Resource Opportunity Assessment

Roslin Village Group and Roslin Men’s Shed

Created for: Roslin Village Group & Roslin Men’s Shed

Prepared by: Richard Witney, On Site Generation Ltd
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Customer and Adviser Details

<table>
<thead>
<tr>
<th>Contact Name</th>
<th>Andy Maginnis</th>
</tr>
</thead>
<tbody>
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<td>Contact Job Title</td>
<td>Secretary</td>
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<tr>
<td>Email</td>
<td><a href="mailto:andymaginnis@gmail.com">andymaginnis@gmail.com</a></td>
</tr>
<tr>
<td>Date of Visit</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; May 2019</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resource Efficient Scotland Adviser</th>
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</tr>
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<tr>
<td>Date approved</td>
<td>31&lt;sup&gt;st&lt;/sup&gt; May 2019</td>
</tr>
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</table>

Resource Efficient Scotland provides free support to identify opportunities involving aspects like energy, renewables, waste, water, transportation and staff engagement. Resource Efficient Scotland can also support the implementation of the measures identified. This can include helping to identify suppliers, design and assess the results of quote or tender specifications and identify and secure funding.

More information on this support and an overview of the opportunities potentially available through resource efficiency are detailed in the “Additional Information” document, separately attached.

Obtaining support from Resource Efficient Scotland on a particular project does not exclude you from obtaining further support to look at other aspects of resource efficiency.

The Resource Efficient Scotland programme is delivered by Zero Waste Scotland as part of its Resource Efficiency Circular Economy Accelerator programme, which helps small to medium sized businesses and organisations become resource efficient and create a more circular economy. It is funded with support from the Scottish Government and European Regional Development Fund.
1 Executive Summary

The Roslin Village Group and the Roslin Men’s Shed are very interested in exploring the asset transfer of the Pavilion from Midlothian Council. The first stage of this process is to assess the costs of running the building which, at present, is heated electrically and is used by only a few groups. The community groups are keen to work with all groups and users of the hall to make full use of the community facility.

The Roslin Pavilion is located in the centre of the village of Roslin, close to the primary school. The floor area is approximately 390m$^2$ and comprises a small hall, main hall, changing rooms, toilets, kitchen and store room. The Pavilion was built in the 1970s and then extended with a large badminton hall (main hall) in 1990.

Total energy & consumption has been estimated at 66,000 kWh to heat, light and run the building at a cost of around £9,120 per year. Water consumption is around 718 m$^3$ per year at a cost of £1,580. This total resource use produces around 23.5 tonnes of CO$_2$ per year.

A site visit was carried out by Richard Witney on the 1st May 2019 with Alan Docherty (building janitor) and Andy Maginnis.

This report has focused on the following recommendations, including: installing LED lighting, a new heating system, solar PV, loft insulation and water saving devices. Other options include resource management awareness raising amongst users.

If all the detailed improvement recommendations are actioned, the community group could save/generate some income of approximately £6,600 and reduce CO$_2$ emissions by 11.7 tonnes per year.

Key actions and next steps:

- Engage with the local community and raise interest in the prospect of the asset transfer.
- Determine what activities and uses of the pavilion are likely to be of interest to the community.

Resource Efficient Scotland provides support on all aspects of resource efficiency and can also provide support with implementation. We will therefore contact you to discuss how we can support you further.
## 1.1 Resource Efficiency Action Table

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Annual cost benefit £ (excl VAT)</th>
<th>Investment required £ (excl VAT)</th>
<th>Payback Years</th>
<th>Energy kWh</th>
<th>Water m³</th>
<th>Waste tonnes</th>
<th>Raw materials tonnes</th>
<th>CO₂ tCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LED Lighting</td>
<td>£475</td>
<td>£5,000</td>
<td>10.5</td>
<td>3,394</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.2</td>
</tr>
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<td>2</td>
<td>New heating system &amp; controls</td>
<td>£4,540</td>
<td>£12,000</td>
<td>2.6</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7.0</td>
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<td>3</td>
<td>Solar PV</td>
<td>£624</td>
<td>£6,000</td>
<td>9.6</td>
<td>5,100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.8</td>
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<td>4</td>
<td>Loft insulation</td>
<td>£644</td>
<td>£3,000</td>
<td>4.7</td>
<td>4,600</td>
<td>0</td>
<td>0</td>
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<td>5</td>
<td>Water saving devices</td>
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<td>£1,000</td>
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<td>0</td>
<td>144</td>
<td>0</td>
<td>0</td>
<td>0.1</td>
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<td><strong>TOTAL</strong></td>
<td></td>
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<td><strong>£27,000</strong></td>
<td><strong>3.2</strong></td>
<td><strong>13,094</strong></td>
<td><strong>144</strong></td>
<td><strong>0</strong></td>
<td><strong>0</strong></td>
<td><strong>11.7</strong></td>
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</tbody>
</table>

Note: Implementing multiple measures may impact on each other and this may result in the realised savings being less that is presented in this report. Unless otherwise stated, the identified savings presented in this report for each measure are calculated independently from other measures. If required, further support can be provided by Resource Efficient Scotland to quantify the impact of implementing multiple measures where they impact on each other.
2 Introduction

The Roslin Pavilion is located in the centre of the village of Roslin, close to the primary school. The floor area is approximately 390m$^2$ and comprises a small hall, main hall, changing rooms, toilets, kitchen and store room. The Pavilion was built in the 1970s and then extended with a large badminton hall (main hall) in 1990.

