Datblygiadau Egni Gwledig

RESOURCE EFFICIENCY REPORT

BRIGHTER FUTURES RHYL

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MONITORING & TARGETING

Detailed and regular energy & resource monitoring is the key starting point in sound energy management practice. **What is not measured cannot be managed**.

Monitoring of energy consumption allows detailed analyses against previous weeks, months and years and can support the identification of reasons behind any large increases in consumption. This data should be discussed every 3-6 months at management meetings to enable wider discussions on the organisations environmental impacts to take place. This will also enable senior management to set realistic targets for reducing consumption year on year and also to disseminate performance to staff and students.

The organisation should consider setting a target for reducing energy consumption which should be reviewed year on year. It is recommended that the organisation consider setting a target for year one at 10%.

A proportion of the savings achieved from one year should then be used to invest in further energy saving measures from the action plan at the end of this report. This results in a cycle of continuous improvement and energy cost reduction.

EXECUTIVE SUMMARY

All of the recommendations in the table below are expanded upon in detail further in the report.

Building feature		Recommendation / Comment
Lighting		As almost all lighting has already been converted to LED, other than converting the final few there are no further recommendations regarding lighting type.
Lighting controls		Automatic lighting controls in some infrequently used areas.
Heating system		The current mains gas boiler system works fine, no need for replacement in the foreseeable future. Long term potential for installation of Air-source heat pump system.
Heating controls		The current two-zone heating system with TRVs and portable thermostats is considered sufficient.
Insulation	**-Walls**	Solid wall construction is currently uninsulated. Potential for internal wall insulation in many rooms. External wall insulation considered unsuitable at this point.
	-Roof	Current loft insulation at joist level is both inadequate and in poor condition. Recommended to replace and install additional layer of insulation.
	-Windows & doors	Full double-glazed windows fitted. Street-side windows are brand new. Older windows towards rear of building have failed seals and need replacing.
Air-tightness		Majority of external doors, widows and loft hatches are draughtproofed – Inspect regularly to ensure effectiveness. Old pub extraction systems should be sealed to prevent unnecessary heat loss. (above door / near TV)
Extraction & Ventilation		Controlled Mechanical ventilation system should be introduced to ensure introduction of fresh air to the building. Ideally a heat recovering unit (MHRV).
Catering and refrigeration	**-Catering**	Potential to replace gas cooking hobs with energy efficient Induction hobs.
	-Refrigeration	Older energy-intensive refrigerators need replacing with window-less, energy efficient (A+++ rated) units.
Electrical equipment		Power-saving functions & one-click panels for all group electronics.
Renewable generation	**Generation**	Consider installing Solar PV system to suitable roof area. Solar PV installations capacity should be scaled according to building electricity usage to avoid oversizing.
	Storage	Consider installing battery storage system alongside solar PV to offset evening electricity use.
Water Efficiency	**-WCs**	All toilets appear to be small-cistern units with dual-flush capabilities
	-Faucets	Some taps are decorative rather than efficient – consider replacing with low-flow aerating taps.

Datblygiadau Egni Gwledig is pleased to be able to offer this report to you for consideration.

OVERVIEW

Brighter Futures Rhyl are situated within an old converted Public House on Wellington Rd. in Rhyl. The original building is of solid brick construction with the newer rear extended part believes to be a narrow cavity wall. The building has been subject to various improvements over the years, with the current organisation being responsible for much of it. It is clear that energy efficiency has been a significant interest of the organisation of late with many new measures being recently installed such as a full LED lighting fitout and new street-side windows.

The organisation uses mains gas for heating and hot water; while a small amount of mains gas is used for catering. Electricity is used for lighting, refrigeration, office and other electronic equipment, assorted kitchen appliances, and some power tools.

