ZERO WASTE SCOTLAND

Energy Efficiency Business Support

Energy Efficiency Assessment

Prepared for :

John M Drysdale and Co

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Investing in a Smart, Sustainable and Inclusive Future

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1 Customer and Advisor Details

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Service	Energy Efficiency Business Support

Assessment details	
Assessment Date	8th February 2021
Report Approved By	Victoria Thomson
Date Approved	8th March 2021

Zero Waste Scotland's Energy Efficiency Business Support Service provides free support to help Scottish small and medium sized-enterprises (SMEs) save energy and reduce their carbon emissions. We identify savings opportunities and can also support the implementation of the opportunities identified. This can include helping to identify suppliers, design and assess the results of quote or tender specifications and identify and secure funding.

Obtaining our support on a particular project does not exclude you from obtaining further support.

Zero Waste Scotland's Energy Efficiency Business Support Service is delivered as part of our Resource Efficiency Circular Economy Accelerator programme, which helps SMEs become resource efficient and create a more circular economy. It is funded with support from the Scottish Government and European Regional Development Fund.

2 Your Journey to Net-Zero Carbon

This assessment was carried out on 8 February 2021 by Mark Tamburrini of Tamburrini Energy Consultants on behalf of Zero Waste Scotland's Energy Efficiency Business Support Service. The main site contact was Renwick Drysdale, Manager of John M Drysdale and Co.

This report follows an assessment for the Client in May 2020 which recommended the installation of a water source heat pump, a solar PV system and LED lights for the proposed glass house development. The Client is opting not to install the recommended water source heat pump until there is more clarity on whether a financial support scheme will be introduced after 31 March 2021 to replace the renewable heat incentive (RHI) and encourage a £450,000 investment.

The Client plans to utilise LED lighting to provide heating between May 2021 (when the glass house is expected to be erected and operational) and Autumn 2021 when a larger heat source will be required to be installed. The Client will wait until late summer 2021 to decide on a suitable heat source for the development.

The Energy Efficiency Business Advisor agreed the scope of work with Renwick Drysdale. The scope of work for this assessment was to: review the opportunity for battery storage to be utilised on site with the solar PV recommendations; and identify potential significant energy efficiency improvements that are discussed during the telephone call. The Manager has contacted the distributed network operator (DNO) and confirmed the local grid infrastructure will not permit exporting energy generated by a solar PV system to the grid and, therefore, wants to pursue the option of battery storage and solar PV.

Scotland has committed to becoming a net-zero society by 2045 which is in line with the advice from the UK Government's independent expert advisors, the UK Committee on Climate Change. To help you understand how your enterprise can support that transition, we have identified that your site has the following carbon emissions and we have identified how you can reduce them to support Scotland's net-zero goals:

Annual carbon impact		Equivalent average car miles
Current carbon emissions (tonnes CO_2e[i])	24.50	86,648
Potential carbon reduction	92%	79,573

Note that the total realised carbon saving may be less if all the recommendations from this report are implemented as the potential savings from each recommendation are calculated in isolation from each other. In reality some measures may affect the potential carbon savings of other measures. Please note that this analysis does not constitute a full carbon footprint.

Recommendations are made in this report to install a 120kWp solar PV system (with battery storage) on the roof of the glass house and shed. Savings of £17,265, 22.5 tonnes of CO_2 and 96,720kWh per year could be possible for an estimated installation cost of £156,600 resulting in a simple payback of nine years. We have assumed all the energy generated by a 120kWp solar PV system (connected to battery storage) will be consumed on site.

We have included an assessment of different sizes of solar PV systems (with battery storage) in the *'Alternative Opportunities'* section of the Recommendation Table to enable the Company to make its own informed decision once quotes are obtained and predicted daily electricity demand profiles at the site are available.

[i] CO_2e means "carbon dioxide equivalent". It is a standard way of presenting the impact considering all associated greenhouse gas emissions.