The Roslin Village Group and the Roslin Men’s Shed are working together to develop a potential business plan to support a community asset transfer of the Roslin Pavilion from Midlothian Council. The Council is actively seeking interest from community groups to run local assets and Roslin village is very interested to secure long-term access to their village hall. The community groups are keen to work with all groups and users of the hall to make a success of the project. The first stage is to understand the energy costs of the building and its potential to reduce the running costs in the future.

Total energy & consumption has been estimated at 66,000 kWh to heat, light and run the building at a cost of around £9,120 per year. Water consumption is around 718 m$^3$ per year at a cost of £1,580. This total resource use produces around 23.5 tonnes of CO$_2$ per year.

A site visit was carried out by Richard Witney on the 1st May 2019 with Alan Docherty (building janitor) and Andy Maginnis (Secretary – Roslin Men’s Shed).

![Roslin Pavilion](image)

**Figure 2.1: Roslin Pavilion.**

2.1 Current resource consumption at the site

<table>
<thead>
<tr>
<th>Resource</th>
<th>Cost</th>
<th>Consumption</th>
<th>Units</th>
<th>CO2e emissions (Tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>£9,120</td>
<td>66,000</td>
<td>kWh</td>
<td>23.20</td>
</tr>
<tr>
<td>Water - Supply</td>
<td>£1,580</td>
<td>718</td>
<td>m$^3$</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>£10,700</strong></td>
<td></td>
<td></td>
<td><strong>23.45</strong></td>
</tr>
</tbody>
</table>

Note: The costs in this table include standing charges and other costs including, where relevant, charges such as the Climate Change Levy. When calculating the potential savings of opportunities, unit costs which exclude standing charges will usually be used to calculate these as reducing consumption will often not reduce the standing charges. It may be beneficial to you to renegotiate your resource contracts if you are going to significantly change your consumption.

Note: The CO2e emissions detailed above are not equivalent to a carbon footprint for the site.
Note: It is good practice to regularly review your current energy and resource tariffs to ensure they meet your requirements. By changing your tariff or supplier you may be able to decrease your energy or resource costs. Contacting your current supplier to check you are on the most appropriate tariff can be a good place to start. We can also direct you to organisations that provide energy switching advice.

3 Detailed and Alternative Opportunities

3.1 LED Lighting

3.1.1 Project Description and Recommended Solution

The pavilion has a mixture of lighting, mainly 5ft 58W T8 fluorescent tubes with 28W fluorescent lighting in the changing rooms. The large main hall has recently had the lighting replaced with LED recessed panels and the lighting is a good quality for sports and other activities.

It is recommended that the remaining lighting through the building is assessed for LED improvements. Possible lighting includes LED tubes retrofitted into existing luminaries or new LED lighting such as 600 x 600 ceiling mounted panels and new LED luminaires. This should include investigating the controls of the lighting to ensure areas of the building switch off lighting when not required.

There may be an opportunity to review the light unit positions to suit the activity of the area and to reduce the number of ceiling units required.

Further lighting improvements which would be beneficial for the building, include:

- Time controls
• Occupancy-linked controls
• Daylight-linked controls
• Localised switching

**Time controls**

Time control systems will switch off lights according to specified timings, with occupants using an override control to switch the lights on for a short length of time. This may be beneficial for certain areas such as the storage areas, corridors and toilets.

**Occupancy-linked controls**

These systems use some form of presence detection, usually ultrasonic, infrared, microwave or acoustic to control the lighting. They will switch on for a certain length of time when occupants are detected. Occupancy sensors are good for areas where people are only present for short periods of time. For example, this could be used in the corridor and changing rooms/toilets.

**Daylight-linked controls**

Daylight-linked controls can be used with both time and occupancy controls as an override dependent on available natural light. This type of control is based on photocell controls and can be used to switch off or dim lights when daylight is adequate which may be suitable for areas of the rooms which receive good daylight levels. However, the hall doesn’t benefit from good quality daylight except in the small hall.

**Localised switching or labelled switching**

Altering the light switching so certain lights can be easily identified and switched on or dimmed for certain areas is a good low cost option. This would allow occupants to control the amount of lighting they require for the task being undertaken. There is already good use of labelled switches in the Pavilion.

![Figure 3.3: Labelled switches in the janitor’s office.](image)

**3.1.2 Costs, Benefits and Finance**

It is estimated that around **£475** per year could be saved by installing new LED lighting and controls throughout the building. This will save approximately 3,394 kWh and 1.2 tonnes of CO₂ per year compared to the existing lighting. With an approximate installation cost of **£5,000**, this will provide a payback of around 10.5 years. Please see Appendix 1 for calculations.

