

# HUMSHAUGH COMMUNITY SOLAR PROJECT

## BUSINESS CASE



March 2023

# BUSINESS CASE

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This report has been prepared by Humshaugh Net Zero CIC.

This Project is supported by the BEIS funded Rural Community Energy Fund which is managed by the North East Yorkshire and Humber Energy Hub and administered by Tees Valley Combined Authority.

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# 1 EXECUTIVE SUMMARY

The Humshaugh Community Solar Project has been developed and supported by the local community. It has been established to generate electricity locally and to offer an investment opportunity for the local area. We want to be able to offer the lowest cost electricity to our community.

The planning application has been supported by the community, and to date, there have been no objections to the project. A decision is due by the end of March 2023.

The technical design for the project is complete and final pricing for all elements will be obtained after planning permission secured.

Discussions on the source of funding are underway and will be the major activity for the next 3 months.

The financial returns for the project are adequate for a community project and, with the correct structure, will allow for any surpluses to be used locally, especially on fuel poverty projects.

The capital cost of the project is estimated to be £1,310,000. The operational costs will be £43,000 per annum. The effect of inflation will effect the power purchase agreement most, as the main expenditure is capital in the first year. The financial analysis is based on real figures i.e. excluding inflation in future years.

The project will generate, on average, 923,00 kWh annually. Income depends on the level of power purchase agreement. At £150/MWh this will create an annual revenue stream of £138,000.

The aim is to secure equity and grant funding for the project, using a community share issue. This will provide a maximum return of 4% to investors.

On these assumptions the nominal internal rate for return for the project is 3.6%. Based on 50% equity, 50% debt over 20 years at an interest rate of 4%, the Equity internal rate of return is 3.1%

These returns are adequate for a community project and allow us to move on to the next steps of finance raising and project execution.

## 2 BACKGROUND

Humshaugh is a parish near Hexham in Northumberland, England. The village had a population of 622 in the 2011 census, and is just north of Chollerford, which is located near Chesters Fort on Hadrian's Wall and is about 21 miles west of Newcastle upon Tyne. There are approximately 350 households in the Parish.

A Climate Emergency was declared by Northumberland County Council on 11<sup>th</sup> June 2019<sup>1</sup>.

A Climate Emergency was declared by Humshaugh Parish Council on 9<sup>th</sup> January 2020<sup>2</sup> and reaffirmed on 8<sup>th</sup> July 2021<sup>3</sup>.

In 2019 informal discussions were held to determine how Humshaugh might tackle the issues needing to be addressed to reach Net Zero within the parish by 2030. It was concluded that the first activity would be to estimate the domestic carbon emissions of the parish. A study was carried out by Newcastle University CURDS and published in June 2020. The estimated annual emissions of CO<sub>2</sub> was estimated to be 5307 tonnes<sup>4</sup>. This excluded the contribution from agriculture.

Humshaugh Net Zero CIC was formed in July 2020. Invitations to join the organisation were sent out within the parish and there are currently over 55 members. Funding was obtained from the RCEF 15 programme, administered by The North East, Yorkshire and Humber Energy Hub<sup>6</sup> to look at the potential for each of the following technologies: solar, wind, hydrogen, heat pumps, grid, smart meters, smart energy trading, anaerobic digestion, and hydro. It established the easily identifiable

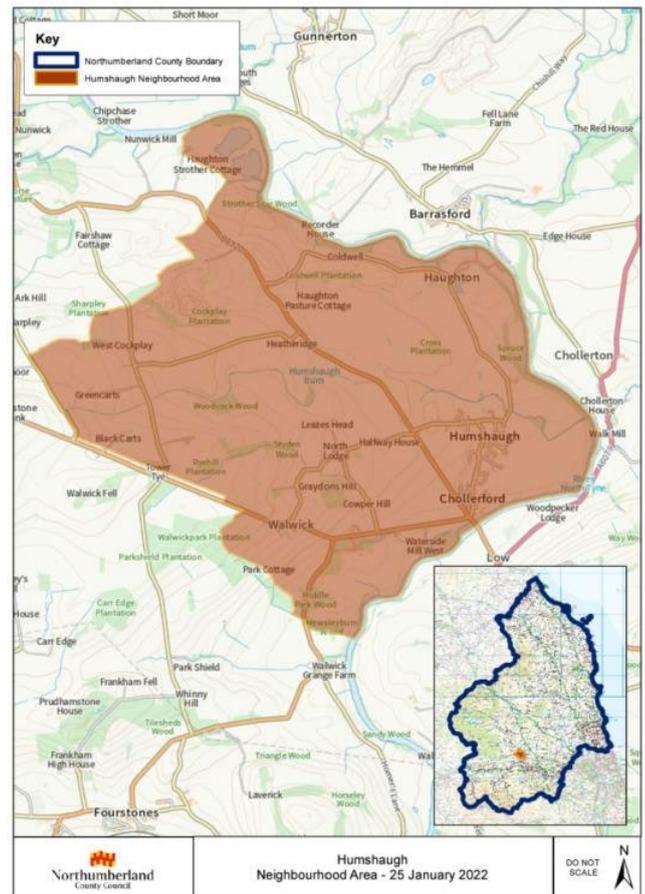


FIGURE 1 HUMSHAUGH PARISH

<sup>1</sup> <https://data.climateemergency.uk/councils/northumberland-council/>

<sup>2</sup> <https://northumberlandparishes.uk/sites/default/files/parish-councils/documents/2020/September/Minutes%20draft%20Bi-monthly%20%28HPC%29%20-%2009%20Jan%202020.pdf>

<sup>3</sup> <https://northumberlandparishes.uk/sites/default/files/parish-councils/documents/2021/July/Minutes%20Humshaugh%20Parish%20Council%20Meeting%208%200July%202021.docx.pdf>

<sup>4</sup> <https://www.humshaughnetzero.org/rcef-reports/humshaugh-baseline-survey>

<sup>5</sup> <https://www.gov.uk/guidance/rural-community-energy-fund>

<sup>6</sup> <https://teesvalley-ca.gov.uk/business/key-sectors/energy-and-renewable/the-north-east-yorkshire-and-humber-energy-hub/>

constraints applicable in the Parish. Reports identified which technologies could make a significant contribution to reducing the carbon dioxide emissions as a result of human activities and lifestyle, as revealed in the 2020 survey of the Parish. The reports also showed that there was an economically viable route to Net Zero for electricity, heating and transport through the use of wind, solar and heat pumps especially when combined with smart energy controls and trading. Exactly how was the next question and would involve discussions with the community, landowners, the Parish Council, Northumberland County Council, electricity suppliers and equipment suppliers. From these discussions it was decided to initially proceed with a feasibility study for a solar pv project and support was obtained from the RCEF 2<sup>7</sup> programme.

