Energy Audit Report

In partnership with Kinver Climate Action Group

Kinver Senior Citizens Club

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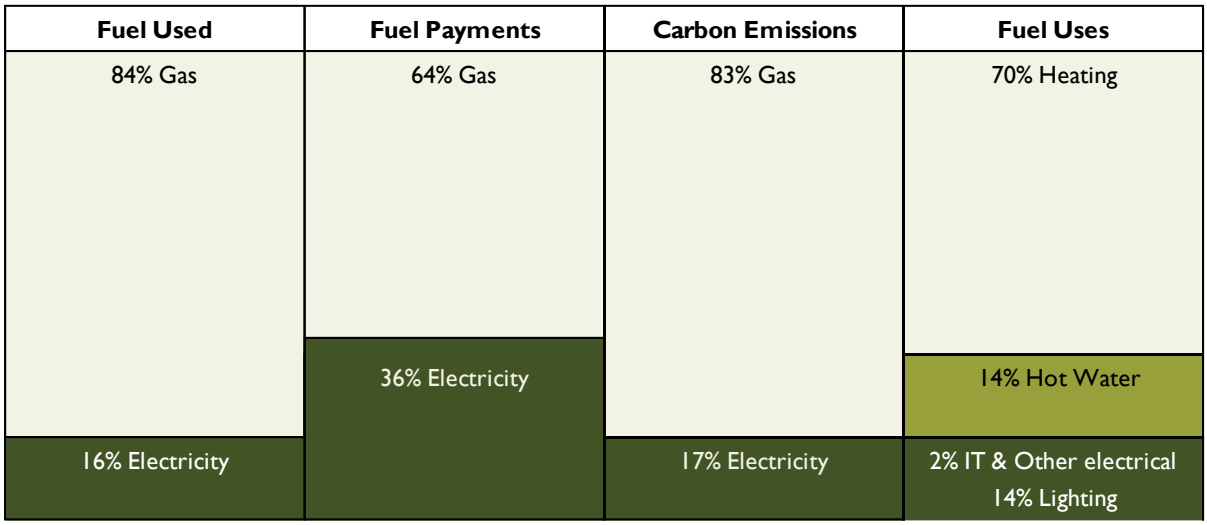
Section

Management Summary

This report presents the results of an energy efficiency survey carried out at Kinver Senior Citizens Club in Kinver, on behalf of Kinver Climate Action Group.

No fiscal utility information has been made available for the site, therefore it has been benchmarked against CIBSE TM46 and it is estimated that Kinver Senior Citizens Club consumes approximately 22,500 kWh of energy, at a cost of £2,970. The equivalent carbon emissions are 4,131 $kgCO_2/yr$.

The following diagram illustrates the make-up of this energy use:



The purpose of the survey was to identify cost effective energy saving opportunities across all areas of the club's activities,

In addition, recommendations have also been made for longer payback measures where the age or condition of the existing plant justifies change.

This survey has identified a range of savings opportunities, which fall into three categories:

- 'No cost' behavioural issues (including control adjustments).
- Low cost/rapid payback measures
- Longer payback projects

If fully implemented, the package of measures should reduce the site's energy consumption by around 10,807kWh/yr (48% of the current total), providing cost savings worth around £1,711 per year at current prices.
Total implementation of projects would cost around £6,409 giving an overall payback period of 3.7 years.

Report Section	Recommendation	Estimated Annual Savings				Estimated Cost (£)	Payback Period (years)
		Energy (kWh)	CO_2 (kg)	Financial (£)	Lifetime CO_2 Saving (kg)		
3.1	Upgrade Loft Insulation	899	200	90	5000	1,440	16.0
3.2	Retrofit Cavity Wall Insulation	3,027	500	303	37000	3,150	10.4
3.3	Install Remote Time Control of Heating System	4,991	900	499	28000	1,000	2.0
3.4	Replace Inefficient Lighting with LED Fittings	1,890	100	819	1000	819	3.7
Totals		10,807	1700	1,711	71,000	6,409	3.7

Capital Costing

The costs provided in this report are for budget purposes and whilst these are based on site inspection as well as sound engineering principles, they are subject to change as the detailed design and implementation methodology is established. Given that a 'firm' cost is subject to so many variables, detailed design, project boundaries, equipment selection, site working, contractor pricing competitiveness, we cannot guarantee the estimates provided in this report.

