

Company



Solar Design Company

Old Station
Machynlleth
United Kingdom

Contact Person:
Bryn Fogden

Phone: 0845 519 7914
Mail: software@solar-design.co.uk

Client

James Smiths

1 Farm Road
Machynlleth
SY20 8AP
United Kingdom
Contact Person:
James Smith

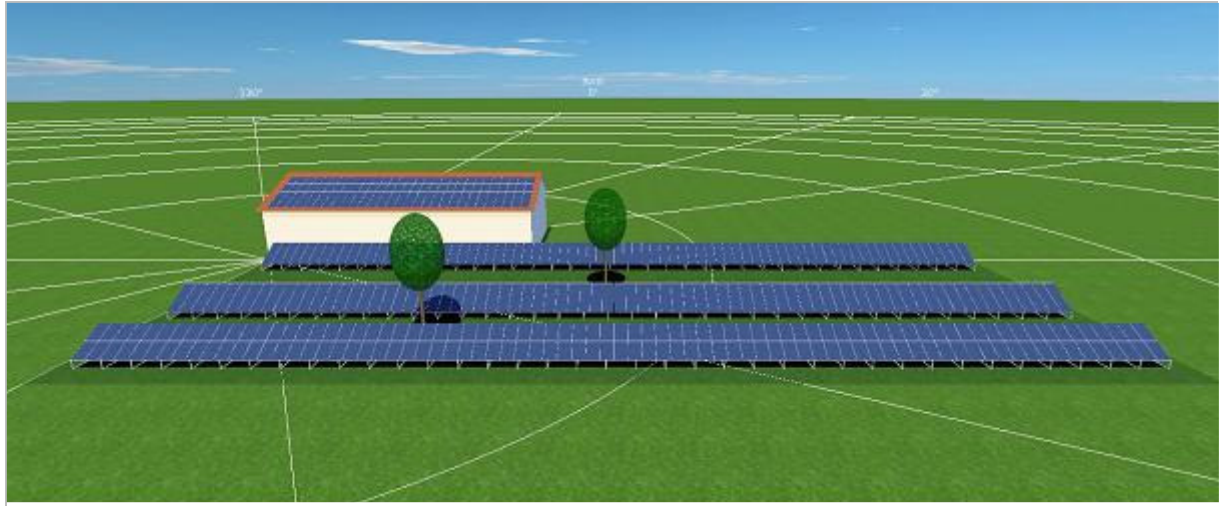
Phone: 01234 567891
Mail: james@example.com

Project



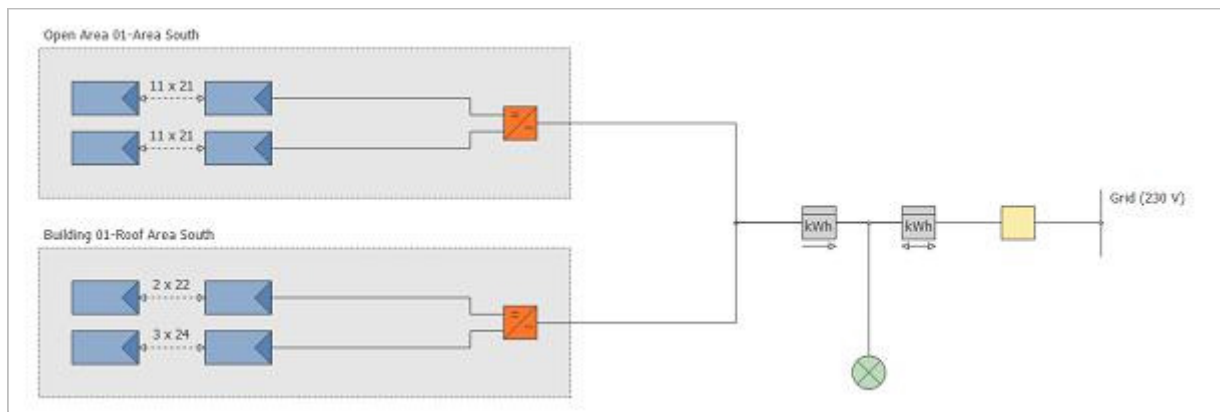
Address:
1 Farm Road
Machynlleth
SY20 8AP
United Kingdom
Start of Operation Date: 01/01/2015
Project description:
Large array on farm building