Unfortunately, historical energy consumption data was not available for the site and as such estimated financial payback of energy efficiency measures cannot be calculated. Upon speaking to a representative of the organisation it was expressed that electricity makes up the vast majority of the annual utilities cost, whilst gas expenditure is relatively low. Regardless, attempts should be made to reduce all forms of energy consumption within the building.

BUILDING FABRIC

Insulation (roof)

A quick inspection of the loft area confirmed the presence if rolled out mineral wool insulation at the joists. The insulation itself however is both in fairly poor condition as well as insufficient, leaving coverage patchy as well as compressed in places due to the loft being used as a storage space.

Figure 1 - Condition of existing loft insulation.

Ideally there should be up to 300mm (12”) of insulation in the loft space. Mineral wool is low cost, but more sustainable options are available such as sheep wool and other recycled fibre products. This type of insulation can be DIY installed, but it can be unpleasant to do, as mineral wool can be an irritant. There is also a wealth of companies specialising in loft insulation, which would be more suited to a community building given the larger roof space compared to a domestic property.

Current prices (for mineral wool) range from £4-7 per m2. The price depends on the thickness of the material and the associated U-value (which is the rate of heat loss through a material).

Recommendation: Replace the old insulation with new material, increasing coverage. Additionally, it is recommended to increase the depth of the joists the allow for the insulation layer to be thicker (at least 250mm) and boxed in with floorboards to prevent any damage from the use as a storage space.

Insulation (walls)

As most of the building consists of solid brick walls, and the increased risk with filling narrow cavities, cavity wall insulation is either not possible or not recommended. This leaves internal and external wall insulation as the remaining options.

External

The second option would be externally insulating the property. This would involve installing an insulation layer fixed to the external walls with a protective render or decorative finish (wood cladding etc.). Generally, the most expensive option, it does have its additional benefits and often the most effective.

The Pros of external wall insulation

External wall insulation is obviously designed to increase the energy efficiency of the property, reducing the heat loss and therefore also demand on the heating system.

The insulation improves the wall's ability to withstand the elements. The extra layer of protection helps preserve the underlying brick, block or stonework, meaning that any remedial works such as repointing can be put on hold. Any structural issues must be resolved prior to installing insulation.

External wall insulation also prevents penetrating damp entering, although it will have no impact on rising damp. In most cases the external wall insulation installers will remove the wall furniture (e.g. guttering) so for many people this provides a good opportunity to check the integrity of it at the same time, resealing any leaks and replacing old pipework, before reattaching it to the wall.

It also means no disruption to the users of the building (inside at least) – all the works are carried out externally.

A key benefit, often overlooked, is that the walls will continue to get warmed by the heating system. This means that when the heating is turned off, this stored warmth will be slowly released back into the building, meaning that the building is kept at a more even temperature. It also means that you won't get condensation on the walls – which is obviously a huge benefit.

The Cons of external wall insulation

In many cases, the soffit and verges (the bits of the roof that over hangs the wall) are more than 100mm so the external wall insulation can butt right up to it. Unfortunately, in some cases (especially older properties) it is not and therefore the insulation needs to be capped at the top (to prevent moisture getting down the back) or the roof needs to be extended over the top of the insulation and this can be costly. Similarly, anything else that is fixed against the external wall (guttering, downpipes, abutting garden walls etc.) can all interfere with the insulation and unless they can be removed (garden walls) they can be a cause of thermal bridging, resulting is condensation on the internal wall.

In most circumstances you don't need any sort of planning permission to do works, however if you are in a conservation area (Parc Cenedlaethol Eryri, AONB etc.) or a listed property, it is advisable to seek permission before getting it installed.

When external solid wall insulation is installed, the installer should go nowhere near the damp course – the insulation should start above it, but that does mean you get some cold bridging there.

If there is any rising damp issue (which may not be noticed until after the insulation is added) & if the EWI is not a breathable solution, the damp in the walls can no longer make its way out externally so the damp may start coming through internally. Therefore, if there is a chance of rising damp, get this sorted first or use a breathable EWI system.