The additional benefits of LED lights is that they are very low maintenance and have improved lifetime of 40,000 hrs compared to 15,000 hrs for fluorescent tubes. This reduces costs associated with re-lamping.
Resource Efficient Scotland SME interest free loan

The Resource Efficient Scotland SME interest free loan is funded by the Scottish Government. This scheme aims to support businesses looking to reduce costs through improved energy, material resource and water efficiency. The scheme is aimed at Scottish businesses that fall within the EC definition of Small and Medium-sized Enterprise (SME), private sector landlords, not-for-profit organisations and charities.

The Scottish Government is also offering 15% cashback to small and medium sized enterprises (SMEs) who wish to install eligible energy efficient equipment. Cashback is only available for a limited time while funds last. Businesses that are successful in application for a loan can ask for 15% of their project cost back – up to the value of £10,000. The cash back offer is not available to renewable energy technologies.

Loans are interest free (0%), unless applying for a renewable technology when the interest rate is 5%. For more information, please visit: www.resourceefficientscotland.com/GovernmentSupportedLoanSchemes

3.2 New heating system and controls

3.2.1 Project Description and Recommended Solution

The Pavilion is heated by electric radiant heaters throughout the building. The main heating provision is in the small hall (7 x 1.2 kW wall mounted radiant heaters) and the main hall (10 x circa 2-3kW wall mounted radiant heaters\(^1\)). A basic heat loss assessment of the building has calculated the old hall building would require around 12 kW of heating and the main hall could require around 24 kW. This assumes the loft insulation is improved.

Previous energy use data is available from Midlothian Council and the building used around £9,120 of electricity in 2017-18. It has been assumed that around 70% of the total electricity used i.e. 46,200 kWh is the present heat requirement. It should also be noted that the main user of the building is the After School Club with some small amount of other use by other local clubs. It is likely that electricity use would increase if the Pavilion was used to its full capacity.

It is recommended that a new condensing combi gas boiler is assessed further and installed in the property to provide heating. A condensing boiler has a large heat exchanger that extracts more heat from the flue gases. In a non-condensing boiler, the flue gases are at a temperature of 120-200°C. In a condensing boiler, more heat is removed and the temperature falls to below 100°C and as low as 50°C for the most efficient boilers operating at reduced boiler return temperature. The water vapour in the gases condenses and the resulting liquid has to be drained away.

\(^1\) There is no data information visible on the heater, but each is connected to the sub distribution board by 16 amp MCB fuse.
The use of the combi boiler would be for the old hall area due to the small volume of these rooms. The main hall should remain using the radiant heaters until further assessment of building users can be undertaken. The main hall could also be easily heated by the gas boiler but the loft insulation should be addressed.

Destratification fans could be installed on the ceiling of the main hall to circulate the warm air from higher levels (approximately 10 m) back down to floor level. Their main use will be in the heating season, however, they could be used in summer to cool the building. They will improve the circulation of warm air from high levels to the lower floor areas.

Heating controls options could include adjustable room temperature stats in all zones and or wireless room stats or wireless TRVs. Many WiFi/internet enabled systems allow remote monitoring which may be suitable for the manager to have access and can control the heating in relation to occupancy.

**Zone controls – room thermostats**

Room thermostats could be fitted to each zone/room, these can either be pre-set/tamper proof or user controlled.

Thermostats and sensors should not be influenced by draughts or heat sources such as sunlight, radiators or equipment. These factors create a false local temperature and may result in heating systems over or under-heating a building. Ideally, thermostats should be
placed in a north facing room, approximately halfway up the wall if possible. This helps to provide a more representative temperature.

**Figure 3.7: Correct thermostat placement.**

Furthermore, advanced options could include zoning each room/zone with wireless TRV and room sensors which can be controlled via one central panel. This would allow each zone to be time and temperature controlled and allow easy adjustment to the room temperature. More sophisticated controls include occupancy sensors which can adjust the room temperature if no movement detected. The system can be linked to a computer timetable so that the building automatically adjusts to the zone temperature required e.g. Yoga in the small hall requires 21°C at 8pm then sets back to 15°C at 9pm.

**Figure 3.8: Time and Temperature Controls.**

For instance, some products are designed for small buildings and supports wireless room stats and TRVs connected to a user control panel. This would allow easy control of all zones by the centre manager.

Building management system to investigate include: Honeywell; Test; Nest; Heatmiser; Danfoss Link.

**Optimum Start / Stop boiler controls**

An optimum start controller is an advanced time control fitted to a heating system. It learns how quickly the building reaches the desired temperature and using an internal and/or external sensor, brings the heating on at the optimum time prior to building occupancy. This typically results in heating switching on later on mild days as shorter warm-up times are required.

**Weather compensation**

Reducing temperatures in heating systems during milder weather can reduce costs and improve occupant comfort. This is done with the installation of weather compensation controls which measure the external temperature and adjust the boiler and circulating temperature accordingly.

