Energy Audit Report

Holme Valley Parish Council

holme valley climate action partnership

Energy Audit Report
Holmfirth Civic Centre
and
Honley Library

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Executive Summary

Background Information

In response to Climate Change and support of their Climate Emergency Action Plan, Holme Valley Climate Action Partnership Limited engaged PASCHALi to carry out energy and carbon audits on the Holmfirth Civic Centre and Honley Library.

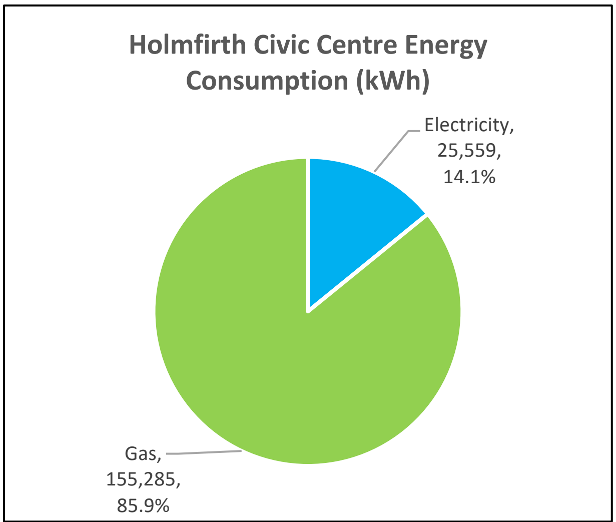
Audit Process

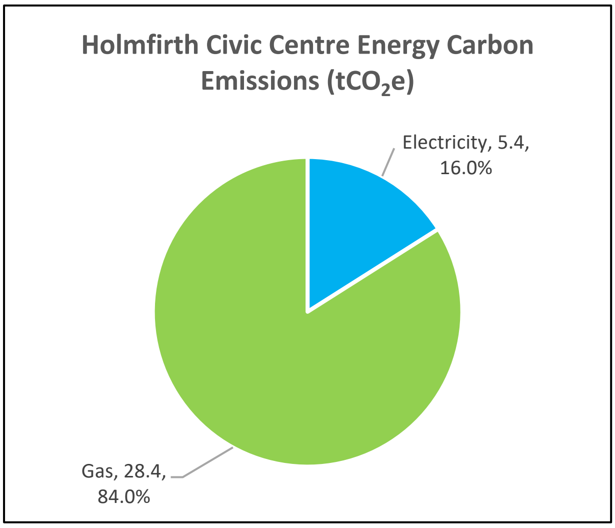
The energy and carbon audit process included the establishment of total annual energy consumption and cost, the physical review of each building envelope and the energy consuming equipment within it, calculation of representative energy profiles and the identification of various energy saving and energy generation opportunities.

Holmfirth Civic Centre Total Energy Consumption and Carbon Emissions

The overall total annual energy consumption for the Holmfirth Civic centre was calculated to be 180,844 kWh and 33.8 tCO_2e.

The following two pie charts show the energy consumption profile by energy source in kWh and tCO_2e.





Holmfirth Civic Centre Summary of Energy Saving and Generation Opportunities

The following two tables provide a summary of the energy saving and feasible generation opportunities identified at the Holmfirth Civic Centre:

Table 1. Summary of the identified Holmfirth Civic Centre energy saving opportunities

Opportunity	Annual Saving (£)	Carbon Saving (tCO_2e)	Payback (Years)
Carry out a deep retrofit of the building	£6,663	16.9	37.5
Upgrade existing lighting to modern LED type with PIR/motion and daylight controls	£2,037	2.1	1.9
Replace existing DHWS with point of use electric system	£726	2.9	2.8
Upgrade existing roof insulation (15% saving in heating)	£690	2.5	4.3
Carry out Air Pressure Test on the building, draught proof and replace fire doors	£460	1.6	10.9
Implement a behaviour change programme	£382	1.0	6.3

Upgrade existing heating controls to provide remote access	£345	1.2	1.4
Install a timer on Zip hot water boiler	£263	0.3	0.2
Install secondary glazing on appropriate windows within Grade II listed part of the site.	£115	0.4	21.7

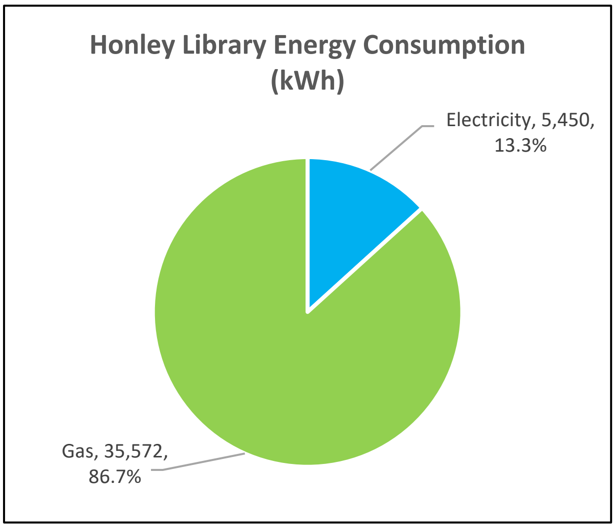
Table 2. Summary of the identified Holmfirth Civic Centre energy generation opportunities

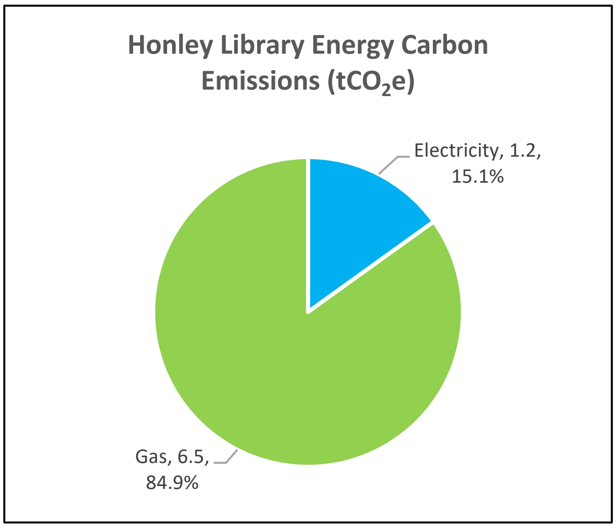
Opportunity	Annual Saving (£)	Carbon Saving (tCO_2e)	Payback (Years)
Solar Photovoltaic Electricity and Thermal Generation **with** Battery Storage	£5,407	8.2	15.6

Honley Library Total Energy Consumption and Carbon Emissions

The overall total annual energy consumption for the Honley Library was calculated to be 41,022 kWh and 7.7 tCO_2e.

The following two pie charts show the energy consumption profile by energy source in kWh and tCO_2e.





Honley Library Summary of Energy Saving and Generation Opportunities

The following two tables provide a summary of the energy saving and feasible generation opportunities identified at the Honley Library:

Table 3. Summary of the identified Honley Library energy saving opportunities

Opportunity	Annual Saving (£)	Carbon Saving (tCO_2e)	Payback (Years)
Carry out a deep retrofit of the building	£1,092	3.8	45.8
Upgrade existing lighting to modern LED type with PIR/motion and daylight controls	£220	0.3	4.5
Upgrade heating controls to provide remote access	£187	1.0	1.9
Install roof insulation (if appropriate)	£187	1.0	13.4
Carry out Air Pressure Test on the building, draught proof and replace fire doors	£156	0.8	12.8
Install double glazed windows	£125	0.7	72.3

Implement a behaviour change programme	£38	0.1	6.7

Table 4. Summary of the identified Honley Library energy generation opportunities

Opportunity	Annual Saving (£)	Carbon Saving (tCO_2e)	Payback (Years)
Solar Photovoltaic Electricity and Thermal Generation **without** Battery Storage	£361	1.3	9.4

Holmfirth Civic Centre Conclusions and Recommendations

1. Natural gas is the most significant energy source accounting for 85.9% of the site's energy consumption, 84.0% of the carbon emissions and 60.1% of the energy costs. Electricity accounts for 14.1% of the site's consumption, 16.0% of the carbon emissions and 39.9% of the energy costs.

2. Heating, DHWS, Lighting and Heating pumps and Plant account for 97.0% of the site's energy consumption, 96.6% of the carbon emissions and 91.6% of the energy costs. The remaining 3.0% of energy consumption, 3.4% of carbon emissions and 8.4% of energy costs are attributable to tea boilers, the lift, small power and other.

3. A significant proportion of the natural gas energy invoices for the reporting period were estimated readings. Recommend readings are regularly taken and provided to the current energy supplier to provide accurate measurement of the site's consumption.

4. The energy saving opportunities of upgrading appropriate lighting to LED, upgrading the roof insulation, replacing existing DHWS with an electric point of use system, installing secondary glazing, draught proofing and carrying a behaviour change programme have a total undiversified savings of 63,980 kWh, £5,017 and 11.9 tCO_2e with a payback of 3.9 years.

5. As an alternative to item 4 above, a deep retrofit of the centre was also considered. Annual savings of up to 90,422 kWh, £6,663 and 16.9tCO_2e could be achieved with a payback of 37.5 years.

6. A combined solar photovoltaic electricity and thermal generation system with battery storage would generate circa 20,593 kWh of electricity and 20,892 kWh of heat annually. This would provide savings of £5,407 and 8.2 tCO_2e with a payback of 15.6 years.

7. Further energy generation and other opportunities have been provided in Appendix A and B.

Honley Library Conclusions and Recommendations

1. Natural gas is the most significant energy source accounting for 86.7% of the site's energy consumption, 84.9% of the carbon emissions and 57.1% of the energy costs. Electricity accounts for 13.3% of the site's consumption, 15.1% of the carbon emissions and 42.9% of the energy costs.

2. Heating, DHWS, Small Power and Lighting for 95.7% of the site's energy consumption, 95.0% of the carbon emissions and 86.0% of the energy costs. The remaining 4.3% of energy consumption, 5.0% of carbon emissions and 14.0% of energy costs are attributable to kettles, other white goods and other sources.

3. Issues with current heating controls is likely to have caused the non-evident relationship between heating degree days and outside air temperature. Review of heating controls is recommended to ensure appropriateness for the site.

4. The energy saving opportunities of upgrading appropriate lighting to LED, upgrading the heating controls, installing insulation, double glazing, draught proofing and implementing a

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behaviour change programme have a total annual undiversified savings of 20,661 kWh, £912 and 3.8 tCO_2e with a payback of 16.6 years.

5. As an alternative to the energy saving opportunities identified in point 4 above, a deep retrofit was considered. This would generate annual savings of up to 20,511 kWh, £1,092 and 3.8 tCO_2e with a payback of 45.8 years.
6. A combined solar photovoltaic electricity and thermal generation system without a battery storage would generate circa 642 kWh of electricity and 6,526 kWh of heat annually. This would provide savings of £361 and 1.3 tCO_2e with a payback of 9.4 years.
7. Further energy generation and other opportunities have been provided in Appendix C and D.