Machynlleth Commercial Example



3D, Grid-connected PV System Electrical Appliances - Net Metering

City	Machynlleth
Climate Data	Machynlleth Railway Station
PV Generator Output	144.5 kWp
Generator Surface	940.3 m ²
Number of PV Modules	578
Number of Inverter	2



The yield

PV Generator power (AC grid)	130,807 kWh
Own Use	29,441 kWh
Annual Grid Feed-in	101,366 kWh
Spec. Annual Yield	905 kWh/kWp
Performance Ratio (PR)	79.2 %
Own Power Consumption	22.5 %

Customer Number: Customer No 2
Project Number: 002
Date of Offer: 10/07/2014

Project Designer: Bryn Fogden
Company: Solar Design Company

Machynlleth Commercial Example

CO ₂ Emissions avoided	58,159 kg / year
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Your Gain

Total investment costs	166,175.00 £
Return on assets	15.82 %
Amortization Period	6.5 Years
Electricity Production Costs	£0.06

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Machynlleth Commercial Example

Set-up of the system

City	Machynlleth
Climate Data	Machynlleth Railway Station
Type of System	3D, Grid-connected PV System Electrical Appliances - Net Metering

Consumption

Total Consumption	65000 kWh
Load Peak	12.1 kW

Solar Generator

1. Module Area	Building 01-Roof Area South
Solar Modules*	116 x JC250M-24/Bb (Virtus II 2012 new)
Manufacturer	ReneSola Ltd.
Inclination	22 °
Orientation	South (180 °)
Installation Type	Flush Mount
Generator Surface	188.7 m ²

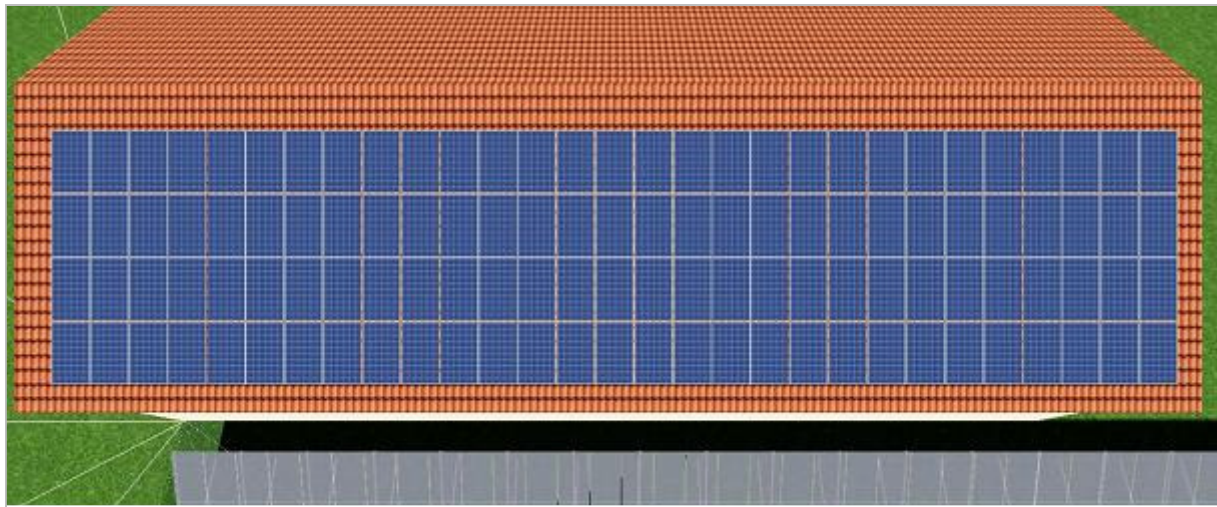


Figure: 3D Design for Building 01-Roof Area South

Losses

Remaining power after 20 Years	80 %
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Machynlleth Commercial Example

Figure: Degradation of Module of Building 01-Roof Area South

2. Module Area	Open Area 01-Area South
Solar Modules*	462 x JC250M-24/Bb (Virtus II 2012 new)
Manufacturer	ReneSola Ltd.
Inclination	30 °
Orientation	South (180 °)
Installation Type	Mounted - Open Space
Generator Surface	751.6 m ²