Figure 3.9 below shows the interrelation between the thermostats, compensator and heating system. Weather compensation controls automatically adjust heating circuit flow.
temperatures in accordance with the outside air temperature. It works by using a sensor outside the building and another connected to the boiler communicating with each other and varying the boiler's water flow temperature accordingly. This is more efficient than the boiler turning on and off, and energy is saved since flow temperature is reduced during milder weather.

![Figure 3.9: Weather Compensation Controls.](image)

For more information, please see:
- CTL148 – How to implement heating zone controls.
- CTG065 – Heating Controls.
- CTV007 v3 – Office based companies: Maximising energy savings in an office environment.

### 3.2.2 Benefits, Costs and Finance

It is estimated that a new gas boiler and heating controls could save approximately £4,500 per year on present heating costs and around 7.0 tonnes of CO$_2$. With an approximate installation cost of £12,000, this would provide a payback of approximately 2.6 years. Please see Appendix 1 for calculations.

### 3.2.3 Risks and Solution Alternatives

This installation cost includes the new radiator system for the rooms but will depend on final costs to connect mains gas to the building which maybe 15-20 metres from the building.

#### Heat pumps

A further technology of interest for the community group is using heat pumps. These systems use electricity to transfer heat from the outside air, Air Source Heat Pumps (ASHP), or surrounding ground, Ground source heat pumps (GSHP) into a building to provide space heating and heating domestic hot water.

In Scotland, the ground about 1m below the surface stays at a constant temperature of about 10°C throughout the year. Ground source heat pumps (GSHP) can transfer this heat from the ground into a building to provide space heating and heating domestic hot water. For every unit of electricity used to generate the heat, 3-4 units of heat are produced. As well as ground source heat pumps, air source heat pumps are also possible.

There are three important components to a GSHP\(^2\) (see Figure 3.10):

- **Evaporator** - takes the heat from the water in the ground loop.
- **Compressor** - moves the refrigerant round the heat pump and compresses the gaseous refrigerant to the temperature needed for the heat distribution circuit.

\(^2\) Carbon Trust Guide CTL150 – How to implement guide on ground source heat pumps.
Condenser - gives up heat to a buffer tank which feeds the distribution system.

![Heat pump cycle diagram]

**Figure 3.10: Heat pump cycle.**

A ground source heat pump provides a clean way to heat buildings, free of all carbon emissions on site. It makes use of solar energy stored in the ground to provide an energy-efficient way of heating the building. Solar recharge of the ground is an integral part of ground source energy which is used to increase the efficiency of ground source heat pumps. They can be installed using a borehole or shallow trenches or, less commonly, by extracting heat from a pond, a lake or the sea.

Heat collecting pipes in a closed ground loop, containing water (with brine/antifreeze) are used to extract this stored energy, which can then be used to provide space heating and domestic hot water. The sizing of the ground loop/borehole is an integral part of the heat pump design. Figure 3.11 indicates typical ground loop design parameters and installation photographs.

![Ground loop design photographs]

**Figure 3.11: Ground loop design.**

The only energy used by a ground source heat pump is electricity to power the compressor and the circulation pumps which transfer heat energy from the ground into the building. A well-designed ground source heat pump installation will deliver three or four times as much thermal energy (heat) as is used in electrical energy to drive the system. For a particularly environmental solution, green electricity can be purchased or this will work well with the solar PV recommendation generating clean, green electricity for the building.
There may be issues with using the surrounding park area for the ground loop and this would require discussions with the council.

The other option (possibly easier installation at the hall) is an air source heat pump (air to water) i.e. using a Low Temperature Hot Water (LTHW) radiator system. Similar to the gas combi boiler, the radiators would have to be installed throughout the building. Due to the more efficient lower flow temperatures of the heat pump, these will be over sized by 1.5 to 2 times the length to achieve the correct surface areas to heat the space.

Both ground source and air to water heat pumps qualify for the Renewable Heat Incentive.

The building has three phase electricity which should support the installation of the heat pump. It will be important to seek permission from Scottish Power (Distribution Network Operator) for approval to connect the heat pump to the building’s electrical supply.

### 3.3 Solar PV

#### 3.3.1 Project Description and Recommended Solution

Photovoltaic (PV) systems use semiconducting material, usually silicon cells, to convert solar radiation into electricity. When light shines on the cell it creates an electric field across the layers, causing electricity to flow; the greater the intensity of the light, the greater the flow of electricity.

90% of PV installations on commercial rooftops use either mono or poly crystalline cells. Monocrystalline PV cells are made from high-purity silicon, giving an even colouring and uniform look to the panels. They are slightly more expensive to manufacture than polycrystalline cells but have higher efficiencies (15-20%). Polycrystalline cells are made from raw silicon, which is cast in square moulds and cut into wafers, giving the panels a distinctive look with the squares visible on the panel surface. Their efficiency is slightly lower (at around 14-17%) as is their cost.³

The electricity generated by the solar PV panels on the roof is fed into the building and used by any electrical load first of all with any excess electricity exported to the grid. The Roslin Pavilion could use approximately 80% of the solar PV generated electricity. A diagram of a PV system configuration is shown below.