This report sets out the Business Case for a 1 MW solar pv project within Humshaugh parish.

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<sup>7</sup> <https://www.gov.uk/guidance/rural-community-energy-fund>

### 3 PROJECT DESCRIPTION

#### 3.1 Site Location

A location for the project was identified close to Lincoln Hill, Humshaugh.

Historically the land had been used in the 19<sup>th</sup> century for a limestone mining operations. As such the condition of the existing land is poor. Therefore the land was not being used for any arable or livestock farming.

The landowner was approached and Heads of Terms for the project were agreed.

An Agreement a draft Lease has been agreed and the key terms are that the lease is for a 25 year term with agreed commercial payment terms.

Access to the site is from the U8144, accessed from the B6320 to the west of Humshaugh village. An automatic traffic survey performed for the planning application shows that the road does not have heavy usage or speed.

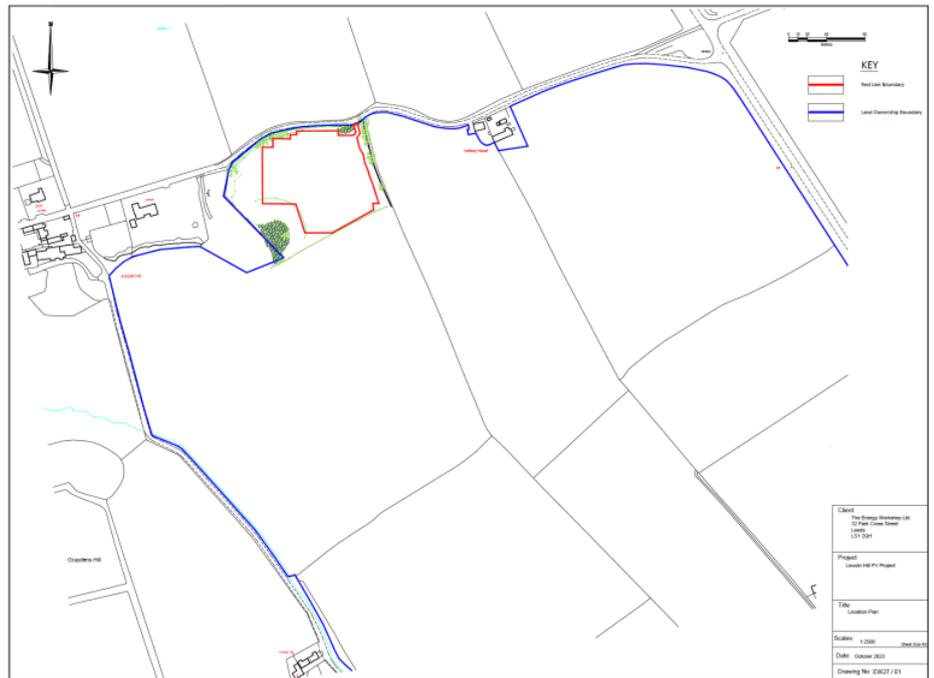


FIGURE 2 SITE LOCATION



FIGURE 3 AERIAL PLAN OF SITE

### 3.2 Detailed Site Layout

A design for a 1 MW solar pv project was prepared with an array layout.

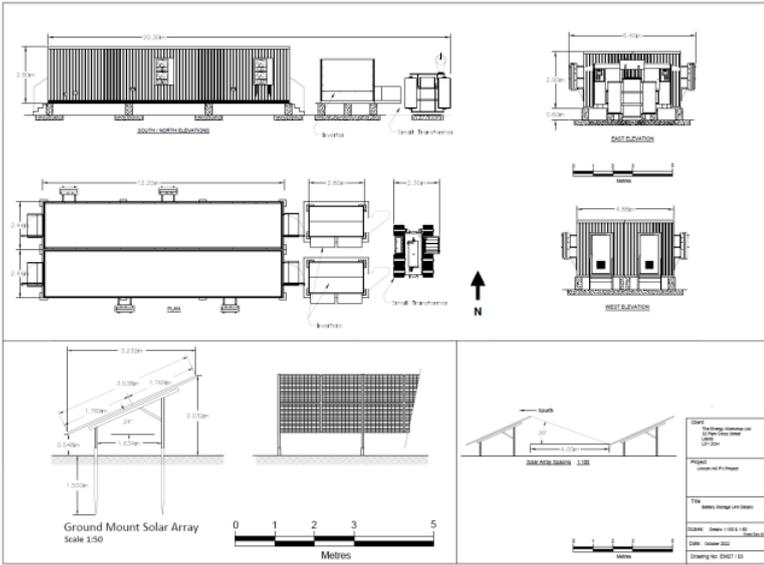
Associated buildings and equipment were also identified including grid connection, transformers, inverters, battery storage and offices.



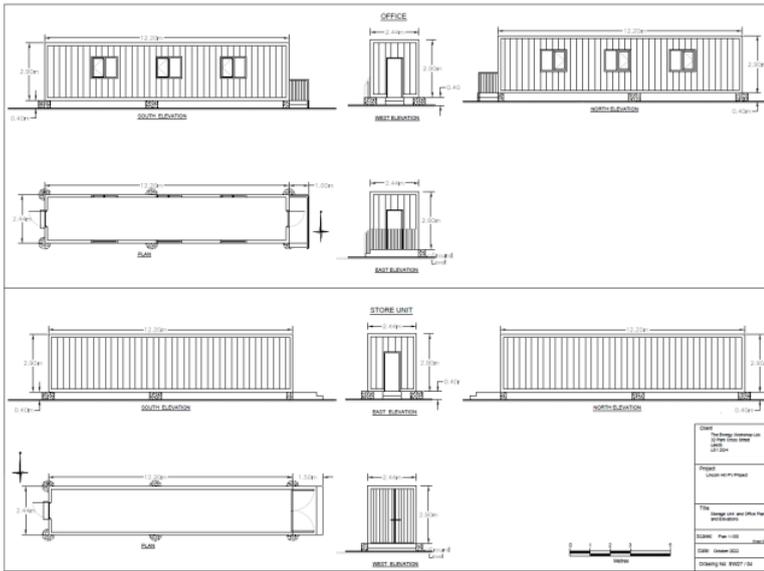
FIGURE 5 LAND OWNERSHIP



FIGURE 4 ARRAY LAYOUT



**FIGURE 7 EQUIPMENT ELEVATIONS**



**FIGURE 6 BUILDING ELEVATIONS**

## 4 PLANNING APPLICATION

A planning application was made on 26th October 2022 for a 1 MW solar array with associated grid connection & storage.

