

INGENIARITZA ELEKTRIKOKO GRADUA
GRADU AMAIERAKO LANA

***MIKROSARE ELEKTRIKO ADIMENDUN BATEN
DISEINUA LEIOAKO CAMPUSEAN***

Ikaslea: Setien, Fernandez, Jon

Zuzendaria: Oñederra, Leyaristi, Oier

Kurtsoa: 2019-2020

Data: 2020/02/10

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***MIKROSARE ELEKTRIKO ADIMENDUN BATEN
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***3. DOKUMENTUA -ERANSKINAK II – HOMER PRO PROGRAMAREN
SIMULAZIO TXOSTENA***

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Data: 2020/02/10



System Simulation Report



File: Mikrosarea.homer

Author: Jon Setien Fernandez

Location: Barrio Sarriena, S/N Bajos de la, Facultad de Ciencias Sociales y de la Comunicación, 48940 Lejona, Vizcaya, Spain (43°19.8'N, 2°58.0'W)

Total Net Present Cost: €140,932.10

Levelized Cost of Energy (€/kWh): €0.0357

Notes: Mikrosare elektriko adimendun baten diseinua EHUko Bizkaiko Campusean jatorri berriztagarriko sorgailuak erabiliz. Parke fotovoltaiko eta miniaerosorgailu batzuk erabilita ibilgailu elektrikoak kargatuko dituzten karga puntuen hornikuntza, back-up bateria sistema batekin.

Sensitivity variable values for this simulation

Variable	Value	Unit
Power Price	0.100	€/kWh

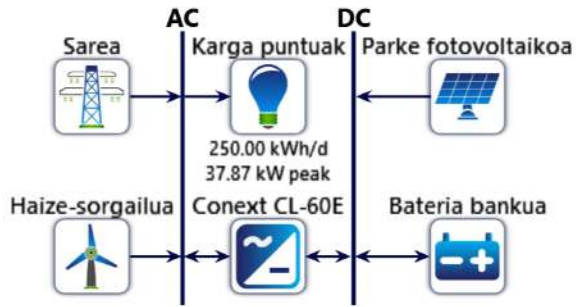
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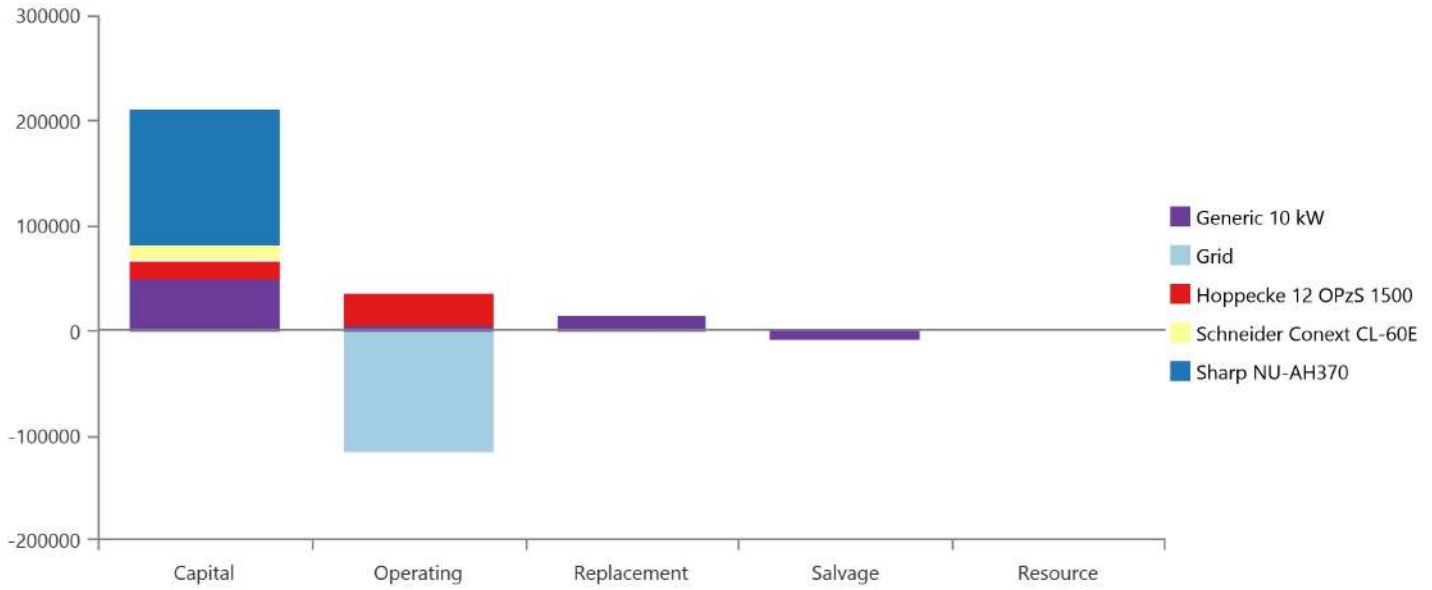
System Architecture

Component	Name	Size	Unit
PV	Sharp NU-AH370	209	kW
Storage	Hoppecke 12 OPzS 1500	1	strings
Wind turbine	Generic 10 kW	1	ea.
System converter	Schneider Conext CL-60E	132	kW
Grid	Grid	999,999	kW
Dispatch strategy	HOMER Load Following		