³ BRE. Solar PV on Commercial Buildings – A guide for owners and developers.
The building has a large area of suitable roof space to install panels using an on-roof system. An un-shaded approximately south east facing PV system installed in Roslin would be expected to generate approximately 850 kWh/yr per kW of installed PV. A system size of 6 kW could be installed (approximately 24 panels @ 250W each).

Solar PV is a popular technology which requires minimal maintenance. Energy storage is becoming more mainstream and battery technology is already available to store the solar PV generated electricity for use at a later time rather than exporting to the grid. This is an option which can be added in the future.

3.3.2 Costs, Benefits and Finance

6 kWp of south east facing PV will generate approximately 5,100 kWh of clean, green electricity and saves 1.8 tonnes of CO₂. The community group could use the majority of the solar PV in the building depending on utilisation rates. The PV system will save around £624 per year. The cost to install a 6 kWp PV system will be about £6,000, giving a payback of around 9.6 years. Please see Appendix 1 for calculations.

3.3.3 Risks and Solution Alternatives

As discussed during the visit, the UK Government Feed in Tariff (FiT) will be closed on the 31st March 2019 to new applicants. The Government is consulting on the Smart Export Guarantee Scheme which, when in place, should provide a payment for any electricity

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exported to the grid. For the purposes of this report, it has been assumed that there will be no exported electricity. For more information, please see: 

www.gov.uk/government/consultations/feed-in-tariffs-scheme

Careful consideration of surrounding buildings and trees is required to ensure they do not impact significantly with regard to shading. If a small area of PV panel is shaded, it can significantly reduce the amount of electricity generated depending on how they are wired. However, with careful design and use of other technologies such as micro inverters (Enphase) or power optimisers (Solaredge inverter), the PV will not be affected to the same levels by any shading. Due to the height of the main hall roof, the solar PV will not be shaded.

Solar PV diverter devices are available which divert excess solar PV generated electricity from being exported to the grid. Instead, the electricity is diverted to a hot water tank fitted with an immersion. This could be a good option for the hall but depends on the amount of hot water required. A large 450 litre hot water tank is located in the changing rooms.

Figure 3.15: Hot water tank.

If the hot water tank is to remain, the community group would benefit from understanding the operation of the immersion heaters (x3) and ensure they are not left on all the time.

Figure 3.16: Solar PV diverter.\(^5\)

Permission will be required from Scottish Power/SSE to connect and export solar PV onto the local grid. Connection permissions should be discussed at an early design stage.

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\(^5\) www.apollosolarproducts.co.uk
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Resource Efficient Scotland SME interest free loan

As discussed in section 3.1.2, Resource Efficient Scotland loans are available and confirmation should be sought regarding the conditions of the loan if no solar PV FiT is available as this may be available at 0%. For more information, please visit:

www.resourceefficientscotland.com/GovernmentSupportedLoanSchemes

3.4 Loft insulation

3.4.1 Project Description and Recommended Solution

The building has two loft spaces which are accessible from the old hall (stores and changing rooms) which has a small amount of insulation at 100mm depth and the majority of the hall has only 50mm of insulation.

![Figure 3.17: Loft space.](image1)

The main hall has a suspended ceiling at a height of 10m. It is not known how much insulation is in the roof but it may be possible to install insulation above this using insulated panels.

![Figure 3.18: Typical insulated ceiling tile.](image2)

Loft and floor insulation should be added old hall roof area and will require to meet current building regulations which is 300mm or equivalent in the loft space.
3.4.2 Costs, Benefits and Finance

If loft insulation is improved, it is estimated that this would save around 10% of the heating energy required, 4,600 kWh of energy. Total heating costs would reduce by £644 a year. The installation cost would be around £3,000 if undertaken as part of other refurbishment works. This would provide a payback of around 4.7 years, save 1.6 tonnes of CO₂ and significantly improve the comfort of building users. Please refer to Appendix 1 for calculations.

3.4.3 Risks and Solution Alternatives

It is assumed that a simple layer of loft insulation quilt will be laid over the ceiling in the office. Natural or recycled insulation products are available which may be of interest and specialist advice should be sought.

Health and safety of personnel installing the new loft insulation should be risk assessed prior to commencing any works. However, this could be undertaken by the community group as a DIY project for the old hall accessible lofts areas.

For more information please read:

3.5 Water saving devices

3.5.1 Project Description and Recommended Solution

Further aspects of resource efficiency such as water use have been discussed during the visit.

It is recommended that water saving devices are also considered as part of any refurbishment to the toilets. Reducing both cold and hot water use by visitors without affecting the washing experience will significantly reduce cold and hot water running costs. Options include:

Dual flush toilets – toilets can account for up to 50% of water use. Installing dual flush toilets could save around 20-30% of water use. Existing toilets, which have large cistern tank, can easily be fitted with a cistern volume adjusters to reduce the amount of water to be flushed. Other simple techniques include, filling a 1-2 litre plastic bottle or placing a small brick in the cistern will permanently displace water from being flushed.
Flow reducers in taps & shower heads – installing flow reducers, aerated/spray and self-closing taps/PIR sensor taps could save up to 50% of water used in the building.