2.1 Recommendation Table

RECOMMENDED OPPORTUNITIES									
		Finance						Annual environmental saving	
		Annual cost savings	**Annual income generated**	**Investment required**	**Payback**	**Potential cashback**	**Payback with cashback**	**Energy**	**CO_2e**
Item	**Description**	£ (excl VAT)	£ (excl VAT)	£ (excl VAT)	Years	£	Years	kWh	tonnes
1	Install a 120kWp solar PV system with battery storage	£17,265	£0	£156,000	9.0	£0	9.0	96,720	22.5
	TOTAL	**£17,265**	**£0**	**£156,000**				**96,720**	**22.5**
ALTERNATIVE OPPORTUNITIES									
1	Install a 100kWp solar PV system with battery storage	£14,387	£0	£131,000	9.1	£0	9.1	80,600	18.8
2	Install a 90kWp solar PV system with battery storage	£12,948	£0	£117,900	9.1	£0	9.1	72,540	16.9
3	Install a 80kWp solar PV system with battery storage	£11,510	£0	£105,200	9.1	£0	9.1	64,480	15.0
4	Install a 70kWp solar PV system with battery storage	£10,071	£0	£92,050	9.1	£0	9.1	56,420	13.2
5	Install a 60kWp solar PV system with battery storage	£8,632	£0	£79,500	9.2	£0	9.2	48,360	11.3

Please note that implementing multiple measures may impact on each other and this may result in the realised savings being less than 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 Zero Waste Scotland's Energy Efficiency Business Support Service to quantify the impact of implementing multiple measures where they impact on each other.

Zero Waste Scotland's Energy Efficiency Business Support Service can support you to implement the recommendations we have suggested in this report. We will therefore contact you to discuss how we can support you further

3 Description of Support Provided

3.1 Scope of Work

The Energy Efficiency Business Advisor agreed the scope of work with the Manager of John M Drysdale and Co. The scope of work for this Implementation Advice was to review the opportunity for battery storage to be utilised on site with the solar PV recommendations.

3.2 Site Background

John M Drysdale and Co also owns KF Forestry, a woodland management and arboriculture business. The Company plans to develop a community woodland site in Kirkcaldy by erecting a glass house, which will be used to germinate tree seedlings, and a shed. The shed will be contiguous with the glass house. The total floor area of the glass house is 2,304m^2 whilst the estimated floor area of the shed is 288m^2. The shed will be used for storage and will not be heated.

3.3 Current resource consumption at the site

The Client was unable to provide annual energy consumption for the site because the development has not yet started. The glass house is required to be heated to a temperature of 18˚C. However, the Client has opted not to commit to the installation of a renewable heating system until early autumn. He hopes, by this time, there is more clarity on the potential financial incentive (i.e. a scheme to replace the renewable heat incentive) for a predicted £450,000 investment for a water source heat pump.

As such, Table 1 provides a summary of the estimated energy consumption, cost, and CO_2 emissions from proposed LED lighting which will be installed in the proposed development. Lighting is likely to be the greatest energy consumer on the site after heating.

Table 1: Summary of energy consumption, costs and CO_2 emissions

Estimated current annual energy use				
Resource	**Cost**	**Consumption**	**Units**	**CO_2e emissions (Tonnes)**
Electricity	£18,759	105,090	kWh	24.50
TOTAL	**£18,759**	**105,090**	**kWh**	**24.50**

Note: Electricity consumption for lighting only = 228 lights x 0.2kW (LED lights) x 2,004 hours = 105,090kWh (including 15% for gear losses).

The unit cost for electricity, provided by the Client, used in calculating savings is 17.85 p/kWh (excluding VAT and standing charges). The electricity cost above includes the Climate Change Levy.

Note:

- The costs in this table do not include standing charges and other costs.
- When calculating the potential savings of opportunities, unit costs which exclude standing charges have been used to calculate these as reducing consumption will often not reduce the standing charges.
- The CO_2e emissions detailed above are not equivalent to a carbon footprint for the site.
- It may be beneficial to you to renegotiate your resource contracts if you are going to significantly change your consumption. It is also good practice to regularly review your energy tariffs to ensure they meet your requirements. By changing your tariff or supplier you may be able to decrease your energy 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.

4 Detailed Energy Efficiency Opportunities

The assumptions and calculations for the renewable energy measure identified below are shown in *Appendix 1 – Supporting calculations*.

4.1 Solar PV with Battery Storage

The ideal location for a solar PV system (to maximise output) in Scotland is between 45 degrees east of south and 45 degrees west of south. A solar PV array could be installed on the roof of the proposed shed and glass house which have a total of 15 south facing roof pitches.

