GROUNDWORK

Groundwork Energy Management Systems

Initial Energy Assessment (IEA)

Address: Heddon Library, Towne Gate, Heddon on the Wall, NE15 OEJ.

Customer reference: [2025/MEJK/NE150EJ]

Date of assessment: [27/06/2025]

Assessor: [Matthew Eves, James Kirk]

Table of Contents

1. Report Summary

This energy assessment and report have been self-funded, as part of the Groundwork Energy Management Systems (GEMS). The Energy Assessment at the premises of Heddon Library was carried out on the 27th of June 2025, conducted by Matthew Eves and James Kirk, as an on-site assessment.

The report describes the library's current building structure and its main services, such as heating and lighting. It also suggests steps the organisation could take to lower energy use and cut carbon emissions.

The library was built in 1974, in the common style of that time. It has sandstone external walls with a brick and block cavity, a solid concrete floor, and a flat roof finished with layers of asphalt.

In 2009 the building was refurbished, adding office space and replacing the cladding with timber. The library reopened in March 2010. More recent improvements include UPVC double glazing throughout and two Worcester Bosch 24kW boilers, installed in 2023, to provide heating and hot water.

Average yearly energy use is 15,216 kWh for gas and 6,589 kWh for electricity. This gives annual carbon emissions of about 4,731 kg.

The organisation could focus first on low-cost measures, upgrading lighting and controls to reduce electricity demand and associated costs. This could be followed by the more costly, but impactful improvement, adding 300mm of insulation above the suspended ceiling and 150mm around the roof edges, which alone would cut gas use by about 5,922 kWh each year and lower emissions by 1,311 kg.

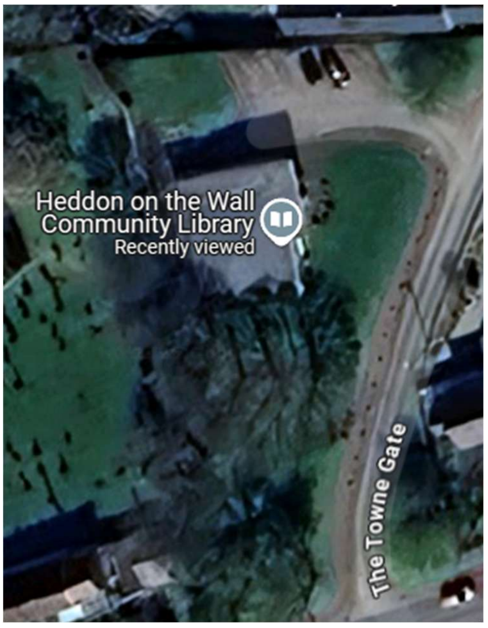
Greater carbon savings would come from combining improvements. These include roof insulation, LED lighting with motion sensors in toilets and corridors, instant hot water heaters in toilets and the kitchen, an 18kW air source heat pump, and solar PV panels. Together, these could cut emissions by around 67%, saving 3,152 kg of carbon each year. To achieve an 80% carbon reduction by 2050 compared to its baseline trajectory, the organisation would be required to install an air-source heat pump no later than 2028.

To reach full carbon neutrality, the organisation would also need to offset the remaining emissions. This could be done by joining approved offsetting schemes or by planting trees, hedges, and perennials on the library's green space

2. Dwelling/building context

Site Context

The premises of the Library, NE15 0EJ, is located on The Towne Gate, Heddon on the Wall, this comes under the Northumberland Local Authority and is part of the Ponteland South and Heddon Electoral Ward which is part of the wider Hexham Parliamentary Constituency. The building sits on a mature site bordered by large evergreen trees to the south and west, with a paved car park and elevated grass area to the north



Easting	413421
Northing	566900
Latitude	54.996502
Longitude	-1.7917542

Architectural Context

The building was constructed in 1974 and has a construction and appearance typical of a library building of this period.

