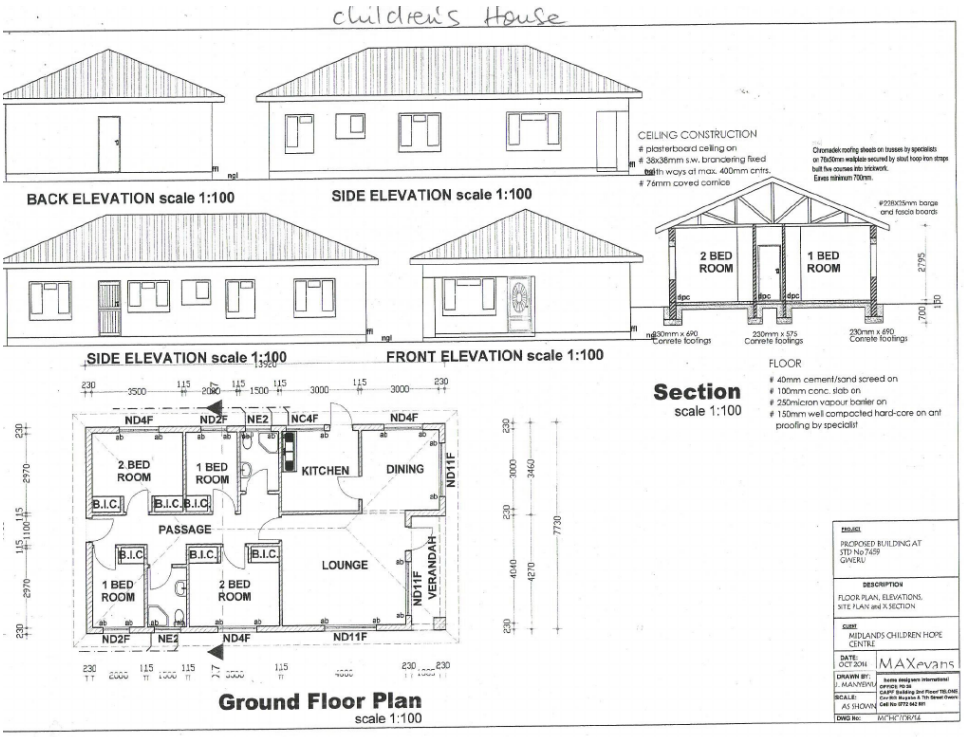
Vedlegg

Barnehjemmet

A.1 Tomten til barnehjemmet

Figur A.1: Oversiktsbilde over tomten til barnehjemmet. Bildet er tatt før hus nummer to ble bygd ved siden av hus 1 (huset med grønt tak innenfor muren

A.2 Plantegning barnehjemmet



Figur A.2: Plantegning av hus 1

A.3 Målinger

Tid [kl]	Strømtrekk [A]			Spenning [V]			Forbruk [W]	
	Hus 1	**Hus 2**	**Sum**	**Paneler**	**Batterier**	**%**	**Samlet**	**Hus 1**
08:00	1.2	1.0	2.2			12	506	276
09:00	1.1	0.5	1.6			6	368	253
10:00	1.7	0.5	2.2	103.3	56.4	8	506	391
11:00	1.1	1.4	2.5	110	53.3	6	575	253
12:00	1.7	0.4	2.1	110.6	53.3	8	483	391
13:00	1.1	0.9	2.0	114.3	53.4	6	460	253
14:00	1.5	0.8	2.3	115.3	53.4	9	529	345
15:00	1.0	0.3	1.3	115.0	53.3		299	230
16:00	1.1	0.9	2.0	51.9	51.9	7	460	253
17:00	1.5	1.0	2.6	50.0	50.0	9	575	345
18:00	1.9	0.7	2.9	50.6	50.6	11	598	437
19:00	1.9	1.0	2.9	50.5	50.5	11	667	437
20:00	2.3	1.0	3.3	50.4	50.4	13	759	529
21:00	2.3	1.0	3.3	50.1	50.1	13	759	529
22:00	2.1	1.0	3.1	50.0	50.0	13	713	483
23:00	1.7	1.0	2.7	49.9	49.9	12	621	391
00:00	1.7	1.0	2.7	49.9	49.9	11	621	391
01:00	1.3							299
02:00	1.3							299
03:00	1.3							299
04:00	1.3							299
05:00	1.3							299
06:00	1.3							299
07:00	1.3							299

Tabell A.1: Målinger utført på husene i Zimbabwe

Simuleringsresultater

B.1 Simulering av det installerte anlegget

System Simulation Report

File: Off-grid-PV.homer

Author: OKGR

Location: Unnamed Road, Mkoba Twp, Zimbabwe (19°27.1'S, 29°44.9'E)

Total Net Present Cost: $254,263.80

Levelized Cost of Energy ($/kWh): $4.75

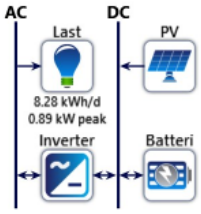
Notes:

Table of Contents

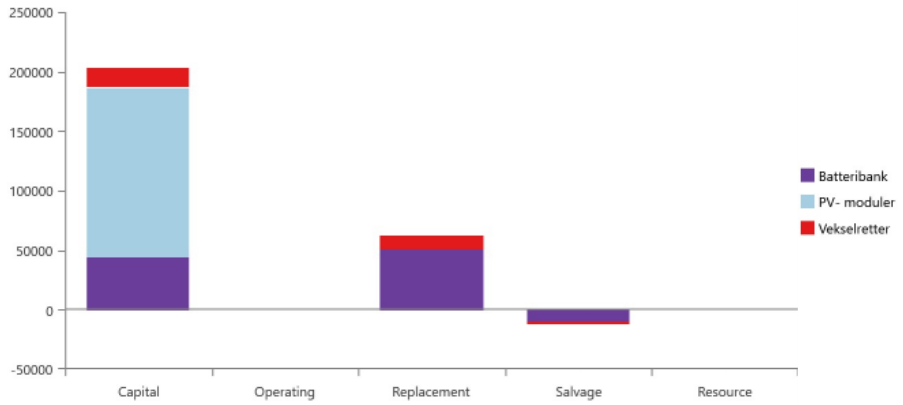
System Architecture

Component	Name	Size	Unit
PV	PV- moduler	3.00	kW
Storage	Batteribank	8	strings
System converter	Vekselretter	2.40	kW
Dispatch strategy	HOMER Cycle Charging		

Schematic



Cost Summary



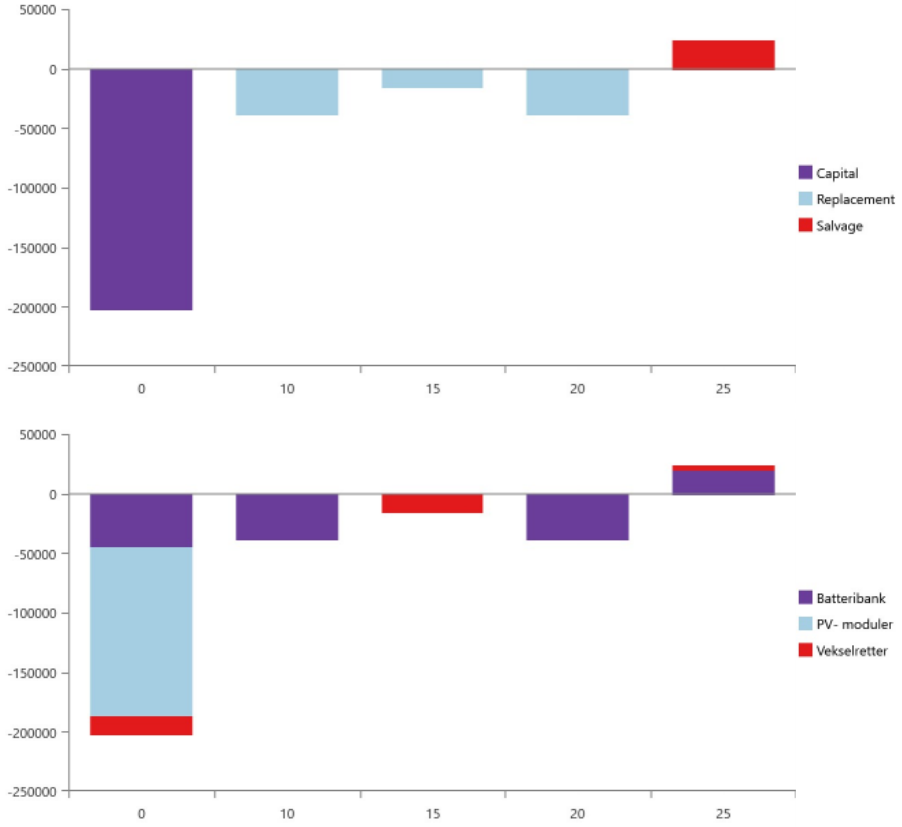
Net Present Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Batteribank	$45,296	$0.00	$52,274	-$9,780	$0.00	$87,790
PV- moduler	$141,380	$0.00	$0.00	$0.00	$0.00	$141,380
Vekselretter	$16,825	$0.00	$11,054	-$2,784	$0.00	$25,094
System	$203,501	$0.00	$63,327	-$12,565	$0.00	$254,264

