OxFutures

Energy Saving Recommendations Report

for

Shed Oxford

February 2018

Survey of Shed Oxford at The Abbey

European Union

European Regional Development Fund

OXFORD BROOKES UNIVERSITY

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ORGANISATION OVERVIEW

Report overview
EiE carried out a site visit and met with Linda Hull from The Abbey and John and Tony from Shed Oxford. All recommendations in this report are based on information and observations obtained during the site visit. The report is set out in order of recommended priority based on ease of implementation, carbon impact, cost and factors discussed on site.

Client details		
Organisation name	Shed Oxford	The Green Sutton Courtnay Abingdon OX14 4AF
Contact name	Linda Hull	linda@theabbey.uk.com 07772 655 035
Date of site visit	13/02/2018	Carried out by Moira Dorey

Energy savings recommendations - summary

Below is a summary of the opportunities recommended in this report. Costs and savings have been estimated using available information; an explanation is provided in detail for each opportunity. Estimations have been made based on energy data provided.

Opportunity	Savings (kWh / yr)	Savings (£ / yr)	Cost (£)	Initial payback	Carbon Impact (tCO_2e / yr)
Install new polycarbonate roof on the greenhouse	0	0	750	n/a	0.00
Move heat from greenhouse to tractor shed?	0	0	20	n/a	0.00
Upgrade lighting to LEDs	350	40	150	3.75	0.14
Increase size of the skylight	0	0	60	n/a	0.00
Consider heating sources for greenhouse	0	0	20	n/a	0.00
Warm the soil in winter	0	0	40	n/a	0.00
Install a PV pump to water greenhouse	0	0	60	n/a	0.00
Consider adding solar PV panels	0	0	145	n/a	0.00
TOTAL	**350 kWh/yr**	**£40/yr**	**£1245**		**0.14 tCO_2e / yr**

Site details

Shed Oxford Community Workshop recently began to take occupancy of a former tractor shed on the grounds of The Abbey. The building is accessed through the greenhouse. At the present time the shed is unheated however the volunteers have a number of projects they would like to undertake to improve their facilities and attract more users to this community space. One of the projects they are planning is to renew the roof of the greenhouse to make the greenhouse a more effective space.

Energy consumption annual profile

Fuel type	Annual Energy use (kWh)	Cost per kWh (p)	Standing charge (p/day)	Approx. annual cost (£)
Electricity	0	11.49	0	0
Wood burner	0	0	0	0

Consumption is not yet known as Shed Oxford have only recently moved into these premises.

ENERGY SAVINGS RECOMMENDATIONS

Install new polycarbonate roof and walls on the greenhouse		
Energy saving (kWh)	**Cost saving (£)**	**Cost of action (£)**
0	0	750

Shed Oxford has undertaken to replace the damaged polycarbonate roof and side walls (above the brick) of the greenhouse. Staff have decided that these elements will be replaced with a improved polycarbonate which, for weight and durability, is a good decision. Additionally, if the greenhouse is going to be heated in the future, improving the u-value of the roof and walls by replacing the current damaged polycarbonate with good quality polycarbonate with a low u-value will improve heat retention in the greenhouse.

Before the decision is taken on what material to purchase a discussion is required on what will be grown in the greenhouse and therefore what conditions are needed. Is light more important that heat retention, for example?

One possible option is 35mm clear multiwall polycarbonate roof sheets that have excellent insulation properties but let less light in. They have a insulation u-value of 1.3 (equivalent to a good double glazed window) but light transmission of only 51%. See:
http://www.premiumplastics.co.uk/35mm-clear-multiwall-polycarbonate-roof-sheets-5959-p.asp

At the other end of the spectrum, 10mm Twinwall Polycarbonate Roofing Sheet has poorer insulation properties at a u-value of 3.0 (lower values indicate better insulation) but let in 81% of the light. See: http://www.premiumplastics.co.uk/10mm-clear-twinwall-polycarbonate-roof-sheet-254-p.asp

For further information on the insulation and light transmission qualities of polycarbonate roofs see: http://www.premiumplastics.co.uk/ekmps/shops/megashop/resources/Other/polycarbonate-roofing.pdf

Actions

- Discuss with The Abbey staff what the proposed use is for the greenhouse and therefore identify whether light or heat are going to be the most important factor.
- Agree what type of polycarbonate sheeting is to be purchased.
- Obtain 3 quotes for purchasing this product - quotes are readily available on-line.