Site usage

The management of the building was transferred from Northumberland County Council to the Heddon on the Wall Community, where the library is now managed by volunteers. The library section of the building is open to the public on Tuesdays, and Fridays between 1300 and 1600, and Saturdays between 1000 and 1200, with two volunteers present at each of these times. The library has a regular group that occupies the space every Tuesday and is occasionally used by the local school, with an average of 25 students using the space on these occasions. The Parish Council and Sustainable Heddon also hold monthly meetings in the building. The office spaces are occupied by an average of 8 people, Monday to Friday from 0800 to 1800.

3. Building Fabric

Walls

Sandstone exterior wall with brick/block cavity. As built to the building regulations of the time of construction.

Floors

Solid floor comprised of a concrete slab without later improvement. Assumed to have no insulation present.

Roofs

Flat asphalt roof. As built to the building regulations of the time of construction.

Windows

Modern UPVC double-glazed (16mm) windows, with trickle vents, throughout the building.

Doors

The main entrance double doors were constructed with UPVC frames with double glazing and were automatically controlled by motion sensors. A second front entrance and a side entrance single doors were again both constructed with UPVC frames with double glazing.

Services

Space heating is provided by a pair of 24kW Worcester Bosch boilers. One supplies the heating for the main library area of the building, with the second providing the heating for the office spaces. The heat is distributed through false ceiling-mounted fan coil heaters in the main library space, controlled by individual thermostatic controls, with two radiators equipped with Thermostatic Radiator Valves (TRVs). The heating in the toilets, corridors, and office spaces is distributed through a wet central heating system with radiators and TRVs. The wet central heating is controlled with a Hive thermostat.

Water heating is provided by one of the two Worcester Bosch 24kW boilers, which also provides the space heating.

Ventilation - Natural ventilation throughout the building with intermittent extract fans mounted in the false ceiling in the accessible toilet and kitchen areas with flexible ducting to the west façade.

***Lighting* -**The majority of the lighting in the building is provided by Compact Fluorescent Lights (CFL), which are controlled by manual switching. There was an additional lighting provided by a T8 twin tube in the boiler room, again manually controlled. The building occupants have installed one LED panel in the main library area and a second in the corridor.

4. Energy Usage

Gas

The organisation is currently in a fixed term tariff, which ends in September 2025. The organisation is currently paying **10.50p/kWh** of gas and a daily standing charge of **25.00p/day**. It has been estimated using utility data and modelling that the building's annual gas consumption is **15,216kWh/year**, with a cost of **£1,688.93/year.**

Electricity

The organisation is currently in a fixed term tariff, which ends in February 2026. The organisation is currently paying **30.13p/kWh** of gas and a daily standing charge of **36.93p/day**. It has been estimated using utility data and modelling that the building's annual electrical consumption is **6,589kWh/year,** with a cost of **£2,120.05/year**.

5. Emissions

Gas

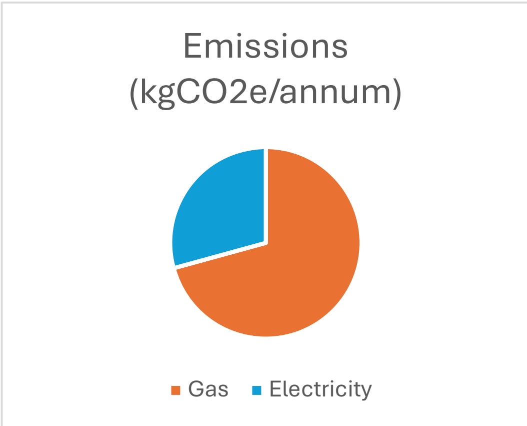
15,216 kWh @ .220 kgCO2e/kWh = 3,347 kgCO2e

Electricity

6,589 kWh @ .210 kgCO2/kWh = 1,383 kgCO2e

Total

4,731 kgCO2e/year



6. Improvement Options

Roof space and perimeter insulation

The organisation could consider the installation of 300mm of loft insulation to the roof space, with a further 150mm of insulation to the perimeter of the roof space. The measure would reduce the building's current gas demand from 15,216kWh/year to 9,294kWh/year. The installation would reduce the building's carbon emissions by 1,311kg/year. Currently, the building's heating demand contributes to 60.8% of total emissions; however, this measure would significantly reduce this to 45.8%. The installation of this measure could cost in the region of £7,000, though this would have a payback time of approximately 10 years.