Schematic



Cost Summary



Net Present Costs

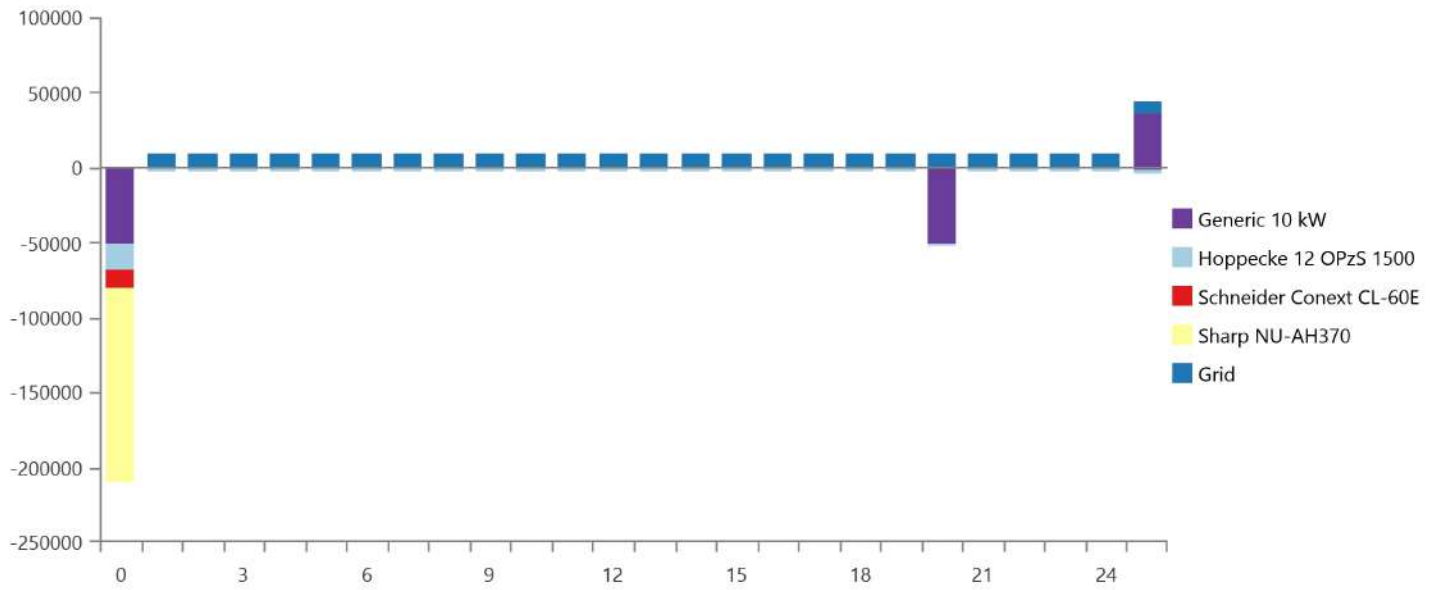
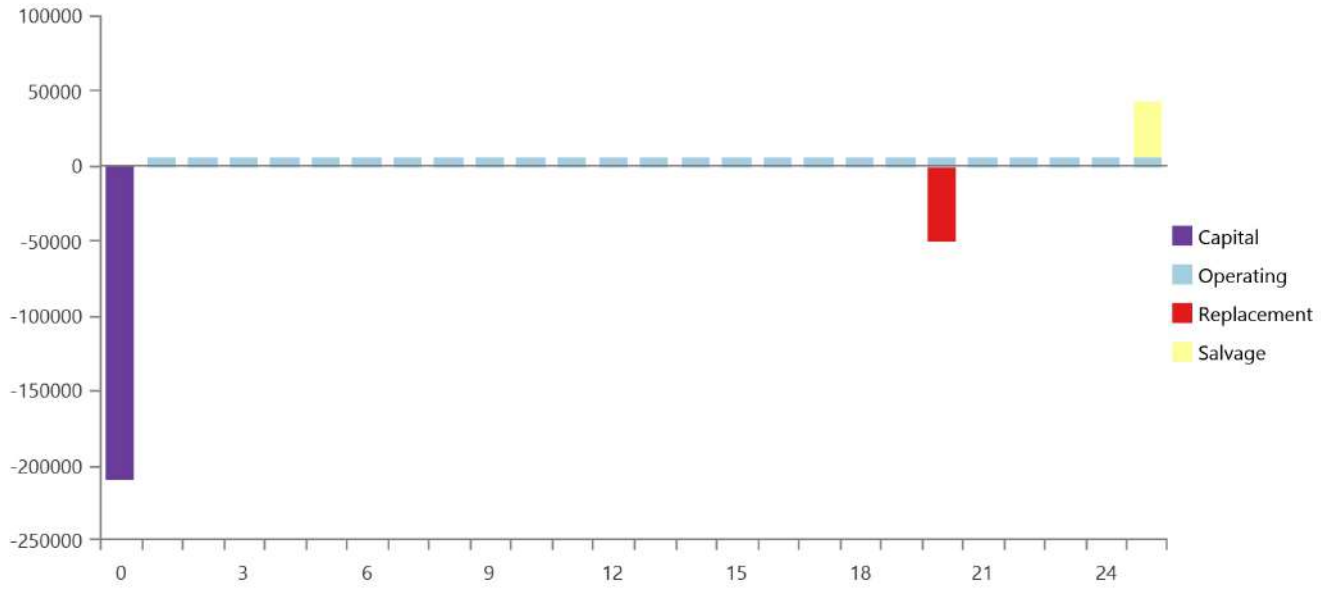
Name	Capital	Operating	Replacement	Salvage	Resource	Total
Generic 10 kW	€50,000	€6,464	€15,940	-€8,983	€0.00	€63,421
Grid	€0.00	-€113,707	€0.00	€0.00	€0.00	-€113,707
Hoppecke 12 OPzS 1500	€18,000	€31,026	€0.00	€0.00	€0.00	€49,026
Schneider Conext CL-60E	€12,259	€0.00	€0.00	€0.00	€0.00	€12,259
Sharp NU-AH370	€129,934	€0.00	€0.00	€0.00	€0.00	€129,934
System	€210,192	-€76,217	€15,940	-€8,983	€0.00	€140,932