The structural integrity of the pitched roofs should be specified to take the weight of solar PV arrays. Space should also be made available in the design of the shed to install inverters, PV distribution board and total generation meter. The Client has also sourced transparent solar PV panels designed to be used on the roofs of glass houses.

The Client has confirmed with the distributed network operator (DNO) that the local grid infrastructure will not permit export of energy. As such, the Client wants to install battery storage to minimise the requirement for importing energy and to prevent the need to export energy. The daily seasonal electricity demand profile on the site, without heating, is not known and out with the scope of this work to determine. The daily seasonal electricity demand could vary significantly and as such, the size of battery (or batteries) required is estimated to match the kWp rating of the solar PV system for the purpose of the report.

As a guideline on installation cost for the Client, we have seen quotes of £485/kWh for 348kWh of battery storage in January 2019 and £528/kWh for 27kWh of battery storage in April 2020. We have, therefore, applied an estimated installation cost of £500/kWh for the cost of battery storage to each of the solar PV and battery storage scenarios assessed in this report.

We have assessed the following solar PV system and battery storage options for the development: 120kWp (with 120kWh battery storage); 100kWp (with 100kWh battery storage); 90kWp (with 90kWh battery storage); 80kWp (with 80kWh battery storage); 70kWp (with 70kWh battery storage); and 60kWp (with 60kWh battery storage).

4.1.1 Project Description and Recommended Solution

We recommend installing a 120kWp system with 120kWh of battery storage on the basis that this system could provide the greatest cost savings with a marginally quicker payback period than the other options assessed. However, the alternative options are presented to allow the Client to make an informed decision once more accurate electricity demand profiles become available (especially in summer when lighting could be switched off and the solar PV system generates the greatest power), quotes are obtained, and the available budget is confirmed.

4.1.2 Benefits, Costs and Finance

Savings of £17,265, 22.5 tonnes of CO_2 and 96,720kWh per year could be possible for an installation cost of £156,000 resulting in a simple payback period of nine years. The battery (or batteries) store electricity to use whenever is necessary or desired. Batteries would accumulate excess energy generated by the PV systems during the day and store it to be used at night (e.g. lights switched off in the glass house on summer days and switched on overnight to promote growth) or when there is no other energy input.

Financial support for installing energy efficiency and/or renewable energy equipment in Scotland is available through the SME Loan scheme[1] which offers SMEs including charities interest-free loans from £1,000 to £100,000 for measures with a payback of 20 years or less. Loan repayments are made over an 8-year period.

For non-renewable energy efficiency measures and air source heat pumps that also provide cooling, the Scottish Government is issuing a 30% cashback to SME Loan recipients for a limited time while funds last. Loan recipients may receive 30% of their project cost back, up to a maximum of £10,000.

For renewable heat measures, excluding air source heat pumps that also provide cooling, the Scottish Government is offering a 75% cashback to SME Loan recipients for a limited time while funds last. Loan recipients may receive 75% of their project cost back, up to a maximum of £10,000 if they choose not to receive the RHI. This cashback would be additional to any received for non-renewable energy-saving measures.

For other renewable energy measures, such as photovoltaics and wind turbines, an SME can apply for the interest-free loan, as for non-renewable or renewable heat measures but there is no cashback.

This report on the cost savings is regarded as a qualifying report for the SME Loan scheme if required. Download the SME Loan application form[ii] using the link below.

If you decide to apply for an SME Loan then the interest foregone on your loan, and any grant received, are regarded as state aid under European rules and are granted as de minimis aid. An estimate of how much aid this might equate to is provided in *Appendix 2 – Potential de minimis*.

4.1.3 Risks and Alternative Solutions

Solar PV is an established renewable technology; however, the Client needs to ensure the structural design of the glass house and shed roofs can support a solar PV system of this scale. We have assumed the solar PV array could be installed at the lower end of the cost scale on the basis that access to the roofs (i.e. scaffolding) will already be provided by the main contractor as part of the build process. The Client should obtain quotes from at least three installers for accurate costs.