Lighting upgrades and controls

a) The organisation may wish to replace their current lighting, which is in the majority provided ceiling mounted lighting fixtures with a pair of 34W 4Pin Compact Fluorescent Lights (CFL), with equivalents using light emitting diodes (LED's). These replacements produce the same amount of illumination using a lower amount of electricity, and could reduce the building's electricity usage from 6,589kWh/year down to 5,325kWh/year, a saving of 1,264kWh/year. In addition, whilst more expensive per unit purchase, on average, LED fixtures last longer than their less energy-efficient counterparts, reducing the total lifetime cost of ownership.

b) The lighting is currently controlled by manual switching; this could result in energy being consumed when a space is not being occupied. The organisation could save 645kWh/year by installing motion sensors to control the lighting in the common corridors and the toilets.

c) The organisation may wish to implement both parts together; this would reduce the building's electricity consumption by 1,620kWh/year whilst simultaneously reducing the building's carbon emissions by 235kg/year.

Hot water method change

The organisation could install Point-of-Use (POU) domestic hot water heaters in the toilet and kitchen areas. The domestic hot water is currently provided by one of the two Worcester Greenstar 2000 boilers, which would be required to be capped off. The installation of two 10L instantaneous water heaters would reduce the gas demand of the building from 15,216kWh/year down to 12,948kWh/year, albeit with an increase in electrical consumption. This leads to a reduction of the organisation's carbon emissions by 213kg/year. This measure is currently viable due to the low water demands for the building because of its low occupancy.

Air-tightness improvement

The organisation could consider having an air-tightness test carried out at the premises. This would indicate any significant areas in the building where air could leak from, such as gaps and cracks in the walls and roof space. This would allow the organisation to target those locations with sealants, membranes, etc, which would result in less thermal energy escaping the building. The building has been modelled with an air permeability of $11m^3/m^2/h$; however, if this were reduced to $5m^3/m^2/h$, the organisation could reduce the building's heating demand by 2,268kWh/year, with a reduction of 298kg/year in the building's carbon emissions.

Heating system conversion (ASHP)

The organisation could consider replacing its current heating system with an appropriately sized air source heat pump (ASHP) to provide the building with heating only, which is calculated to be 24kW if no other improvements are made. Due to the building having a low hot water demand, a cylinder would not be recommended; however, the installation of instantaneous water heaters in the toilets and the kitchen areas would be required in its place. The installation would significantly reduce the building's carbon emissions by 2,135kg/year or around 40%. Whilst reducing the building's demand for gas to zero, the electricity demand would increase to 12,362kWh/year. This would increase the organisation's annual utility bills, due to the unit price of electricity being significantly higher than that of gas. The installation of this measure could cost in the region of £25,000. If installed alongside other demand reduction measures the capital and operational costs would be lower.

Solar photovoltaics

The organisation has previously gained planning permission to install solar photovoltaic (PV) panels to the roof space. The organisation should have a full feasibility study carried out to determine if the roof is structurally strong enough to hold the weight of the solar PV panels and the accompanying fixation system. For best performance, the system should be mounted on frames and angled to 30˚, with the panels should be positioned at the north end of the building, angled towards the south. This would minimise the amount of shading that the panels would receive from the trees located at the south end of the building. The installation of a 3kWp array has the potential to reduce the building's dependence on grid-supplied electricity by 2,155kWh/year, and a reduction in carbon emissions of 261kg/year. The installation of this measure could cost in the region of £5,500 and have a potential payback time of 8.5years. This installation would be beneficial to the organisation if paired with an ASHP to provide the building with heating in the shoulder months (Apr, May, Sep & Oct).