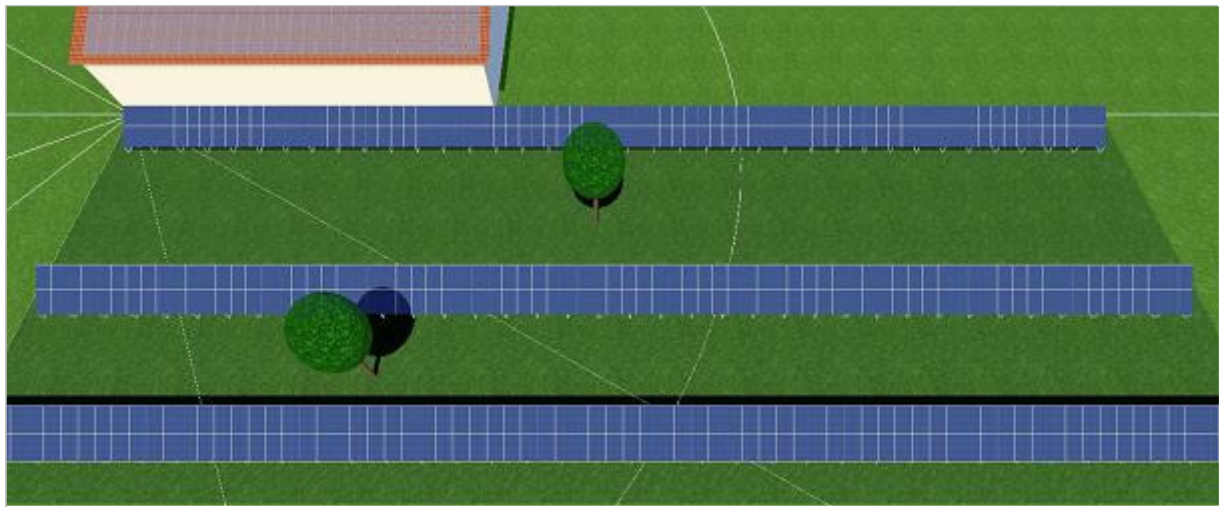


Figure: 3D Design for Open Area 01-Area South

Losses

Remaining power after 20 Years 100 %

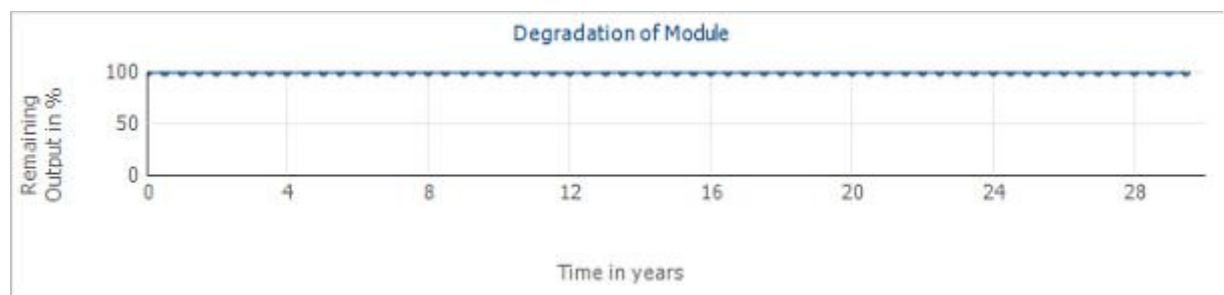


Figure: Degradation of Module of Open Area 01-Area South

Inverter

1. Module Area	Building 01-Roof Area South
Inverter 1*	1 x TRIO-27,6-TL-OUTD
Manufacturer	Power-One
Configuration	MPP 1: 3 x 24 MPP 2: 2 x 22
2. Module Area	Open Area 01-Area South
Inverter 1*	1 x PVI-CENTRAL-100

Customer Number: Customer No 2
Project Number: 002
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Machynlleth Commercial Example

Manufacturer	Power-One
Configuration	MPP 1: 11 x 21 MPP 2: 11 x 21

AC Mains

Number of Phases	3
Mains Voltage (1-phase)	230 V
Displacement Power Factor ($\cos \varphi$)	+/- 1

Cable

Total Loss	2.92 %
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* The guarantee provisions of the respective manufacturer apply