A solar PV array will accumulate dirt over the course of its operation. This reduces the light input to the panels and the power output of the modules. The majority of accumulated dirt will be washed away by rainfall; however, bird activity may be an issue at the site as rain will not remove bird droppings easily. We have assumed there will be no shading on the solar PV array, further investigation is required to confirm this.

Cleaning agents should be used which do not damage solar PV panels, seals, or electrical connections. The wiring should also be inspected for arcing and corrosion. We have assumed that any maintenance could be undertaken in-house at no cost to the Company. However, the Company may not have the capacity to undertake any maintenance (e.g. visual checks, inspections and occasional cleaning) and as such, a maintenance cost may need to be factored into the business case.

We have carried out a basic assessment of the battery storage requirements at the site. However, the Client is likely to require a detailed electricity demand profile for the site to ensure battery storage requirements for the site's daily seasonal demand profile are correctly sized.

There are battery manufacturers who provide a 10-year guarantee; however, the Owner should factor in battery replacement after 15 years. We have not considered the potential annual maintenance or lifecycle costs of the batteries in this this report. Batteries in solar applications need to meet the demands of unstable grid energy, heavy cycling (charging and discharging) and irregular full recharging. There is a variety of battery types fitted for these unique requirements. Key considerations for battery selection include cost, cycle life, product warranty, installation, and maintenance. Types of batteries include lead acid, lithium-ion, and flow batteries.

The Client should note that the risks identified above apply to the five solution alternatives discussed below.

[ii] https://energy.zerowastescotland.org.uk/SMELoan

Solution Alternative 1 – Install a 100kWp solar PV system with battery storage

Solution Alternative 1 is to install a solar PV system rated at 100kWp with 100kWh of battery storage on the south facing roof pitches of the glass house and shed at an angle of inclination of 30 degrees and orientated due south. We have assumed 100% of the energy generated by a solar PV system of this size, including battery storage, would be consumed on site. Savings of £14,387, 18.8 tonnes of CO_2 and 80,600kWh per year could be possible for an installation cost of £131,000 resulting in a simple payback period of just over nine years.

Solution Alternative 2 – Install a 90kWp solar PV system with battery storage

Solution Alternative 2 is to install a solar PV system rated at 90kWp with 90kWh of battery storage on the south facing roof pitches of the glass house and shed at an angle of inclination of 30 degrees and orientated due south. We have assumed 100% of the energy generated by a solar PV system of this size, including battery storage, would be consumed on site. Savings of £12,948, 16.9 tonnes of CO_2 and 72,540kWh per year could be possible for an installation cost of £117,900 resulting in a simple payback period of just over nine years.

Solution Alternative 3 – Install an 80kWp solar PV system with battery storage

Solution Alternative 3 is to install a solar PV system rated at 80kWp with 80kWh of battery storage on the south facing roof pitches of the glass house and shed at an angle of inclination of 30 degrees and orientated due south. We have assumed 100% of the energy generated by a solar PV system of this size, including battery storage, would be consumed on site. Savings of £11,510, 15.0 tonnes of CO_2 and 64,480kWh per year could be possible for an installation cost of £105,200 resulting in a simple payback period of just over nine years.

Solution Alternative 4 – Install a 70kWp solar PV system with battery storage

Solution Alternative 4 is to install a solar PV system rated at 70kWp with 70kWh of battery storage on the south facing roof pitches of the glass house and shed at an angle of inclination of 30 degrees and orientated due south. We have assumed 100% of the energy generated by a solar PV system of this size, including battery storage, would be consumed on site. Savings of £10,071, 13.2 tonnes of CO_2 and 56,420kWh per year could be possible for an installation cost of £92,050 resulting in a simple payback period of just over nine years.

Solution Alternative 5 – Install a 60kWp solar PV system with battery storage

Solution Alternative 5 is to install a solar PV system rated at 60kWp with 60kWh of battery storage on the south facing roof pitches of the glass house and shed at an angle of inclination of 30 degrees and orientated due south. We have assumed 100% of the energy generated by a solar PV system of this size, including battery storage, would be consumed on site. Savings of £8,632, 11.3 tonnes of CO_2 and 48,360kWh per year could be possible for an installation cost of £79,500 resulting in a simple payback period of just over nine years.