Check for dripping taps and fix immediately – two drops/second costs around £21/year, drops breaking into a stream cost £70/year.

3.5.2 Benefits, Costs and Finance

It is estimated that around £316 per year could be saved by installing water saving devices such as cistern volume adjusters, sprayhead taps and efficient shower heads etc. This will save approximately 144 m$^3$ and 0.1 tonnes of CO$_2$ per year. With an approximate cost of £1,000 this would provide a payback of around 3.2 years. Please see appendix 1 for calculations.

4 Other Resource Efficiency Opportunities

4.1 Resource Management Awareness

4.1.1 Project Description and Recommended Solution

Responsibility and Commitment

Commitment to energy efficiency has to come from the top and should be backed up by a personalised mission statement and energy policy. It is also important to appoint an energy ‘champion’. In a small business or building, this may be the owner/manager but in larger companies, a core member will often improve involvement and awareness across the whole team. Either way, people responsible for energy management in an organisation need to have resources and time allocated to make a difference.
Resource Use Policy / Environmental Policy

Many organisations have produced a statement which sets out the policy towards saving energy and other environmental commitments. It should be simple, easy to read and cover all major potential initiatives to be taken by the organisation to improve energy efficiency and environmental performance. Once produced it should be made available to all building users and a copy posted in the main noticeboards so it is available for visitors to read.

An environmental policy checklist, along with environmental policy examples is available from the Resource Efficient Scotland website here:

http://www.resourceefficientscotland.com/guide/environmental-policy-example-template

Checking your resource use

Throughout UK organisations there are significant errors introduced through faulty meter readings, unmonitored energy use and inaccurate billing. Organisations can save significant energy costs through carefully comparing meter readings with bills. Also, by noting these readings against site usage it may be possible to identify anomalies in energy usage.

A simple chart of usage plotted against months can be used to assess progress against targets. Community group members should be involved in this task to spread the understanding of energy management.

Staff awareness and good housekeeping

Everyone working in the organisation has an impact on energy use, so it should be everyone’s responsibility to use energy wisely.

Very simple practices such as switching off unnecessary equipment and lighting when not in use will make a difference to energy consumption. Also, walkarounds and checklists are important.

Some means of raising awareness are:

- Making building users/visitors aware of the cost of energy and potential savings;
- Raising energy use during meetings;
- The use of a suggestion box, and giving token awards for good ideas;
- Poster campaign to encourage good practice;
- Clear labelling of switches and controls;
- Giving feedback to building users to encourage further participation;
- Community group training courses;
- Undertake regular housekeeping walkarounds.

Further aspects of resource efficiency such as draughtproofing and water use have been discussed during the visit.

Draughtproofing

During the visit, draughtproofing appears to require attention to door openings to ensure they are effectively draughtproofed. Cold air usually gets in around window and door frames and through keyholes and letterboxes. Damaged or rotten doors and window frames may also let air in through gaps and holes. The windows in the small hall is double glazed and in good condition.

Ventilation heat loss accounts for a significant portion of total heat loss and this is relatively straightforward to address and a low cost option. Reducing draughts in the building will improve the comfort levels for customers and staff.
For more information please read:
Carbon Trust Guide 063 – How to implement draughtproofing.

**Environmental Champion/Green Team**

Two of the key barriers to behaviour change are: a lack of knowledge (what to do, how to do it, why it is being done and who to ask for advice) and peer pressure (if no-one else is adopting the change, why should I?). You can address these issues by recruiting, training and managing a group of **environmental champions** who can be highly effective at spreading resource-efficiency messages on a one-to-one basis throughout your organisation. These individuals can provide guidance and mentoring to building users and help to set a positive example of the benefits of adopting the changes you are promoting.

Environmental champions need to be enthusiastic, personable, good communicators and have a positive attitude to environmental issues. The best way of managing the work of your environmental champions is to set up a green team. Being part of a green team should be positioned as a means for career enhancement – a way of demonstrating initiative, commitment, skills and raising their personal profile.

Resource Efficient Scotland offer a free CPD certified online Green Champions Training Course which is split into three short training packs, ideal for bitesize learning. For more information, please see:

[http://greenchampionsresourceefficientscotland.com/](http://greenchampionsresourceefficientscotland.com/)


**5 Conclusion**

The Roslin Village Group and the Roslin Men’s Shed are very interested in exploring the asset transfer of the Pavilion from Midlothian Council. The first stage of this process is to assess the costs of running the building which, at present, is heated electrically and is used by only a small number of groups. It is the main aim of this project to increase the popularity of the village hall and to become a hub for community activities.

This report has focused on the following recommendations, including: installing LED lighting, a new heating system, solar PV, loft insulation and water saving devices. Other options include resource management awareness raising amongst users.