Machynlleth Commercial Example

Simulation results

PV System

PV Generator Output	144.5 kWp
Spec. Annual Yield	905 kWh/kWp
Performance Ratio (PR)	79.2 %
PV Generator power (AC grid)	130,807 kWh/year
Own Use	29,441 kWh/year
Annual Grid Feed-in	101,366 kWh/year
Maximum Feed-in Power Clipping	0 kWh/year
Own Power Consumption	22.5 %
CO ₂ Emissions avoided	58,159 kg / year

Consumer

Consumption	65,000 kWh/year
Stand-by Consumption	113 kWh/year
Total Consumption	65,113 kWh/year
covered by solar power	29,441 kWh/year
covered by grid	35,672 kWh/year
Solar Fraction	45.2 %

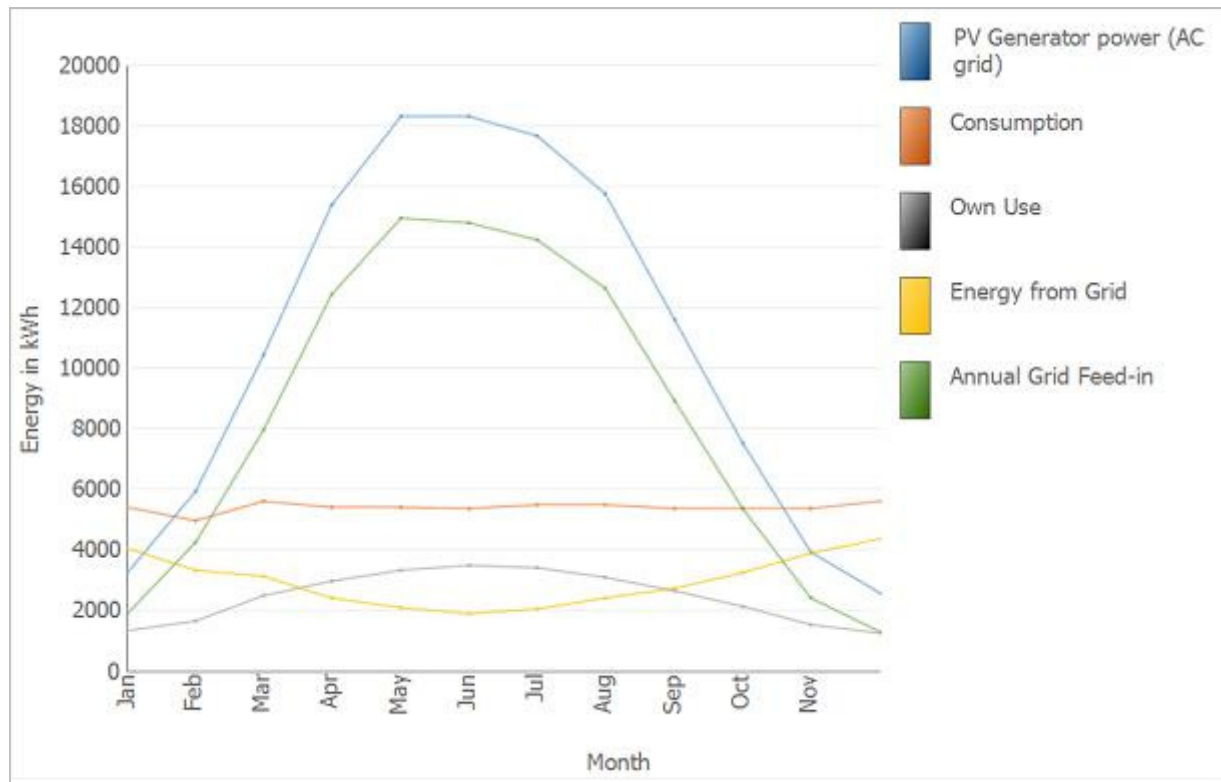


Figure: Production Forecast with consumption

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PV System Energy Balance

Global radiation - horizontal	1,022.1 kWh/m²	
Deviation from standard spectrum	-10.22 kWh/m ²	-1.00 %
Orientation and inclination of the module surface	130.05 kWh/m ²	12.85 %
Shading of diffuse radiation by horizon	0.00 kWh/m ²	0.00 %
Reflection on the Module Interface	-52.83 kWh/m ²	-4.63 %
Global Radiation at the Module	1,089.1 kWh/m²	

$$\begin{aligned}
 & 1,089.1 \text{ kWh/m}^2 \\
 & \times 940.34 \text{ m}^2 \\
 & = 1,024,143.5 \text{ kWh}
 \end{aligned}$$