Measurement package

The combination of improved insulation to the roof space (Option 1), replacement of the lighting to LED and the installation of motion sensors to the toilets and corridors (Option 2C), installation of instantaneous hot water heaters to the toilets and kitchen (Option 3), the installation of a 18kW ASHP to provide heating (Option 5), and the installation of solar PV panels to the building (Option 6) could reduce the building's current carbon emissions by 67%. This would be a carbon saving of 3,152kg/year. The estimated installation costs would be £39,000 and would have a payback time of approximately 24 years.

Improvement Option	Gas Usage (kWh/year)	Electricity Usage (kWh/year)	Carbon Emissions (kg/year)	Reduction in Carbon Emissions (kg/year)	Emissions reduction (%)	Possible capital costs (£)	Cost reduction (£/year)	Payback Period (Years)
Status-Quo	15216	6589	4731					
Roof & perimeter insulation	9294	6550	3420	1311	27.7	6948	633.51	11
LED replacement	15588	5325	4547	184	3.9	510	341.87	1.5
Lighting controls	15401	5942	4636	95	2.0	75	175.34	0.4
LED upgrade & controls	15696	4969	4497	235	5.0	585	437.71	1.4
Point of use hot water	12948	7949	4518	213	4.5	500	144.19	5.2
Air Source Heat Pump (ASHP)	0	12362	2596	2135	45.1	25000	-141.81	N/A
Solar photovoltaics (PV)	15216	4434	4470	261	5.5	5500	649.33	8.5
Combination package	0	6608	1579	3152	66.6	38500	1592.01	24.2

Table 1 Summary table of the building's gas and electricity usage, and carbon reductions for different improvement options.

Roof insulation and transition to an ASHP provide the largest annual reductions in carbon emissions, if the organisation wishes to install individual measures to the building, as highlighted in Table 1. Lighting upgrades could be implemented in the building at a relatively low cost and are fast and easy measures to implement. Combined fabric improvements with a transition to an ASHP would provide the maximum carbon reductions to the building, as well as allowing for a smaller heat pump size.

