Distributed Generation Proposal

PREPARED FOR:
Private, Private
Leighton Buzzard, UK

PREPARED BY:
James Hoare, Engineer
LHW Partnership LLP, N/A
N/A

This proposal has been generated using HOMER Grid, a dynamic software engine that runs complex simulations and sensitivity analyses with your energy data. It evaluates thousands of variables to compare value streams, assess system options, and provide risk-mitigation and cost reduction strategies. Originally developed at the US Department of Energy's National Renewable Energy Laboratory, the HOMER software is a risk-mitigation tool trusted by over 200,000 project developers and financial institutions to produce informed economic feasibility studies, system design and engineering insight, as well as energy cost savings.

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Project Summary

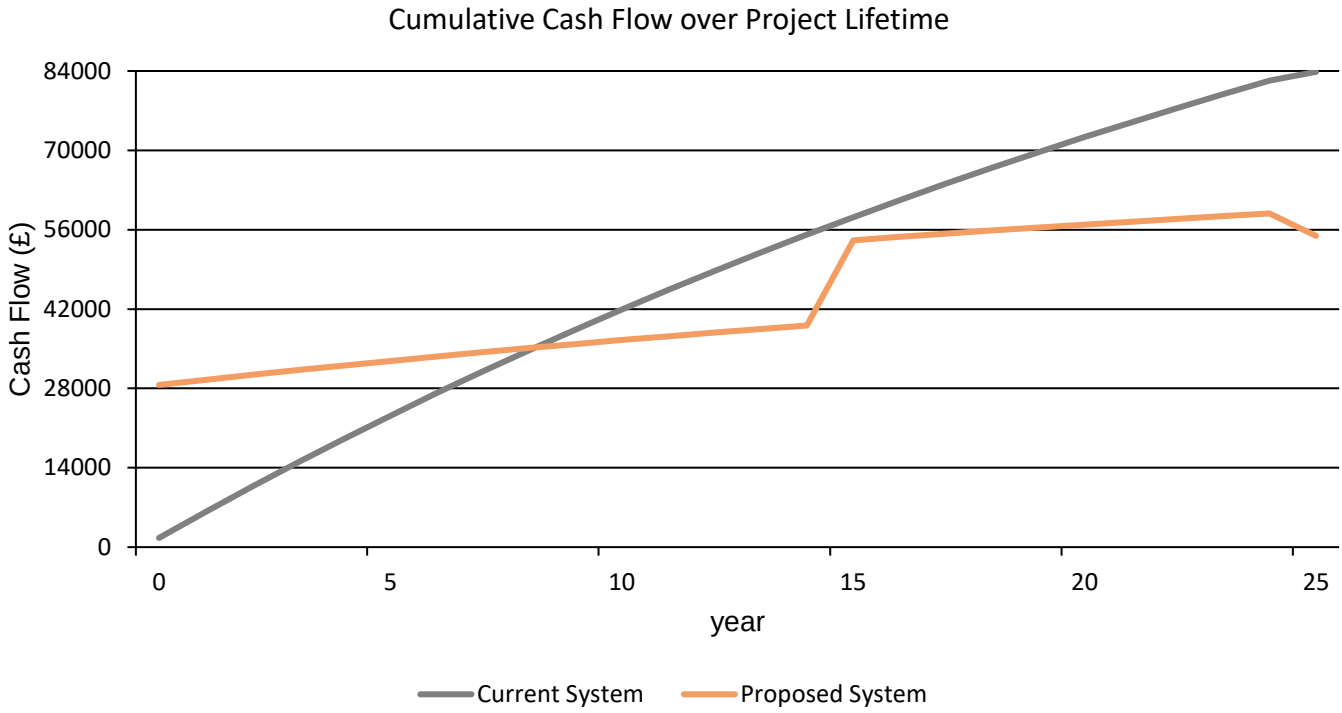
CURRENT SYSTEM

The electric needs of Leighton Buzzard, UK are met with a grid connection and 6.5 kW of generator capacity. You currently spend £2,925 on your utility bill per year. 0% of your utility bill is demand charges.

PROPOSED SYSTEM

We propose adding 6.5 kW of PV and 30 kWh of battery capacity. We also recommend switching your utility billing rate from 'Simple Tariff' to 'Outgong/Cosy & Flux Copy(1)'. This would reduce your annual utility bill to £909.73. Your investment has a payback of 7.16 years and an IRR of 11.39%.