This followed a local consultation event in Humshaugh Village Hall, a leaflet drop to local residents, notices in the local press and an article in the Hexham Courant. To date there have been no objections to the project.

Construction/operation of 1 Megawatt (2100no 540w panels in 13 rows) solar array, associated energy storage project with works including installation of ancillary equipment. 

Land East Of Halfway House Lincoln Hill Humshaugh  
Northumberland

Ref. No: 22/03978/FUL | Received: Wed 26 Oct 2022 | Validated: Mon 05 Dec 2022 | Status: Registered

**FIGURE 8 PLANNING NOTICE**

A recent consultation for the Humshaugh Neighbourhood Plan showed over 91% support for a large scale solar pv project within the parish<sup>8</sup>.

There have been no objections to the project from Historic England. NCC Highways Development Management requested further information, which has been supplied. No objection received from NCC Environment & Design Team. Positive support has been received from NCC Climate Action Team.

Feedback from the planning team indicate decision to be made by the end of March, 2023.

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<sup>8</sup> <https://humshaugh.info/consultation/>

# 5 TECHNICAL

## 5.1 Ground works

The location of the site is a 1 ha field which is currently used for set aside. The quality of the land is poor with little vegetation cover. The entrance to site is from the minor U8144 road which is between the B6320 and Lincoln Hill. The site entrance will be widened, and 2 new secure gates will be fitted. The access will be widened and there will be a hardcore track laid from the entrance, including turning extension, to the location of the electrical containers.



FIGURE 10 SITE CONDITIONS

The track will use a geotextile base before the hardcore is laid. The electrical containers will be located on 6 x 300mm square concrete foundation points. There will be parking spaces laid for site vehicles.

spaces laid for site vehicles.

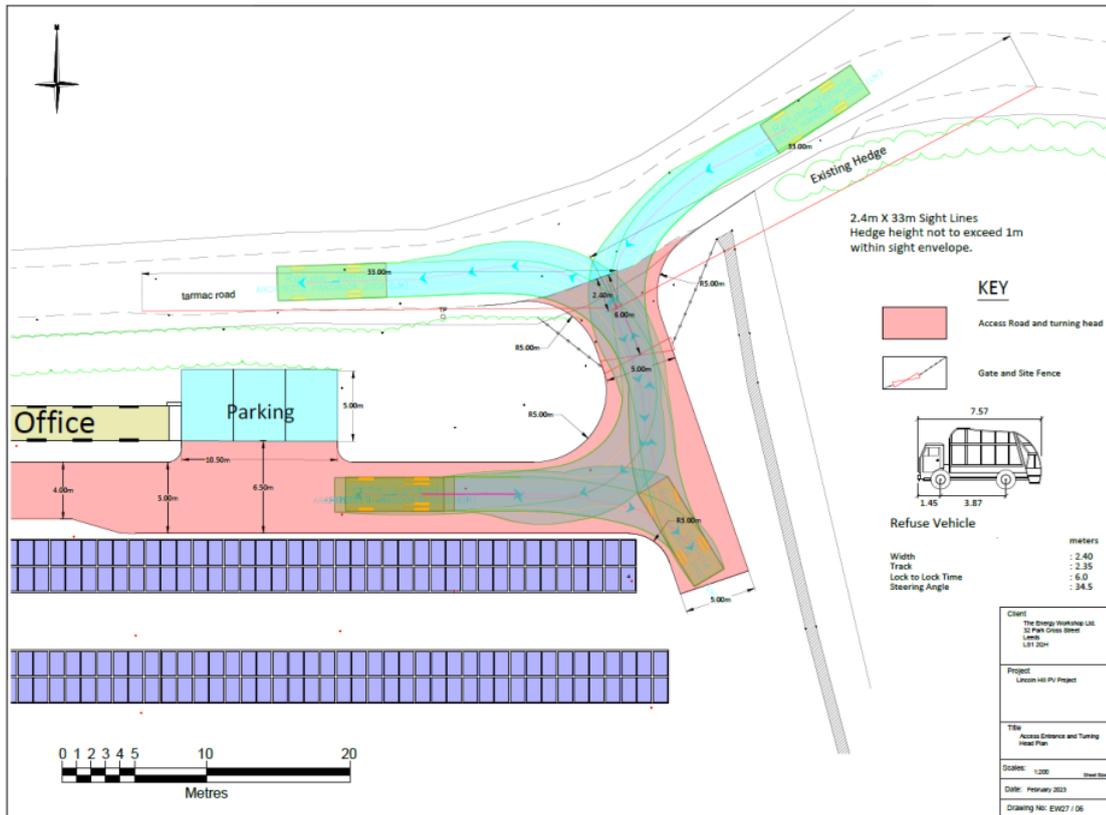


FIGURE 11 SITE ACCESS DETAILS



### 5.3 PV array

The pv array will consist of thirteen strings of panel, with a total of 1752 540W panels. Each string will be connected to an inverter. The panels will be mounted on ground mount frames.



FIGURE 13 PV ARRAY LAYOUT

The output of the project is estimated to be 975 kWh from the project. The yield reduction due to shading will be 6.2%.

CO2 emissions avoided each year will be 433,877 kg.

Details of the candidate pv panels and inverters are shown in APPENDIX A.

## 6 PROJECT PLAN

The current supply chain waiting time is 3-4 months for pv panels, 6 months for HV equipment and 6-9 months for grid connection.

The project plan from financial close is expected to be as follows, remembering that winter construction periods will be avoided.