You require scaffolding, which can add slightly to the cost, although if you try to do other works at the same time (that require scaffolding) then obviously you just pay once.

Internal

Internal wall insulation, as the name suggests, involves adding insulation boards (normally PIR boards, but this can be mineral wool) to the internal faces of the external walls of the property and then plastering or some kind of other internal decorator on top of the insulation to finish.

The Pros of internal wall insulation

Like external wall insulation, insulating the building internally will lead to significant energy savings. Internal wall insulation is relatively easy to do, and can be done on a room-by-room to minimise disruption and spread costs. Additionally, there is no added scaffolding expenses associated with insulating a property internally.

The Cons of internal wall insulation

Losing internal space can be a major issue with internal wall insulation – typically around 10cm depth on each insulated surface.

Unlike external wall insulation, where the amount of insulation that can be added is essentially unlimited, for internal insulation there reaches a point where people will be unhappy to lose the space which obviously puts a limit on the thermal efficiency one can achieve.

If there are any penetrating damp issues, these must be resolved prior to installing the internal wall insulation otherwise far worse issues can occur down the line. In addition, the bricks will still be open to the elements, which potentially means general maintenance still needs to take place.

Recommendation: Due to the nature of the external surfaces of the building, external wall insulation would be a more complicated and expensive job, on top of losing the external aesthetic of the old building. There Is definitely some scope for installing internal wall insulation, especially on some 1st floor walls to reduce heat loss – as long as the organisation is happy to lose a little of the internal floor space.

Windows & Doors

All windows within the building are fitted with PVC double-glazed units. The front, street-side windows have been recently replaced with brand new units whilst the rest are older models. Unfortunately, some of the older units show signs of having a failed vacuum and broken seals. These should ideally be replaced with new windows.

(Upon speaking to a representative of the organization it was discovered that new replacement windows have already been commissioned for some of the back units)

As for the doors, it follows a similar condition to the older windows. Whilst they appear to be in acceptable condition, with draught-proofing and seals in place. Long-term the organization should consider replacing the older wooden doors with thermally broken, insulated doors.

Recommendation (windows): As there are already imminent plans in place to replace some underperforming windows there are no further immediate concerns in this area. However, any remaining older windows should be monitored to make sure they remain in good condition to avoid further deterioration.

Additional Considerations

1. **Sealing old extractors:** There are two old extractor vents in the front (old bar) room. In the past these would've been used to ensure adequate ventilation in a smoky pub environment. In present day they are now obsolete and simply represent a significant heat loss through draughts. These should be sealed, both internally and externally with the addition of some form of insulation in the gap to minimize any further heat loss.

2. **Inspect Secondary loft area:** There is a second, smaller loft area that is separate from the main building. Access to this loft for inspection was not possible during the survey, therefore it is recommended that one is carried out by the organization themselves, and that the insulation levels are increased to meet current standards. It does not appear to be a particularly large area, so it should not represent a high-cost measure.

3. **Ventilation Strategy:** The current ventilation strategy at the site is simply opening the external doors to the front area. Whilst this certainly get the job done, it also releases a great deal of heated air out of the building and introduces a lot of cold air in its place, increasing the demand on the heating system. Instead, the organization should install a mechanical ventilation system, perhaps in the gap that is currently occupied by the extractor to introduce a steady stream of fresh air into the building. Better still, this should ideally be a heat-recovery system Mechanical Ventilation Heat Recovery, or MVHR for short, uses the heat in the stale air removed to pre-warm the fresh air entering the building, lowering the amount of energy lost in the process.