7. Carbon emission projections and offsetting

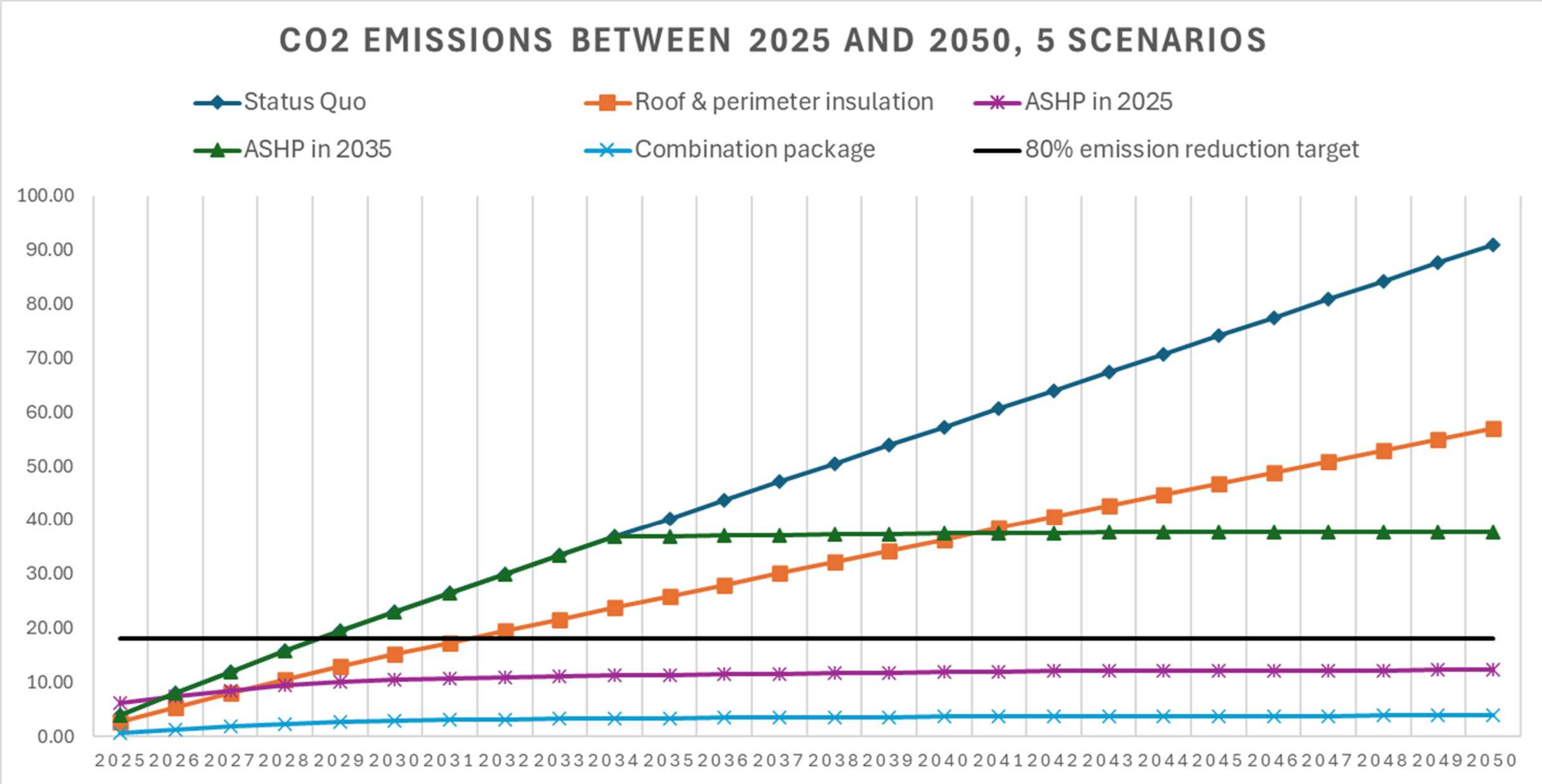


Figure 1 – Culminative CO2 emissions projection for five scenarios against an 80% reduction target

Looking forward to 2050 it is important to assess the impact of a decarbonising grid on the emissions from your building. Within Figure 2 is the projected emissions in tCO2e over the next 25 years for five scenarios. The reduction in emissions from roof and perimeter insulation as shown on the orange line, is marked in comparison to the status quo, but limited in its impact due to the inherent carbon emissions of natural gas use. The next two lines, green and purple, show the differing impact of transitioning to an ASHP at two timepoints, green being at the end of the reasonable lifetime of your gas boiler system, and purple being an immediate transition. Even with an initial addition to account for the embodied carbon of your recently installed boilers to the immediate transition, an ASHP will produce a relative carbon surplus within two years. The lowest carbon emissions over the period are the combination of heating conversion with other measures designed to reduce overall demand.

Other Carbon Reductions

With few exceptions, there is little capacity for any individual building to become carbon neutral or even negative without significant microgeneration, which, given the site context, is not possible here. However, at very low levels of annual emissions, offsetting either on-site or off-site can mitigate the intrinsic carbon emissions of occupying a building.

Onsite - Planting a tree-focused garden

The organisation may wish to utilise the green spaces on its site, which are currently covered by a grass lawn, to sequester carbon dioxide from the atmosphere. The organisation could incorporate a range of perennial plants, small to medium-sized trees, and hedges to their green space at the entrance of the building. This would also increase the biodiversity of plant and animal species in the area, which would benefit the natural environment.

Below is a potential range of plants that could be planted by the organisation, which includes the possible amounts of carbon that can be captured.

For maximum CO_2 capture, prioritise tree planting.

Feature	Area	CO_2/year estimate
4 medium-sized trees	~20 m²	80–120 kg
Native hedge (15m)	~7 m²	30–75 kg
Ground cover/shrubs	~25 m²	10–20 kg
Perennials + mulch	~20 m²	5–10 kg
Lawn/meadow	~54 m²	3–5 kg
Total (estimated)	**126 m²**	**130–230 kg CO_2/year**

Trees such as silver birch, rowan could be suitable for the available space. English oak can sequester much greater amounts of carbon dioxide over its lifetime; however, there is only limited space at the site.