	M1	M2	M3	M4	M5	M6	M7	M8	M9
Financial close									
Procurement completed									
Site clearance & roads									
Grid connection									
HV works									
PV installation									
Commissioning									

## 7 FINANCIAL PROJECTIONS

### 7.1 Capital Expenditure

#### 7.1.1 Site Establishment

Item No.	Item Description	Unit	Quantity	Sub-total
<b>Item 1 - Foundations</b>				
	Inverters	£ 2,250	2	£ 4,500
	Battery store	£ 2,250	2	£ 4,500
	<b>Item 1 - Total</b>			<b>£ 9,000</b>
<b>Item 2 - Tracks</b>				
	Clear site			2,000
		£ 2,000	1	
	Removal of soil, geotextile and 300mm of stone	£ 155	100	£ 15,500
	<b>Item 2 Total</b>			<b>£ 15,500</b>
<b>Item 3 - Fencing and Gates</b>				
	V3 mesh	£ 5,400	1	£ 5,400
	Installation and foundations	£ 1,600	2	£ 3,200
	Gates	£ 4,500	1	£ 4,500
	Signage	£ 1,000	1	£ 1,000
	<b>Item 3 - Total</b>			<b>£ 14,100</b>
<b>Item 4 - Contingency</b>				
		10,000		
		£ 0	1	£ 10,000
	<b>Grand Total</b>			<b>£ 48,600</b>

## 7.1.2 Grid Connection

Item No.	Item Description	Unit	Quantity	Sub-total
<b>Item 1 - Preliminaries</b>				
	Ground surveys	£ 2,000	1	£ 2,000
	Welfare and Security	£ 1,000	1	£ 1,000
	<b>Item 1 Total</b>			<b>£ 3,000</b>
<b>Item 2 - Electrical</b>				
	20kV Electrical Design	£ 10,000	1	£ 10,000
	20 kV metered switch gear	£ 35,000	1	£ 35,000
	20kV Cable	£ 123	450	£ 55,440
	20 kV cable terminations	£ 1,650	2	£ 3,300
	cable laying	£ 72	450	£ 32,175
	Earthing Measurements and Design	£ 2,000	1	£ 2,000
	Earthing	£ 2,000	1	£ 2,000
	<b>Item 2 Total</b>			<b>£ 139,915</b>
<b>Item 3 - Metering</b>				
	Install metering	£ 2,000	1	£ 2,000
	<b>Item 3 Total</b>			<b>£ 2,000</b>
	<b>Grand Total</b>			<b>£ 144,915</b>

### 7.1.3 Electrical HV

Item No.	Item Description	Unit	Quantity	Sub-total
<b>Item 1 - Preliminaries</b>				
	Ground surveys	£ 600	1	£ 600
	Electrical Design Civil Design	£ 2,000	1	£ 2,000
	Welfare and Security	£ 1,000	1	£ 1,000
	<b>Item 1 - Total</b>			<b>£ 3,600</b>
<b>Item 2 - Hire</b>				
	Crane for Installation	£ 5,000	1	£ 5,000
	<b>Item 2 Total</b>			<b>£ 5,000</b>
<b>Item 3 - HV Electrical</b>				
	20kV/0.4kV Transformer 1MVA	£ 15,000	1	£ 15,000
	HV Cable Terminations	£ 1,650	2	£ 3,300
	20kV switchgear customer side	£ 30,000	1	£ 30,000
	Control Cabling	£ 500	1	£ 500
	LV Cable Terminations	£ 303	1	£ 303
	20kV Cable £/M	£ 123	20	£ 2,464
	0.4kV Cable £/M x 3off	£ 168	5	£ 842
	Cable duct	£ 33	20	£ 660
	Switchgear Install and Test	£ 1,320	1	£ 1,320
	Battery	£ 3,000	1	£ 3,000
	Underground earthing system (Sub area only)	£ 5,500	1	£ 5,500
	Cable Installation/ Dig & Lay (Soft Dig)	£ 72	20	£ 1,430
	Commissioning	£ 5,000	1	£ 5,000
	<b>Item 3 - Total</b>			<b>£ 69,318</b>
<b>Grand Total</b>				<b>£ 77,918</b>

#### 7.1.4 Solar PV

The costs for the pv array have been estimated as follows:

- 1752 x JA Solar 540W panels
- Solis Inverters (5 years warranty)
- Ground mount system
- Electrical and Ancillary equipment
- Fully installed and commissioned

TOTAL £852,111 (Ex VAT)\*

#### 7.1.5 Project Management

An allowance of £20,000 has been allowed to cover required project management and engineering contract.

#### 7.1.6 Ancillary costs

A CCTV system will be installed. This will require a broadband connection.

Works will be carried out to enhance the land for wildlife.

- CCTV (5k)
- Broadband (£1k)
- Land works for wildlife (£5k)

#### 7.1.7 Financing costs

Construction insurance will be secured (£5k)

Interest during construction has been allowed for in costs (£20k)

## 7.2 Operational Costs

### 7.2.1 Rent

The agreements secured require annual payments for £16,000, reviewed every 5 years.

### 7.2.2 Rates

The estimate for rates is £10,000 per annum.

### 7.2.3 Electrical charges

The estimate for charges to use the electrical system and any imports is estimated at £3000 per annum.

### 7.2.4 Management & Maintenance contract

The cost for annual management maintenance is estimated to be £11,000.

### 7.2.5 Insurances

Annual insurances will cost £5000.

### 7.2.6 CCTV & Broadband

The annual costs will be £1000.

### 7.2.7 Accounting

The annual accounting cost will be £3000

## 7.3 Power Purchase Sales

Discussions are underway for securing the best power purchase agreement for a community solar project.

The current estimate is £150 /MWh although it could be possible to achieve a higher figure.

## 8 FINANCIAL PROJECTIONS

### 8.1 CAPEX Summary

<b>CAPEX SUMMARY</b>	<b>£k</b>
Construction insurance	5
Site establishment	49
Grid connection	145
HV electrical	78
PV Array	853
Project management/engineer	20
Ancillaries	41
Storage inverter	50
Contingency	50
Interest during construction	20
<b>TOTAL</b>	<b>1,310</b>

### 8.2 OPEX Summary

<b>OPEX</b>	<b>£k</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>
Rent	(16)	(16)	(16)	(16)	(16)	(16)	(16)
Rates	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Management	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Insurance	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Office	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Accounting	(3)	(3)	(3)	(3)	(3)	(3)	(3)
CCTV	(1)	(1)	(1)	(1)	(1)	(1)	(1)
O&M	(4)	(4)	(4)	(4)	(4)	(4)	(4)
	0	0	0	0	0	0	0
	<b>£k</b>	<b>0</b>	<b>(46)</b>	<b>(46)</b>	<b>(46)</b>	<b>(46)</b>	<b>(46)</b>