Simple payback:	7.16 yr	Net Present Value:	£28,943
Return on Investment:	7.80 %	Capital Investment:	£27,000
Internal Rate of Return:	11.4 %	Annualized Savings:	£3,162



ABOUT LHW PARTNERSHIP LLP

LHW Partnership is a specialist engineering consultancy, established to provide high quality engineering expertise with the aim of accelerating the adoption of quality, low carbon energy projects.

Founded by James Hoare in 2013, one of the most experienced professionally qualified engineers in the sector, with over 31 years renewable energy engineering experience, and has undertaken a range of engineering services including feasibility, design, installation, commissioning review, inspection, auditing and verification of thousands of renewable energy systems from small "off-grid" systems to larger 300MWp+ utility scale PV systems.

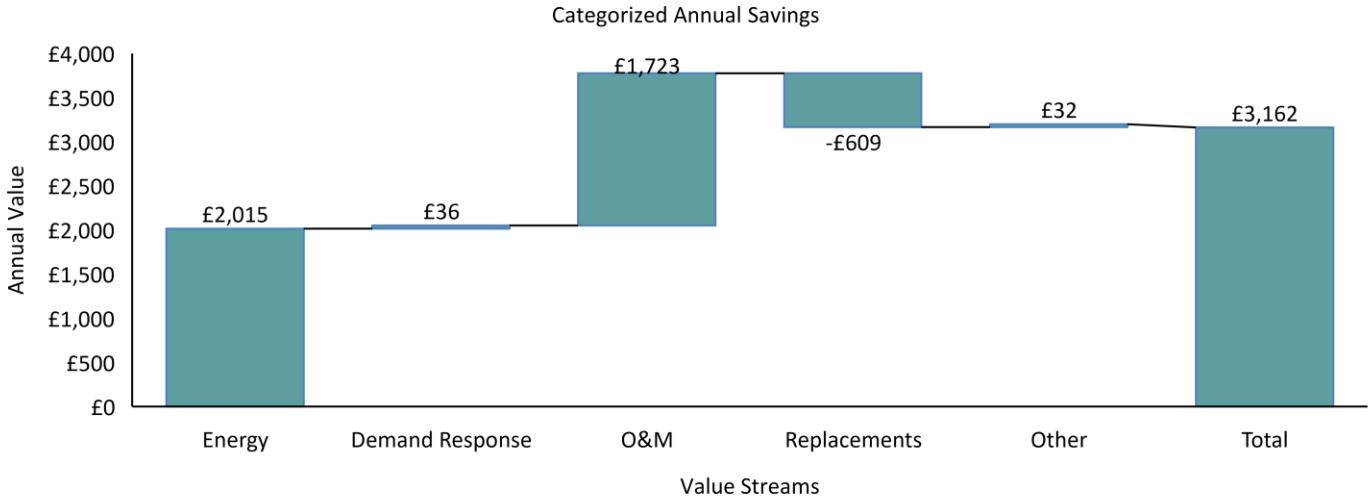
LHW Engineers have been involved in the energy industry since the 1980s and with renewable energy since 1991, working with some of the UK's first wind farms. We hold many years project engineering experience in renewable and energy efficiency (heat and power), including technical and financial feasibility, project planning, design and installation management. James Hoare is an elected "IET Presidents List" Expert Witness in Solar PV and High Voltage Systems.

A particular facet is the early adoption of innovative but proven technologies, both within and from outside the sector, and to find new ways of solving challenges presented.