1.0 Background

Holme Valley Parish Council recognises that Climate Change poses a substantial risk that will likely have a detrimental impact on future generations if left unmanaged. The Councils response to Climate Change includes:

1. The establishment of Holme Valley Climate Change Action Partnership Limited (HVCAP)
2. The implementation of the Holme Valley Parish Council's Climate Emergency Action Plan which commits the Council to become carbon neutral by 2030.

In support of the above, PASCHALi were engaged by HVCAP to carry out energy and carbon saving audits on the Holmfirth Civic Centre and the Honley Library. To ensure a harmonious approach, the principles of BS EN 16247 were followed. The findings of the report will support HVCAP with the development of their roadmap to achieving carbon net zero.

The energy and carbon saving audits were undertaken on 8th June 2021. Weather conditions were clear and dry.

2.0 Audit Process

2.1 Energy and carbon audit description

The aims of the energy and carbon audit(s) are:

1. To carry out an Energy Analysis and establish the total annual energy consumption and cost.
2. To review where possible:
    a. The thermal performance of the building envelope such as insulation, window type, draft proofing, thermal insulation, and general air leakage performance.
    b. Existing energy consuming equipment - including their type, age and operation.
3. Establish representative energy profiles
4. Identify ways to reduce energy and carbon emissions through physical and behavioural opportunities.

2.2 Energy audit methodology

In agreement with the Client the following methodology and information was used for the energy and carbon audit:

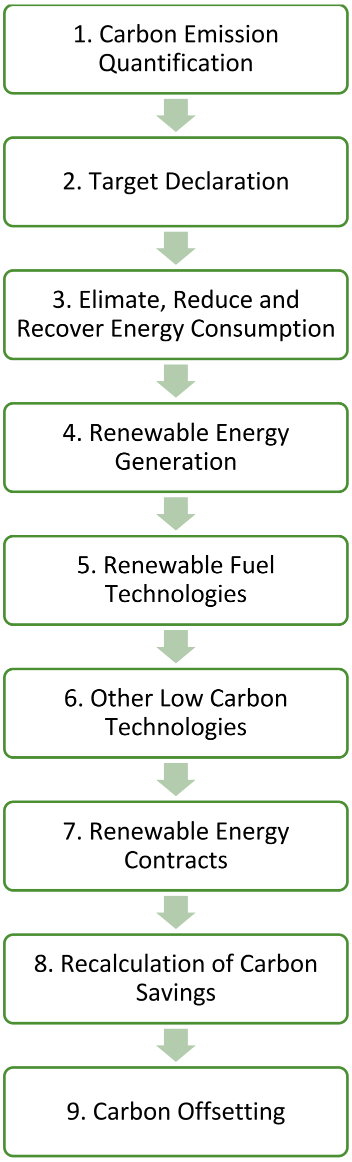
1. Actual utility consumption & cost recorded by the client for their internal reporting purposes.
2. BEIS 2020 CO_2e conversion factors were applied to energy kWh consumption to calculate carbon emissions.
3. The Energy Consumption reference period and the physical audit reference period was agreed to be the 12 months from 1st February 2019 to 31st January 2020. This was to take into action normal working conditions prior to the Covid-19 pandemic.
4. The energy audits followed the principles of BS EN 16247.
5. No unusual conditions were reported during the reference period.
6. The energy saving opportunities identified are indicative and require further detailed analysis if they become the preferred option. Capital costs and savings are indicative only and are based on PASCHALi's knowledge. No contractor quotations were sought or obtained.
7. Payback calculations have been used as the method of cost analysis.
8. The cumulative impact of each energy saving opportunity has not been considered. It is recommended that this is reviewed at a later date once the list of energy saving opportunities has been prioritised.

3.0 Roadmap to Net Zero

The demand for organisations to demonstrate carbon emission reduction and management has significantly increased in the last decade, examples of this can be seen by the introduction of regulations such as the CRC Energy Efficiency Scheme, Streamlined Energy and Carbon Reporting (SECR) and Energy Savings Opportunity Scheme (ESOS). This increased demand has seen organisations commit to becoming carbon neutral i.e. by using a variety of methods and processes their resulting net carbon emissions equate to zero. Examples of such organisations include Kingspan, Rolls Royce, Microsoft, Amazon, Google, Aldi UK and Ireland, Sky and GSK UK.

Currently there is not an approved standard (ISO or other) available that organisations can implement to achieve and demonstrate carbon neutrality. Organisations can self-declare and then verify through third party organisations; however, the methodologies, requirements and boundaries used by these third parties vary.

A Publicly Available Specification (PAS) 2060:2014, published by the BSI Standards Limited, is now available and provides a framework on how organisations can demonstrate carbon neutrality. This PAS is working towards becoming an International Standard (ISO) and is accepted in the industry as a good framework for organisations becoming carbon neutral. Following the principles of this PAS, PASCHALi have developed a methodology which can be followed to help HVCAP achieve and demonstrate Carbon Neutrality. The process is outlined below:



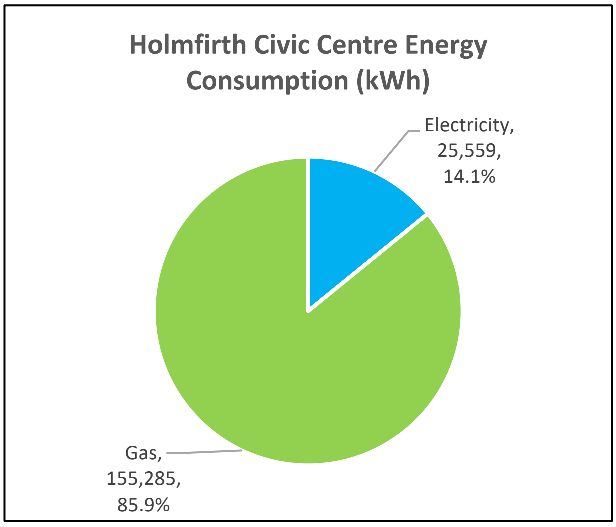
4.0 Analysis of Total Energy Consumption

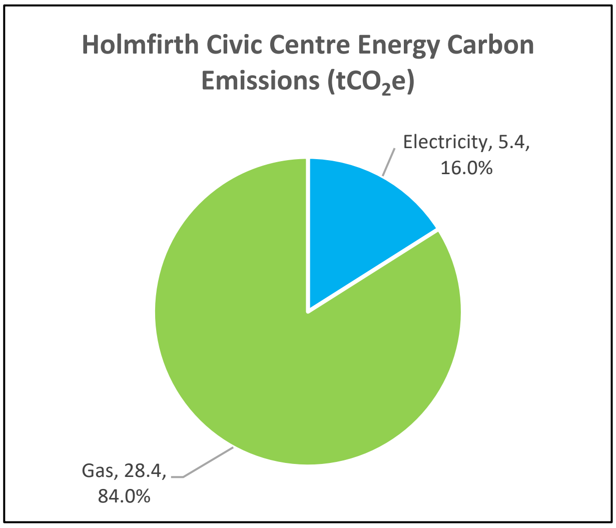
An overall energy analysis was undertaken to identify the consumption, costs and carbon emissions for Holmfirth Civic Centre and Honley Library. The below tables and bar charts show individual breakdowns of energy, carbon and cost for each site:

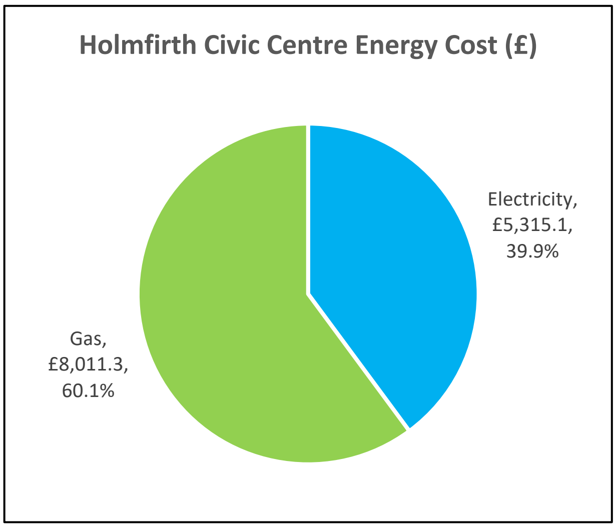
4.1 Holmfirth Civic Centre

Table 5. Holmfirth Civic Centre energy, carbon, and cost summary

Energy Source	kWh Consumption	Carbon Emissions (tCO_2e)	Cost (£)	% of Total Consumption	% of Total Carbon emissions	% of Total Cost
Electricity	25,559	5.4	£5,315.13	14.1%	16.0%	39.9%
Gas	155,285	28.4	£8,011.26	85.9%	84.0%	60.1%
TOTAL	**180,844**	**33.9**	**£13,326.39**	**100.0%**	**100.0%**	**100.0%**





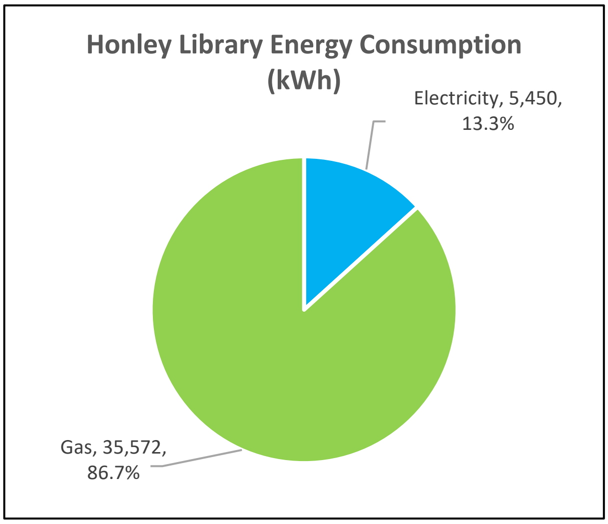


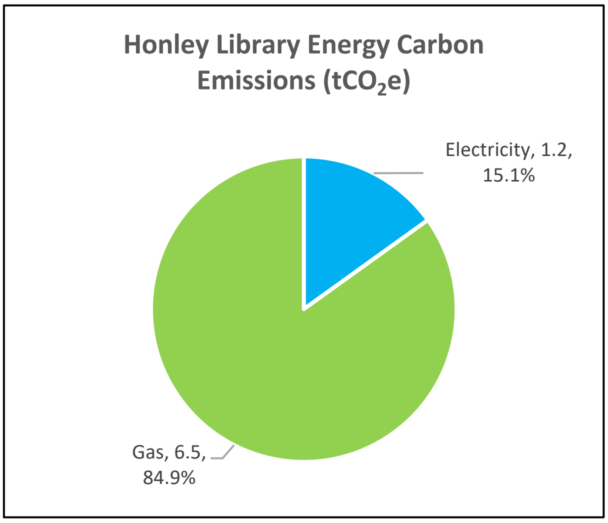
Natural gas is the most significant energy source accounting for 85.9% (155,285 kWh) of energy consumption, 84.0% (28.4 tCO_2e) of energy carbon emissions and 60.1% (£8,011.3) of energy costs. Electricity accounts for 14.1% (25,559 kWh) of energy consumption, 16.0% (5.4 tCO_2e) of energy carbon emissions and 39.9% (£5,315.1) of energy costs.