Annualized Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Batteribank	$2,555	$0.00	$2,949	-$551.71	$0.00	$4,952
PV- moduler	$7,975	$0.00	$0.00	$0.00	$0.00	$7,975
Vekselretter	$949.12	$0.00	$623.54	-$157.08	$0.00	$1,416
System	$11,480	$0.00	$3,572	-$708.78	$0.00	$14,343

Cash Flow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15
20
25
Capital
Replacement
Salvage
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-50000
-100000
-150000
-200000
-250000
0
10
15
20
25
Batteribank
PV- moduler
Vekselretter

Electrical Summary

Excess and Unmet

Quantity	Value	Units
Excess Electricity	2,294	kWh/yr
Unmet Electric Load	0	kWh/yr
Capacity Shortage	0	kWh/yr

Production Summary

Component	Production (kWh/yr)	Percent
PV- moduler	5,940	100
Total	5,940	100

Consumption Summary

Component	Consumption (kWh/yr)	Percent
AC Primary Load	3,022	100
DC Primary Load	0	0
Deferrable Load	0	0
Total	3,022	100

PV: PV- moduler

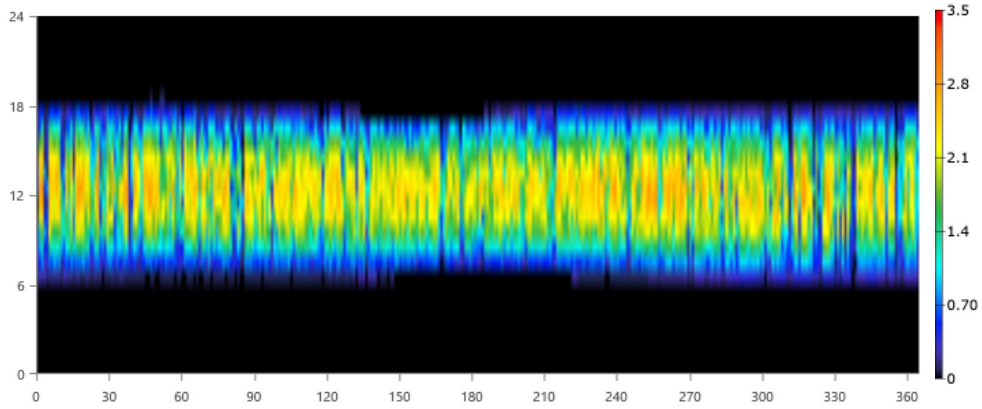
PV- moduler Electrical Summary

Quantity	Value	Units
Minimum Output	0	kW
Maximum Output	3.01	kW
PV Penetration	197	%
Hours of Operation	4,405	hrs/yr
Levelized Cost	1.34	$/kWh

PV- moduler Statistics

Quantity	Value	Units
Rated Capacity	3.00	kW
Mean Output	0.678	kW
Mean Output	16.3	kWh/d
Capacity Factor	22.6	%
Total Production	5,940	kWh/yr

PV- moduler Output (kW)



Storage: Batteribank

Batteribank Properties

Quantity	Value	Units
Batteries	8.00	qty.
String Size	1.00	batteries
Strings in Parallel	8.00	strings
Bus Voltage	12.0	V

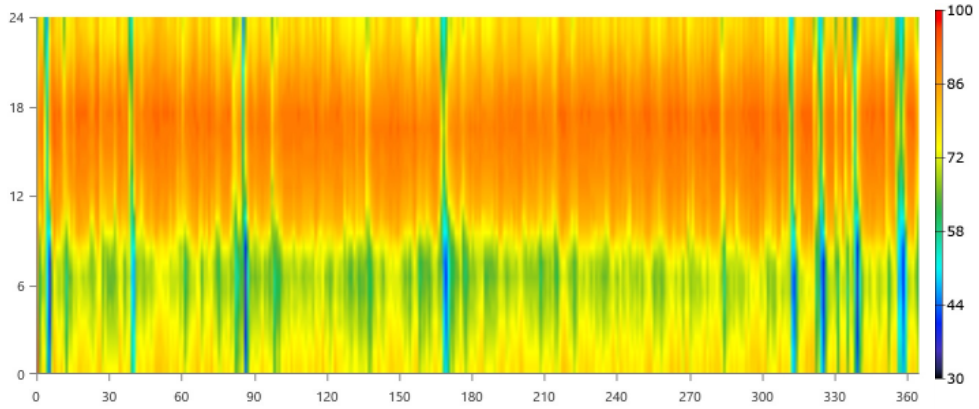
Batteribank Result Data

Quantity	Value	Units
Average Energy Cost	0	$/kWh
Energy In	2,353	kWh/yr
Energy Out	1,889	kWh/yr
Storage Depletion	7.19	kWh/yr
Losses	471	kWh/yr
Annual Throughput	2,112	kWh/yr

Batteribank Statistics

Quantity	Value	Units
Autonomy	50.7	hr
Storage Wear Cost	0.0220	$/kWh
Nominal Capacity	25.0	kWh
Usable Nominal Capacity	17.5	kWh
Lifetime Throughput	21,118	kWh
Expected Life	10.0	yr

Batteribank State of Charge (%)



Converter: Vekselretter

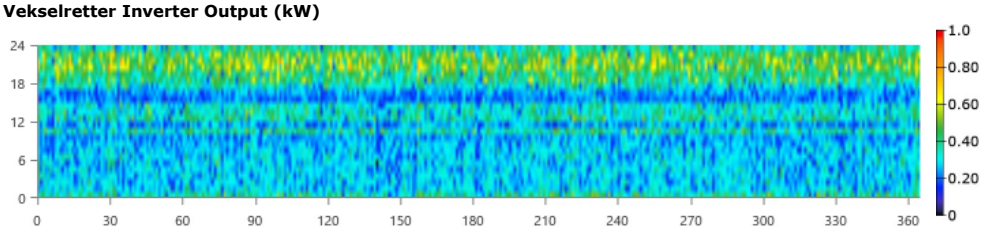
Vekselretter Electrical Summary

Quantity	Value	Units
Hours of Operation	8,760	hrs/yr
Energy Out	3,022	kWh/yr
Energy In	3,181	kWh/yr
Losses	159	kWh/yr

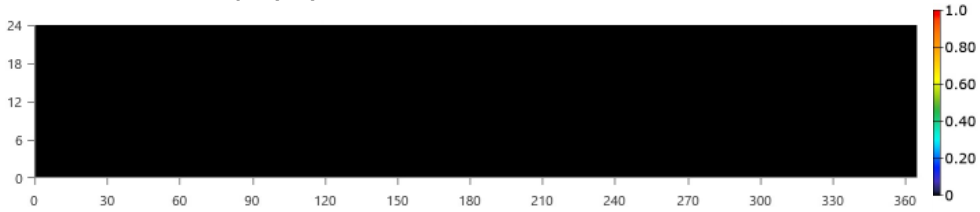
Vekselretter Statistics

Quantity	Value	Units
Capacity	2.40	kW
Mean Output	0.345	kW
Minimum Output	0.0142	kW
Maximum Output	0.893	kW
Capacity Factor	14.4	%

Vekselretter Inverter Output (kW)



Vekselretter Rectifier Output (kW)



B.2 Simulering av et optimalisert PV- anlegg

System Simulation Report

File: Off-grid-PV.homer

Author: OKGR

Location: Unnamed Road, Mkoba Twp, Zimbabwe (19°27.1'S, 29°44.9'E)

Total Net Present Cost: $227,684.60

Levelized Cost of Energy ($/kWh): $4.25

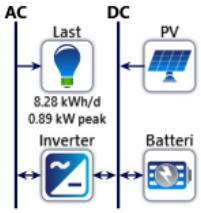
Notes:

Table of Contents

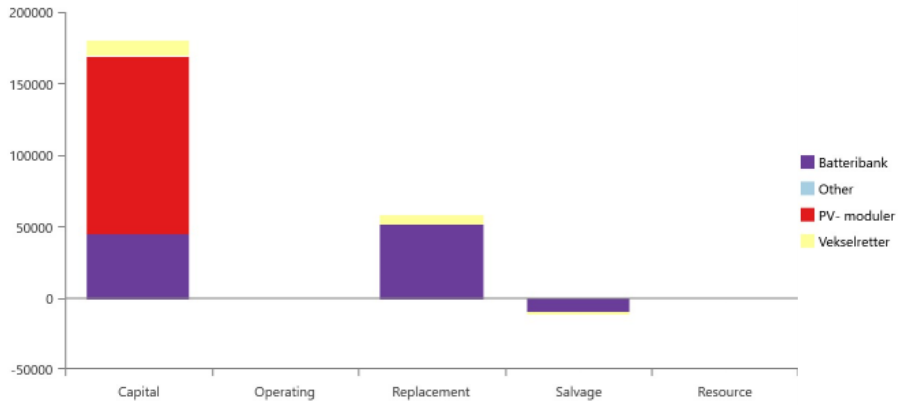
System Architecture

Component	Name	Size	Unit
PV	PV- moduler	2.63	kW
Storage	Batteribank	8	strings
System converter	Vekselretter	1.50	kW
Dispatch strategy	HOMER Cycle Charging		