HEATING & HOT WATER

Heating

Heating to the building is supplied by a mains gas **IDEAL I-Mini 30** boiler, which has an excellent seasonal efficiency of 89%. It is a relatively new model and has been regularly serviced with the heating delivered via a wet radiator system of a similar age. Each radiator has been fitter with a thermostatic radiator valve (TRV), which roughly regulates the temperature of each room. There is a central portable digistats that is used to control the overall temperature of the building. Additionally, the heating system is split into two zones, upstairs and downstairs, which allows for each zone to be heated individually. The organisation often leaves the upstairs heating turned 'off' as heat rising from downstairs is enough to keep it comfortable. The boiler also supplies direct hot water to several outlets within the building.

Given the age and efficiency of the boiler there is no need to consider a boiler replacement for the foreseeable future. Similarly, the optimisation of the heating controls are modern enough to not need any additional upgrades.

Temperatures should be set to 19-20˚C for heating and if cooling, no lower than 23-24˚C. Every degree of overheating or cooling) increases energy costs by 8%. However, the temperature should also be adjusted depending on the type of activities taking place in the building. For example, a room used for yoga will require a warmer environment; whereas a corridor or high activity sport, such as dancing, would require a lower temperature.

Activity/Room	Temperature (°C)
Office/General	19-20
Corridors	15
Hall – sedentary	19-20
Hall – high activity	13

Additional Consideration: Air-Source Heat Pump

An air-source heat pump uses electricity to extract heat from the external air and uses this to provide heat to the building. Whilst electricity is by far the most expensive fuel type at the moment, the efficiency is ASHP far exceeds anything that can be achieved with fossil fuel heating, meaning that it is often a cheaper method of space heating.

The coefficient of performance (COP) of a heat pump system is a measure of its efficiency. Essentially, it's the ratio of useful energy produced (heat) to electrical energy consumed. Most ASHP systems will operate on a COP of 3-3.5, meaning that for every 1kWh of electricity it consumes, it produces 3-3.5kWh of heat to the building (in other words it's 300-350% efficient). The high-end, most efficient oil, LPG or gas boiler systems on the market today operate at a maximum of around 93% efficiency. It is in the efficiency of the system where ASHP shines despite the fact that electricity is the more expensive fuel. This is highlighted in the table below:

Heating type (Fuel)	Fuel unit price (p/kWh)	Heating System Efficiency	Effective heat price (p/kWh of heat)	Kg/CO_2 Per kWh heat
Mains gas	3.75p	92%	**4.08**	0.20
Oil	5.25p	92%	5.71	0.30
LPG	6.75p	92%	7.34	0.23
ASHP	16p	350%	**4.57**	**0.09**
Direct electric heating	16p	100%	16.00	0.31

As can be seen the effective heat price of ASHP is lower than that of both LPG and Oil, whilst being even comparable to mains gas. When it comes to the equivalent CO_2 emissions, ASHP is the clear winner by a significant margin.

Air-Source Heat Pump - Additional considerations

Suitability of existing system	ASHP systems operate at a lower temperature than traditional fossil fuel boilers. Because of this they require larger area radiations in order to adequately heat the space. Ideally, air-source heat pump should be distributed *through underfloor heating.*
Noise	The noise from an ASHP is directional and consideration should be given to the noise produced. As a commercial property this shouldn't pose much of a problem. However, neighbouring residential properties could be in audible range.
Location	The external condenser component of the ASHP is fairly sizeable and needs an open, well ventilated patch to stand on.
Building Thermal efficiency	Because of the nature of how ASPH heats a building (low heat, passively) to make the most out of a heat pump system it is vital that the rest of the building is made as thermally efficient as possible. (Insulation, draughtproofing, etc.)
Hot Water	Hot water cylinders can be fitted to work along with the ASHP; however, these will bring down the efficiency of the system, and given the relatively low hot-water usage of the site, small undercounter or even instant hot water heaters would be better suited. These are detailed in the next section.