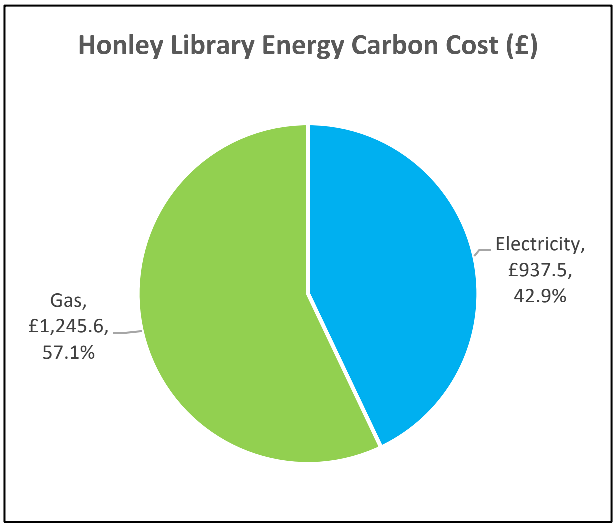
4.2 Honley Library

Table 6. Honley Library energy, carbon, and cost summary

Energy Source	kWh Consumption	Carbon Emissions (tCO_2e)	Cost (£)	% of Total Consumption	% of Total Carbon emissions	% of Total Cost
Electricity	5,450	1.2	£937.47	13.3%	15.1%	42.9%
Gas	35,572	6.5	£1,245.63	86.7%	84.9%	57.1%
TOTAL	**41,022**	**7.7**	**£2,183.10**	**100.0%**	**100.0%**	**100.0%**







Natural gas is the most significant energy source accounting for 86.7% (35,572 kWh) of energy consumption, 84.9% (6.5 tCO_2e) of energy carbon emissions and 57.1% (£1,245.6) of energy costs. Electricity accounts for 13.3% (5,450 kWh) of energy consumption, 15.1% (1.2 tCO_2e) of energy carbon emissions and 42.9% (£937.5) of energy costs.

5.0 Energy – Physical Audits

5.1 Building Energy Audit – Holmfirth Civic Centre

This naturally ventilated building is located in the centre of Holmfirth and consists of 3 floors and cellar. The site comprises two halls, receptions rooms, exhibition room, club room, two kitchens and amenities. These rooms and kitchens can be hired by the public for events. The site was reported to operate during the following times:

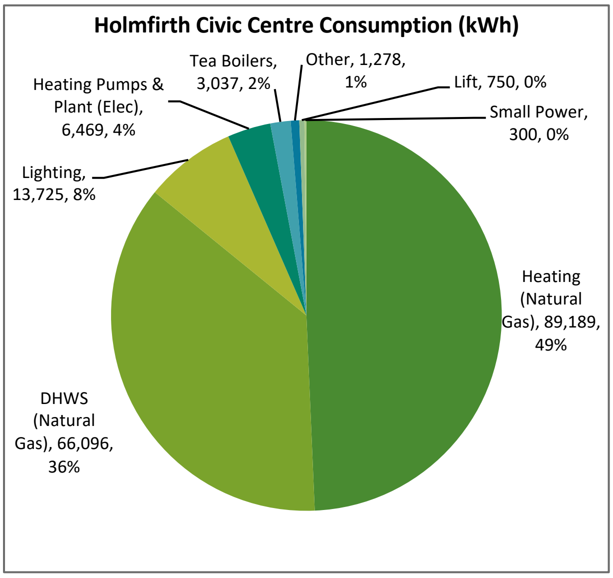
Table 7. Holmfirth Civic Centre operating times

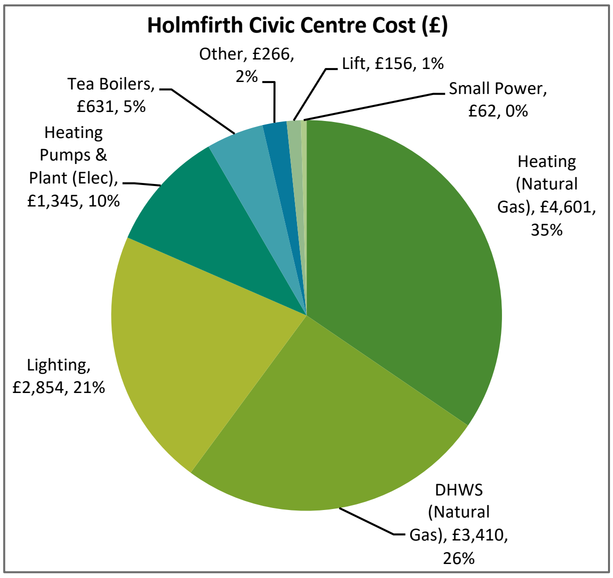
Days of the Week	Civic Centre Staff	Available Hiring Times
Monday to Thursday	09:30hrs to 14:30hrs	16:00hrs to 22:00hrs
Friday	09:30hrs to 14:30hrs	-
Saturday	-	08:00hrs to 16:00hrs
Sunday	-	17:00hrs to 22:00hrs (once a month)

Taking the above into consideration and the additional information obtained from the physical on-site audit, the following energy profile was calculated:

Table 8. Holmfirth Civic Centre energy profile

Utility	Use	Consumption (kWh)	Cost (£)	Carbon Emissions (tCO_2e)	% of site consumption	% of site cost	% of carbon emissions (tCO_2e)
Electricity	Lighting	13,725	£2,854	2.9	7.6%	21.4%	8.6%
	Heating Pumps & Plant (Elec)	6,469	£1,345	1.4	3.6%	10.1%	4.1%
	Tea Boilers	3,037	£631	0.6	1.7%	4.7%	1.9%
	Other	1,278	£266	0.3	0.7%	2.0%	0.8%
	Lift	750	£156	0.2	0.4%	1.2%	0.5%
	Small Power	300	£62	0.1	0.2%	0.5%	0.2%
	Total Elec	**25,559**	**£5,315**	**5.4**	**14.1%**	**39.9%**	**16.0%**
Gas	Heating	89,189	£4,601	16.3	49.3%	34.5%	48.2%
	DHWS	66,096	£3,410	12.1	36.5%	25.6%	35.7%
	Total Gas	**155,285**	**£8,011**	**28.4**	**85.9%**	**60.1%**	**84.0%**
Total		**180,844**	**£13,326**	**33.8**	**100.0%**	**100.0%**	**100.0%**





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5.2 Building Energy Audit – Honley Library, Honley

This is a naturally ventilated building based in the centre of Honley and comprises a library, plant room and staff amenities. The site was reported to operate during the following times:

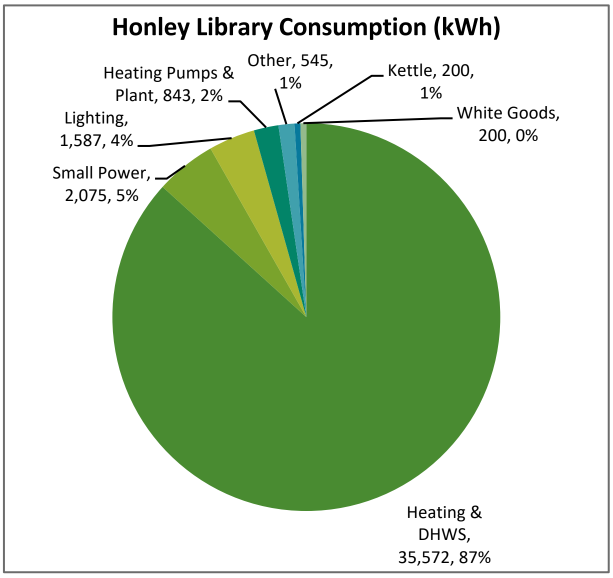
Table 9. Honley Library operating times

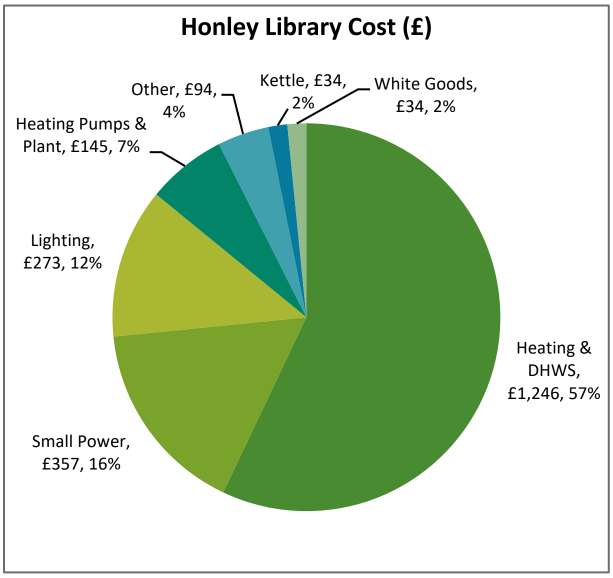
Days of the Week	Opening Times
Monday & Friday	13:00hrs to 17:00hrs
Tuesday	13:00hrs to 18:00hrs
Wednesday & Saturday	10:00hrs to 13:00hrs
Thursday & Sunday	Closed

Taking the above into consideration and the additional information obtained from the physical on-site audit, the following energy profile was calculated:

Table 10. Honley Library Energy Profile

Utility	Use	Consumption (kWh)	Cost (£)	Carbon Emissions (tCO_2e)	% of site consumption	% of site cost	% of carbon emissions (tCO_2e)
Electricity	Small Power	2,075	£357	0.44	5.1%	16.4%	5.7%
	Lighting	1,587	£273	0.34	3.9%	12.5%	4.4%
	Heating Pumps & Plant	843	£145	0.18	2.1%	6.6%	2.3%
	Other	545	£94	0.12	1.3%	4.3%	1.5%
	Kettle	200	£34	0.04	0.5%	1.6%	0.6%
	Other White Goods	200	£34	0.04	0.5%	1.6%	0.6%
	Total Elec	**5,450**	**£937**	**1.2**	**13.3%**	**42.9%**	**15.1%**
Gas	Heating & DHWS	35,572	£1,246	6.5	86.7%	57.1%	84.9%
	Total Gas	**35,572**	**£1,246**	**6.5**	**86.7%**	**57.1%**	**84.9%**
Total		**41,022**	**£2,183**	**7.7**	**100.0%**	**100.0%**	**100.0%**