If all the detailed improvement recommendations are actioned, the community group could save/generate some income of approximately £6,600 and reduce CO\textsubscript{2} emissions by 11.7 tonnes per year.
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Appendix 1 – Supporting calculations

Total energy use

<table>
<thead>
<tr>
<th>Energy</th>
<th>kWh</th>
<th>Cost (p/kWh)</th>
<th>Total Cost (£)</th>
<th>CO₂ (T)</th>
<th>CO₂ factor (kgCO₂/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>66,000</td>
<td>14</td>
<td>9,120</td>
<td>23.2</td>
<td>0.35156</td>
</tr>
<tr>
<td>Total</td>
<td>66,000</td>
<td></td>
<td>9,120</td>
<td>23.2</td>
<td></td>
</tr>
</tbody>
</table>

Note: Based on Midlothian Council data 2017-18

Proportion of electrical energy use (approx)

<table>
<thead>
<tr>
<th>Proportion of energy use</th>
<th>%</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking - Electric</td>
<td>10</td>
<td>6,600</td>
</tr>
<tr>
<td>Heating &amp; Hot Water</td>
<td>70</td>
<td>46,200</td>
</tr>
<tr>
<td>Other electricity (lighting, equipment)</td>
<td>20</td>
<td>13,200</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>66,000</td>
</tr>
</tbody>
</table>

Note: Based on benchmark data and simple heatloss

Water use

<table>
<thead>
<tr>
<th>Water</th>
<th>m³</th>
<th>Water cost (£/m³)</th>
<th>Total Cost (£)</th>
<th>CO₂ (T)</th>
<th>CO₂ factor (kgCO₂/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>718</td>
<td>2.2</td>
<td>1,580</td>
<td>0.2</td>
<td>0.344</td>
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</table>

Note: Water cost is based annual cost of water from accounts.

LED lighting

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Total power (kW)</th>
<th>Total energy (kWh)</th>
<th>Saving energy (kWh)</th>
<th>Elec p/kWh</th>
<th>CO₂ saving (T)</th>
<th>Cost saving (£)</th>
<th>Cost (£)</th>
<th>Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing lighting</td>
<td>3.27</td>
<td>5,559</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED lighting</td>
<td>2.16</td>
<td>2,165</td>
<td>3,394</td>
<td>14</td>
<td>1.2</td>
<td>475</td>
<td>5,000</td>
<td>10.5</td>
</tr>
</tbody>
</table>
## Lighting survey

<table>
<thead>
<tr>
<th>Lighting survey</th>
<th>No of lights</th>
<th>Existing (W)</th>
<th>Total watts</th>
<th>Running hours</th>
<th>Total energy (kWh)</th>
<th>LED replacement (W)</th>
<th>Total watts</th>
<th>Total energy (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small hall</td>
<td>9</td>
<td>58</td>
<td>522</td>
<td>1700</td>
<td>887.4</td>
<td>25</td>
<td>225</td>
<td>382.5</td>
</tr>
<tr>
<td>Corridor</td>
<td>6</td>
<td>58</td>
<td>348</td>
<td>1700</td>
<td>591.6</td>
<td>25</td>
<td>150</td>
<td>255</td>
</tr>
<tr>
<td>Reception</td>
<td>2</td>
<td>28</td>
<td>56</td>
<td>1700</td>
<td>95.2</td>
<td>14</td>
<td>28</td>
<td>47.6</td>
</tr>
<tr>
<td>Changing rooms</td>
<td>18</td>
<td>28</td>
<td>504</td>
<td>1700</td>
<td>856.8</td>
<td>14</td>
<td>252</td>
<td>428.4</td>
</tr>
<tr>
<td>Stores</td>
<td>3</td>
<td>58</td>
<td>174</td>
<td>1700</td>
<td>295.8</td>
<td>25</td>
<td>75</td>
<td>127.5</td>
</tr>
<tr>
<td>Kitchen</td>
<td>4</td>
<td>58</td>
<td>232</td>
<td>1700</td>
<td>394.4</td>
<td>25</td>
<td>100</td>
<td>170</td>
</tr>
<tr>
<td>Main hall (LED)</td>
<td>21</td>
<td>60</td>
<td>1260</td>
<td>1700</td>
<td>2142</td>
<td>60</td>
<td>1260</td>
<td>2142</td>
</tr>
<tr>
<td>Toilets</td>
<td>3</td>
<td>58</td>
<td>174</td>
<td>1700</td>
<td>295.8</td>
<td>25</td>
<td>75</td>
<td>127.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>3270</td>
<td></td>
<td>5559</td>
<td>2165</td>
<td>3680.5</td>
<td></td>
</tr>
</tbody>
</table>

Notes:  
M-F based on 6 hours per week day for school club = 1,200 hrs/yr  
Other clubs use at 10 hrs per week = 500 hrs/yr

## New gas combi boiler & heating controls

<table>
<thead>
<tr>
<th></th>
<th>Heating requirement (kWh/yr)</th>
<th>Boiler efficiency (%)</th>
<th>Gas consumption (kWh)</th>
<th>Saving (kWh)</th>
<th>CO2 saving (T)</th>
<th>p/kWh</th>
<th>Total running cost (£)</th>
<th>Cost saving (£)</th>
<th>Cost (£)</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>New gas combi</td>
<td>46,000</td>
<td>92</td>
<td>50,000</td>
<td>0</td>
<td>7.0</td>
<td>3.8</td>
<td>1,900</td>
<td>4,540</td>
<td>12,000</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Note: Based on current usage. The main hall would not be heated by gas boiler.
### Solar PV