Schematic



Cost Summary



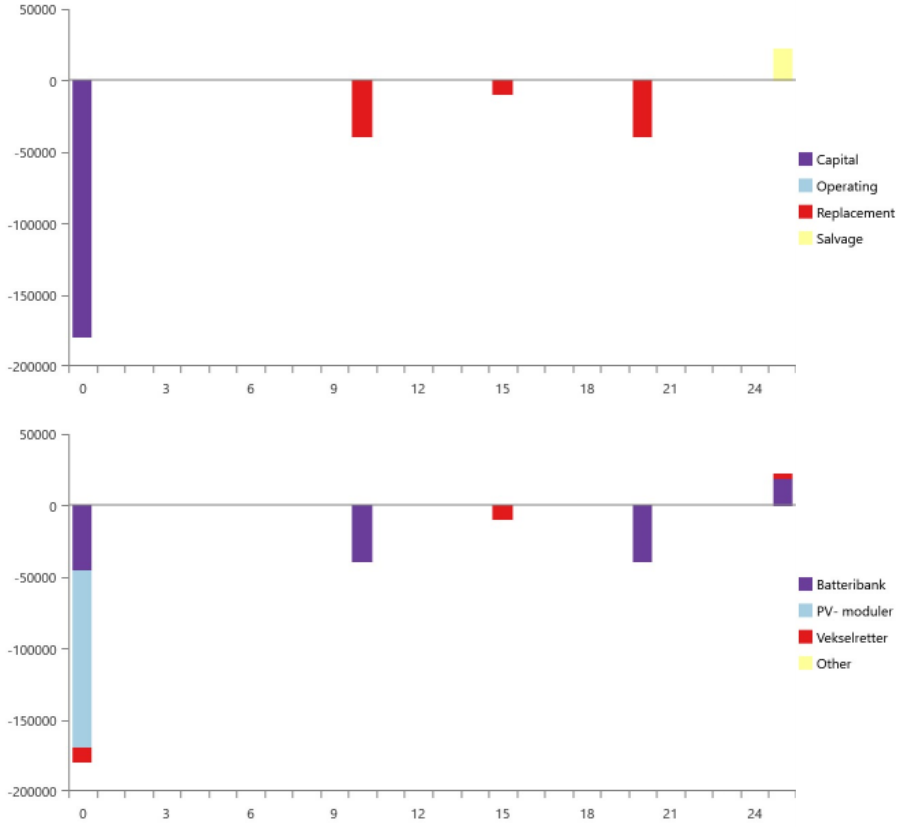
Net Present Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Batteribank	$45,296	$0.00	$52,274	-$9,780	$0.00	$87,790
Other	$0.00	$50.87	$0.00	$0.00	$0.00	$50.87
PV- moduler	$124,178	$0.00	$0.00	$0.00	$0.00	$124,178
Vekselretter	$10,504	$0.00	$6,901	-$1,738	$0.00	$15,666
System	$179,978	$50.87	$59,175	-$11,518	$0.00	$227,685

Annualized Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Batteribank	$2,555	$0.00	$2,949	-$551.71	$0.00	$4,952
Other	$0.00	$2.87	$0.00	$0.00	$0.00	$2.87
PV- moduler	$7,005	$0.00	$0.00	$0.00	$0.00	$7,005
Vekselretter	$592.53	$0.00	$389.28	-$98.06	$0.00	$883.75
System	$10,153	$2.87	$3,338	-$649.77	$0.00	$12,844

Cash Flow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Capital
Operating
Replacement
Salvage
50000
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-50000
-100000
-150000
-200000
0
3
6
9
12
15
18
21
24
Batteribank
PV- moduler
Vekselretter
Other

Electrical Summary

Excess and Unmet

Quantity	Value	Units
Excess Electricity	1,572	kWh/yr
Unmet Electric Load	1.62	kWh/yr
Capacity Shortage	2.87	kWh/yr

Production Summary

Component	Production (kWh/yr)	Percent
PV- moduler	5,217	100
Total	5,217	100

Consumption Summary

Component	Consumption (kWh/yr)	Percent
AC Primary Load	3,021	100
DC Primary Load	0	0
Deferrable Load	0	0
Total	3,021	100

PV: PV- moduler

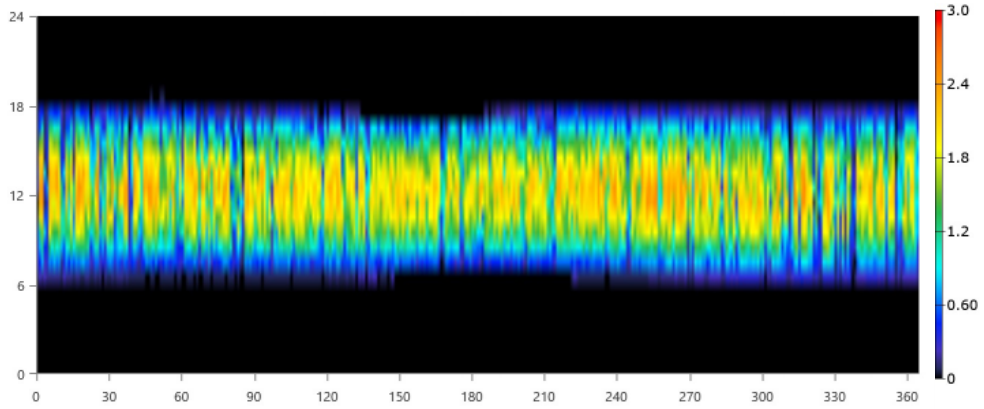
PV- moduler Electrical Summary

Quantity	Value	Units
Minimum Output	0	kW
Maximum Output	2.64	kW
PV Penetration	173	%
Hours of Operation	4,405	hrs/yr
Levelized Cost	1.34	$/kWh

PV- moduler Statistics

Quantity	Value	Units
Rated Capacity	2.63	kW
Mean Output	0.596	kW
Mean Output	14.3	kWh/d
Capacity Factor	22.6	%
Total Production	5,217	kWh/yr

PV- moduler Output (kW)



Storage: Batteribank

Batteribank Properties

Quantity	Value	Units
Batteries	8.00	qty.
String Size	1.00	batteries
Strings in Parallel	8.00	strings
Bus Voltage	12.0	V

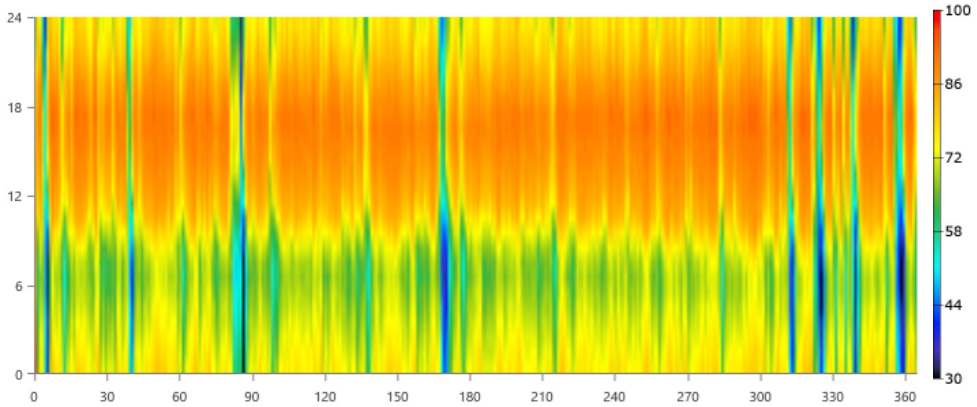
Batteribank Result Data

Quantity	Value	Units
Average Energy Cost	0	$/kWh
Energy In	2,366	kWh/yr
Energy Out	1,901	kWh/yr
Storage Depletion	8.77	kWh/yr
Losses	474	kWh/yr
Annual Throughput	2,125	kWh/yr

Batteribank Statistics

Quantity	Value	Units
Autonomy	50.7	hr
Storage Wear Cost	0.0220	$/kWh
Nominal Capacity	25.0	kWh
Usable Nominal Capacity	17.5	kWh
Lifetime Throughput	21,254	kWh
Expected Life	10.0	yr

Batteribank State of Charge (%)



Converter: Vekselretter

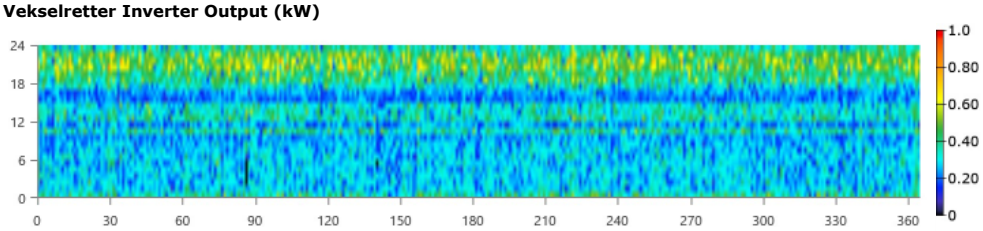
Vekselretter Electrical Summary

Quantity	Value	Units
Hours of Operation	8,758	hrs/yr
Energy Out	3,021	kWh/yr
Energy In	3,180	kWh/yr
Losses	159	kWh/yr

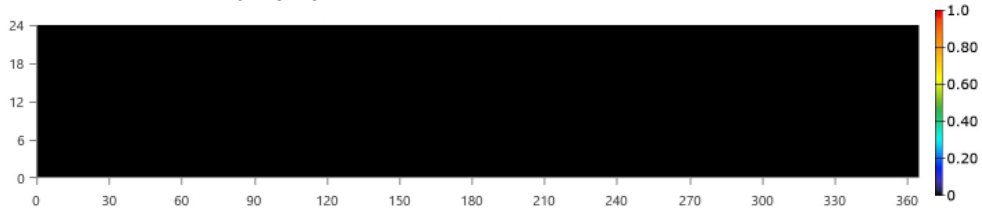
Vekselretter Statistics

Quantity	Value	Units
Capacity	1.50	kW
Mean Output	0.345	kW
Minimum Output	0	kW
Maximum Output	0.893	kW
Capacity Factor	23.0	%