Verdict: *Converting from mains gas heating to an electric Air-source heat pump is unlikely to have any financial benefits for the organisation in the current energy climate. However, it would drastically lower their carbon footprint.*

LIGHTING

Whilst it was good to see that the site had already converted the vast majority of lighting to full LED lighting, they are encouraged to replace all remaining lighting to LED as well. LED lamps typically use only 10-20% of the power consumption that halogen/tungsten lamps would require. A typical 50W halogen spotlight can be replaced by a 5-7W LED, representing substantial energy and cost savings. The LED spotlights vary in price from £7-10 per lamp up to £40 per lamp (high performance, long-life), but attention should be spent on the lumen output comparison of selected lamps to ensure the LED unit can compare against the halogen spotlight that would normally have been installed. Additionally, the colour (temperature) of the light is very important; be careful when buying lamps by choosing the right colour temperature for the right location and application. 2700K (Kelvin – colour) is warm-white; 4000-6500K is day-white.

When sourcing LED lighting solutions a specialist supplier should be engaged, as there are many poor-quality products on the market. Most suppliers will provide a free lighting survey to assess the requirements of the business, with some offering discounts according to quantity ordered. Additionally, there are suppliers offering five year guarantees on their LED products.

Most LEDs will have an operational life of 30,000-50,000 hours, but some products can go beyond this – at extra cost.

The table below gives a brief overview of current lighting and recommended LED replacements:

Lighting controls

Lighting controls can be installed in most areas of a building and can range from a simple motion sensor or sophisticated combinations of motion sensor, digital dimming and daylight sensors.

In areas used infrequently they can save 50-70% of lighting energy use. The main types of lighting control and characteristics are outlined below.

Type of control	Characteristics
Passive infrared (PIR) sensors	• Low cost at £15-30 per sensor (plus labour). • Detects movement within a defined parameter and switches lights off after a set number of minutes. • Line of sight device can be problematic in toilets (where cubicles block the sight) or within storage areas, if the length of time has not been set appropriately.
Ultrasonic	• Medium cost at over £50 each (plus labour). • Acts like a PIR sensor, but is not line of sight; therefore, is best suited in storage areas or toilets.
Manual/timed	• Time lag (or push button) switches can be used for some intermittent areas. Such as stairwells or cupboards.

	• Low cost.
Daylight	• Daylight sensors can be ideal for external lighting, especially when linked to movement sensors for security purposes. • Can also be used internally, when lots of daylight potential exists in bright rooms with lots of windows. • Digital dimming allows modern lighting to be dimmed by 2% intervals and can link in with daylight and motion sensors. • Tend to be high cost items and so may not be suitable for community buildings. This type of sensor typically costs £100-200 each, due to the sophistication of the technology.

Table 1: Lighting control types & characteristics

ELECTRICAL EQUIPMENT

Induction hobs

Induction hobs deliver heat to the pan using a magnetic field. This field creates an induction current, which generates heat and is drawn upwards into the ferrous pan. This heats the pan instantly and thus the food in it. Induction hobs heat up quickly and are therefore capable of reducing cooking times.

As almost all of the heat generated is transferred into the food, they use much less energy than other hobs. When a pan is lifted off the hob the heating stops immediately, automatically turning the hob off saving energy and improving safety.

The energy requirement of an induction hob is 40-50% less than that of a conventional gas or electric hob. Standard electric hob cookers are typically only 50% efficient (due to an electric element being heated, which then sometimes heats a metal plate, which eventually heats the pan and the food). As less heat is generated, further savings are possible through reduced ventilation requirements given that space heat gains are reduced by up to 50% (compared to a conventional gas burner).

It should be noted that specific pan's must be used with these units so that the induction current can be generated.

Domestic four ring units can be purchased for around £400 and they are typically inset into the kitchen work surface. Because switching to induction hobs can involve a slight adjustment in behaviour of catering staff it is always recommended to consult the most frequent user of the facilities to decide whether the switch will be welcomed or not.