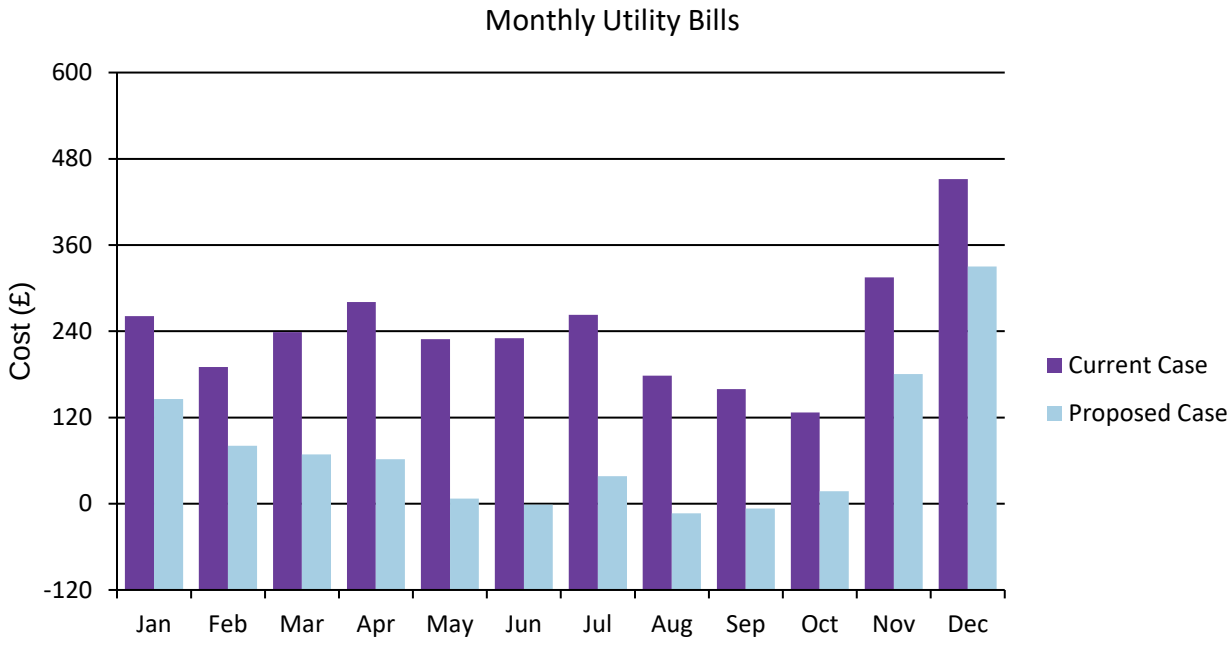
Savings Summary

The chart summarizes down your estimated annual savings in the following categories:

1. Energy: Consumption reduction and self-consumption
2. Demand Response: Programs incentivize reduced consumption at specific dates and times
3. O&M: Operating and maintenance costs of the proposed components
4. Replacements: Cost to replace proposed system components over the project lifetime
5. Other: Cost differences not included in the other categories
6. Total: The total savings (annualized) of the proposed system



Your monthly utility bill savings by month:



Savings Details

1. Utility Bill Savings

The facility at Leighton Buzzard, UK is served by Octopus. The electricity tariff plan you are currently on is the Outgong/Cosy & Flux Copy(1).

Your monthly electricity bill has two main parts:

1) Energy charges for the total amount of electricity you consume.

2) Demand charges—for “peak usage.” If your facility tends to use a lot of power over short periods, your demand charges will comprise a larger part of your bill. If you use power at a more consistent rate throughout the month, your demand charges will generally comprise a smaller part of your bill. Demand charges make up a significant portion of commercial and industrial customers’ total electricity costs: typically, between 30 and 70 %.

Your annual utility bills and savings by category:

	Consumption Charge	Demand Response	Fixed Rate	Total
Base Case	£2,817	-£36.16	£144.00	£2,925
Proposed Case	£796.24	-£36.16	£149.65	£909.73
Annual Savings	**£2,021**	**£0.00**	**-£5.65**	**£2,015**

Current System: Grid-Connection and Generator
Proposed System: Grid-Connection, Solar, Generator, and Storage

2. Demand Response Programs

Demand Response Programs are incentives offered by utilities in exchange for lowering your consumption at certain times during the year. If your facility has managed to successfully reduce its demand during the event, then the utility would pay you a pre-approved amount for every kW reduced. This is known as the demand reduction incentive.