Vekselretter Inverter Output (kW)



Vekselretter Rectifier Output (kW)



B.3 Simulering av et frittstående biogassanlegg

System Simulation Report

File: stand-alone-biogas.homer

Author: OKGR

Location: Unnamed Road, Gweru, Zimbabwe (19°27.2'S, 29°46.2'E)

Total Net Present Cost: $1,634,650.00

Levelized Cost of Energy ($/kWh): $30.51

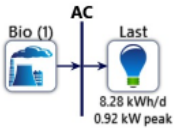
Notes:

Table of Contents

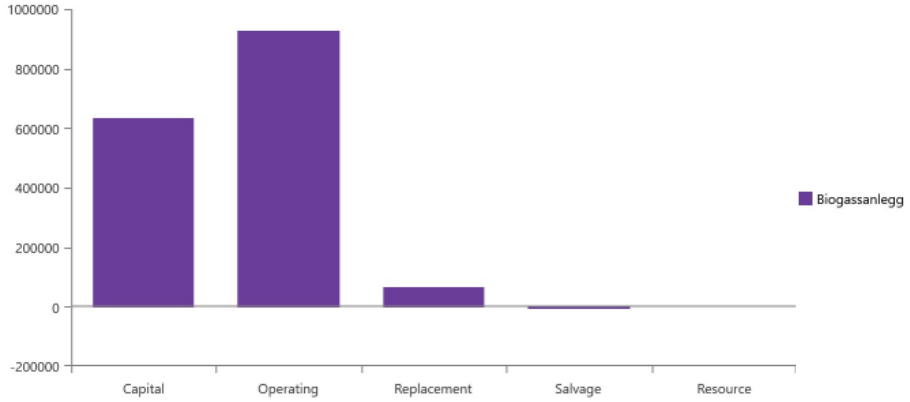
System Architecture

Component	Name	Size	Unit
Generator	Biogassanlegg	3.00	kW
Dispatch strategy	HOMER Cycle Charging		

Schematic



Cost Summary



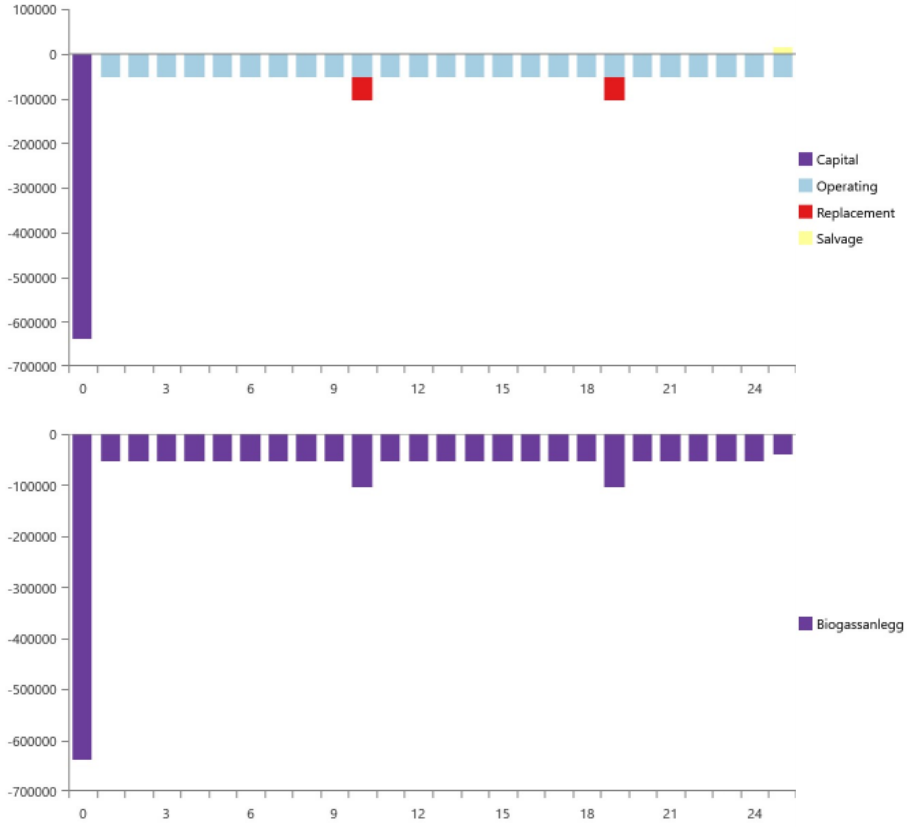
Net Present Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Biogassanlegg	$638,876	$931,731	$70,755	-$6,712	$0.00	$1.63M
System	$638,876	$931,731	$70,755	-$6,712	$0.00	$1.63M

Annualized Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Biogassanlegg	$36,040	$52,560	$3,991	-$378.63	$0.00	$92,212
System	$36,040	$52,560	$3,991	-$378.63	$0.00	$92,212

Cash Flow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15
18
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24
Capital
Operating
Replacement
Salvage
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-400000
-500000
-600000
-700000
0
3
6
9
12
15
18
21
24
Biogassanlegg

Electrical Summary

Excess and Unmet

Quantity	Value	Units
Excess Electricity	2,256	kWh/yr
Unmet Electric Load	0	kWh/yr
Capacity Shortage	0	kWh/yr

Production Summary

Component	Production (kWh/yr)	Percent
Biogassanlegg	5,278	100
Total	5,278	100

Consumption Summary

Component	Consumption (kWh/yr)	Percent
AC Primary Load	3,022	100
DC Primary Load	0	0
Deferrable Load	0	0
Total	3,022	100

Generator: Biogassanlegg (Biogas)

Biogassanlegg Electrical Summary

Quantity	Value	Units
Electrical Production	5,278	kWh/yr
Mean Electrical Output	0.603	kW
Minimum Electrical Output	0.600	kW
Maximum Electrical Output	0.918	kW

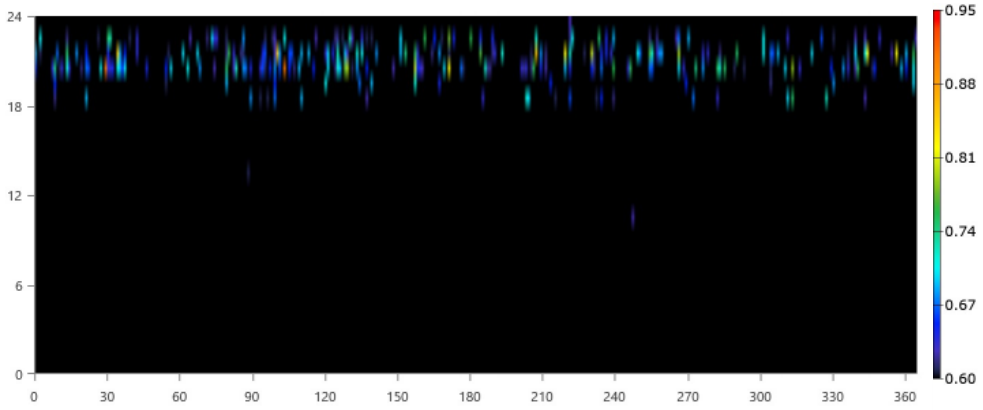
Biogassanlegg Fuel Summary

Quantity	Value	Units
Fuel Consumption	0.270	tons/yr
Specific Fuel Consumption	0.818	m^3/kWh
Fuel Energy Input	24,223	kWh/yr
Mean Electrical Efficiency	21.8	%

Biogassanlegg Statistics

Quantity	Value	Units
Hours of Operation	8,760	hrs/yr
Number of Starts	1.00	starts/yr
Operational Life	9.13	yr
Capacity Factor	20.1	%
Fixed Generation Cost	6.64	$/hr
Marginal Generation Cost	0	$/kWh

Biogassanlegg Output (kW)

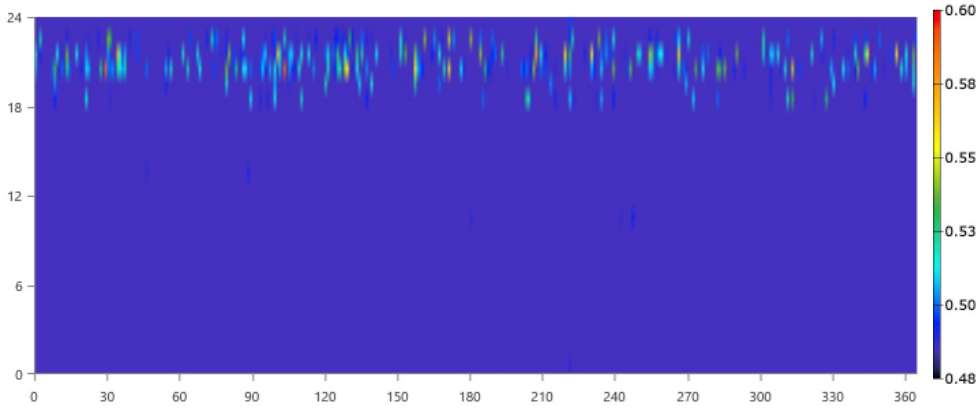


Fuel Summary

Biogas Consumption Statistics

Quantity	Value	Units
Total feedstock consumed	0.270	tons
Avg feedstock per day	0.000739	tons/day
Avg feedstock per hour	0.0000308	tons/hour