5.3 Degree Day Analysis

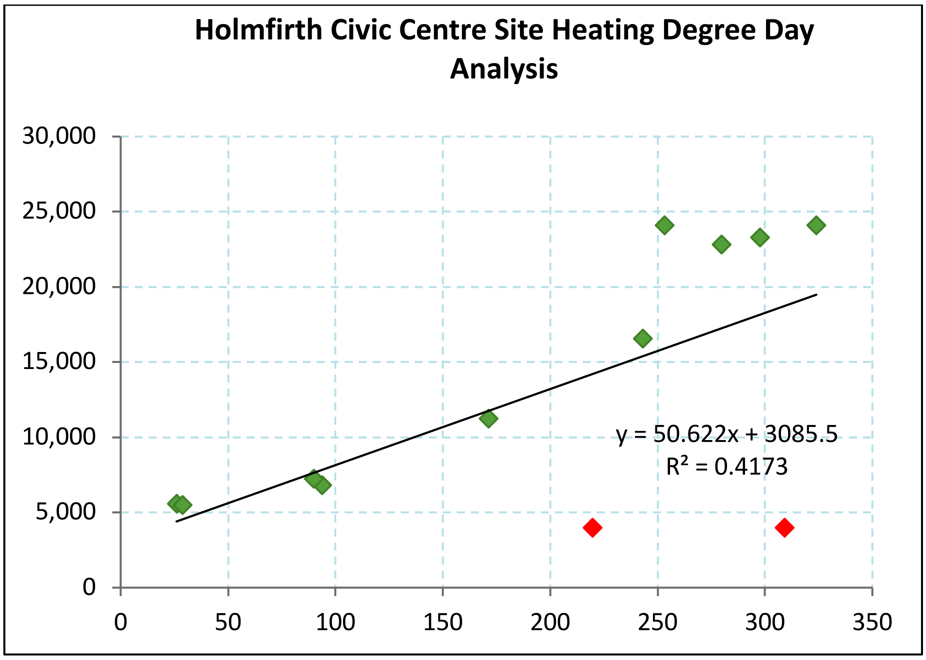
Degree days are used by the energy industry to calculate the effect of outside air temperature on building energy consumption and performance. They are a way of normalising year to year variations of outside temperature. Two-degree days measurements are commonly used. They are:

1. Heating degree days measure how much (in degrees), and for how long (in days) outside air temperature was ***lower*** than a specific base temperature.
2. Cooling degree days measure how much (in degrees), and for how long (in days), outside air temperature was ***higher*** than a specific base temperature.

A heating degree day analysis was undertaken for both sites. The following two graphs summarise the main findings.

A cooling degree day analysis was deemed inappropriate as both sites are naturally ventilated and therefore highly unlikely to demonstrate a correlation between energy and cooling degree days.

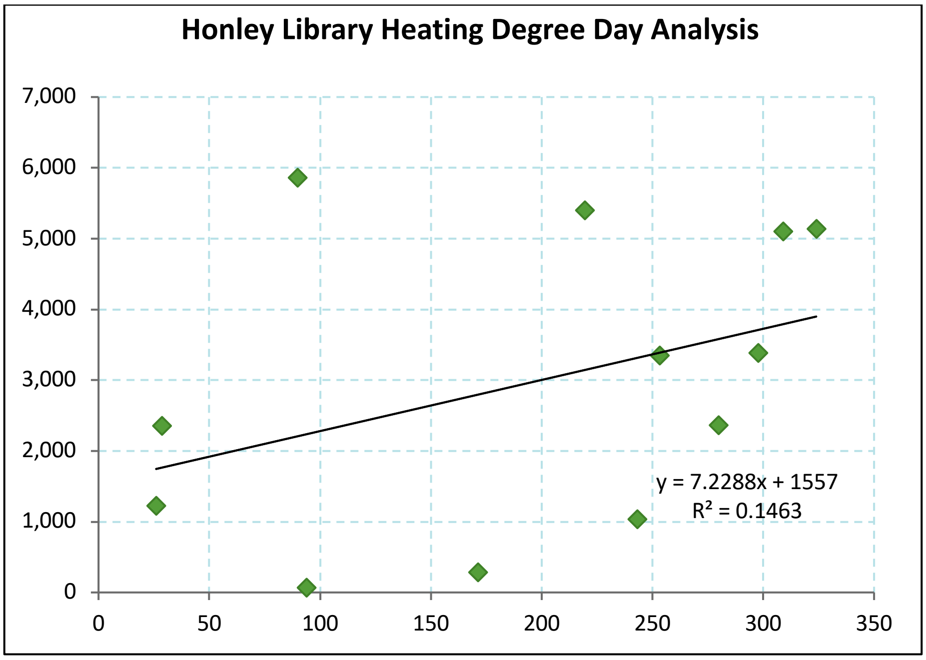
4.3.1 Holmfirth Civic Centre Heating Degree Day Analysis



On inspection of the provided gas bills, it appears that a significant proportion of the invoices in the reporting year were estimated by the energy supplier and an actual reading was provided in Oct-19. Therefore, this has affected the results of the heating degree day analysis. It is recommended that regular meter readings are taken by site and provided to the energy supplier to ensure that accurate bills and consumption is regularly recorded.

The above heating degree day analysis demonstrates a weak relationship between heating degree days and outside air temperature. On closer review it is clear that there are two potentially spurious points in Oct and Nov 2019 (highlighted in red on the above graph) that are affecting the heating degree day results. If these two points are excluded from the analysis, then the relationship between heating degree days and outside air temperature is more significant, giving a R^2 of 0.93.

5.3.2 Honley Library Heating Degree Day Analysis



The above chart shows that there is no evident relationship between heating degree days and outside air temperature. This could be due to the site's reported issues with controlling temperature settings. Further review is recommended to determine whether the existing controls are suitable for use.

6.0 Energy and Carbon Saving Opportunities

6.1 Holmfirth Civic Centre

Following the physical audit of the Holmfirth Civic Centre, energy saving and generation opportunities were explored to determine their appropriateness for the site. The following sections provide an overview of the main findings.

6.1.1 Lighting

The existing lighting varied throughout the site, between LED, Fluorescent and Halogen/Metal Halide types. Circa 85 nr internal light fittings were observed on-site, circa 55 are non-LED types used for general and stage lighting. Controls were observed to be manual switching. As lighting accounts for circa 54% of the overall electricity consumption it would be beneficial to upgrade them to more efficient LED type with appropriate PIR/motion and lighting controls. Pictures of some of the observed lighting are shown below:

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 11. Holmfirth Civic Centre Energy Saving Opportunities Summary - Lighting

Opportunity	Electricity savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Upgrade lighting to LED type	8,759.9	1.9	£1,822	£3,315	1.8
Additional motion and daylight controls on new LED light fittings	1,031.7	0.2	£215	£634	3.0
TOTAL	**9,791.6**	**2.1**	**£2,036**	**£3,960**	**1.9**

6.1.2 Heating system

The site's heating provision is supplied by three Wessex 100 modular boilers to three main zones: Main Hall, Lesser Hall, and Reception. Site reported to manually adjust the boiler timing weekly to account for the projected heating demand. To provide stricter control of the system, consider upgrading the controls to allow remote access and adjustment. Pictures of the boilers and controls are shown below:

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 12. Holmfirth Civic Centre Energy Saving Opportunities Summary - Heating

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Upgrade heating controls	6,689	1.2	£345	£500	1.4
TOTAL	**6,689**	**1.2**	**£345**	**£500**	**1.4**

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6.1.3 Domestic Hot Water Service (DHWS)

The domestic hot water service (DHWS) is provided by an 11.7 kW direct gas fired boiler located in the plant room adjacent to the lesser hall, please see a picture below of the direct gas fired boiler used for DHWS.

It is understood that the domestic hot water service is supplied to all kitchen and welfare facilities. Due to the limited day usage and usage being dependent on the hiring of space, there is potential to change the current DHWS to an electric point of use system. This will reduce the heat loss through unnecessary distribution through the existing secondary circulation system.

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 13. Holmfirth Civic Centre Energy Saving Opportunities Summary - DHWS

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Install alternative electric point of use DHWS	16,524	2.9	£726	£2,000	2.8
TOTAL	**16,524**	**2.9**	**£726**	**£2,000**	**2.8**

Presented savings take into account increases in electricity consumption, cost and carbon emissions.

6.1.4 Building Fabric - Windows

It was reported that a proportion of the windows within the Grade II listed part of the building have secondary glazing installed. Additional natural gas savings can be generated from installing secondary glazing on remaining appropriate windows. Please find below a picture of a window that could be secondary glazed.

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 14. Holmfirth Civic Centre Energy Saving Opportunities Summary – Building Fabric (Windows)

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Install secondary glazing on appropriate windows	2,230	0.4	£115	£2,500	21.7
TOTAL	**2,230**	**0.4**	**£115**	**£2,500**	**21.7**

6.1.5 Building Fabric - Roof insulation

Due to access restrictions, the roof insulation could not be inspected. However, if the insulation is limited and can be improved then a saving of between to 10% to 15% on heating gas consumption is likely achievable. It is recommended that a specialist is engaged to assess the roof insulation and accurately determine the saving potential.

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 15. Holmfirth Civic Centre Energy Saving Opportunities Summary – Building Fabric (Roof Insulation)

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
If able, install additional roof insulation	8,919 to 13,378	1.6 to 2.5	£460 to £690	£3,000	4.3 to 6.5
TOTAL	**8,919 to 13,378**	**1.6 to 2.5**	**£460 to £690**	**£3,000**	**4.3 to 6.5**

6.1.5 Building Fabric – Air Infiltration

Although an air pressure test was not carried out as part of this assessment, due to age and type of building there is potential for significant air leakage which will likely cause an increase in gas heating usage. It is recommended that an air pressure test is carried out to determine the extent of air leakage and using the results to carry out draught proofing and replacement of old fire doors.

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 16. Holmfirth Civic Centre Energy Saving Opportunities Summary – Building Fabric (Air Infiltration)

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Conduct Air Pressure Test on the building, draught proof and replace fire doors.	8,919	1.6	£460	£5,000	10.9
TOTAL	**8,919**	**1.6**	**£460**	**£5,000**	**10.9**

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6.1.6 Hot Water Zip Boilers

It was noted that the kitchen operates a Zip water boiler for the provision of boiling water. It does not appear to have timer controls installed and is constantly left on. Please see a picture of the Zip boiler below.

Energy savings can be achieved by installing timer controls on the Zip boiler to switch it off when it is not needed e.g., weeknights and weekends.

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 17. Holmfirth Civic Centre Energy Saving Opportunities Summary – Hot Water Zip Boilers

Opportunity	Electricity Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Install timer controls on existing Zip Boiler	1,264	0.27	£263	£50	0.2
TOTAL	**1,264**	**0.27**	**£263**	**£50**	**0.2**

6.1.7 Behaviour Change Programme

To support and enhance existing internal procedures, consider implementing a behaviour change programme. As three staff operate on site, consider engaging other Holme Valley Parish Council sites to encourage and support energy saving opportunities in other areas. Savings shown below are an estimate of what could potentially be achieved at the Holmfirth Civic Centre only.

Table 18. Holmfirth Civic Centre Energy Saving Opportunities Summary – Behaviour Change Programme

Opportunity	Energy Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Implement a behaviour change Programme	5,184	1.0	£382	£2,400	6.3
TOTAL	**5,184**	**1.0**	**£382**	**£2,400**	**6.3**

6.1.8 Entire Building Envelope – Deep Retrofit

As an alternative to opportunities 6.1.1 to 6.1.7, consideration could also be given to undertaking a deep retrofit of the entire building. This is a whole building analysis and construction process which will take into consideration often high up-front cost opportunities such as windows and HVAC plant that have much longer pay-backs. Savings of up to 50% on energy and carbon emissions can be achieved from undertaking this opportunity.

