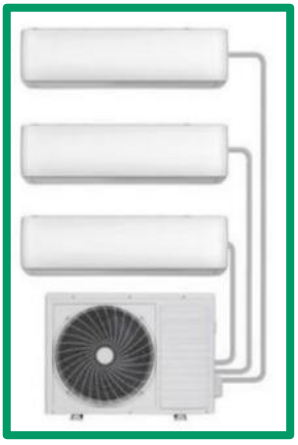
Savings are dependent on the findings of the recent building survey. If no insulation is present and it is possible to add it, adding insulation will reducing heating requirements. Moving from no insulation to 300mm of insulation (or equivalent) could reduce heating requirements in the room by 20%, equal to an estimated 2,660kWh and £793 per year. If 100mm of insulation or equivalent is already present, savings would be closer to 10% or 1,330kWh and £396 per year. Costs are subject to findings and contractors' quotes. 300mm of mineral wool for an area of 250m^2 would cost in the region of £2000 plus the cost of installation at £1000 to £1500.

6) Consider an air to air heat pump system

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
5,201	1,550 to 1,705	10,000 to 15,000

The current ceramic radiant heaters in the Upper Chamber are old and failing and are not very effective at warming the room. One replacement for these heaters that would be low carbon and lower running costs is an air to air source heating system (ASHP) that uses electricity but will deliver 3 units of heating from 1 unit of energy, making it 300% more efficient than current heating. Inertia in the air is increased via compression through the heat pump and transferred to gas sent to fan emitters. We recommend investigating an air source heating system as a potentially efficient and low cost heating solution. Two specialist local companies with relevant heat pumps experience are below. However you may also be aware of heat pump specialists in your area. See: https://www.eheatgroup.com/meetinghalls.php and https://www.carltonservices.co.uk/news/case-study-heating-with-air-con/

When selecting a contractor, ensure that they cover commercial as well as domestic installations and are confident about correctly designing and sizing a heat pump system for your Upper Chamber. Fan emitters need to be capable of heating right to the centre of the room. Consider adding destratification fans to circulate the warm air from the high ceiling into the room. For example see: https://www.puravent.co.uk/products/fans/destratification-fans/standard-destratification-fans.html
For further details on ASHPs see: https://www.thegreenage.co.uk/tech/air-source-heat-pumps/



Ensure the insulation is added above the ceiling (see previous recommendation) prior to a heat pump installation. If coupled with solar technology producing electricity to power the pumps, this technology could provide heating at low running costs. A multi-split ASHP system will provide heat for up to four indoor units off one outdoor unit (see image). Heat pumps require an external unit on the side of the building that can provide heat for several indoor units which will blow hot air into the room. Take this into consideration when you are considering the location of the outside units. Air-to air ASHPs can also be used to cool the buildings in the summer however we would recommend this is used sparingly or not at all as it will increase energy use. A supplementary heating system may need to be considered for particularly cold weather. Discuss this with installers, however one option would be to leave the radiant heaters in place as back-up when necessary. Finally, this type of heat pump cannot be used to produce hot water.

Actions

- Discuss the potential for an ASHP system at the site.
- Engage a qualified contractor to develop feasible design specifications. Ask for advice on leaving the current heaters in place as supplementary heating for very cold days.
- Request quotes from three competent and qualified suppliers.
- Choose a preferred supplier and arrange for the system to be installed.

Costs and savings

Savings are based on current heaters being seven 2kW (14kW input / output) replaced with eight ASHP fan emitters (5.33 kW input / 16kW output. We assume the current heaters are on for 20 hours a week from October to March (26 weeks) for a total of 520 hours. Replaced by 15 hours a week for a total of 390 hours. Costs are estimated and depend on final design specifications.

7) Add solar PV panels

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
4,006	1,261 to 1,387	13,440 to 16,800

There is sufficient space to install 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. We recommend, subject to survey, a 6.72 kWp solar array of 16 panels generating an estimated 5,342 kWh of electricity per year. For every kWh generated from solar panels that you use on site you will save 29.8p (your day time electricity rate). Surplus solar electricity is exported back to the National Grid and you will receive approximately 3 to 5p per kWh from the Smart Export Guarantee, paid through your electricity supplier. We anticipate 75% of electricity generated will be used on site.

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 as well as orientation of the roofs. A recent quote suggests both SW and NE facing roofs are suitable (see image) however other installers may recommend alternative configurations to maximise solar gain.

Consider a battery to store electricity that would have been exported for use when the sun is not shining. This will add approximately £10,000 to overall costs but save an additional £320 per year.

Actions

- When funding is secured, engage a solar PV contractor to design a solution for your premises. They will assess feasibility of the project, considering obstructions, such as trees. 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 an assessment of the roof - can it 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 £2,000 to £2,500 per kWp, contractor prices may be higher due to the roof accessibility (height and fragility of the tiles). Prices from contractors will differ but roof capacity is based on your recent quote.

FURTHER RESOURCES

Information on replacing paper towels with hand dryers

The toilets currently offer paper towels for hand drying. You are considering moving to electric hand dryers and are interested in the implications of doing this. Below are some considerations when making this decision.

Environmental impact - There are two types of hand dryer – jet air and hot air. Jet air hand dryers work by propelling water off with air power, rather than evaporating water from the hands, and as a result only use a small amount of energy per use. Some of these dryers claim that 1kW of electricity can dry 500 to 600 pairs of hands. Although dryers have an environmental impact in manufacture and running cost this is considerably lower than the environmental impact of the manufacture, transportation and disposal of paper towels which, although they are made from recycled paper, are not recyclable and go to landfill.

Cost - Based on manufacturers claims, and assuming each dryer would be used for 20 dries a day over 350 days then the total cost of running each dryer would be around £4 to £5 annually. The ongoing cost is therefore probably significantly lower than buying paper towels.

Hygiene - The primary factor in germs spreading is more related to how users wash their hands than whether they use paper towel or hand dryer. Paper towels are only recommended now for hygiene reasons in high risk environments like hospitals and care homes.

Noise interference - One objection to the introduction of hand dryers is that they may be noisy. The published noise levels of hand dryers vary from 54dB to 90dB measured at 1 metre distance from the dryer. The very quiet dryers are very expensive however there are many reasonable prices dryers at between 64dB and 70dB. Other factors that will determine the levels of noise disruption that dryers may cause is how close they are sited to quiet rooms and robust mountings that reduce vibration.

For further reading see:
https://www.washroomhub.co.uk/hand-dryers-vs-paper-towels
https://www.handydryers.co.uk/articles/comparison-electric-hand-dryers-vs-paper-towels.html
https://www.handydryers.co.uk/quiet-hand-dryers.html

Funding

Possible sources of funding for the recommendations in this report:

Salix Public Sector Decarbonisation Scheme:
https://www.salixfinance.co.uk/schemes/phase-4-public-sector-decarbonisation-scheme

FURTHER RESOURCES

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) Upgrade lighting to LEDs	◯	◯	◯	◯	◯
2) Insulate boiler room pipework	◯	◯	◯	◯	◯
3) Match heating times to building occupancy	◯	◯	◯	◯	◯
4) Add timer to hot water	◯	◯	◯	◯	◯
5) Review and add loft insulation	◯	◯	◯	◯	◯
6) Consider an air to air heat pump system	◯	◯	◯	◯	◯
7) Add solar PV panels	◯	◯	◯	◯	◯