Biogas Consumption (m³/hr)



Emissions

Pollutant	Quantity	Unit
Carbon Dioxide	0.346	kg/yr
Carbon Monoxide	0	kg/yr
Unburned Hydrocarbons	0	kg/yr
Particulate Matter	0	kg/yr
Sulfur Dioxide	0	kg/yr
Nitrogen Oxides	0	kg/yr

B.4 Simulering av et optimalisert hybrid anlegg

System Simulation Report

File: Opti-hybrid.homer

Author: OKGR

Location: Unnamed Road, Gweru, Zimbabwe (19°27.2'S, 29°46.2'E)

Total Net Present Cost: $832,712.50

Levelized Cost of Energy ($/kWh): $15.54

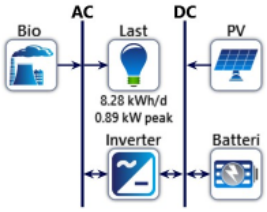
Notes:

Table of Contents

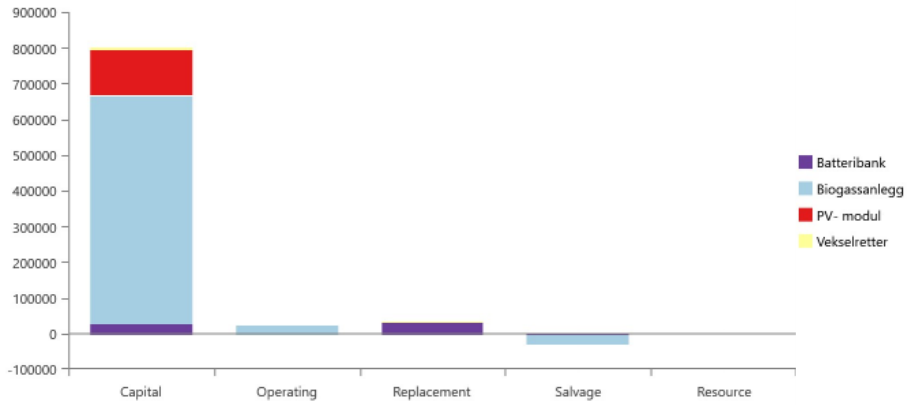
System Architecture

Component	Name	Size	Unit
Generator	Biogassanlegg	3.00	kW
PV	PV- modul	2.66	kW
Storage	Batteribank	5	strings
System converter	Vekselretter	0.894	kW
Dispatch strategy	HOMER Load Following		

Schematic



Cost Summary



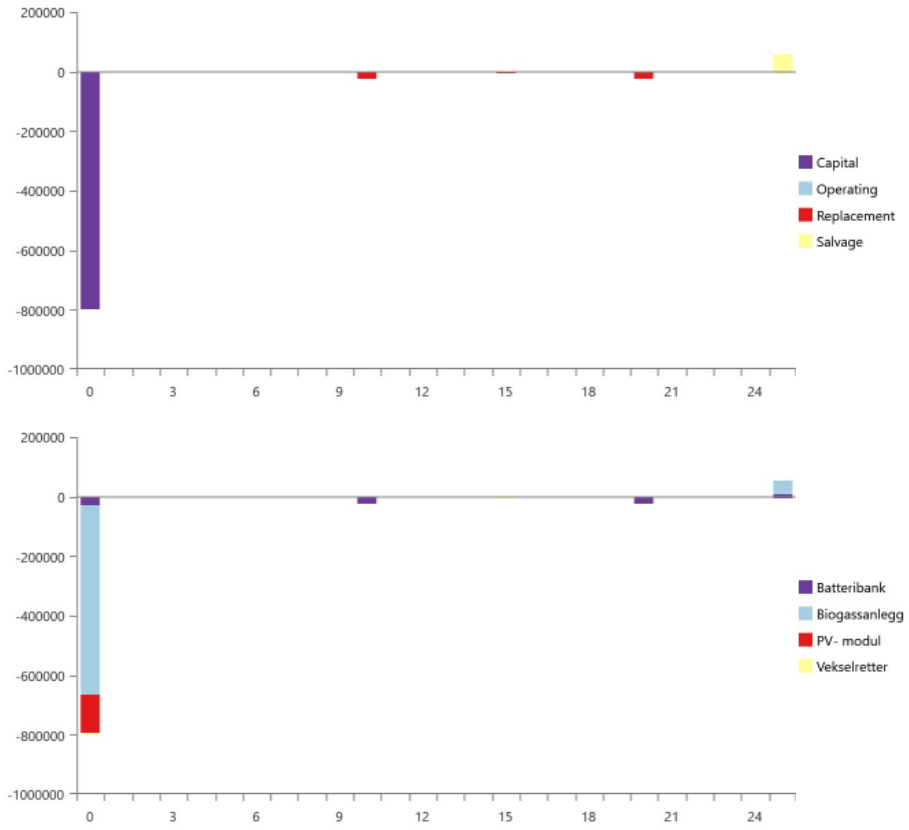
Net Present Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Batteribank	$28,310	$0.00	$32,671	-$6,113	$0.00	$54,869
Biogassanlegg	$638,876	$27,548	$0.00	-$23,500	$0.00	$642,924
PV- modul	$125,570	$0.00	$0.00	$0.00	$0.00	$125,570
Vekselretter	$6,269	$0.00	$4,119	-$1,037	$0.00	$9,350
System	$799,025	$27,548	$36,790	-$30,650	$0.00	$832,713

Annualized Costs

Name	Capital	Operating	Replacement	Salvage	Resource	Total
Batteribank	$1,597	$0.00	$1,843	-$344.82	$0.00	$3,095
Biogassanlegg	$36,040	$1,554	$0.00	-$1,326	$0.00	$36,268
PV- modul	$7,084	$0.00	$0.00	$0.00	$0.00	$7,084
Vekselretter	$353.64	$0.00	$232.33	-$58.53	$0.00	$527.44
System	$45,074	$1,554	$2,075	-$1,729	$0.00	$46,974

Cash Flow


200000
0
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-400000
-600000
-800000
-1000000
0
3
6
9
12
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18
21
24
Capital
Operating
Replacement
Salvage
200000
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-200000
-400000
-600000
-800000
-1000000
0
3
6
9
12
15
18
21
24
Batteribank
Biogassanlegg
PV- modul
Vekselretter

Electrical Summary

Excess and Unmet

Quantity	Value	Units
Excess Electricity	528	kWh/yr
Unmet Electric Load	0	kWh/yr
Capacity Shortage	0	kWh/yr

Production Summary

Component	Production (kWh/yr)	Percent
PV- modul	3,998	96.2
Biogassanlegg	157	3.78
Total	4,155	100

Consumption Summary

Component	Consumption (kWh/yr)	Percent
AC Primary Load	3,022	100
DC Primary Load	0	0
Deferrable Load	0	0
Total	3,022	100

Generator: Biogassanlegg (Biogas)

Biogassanlegg Electrical Summary

Quantity	Value	Units
Electrical Production	157	kWh/yr
Mean Electrical Output	0.606	kW
Minimum Electrical Output	0.600	kW
Maximum Electrical Output	0.893	kW

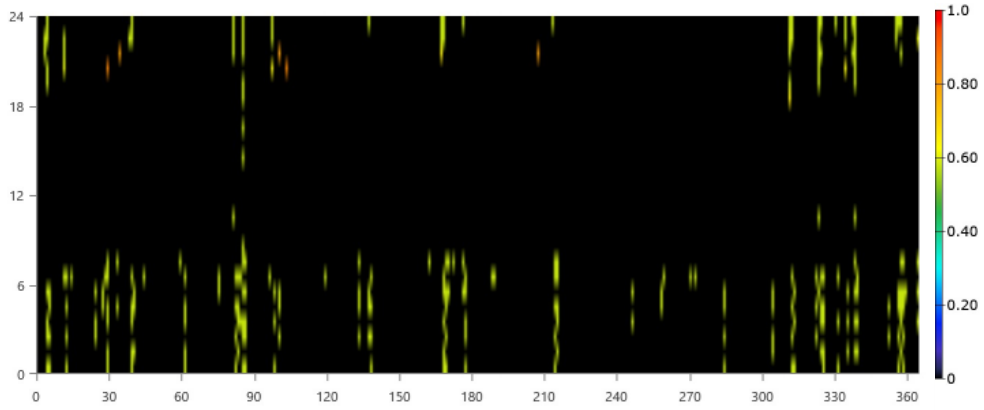
Biogassanlegg Fuel Summary

Quantity	Value	Units
Fuel Consumption	0.00800	tons/yr
Specific Fuel Consumption	0.815	m^3/kWh
Fuel Energy Input	718	kWh/yr
Mean Electrical Efficiency	21.9	%

Biogassanlegg Statistics

Quantity	Value	Units
Hours of Operation	259	hrs/yr
Number of Starts	175	starts/yr
Operational Life	309	yr
Capacity Factor	0.598	%
Fixed Generation Cost	6.64	$/hr
Marginal Generation Cost	0	$/kWh

Biogassanlegg Output (kW)