Costs and savings

10mm Twinwall sheets are considerable less expensive than 35mm sheets. The roof area of the greenhouse has been estimated as 28m2 plus side and end walls of 14m2. On this basis an average cost of £500 is estimated however this cost will vary considerable depending on the product selected.

ENERGY SAVINGS RECOMMENDATIONS

Move heat from greenhouse to tractor shed?		
Energy saving (kWh)	**Cost saving (£)**	**Cost of action (£)**
0	0	20

The tractor shed is currently unheated. While there are plans to install a wood burning stove, the shed users are also interested in using the heat generated from the sun in the greenhouse to pre-heat the shed, which is well insulated but is a cold space. The following video illustrates one way that this can be done fairly cheaply:
https://www.youtube.com/watch?v=f2jH8PcuOMs

Actions

- Investigate options for warming the shed from the greenhouse.

Costs and savings

Cost have been estimated £20 for parts.

Upgrade lighting to LEDs		
Energy saving (kWh)	**Cost saving (£)**	**Cost of action (£)**
350	40	150

Lights currently installed in the shed include 4 x 6ft tubes, 2 x 5ft tubes and 8 x 2ft tubes. We recommend replacing these, when they fail, with LEDs. LED lights are more energy efficient and exist for nearly every fitting. They can reduce electricity use by up to 90% compared to other lighting. Additionally LEDs last up to 35,000 hours before they need to be replaced (fluorescent lights last 15,000 hours) resulting in reduced maintenance costs. Example LEDs can be found here:
https://www.tlc-direct.co.uk
http://www.lightingsupermarket.com
https://www.ledhut.co.uk/

When selecting replacement lights there is also an opportunity to provide better lighting rather than using equivalent lights. Consider both the light quality preferred (known as colour temperature) that ranges from warm white, cool white or daylight and the level of brightness needed (measured in lumens).

Ensure that, whichever supplier you use, they offer a minimum 5 year failure replacement guarantee and are prepared to let you test a number of LEDs to ensure the light quality is correct before making a final purchase.

Actions

- Once current lights fail, ensure they are replaced with LED lights.
- Ensure LED tubes are compatible with fixtures (often the starter or ballast needs to be removed).

Costs and savings

Costs are based on 4 x new LED fittings @ £20 to replace the 6ft tubes, 2 x 22W tubes and 8 x 9w LED tubes at a total cost of £150, installed by a volunteer. Savings are based on lights being switched on 20 hours a week x 52 weeks (1,040 hrs) and reducing the wattage from 540W/hr to 204W/hr.

Increase size of the skylight		
Energy saving (kWh)	**Cost saving (£)**	**Cost of action (£)**
0	0	60

There is very little natural light coming into the tractor shed, particularly over the work areas. As you are in the process of refurbishing the building anyway, this is an ideal opportunity to consider adding natural light. Adding natural light will allow the strip lighting to be turned off more frequently.

There is currently a small skylight in the roof. The size of this skylight could be increased to bring in more natural light. As described in the first recommendation, polycarbonate roofs are lightweight and easy to install. Following on from the arguments laid out in the first recommendation, in the case of the tractor shed insulation is probably more important that light therefore 35mm polycarbonate sheeting should be used.

Also bear in mind that rain falling onto polycarbonate roofing can be noisy therefore sound reduction levels should be taken into account where users will be working underneath this skylight.

You may want to ensure that this skylight can be opened in the summer for ventilation purposes.

When considering adding a skylight you may also want to consider adding internal or external insulation to the roof of the shed to improve heat retention.

Actions

- Carry out a survey of the roof to ensure that changes to the roof structure can be made safely.
- Confirm that changes to this roof are not in contravention of The Abbey's listed status.
- Plan the installation to include well insulated polycarbonate roofing and an opening skylight.
- Gather a group of volunteers to install the skylight.

Costs and savings

Costs are based on a 1m x 2.1m polycarbonate sheet costing £60 installed by volunteers with framing made from wood offcuts on site.

ENERGY SAVINGS RECOMMENDATIONS

Consider alternative heating sources for the greenhouse		
Energy saving (kWh)	**Cost saving (£)**	**Cost of action (£)**
0	0	20

AIR SOURCE HEATING

During the site visit we discussed options for using air-source heating to warm the greenhouse slightly in the winter through the installation of a home-made air source heat pump. Many of the DIY suggestions come from the USA and involve converting old air-conditioning units which you are unlikely to have however here are a couple of links to other options:

DIY Heat Pump from an old Fridge:
https://www.youtube.com/watch?v=b3fL0r-Z2qM

DIY Air to water heat pump to heat a small radiator:
https://www.youtube.com/watch?v=L6RfIUUhgLs

If you would like to read further information on how air-source heat pumps work a useful resource is:
http://www.which.co.uk/energy/creating-an-energy-saving-home/guides/air-source-heat-pumps-explained

USING OLD NIGHT STORAGE BRICKS

There are also a number of intesting ideas for using your old night storage heater bricks to keep the chill off the greenhouse in winter or overnight in summer.