Annualized Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Generic 10 kW	€3,868	€500.00	€1,233	-€694.91	€0.00	€4,906
Grid	€0.00	-€8,796	€0.00	€0.00	€0.00	-€8,796
Hoppecke 12 OPzS 1500	€1,392	€2,400	€0.00	€0.00	€0.00	€3,792
Schneider Conext CL-60E	€948.25	€0.00	€0.00	€0.00	€0.00	€948.25
Sharp NU-AH370	€10,051	€0.00	€0.00	€0.00	€0.00	€10,051
System	€16,259	-€5,896	€1,233	-€694.91	€0.00	€10,902



Cash Flow



Electrical Summary

Excess and Unmet

Quantity	Value	Units
Excess Electricity	11,669	kWh/yr
Unmet Electric Load	0	kWh/yr
Capacity Shortage	0	kWh/yr

Production Summary

Component	Production (kWh/yr)	Percent
Sharp NU-AH370	292,124	90.0
Generic 10 kW	13,198	4.07
Grid Purchases	19,099	5.89
Total	324,420	100

Consumption Summary

Component	Consumption (kWh/yr)	Percent
AC Primary Load	91,250	29.9
DC Primary Load	0	0
Deferrable Load	0	0
Grid Sales	214,113	70.1
Total	305,363	100

PV: Sharp NU-AH370

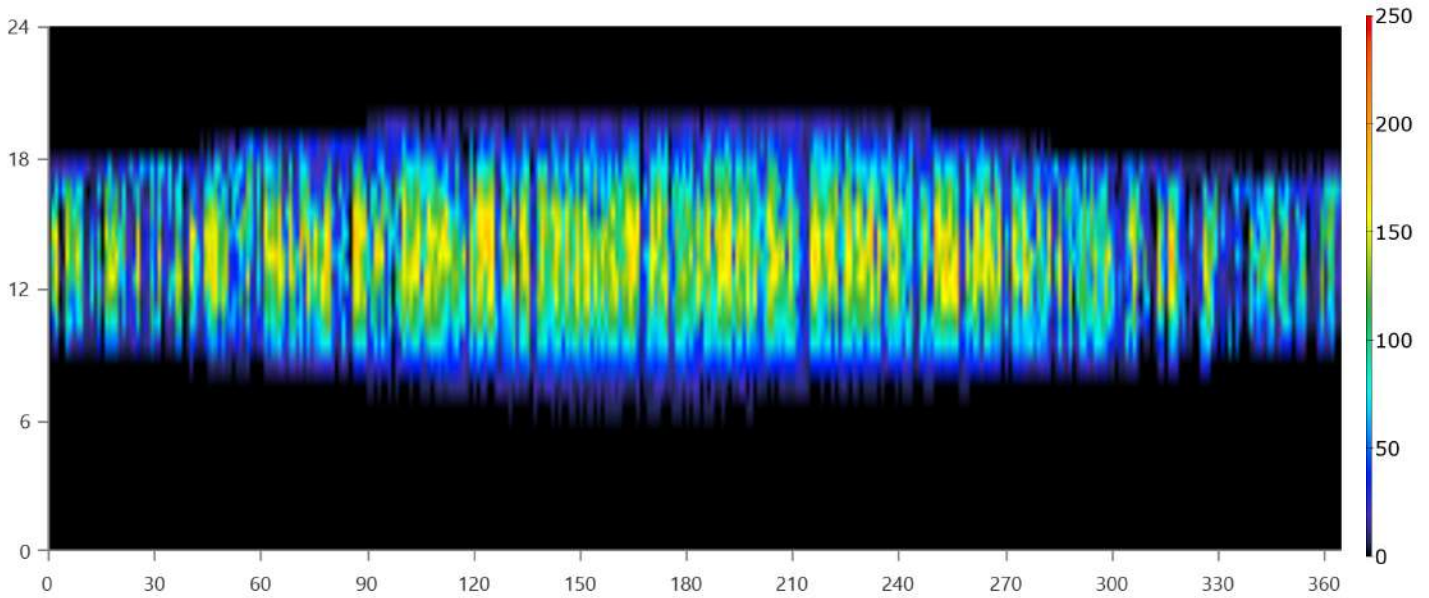
Sharp NU-AH370 Electrical Summary

Quantity	Value	Units
Minimum Output	0	kW
Maximum Output	207	kW
PV Penetration	320	%
Hours of Operation	4,387	hrs/yr
Levelized Cost	0.0344	€/kWh

Sharp NU-AH370 Statistics

Quantity	Value	Units
Rated Capacity	209	kW
Mean Output	33.3	kW
Mean Output	800	kWh/d
Capacity Factor	16.0	%
Total Production	292,124	kWh/yr

Sharp NU-AH370 Output (kW)