Refrigeration

An old 'D' rated under-counter fridge could be costing more than a £100 a year to operate – often just to keep the odd bottle of milk cool. Modern A^{+++} rated fridges cost a fraction of this to operate (£10-20 per year) and the energy use is clearly stated on the new energy labels that all new refrigeration units are packaged with. It should be noted that A^{+} is now the least efficient (new to market) fridge/freezer available.

It is recommended that cleaning and vacuuming the back of the refrigerator condenser (a grill-like thin radiator) takes place as a regular occurrence. This can save in excess of 150kWh per year (approximately £20 at 13p/kWh for electricity). For this to be practical we suggest that the community building does not install integrated refrigerators or freezers as they cannot easily be pulled out for cleaning.

It is also recommended that if a refrigeration unit is only used on an infrequent basis then it should either be switched off or installed with a seven-day timer for events that happen on a regular weekly basis. Full fridges should be packed in such a way as to help the flow of cool air around the fridge.

Freezes should always be filled to make them more efficient. By minimizing the amount of cold air that escapes with each opening, so is the amount of energy required to bring the freezer back down to temperature. This can be done with something as simple as boxes filled with bubble wrap for example.

Recommendation: The organization has already stated hat it plans to get rid of some of the old, windowed fridge freezers and replace them with brand new units. As such there are no further recommendations, besides the cleaning and storage tips, regarding refrigeration.

Office and auxiliary equipment

There is a common misconception that adding a screen saver will reduce energy consumption. In fact, some screen savers can increase energy consumption. Therefore, the organisation should check that computers are set to power save when they are not in use. Users should also be encouraged to switch off the monitors of their PC when they are not in use.

The organisation should make use of power down plugs or one-click panel plugs to turn off all IT equipment when not needed. These plugs are incorporated with energy saving measures. The power down plug is for use with a computer or TV, which automatically switches off devices, such as printers, scanners ad speakers, linked to your desktop computer (or DVD player linked to the TV) when the computer is switched off.

The one-click panel works by monitoring the power needs of the main device plugged in (i.e. computer) and through this monitoring of consumption it will turn off any peripheral items.

RENEWABLE ENERGY OPTIONS

In keeping with our sustainable energy hierarchy, we always advise that the potential for small-scale renewable energy technologies is considered normally *after* all opportunities for energy saving have been implemented. This has already begun to be addressed at the site; but of course, saving energy is a continuous and on-going process, and there is much work still to do.

Solar PV

Background guidance

Solar photovoltaic (PV) is now a very popular and widely deployed technology across all sectors, with recent growth driven by dramatic price falls and the UK arrival of feed-in tariffs (FITs) in 2010. The FITs themselves have had a chequered history, due to frequent changes by government, which has created some difficulties for the industry.

System Costs – typical solar PV systems would currently cost around £1,000–1,400 *per kW** of peak installed capacity, as reflected in the calculations presented later. It should be noted that only a few years ago, the cost would have been closer to £4,000–6,000 per kW. Further dramatic price falls are not expected, since the basic panel price is no longer the dominant component of overall system costs.

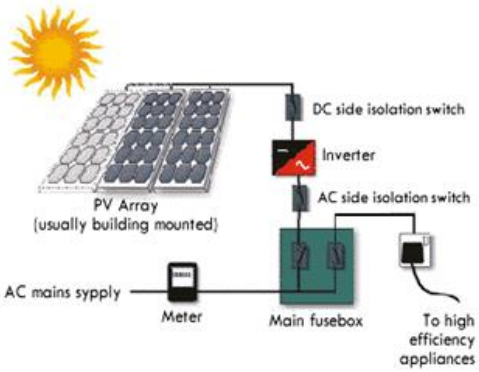
Energy Generation – a typical well-sited 1kWp solar PV system in the facing south will generate 900-950 kWh annually. Some systems are achieving even higher outputs in this area, although annual figures will vary by +/- 5% based on the weather.