Global PV Radiation	1,024,143.5 kWh	
Soiling	0.00 kWh	0.00 %
STC Conversion (Rated Efficiency of Module 15.37%)	-866,682.53 kWh	-84.63 %

Rated PV Energy	157,460.9 kWh	
Module-specific Partial Shading	-3,467.84 kWh	-2.20 %
Part Load	-263.67 kWh	-0.17 %
Temperature	-429.61 kWh	-0.28 %
Diodes	-998.39 kWh	-0.65 %
Mismatch (Manufacturer Information)	-3,046.03 kWh	-2.00 %
Mismatch (Configuration/Shading)	-5,541.81 kWh	-3.71 %
String Cable	-4.48 kWh	0.00 %
DC Main Cable	-404.28 kWh	-0.28 %

PV Energy (DC) without inverter regulation	143,304.8 kWh	
Regulation on account of the MPP Voltage Range	-11.35 kWh	-0.01 %
Regulation on account of the max. DC Current	0.00 kWh	0.00 %
Regulation on account of the max. DC Power	0.00 kWh	0.00 %
Regulation on account of the max. AC Power/cos phi	0.00 kWh	0.00 %
MPP Matching	-308.10 kWh	-0.22 %
PV energy (DC)	142,985.4 kWh	

Energy at the Inverter Input	142,985.4 kWh	
Input voltage deviates from rated voltage	-588.10 kWh	-0.41 %

Machynlleth Commercial Example

Financial Analysis

System Data

PV Generator Output	144.5 kWp
Start of Operation of the System	01/01/2015
Assessment Period	19 Years

Payment overview

Total investment costs	166,175.00 £
Total investment costs	1,150.00 £/kWp
Incoming Subsidies	0.00 £
One-off Payments	0.00 £
Annual Costs	0.00 £/year
Other revenue or savings	0.00 £/year

Remuneration and savings

First year remuneration	18,513.31 £
Specific Feed-in Remuneration	0.0477 £/kWh
First year savings	4,958.06 £

Economic Parameters

Return on assets	15.82 %
Accrued Cash Flow (Cash Balance)	479,444.87 £
Amortization Period	6.5 Years