Recommendations:

Site to implement measures 3.1 through 3.4 as a holistic approach to achieving a best practice level of energy efficiency.

The implementation of the recommended measures will not only yield valuable operating cost savings to the site but will also significantly improve the standard of the installed building services, thereby enhancing the environment and reducing subsequent maintenance requirements.

1.0 Introduction

This report presents the results of an Energy Efficiency Survey carried out at Kinver Senior Citizens Club in Kinver, South Staffordshire, on behalf of Kinver Climate Action Group (KCAG). The survey was carried out during March 2023.

Our main site contact was Eunice Lord (KCAG), whose assistance is gratefully acknowledged.

The purpose of the survey was to identify cost-effective energy saving opportunities across all areas of the site's activities that will both reduce the cost of energy associated with running the club and will also demonstrate their commitment to carbon reduction.

In addition, consideration has been given to low and zero carbon opportunities that may not currently be appropriate for the site but should be on their radar as they transition to net-zero carbon in line with government commitments.

1.1 Kinver Senior Citizens Club

Kinver Senior Citizens Club is a social welfare club targeted at the village's senior citizens. The property is around 180m² and consists of a large, open plan social space, a kitchen, an office (which is now used for storage) and toilets.

Activities that the club provides are aimed at maintaining a contact point for senior members of the community, to provide entertainment and outings, with regular sessions of games and quizzes to stimulate mental agility. The club premises are also sometimes rented out to other charities to provide an income stream.

Through discussions with club users, the space is typically used 4/5 days per week for around 2 hours and rarely at weekends.

Limited information is known with regards to the history of the building but it is understood that it was originally constructed in the mid 1970's and was donated by a local developer. It is also believed that the land is leased from the local authority and this has around 10 years remaining on it.

The building appears to be a cavity wall construction, with a pitched tile roof and double glazed windows throughout. Given the building's age, it is unlikely that the cavity walls are filled, and following inspection of the loft space, there is insulation present, but this does not conform to current standards. The double-glazed windows do not appear to be original, however similarly are likely to be in the order of 15-20 years of age, meaning their thermal properties are likely to be circa 50% less than modern equivalents.

The building's heating and hot water needs are met by a combination boiler located in the kitchen. Currently the heating system is controlled by a domestic type time clock/programmer.

The heating system consists of a typical two-pipe system feeding double panel radiators fitted with thermostatic radiator valves.

The building's lighting system is antiquated and consists of switched-start fluorescent lighting fittings in the main hall and entrance lobby, with incandescent fittings everywhere else. All lighting is switched manually.

During the survey it was noted that the southerly facing facades of the building are somewhat shaded, which may prohibit consideration for the installation of solar photovoltaics.

1.2 Energy Consumption and Costs

Annually, Kinver Senior Citizens Club consumes approximately 22,500 kWh of energy, at a cost of around £2,970. The equivalent carbon emissions are 4,131 $kgCO_2/yr$.

The following table shows the breakdown of these energy figures between fuel (based on consumption data which has been benchmarked against CIBSE TM46)

Table 2 - Fuel and consumption figures within the past year

Fuel Type	Consumption		Cost		Carbon Emissions	
	kWh/yr	%	£/yr	%	$kgCO_2/yr$	%
Electricity	3,600	16	1,080	36	688	17
Natural gas	18,900	84	1,890	64	3,443	83
Totals	**22,500**	**100.0**	**2,970**	**100.0**	**4,131**	**100.0**

In the absence of the site's energy prices, we have assumed prices for use with this report:

Electricity: 30 p/kWh
Natural gas: 10 p/kWh

1.3 Energy Audit

The following table provides an approximate breakdown of the building's energy consumption, by end use.