Demand Response Program: Generic Demand Response

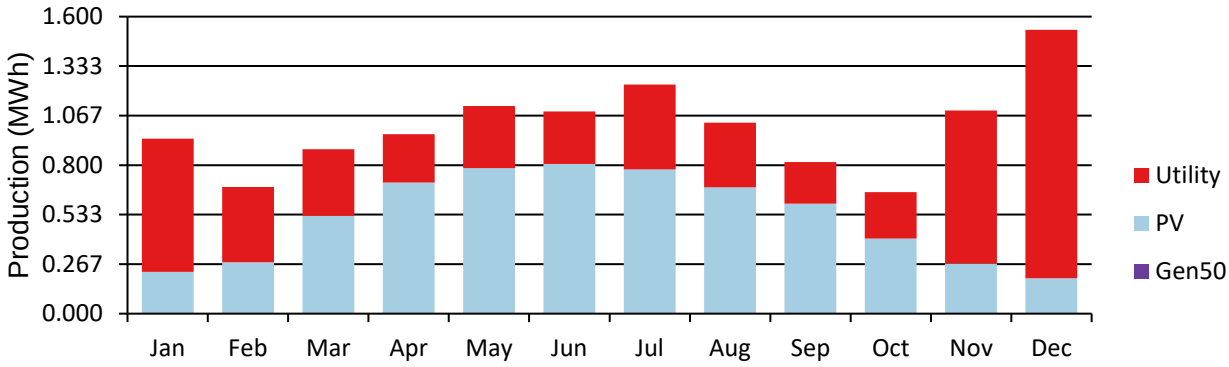
Octopus offers an incentive of **£2.50 for every kW** reduced. You are required to reduce your consumption for a period of 2.0 hours when notified by the utility. Signing up for this program leads to a total revenue of **£36.16**. Below are the demand response events that occur in a year, and the revenue incurred by reducing your facility's peak during each one of them.

Event Date	Reduction (kW)	Revenue (£)
Tue 30 Oct 06:00 PM	1.52	£3.80
Tue 06 Nov 06:00 PM	0.434	£1.08
Wed 21 Nov 06:00 PM	0.227	£0.568
Mon 31 Dec 05:00 PM	0.145	£0.362
Sun 21 Jan 06:00 PM	0.754	£1.89
Thu 25 Jan 06:00 PM	1.90	£4.75
Mon 29 Jan 06:00 PM	0.775	£1.94
Thu 08 Feb 07:00 PM	1.87	£4.67
Sun 18 Feb 06:00 PM	0.289	£0.723
Thu 22 Feb 07:00 PM	0.961	£2.40
Sat 03 Mar 07:00 PM	0.310	£0.775
Tue 13 Mar 06:00 PM	0.207	£0.517
Wed 14 Mar 06:00 PM	1.02	£2.56
Sun 25 Mar 05:00 PM	0.207	£0.517
Mon 26 Mar 06:00 PM	1.77	£4.42
Wed 28 Mar 05:00 PM	2.08	£5.19

Consumption Summary

Electric Consumption

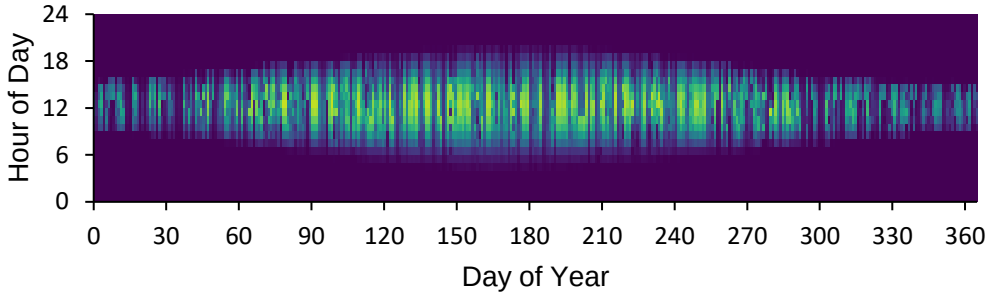
This facility uses 25 kWh/day and has a peak of 7.118 kW. In the proposed system, the following generation sources serve the electrical load.

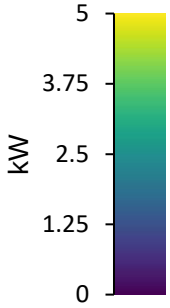


PV: PV Production

The Generic PV system has a nominal capacity of 6.50 kW. The annual production is 6,241 kWh/yr.

Rated Capacity	6.50 kW	Total Production	6,241 kW
Capital Cost	£5,000	Specific Yield	960 kWh/kW
LCOE	0.0453 £/kWh	PV Penetration	68.4 %