Machynlleth Commercial Example

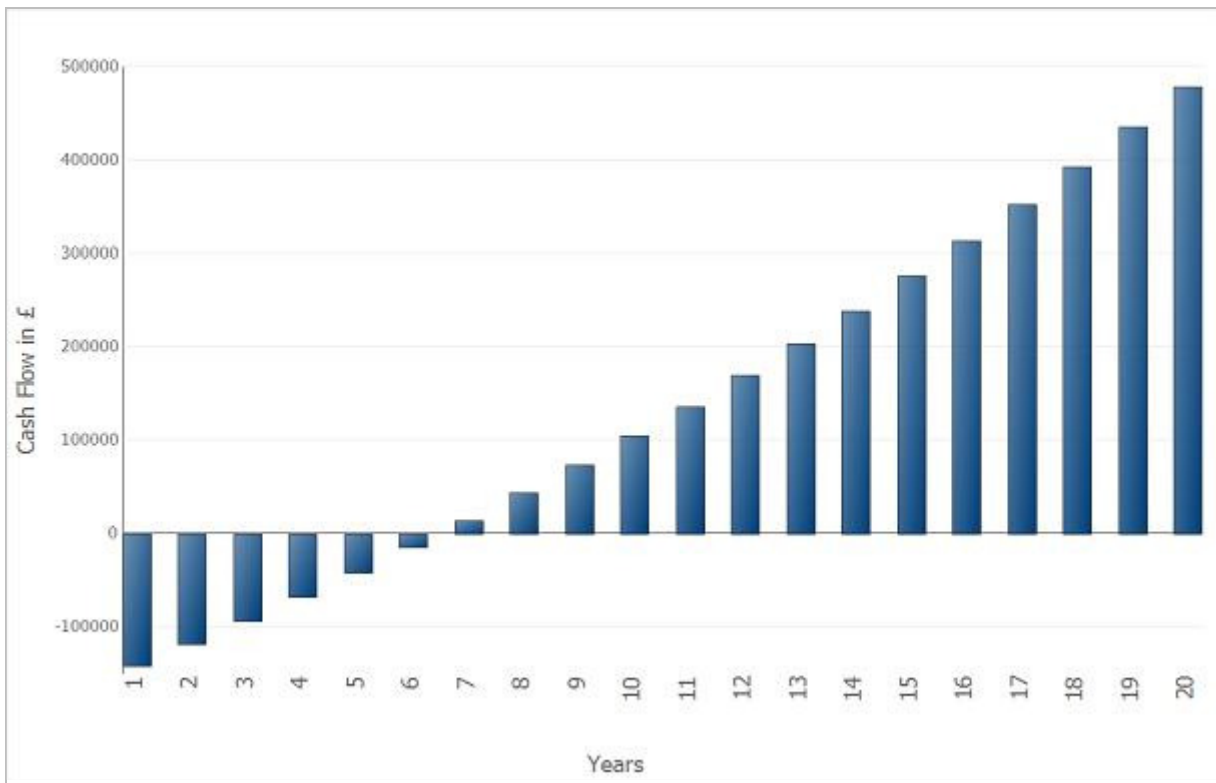


Figure: Accrued Cash Flow (Cash Balance)

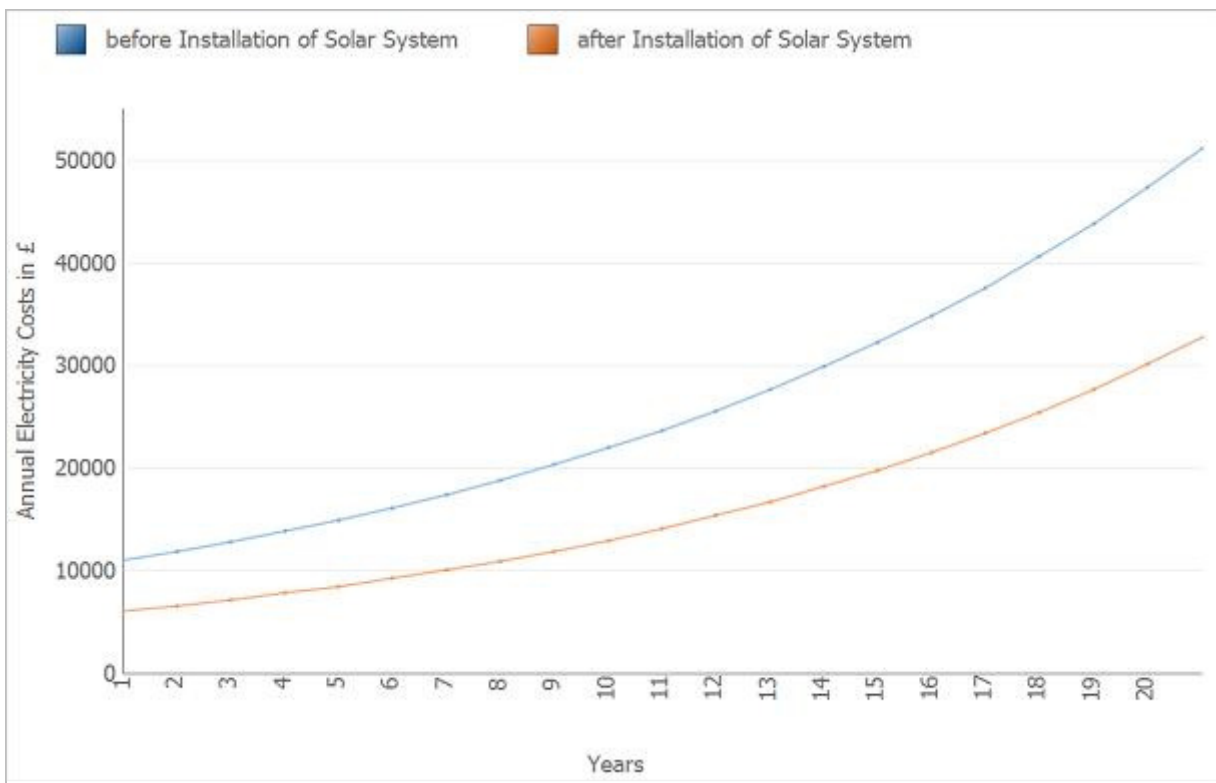


Figure: Electricity Cost Trend (Price Increase Rate 8 %)