PV: PV- modul

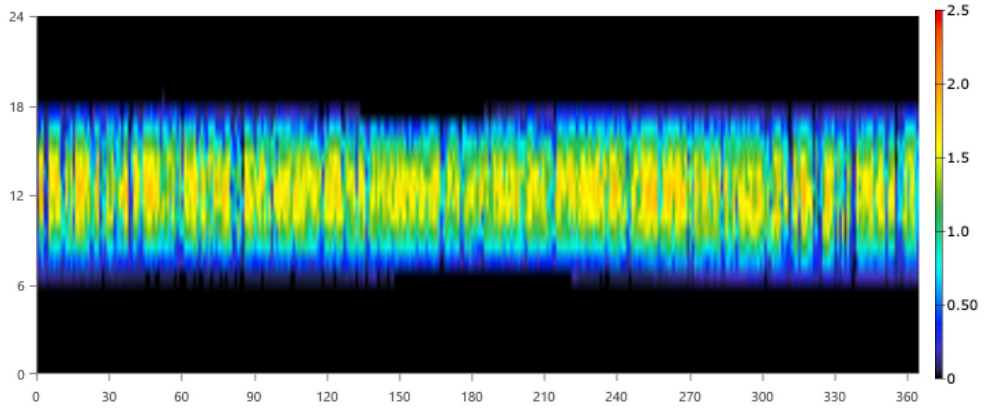
PV- modul Electrical Summary

Quantity	Value	Units
Minimum Output	0	kW
Maximum Output	2.03	kW
PV Penetration	132	%
Hours of Operation	4,406	hrs/yr
Levelized Cost	1.77	$/kWh

PV- modul Statistics

Quantity	Value	Units
Rated Capacity	2.66	kW
Mean Output	0.456	kW
Mean Output	11.0	kWh/d
Capacity Factor	17.1	%
Total Production	3,998	kWh/yr

PV- modul Output (kW)



Storage: Batteribank

Batteribank Properties

Quantity	Value	Units
Batteries	5.00	qty.
String Size	1.00	batteries
Strings in Parallel	5.00	strings
Bus Voltage	12.0	V

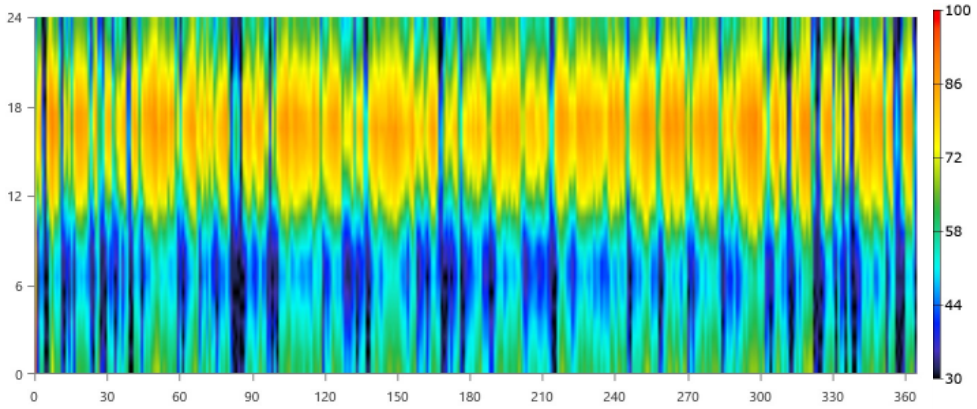
Batteribank Result Data

Quantity	Value	Units
Average Energy Cost	0	$/kWh
Energy In	2,290	kWh/yr
Energy Out	1,842	kWh/yr
Storage Depletion	10.7	kWh/yr
Losses	459	kWh/yr
Annual Throughput	2,059	kWh/yr

Batteribank Statistics

Quantity	Value	Units
Autonomy	31.7	hr
Storage Wear Cost	0.0220	$/kWh
Nominal Capacity	15.6	kWh
Usable Nominal Capacity	10.9	kWh
Lifetime Throughput	20,591	kWh
Expected Life	10.0	yr

Batteribank State of Charge (%)



Converter: Vekselretter

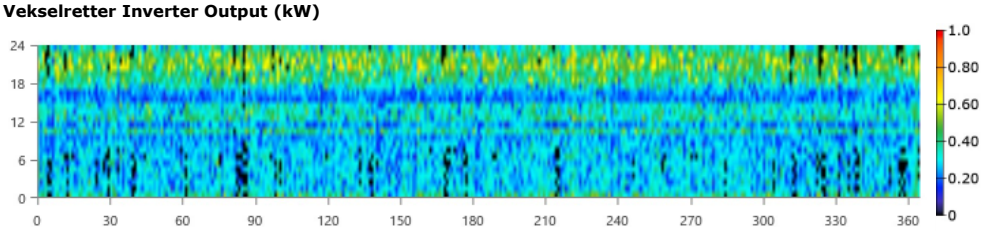
Vekselretter Electrical Summary

Quantity	Value	Units
Hours of Operation	8,501	hrs/yr
Energy Out	2,924	kWh/yr
Energy In	3,078	kWh/yr
Losses	154	kWh/yr

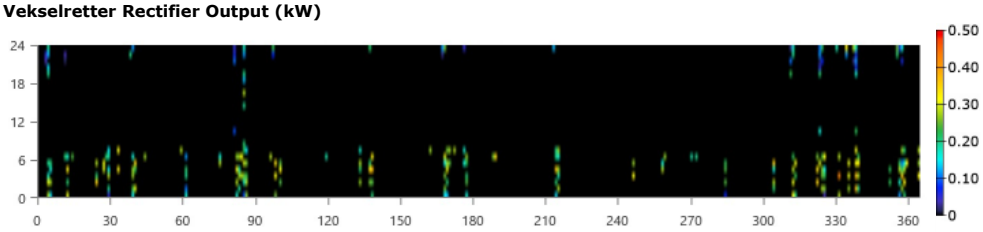
Vekselretter Statistics

Quantity	Value	Units
Capacity	0.894	kW
Mean Output	0.334	kW
Minimum Output	0	kW
Maximum Output	0.809	kW
Capacity Factor	37.3	%

Vekselretter Inverter Output (kW)



Vekselretter Rectifier Output (kW)

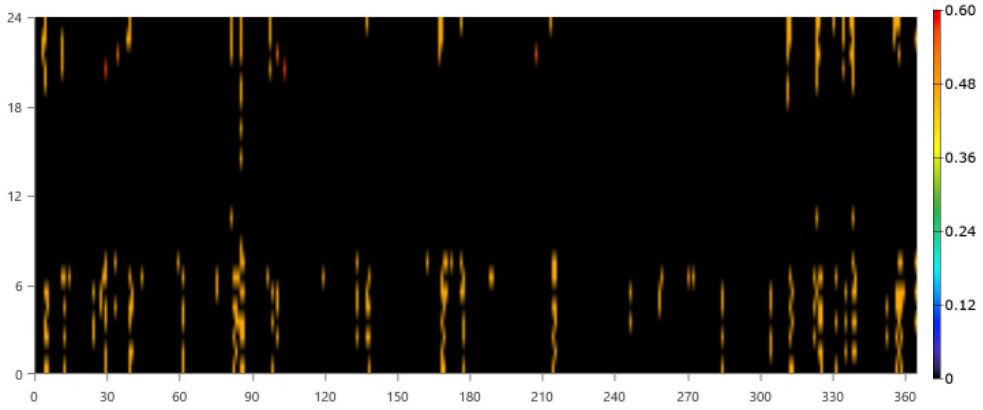


Fuel Summary

Biogas Consumption Statistics

Quantity	Value	Units
Total feedstock consumed	0.00800	tons
Avg feedstock per day	0.0000219	tons/day
Avg feedstock per hour	0	tons/hour

Biogas Consumption (m³/hr)



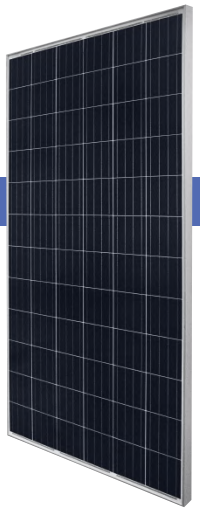
Emissions

Pollutant	Quantity	Unit
Carbon Dioxide	0.0103	kg/yr
Carbon Monoxide	0	kg/yr
Unburned Hydrocarbons	0	kg/yr
Particulate Matter	0	kg/yr
Sulfur Dioxide	0	kg/yr
Nitrogen Oxides	0	kg/yr

Produktblader

C.1 PV moduler

RenewSys®
let there be light



DESERV™

3M6 - 300/305/310/315/320/325/330

DESERV 3M6 72 cells PV Modules Series is offered with power ratings ranging from 300 Wp to 330 Wp.
These high performance Multi-Crystalline Silicon Modules are designed for on-grid, as well as off-grid applications.