- CO_2 sequestration increases as plants mature (especially trees and hedges).
- These numbers are **annual sequestration rates**; over 10 years, even a small garden could sequester **800–2000 kg of CO_2**.

Soil health is key—**no-dig gardening, composting**, and **mulching** boost long-term carbon storage in the soil.

Offsite - Carbon offsetting

Currently, there are only two accredited standards for carbon offsetting in the UK – The Woodland Carbon Code and the Peatland Code. Further research is needed to develop more offsetting schemes. (Environment Agency, https://assets.publishing.service.gov.uk/media/60cc698cd3bf7f4bcb0efe02/Achieving_net_zero_-_a_review_of_the_evidence_behind_carbon_offsetting_-_report.pdf)

Organisational/Habitual Changes

The building's energy demands can also be reduced through the service users' awareness and training of energy-saving measures and ensuring that these are implemented when the building is in use. Some examples of these could be:

- Switching off electrical equipment when they are not in use.
- Ensuring that portable electrical heaters are only used when necessary.
- Ensuring that thermostatic controls are set correctly, so that heating systems only operate when required.
- Ensuring that TRVs are used correctly to regulate rooms to a suitable temperature.
- Ensuring lighting systems are not being used when rooms are unoccupied.
- Ensuring that windows are closed when the heating is on in a room.

The organisation may wish to replace its current computers/laptops with more energy-efficient equivalents at the end of their lifetime.

8. Conclusions

The fabric of the Heddon on the Wall Library is in good condition. The organisation aims to reduce its current carbon emissions of 4731kg/year to ultimately becoming net zero. The organisation could achieve a 67% carbon emissions reduction through installing energy efficient measures to the building, including insulation to the roof space, replacing the lighting to LED, the installation of an air source heat pump to provide heating, point of use water heaters, and the installation of solar PV panels.

The organisation would also need to consider offsetting some of its carbon emissions through accredited schemes and through the generation of a garden space to be able to achieve a target of becoming net zero.

In the first instance, the organisation should consider installing 300mm of insulation to the roof space and 150mm to the roof perimeter. This would be a relatively cost and time-effective measure to install, reducing the annual heating demands of the building by 5922kWh/year. The organisation should also consider upgrading the current CFL lighting system to LED equivalents, in conjunction with sensor controls in intermittently used spaces. This is again a relatively cost and time-effective measure and could reduce the building's electricity consumption by 1620kWh/year.

In the longer term, the organisation would need to install an air-source heat pump in the process of decarbonising the building, which could reduce the carbon emissions by 2135kg/year. The organisation has only recently installed the current heating system, however, to achieve an 80% reduction in carbon emissions by 2050, the installation of an air source heat pump would be required by 2028 without, and 2031 with fabric and services improvements. Therefore, the organisation should implement this measure at the earliest opportunity when funding is available.

J.Kirk

The Groundwork audit was carried out in good faith and within a limited time frame. Groundwork's advisors make every effort to ensure the information provided verbally and through this document is appropriate and accurate.

Groundwork reserves the right to amend their conclusions and recommendations should further, or more detailed information become available. The final decision regarding any advice/ information provided by Groundwork is the commercial responsibility of the company.

The preceding report provides advice and guidance in relation to environmental good practice and highlights potential environmental legal breaches which may require attention. It is your responsibility to check if any relevant health and safety regulations apply, and to ensure that you comply with these.

Groundwork Yorkshire

Groundwork was founded in the North of England at a time of political, social and economic challenge. It was an experiment to help communities cope with change; to work together; to make their lives and neighbourhoods better. That spirit of enterprise and innovation has never been more needed.

In every community – however disadvantaged – there are deep reserves of pride: people with the passion and ideas to improve their circumstances and surroundings.

Groundwork exists to harness that pride: to unlock that passion. Our services, projects and programmes change people's lives. They can also make our communities more resilient for the future.

Groundwork is an organisation that embraces transformation. We positively change places and people's lives - in partnership - where we can.

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