Machynlleth Commercial Example

Cashflow Table

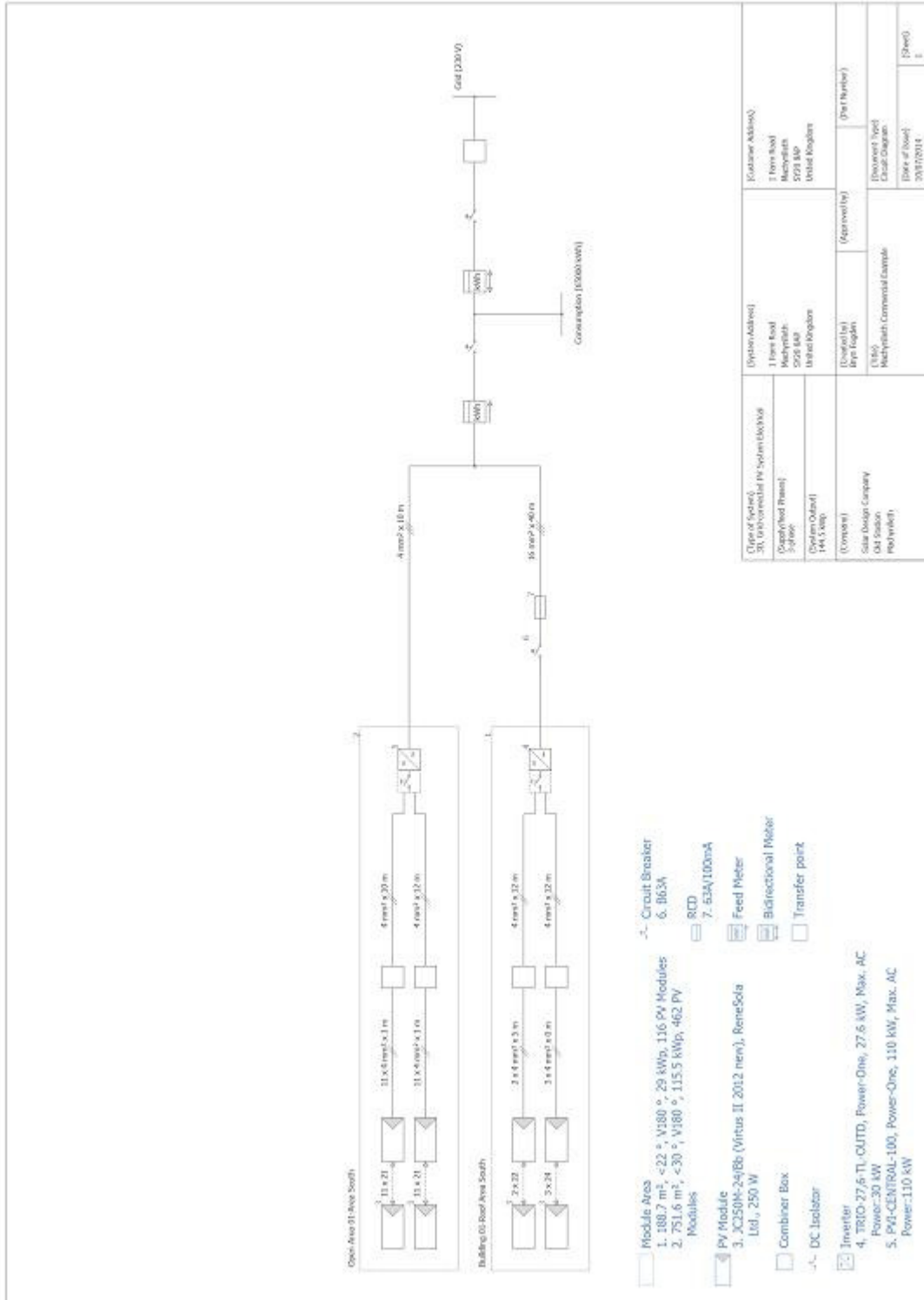
Position	year 1	year 2	year 3	year 4	year 5
Investments	-£166,175.00	£0.00	£0.00	£0.00	£0.00
Feed-in / export tariff	£18,504.75	£18,875.92	£19,252.55	£19,634.63	£20,022.14
Electricity Savings	£4,958.06	£5,282.74	£5,647.42	£6,036.64	£6,451.98
Annual Cash Flow	-£142,712.19	£24,158.66	£24,899.97	£25,671.26	£26,474.12
Accrued Cash Flow (Cash Balance)	-£142,712.19	-£118,553.53	-£93,653.56	-£67,982.30	-£41,508.18