Wind Turbine: Generic 10 kW

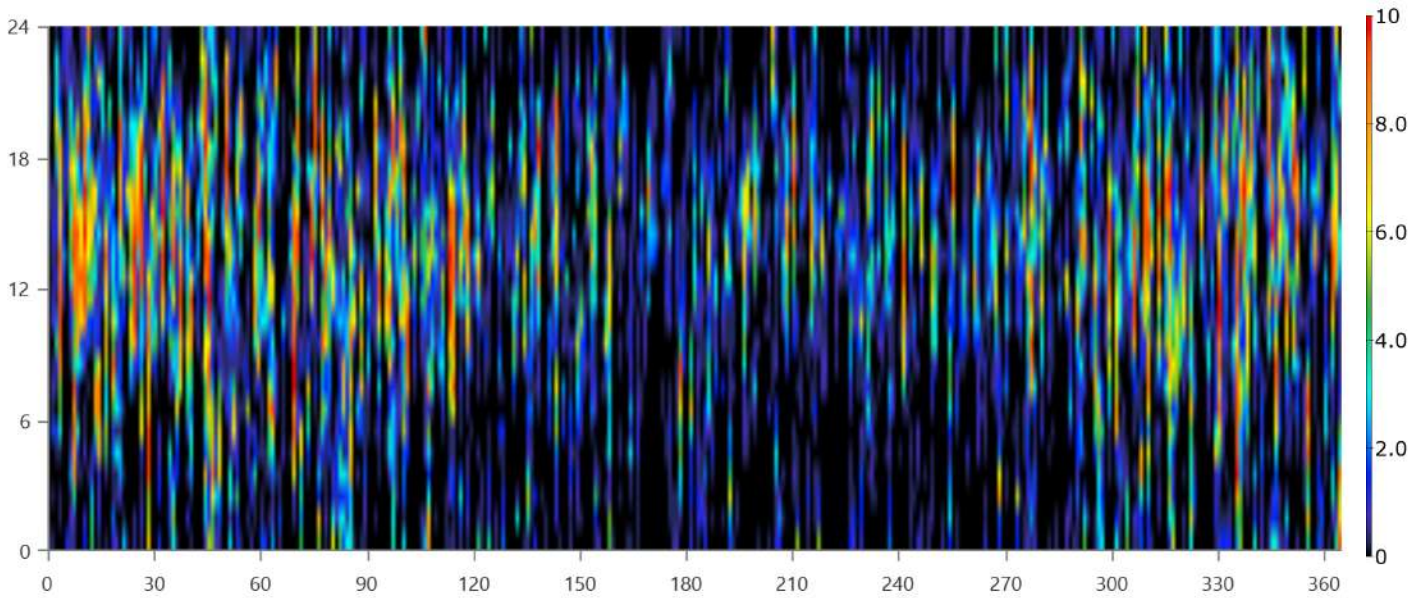
Generic 10 kW Electrical Summary

Quantity	Value	Units
Minimum Output	0	kW
Maximum Output	10.0	kW
Wind Penetration	14.5	%
Hours of Operation	6,812	hrs/yr
Levelized Cost	0.372	€/kWh

Generic 10 kW Statistics

Quantity	Value	Units
Total Rated Capacity	10.0	kW
Mean Output	1.51	kW
Capacity Factor	15.1	%
Total Production	13,198	kWh/yr

Generic 10 kW Output (kW)



Storage: Hoppecke 12 OPzS 1500

Hoppecke 12 OPzS 1500 Properties

Quantity	Value	Units
Batteries	24.0	qty.
String Size	24.0	batteries
Strings in Parallel	1.00	strings
Bus Voltage	48.0	V