Inclination		West					South						East
		-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90
Vertical	90	56	60	64	67	69	71	71	71	71	69	65	62	58
	80	63	68	72	75	77	79	80	80	79	77	74	69	65
	70	69	74	78	82	85	86	87	87	86	84	80	76	70
	60	74	79	84	87	90	91	93	93	92	89	86	81	76
	50	78	84	88	92	95	96	97	97	96	93	89	85	80
	40	82	86	90	95	97	99	100	99	98	96	92	88	84
	30	86	89	93	96	98	99	100	100	98	96	94	90	86
	20	87	90	93	96	97	98	98	98	97	96	94	91	88
	10	89	91	92	94	95	95	96	95	95	94	93	91	90
Flat	0	90	90	90	90	90	90	90	90	90	90	90	90	90

Safety & Maintenance – Solar panels require very little maintenance. They do need to be kept reasonably clean but mounting the panels at a standard roof angle will ensure that rain will wash most of the dust off the array. The panels can be cleaned by hand using a hose if required. The panels have a glass covering which can be smashed if hit by hard objects – it is best to site panels where they are unlikely to be subjected to vandalism or have things dropped on them.

Connections & Metering - As well as the panels, space needs to be found for one or more inverters, which convert DC power to grid-synchronised AC power before feeding it into your existing circuits or the grid. Inverters will shut down the PV system in the event of any grid anomalies, including power cuts; they can also start-up and re-synchronise automatically when the grid stabilises again. Inverters are always wired such that they can also be isolated manually via switches on both the DC and AC sides (see schematic), but under normal usage, their operation is fully automatic.

Metering is another important consideration: a generation meter records all units generated by the PV system, and is required in order to claim the FIT, for which all small-scale renewable electricity is eligible. Generation meters are now to be fitted as standard by all solar PV installers. It is sometimes desirable to fit a separate export meter to record only the net units exported to the grid; but systems below 30 kW can be 'deemed' at 50% export, which would be to the organisation's benefit.



Economics - Mainstream grant support for PV has long gone and the Government's Feed-In Tariff scheme closed at the end of March 2019. Therefore, the installation of a PV array has been assessed assuming no FIT payments.

The Smart Export Guarantee - Following the cessation of the government FIT's scheme it was replaced in January 2020 by the smart export guarantee (SEG). The SEG is an obligation set by the government for licensed electricity suppliers to offer a tariff and make payment to small-scale renewable generators for electricity exported to the National Grid. However, the law only stipulates that the suppliers must pay a tariff 'greater than zero' resulting in many offering a very low tariff to customers. A handful of electricity suppliers offer a reasonable export tariffs of around 5p/kWh, a comparison of which can be found on the following website (accurate as of January 2020).

https://www.solar-trade.org.uk/seg/

	Supplier	Tariff Rate
1	Social Energy	**5.6p**
2	Octopus Energy	5.5p
-	E.ON Energy	5.5p
4	Bulb Energy	5.38p
5	OVO Energy	4.0p
-	ScottishPower	4.0p

Figure 2 - Top 6 SEG export tariff rate comparison (January 2020)

Site Suitability

The image below highlights a potential location for a solar PV installation; There are several candidates for the best location, either south-east or south-west facing.

The organization has previously obtained quotes for PV installations from a local installer and these were made available for review. The original plan was to have 2 separate systems installed; one to generate electricity for the building, and another as a source of income from exports. This is currently not recommended as solar PV installations are no longer viable to install as a source of income alone, only as a means of offsetting imported electricity.

There is enough available roof area for a sizeable solar PV system, however, when installing a PV system, it is best to size the system based on the energy demand of the building, any bigger would be a waste of investment as shown in the examples below. 'Scenario 1' assumes the organization uses 50% of the generated electricity on site, whilst 'scenario 2' shows the viability of installing a Solar PV system based on exports alone. (Size based on quotation provided. Note: These figures are rough estimates based on details provided and are used to showcase the viability rather than give performance estimates.)