<table>
<thead>
<tr>
<th></th>
<th>kW</th>
<th>Predicted PV generation per kW installed (from PVGIS) kWh/kWp</th>
<th>kWh/yr</th>
<th>Fit rate (p)</th>
<th>Total FIT income (£)</th>
<th>Total export income (Export at 5.2p)</th>
<th>Total FIT income (FIT+export) (£)</th>
<th>Saved electricity (£)</th>
<th>Total (£)</th>
<th>CO₂ saving (T)</th>
<th>Cost (£)</th>
<th>Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV</td>
<td>6</td>
<td>850</td>
<td>5,100</td>
<td>0.00</td>
<td>0</td>
<td>53</td>
<td>53</td>
<td>571</td>
<td>624</td>
<td>1.8</td>
<td>6,000</td>
<td>9.6</td>
</tr>
</tbody>
</table>

**Note:**
- 850 kWh/kWp installed from PVGIS at 30 degree panel angle facing south east
- Total export is assumed at 20%.
- Saved electricity based on 14p/kWh assumed electricity price paid.
- Total saving = Total FiT + Total Export + Saved electricity

### Loft insulation - saving 10%

<table>
<thead>
<tr>
<th></th>
<th>Saving (kWh)</th>
<th>Cost saving (£)</th>
<th>CO₂ saving (T)</th>
<th>Cost (£)</th>
<th>Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loft</td>
<td>4,600</td>
<td>644</td>
<td>1.6</td>
<td>3,000</td>
<td>4.7</td>
</tr>
</tbody>
</table>

**Note:** Based on simple heat loss assessment savings
- Based on heating with electric

### Water savings

<table>
<thead>
<tr>
<th></th>
<th>Water use (m³/yr)</th>
<th>Saving (m³)</th>
<th>CO₂ saving (T)</th>
<th>Cost saving (£)</th>
<th>Cost (£)</th>
<th>Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cistern &amp; flow reducers</td>
<td>718</td>
<td>144</td>
<td>0.07</td>
<td>316</td>
<td>1,000</td>
<td>3.2</td>
</tr>
</tbody>
</table>
## Heatloss Assessment

| Room          | Length (m) | Width (m) | Height (m) | Area (m²) | Area Design Temp (°C) | Internal Heat Loss (W) | Total Area (m²) | Calc. Heat Loss (W) | Heat Loss (W) | Heat Loss Area (W/m²) | Heat Loss Area (W/m²) | Area (m²) | Calc. Heat Loss (W) | Heat Loss (W) | Heat Loss Area (W/m²) | Heat Loss Area (W/m²) | Total Fab. heat loss W | Total heat loss W | Fabric loss (W) | Air loss (W) | TOTAL (W) | TOTAL (W-10%) | Space heating Requirement (kWh/yr) |
|---------------|------------|-----------|------------|-----------|-----------------------|------------------------|----------------------|---------------------|----------------|-----------------------|-----------------------|-----------|---------------------|----------------|---------------------|-----------------------|---------------------|----------------|----------|-----------|----------|-----------------|
| Entrance      | 9.1         | 9.2       | 4.4        | 39.5      | 21.5                  | 184                    | 67                   | 57.7                | 19.8          | 0.53                  | 0.53                  | 3.12      | 14.0                | 19.8          | 0.53                | 0.53                  | 28                   | 48               | 0.53                | 0.53               | 1960            |
| Changing room | 10.8        | 7.0       | 2.4        | 14.2      | 0                     | 445                    | 64                   | 44                  | 25.5          | 1.84                  | 1.84                  | 6.33      | 48                  | 25.5          | 1.84                | 1.84                  | 475                | 76.0             | 10418             | 10418             |
| Kitchen       | 4.5         | 3.6       | 2.4        | 11.0      | 0                     | 182                    | 16                   | 16                  | 13.2          | 1.16                  | 1.16                  | 3.33      | 27.0                | 13.2          | 1.16                | 1.16                  | 182                | 27.0             | 333                 | 333                |
| Master bath   | 10.5        | 6.5       | 2.1        | 13.3      | 1                      | 493                    | 140                  | 140                 | 37.0          | 2.77                  | 2.77                  | 8.0       | 59.0                | 37.0          | 2.77                | 2.77                  | 293                | 47.0             | 2334               | 2334               |
| Total         |             |           |            |           |                       |                        | 517                  | 417                 | 55.8          | 4.87                  | 4.87                  | 13.3      | 131.3               | 55.8          | 4.87                | 4.87                  | 2109               | 318              | 333                 | 333                |

**Recommendation**

- Entrance: 28%  
- Changing room: 76.5%  
- Kitchen: 33.7%  
- Master bath: 104.1%  

**Total energy (kWh):** 10418