Position	year 6	year 7	year 8	year 9	year 10
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / export tariff	£20,415.05	£20,813.35	£21,216.99	£21,625.93	£22,040.11
Electricity Savings	£6,895.15	£7,367.93	£7,872.23	£8,410.07	£8,983.57
Annual Cash Flow	£27,310.21	£28,181.29	£29,089.22	£30,035.99	£31,023.69
Accrued Cash Flow (Cash Balance)	-£14,197.97	£13,983.31	£43,072.54	£73,108.53	£104,132.22

Position	year 11	year 12	year 13	year 14	year 15
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / export tariff	£22,459.49	£22,883.99	£23,313.53	£23,748.03	£24,187.39
Electricity Savings	£9,595.01	£10,246.79	£10,941.44	£11,681.65	£12,470.28
Annual Cash Flow	£32,054.50	£33,130.77	£34,254.96	£35,429.68	£36,657.67
Accrued Cash Flow (Cash Balance)	£136,186.72	£169,317.49	£203,572.45	£239,002.13	£275,659.80

Position	year 16	year 17	year 18	year 19	year 20
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / export tariff	£24,631.51	£25,080.28	£25,533.55	£25,991.19	£26,453.06
Electricity Savings	£13,310.32	£14,204.96	£15,157.55	£16,171.65	£17,251.00
Annual Cash Flow	£37,941.83	£39,285.23	£40,691.10	£42,162.84	£43,704.05
Accrued Cash Flow (Cash Balance)	£313,601.63	£352,886.87	£393,577.97	£435,740.82	£479,444.87

Machynlleth Commercial Example



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Environment

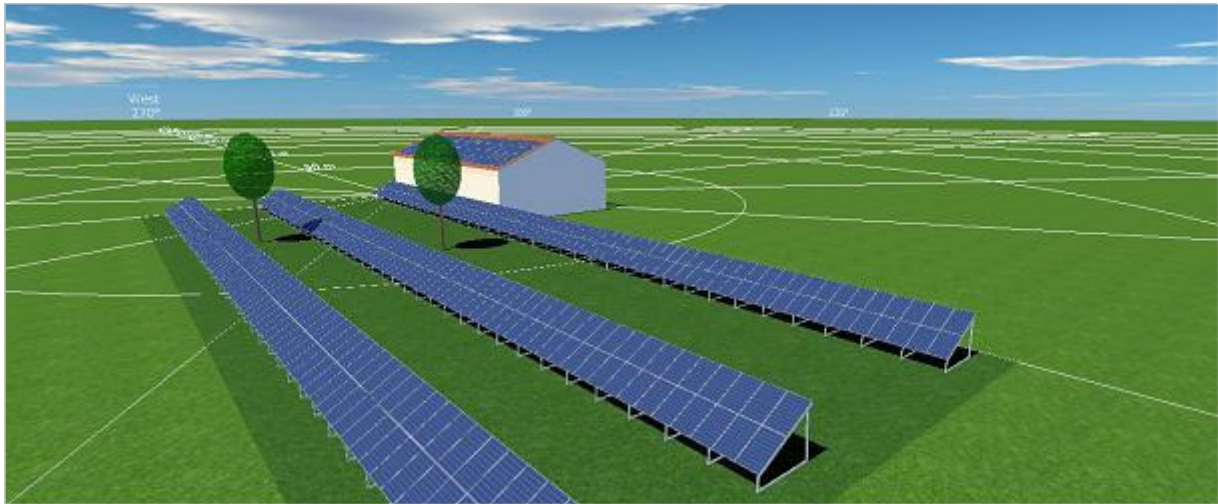


Figure: Screenshot01