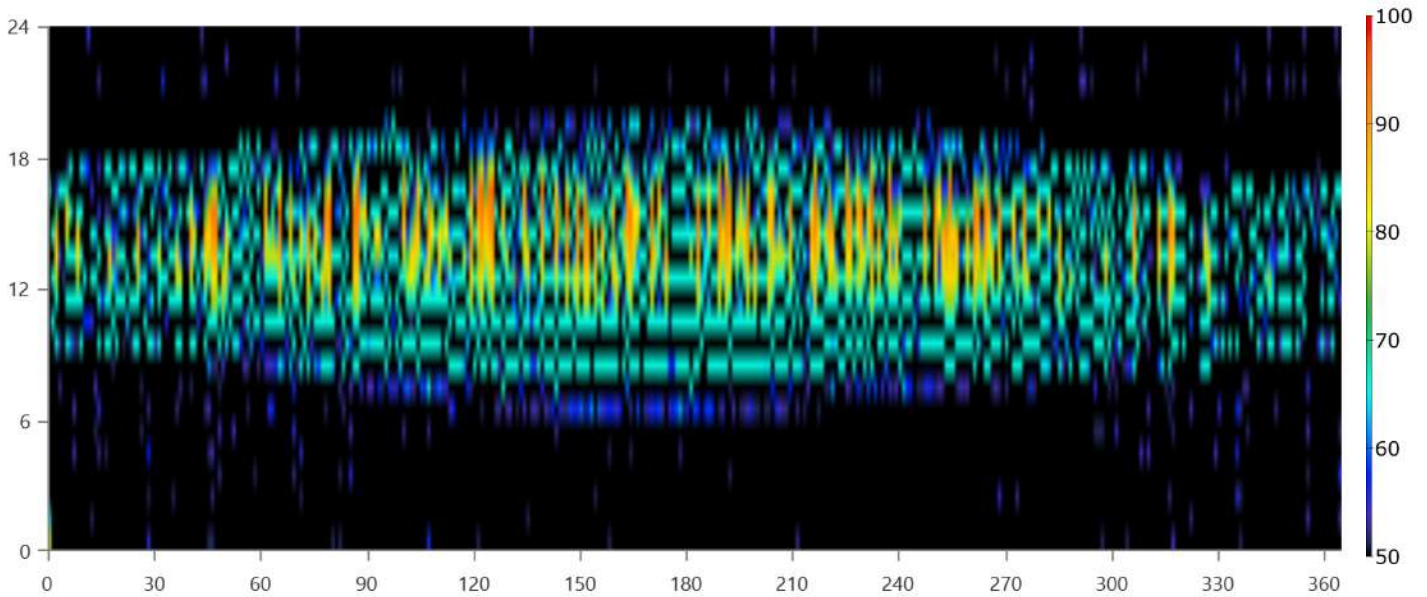
Hoppecke 12 OPzS 1500 Result Data

Quantity	Value	Units
Average Energy Cost	0	€/kWh
Energy In	23,231	kWh/yr
Energy Out	20,019	kWh/yr
Storage Depletion	43.1	kWh/yr
Losses	3,256	kWh/yr
Annual Throughput	21,587	kWh/yr

Hoppecke 12 OPzS 1500 Statistics

Quantity	Value	Units
Autonomy	4.14	hr
Storage Wear Cost	0	€/kWh
Nominal Capacity	86.2	kWh
Usable Nominal Capacity	43.1	kWh
Lifetime Throughput	121,930	kWh
Expected Life	5.65	yr

Hoppecke 12 OPzS 1500 State of Charge (%)



Converter: Schneider Conext CL-60E

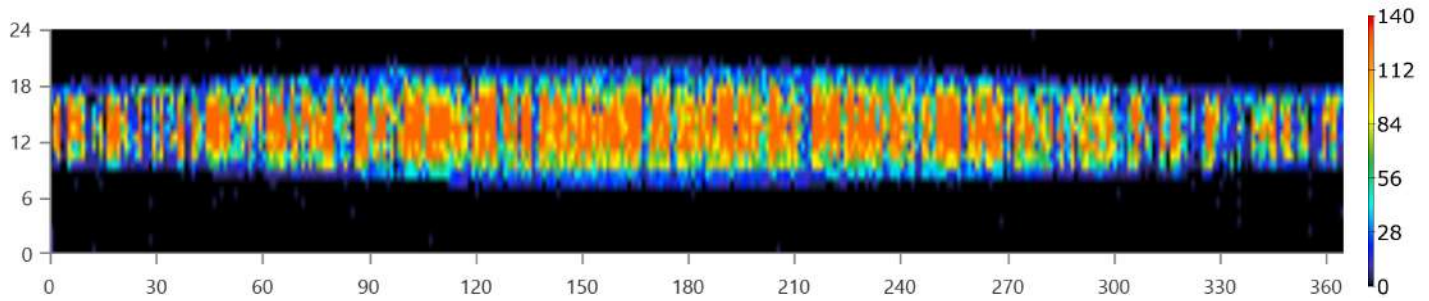
Schneider Conext CL-60E Electrical Summary

Quantity	Value	Units
Hours of Operation	4,761	hrs/yr
Energy Out	273,627	kWh/yr
Energy In	277,794	kWh/yr
Losses	4,167	kWh/yr

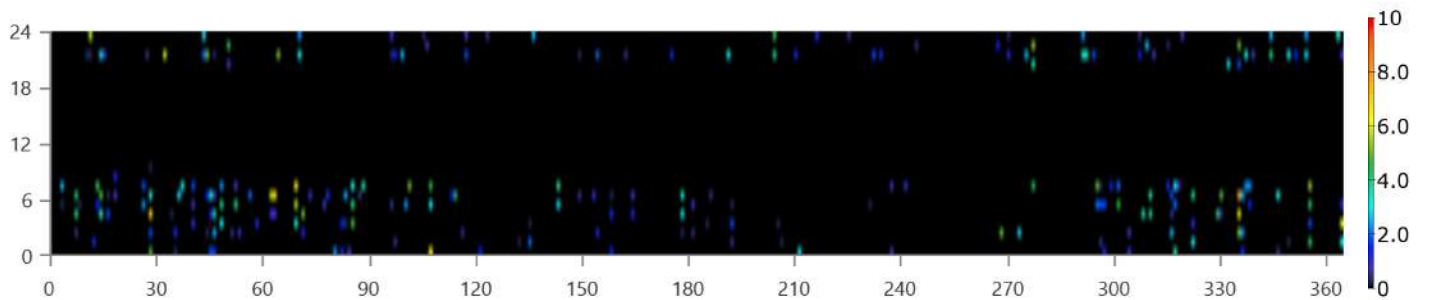
Schneider Conext CL-60E Statistics

Quantity	Value	Units
Capacity	132	kW
Mean Output	31.2	kW
Minimum Output	0	kW
Maximum Output	132	kW
Capacity Factor	23.7	%

Schneider Conext CL-60E Inverter Output (kW)



Schneider Conext CL-60E Rectifier Output (kW)