5 Conclusion

John M Drysdale and Co is committed to energy efficiency and as such, requested Zero Waste Scotland's Energy Efficiency Business Support Service to identify energy saving measures which have a high probability of implementation.

The report estimates energy, associated cost, and CO_2 savings of 96,720kWh, £17,265 and 22.5 tonnes respectively through the installation of a 120kWp solar PV system with battery storage on the roof pitches of the Company's proposed glass house and shed.

6 Disclaimer

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7 Confidentiality

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For more information visit https://www.zerowastescotland.org.uk/privacy-policy

8 Appendix 1 – Supporting calculations

The carbon factor used for electricity in the supporting calculations below is 0.000233140 tCO_2/kWh.

DETAILED AND ALTERNATIVE OPPORTUNITIES

Solar PV analysis		**Alternative Opportunities**					
	Item 1	**1**	**2**	**3**	**4**	**5**	
Estimated installed peak capacity	120	100	90	80	70	60	
Estimated installation cost	£156,000	£131,000	£117,900	£105,200	£92,050	£79,500	kWp
Electricity Output (sourced from https://ec.europa.eu/jrc/en/pvgis)	806	806	806	806	806	806	
							kWh/kW Peak Power
Estimated SEG tariff	£0.04	£0.04	£0.04	£0.04	£0.04	£0.04	
Estimated % of energy generated by the solar PV system which could be consumed on site with battery storage installed	100%	100%	100%	100%	100%	100.00%	
Estimated annual energy generated by the solar PV system which could be consumed on site with battery storage installed	96,720	80,600	72,540	64,480	56,420	48,360	kWh
Estimated annual energy generated by the solar PV system which could be exported to the grid	0	0	0	0	0	0	kWh
CO_2 savings	22.5	18.8	16.9	15.0	13.2	11.3	tonnes
Annual savings							
Cost savings on imported energy	£17,265	£14,387	£12,948	£11,510	£10,071	£8,632	
Cost savings from exported energy	£0	£0	£0	£0	£0	£0	
Total CO_2 savings	22.5	18.8	16.9	15.0	13.2	11.3	tonnes
Total cost savings	£17,265	£14,387	£12,948	£11,510	£10,071	£8,632	
Payback period	9.0	9.1	9.1	9.1	9.1	9.2	years

9 Appendix 2 – Potential de minimis

Advice from Zero Waste Scotland's Energy Efficiency Business Support service

The advice that has been provided to you and this report are NOT classed as aid delivered under the European Commission's de minimis state aid regulations.

If you would like further advice to implement the recommendations or to look at further opportunities, then contact your advisor and they will help you. That support is also NOT classed as aid delivered under the European Commission's de minimis state aid regulations.

This means that the advice you receive does not count towards the limits that are set on de minimis aid.

Funding from the SME Loan

If you decide to apply to the SME Loan scheme for interest-free financial support then the interest foregone on your loan, and any grant received, are regarded as state aid under European rules and is granted as de minimis aid under Commission Regulation (EU) 1407/2013 (general de minimis), Commission Regulation (EU) 1408/2013 (production of agricultural products) or Commission Regulation (EU) 717/2014 (fisheries and aquaculture products).

The value of the interest foregone will depend on which measures you apply for and whether a grant is available however we have estimated the potential value of de minimis that could apply to the recommendations made if there was no grant or cashback:

ESTIMATED DE MINIMIS ASSOCIATED WITH ACCESSING THE SME LOAN					
Item	**Description**	**Investment required**	**Potential SME Loan**	**Interest rate applied**	**Interest forgone**
1	Install a 120kWp solar PV system with battery storage	£156,000	£100,000	0%	£21,535.23

The information provided above is just an estimate and does not include any de minimis aid resulting from any supporting grants. The actual state aid that applies will be supplied to you in the offer letter from the SME Loan team if you decide to apply for the loan.

There is a ceiling of €200,000 (approximately £175,860) for all de minimis aid provided to any one firm over a 3-year period. For organisations involved in the production of agricultural products the ceiling is €15,000 (approximately £13,190) over a 3-year period and for organisations involved in the fisheries and aquaculture sector the ceiling is €30,000 over a 3-year period (approximately £26,379).

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Energy Efficiency Business Support