Table 6 - Energy Consumption by End Use

Energy Use	Consumption		Cost		Carbon Emissions	
	kWh	%	£	%	$kgCO_2$	%
Heating	15,750	70	1,575	53	2869	69
Hot water	3,150	14	315	11	574	14
Lighting	3,150	14	945	32	602	15
Computing	225	1	68	2	43	1
Other electrical loads	225	1	68	2	43	1
Totals	**22,500**	**100.0**	**2,970**	**100**	**4,131**	**100**

2.0 Behavioural Change and Control Adjustment Opportunities

Kinver Senior Citizens Club is used for a limited time period each week and was not in operation at the time of survey, however there were no obvious items of plant and equipment running unnecessarily. The exception was the central heating system, which upon interrogation of the timeclock appears to be operating during the following periods:

Day	Schedule 1	Schedule 2	Schedule 3
Monday	06:30 – 08:30	11:00 – 15.45	18:00 – 21:00
Tuesday	05:30 – 07:30	09:30 – 12:30	-
Wednesday	06:30 – 07:30	13:00 – 14:00	18:00 – 21:00
Thursday	06:30 – 07:30	09:30 – 13:00	18:00 – 21:00
Friday	06:30 – 09:30	10:00 – 14:00	-
Saturday	06:30 – 08:30	22:00 – 23:00	-
Sunday	06:30 – 08:30	12:00 – 13:00	22:30 – 23:30

Given that the site is typically occupied for around 8-10 hours per week, and even if a preheat period (say 1 hour maximum) is built in, the system is operating for at least twice the amount of time that it needs to be to service its users. In addition to this, it is not possible to build in holiday periods (such as bank holidays or other periods when the building is not in use) into the schedule and it is unlikely that the controller is being adjusted during the warmer months, meaning the system relies on the main thermostat to hold-off the heating.

It should be noted that the hot water is drawn off on demand as the boiler is a combination type.

No direct operational savings have been allocated to this measure as they have been captured in recommendation 3.3.

3.0 Recommendations

3.1 Upgrade Loft Insulation

Upon inspection of the loft space there is approximately 100mm of mineral wool insulation present, which was likely installed when the building was first constructed but regardless could be improved to current levels. It is recommended that an additional 200mm of insulation is rolled out above the existing, taking the total to 300mm which is comparable to a new build property. Loft insulation is relatively cheap and quick to install, with minimal disturbance to the club. It does not need to be fitted by a professional and can provide good thermal savings with a reasonable return on investment.

Assumptions

The loft insulation will improve the U-value from an estimated 0.3 W/m^2K to 0.14 W/m^2K.
It is assumed that there is circa 180m^2 of loft space that should be insulated.
Heating operating hours are expected to be 2600 hours annually.

Energy and Carbon Savings

Based on an immediate implementation date, the following savings are forecast:

	BaU	Proposed Measure	Annual Saving	Annual Saving (%)
Energy Type(s)	Natural Gas	Natural Gas	N/A	N/A
Annual Consumption (kWh)	18,900	18,001	988	5%
Annual Cost (£)	£1,890	£1,800	£90	5%
Average Annual Emissions ($kgCO_2$)	3500	3300	200	6%

The capital cost for implementing this measure is estimated at £1,440 and this is forecast to provide a simple payback of 16.0 years.

Risk and Barriers

Implementation of this measure is subject to the following risks and barriers:

- Establish and implement appropriate health and safety protocols prior to installation, especially relating to working at heights and review the asbestos register prior to commencing work on site.

3.2 Retrofit Cavity Wall Insulation

Kinver Senior Citizens Club appears to be a cavity wall construction and given its age and an inspection of the property it is likely that cavity walls were neither installed with thermal insulation when the property was built, nor have they been retrofitted with it (subject to an intrusive survey).

We would therefore recommend the installation of cavity wall thermal insulation to reduce the heat loss from the building and estimate that the total wall area to consider for cavity insulation is approximately 126 m2.

