Bayston Hill Parish Council

Greenhouse Gas Audit

June 2023

BAYSTON HILL
PARISH COUNCIL

marches
energy agency

Introduction

Bayston Hill Parish Council (BHPC) has commissioned Marches Energy Agency to produce a greenhouse gas (GHG) audit tool, along with a series of indicative carbon-saving recommendations, to aid their objective of reaching carbon neutrality by 2030.

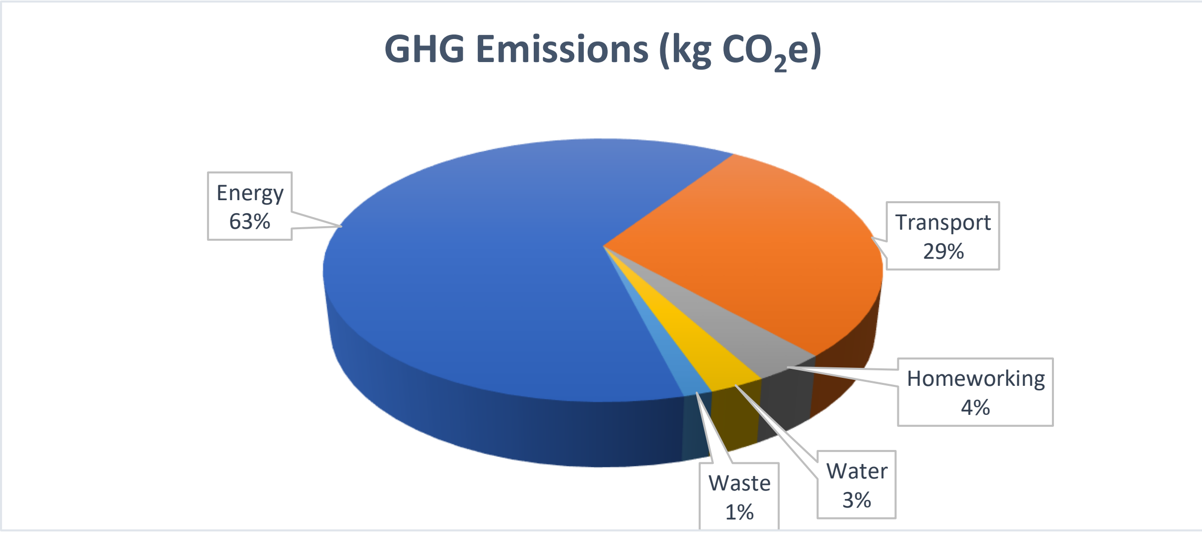
This GHG Corporate Accounting and Reporting Standard has been used as recommended by the UK Government. This is the internationally recognised standard from the World Resources Institute and World Business Council for Sustainable Development for reporting on GHG. The gases included in the audit, of which the first three are the most relevant to this project, are listed below. The aggregation of the environmental impact of GHG associated with operational activity are expressed in terms of their CO_2 equivalence, as CO_2e.

- Carbon Dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydrofluorocarbons (HFCs),
- Perfluorocarbons (PFCs),
- Sulphur hexafluoride (SF_6)
- Nitrogen trifluoride (NF_3).

The GHG auditing tool has been created for BHPC, which should be completed on an annual basis. The tool contains instructions on how to enter and update data such as GHG conversion factors, though MEA can assist with this if desired. When completing the GHG emissions audit each year, any changes in terms of buildings or staffing should be noted to add context.

A baseline of GHG emissions has been established, from which GHG emissions reductions can be calculated on an annual basis. These emissions accounted for electricity, transport, home-working, water and waste. The audit establishes the GHG emissions released as a result of operating its assets to deliver its services. The primary assets relevant to the audit are the pavilion and toilet block, the parish office, the youth club. Emissions from the deputy clerk’s vehicle is also included.