## 8.3 Profit & Loss

PROFIT & LOSS	£k	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Sales		0	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
Costs		0	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
<b>Profit before Interest &amp; tax &amp; depreciation</b>		<b>0</b>	<b>95</b>																			
Loan Interest		0	(26)	(25)	(24)	(23)	(22)	(21)	(20)	(19)	(18)	(17)	(16)	(14)	(13)	(12)	(10)	(9)	(7)	(5)	(4)	(2)
Depreciation		0	(66)	(62)	(59)	(56)	(53)	(51)	(48)	(46)	(43)	(41)	(39)	(37)	(35)	(34)	(32)	(30)	(29)	(27)	(26)	(25)
<b>Profit after interest and depreciation</b>		<b>0</b>	<b>4</b>	<b>8</b>	<b>12</b>	<b>16</b>	<b>20</b>	<b>23</b>	<b>27</b>	<b>30</b>	<b>34</b>	<b>37</b>	<b>41</b>	<b>44</b>	<b>47</b>	<b>50</b>	<b>53</b>	<b>57</b>	<b>60</b>	<b>63</b>	<b>66</b>	<b>69</b>
Taxation		0	0	0	0	0	0	0	0	0	0	0	0	0	(2)	(10)	(11)	(12)	(12)	(13)	(13)	(14)
<b>NET PROFIT</b>		<b>0</b>	<b>4</b>	<b>8</b>	<b>12</b>	<b>16</b>	<b>20</b>	<b>23</b>	<b>27</b>	<b>30</b>	<b>34</b>	<b>37</b>	<b>41</b>	<b>44</b>	<b>47</b>	<b>48</b>	<b>43</b>	<b>45</b>	<b>48</b>	<b>50</b>	<b>52</b>	<b>55</b>

## 8.4 Balance Sheet

BALANCE SHEET	£k	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
<b>FIXED ASSETS</b>		1,310	1,245	1,183	1,124	1,067	1,014	963	915	869	826	785	745	708	673	639	607	577	548	521	494	470
<b>CURRENT ASSETS</b>																						
Bank		0	47	94	142	189	236	283	331	378	425	472	520	567	614	660	702	738	774	809	843	877
<b>TOTAL CURRENT ASSETS</b>		0	47	94	142	189	236	283	331	378	425	472	520	567	614	660	702	738	774	809	843	877
<b>CURRENT LIABILITIES</b>																						
Tax		0	0	0	0	0	0	0	0	0	0	0	0	0	0	(1)	(5)	(6)	(6)	(6)	(7)	(7)
<b>TOTAL CURRENT LIABILITIES</b>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	(1)	(5)	(6)	(6)	(6)	(7)	(7)
<b>NET ASSETS</b>		<b>1,310</b>	<b>1,292</b>	<b>1,277</b>	<b>1,265</b>	<b>1,256</b>	<b>1,250</b>	<b>1,247</b>	<b>1,246</b>	<b>1,247</b>	<b>1,251</b>	<b>1,257</b>	<b>1,265</b>	<b>1,275</b>	<b>1,287</b>	<b>1,298</b>	<b>1,304</b>	<b>1,309</b>	<b>1,316</b>	<b>1,323</b>	<b>1,331</b>	<b>1,339</b>
<b>FINANCED BY:</b>																						
Equity		655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655
Loans		655	633	610	587	562	536	509	481	452	422	391	358	325	289	253	215	175	134	91	46	(0)
DSR																						
Retained Profit & Loss		0	4	12	23	39	59	82	109	140	173	211	251	295	342	391	434	479	527	577	629	684
<b>TOTAL</b>		<b>1,310</b>	<b>1,292</b>	<b>1,277</b>	<b>1,265</b>	<b>1,256</b>	<b>1,250</b>	<b>1,247</b>	<b>1,246</b>	<b>1,247</b>	<b>1,251</b>	<b>1,257</b>	<b>1,265</b>	<b>1,275</b>	<b>1,287</b>	<b>1,298</b>	<b>1,304</b>	<b>1,309</b>	<b>1,316</b>	<b>1,323</b>	<b>1,331</b>	<b>1,339</b>

## 9 FUNDING

The current project timetable is based on obtaining planning permission by the end of March 2023. When successful this will allow the final project timetable to be confirmed and funding to be raised. The expectation is that this is completed within 9 months, allowing construction to start in early 2024. The construction period on site should be 3 months.

The overall funding required for the project is £1,291,000. Funding will be a mixture of grant, equity and loan. Cash flow funding might be required to cover VAT payments.

Grant funding of £67,000 was received from RCEF 2, the BEIS funded Rural Community Energy Fund which is managed by the North East Yorkshire and Humber Energy Hub and administered by Tees Valley Combined Authority. This funding was to secure planning permission for the project, technical design and preparation for funding. This funding was spent by the end of March 2023.

The project is to be community owned. The aim is to secure a minimum of 50% equity from the community and the balance by loans with an interest rate of [4]%, secured on the asset.

The Green Deal Fund of the North of Tyne Mayoral Fund, administered by Amber Capital can support 50% of the funding of the project, up to a maximum of £2 million. They can provide a mix of grant, equity and debt to a community business. Discussions are ongoing.

Community share options are being discussed, candidate organisations that could assist include Shareenergy and Energy4all.

The Community Shares Booster Fund is provided by Power to Change and Architectural Heritage Fund and delivered in partnership with and delivered in partnership with Coops UK, Locality, Plunkett Foundation and Co-operative and Community Finance.

It can provide:

**Development grants** of between £2,000 and £10,000, averaging around £5,000, to prepare a community share offer. This support can cover financial planning, governance support, , marketing costs and being assessed for the Community Shares Standard Mark.

**Equity match investment** ranging from £10,000 to £100,000, although the typical investment is expected to be £20,000 to £50,000. This is an offer of investment to match money raised from the community, providing the minimum share offer target is achieved. Applications for equity match are open to community businesses that are investment ready, including those that have already launched their share offers.

**Subscription underwriting:** If affordability is an issue for community investors, Co-operative and Community Finance (CCF) can offer an interest-free repayable loan to enable people to buy shares through instalments over a maximum of 12 months, with the society receiving the full investment upfront.

**Loan finance** may be available from Cooperative and Community Finance (CCF).

Discussions have been held with the Climate Action Team of Northumberland County Council. They have indicated that they are aiming to provide long term loans and power purchase agreements.

Contact has been made with Octopus Energy to determine what power purchase agreements could be secured for the project.

Northern Powergrid have committed to supply a battery storage unit to the project – one that had been used on another project. Discussions are underway on how we could incorporate this into a joint project which would receive grant funding. This could include a fast EV charging point powered by the project which could be used by the village and by Northern Powergrid vehicles during extreme weather events.