Table 19. Holmfirth Civic Centre Energy Saving Opportunities Summary – Deep Retrofit

Opportunity	Energy Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Deep Retrofit	90,422	16.9	£6,663	£250,000	37.5
TOTAL	**90,422**	**16.9**	**£6,663**	**£250,000**	**37.5**

6.1.9 Renewable Generation Opportunities

Multiple renewable generation opportunities were assessed against community impact, ease of installation and applicability. They were then categorized into Green (feasible), Amber (further investigation required) and Red (not feasible). The following sections provides a summary of the generation potential and carbons savings from green and amber opportunities as well as an explanation of why some opportunities were not feasible (red).

6.1.9.1 Feasible Renewable Generation Opportunities (Green)

Table 20. Holmfirth Civic Centre Energy Generation Opportunities Summary – Feasible

Opportunity	Energy Generation & Usage (kWh)	Emissions Savings (tCO_2e)	Savings & Incentives (£)	Capital Costs (£)	Payback (yrs)
Solar Photovoltaic Electricity Generation - Without Battery Storage (25% usage and 75% sold back to the grid)	25% use = 5,223 75% Grid= 15,669 *Total 20,892*	1.1	£1,635	£42,480	26.0
Solar Photovoltaic Electricity Generation -With Battery Storage (100% usage)	100% use = 20,892	4.4	£4,345	£66,480	15.3
Solar Photovoltaic Electricity & Thermal Generation-With Battery Storage (100% usage)	Elec = 20,892 Thermal = 20,593	8.2	£5,407	£84,400	15.6

6.1.9.2 Further Investigation Required Renewable Generation Opportunities (Amber)

Table 21. Holmfirth Civic Centre Energy Generation Opportunities Summary – Further Investigation Required

Opportunity	Energy Generation & Usage (kWh)	Emissions Savings (tCO_2e)	Savings (£)	Capital Costs (£)	Payback (yrs)
Wind – VAWT (Vertical Axis -With Battery Storage (100% usage))	17,890	3.8	£3,721	£74,000	19.9
Heat Pump – Air Source	115,202	19.4	£584	£27,500	47.1
Heat Pump – Ground source Vertical (Borehole)	115,202	19.4	£584	£51,500	88.1
High Efficiency Storage Heaters	115,202	2.0	-£16,528	£10,000	N/A
Underfloor Heating	108,002	6.6	£1,857	£22,500	12.1
Solar Thermal Generation	20,593	3.8	£1,062	£6,265	5.9

6.1.9.3 Not Feasible Renewable Generation Opportunities (Red)

Table 22. Holmfirth Civic Centre Energy Generation Opportunities Summary – Non-Feasible

Type	Opportunity	Rationale
Electricity	Hydro	1. Planning permission and complex surveys and impact studies will be required 2. Insufficient water head to generate enough energy to be worthwhile.
	Tidal/Wave	1. No local access to tidal waters nearby.
	Anaerobic Digestion	1. Limited space for equipment 2. Lack of guaranteed fuel source 3. Potential to release offensive odours
Thermal	Heat Pump – Ground Source Horizontal	1. Available ground area is insufficient for a horizontal system. 2. The borehole type system is very disruptive, geological assessments and surveys will need to the carried out.
	Heat Pump – Water Source	1. Holme river is circa 100m distance from site. In addition, multiple buildings and car parks are in between the civic centre and the river. There would likely to be significant disruptions if this generation measure was installed.
	Geothermal – High Grade Heat	1. No significant source of heat below the site reported.
	Biomass	1. Insufficient space for equipment
Hybrid	Combined Heat and Power (CHP)	1. Insufficient space for equipment
Energy Storage	Flywheel	1. Not suitable for current site usage as it is a short-term energy storage solution.
	Gravitational	1. No suitable sites nearby e.g., mine shafts
	Pumped Hydro	1. No suitable sites nearby e.g., mine shafts

6.1.8.4 Other Low Carbon Solutions - Hydrogen

There are a number of studies and projects in the UK testing out whether replacing natural gas with hydrogen is safe, how much it would cost, and how disruptive the process would be. We recommend that when the results of these studies are officially released then the viability of using hydrogen as an alternative fuel source is considered. Early results show that upgrading equipment to safely operate with hydrogen gas will likely have a significant cost with paybacks greater than 10 years.

6.2 Honley Library

Following the physical audit of the Honley Library, energy saving and generation opportunities were explored to determine their appropriateness for site. The following sections provide an overview of the main findings.

6.2.1 Lighting

The existing lighting throughout the site was observed to be T8 Fluorescent tube type with manual controls. In addition, the site has roof lights that provide internal space with natural daylight. Consideration should be given to the replacement of artificial lighting with modern energy efficient LED type with Motion/PIR and daylight controls. Below are pictures of the existing lighting and roof lights. Specialists should review the lighting design of the site prior to any installation to ensure that recommended LED replacements are fit for purpose.

In support of this opportunity, we have drafted a lighting brief to support any quotes for upgrading of lighting installations (please see Appendix E for further details).

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 23. Honley Library Energy Saving Opportunities Summary - Lighting

Opportunity	Electricity Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Upgrade lighting to LED type	1,203.8	0.26	£207	£900	4.3
Additional motion and daylight controls on new LED light fittings	76.6	0.02	£13	£90	6.8
TOTAL	**1,280.4**	**0.3**	**£220**	**£990**	**4.5**

6.2.2 Heating and Domestic Hot Water Service

The site's heating provision and Domestic Hot Water Service (DHWS) is supplied by a Remeha 45s Quinta Ace condensing boiler. The boiler is controlled by a Satchwell DC1100 Optimiser/Compensator. The boiler and controls are located in an adjacent room, only accessible from the outside. Site reported that controls are adjust manually.

To provide stricter control of the system, consider upgrading the controls to allow remote access and adjustment. Pictures of the heating system and controls have been provided below.

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 24. Honley Library Energy Saving Opportunities Summary - DHWS

Opportunity	Gas savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Upgrade heating controls	5,336	1.0	£187	£350	1.9
TOTAL	**5,336**	**1.0**	**£187**	**£350**	**1.9**

6.2.3 Behaviour Change Programme

To support and enhance existing internal procedures, consider implementing a behaviour change programme. Consider engaging other Holme Valley Parish Council sites to encourage and support energy saving opportunities in other areas. Savings shown below are an estimate of what could potentially be achieved at the Honley Library only.

Table 25. Honley Library Energy Saving Opportunities Summary – Behaviour Change

Opportunity	Energy Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Implement a behaviour change Programme	706	0.13	£38	£250	6.7
TOTAL	**706**	**0.13**	**£38**	**£250**	**6.7**

6.2.4 Building Fabric – Roof Insultation

Due to access restrictions, the roof insulation could not be inspected. However, if the insulation is limited and can be improved then a saving of up to 20% on heating gas consumption is likely achievable. It is recommended that a specialist is engaged to assess the roof insulation and accurately determine the saving potential.

The below table provides a summary of the potential savings (energy, carbon, and cost) and likely payback period:

Table 26. Honley Library Energy Saving Opportunities Summary – Roof Insulation

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
If able, install additional roof insulation	5,336	1.0	£187	£2,500	13.4
TOTAL	**5,336**	**1.0**	**£187**	**£2,500**	**13.4**

6.2.5 Building Fabric – Windows

The windows observed on-site were single-pane wooden framed types. Additional gas savings can be generated from installing double glazed windows on appropriate windows. Please see below a picture of a window that could be double glazed.

Table 27. Honley Library Energy Saving Opportunities Summary – Windows

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Install double glazing on appropriate windows	3,557	0.7	£125	£9,000	72.3
TOTAL	**3,557**	**0.7**	**£125**	**£9,000**	**72.3**

6.2.6 Building Fabric – Air Infiltration

Although an air pressure test was not carried out as part of this assessment, due to age and type of building there is potential for significant air leakage which will likely cause an increase in gas heating usage. It is recommended that an air pressure test is carried out to determine the extent of air leakage and using the results to carry out draught proofing.

Table 28. Honley Library Energy Saving Opportunities Summary – Air infiltration

Opportunity	Gas Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Conduct Air Pressure Test on the building and draught proof	4,446	0.8	£156	£2,000	12.8
TOTAL	**4,446**	**0.8**	**£156**	**£2,000**	**12.8**

6.2.7 Entire Building Envelope – Deep Retrofit

As an alternative to opportunities 6.2.1 to 6.2.6, consideration could also be given to undertaking a deep retrofit of the entire building. This is a whole building analysis and construction process which will take into consideration often high up-front cost opportunities such as windows and HVAC plant that have much longer pay-backs. Savings of up to 50% on energy and carbon emissions can be achieved from undertaking this opportunity.

Table 29. Honley Library Energy Saving Opportunities Summary – Deep Retrofit

Opportunity	Energy Savings (kWh)	Emissions Savings (tCO_2e)	Avoided Costs (£)	Implementation Costs (£)	Payback (yrs)
Deep Retrofit	20,511	3.8	£1,092	£50,000	45.8
TOTAL	**20,511**	**3.8**	**£1,092**	**£50,000**	**45.8**

6.2.8 Renewable Generation and Other Opportunities

Multiple renewable generation opportunities were assessed against community impact, ease of installation and applicability. They were then categorized into Green (feasible), Amber (further investigation required) and Red (not feasible). The following sections provide a summary of the generation potential and carbons savings from green and amber opportunities as well as an explanation of why some opportunities were not feasible (red).

6.2.8.1 Feasible Renewable Generation Opportunities (Green)

Table 30. Honley Library Energy Generation Opportunities Summary – Feasible

Opportunity	Energy Generation & Usage (kWh)	Emissions Savings (tCO_2e)	Savings (£)	Capital Costs (£)	Payback (yrs)
Solar Photovoltaic Electricity Generation - Without Battery Storage (50% usage and 50% sold back to the grid)	50% use = 642.5 50% Grid= 642.5 *Total 1,285*	0.14	£133	£2,650	19.7
Solar Photovoltaic Electricity & Thermal Generation Without Battery Storage (50% usage and 50% sold back to the grid)	Elec = 50% use = 642.5 50% Grid= 642.5 Heat= 6,526	1.3	£361	£3,400	9.4

6.2.8.2 Further Investigation Required Renewable Generation Opportunities (Amber)

Table 31. Honley Library Energy Generation Opportunities Summary – Further Investigation Required

Opportunity	Energy Generation & Usage (kWh)	Emissions Savings (tCO_2e)	Savings (£)	Capital Costs (£)	Payback (yrs)
Wind – VAWT (Vertical Axis) Without Battery Storage (50% usage and 50% sold back to the grid)	10% use = 1,789 90% Grid= 16,103 *Total 17,892*	0.4	£871	£50,000	57.4
Heat Pump – Air Source	27,462	4.6	-£148	£8,500	N/A
Heat Pump – Ground Source Vertical (Borehole)	27,462	4.6	-£148	£32,500	N/A
High Efficiency Storage Heaters	27,462	0.5	-£3,522	£6,000	N/A
Underfloor Heating	25,746	1.6	£301	£5,000	16.6
Solar Thermal Generation	6,526	1.2	£229	£2,266	9.9

6.2.8.3 Not Feasible Renewable Generation Opportunities (Red)

Table 32. Honley Library Energy Generation Opportunities Summary – Non-Feasible

Type	Opportunity	Rationale
Electricity	Solar Photovoltaic Electricity Generation -With Battery Storage	1. Due to potential size of system plus current site usage, the incorporation of battery storage is not practicable at this time.