System Details	Scenario 1	Scenario 2
System capacity (kWp)	3.2	2.6
Annual generation (kWh)	2,848	2,278
Offset units (kWh)	1,424	0
Offset Units (%)	50%	0%
Exported units (%)	50%	100%
Import savings (annual)	£256	£0
Potential annual SEG income	£71	£114
Full installed cost	£4,160	£3,328
Simple Payback (Including SEG) (Years)	**12.7**	**29.2**

WATER EFFICIENCY

Toilets

Older toilets and cisterns tend to be very wasteful when it comes to water. It is possible to purchase dual flush toilets for around £150 each. The toilets come with smaller cisterns and allow for reduced flushes when required.

It was great to note that all the toilets at the site appear to be small-cistern, dual-flush units. The critical aspect of dual flush toilets is appropriate signage so that users understand how to operate them to avoid wasting water.

Taps

Some of the faucets found withing the building, whilst looking attractive are not particularly water-efficient. These should ideally be replaced with aerating taps if any work is carried out on bathrooms.

Non-concussive taps (also known as self-closing taps, push button taps and press taps) can be purchased for around £20-30 (per pair). Non-concussive taps deliver a set, timed water flow, negating the possibility of taps being accidentally left open. Ideal for commercial bathrooms that receive unsupervised use.

Taps should be purchased that have a reduced flow of around 3.5 litres per minute. This should reduce water use by 30-40% per tap. Typically, a return on investment of around 2-3 years is possible on aerating (reduced flow), non-concussive taps.

Rainwater collection

Rainwater collection is advantageous to any site that has a garden, potted plants or any other outside feature that might require watering. Plants do not require treated water and as such, watering with tap water can be wasteful and even harmful to plants. Whilst the site does not appear to be on a metered water connection, they can still reduce their carbon footprint by installing a water butt. This will collect and store rainwater during wetter months to be used as irrigation during the summer.

Figure 3 - Wood effect water butt, made from recycled plastic.

Prices range from as little as £20 (excluding installation) up into the hundreds depending on quality and design; with sizes ranging from less than 100L to giant tanks with 3500L+ capacities. Units can be bought to blend in with traditional buildings mimicking wooden barrels, storage sheds etc.

RECOMMENDATIONS

A comprehensive list of all recommendations found within this report.

Suggested action	Area	Impact
Loft insulation (main loft)	Building fabric	Reduced heating, comfort
Loft insulation (secondary loft)	Building fabric	Reduced heating, comfort
Draughtproof Hatch (sec. loft)	Airtightness	Minor reduced heating, comfort
Internal wall insulation (1st floor)	Building fabric	Reduced Heating + comfort
New windows for rear of building	Windows & doors	Reduced heating (minor), increased air-tightness
Replace side bar door with insulated door.	Windows & doors	Reduced heating, comfort & increased airtightness
Seal old extracts / Replace with MHRV	Ventilation, airtightness	Increased air-tightness, better ventilation strat.
Switch remaining to suitable LED lights	Lighting	Reduced electricity use (minor)
Induction Hobs to replace gas (as needed)	Catering	Reduced carbon
Replace old inefficient fridges	Catering	Reduced electricity
Solar PV Array with battery storage	Renewable generation	Reduced electricity costs, reduced carbon footprint
Water collection but for external use	Water	Reduced water consumption
Replace fancy faucets with water-efficient aerating sets.	Water	Reduced water consumption

Potential Future considerations

These are measures that would potentially be very impactful on energy bills, carbon footprint and general comfort of the building but are very expensive, not yet viable or require large scale works. These should be viewed as long-term ambitions to aim towards rather than current goals.

Suggested action	Area	Impact
Replace gas boiler with air-source heating system	Heating	Reduced carbon (major)
External wall insulation to entire building	Building fabric	Reduced heating (major), comfort
EV ChargePoint	Transport / Income	Reduced carbon, potential income