The savings are based upon the U-Value (Thermal Transmittance) of the existing uninsulated brick cavity walls being 1.0 W/m2K and the U-Value of the proposed insulated cavity walls is 0.3 W/m2K (Ref: historic Building Regulations and CIBSE Design Guide A).

The annual thermal savings is 2,752 kWh, and the thermal efficiency of the gas-fired boilers is assumed to be 91%, resulting in annual gas savings of 3,027 kWh.

Assumptions

We have assumed that the building's external walls have an uninsulated cavity space (TBC) and are suitable for the installation of thermal insulation. We also assume that the average temperature difference is taken to be 12oC and the heating time is assumed to be 2,600 hours p.a.

Energy and Carbon Savings

Based on an immediate implementation date, the following savings are forecast:

	BaU	Proposed Measure	Annual Saving	Annual Saving (%)
Energy Type(s)	Natural Gas	Natural Gas	N/A	N/A
Annual Consumption (kWh)	18,001	14,974	3,027	17%
Annual Cost (£)	£1,800	£1,497	£303	17%
Average Annual Emissions (kCO_2)	3300	2800	500	15%

The capital cost for implementing this measure is estimated at £3,150 and this is forecast to provide a simple payback of 10.4 years.

Risk and Barriers

- Establish that the wall cavity (if present) is suitable for injecting thermal insulation i.e., the cavity is free from dampness, structurally sound and has a minimum depth of 50mm.

3.3 Install Remote Time Control of Heating System

The heating system is currently set to operate for far longer periods than are necessary to suit occupancy of the building. This is presumably due to minor adjustments over time that have been scheduled to accommodate ad-hoc use. Currently the system is set as follows:

Day	Schedule 1	Schedule 2	Schedule 3
Monday	06:30 – 08:30	11:00 – 15.45	18:00 – 21:00
Tuesday	05:30 – 07:30	09:30 – 12:30	-
Wednesday	06:30 – 07:30	13:00 – 14:00	18:00 – 21:00
Thursday	06:30 – 07:30	09:30 – 13:00	18:00 – 21:00
Friday	06:30 – 09:30	10:00 – 14:00	-
Saturday	06:30 – 08:30	22:00 – 23:00	-
Sunday	06:30 – 08:30	12:00 – 13:00	22:30 – 23:30

Notwithstanding the requirement for both preheat periods, fabric protection and the fact that users of the space are primarily the elderly, by reviewing the current heating time schedules to suit actual use, then providing remote access to a suitable member that enables operation to be reviewed on a regular basis and overridden for short periods only to suit intermittent use, as opposed to a wholescale time schedule overhaul, significant energy savings should be achieved.

If this measure is to be successfully implemented, then it relies on a member(s) to be accountable and review operation weekly. There are numerous domestic level controllers on the market that do not incur significant capital outlay and can be linked to a smartphone via an app.

Assumptions

Operating hours can be reduced to 3 hours per day, 6 days per week, which allows for an hour pre-heat and accounts for intermittent weekend use.

Operating hours would therefore be reduced from 2600 annually to around 1200.

Energy and Carbon Savings

Based on an immediate implementation date, the following savings are forecast:

	BaU	Proposed Measure	Annual Saving	Annual Saving (%)
Energy Type(s)	Natural Gas	Natural Gas	N/A	N/A
Annual Consumption (kWh)	14,974	9,983	4,991	33%
Annual Cost (£)	£1,497	£998	£499	33%
Average Annual Emissions ($kgCO_2$)	2800	1900	900	11%

The capital cost for implementing this measure is estimated at £1,000 and this is forecast to provide a simple payback of 2.0 years.

Risk and Barriers

Implementation of this measure is subject to the following risks and barriers:

- Operating hours need to be reviewed regularly to ensure that the same pattern does not occur. Individuals will need to be responsible for monitoring this which may impose on their free time if the club is used outside of 'normal' hours.

3.4 Replace Inefficient Lighting with LED Fittings

Lighting in Kinver Senior Citizens Club consists of antiquated switch start fluorescents in the Main Hall and Entrance Lobby, and tungsten fittings throughout the remainder of the building.