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	Hydro	1. Planning permission and complex surveys and impact studies will be required 2. Insufficient water head to generate enough energy to be worthwhile.
	Tidal/Wave	1. No local access to tidal waters nearby.
	Anaerobic Digestion	1. Limited space for equipment 2. Lack of guaranteed fuel source 3. Potential to release offensive odours
Thermal	Heat Pump – Ground Source	1. Available ground area is insufficient for a horizontal system. 2. The borehole type system is very disruptive, geological assessments and surveys will need to the carried out.
	Heat Pump – Water Source	1. No suitable water source located nearby.
	Geothermal – High Grade Heat	1. No significant source of heat below the site reported.
	Biomass	1. Insufficient space for equipment
Hybrid	Combined Heat and Power (CHP)	1. Insufficient space for equipment
Energy Storage	Flywheel	1. Not suitable for current site usage as it is a short-term energy storage solution.
	Gravitational	1. No suitable sites nearby e.g., mine shafts
	Pumped Hydro	1. No suitable sites nearby e.g., mine shafts

6.2.8.4 Other Low Carbon Solutions - Hydrogen

There are a number of studies and projects in the UK testing out whether replacing natural gas with hydrogen is safe, how much it would cost, and how disruptive the process would be. We recommend that when the results of these studies are officially released then the viability of using hydrogen as an alternative fuel source is considered. Early results show that upgrading equipment to safely operate with hydrogen gas will likely have a significant cost with paybacks greater than 10 years.

7.0 Energy Saving Opportunities Summary

7.1 Holmfirth Civic Centre

Energy saving and generation opportunities identified for the site are shown in more detail in Appendix A & B. Below are two tables summarising the cumulative energy saving and generation opportunities.

Identified Energy Saving Opportunities:

Table 33. Holmfirth Civic Centre Energy Opportunities Summary

Opportunity	Annual Saving (£)	Carbon Saving (tCO_2e)	Payback (Years)
Carry out a deep retrofit of the building	£6,663	16.9	37.5
Upgrade existing lighting to modern LED type with PIR/motion and daylight controls	£2,037	2.1	1.9
Replace existing DHWS with point of use electric system	£726	2.9	2.8
Upgrade existing roof insulation (15% saving in heating)[2]	£690	2.5	4.3
Carry out Air Pressure Test on the building, draught proof and replace fire doors	£460	1.6	10.9
Implement a behaviour change programme	£382	1.0	6.3
Upgrade existing heating controls to provide remote access	£345	1.2	1.4
Install a timer on Zip hot water boiler	£263	0.3	0.2
Install secondary glazing on appropriate windows within Grade II listed part of the site.	£115	0.4	21.7

Notes:

1. The potential cumulative impact of implementing multiple energy saving opportunities (diversity) has not been considered.
2. Roof insulation savings potential of 15% has been shown. This needs to be confirmed by inspection by an appropriate specialist.

Identified Energy Generation Opportunities:

Table 34. Holmfirth Civic Centre Energy Generation Summary

Opportunity	Annual Saving & incentives (£)	Carbon Saving (tCO_2e)	Payback (Years)
Solar Photovoltaic Electricity and Thermal Generation with Battery Storage[1]	£5,407	8.2	15.6

Notes:

1. Solar electricity and thermal generation with battery storage saving has been presented in the summary table.

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7.2 Honley Library

Energy saving and generation opportunities identified for the site are shown in more details in Appendix C and D. Below are two tables summarising the cumulative energy saving and generation opportunities.

Identified Energy Saving Opportunities:

Table 35. Honley Library Energy Opportunities Summary

Opportunity	Annual Saving (£)	Carbon Saving (tCO_2e)	Payback (Years)
Carry out a deep retrofit of the building	£1,092	3.8	45.8
Upgrade existing lighting to modern LED type with PIR/motion and daylight controls	£220	0.3	4.5
Upgrade heating controls to provide remote access	£187	1.0	1.9
Install roof insulation (if appropriate)	£187	1.0	13.4
Carry out Air Pressure Test on the building, draught proof and replace fire doors	£156	0.8	12.8
Install double glazed windows	£125	0.7	72.3
Implement a behaviour change programme	£38	0.1	6.7

Notes:

1. The potential cumulative impact of implementing multiple energy saving opportunities (diversity) has not been considered.

Identified Energy Generation Opportunities:

Table 36. Honley Library Energy Generation Summary

Opportunity	Annual Saving & Incentives(£)	Carbon Saving (tCO_2e)	Payback (Years)
Solar Photovoltaic Electricity and Thermal Generation without Battery Storage$_1$	£361	1.3	9.4

Notes:

1. Solar electricity and thermal generation without battery storage saving has been presented in the summary table.

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8.0 Renewable (Green) Energy Contracts

Organisations can source renewable energy contracts from certain energy suppliers. Companies pay a premium to confirm that the energy sourced has been generated through renewable means. Energy suppliers prove that the energy purchased by the organisation meets the renewable energy criteria by obtaining certificates through the following schemes:

1. Renewable Energy Guarantees of Origin (REGO's) – Renewable electricity generation
2. Green Gas Certificates (GGC's) – Biomethane generation and insertion into the Gas Network

The amount and type of renewable energy sourced will affect the amount of associated carbon emissions produced. The renewable energy mix information is held by the chosen energy supplier with who the renewable energy contract was secured. In addition, only a certain number of supplies could potentially be deemed suitable for these types of renewable energy contracts. This is heavily dependent on the energy purchasing strategy implemented by HVCAP.

Certain energy providers offer energy contracts deemed low carbon however, the majority of these are generated using nuclear power. This type of energy contract is often referred to as "Blue".

Renewable (Green) Energy Contracts could become part of an organisation's pathway to carbon zero and further review is recommended.

9.0 Generation of Capital

9.1 Value Added Tax (VAT)

VAT is currently set at 20%, however for registered charities this is reduced to 5% on fuel and power if it is used for non-business activities. The 15% saving could be used to support energy saving and generation technologies.

9.2 Grants

We are aware of some specific sources of funding currently available which could be used to support the HVCAP net zero strategy. These are subject to strict eligibility criteria, and it is recommended that further investigation is carried out for appropriateness.

9.3 Internal of Price of Carbon

Many organisations, in support of their Climate Change impact reduction strategies, use an internal price of carbon in their emissions calculations. This theoretical cost per tonne aims to incorporate the impacts of Climate Change in all relevant future purchasing by giving key stakeholders a financial understanding of how the organisation is responding to specific Climate Change issues. Example companies to implement this include Microsoft, Unilever, ASDA and Disney.

If used, this internal price of carbon could generate funds to support energy saving and generation technologies.

10.0 Carbon Offsetting

Carbon offsetting is a process where organisations invest in carbon reducing projects (not on-site) as a way of compensation for the amount of carbon emissions they have produced. These schemes vary throughout the world and can be verified through third-party certifications such as The Gold Standard. Carbon Offsetting may also vary depending on the chosen scheme.

Carbon offsetting could become part of an organisation's pathway to carbon zero and further review is recommended.

11.0 Overall Conclusions and Recommendations

11.1 Holmfirth Civic Centre

1. The most significant energy source at the Holmfirth Civic Centre is natural gas which accounts for 85.9% (155,285 kWh) of consumption, 84.0% (28.4 tCO_2e) of carbon emissions and 60.1% (£8,011.3) of energy costs. Electricity accounts for 14.1% (25,559 kWh) of consumption, 16.0% (5.4 tCO_2e) of carbon emissions and 39.9% (£5,315.1) of energy costs.

2. The information obtained from the physical energy and carbon audit was used to calculate an energy profile for the site. It showed the most significant energy consumers being:
    i. Heating accounting for circa 49.3% (89,189 kWh) of the site's energy consumption, 48.2% (16.3 tCO_2e) of the site's carbon emissions and 34.5% (£4,601) of the site's energy costs.
    ii. DHWS which accounted for circa 36.5% (66,096 kWh) of the site's energy consumption, 35.7% (12.1 tCO_2e) of the site's carbon emissions and 25.6% (£3,410) of the site's energy costs.
    iii. Lighting accounts for 7.6% (13,725 kWh) of the site's consumption, 8.6% (2.9 tCO_2e) of the site's carbon emissions and 21.4% (£2,854) of the site's energy costs.
    iv. Heating Pumps and Plant (Elec) account for 3.6% (6,469 kWh) of site's energy consumption, 4.1% (1.4 tCO_2e) of the site's carbon emissions and 10.1% of the site's energy costs.
    v. The remaining 3.0% (5,365 kWh) of the site's energy consumption, 3.4% (1.2 tCO_2e) of the sites carbon emissions and 8.4% (£1,116) of the site energy costs are attributable to Tea Boilers, Lift, Small Power and Other.

3. The degree day analysis showed a good relationship between outside air temperature and natural gas consumption. However, a significant proportion of the natural gas invoices provided were based on estimate readings. It is recommended that meter readings are regularly taken and provided to the current energy supplier to ensure accurate natural gas measurements are captured and recorded. This will be needed to show the impact of implemented energy saving solutions.

4. The identified energy and carbon saving opportunities of upgrading appropriate lighting to LED type, upgrading roof insulation, replacing existing DHWS with an electric point of use system, installing roof insulation, draught proofing, replacing fire doors, installing timers on zip boilers and carrying out a behaviour change programme could generate savings of circa 63,980 kWh, £5,018 and 11.9 tCO_2e with a payback of 3.9 years. We would recommend engaging appropriate specialists to confirm savings and costs.

5. Deep retrofit was also considered as an alternative to the other energy solutions. Savings of up 90,422 kWh, £6,663 and 16.9 tCO2e could be achieved with a payback of 37.5 years.

6. A good number of energy generation and saving technologies were reviewed and considered as part of this energy and carbon audit - see Appendix B for further details. A feasibility assessment was carried out and showed solar photovoltaic energy generation as a viable option. Assessment of the available roof space shows that a combined solar photovoltaic electricity and thermal solution with battery storage would generate savings of £5,407, 20,892 kWh of electricity and 20,593 kWh of heat, 8.2 tCO_2e in carbon emissions with a payback of 15.6 years. We recommend that a solar photovoltaic specialist is engaged to confirm saving potential.

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11.2 Honley Library

1. The most significant energy source at the Honley Library is natural gas which accounts for 86.7% (35,572 kWh) of consumption, 84.9% (6.5 tCO_2e) of carbon emissions and 57.1% (£1,245.6) of energy costs. Electricity accounts for 13.3% (5,450 kWh) of consumption, 15.1% (1.2 tCO_2e) of carbon emissions and 42.9% (£937.5) of energy costs.