# APPENDIX A. Equipment

## Candidate Solar Panel Details



Higher output power



Lower LCOE



Less shading and lower resistive loss

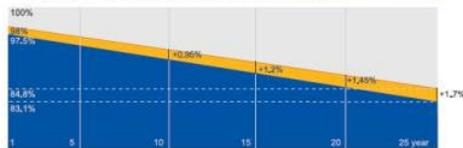


Better mechanical loading tolerance

### Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty

0.55% Annual Degradation Over 25 years



■ New linear power warranty ■ Standard module linear power warranty

### Comprehensive Certificates

- IEC 61215, IEC 61730, UL 61215, UL 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- ISO 45001: 2018 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval



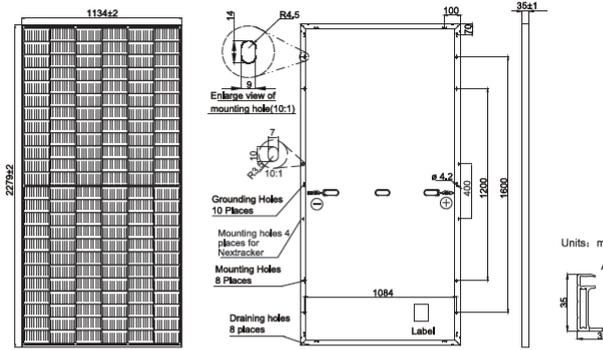
**JASOLAR**

[www.jasolar.com](http://www.jasolar.com)

Specifications subject to technical changes and tests. JA Solar reserves the right of final interpretation.



MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	28.6kg±3%
Dimensions	2279±2mm×1134±2mm×35±1mm
Cable Cross Section Size	4mm <sup>2</sup> (IEC) , 12 AWG(UL)
No. of cells	144(6×24)
Junction Box	IP68, 3 diodes
Connector	QC 4.10(1000V) QC 4.10-35(1500V)
Cable Length (Including Connector)	Portrait: 300mm(+)/400mm(-); Landscape: 1300mm(+)/1300mm(-)
Packaging Configuration	31pcs/Pallet, 620pcs/40ft Container

ELECTRICAL PARAMETERS AT STC

TYPE	JAM72S30 -530/MR	JAM72S30 -535/MR	JAM72S30 -540/MR	JAM72S30 -545/MR	JAM72S30 -550/MR	JAM72S30 -555/MR
Rated Maximum Power(P <sub>max</sub> ) [W]	530	535	540	545	550	555
Open Circuit Voltage(V <sub>oc</sub> ) [V]	49.30	49.45	49.60	49.75	49.90	50.02
Maximum Power Voltage(V <sub>mp</sub> ) [V]	41.31	41.47	41.64	41.80	41.96	42.11
Short Circuit Current(I <sub>sc</sub> ) [A]	13.72	13.79	13.86	13.93	14.00	14.07
Maximum Power Current(I <sub>mp</sub> ) [A]	12.83	12.90	12.97	13.04	13.11	13.18
Module Efficiency [%]	20.5	20.7	20.9	21.1	21.3	21.5
Power Tolerance	0~+5W					
Temperature Coefficient of I <sub>sc</sub> (α <sub>Isc</sub> )	+0.045%/°C					
Temperature Coefficient of V <sub>oc</sub> (β <sub>Voc</sub> )	-0.275%/°C					
Temperature Coefficient of P <sub>max</sub> (γ <sub>Pmp</sub> )	-0.350%/°C					
STC	Irradiance 1000W/m <sup>2</sup> , cell temperature 25°C, AM1.5G					

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer. They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

TYPE	JAM72S30 -530/MR	JAM72S30 -535/MR	JAM72S30 -540/MR	JAM72S30 -545/MR	JAM72S30 -550/MR	JAM72S30 -555/MR
Rated Max Power(P <sub>max</sub> ) [W]	401	405	408	412	416	420
Open Circuit Voltage(V <sub>oc</sub> ) [V]	46.18	46.31	46.43	46.55	46.68	46.85
Max Power Voltage(V <sub>mp</sub> ) [V]	38.57	38.78	38.99	39.20	39.43	39.66
Short Circuit Current(I <sub>sc</sub> ) [A]	11.01	11.05	11.09	11.13	11.17	11.21
Max Power Current(I <sub>mp</sub> ) [A]	10.39	10.43	10.47	10.51	10.55	10.59
NOCT	Irradiance 800W/m <sup>2</sup> , ambient temperature 20°C, wind speed 1m/s, AM1.5G					

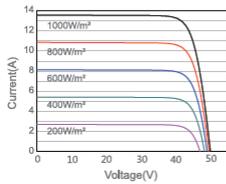
\*For NexTracker installations, Maximum Static Load, Front is 2000Pa while Maximum Static Load, Back is 2000Pa.

OPERATING CONDITIONS

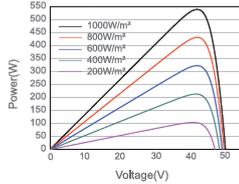
Maximum System Voltage	1000V/1500V DC
Operating Temperature	-40°C~+85°C
Maximum Series Fuse Rating	25A
Maximum Static Load, Front*	5400Pa(112lb/ft <sup>2</sup> )
Maximum Static Load, Back*	2400Pa(50lb/ft <sup>2</sup> )
NOCT	45±2°C
Safety Class	Class II
Fire Performance	UL Type 1

CHARACTERISTICS

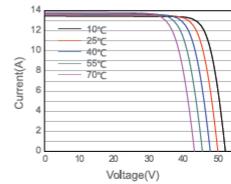
Current-Voltage Curve JAM72S30-540/MR



Power-Voltage Curve JAM72S30-540/MR



Current-Voltage Curve JAM72S30-540/MR



Premium Cells, Premium Modules

Version No. : Global\_EN\_20210531A



## Solis-(100-110)K-5G, Solis-125K-HV-5G

Solis Three Phase Inverters



### Features:

- ▶ 99% Max. efficiency
- ▶ Wide voltage range and low startup voltage
- ▶ 10 MPPT design with precise MPPT algorithm
- ▶ THDi<3%, low harmonic distortion against grid
- ▶ Anti-resonance, supporting over 6MW paralleled in one transformer
- ▶ Perfect commercial site monitoring solution
- ▶ Intelligent redundant fan-cooling
- ▶ Strings intelligent monitoring, Smart I-V Curve Diagnosis supported
- ▶ Fuse free design to avoid fire hazard
- ▶ Type II surge arrester for both DC and AC, type I surge arrester optional
- ▶ Leakage current repression technology
- ▶ Volt-watt work mode integrated
- ▶ DC input reverse alarm
- ▶ Optional anti-PID function integrated
- ▶ Integrated DC switches, AC switch optional