Grid: Grid

Grid rate: Demand 1

Month	Energy Purchased (kWh)	Energy Sold (kWh)	Net Energy Purchased (kWh)	Peak Demand (kW)	Energy Charge	Demand Charge
January	0	0	0	28.6	€0.00	€0.00
February	0	0	0	23.7	€0.00	€0.00
March	0	0	0	19.3	€0.00	€0.00
April	0	0	0	20.3	€0.00	€0.00
May	0	0	0	16.6	€0.00	€0.00
June	0	0	0	17.3	€0.00	€0.00
July	0	0	0	11.8	€0.00	€0.00
August	0	0	0	19.0	€0.00	€0.00
September	0	0	0	21.3	€0.00	€0.00
October	0	0	0	20.5	€0.00	€0.00
November	0	0	0	30.6	€0.00	€0.00
December	0	0	0	25.4	€0.00	€0.00
Annual	0	0	0	30.6	€0.00	€0.00

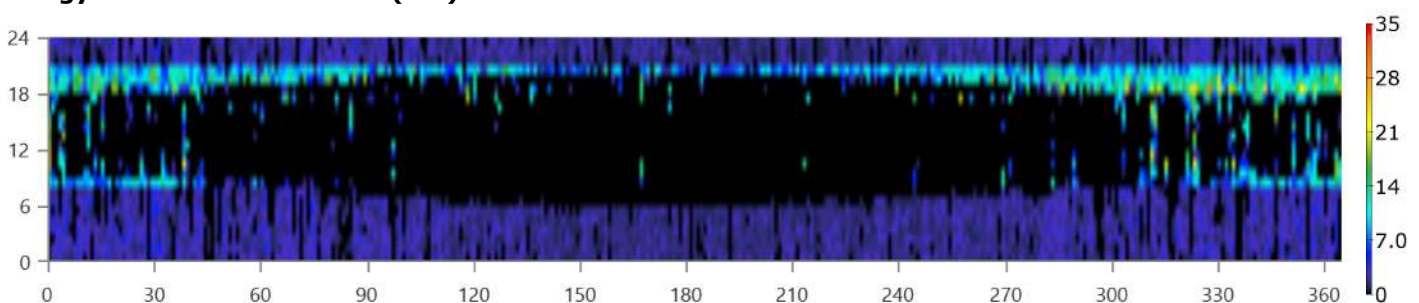
Grid rate: Rate 1

Month	Energy Purchased (kWh)	Energy Sold (kWh)	Net Energy Purchased (kWh)	Peak Demand (kW)	Energy Charge	Demand Charge
January	2,684	11,095	-8,410	0	-€286.29	€0.00
February	1,702	12,648	-10,947	0	-€462.27	€0.00
March	1,471	18,728	-17,257	0	-€789.29	€0.00
April	1,069	21,548	-20,480	0	-€970.55	€0.00
May	952	23,660	-22,707	0	-€1,088	€0.00
June	834	24,058	-23,224	0	-€1,120	€0.00
July	719	25,152	-24,434	0	-€1,186	€0.00
August	1,014	23,062	-22,049	0	-€1,052	€0.00
September	1,363	19,799	-18,437	0	-€853.70	€0.00
October	1,776	15,061	-13,286	0	-€575.50	€0.00
November	2,620	10,375	-7,754	0	-€256.70	€0.00
December	2,897	8,927	-6,030	0	-€156.68	€0.00
Annual	19,099	214,113	-195,014	0	-€8,796	€0.00

Grid rate: All

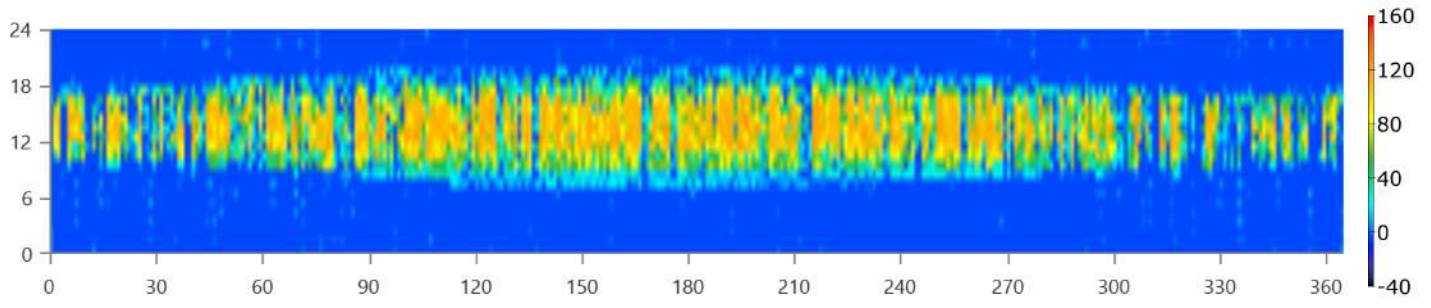
Month	Energy Purchased (kWh)	Energy Sold (kWh)	Net Energy Purchased (kWh)	Peak Demand (kW)	Energy Charge	Demand Charge
January	2,684	11,095	-8,410	28.6	-€286.29	€0.00
February	1,702	12,648	-10,947	23.7	-€462.27	€0.00
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September	1,363	19,799	-18,437	21.3	-€853.70	€0.00
October	1,776	15,061	-13,286	20.5	-€575.50	€0.00
November	2,620	10,375	-7,754	30.6	-€256.70	€0.00
December	2,897	8,927	-6,030	25.4	-€156.68	€0.00
Annual	19,099	214,113	-195,014	30.6	-€8,796	€0.00

Energy Purchased From Grid (kW)