Headline findings

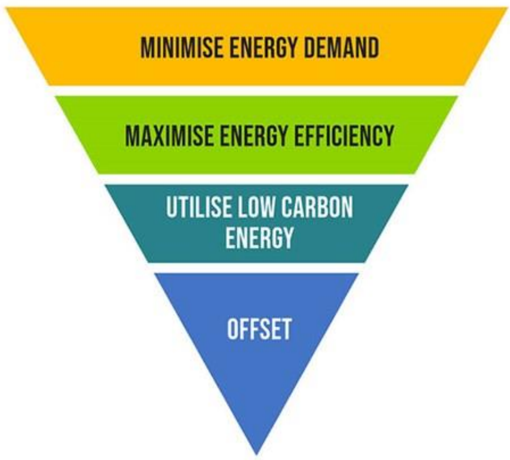


For the baseline year, BHPC emitted 6755.22 kg CO_2e from April 2022 to April 2023. As is shown in the pie chart, the vast majority of emissions can be attributed to energy (63%) and transport (29%).

Furthermore, with appropriate evidence, the energy-based emissions can be removed from the total figure, as the electricity tariff is 100% renewable; an email from the supplier confirming that the supply is certified for 100% renewable energy would suffice. Despite this, energy-based emissions should still be calculated and reported annually, to show energy use. Whilst it is ideal that energy supply is 100% renewable, there are still wider economic and environmental benefits which could be achieved from reducing energy demand, therefore for the purposes of this report, energy-based emissions have been considered.

The report explores a number of recommendations, and their potential estimated impact, before detailing an action plan to reduce emissions as much as possible by 2030.

The following energy efficiency hierarchy is applicable to all GHG emissions, and it is with this framework in mind that the recommendations have been produced. Note that the utilisation of low-carbon energy should only be considered after the reduction of energy demand and the maximisation of energy efficiency has been prioritised. Offsetting should only be considered as a last resort for truly unavoidable emissions.



Recommendations

The following recommendations have been made within the context of Bayston Hill Parish Council's objective of achieving carbon neutrality by 2030. Some recommendations represent low-hanging fruit, whereas others will require more transformative change.

Energy – 63% of total emissions

Reducing demand:

- Improve the building fabric
- Draughtproof thoroughly

Across all three sites, the pavilion, the parish office and the youth club building, the main opportunity for reducing energy demand is via improvements to the building fabric. All sites would benefit from either topping up loft insulation in the case of the pavilion and the youth club, or installing flat-roof insulation in the case of the parish office. Thorough draughtproofing of door and window seals should also be conducted throughout each site. The youth club would benefit from additional measures, such as a roof insulation and external wall insulation. As discussed overleaf, solar panels could be installed on the youth club roof, however this could require a roof replacement to enable this. Since the youth club would require a significant level of investment, it might be more cost-effective to replace the building with a modern equivalent instead.

Maximising efficiency:

- Replace old heating systems with more efficient systems
- Ensure smart heating controls are installed
- Replace old, inefficient lighting with LED equivalents

All sites currently depend on old, inefficient electric systems for heating that will likely be wasting energy. Heat pumps represent a significant upgrade, with typical real-world efficiencies of approximately 250-300%; meaning, for every kWh of power used by the heat pump, 2.5-3.0 kWh's of heat is outputted.

Ground-source heat pumps are the most efficient, though the cost and disruption required is prohibitive; typical costs can be £25,000 or more.

Air-source heat pumps provide comparable efficiency at a much-reduced cost; air to air systems are typically £3000, whereas air to water systems are typically £10,000.

Air to water heat pumps work as a central heating system, requiring large radiators or underfloor heating, and stable set-temperatures to maximise efficiency. Air to air heat pumps work more like room heaters, requiring wall or ceiling mounted fan blowers. They are capable of heating a large space quickly, and are therefore appropriate for spaces which are intermittently occupied. Another advantage of air-to-air heat pumps is that they can provide effective cooling too via the fan blowers, which is harder to achieve in an air to water heat pump via radiators.

The pavilion, which is not currently regularly heated, and the youth club which is not currently consistently occupied, might benefit most from an air-to-air system which doesn't require consistent running to achieve high efficiencies.

Regardless of which type of air-source heat pump is chosen for each site, all sites should have smart heating controls installed to further maximise efficiency through features such as programmable timing, thermostatic control and weather-compensation. A system which allows for long-distance remote controlling via an app could allow the heating to be activated at short notice without incurring further transport emissions.