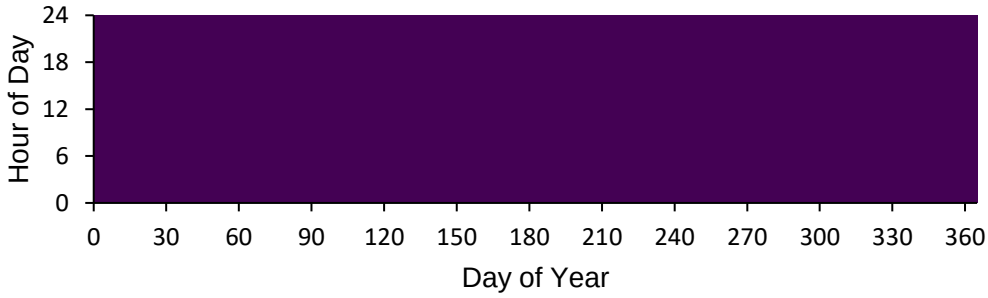




Generator: Generic Small Genset (size-your-own) (Diesel)

Power output from the Generic generator system, rated at 6.50 kW using Diesel as fuel, is 0 kWh/yr.

Capacity	6.50 kW	Generator Fuel	Diesel
Operational Life	1,000 yr	Generator Fuel Price	1.50 £/L
Capital Cost	£1,625	Fuel Consumption	0 L
Marginal Generation Cost	0.410 £/kWh	Fixed Generation Cost	54.6 £/hr


24
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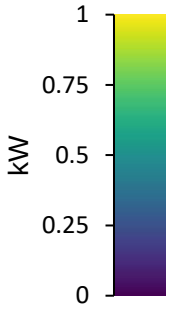
1
0.75
0.5
0.25
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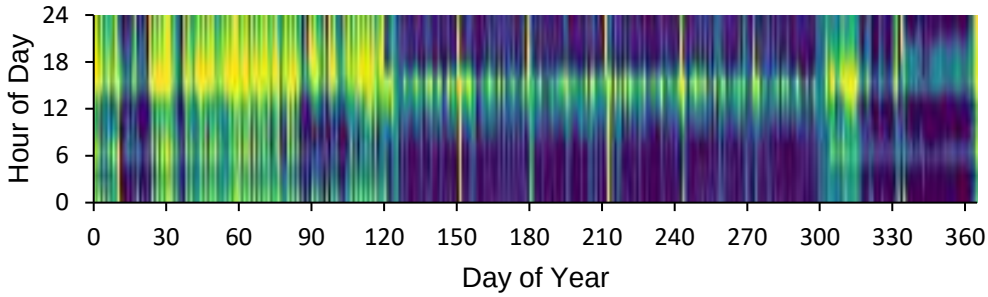
kW

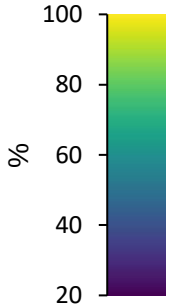
Storage: BYD LVL 15.4 Copy

The Generic storage system's nominal capacity is 29.6 kWh. The annual throughput is 5,619 kWh/yr.

Rated Capacity	29.6 kWh
Annual Throughput	5,619 kWh/yr
Maintenance Cost	10.0 £/yr
Autonomy	22.7 hr

Expected Life	15.0 yr
Capital Costs	£20,000
Losses	563 kWh/yr

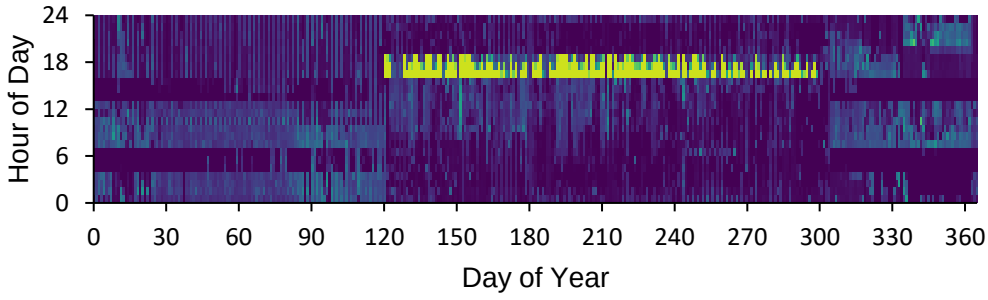




Converter: System Converter

Capacity	6.50 kW
Mean Output	0.847 kW
Minimum Output	0 kW
Maximum Output	6.50 kW
Capacity Factor	13.0 %

Hours of Operation	6,452 hrs/yr
Energy Out	7,415 kWh/yr
Energy In	7,806 kWh/yr
Losses	390 kWh/yr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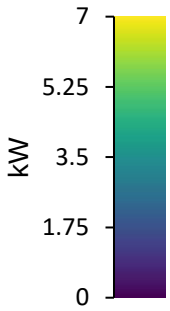
Day of Year


kW
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5.25
3.5
1.75
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Cash Flows