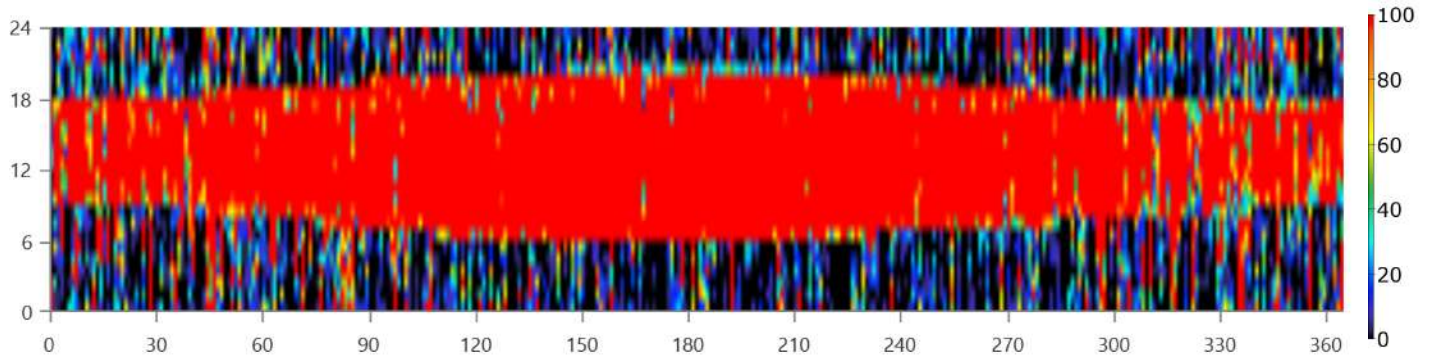
Energy Sold To Grid (kW)



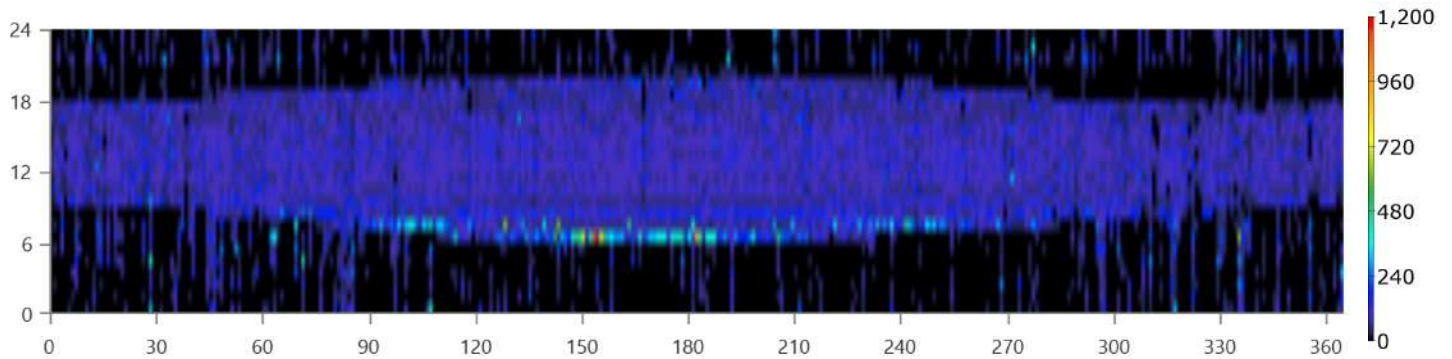
Renewable Summary

Capacity-based metrics	Value	Unit
Nominal renewable capacity divided by total nominal capacity	100	%
Usable renewable capacity divided by total capacity	100	%
Energy-based metrics	Value	Unit
Total renewable production divided by load	100	%
Total renewable production divided by generation	94.1	%
One minus total nonrenewable production divided by load	100	%
Peak values	Value	Unit
Renewable output divided by load (HOMER standard)	1,150	%
Renewable output divided by total generation	100	%
One minus nonrenewable output divided by total load	100	%

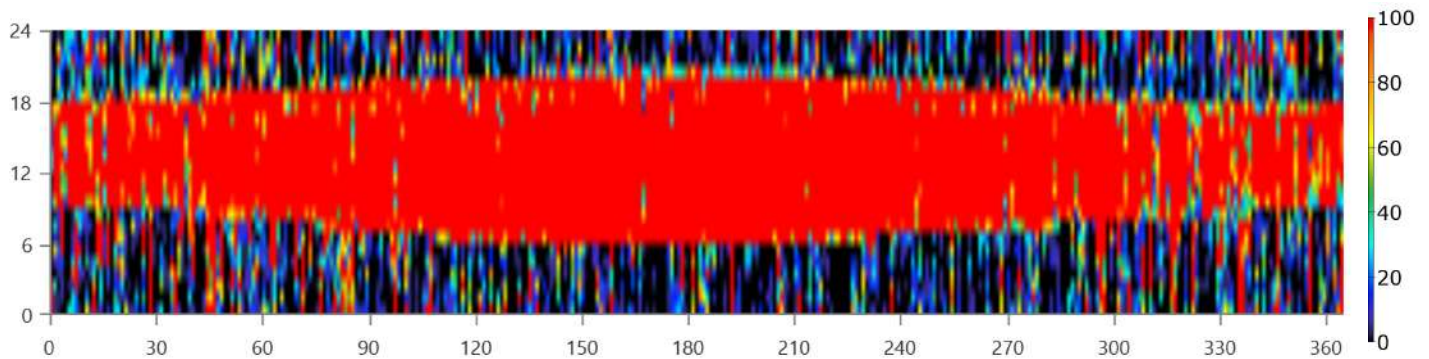
Instantaneous Renewable Output Percentage of Total Generation