2. The information obtained from the physical energy and carbon audit was used to calculate an energy profile for the site. It showed that most significant energy consumers being:

   i. Heating and DHWS accounts for circa 86.7% (35,572 kWh) of the site's energy consumption, 84.9% (6.5 tCO_2e) of the site's carbon emissions and 57.1% (£1,246) of the site's energy costs.

   ii. Small Power accounts for circa 5.1% (2,075 kWh) of the site's energy consumption, 5.7% (0.4 tCO_2e) of the site's carbon emissions and 16.4% (£357) of the site's energy costs.

   iii. Lighting accounts for 3.9% (1,587 kWh) of the site's consumption, 4.4% (0.3 tCO_2e) of the site's carbon emissions and 12.5% (£273) of the site's energy costs.

   iv. The remaining 4.3% (1,788 kWh) of the site's energy consumption, 5.0% (0.4 tCO_2e) of the sites carbon emissions and 14.0% (£307) of the site energy costs are attributable to heating pumps and plant, kettles, other white goods, and other.

3. The degree day analysis did not show an evident relationship between outside air temperature and natural gas consumption. This could be due to the sites reported issues with controlling temperature. Recommend a further review of the heating controls is carried out to determine their appropriateness for the current site use.

4. The identified energy and carbon saving opportunities of upgrading appropriate lighting to LED type, upgrading heating controls to provide remote access, installing roof insulation, draught proofing, installing secondary glazing and implementing a behaviour change programme have a total annual undiversified savings of circa £912, 20,661kWh 3.8 tCO_2e with a payback of 16.6 years. We would recommend engaging appropriate specialists to confirm savings and costs.

5. Deep retrofit was also considered as an alternative to the other energy solutions. Savings of up 20,511 kWh, £1,484 and 3.8 tCO_2e could be achieved with a payback of 33.7 years.

6. A good number of energy generation and saving technologies were reviewed and considered as part of this energy and carbon audit See Appendix D for further details. A feasibility assessment was carried out and showed solar photovoltaic energy generation as a viable option. Assessment of the available roof space shows that a combined solar photovoltaic electricity and thermal solution without battery storage would generate savings of £361, 642 kWh of electricity and 6,526 kWh of heat, 1.3 tCO_2e in carbon emissions with a payback of 9.4 years. We recommend that a solar photovoltaic specialist is engaged to confirm saving potential.

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Appendix A – Holmfirth Civic Centre Energy and Carbon Saving Opportunity Schedule

Notes:

1. The potential cumulative impact of implementing multiple energy saving opportunity (diversity) has not been considered.

Ref.	Resource	Opportunity	Energy Savings (kWh/yr)	Carbon Savings (tCO_2e)	Cost Savings (£/yr)	Implementation Cost (£)	Payback (yrs)
Op 1	All	Carry out a deep retrofit of the Holmfirth Civic Centre. Savings of up to 50% in energy consumption and carbon emissions could potentially be realised	90,422	16.9	£6,663	£250,000	37.5
Op 2	Lighting	Consider upgrading appropriate lighting with LED type.	8,760	1.9	£1,822	£3,315	1.8
Op 3	Heating	Due to access restrictions, the roof insulation could not be inspected. If this insulation is limited and can be improved, then between 10% to 15% saving in heating natural gas consumption could be realised. Recommend a specialist is engaged and inspection of the roof insulation is undertaken to accurately determine the saving potential.	8,919 to 13,378	1.6 to 2.5	£460 to £690	£3,000	4.3 to 6.5
Op 4	DHWS	Review Direct Gas Fired DHWS with a view to replace point of use with electric alternative. This will reduce the energy losses from continually cycling hot water. This solution is based on discussed usage, where hot water was needed for amenity provision at certain times during the day. Cost savings factor in the increased energy consumption from electric DHWS point of use.	16,524	2.9	£726	£2,000	2.8

Op 5	Heating	Carry out an air pressure testing on the Holmfirth Civic Centre to determine the extent to which air is lost through leaks in the building fabric. Dependent on the results, carry out draught proofing and replacement of fire doors to reduce air leaks. If significant losses are being experienced, then up to 10% in gas heating savings could potentially be realised.	8,919	1.6	£460	£5,000	10.9
Op 6	Greener Working	Renew the Greener Working Campaign to reduce waste energy consumption and encourage environmentally friendly behaviour from staff and clients.	5,184	1.0	£382	£2,400	6.3
Op 7	Heating	Review existing heating controls with a view to provide remote access in order to review and adjust settings according to demand. Savings are based on potential savings from heating being accidentally left on when not needed.	6,689	1.2	£345	£500	1.4
Op 8	Zip Boilers	Install timers on all hot water zip boilers.	1,264	0.3	£263	£50	0.2
Op 9	Lighting	Consider installing motion and daylight sensors on Recommended LED light fittings. These calculations assume a reduction of 1 hour per day in office and meeting room lighting consumption is achievable.	1,032	0.2	£215	£645	3.0
Op 10	Heating	In the Grade II listed part of the building, consider continuing the window upgrade programme by installing secondary glazing on circa 5nr remaining windows. A conservative 2.5% reduction in existing heating consumption has been estimated.	2,230	0.4	£115	£2,500	21.7

Appendix B – Holmfirth Civic Centre Renewable and Other Opportunities Schedule

Summary of Feasibility Assessment					1=Poor, 3=Neutral, 5=Excellent			
Type	**Category**	**Advantages**	**Disadvantages**	**Cost (£)**	**Community Impact**	**Ease of Installation**	**Applicability**	**Green - Feasible Amber – Feasible Red – Not Feasible**
Electricity	Solar Photovoltaic	1. Payback time within 10 to 15 years is a realistic prospect. 2. Solar panels are a developed and proven technology. 3. Energy generation is predictable to a certain degree.	1. Restrictions on solar panel installation due to parts of the building being listed - can't be visible from roadside. 2. UK climate is not entirely suited to significant solar generation. 3. Intermittent generation - no energy generated at night and very little in the winter months. Alternative energy source is still required, and storage would be very beneficial. 4. Feasibility regarding size, positioning and costs needs to be verified due to size of system.	High	3	4	5	
	Wind – HAWT (Horizontal Axis)	1. Outward demonstration of council's commitment to being green. 2. Developed and proven technology. 3. Energy generation is predictable to a certain degree.	1. Unlikely to be feasible due to site space constraints. 2. Planning permission, complex surveys and impact studies will be required. 3. Intermittent generation. Alternative energy source is still required, and storage would be very beneficial.	Medium to High	2	2	3	

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	Wind – VAWT (Vertical Axis)	1. More efficient in lower wind speeds and in turbulent air (roadside), i.e. better suited for town centres. 2. Can be viewed as a futuristic/artistic installation. 3. More flexibility in mounting. Various models of VAWT can be mounted on roofs, poles, walls or the ground.	1. More expensive than a HAWT 2. Unlikely to be feasible due to site space constraints. 3. Planning permission and complex surveys and impact studies will be required. 4. Still a developing technology, may be out of date in a short period.	High	3	3	4	
	Hydro		1. Planning permission and complex surveys and impact studies will be required. 2. Insufficient water head to generate enough energy to be worthwhile.	-	-	-	-	
	Tidal/Wave		1. No appropriate water source nearby.	-	-	-	-	
	Anaerobic Digestion	1. Potential for fuel source from local farms.	1. Limited space for the equipment. 2. Lack of guaranteed fuel source. 3. Potential to release offensive odours.	-	-	-	-	

Heating	Heat Pump – Air Source	1. Can provide heating and DHWS. 2. Reduces or removes the site's reliance on gas.	1. More expensive than current gas system to operate. 2. Renewable Heat Incentive (RHI) payments have ended. 3. 35-40kW heat output required for winter months, resulting in it being oversized for the majority of the year.	Medium	3	4	5	
	Heat Pump – Ground Source Horizontal		1. Available ground area is insufficient.	-	-	-	-	
	Heat Pump – Ground Source Vertical	1. Vertical (borehole) ground source heat pumps provide an alternative where horizontal space is limited. 2. The visual impact on the surface is minimal. 3. Less dependent on the external climate.	1. Excavating a borehole can add significant capex costs to the project. The greater the heating requirement, the longer and deeper the borehole will need to be. 2. Ground surveys will be required to ensure the geology below is suitable for borehole(s). 3. Likely to be more expensive than current gas system to operate. 4. Renewable Heat Incentive (RHI) payments have ended for non-domestic installations.	Medium to High	2	2	2	
	Heat Pump – Water Source		1. Circa 100m and several buildings and car parks between the civic centre and Holme river. Significant disruption would be caused.	-	-	-	-	

	High Efficiency Storage Heaters	1. These highly efficient electric storage heaters will reduce or remove the site’s reliance on gas. 2. Would allow the site to take advantage of off-peak electricity prices.	1.At current energy rates, the storage heaters would be more expensive than the current gas system to operate.	Low	3	5	4	
	Underfloor Heating	1. More efficient method of heating than gas central heating.	1. Would require significant work to install - floors would have to be pulled up.	Low-Medium	3	2	4	
	Geothermal		1. No significant source of heat below site. 2. Not a cost-effective way to heat this building.	-	-	-	-	

	Solar - Thermal	1. Payback time within 10 to 15 years is a realistic prospect. 2. Circa 243m2 of useable roof area facing a South-East direction. 3. Solar panels are a developed and proven technology. 4. Energy generation is predictable to a certain degree." 5. Increase carbon reduction compared to Solar PV. 6. The most appropriately sized system will only take up one roof and provide the centre with 33% of their hot water requirements.	1. Restrictions on solar panel installation due to parts of the building being listed - can't be visible from roadside. 2. UK climate is not entirely suited to significant solar generation. 3. Most heat generated in the summer whereas it will be needed mostly in the winter.	Low	3	4	5	
	Biomass		1. Insufficient space for the equipment.	-	-	-	-	

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Hybrid (Electricity and Heating)	CHP		1. Insufficient space for the equipment.	-	-	-	-	
	Solar Photovoltaic Electricity and Thermal	1. Allows the generation of electricity and heat from a single source. 2. Despite increased capital costs, potential to reduce payback period versus just PV or thermal. 3. Battery storage allows for maximum use of the generated energy. Based on current incentives and tariff rates, this is the most competitive option.	1. Developing combined technology. 2. The two processes may impact each other's efficiency, reducing potential output. 3. Higher capital costs and more difficult installation.	High	3	3	5	
Energy Storage	Flywheel		1. Not suitable for current site use.	-	-	-	-	
	Gravitational		1. No suitable sites.	-	-	-	-	
	Pumped Hydro		1. No suitable sites.	-	-	-	-	

Energy Saving and Incentive Summary of Green (feasible) and Amber (further investigation required)

Type	Category	Potential Output use by site (kWh)	Carbon Saving (tCO_2e)	Capital Costs (£)	Annual Savings and Incentives (£)	Payback (yrs)
Electricity Generation	Solar Photovoltaic – **Without** Battery Storage	5,223	1.1	£42,480	£1,635	26.0
	Solar Photovoltaic – **With** Battery Storage	20,892	4.4	£66,480	£4,345	15.3
	Wind – VAWT (Vertical Axis) – **Without** Battery Storage	8,945	1.9	£50,000	£2,174	23.0
	Wind – VAWT (Vertical Axis) – **With** Battery Storage	17,892	3.8	£74,000	£3,721	19.9
Heating	Heat Pump – Air Source	115,202	19.4	£27,500	£584	47.1
	Heat Pump – Ground Source Vertical (Borehole)	115,202	19.4	£51,500	£584	88.1
	High Efficiency Storage Heaters	115,202	2.0	£10,000	-£16,528	N/A
	Underfloor Heating	108,002	6.6	£22,500	£1,857	12.1
	Solar Thermal	20,593	3.8	£6,265	£1,062	5.9
Hybrid	Solar Photovoltaic Electricity and Thermal – **Without** Battery Storage	Elec – 5,223 Heat - 20,593	4.9	£60,400	£2,697	22.4
	Solar Photovoltaic Electricity and Thermal – **With** Battery Storage	Elec – 20,892 Heat - 20,593	8.2	£84,400	£5,407	15.6

Appendix C – Honley Library Energy and Carbon Saving Opportunity Schedule

Notes:

1. The potential cumulative impact of implementing multiple energy saving opportunity (diversity) has not been considered.