KEY FEATURES

- Made in India
- Positive power tolerance
- Highly reliable anti- reflective coated glass
- **Windload - 2400 Pa**
  Snowload - 5400 Pa
- IP67 Junction box
- 1000 V V_{dc}
- PID resistant
- 25 YEARS Limited power output warranty
- 10 YEARS Product warranty

IEC Certified - 61215, 61730, TS 62804, 61853
IEC 61701 (Salt mist corrosion resistant- Severity 6)
IEC 62716 (Ammonia corrosion resistant)
UL Certified 1703
IEC 60068-2-68 (Sand Abrasion)
Listed in Dewa

IMS Certified Company (ISO 9001:2015 & OHSAS 18001:2007)

Independently Audited by
SOLARBUYER

RenewSys has a global presence with offices in India, Mauritius, Nigeria, South Africa, Singapore, UAE, representatives in Europe, USA, and Mexico, and an evolving distributor network.

inter solar award 2018 Finalist
CONSERV® E 360 - POE Encapsulant

Performance under standard test conditions (1000W/m² AM 1.5, 25°C)

	DESERV 3M6-310	DESERV 3M6-305	DESERV 3M6-310	DESERV 3M6-315	DESERV 3M6-320	DESERV 3M6-325	DESERV 3M6-330
Rated power (Pmax), Wp	300	305	310	315	320	325	330
Max power voltage (Vmp), V	36.52	36.75	36.86	36.92	37.20	37.41	37.62
Max power current (Imp), A	08.22	08.30	08.41	08.55	08.61	08.69	08.78
Open circuit voltage (Voc), V	45.65	45.94	46.08	46.15	46.18	46.21	46.24
Short circuit current (Isc), A	08.56	08.65	08.76	08.91	09.06	09.18	09.30
Module efficiency (%)	15.48	15.74	16.00	16.26	16.51	16.77	17.03

Operating Conditions

Ambient temperature, °C	-40 to +85
Maximum system voltage,Vdc	1000
Hail impact velocity, m/sec	23
Maximum surface load capacity, Pascals	5400

Cell Temperature Coefficients

Open circuit voltage	- 0.30 % / °C
Short circuit current	+ 0.05 % / °C
Nominal power	- 0.40 % / °C

Physical Parameters

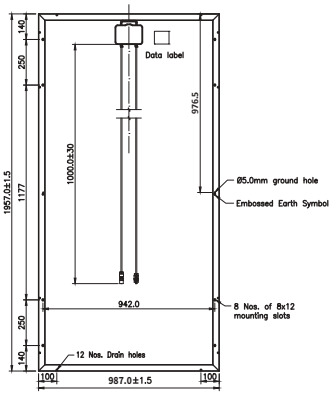
No. of cells	72
Module dimensions (mm)	1957 X 987
Module thickness (mm)	40
Approximate weight (kg)	21.5

Mechanical Characteristics

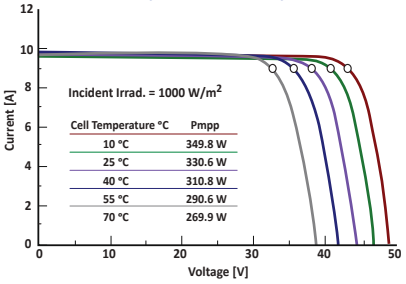
Cable	NO. 12 AWG, 4mm² (1.2m standard)
PV Connectors	MC4/MC4 (Compatible)/TYCO
Frame	Anodized Aluminum Alloy
Junction box	IP67 Junction Box With 4 Rail
Glass	3.2mm Thick Low Iron Tempered (4mm available on request)

NOCT - DESERV 3M6	300 Wp	305 Wp	310 Wp	315 Wp	320 Wp	325 Wp	330 Wp
Pmax (W)	223.27	226.99	230.71	234.43	238.15	241.88	245.60
Voltage Vmp (V)	33.40	33.61	33.71	33.77	34.02	34.21	34.45
Current Imp (A)	6.69	6.76	6.85	6.96	7.01	7.07	7.14
Open Circuit Voltage Voc (V)	42.45	42.72	42.85	42.91	42.94	42.97	43.00
Short Circuit Current Isc (A)	6.99	7.07	7.16	7.28	7.40	7.50	7.56

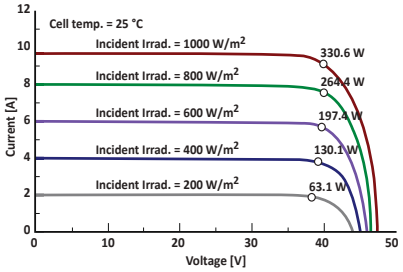
RenewSys DESERV 3M6 - 72 Cells
Solar PV Module Dimensions



RenewSys DESERV 3M6 - 330 Wp: I-V curves
Cell temperature sensitivity chart



RenewSys DESERV 3M6 - 330 Wp: I-V curves
Incident irradiance sensitivity chart



Registered Office
98, Jolly Maker Chambers No.2, 225 Nariman Point, Mumbai - 400 021, Maharashtra, India
Tel.: + 91 22 30040500

Factory
Plot No.6, Survey # 114/P, Srinagar Village, Maheshwaram Mandal, Dist-Rangareddy, Hyderabad - 501 359, Telangana, India
Tel.: + 91 40 67303000 Fax: + 91 40 67303003

renewsys@renewsysindia.com ❖ www.renewsysworld.com

C.2 Batteri

Zoom

SonX RA12 260Ah 12V AGM Battery

Be the first to review this product

RA12-260D is an AGM deep cycle battery with 10 years floating design life,specially designed for frequent cyclic discharge use. By using thick grid & specific paste plates the battery has 30% more cyclic life time than standby batteries. Applications include solar & wind energy systems, golf carts, electric wheelchairs, etc.

Download the specification sheet here.

Please note that stock is due on the 6th September 2017, so all orders placed now will be fulfilled after this date.

SKU: SSB-SX-260AH-12V

Sign up for price alert

Excl. Tax: R 6,614.78
Incl. Tax: R 7,607.00

Qty: 1

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Product Description | Additional Information | Reviews

Product Tags

RA12-260D is an AGM deep-cycle battery with 10 years floating design life, specially designed for frequent cyclic discharge use. By using thick grid & specific paste plates the battery has 30% more cyclic life time than standby batteries. Applications include solar & wind energy systems, golf carts, electric wheelchairs, etc.

Technical Specifications
Cells Per Unit : 6
Voltage Per Unit : 12
Capacity : 260Ah@10hr-rate to 1.80V per cell @25oC
Weight Approx. : 74.0 Kg
Max. Discharge Current : 2600 A (5 sec)
Internal Resistance : Approx. 3.5 mΩ
Operating Temperature Range : Discharge: -20 ~60, Charge: 0oC~50oC Storage: -20oC~60oC
Normal Operating Temperature Range : 25oC±5oC
Float charging Voltage : 13.6 to 13.8 VDC/unit Average at 25oC
Recommended Maximum Charging Current Limit : 78A
Equalization and Cycle Service : 14.6 to 14.8 VDC/unit Average at 25oC
Self Discharge : VRLA batteries can be stored for more than 6 months at 25oC. Self-discharge ratio less than 3% per month at 25oC. Please charge batteries before using.
Terminal : Terminal F14
Container Material : A.B.S. (UL94-HB) , Flammability resistance of UL94-V1 can be available upon request.
Dimensions : Dimension: 520(L)×268(W)×220(H)mm

Please note that stock availability is subject to prior sales. Prices exclude delivery.

You may also be interested in the following product(s)

SonX RA12 100Ah 12V AGM Battery

Excl. Tax: R 2,505.22

SonX RT12 26Ah 12V AGM Battery

Excl. Tax: R 870.43

SonX RA12 150A 12V AGM Batter

Excl. Tax: R 4,185.22

Incl. Tax: R 2,881.00 Incl. Tax: R 1,000.99 Incl. Tax: R 4,813.00

C.3 Vekselretter

28-05-2018

MultiPlus-II 48/3000/35-32 230V (formerly called MultiGrid-II)

Comparison to the MultiGrid 48/3000/35-50 230V and installation suggestions

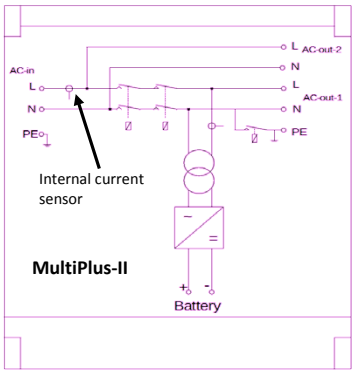


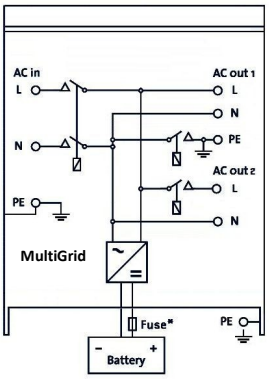
1. Specifications

	MultiPlus-II 48/3000/35 230V	MultiGrid 48/3000/35-50 230V	MultiPlus 48/3000/35 230V
PowerControl & PowerAssist	Yes		
Transfer switch	32 A	50 A	16 A or 50 A
INVERTER			
DC Input voltage range	38 – 66 V		
Output	Output voltage: 230 VAC ± 2% Frequency: 50 Hz ± 0,1% (1)		
Cont. output power at 25°C (3)	3000 VA		
Cont. output power at 25°C	2400 W		
Cont. output power at 40°C	2200 W		
Cont. output power at 65°C	1700 W		
Peak power	5500 W	6000 W	
Maximum efficiency	95 %		
Zero load power	11 W	25 W	
Zero load power in AES mode	7 W	20 W	
Zero load power in Search mode	2 W	12 W	
CHARGER			
AC Input	Input voltage range: 187-265 VAC Input frequency: 45 – 65 Hz		
Charge voltage 'absorption'	57,6 V		
Charge voltage 'float'	55,2 V		
Storage mode	52,8 V		
Maximum battery charge current (4)	35 A		
Battery temperature and voltage sensor	VE.Bus Smart dongle (6) (optional)	Yes	
GENERAL			
Auxiliary output	Yes (32 A) Directly connected to the AC input	Yes (16 A) Relay with 2 minutes turn on delay	
External current sensor (optional)	Yes	No	
Programmable relay (5)	Yes, but not the same functionality		
Protection (2)	a - g		
VE.Bus communication port	For parallel and three phase operation, remote monitoring and system integration		
General purpose com. ports	Yes, Aux in 1 and Aux in 2		
Remote on-off	Yes		
Operating temperature range	-40 to +65°C (fan assisted cooling)		
Humidity (non-condensing)	max 95%		
ENCLOSURE			
Material & Colour	Steel, blue RAL 5012	Aluminium, blue RAL 5012	
Protection category	IP 22		
Battery-connection	Two M6 bolts	Four M8 bolts	
230 V AC-connection	Screw terminals 13 mm² (6 AWG)		
Weight	18 kg		
Dimensions (hxwxd)	499 x 268 x 141 mm	362 x 258 x 218 mm	