Instantaneous Renewable Output Percentage of Total Load



100% Minus Instantaneous Nonrenewable Output as Percentage of Total Load



Compare Economics

IRR (%): **7.65**

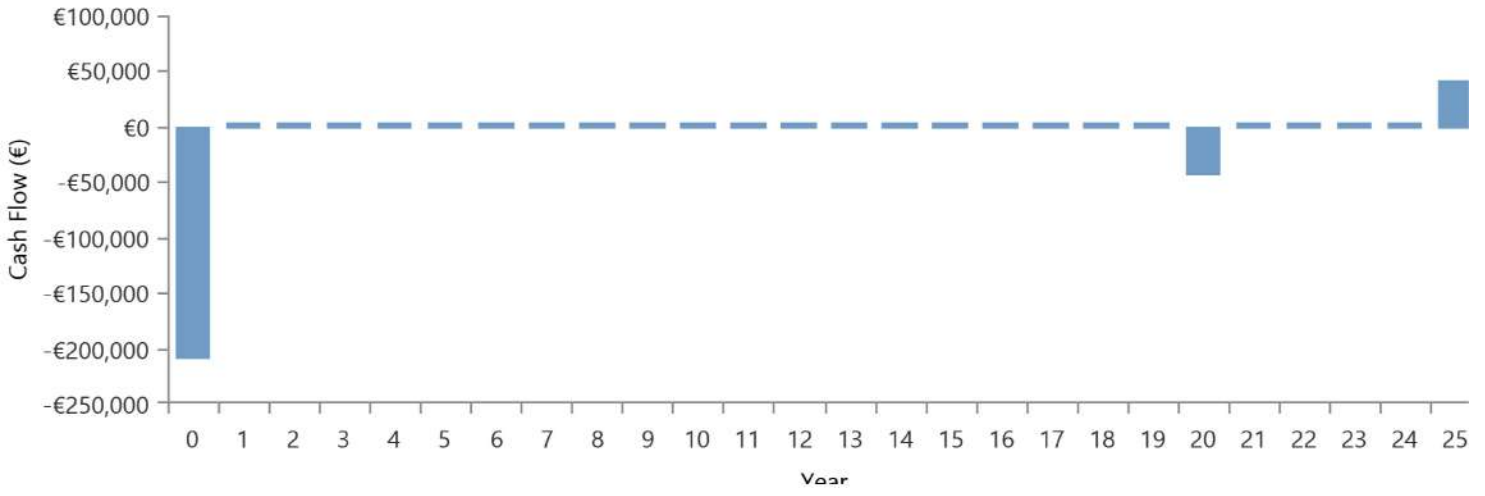
Discounted payback (yr): **17.3**

Simple payback (yr): **10.7**

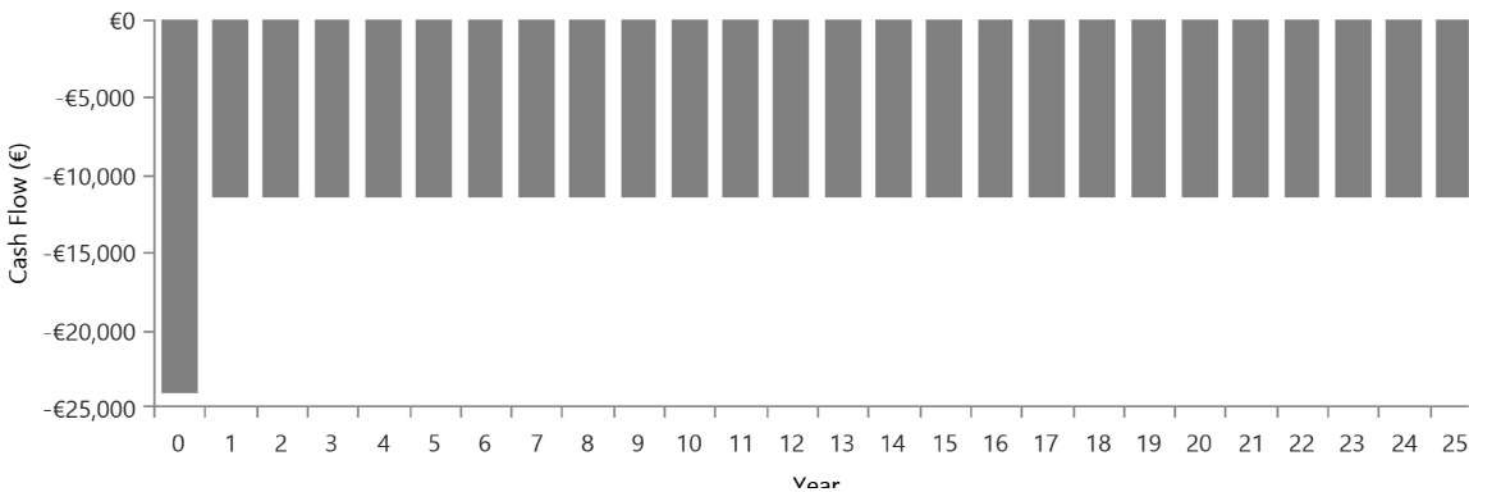
	Base Case	Current System
Net Present Cost	€173,087	€140,932
CAPEX	€24,129	€210,193
OPEX	€11,523	-€5,358
LCOE (per kWh)	€0.147	€0.0357
CO2 Emitted (kg/yr)	57,664	12,071
Fuel Consumption (L/yr)	0	0



Current Annual Nominal Cash Flows



Base Case Annual Nominal Cash Flows



Cumulative Discounted Cash Flows