- Dig a hole in the centre of your greenhouse put in your fire bricks, cover and get a tube similar to the one that comes out of the tumble dryer. Tie it up to the top of the roof and fit a small fan on the end (e.g. like in a PC computer). On warm days have the fan sucking in heat into the heat pit and when night time comes swap over the terminals and let it suck the air from the heat pit up into the green house creating a nice warm atmosphere all night.

- You could build a cold frame in the greenhouse or outside with the bricks inside. They will heat up in the sun and may keep plants warmish overnight. They might also be useful underneath seedling trays for the same purpose inside the greenhouse.

Actions

- Follow the links and consider options for a DIY air-source heat pump.
- Research further options for DIY air-source heating.
- Consider uses for old night storage heater bricks.
- Check your recycling store for appropriate parts.

Costs and savings

Costs are based on £20 for parts that you do already have in your recycling store.

Warm the soil in winter

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
0	0	40

You have also been considering how to heat the soil in winter to allow crops to be grown in winter. Soil warming cables can be used to warm the soil rather than warming the whole greenhouse and will promote plant growth.

For examples of how to do this see:
https://www.quickcrop.co.uk/blog/how-to-make-a-heat-bench-propagator-using-a-soil-warming-cable/

For an example of soil warming cable costs see:
https://www.twowests.co.uk/soil-warming-cable

Actions

- Consider the advantanges and possible uses of winter soil warming for winter crops.
- Use items from recycling sheds to create propagators.

Costs and savings

Cost of action is estimated at £40 based on a 20ft length.

Install a PV pump to water the greenhouse

Energy saving (kWh)	Cost saving (£)	Cost of action (£)
0	0	60

You are considering ways to make better use of collected water for watering, ideally making use of solar electricity too. A small solar pump may not be powerful enough to pull water to the top of the building however this would need further investigation. The following solar pump can be used for farm watering:

https://tinyurl.com/y7usus9j

There are a number of watering options that use solar power to water from a butt. A good example of this can be found here:

https://tinyurl.com/ybw8egy5

As the greenhouse is currently watered by a hose from the mains tap, there will be some saving on the water bill as a result of this measure. Savings are dependant on the method of collection and the how much water storage is installed.

Actions

- Investigate options for using solar power to bring water from water butts for greenhouse and garden watering.

Costs and savings

Costs are estimated as £60 based on the Wesfalia watering set in the second link.

ENERGY SAVINGS RECOMMENDATIONS

Consider adding solar PV panels		
Energy saving (kWh)	**Cost saving (£)**	**Cost of action (£)**
0	0	145

You are interested in using solar power to bring some light to your recycling sheds. Solar panel lighting systems can be purchased as a set to light otherwise unlit sheds and outbuildings similar to your recycling shed. They store solar power during the day and discharge at night when required to power lights. For example see:

http://www.photonicuniverse.com/en/catalog/full/189-25W-Off-Grid-Solar-Lighting-System-with-4-LED-Lights-Solar-Panel-and-Battery.html?gclid=EAIaIQobChMIvcqV7s252QIVRUAbCh3VAQF0EAQYAiABEgIVUfD_BwE

These systems may not provide sufficient light to give adequate lighting for use of equipment such as a lathe.

Actions

- Assess the practicality of PV panels on your recycling shed roof or nearby, e.g. will your flat roof would bear the weight? Will summer tree cover block out the sun on the panels?
- Assess the use of this lighting. Is it for general background lighting or is it needed for close work?

Costs and savings

Cost is estimated as £145 based on the above link.

FURTHER RESOURCES

FUNDING

Possible sources of funding for the recommendation in this report:

OxFutures – 25% funding towards the cost of energy reduction and generation measures. Contact Alison Grunewald E-mail: alison.grunewald@lowcarbonhub.org.

TOE2 – Grants of up to £5000 for energy efficiency actions. http://www.trustforoxfordshire.org.uk/ Contact Lynn Parker admin@trustforoxfordshire.org.uk

Carbon Trust Green Business Fund - https://www.carbontrust.com/client-services/programmes/green-business-fund