LED tubes could replace the older compact fluorescent strips currently installed, as these are typically 80% more efficient. The floodlights at the pavilion site could also be replaced with LED's to improve efficiency by roughly 90%. All lighting could be controlled by PIR sensors for even greater efficiency.

Low-carbon energy:

- Install solar PV on any appropriate roof space
- Install battery storage
- Install a diverter or thermal store for hot ware use

In addition to the current solar photovoltaic array on the pavilion, further panels should be added to any appropriate roof space, such as the youth club and any potential new buildings at the pavilion site.

Battery storage at the pavilion, and possibly the youth club, could allow opportunity for reducing the cost of electricity use. Any surplus energy from the solar panels can be stored for later use, meaning that less electricity is both imported and exported to and from the grid. Some battery systems also allow electricity to be imported from the grid during off-peak times, potentially reducing the cost of electricity significantly. Battery storage becomes particularly appealing if running electric vehicles and appliances.

A diverter or thermal store could be installed to further utilise the solar panels, and provide hot water to the pavilion and possibly the youth club. It is worth noting that in order to get the best out of battery storage and a diverter or thermal store (which is essentially another form of storage), a significant solar PV array would be required. With this in mind, and the relatively limited scope for increasing the number of solar panels, it may be more cost-effective to install either the battery storage or the hot-water setup.

Transport – 29% of total emissions

Reducing demand:

- Explore replacing deputy clerk mileage with active travel where possible

Replacing car journeys with active travel modes where possible would provide a number of benefits; as well as reducing transport-based GHG emissions, active travel modes such as walking and cycling contribute towards reducing air pollution, and increasing both physical and mental health and wellbeing. Naturally there will be car journeys which would not be feasible to replace with active travel, such as transporting heavy cargo, however any reduction in car use would be positive. This also offers the opportunity to champion active travel within the community, and encourage Bayston Hill residents to also reduce their car use.

Maximising efficiency and low-carbon energy:

- Replace the tractor and mower with electric models

Electric vehicles and appliances are typically much more efficient than fossil-fuel based models, and can be considered as renewably-powered if charged up by either the solar panels, or on-site electricity if the supply has been certified as being 100% renewable. This could increase the effectiveness of installing battery storage, as this would significantly reduce the cost of powering the tractor and mower; the electricity would either be free if supplied by the solar panels, or cheap off-peak rates if supplied by the grid overnight.

The tractor is responsible for approximately 90% of transport-based GHG emissions, and could therefore be considered the greatest priority, though it would also be considerably more expensive than the mower. Consideration could also be given to purchasing a second-hand electric tractor and mower in order to avoid further embodied emissions and reduce the cost, though this would have to be weighed up against the life expectancy of the tractor, in particular the battery.

Alternatively, an electric buggy could be purchased to reduce unnecessary use of the tractor. This would likely be much cheaper, though would not have as great an impact on reducing GHG emissions.

Homeworking – 4% of total emissions

There is limited scope for improvements here.

The GHG emissions conversion factor used takes into account equipment and heating. Equipment could be upgraded to the maximum efficiency appliances. Likewise, the heating system, though this falls outside of the scope of the Parish Council.

If PV, battery storage and a heat pump system are implemented at the pavilion site, then the low-carbon energy there could be utilised by reducing homeworking hours, if and when the parish office is integrated at the pavilion. However, by doing this transport emissions and fuel costs associated with commuting to the pavilion site from south Staffordshire would increase significantly. Considering this, it would likely not make sense to reduce homeworking hours.

Water – 3% of total emissions

Reducing demand:

- Install a rainwater recycling system
- Replace toilets within the toilet block with compost versions

Installing a rainwater recycling system would significantly reduce the quantity of water supplied for purposes such as irrigation. A cheap solution could be to install one or multiple water butts at the pavilion site, whereas an underground tank would provide greater storage capacity but at greater expense and disruption. It would be worth considering how much water is used for non-potable purposes, to identify how much water storage would be required; for example, if plans to install new changing rooms go ahead, grey water recycling could be utilised for the toilets.