Project Lifetime	25 years	Expected Inflation Rate	5.0%
Nominal Discount Rate	8.0%	Real Interest Rate	2.9%

Year	1	2	3	4	5	6	7	8	9	10
BYD LVL 15.4 Copy	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)
Generic Small Genset (size-your-own)	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Outgong/Cosy & Flux Copy(1)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)
PV Production	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
System Converter	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00

Year	11	12	13	14	15	16	17	18	19	20
BYD LVL 15.4 Copy	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)
Generic Small Genset (size-your-own)	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Outgong/Cosy & Flux Copy(1)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)
PV Production	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
System Converter	£0.00	£0.00	£0.00	£0.00	(£2,000)	£0.00	£0.00	£0.00	£0.00	£0.00

Year	21	22	23	24	25
BYD LVL 15.4 Copy	(£10.00)	(£10.00)	(£10.00)	(£10.00)	(£10.00)
Generic Small Genset (size-your-own)	£0.00	£0.00	£0.00	£0.00	£1,584
Outgong/Cosy & Flux Copy(1)	(£909.73)	(£909.73)	(£909.73)	(£909.73)	(£909.73)
PV Production	£0.00	£0.00	£0.00	£0.00	£0.00
System Converter	£0.00	£0.00	£0.00	£0.00	£666.67

Utility Bill Details

Utility Monthly Summary - Current System

Month	Energy Purchased (kWh)	Energy Sold (kWh)	Net Energy Purchased (kWh)	Peak Load (kW)	Energy Charge	Demand Charge	Demand Response	Fixed Charge	Minimum Charge	Taxes	Total
January	833	4.20	829	3.99	£257.64	£0.0	-£8.57	£12.00	£0.0	£0.0	£261.07
February	602	4.80	597	2.55	£185.99	£0.0	-£7.80	£12.00	£0.0	£0.0	£190.19
March	783	11.0	772	3.16	£240.97	£0.0	-£13.97	£12.00	£0.0	£0.0	£239.00
April	866	0	866	3.65	£268.55	£0.0	£0.0	£12.00	£0.0	£0.0	£280.55
May	702	0	702	3.11	£217.18	£0.0	£0.0	£12.00	£0.0	£0.0	£229.18
June	703	0	703	2.93	£218.29	£0.0	£0.0	£12.00	£0.0	£0.0	£230.29
July	808	0	808	2.69	£250.82	£0.0	£0.0	£12.00	£0.0	£0.0	£262.82
August	538	0	538	3.05	£166.31	£0.0	£0.0	£12.00	£0.0	£0.0	£178.31
September	476	0	476	3.18	£147.59	£0.0	£0.0	£12.00	£0.0	£0.0	£159.59
October	382	0.843	382	3.22	£118.85	£0.0	-£3.80	£12.00	£0.0	£0.0	£127.06
November	985	5.22	980	3.87	£304.69	£0.0	-£1.65	£12.00	£0.0	£0.0	£315.04
December	1,421	2.96	1,418	7.12	£440.02	£0.0	-£0.36	£12.00	£0.0	£0.0	£451.66
Annual	9,101	29.0	9,072	7.12	£2,817	£0.0	-£36.16	£144.00	£0.0	£0.0	£2,925

Utility Monthly Summary - Proposed System

Month	Energy Purchased (kWh)	Energy Sold (kWh)	Net Energy Purchased (kWh)	Peak Load (kW)	Energy Charge	Demand Charge	Demand Response	Fixed Charge	Minimum Charge	Taxes	Total
January	717	0	717	3.99	£141.63	£0.0	-£8.57	£12.71	£0.0	£0.0	£145.77
February	407	0	407	2.55	£76.94	£0.0	-£7.80	£11.48	£0.0	£0.0	£80.62
March	358	4.75	354	3.16	£70.08	£0.0	-£13.97	£12.71	£0.0	£0.0	£68.81
April	260	6.92	253	3.65	£49.43	£0.0	£0.0	£12.30	£0.0	£0.0	£61.73
May	334	321	13.8	3.11	-£5.54	£0.0	£0.0	£12.71	£0.0	£0.0	£7.17
June	284	305	-20.9	2.93	-£13.42	£0.0	£0.0	£12.30	£0.0	£0.0	-£1.12
July	456	322	134	2.69	£25.69	£0.0	£0.0	£12.71	£0.0	£0.0	£38.40
August	348	402	-53.9	3.05	-£26.02	£0.0	£0.0	£12.71	£0.0	£0.0	-£13.31
September	224	263	-38.9	3.18	-£18.89	£0.0	£0.0	£12.30	£0.0	£0.0	-£6.59
October	250	199	51.1	3.22	£8.57	£0.0	-£3.80	£12.71	£0.0	£0.0	£17.48
November	825	0	825	3.87	£169.88	£0.0	-£1.65	£12.30	£0.0	£0.0	£180.53
December	1,339	0	1,339	7.12	£317.89	£0.0	-£0.36	£12.71	£0.0	£0.0	£330.23
Annual	5,803	1,823	3,980	7.12	£796.24	£0.0	-£36.16	£149.65	£0.0	£0.0	£909.73