Aside from the fact that in late 2023 manufacturers will no longer be allowed to make fluorescent fittings to replace those in the club, from an environmental stand point it is recommended that they are replaced with light emitting diode (LED) types that will more than half the wattage of each fitting and will also reduce maintenance/replacement of lamps.

We estimate that replacing the remaining florescent lamps with LED lighting across the site will reduce the associated lighting energy consumption by around 60% resulting in annual energy savings in the region of 1,890 kWh and with a financial value of £567 per year. Capital costs are estimated at £3,000 giving a payback period of 5.3 years.

Assumptions

The above calculations have been based upon the current annual lighting load of 3,150 kWh being reduced by 60% to 1,260 kWh.

Energy and Carbon Savings

Based on an immediate implementation date, the following savings are forecast:

	BaU	Proposed Measure	Annual Saving	Annual Saving (%)
Energy Type(s)	Grid Electricity	Grid Electricity	N/A	N/A
Annual Consumption (kWh)	3,150	1,260	1,890	60%
Annual Cost (£)	£945	£378	£567	60%
Average Annual Emissions ($kgCO_2$)	300	200	100	33%

The capital cost for implementing this measure is estimated at £3,000 and this is forecast to provide a simple payback in 5.3 years.

Risk and Barriers

Installation of the new lighting will involve a degree of disruption and may have to be scheduled outside the hours of normal occupation, which could increase installation costs.

4.0 Longer Payback Measures

4.1 Solar Photovoltaic (PV) Panels

In theory a 4kW solar photovoltaic (PV) system could be fitted to the SE/SW facing roofs of Kinver Senior Citizens Club.

The approximate cost/benefit of such a system would be as follows:

Electricity Generated:	3,375 kWh per annum
Electricity used on site Saving:	£1,013 per annum
Cost:	£6,000
Payback:	5.9 years

These figures are notionally based on 25% shading, however if upon a more detailed investigation the level of shading was found to be greater than this then the savings and financial return would be reduced. In addition to this, without half hourly electricity data it is unclear exactly how much electricity is being used at what times, therefore there is further risk that the site would export more than they use during certain periods.

In summary, before investing a reasonable amount of money in a solar PV system for the club, we would recommend that half hourly electricity data is obtained and this is used to inform a more thorough review.

4.2 Replace Gas Fired Boiler with Air Source Heat Pump (ASHP)

Kinver Senior Citizens Club is served by a gas fired combination boiler which provides heating to the building as well as domestic hot water for cleaning and hand washing purposes.

If the club is to pursue a strategy of decarbonization then an alternative heat source to replace the fossil fueled boiler will be necessary. The club may wish to consider replacing the system with simple electric storage or panel heaters, which as the electricity grid decarbonizes further would remove the carbon emissions associated with the heating system, however the installation of an ASHP would operate approximately three times more efficiently than standard electric heaters and is therefore a far better long term approach.

The installation of an air source heat pump would cost in the order of £10,000 - £12,000 to implement depending on the level of pipework/emitter modifications that are required to facilitate it and would currently cost roughly the same to operate as the existing system (given that the cost ratio of electricity to gas is 3:1), meaning it unlikely that such a system will be installed any time soon.

It is also worth noting that ASHP's operate at a much lower temperature than the current boiler and this could pose a perceptional issue with the users as these systems are not generally considered as 'cosy'.

5.0 Next Steps

The recommendations contained within this report are based on a short site survey and discussions with appropriate members.

The savings projections are believed to be realistic (but cannot be guaranteed), and implementation costs are based on our experience of implementing similar projects.

While many of the smaller projects may be safely implemented on this basis, the larger projects have some risk and would warrant further consideration before committing to proceed.

As with any not-for-profit establishment, it is assumed that Kinver Senior Citizens Club has limited disposable income to progress with the measures recommended in this report. We would be happy to support Kinver Climate Action Group with fundraising programmes and similarly will provide the necessary consultancy time required to specify the recommendations included, procure contractors and project manage any elements that require technical assistance.