Installing compost toilets at the toilet block would significantly reduce GHG emissions associated with water treatment, though these emissions only make up 7% of water-based emissions, which in turn make up only 3% of total emissions. This would likely not be a very cost-effective intervention, when compared to other recommendations previously discussed, and so should not be prioritised.

Maximising efficiency:

- Install water-saving taps and shower heads
- Install water-saving devices in toilet cisterns

Installing water-saving taps, shower heads and toilet cistern devices would allow for emissions associated with both water supply and water treatment to be reduced moderately. As these would be relatively cheap to install, this represents a cost-effective intervention.

Waste – 1% of total emissions

Reducing demand:

- Implement a comprehensive composting system

100% of BHPC waste is collected by Veolia and 'diverted'; according to their website, Veolia endeavour to reuse, recycle, compost or destroy via combustion as much waste as possible to avoid sending waste to landfill. The vast majority of this is destroyed via combustion. Incorporating a thorough recycling system could help to increase the proportion of waste that is recycled by Veolia.

However, there is further opportunity for emissions reduction. According to the GHG emissions conversion factors (link provided within the audit tool), recycling paper waste produces 60% more GHG emissions than composting, likely due to the energy required during the recycling process. Therefore, implementing a comprehensive composting system for organic and shredded paper waste could provide a modest reduction in GHG emissions. Despite this offering significantly less scope for GH emissions reduction than energy or transport-based recommendations, this still represents a cost-effective solution as it would cost very little to implement and manage. There is also a potential social value benefit here, as the compost could be integrated with the nearby allotments.

Action plan

Recommendations have been ordered by priority based on cost-effectiveness. Please note that all figures for costs, savings and payback periods are indicative estimations and could vary significantly based on a multitude of factors.

Pavilion

Recommendation	Cost	Savings (£)	Savings (kg CO_2e)	Payback (years)	Indicative date	Date completed
LED tubes x6	£150	£135	83.85	1.1		
Loft insulation top-up	£1,000	£100	76.93	10.0		
Draughtproofing	£20	£5	3.85	4.0		
Air-to-air heat pump	£3,000	£1000	569.26	3.0		
Smart heating controls	£200	£100	76.93	2.0		
Solar PV	£3,500	£450	346.17	7.8		
Battery storage	£8,000	£1000	569.26	8.0		
Solar PV diverter + water tank	£1200	£150	115.39	8.0		
Electric tractor	£25,000	£415	827.07	60.2		
Electric sit-on mower	£1,500	£14.50	17.93	103.4		
Water-saving devices	£500	£150	11.52	3.3		
Water butts	£40	£100	7.68	0.4		
Composting system	£50	£0	10.64	-		
Compost toilets	£1,200	£40	5.61	30.0		
Underground rainwater harvesting tank	£2,000	£100	7.68	20.0		

Parish office

Recommendation	Cost	Savings (£)	Savings (kg CO_2e)	Payback (years)	Indicative date	Date completed
LED tubes x3	£75	£68	41.93	1.1		
Roof insulation	£7500	£250	192.32	30.0		
Draughtproofing	£20	£5	3.85	4.0		
Air-to-air heat pump	£3,000	£331	254.63	9.1		
Smart heating controls	£200	£100	76.93	2.0		

Youth club building

Recommendation	Cost	Savings (£)	Savings (kg CO_2e)	Payback (years)	Indicative date	Date completed
LED tubes x6	£150	£135	83.85	1.1		
Double-glazed windows	£2000	£100	8.89	20.0		
Draughtproofing	£20	£5	3.85	4.0		
Replace roofing	£5000	£100	8.89	50.0		
Loft insulation top-up	£750	£75	57.69	10.0		
External wall insulation	£20,000	£1,000	569.26	20.0		
Air-to-air heat pump	£3,000	£600	361.56	5.0		
Smart heating controls	£200	£100	76.93	2.0		
PV	£7,000	£900	492.34	7.8		
Battery storage	£8,000	£1000	569.26	8.0		