Glossary Section

Annualized Savings
The difference in annualized cost between the base case system and the proposed system. The annualized cost is the cost that, if it were to repeat in every year of the project lifetime, would give the same net present cost as the actual cash flow sequence.

Capital Investment
The capital investment is the additional installed cost of the proposed system relative to the base case system at the start of the project.

Internal rate of return
Internal rate of return (IRR) is the discount rate at which the base case and proposed system have the same net present cost. HOMER calculates the IRR by determining the discount rate that makes the present value of the difference of the two cash flow sequences equal to zero.

Net Present Cost
The total net present cost (NPC) of a system is the present value of all the costs the system incurs over its lifetime, minus the present value of all the revenue it earns over its lifetime. Costs include capital costs, replacement costs, O & M costs, fuel costs, emissions penalties, and the costs of buying power from the grid. Revenues include salvage value and grid sales revenue. HOMER calculates the total NPC by summing the total discounted cash flows in each year of the project lifetime.

Net Present Value
Net Present Value (NPV), also referred to as net present worth, is the difference between the net present costs of the base case system and the proposed system.

Return on Investment
Return on Investment (ROI) is the yearly cost savings relative to the initial investment. The ROI is the average yearly difference in nominal cash flows over the project lifetime, divided by the difference in capital cost.

Simple payback
Simple payback is the number of years at which the cumulative cash flow of the difference between the proposed system and base case system switches from negative to positive. The payback is an indication of how long it would take to recover the difference in investment costs between the proposed system and the base case system.

Total Annualized Cost
Total Annualized Cost is the annualized value of the total net present cost. The annualized cost of a component is the cost that, if it were to occur equally in every year of the project lifetime, would give the same net present cost as the actual cash flow sequence associated with that component. HOMER calculates annualized cost by first calculating the net present cost, then multiplying it by the capital recovery factor.

HOMER Energy

ABOUT HOMER ENERGY

HOMER software is used by more than 200,000 users in 193 different countries.

HOMER Energy is the world's leading microgrid modeling software company. The Hybrid Optimization of Multiple Energy Resources (HOMER) software helps engineers and project developers navigate the complexities of designing cost-effective and reliable microgrids that combine traditional and renewable generation sources.

HOMER evaluates thousands of variables to compare value streams, assess system options, and provide risk-mitigation and cost reduction strategies. The software includes hundreds of preconfigured components to offer detailed insight, while addressing the modeling requirements of all major microgrid segments.

HOMER software is utilized by over 200,000 users in 193 countries and is trusted by governments, financial institutions, military agencies, utilities, energy systems integrators, and NGOs to design hybrid power systems. In the last decade, HOMER has demonstrated its effectiveness for analyzing complex distributed energy systems, including grid-tied hybrid renewable microgrids and situations where the grid is insufficiently reliable, such as islands and remote communities.

ABOUT HOMER GRID

HOMER Grid is a powerful software solution for modeling hybrid energy systems and evaluating options to reduce electricity expenditures. It is a robust tool that combines engineering and economics information in one comprehensive model while rapidly performing complex calculations to determine the value of self-consumption, demand charge reduction, and energy arbitrage.

HOMER Grid allows users to compare multiple components and design outcomes, identify points at which different technologies become cost-competitive, and consider options for minimizing project risk and determining the most economic design. With integrated access to more than 20k tariffs in the US, Canada, and Mexico, and the ability to model any tariff, HOMER Grid simulates real-world performance to deliver informed choices for system design and optimization.