### Model:

- 400V: Solis-100K-5G    Solis-110K-5G
- 480V: Solis-125K-HV-5G

## APPENDIX B. Preapplication Response



### Northumberland County Council

#### Pre-Application Enquiry

Dan Grierson  
The Energy Workshop  
32 Park Cross Street  
Leeds  
LS1 2QH

Planning Ref: 22/00477/PREAPP  
Your Ref:  
Contact: Mr David Love  
Direct Line:  
E-Mail: David.love@northumberland.gov.uk  
Date: 10th August 2022

Dear Mr. Grierson,

**TOWN AND COUNTRY PLANNING ACT 1990 (AS AMENDED)  
ERECTION OF A COMMUNITY OWNED GROUND MOUNTED SOLAR ARRAY  
WITH AN INSTALLED CAPACITY OF CIRCA 0.5 MEGAWATTS  
LINCOLN HILL, HUMSHAUGH, NORTHUMBERLAND,**

#### Introduction

Thank you for your enquiry. Having taken the time to consider your proposal and assess the history of the site, I am now in the position to provide you with the following response.

#### Requirement for Planning Permission

The Town and Country Planning (General Permitted Development) Order 2015 refers to permitted development rights for a range of development not requiring planning permission. I have considered the content of your enquiry and conclude that **planning permission would be required** for the proposed development.

#### Site Constraints

- Areas of High Landscape Value
- Coal Advice Area
- Impact Risk Zone SSSI
- World Heritage Site Buffer Zone

When considering proposals for new development, the planning history of a site is a material consideration. The history for this site is set out below.

#### Planning History

None relevant

#### Relevant Planning Policy

##### National Planning Policy

NPPF - National Planning Policy Framework (2021)

NPPG - National Planning Practice Guidance (2021, as updated)

Development Plan Policy

STP 1 - Spatial strategy (Strategic Policy)  
STP 2 - Presumption in favour of sustainable development (Strategic Policy)  
STP 3 - Principles of sustainable development (Strategic Policy)  
STP 4 - Climate change mitigation and adaptation (Strategic Policy)  
ENV 1 - Approaches to assessing the impact of development on the natural, historic, and built environment (Strategic Policy)  
ENV 2 - Biodiversity and geodiversity  
ENV 3 - Landscape  
ENV 7 - Historic environment and heritage assets  
ENV 8 - Frontiers of the Roman Empire - Hadrian's Wall World Heritage Site

Other Documents/Strategies

Northumberland Landscape Character Assessment  
The Renewable Energy, Low Carbon Energy Generation and Energy Efficiency Study

**Consultee Responses**

County Archaeologist  
No response received.

Public Protection  
Standard comments.

Planning Strategy  
As a community-led project for renewable energy, the principle of development in policy terms is supported by the policies in the development plan. This on provision that the potential affects regarding landscape, visual impact and any impact on designated landscapes are assessed and considered acceptable.

**Main Considerations**

In assessing the acceptability of any proposal regard must be given to policies contained within the development plan unless material considerations indicate otherwise. The National Planning Policy Framework (NPPF) is a material consideration and states that the starting point for determining applications remains with the development plan, which in this case contains policies from the Northumberland Local Plan.

In relation to the principle of this development in policy terms, it is considered that the following main matters are relevant and need to be considered:

- Spatial strategy
- Principle of renewable energy development
- Impacts on Hadrian's Wall World Heritage Site

**Appraisal**

Introduction

This pre-application enquiry is for a solar array with associated infrastructure. The connection to the distribution network would be underground and the proposal would utilise the existing agricultural access onto the site. No existing trees or hedgerows would be affected and the opportunity would be taken to deliver some habitat enhancement and landscaping work within and around the site. The prospective applicant is the community group Humshaugh Net Zero. These comments focus on the principle of development.

The pre-application site is located to the south of Lincoln Hill road. It is currently unused scrub and is surrounded by agricultural land in all other directions.

In accordance with Section 38 (6) of the Planning and Compulsory Purchase Act 2004, planning applications must be determined in accordance with the development plan, unless material considerations indicate otherwise.

The National Planning Policy Framework (NPPF) (July 2021) and Planning Practice Guidance (PPG) are material considerations in determining any application as well as the National Design Guide which forms part of the PPG. The most relevant paragraphs of the NPPF are paragraphs 152, 156 and 158.

### Spatial Strategy

Policy STP 1 sets the spatial strategy for Northumberland. This directs development towards established settlements unless the development meets one of the exceptions listed in part g of the policy. This includes if the development provides for essential energy infrastructure in accordance with other policies in the Local Plan.

### Principle of Development

Policies STP 1 and REN 1 provide the spatial strategy for the renewable energy developments. There is support for such proposals but only when they meet specific criteria. Further support is offered when proposals can demonstrate community backing.

Policy STP 4 states that support will be given to development proposals that help mitigate climate change. Policy REN 1 states that applications for renewable energy developments will be supported where it has been demonstrated that the environmental, social, and economic effects of the proposal, individually and cumulatively, are acceptable or can be made acceptable. The policy includes several specific considerations which are relevant to this proposal:

- Landscape character and sensitivity of landscape and visual receptors including landscapes and views demonstrated to be of value at the local community level;
- The special qualities and the statutory purposes of Northumberland National Park;
- Hadrian's Wall World Heritage Site; and
- Amenity due to visual impact.

The site is approximately 1.2km from the boundary of Northumberland National Park and within the buffer zone for Hadrian's Wall World Heritage Site (which is discussed in more detail below). Given the small scale of the proposal, and local topography, it

is likely that there will not be unacceptable effects in the areas listed above, however this will still require consideration at the proposal stage.

Policy REN 1 also states that positive weight will be given to proposals where there is clear evidence of them being community-led.

Paragraph 152 of the NPPF makes clear the importance of the planning system supporting the transition to a low carbon future and states renewable energy and associated infrastructure should be supported. Paragraph 156 adds that community-led initiatives for renewable energy should be supported. Paragraph 158 states that applications for renewable energy development should be approved if the impacts are (or can be made) acceptable.

In summary, the principle of a renewable energy development receives strong policy support, on provision that the potential impacts are assessed and considered acceptable.

#### Impact on the Setting of Hadrian's Wall

Policy ENV 8 of the NLP states that development proposals within Hadrian's Wall World Heritage Site Buffer Zone should where possible, seek opportunities to sustain and better reveal its significance. This includes seeking to protect and where appropriate enhance, the setting of the WHS.

It seems likely that the proposal will not harm the setting of the WHS, due to its small scale and local topography. However, this will still need to be assessed at the application stage.