Ref.	Resource	Opportunity	Energy Savings (kWh/yr)	Carbon Savings (tCO_2e)	Cost Savings (£/yr)	Implementation Cost (£)	Payback (yrs)
Op 1	All	Carry out a deep retrofit of the Honley Library. Savings of up to 50% in energy consumption and carbon emissions could potentially be realised	20,511	3.8	£1,092	£50,000	45.8
Op 2	Lighting	Consider upgrading appropriate lighting with LED type with PIR/motion and daylight control.	1,204	0.26	£207	£900	4.3
Op 3	Heating	Upgrade existing heating controls to provide remote access. Not only would this save on gas consumption, but also provide easier access to onsite staff and prevent the need to go into the external boiler room in order to adjust temperature settings. A conservative 10% saving has been used to calculate potential energy cost reduction.	5,336	1.0	£187	£350	1.9
Op 4	Heating	Due to access restrictions, the roof insulation could not be inspected. If this insulation is limited and can be improved, then up to 20% saving in heating natural gas consumption could be realised. Recommend a specialist is engaged and inspection of the roof insulation is undertaken to accurately determine the saving potential.	5,336	1.0	£187	£2,500	13.4

Op 5	Heating	Carry out an air pressure testing on Honley Library to determine the extent to which air is lost through leaks in the building fabric. Dependent on the results, carry out draught proofing. If significant losses are being experienced, then between 5% and 10% in gas heating savings could potentially be realised.	4,446	0.8	£156	£2,000	12.8
Op 6	Heating	Replace single glazed windows with double glaze type.	3,557	0.7	£125	£9,000	72.3
Op 7	Greener Working	Renew the Greener Working Campaign to reduce waste energy consumption and encourage environmentally friendly behaviour from staff and clients.	706	0.13	£38	£250	6.7
Op 8	Lighting	Consider installing PIR and daylight sensors controls. These calculations assume a reduction of 2 hour per day in lighting consumption is achievable and based on installed LEDs	77	0.02	£13	£90	6.8

Appendix D – Honley Library Renewable and Other Opportunities Schedule

Summary of Feasibility Assessment

Type	Category	Advantages	Disadvantages	Cost (£)	Community Impact	Ease of Installation	Applicability	Green -Feasible Amber – Feasible Red – Not Feasible
					1=Poor, 3=Neutral, 5=Excellent			
Electricity Generation	Solar Photovoltaic	1. Payback time within 10 to 15 years is a realistic prospect. 2. Solar panels are a developed and proven technology. 3. Energy generation is predictable to a certain degree.	1. UK climate is not entirely suited to significant solar generation. 2. Intermittent generation - no energy generated at night and very little in the winter months. Alternative energy source is still required, and storage would be very beneficial. 3. Feasibility regarding size, positioning and costs needs to be verified due to size of system.	High	3	4	5	
	Wind – HAWT (Horizontal Axis)	**1.** Outward demonstration of council's commitment to being green. 2. Developed and proven technology. 3. Energy generation is predictable to a certain degree.	1. Unlikely to be feasible due to site space constraints. 2. Planning permission, complex surveys and impact studies will be required. 3. Intermittent generation. Alternative energy source is still required, and storage would be very beneficial.	Medium to High	2	2	3	
	Wind – VAWT (Vertical Axis)	1. More efficient in lower wind speeds and in turbulent air	1. More expensive than a HAWT	High	3	3	4	

		(roadside), i.e. better suited for town centres. 2. Can be viewed as a futuristic/artistic installation. 3. More flexibility in mounting. Various models of VAWT can be mounted on roofs, poles, walls or the ground.	2. Unlikely to be feasible due to site space constraints. 3. Planning permission and complex surveys and impact studies will be required. 4. Still a developing technology, may be out of date in a short period.					
	Hydro		1. Planning permission and complex surveys and impact studies will be required. 2. Insufficient water head to generate enough energy to be worthwhile.	-	-	-	-	
	Tidal/Wave		1. No appropriate water source nearby.	-	-	-	-	
	Anaerobic Digestion	1. Potential for fuel source from local farms.	1. Limited space for the equipment. 2. Lack of guaranteed fuel source. 3. Potential to release offensive odours.	-	-	-	-	

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Heating	Heat Pump – Air Source	1. Can provide heating and DHWS. 2. Reduces or removes the site’s reliance on gas.	1. More expensive than current gas system to operate. 2. Renewable Heat Incentive (RHI) payments have ended.	Medium	3	4	5	
	Heat Pump – Ground Source Horizontal		1. Available ground area is insufficient.	-	-	-	-	
	Heat Pump – Ground Source Vertical (Borehole)	1. Vertical (borehole) ground source heat pumps provide an alternative where horizontal space is limited. 2. The visual impact on the surface is minimal. 3. Less dependent on the external climate.	1. Excavating a borehole can add significant capex costs to the project. The greater the heating requirement, the longer and deeper the borehole will need to be. 2. Ground surveys will be required to ensure the geology below is suitable for borehole(s). 3. Likely to be more expensive than current gas system to operate. 4. Renewable Heat Incentive (RHI) payments have ended for non-domestic installations.	Medium to High	2	3	3	
	Heat Pump – Water Source		1. Circa 400m and multiple buildings between the Library and the Holme river and Mag Brook. Significant disruption would be caused.	-	-	-	-	

	High Efficiency Storage Heaters	1. These highly efficient electric storage heaters will reduce or remove the site's reliance on gas. 2. Would allow the site to take advantage of off-peak electricity prices.	1.At current energy rates, the storage heaters would be more expensive than the current gas system to operate.	Low	3	5	4	
	Underfloor Heating	1. More efficient method of heating than gas central heating.	1. Would require significant work to install - floors would have to be pulled up.	Low-Medium	3	2	4	
	Geothermal		1. No significant source of heat below site. 2. Not a cost-effective way to heat this building.	-	-	-	-	

	Solar - Thermal	1. Payback time within 10 to 20 years is a realistic prospect. 2. Solar panels are a developed and proven technology. 3. Energy generation is predictable to a certain degree." 4. Increase carbon reduction compared to Solar PV.	1. UK climate is not entirely suited to significant solar generation. 2. Most heat generated in the summer whereas it will be needed mostly in the winter.	Low	3	4	5	
	Biomass		1. Insufficient space for the equipment.	-	-	-	-	

Hybrid (Electricity and Heating)	CHP		1. Insufficient space for the equipment.	-	-	-	-	
	Solar Photovoltaic Electricity and Thermal	1. Allows the generation of electricity and heat from a single source. 2. Despite increased capital costs, potential to reduce payback period versus just PV or thermal.	1. Developing combined technology. 2. The two processes may impact each others efficiency, reducing potential output. 3. Higher capital costs and more difficult installation.	High	3	3	5	
Energy Storage	Flywheel		1. Not suitable for current site use	-	-	-	-	
	Gravitational		1. No suitable sites.	-	-	-	-	
	Pumped Hydro		1. No suitable sites.	-	-	-	-	

Energy Saving and Incentive Summary of Green (feasible) and Amber (further investigation required)

Type	Category	Potential Output use by site (kWh)	Carbon Saving (tCO_2e)	Capital Costs (£)	Annual Savings and Incentives (£)	Payback (yrs)
Electricity Generation	Solar Photovoltaic – **Without** Battery Storage	642	0.14	£2,625	£133	19.7
	Solar Photovoltaic – **With** Battery Storage	1,285	0.27	£6,125	£221	27.7
	Wind – VAWT (Vertical Axis) – **Without** Battery Storage	1,789	0.4	£50,000	£871	57.4
	Wind – VAWT (Vertical Axis) – **With** Battery Storage	4,472	0.9	£53,500	£1,239	43.2
Heating	Heat Pump – Air Source	27,462	4.6	£8,500	-£148	N/A
	Heat Pump – Ground Source Vertical (Borehole)	27,462	4.6	£32,500	-£148	N/A
	High Efficiency Storage Heaters	27,462	0.5	£6,000	-£3,522	N/A
	Underfloor Heating	25,746	1.6	£5,000	£301	16.6
	Solar Thermal	6,526	1.2	£2,266	£229	9.9
Hybrid	Solar Photovoltaic Electricity and Thermal – **Without** Battery Storage	Elec – 642 Heat – 6,526	1.3	£3,400	£361	9.4
	Solar Photovoltaic Electricity and Thermal – **With** Battery Storage	Elec – 1,285 Heat – 6,526	1.5	£6,900	£450	15.3

Appendix E – Honley Library Lighting Brief

The below lighting brief was provided from PASCHALi to Malcolm Ellis under the cover of email on 7th July 2021 at 15:21:

Please provide tender quotations for the following works at Honley Library:

Full Library Lighting Replacement

- Allow for taking down and removing the existing lighting fittings.
- Supply and install new LED light fittings (number to be confirmed in quote) to provide lighting levels suitable and appropriate for a small public library with multi-use community use, containing bookshelves, study areas, play areas, display areas and ancillary spaces. Lighting levels to be stated in the quotation and must follow the latest recommendations as published in CIBSE Lighting Guide 5: Lighting for Education, in particular sections 5.12.
- Lighting controls to be automatic and be provided for energy saving and comfort purposes. They should include daylight dimming and presence detection.
- Control of main lighting to be by handheld remote controls (three to be supplied) and one main switch easily accessible by library staff only.
- Wiring and trunking installation to be checked and confirmed suitable for the new lighting installation. Tenderer to include for any additional wiring, trunking, materials and certification as needed in accordance with the latest Wiring Regulations (18th Edition) as published by the IET.
- Any external light fittings to be included in the above replacement project.
- Tenderer to outline and confirm design at price submission stage.

Provision of Library Boiler Heating Controls

- Supply and install suitable HIVE or equivalent heating controls to the existing heating system so as to provide seven-day multi on/off scheduling, thermostatic temperature control, boost settings, frost protection and remote access via Wi-Fi and mobile phone App. Final position of thermostat to be agreed.