#### **Conclusion**

As a community-led project for renewable energy, the principle of development in policy terms is supported by the policies in the development plan. This on provision that the potential affects regarding landscape, visual impact and any impact on designated landscapes are assessed and considered acceptable.

Having considered the content of your enquiry, I can summarise that the principle of the development **would** be acceptable. The proposals **could** considered to be in accordance with the development plan. If a planning application is submitted, it **could** be likely to be looked upon favourably.

#### **Validation Requirements**

If you wish to apply for planning permission based on the above advice, you can start your application online by using the Planning Portal website. The following plans and documents will be required as a minimum to accompany your application:

- Fee
- Completed application form
- Site Location Plan (1:1250)
- Existing and Proposed Site (Block) Plans showing details of access, parking etc.
- Flood Risk Assessment
- Heritage Statement

- Supporting Planning Statement
- Ecology Report

Please ensure that you read the Council's <https://www.northumberland.gov.uk/Validationchecklist> before you submit an application as any incorrect/missing information will cause a delay. Additional documents may be requested over and above those listed above. The submitted information will be checked as part of our validation process and the timescale for a decision will not begin until all the correct information/fee is submitted - this is known as the valid date. The timescale for a decision on your application will start from this date and not when your application is submitted so it is important to ensure your application is complete (valid) when it is submitted.

All plans and drawings must be drawn to a recognised scale (1:100, 1:200, 1:1250, etc.). It may be advisable to acquire the services of an architect or planning agent to assist in the drawing of these plans and submission of the application. The site location plan should show the direction of north, the land to which the application relates edged in red and any other land in your ownership edged in blue. All other plans should include an appropriate level of detail to allow Officers and members of the public to understand the development and any changes being proposed.

Please note, this response is based entirely on the information submitted with your enquiry, and is applicable only at the current time. The response does not constitute a certificate of lawful proposed development, nor is it to be considered binding upon the Council. The advice given relates to current planning policy and legislation, which may change over time, and is given without prejudice to any Officer's recommendation or decision in relation to any future proposals.

The works may require approval under the current Buildings Regulations and in this respect, you are therefore advised to make appropriate contact with the Council's Building Control Department by calling 0345 600 6400.

It should be noted that, irrespective of the situation regarding the need for planning permission, any necessary works within the highway, including the provision or alteration of an access, is subject to separate legislation and approval by the Council as Highway Authority. For the avoidance of doubt "highway" includes footway and / or verge.

To make arrangements for approval and inspection of access works within the highway please contact the Highways Area Office at:

North Northumberland: [northernareahighways@northumberland.gov.uk](mailto:northernareahighways@northumberland.gov.uk)

Tynedale: [westernareahighways@northumberland.gov.uk](mailto:westernareahighways@northumberland.gov.uk)

Castle Morpeth: [centralareahighways@northumberland.gov.uk](mailto:centralareahighways@northumberland.gov.uk)

Ashington, Blyth, Cramlington and Bedlington: [blythdepot@northumberland.gov.uk](mailto:blythdepot@northumberland.gov.uk)

For further information on the planning process, including more detail of how to apply for planning permission, please visit the Planning section of the Council's website at [www.northumberland.gov.uk/planning](http://www.northumberland.gov.uk/planning)

I trust the information within this response is clear. If you have any comments or wish to discuss this with me any further please do not hesitate to contact me using the details provided at the top of the page.

Yours sincerely,

Mr David Love  
Specialist Senior Officer  
Development Management Team

# APPENDIX C. Solar Power Output Calculations

14/02/2023, 08:02

PVWatts Calculator



## RESULTS

831,014 kWh/Year\*

The energy output range is based on analysis of 30 years of historical weather data and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

Disclaimer: The PVWatts® Model ("Model") is provided by the National Renewable Energy Laboratory ("NREL"), which is operated by the Alliance for Sustainable Energy, LLC ("Alliance") for the U.S. Department of Energy ("DOE") and may be used for any purpose whatsoever.

The names DOE/NREL/ALLIANCE shall not be used in any representation, advertising, publicity or other manner whatsoever to endorse or promote any entity that adopts or uses the Model. DOE/NREL/ALLIANCE shall not provide any support, consulting, training or assistance of any kind with regard to the use of the Model or any updates, revisions or new versions of the Model.

YOU AGREE TO INDEMNIFY DOE/NREL/ALLIANCE, AND ITS AFFILIATES, OFFICERS, AGENTS, AND EMPLOYEES AGAINST ANY CLAIM OR DEMAND, INCLUDING REASONABLE ATTORNEYS' FEES, RELATED TO YOUR USE, RELIANCE, OR ADOPTION OF THE MODEL FOR ANY PURPOSE WHATSOEVER. THE MODEL IS PROVIDED BY DOE/NREL/ALLIANCE "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. IN NO EVENT SHALL DOE/NREL/ALLIANCE BE LIABLE FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO CLAIMS ASSOCIATED WITH THE LOSS OF DATA OR PROFITS, WHICH MAY RESULT FROM ANY ACTION IN CONTRACT, NEGLIGENCE OR OTHER TORTIOUS CLAIM THAT ARISES OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE MODEL.

The energy output range is based on analysis of 30 years of historical weather data and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

	[ kWh / m <sup>2</sup> / day ]	[ kWh ]
January	0.88	22,022
February	1.53	35,742
March	2.48	63,550
April	3.75	92,608
May	4.67	116,019
June	5.00	118,602
July	5.03	122,051
August	4.32	106,123
September	3.03	73,242
October	1.63	41,046
November	0.98	23,699
December	0.66	16,310
<b>Annual</b>	<b>2.83</b>	<b>831,014</b>

### Location and Station Identification

Requested Location	1 lincoln hill, humshaugh
Weather Data Source	(INTL) FINNINGLEY, UNITED KINGDOM 31 mi
Latitude	53.48° N
Longitude	1.00° W

### PV System Specifications

DC System Size	1000 kW
Module Type	Standard
Array Type	Fixed (open rack)
System Losses	14.08%
Array Tilt	20°
Array Azimuth	180°
DC to AC Size Ratio	1.2
Inverter Efficiency	96%
Ground Coverage Ratio	0.4%
Albedo	From weather file
Bifacial	No (0)
Monthly Irradiance Loss	Jan 0% Feb 0% Mar 0% Apr 0% May 0% June 0% July 0% Aug 0% Sept 0% Oct 0% Nov 0% Dec 0%

### Performance Metrics

DC Capacity Factor	9.5%
--------------------	------

<https://pvwatts.nrel.gov/pvwatts.php>

1/1