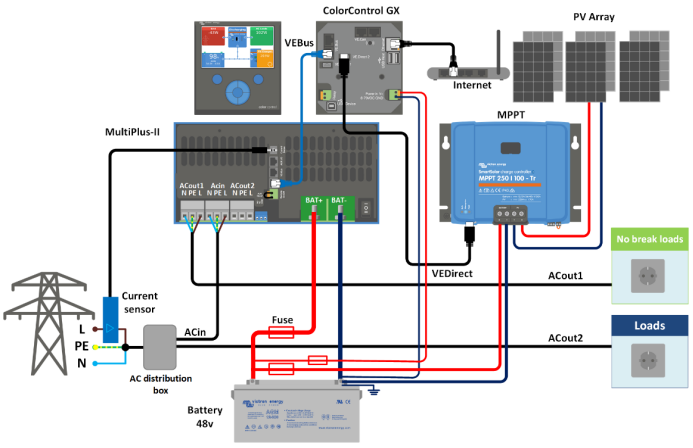
1) Can be adjusted to 60 Hz
2) Protection key:
a) output short circuit b) overload c) battery voltage too high d) battery voltage too low e) temperature too high
f) 230 VAC on inverter output g) input voltage ripple too high
3) Non-linear load, crest factor 3:1
4) At 25°C ambient
5) Programmable relay which can be set for general alarm, DC under voltage or genset start/stop function
AC rating: 230V / 4A, DC rating: 4A up to 35VDC and 1A up to 60VDC
6) Expected to be available in Q3 2018

2. Block diagrams





The AC-in current sensor (internal current sensor) of the MultiPlus-II is placed directly on the AC input. AC-out-2 is connected to the AC input, 'downstream' of the current sensor.

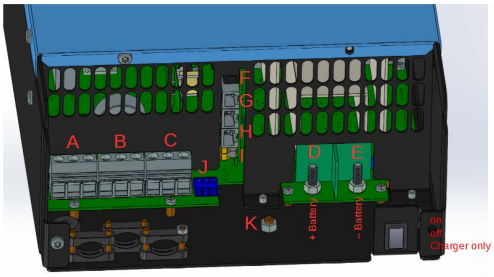


Application example of the external current sensor:
The external current sensor (F) replaces the internal current sensor when connected.
The functionality is identical to the internal sensor.
The external sensor[1] can for example be used to regulate power from the grid to zero, as long as the total load (Loads + No break loads) does not exceed to capacity of the MultiPlus-II, or to implement the PowerAssist function (max current 32A)

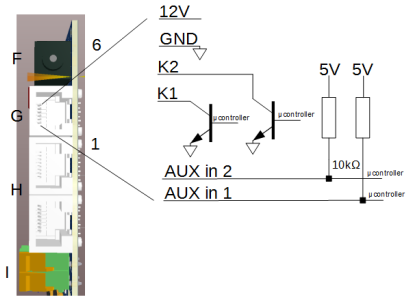
[1] Length of connection cable: 1 meter. Do not increase length: risk of malfunction due to EMI.

3. Analog and digital interfaces

3.1 MultiPlus-II



A	Load connection. AC out1. Left to right: N (neutral), PE (earth/ground), L (phase)
B	AC input: Left to right: N (neutral), PE (earth/ground), L (phase)
C	Load connection. AC out2. Left to right: N (neutral), PE (earth/ground), L (phase)
D	M6 battery positive connection.
E	M6 battery minus connection.
F	External current sensor (not available on MultiGrid)
G	RJ12 additional IO connector (see below)
H	2x RJ45 VE-BUS connector for remote control and/or parallel / three-phase operation (VE.Bus)
I	Connector for remote switch: Short to switch “on”.
J	Programmable relay (left to right) NO, NC, COM.(virtual switch in VE.Configure)
K	Primary ground connection M8 (PE).



Detail of the RJ12 additional IO connector (G)

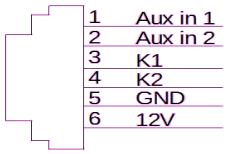
RJ12 additional IO connector

Aux in 1 and Aux in 2: 0 – 5V (same fio as in MultiGrid)

K1, K2: open collector 70V 100mA max (open collector inputs, replaces the programmable relay contacts of the MultiGrid)

12V: 12V 100mA max power supply

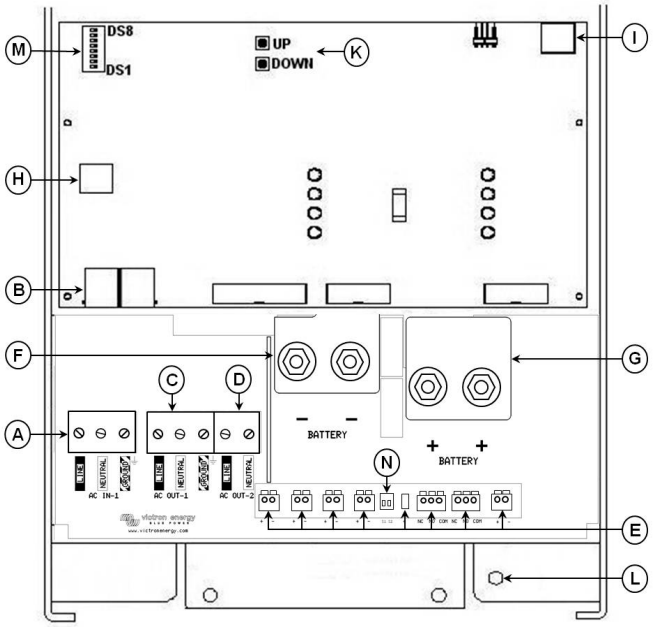
Gnd: common ground



Detail of the RJ12 additional IO connector (G)

3

3.2 MultiGrid

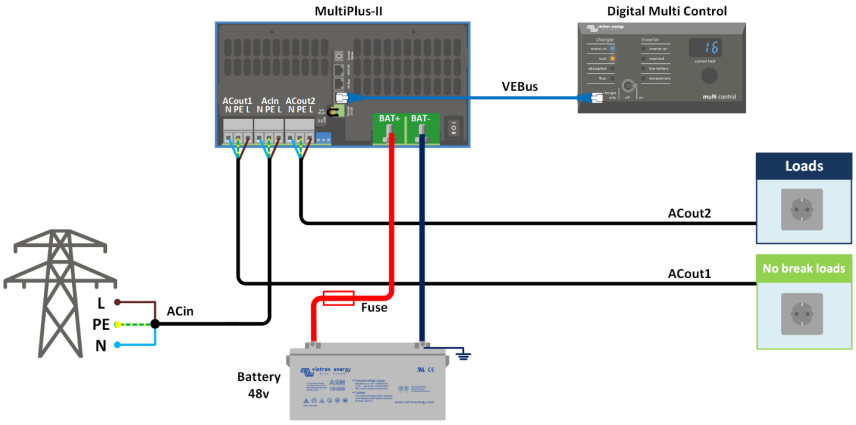


A	AC input: Left to right: L (phase), N (neutral), PE (earth/ground).
B	2x RJ45 connector for remote control and/or parallel / three-phase operation (VE.Bus)
C	Load connection. AC out1. Left to right: L (phase), N (neutral), PE (earth/ground).
D	Load connection. AC out2. Left to right: PE (earth/ground), L (phase), N (neutral).
E	Terminals Temperature sensor (not available on the MultiPlus-II: VE.Bus Smart dongle needed) Aux input 1 (same fio as MultiPlus-II) Aux input 2 (same fio as MultiPlus-II) Starter battery plus + (starter battery minus must be connected to service battery minus) Not available on the MultiPlus-II. Programmable relay contacts K1 Programmable relay contacts K2 Voltage sense (not available on the MultiPlus-II: VE.Bus Smart dongle needed)
F	Double M8 battery minus connection.
G	Double M8 battery positive connection.
H	Connector for remote switch: Short left and middle terminal to switch 'on'. Short right and middle terminal to switch to 'charger only'. Charger only mode not available on MultiPlus-II.
I	Alarm contact: (left to right) NC, NO, COM.
K	Pushbuttons for set-up mode. Not available on MultiPlus-II.
L	Primary ground connection M8 (PE).
M	Dipswitches DS1- DS8 for set-up mode. Not available on MultiPlus-II.
N	Slide switches, factory setting: SW1= down (off) position, SW2 = down (off) position. Not available on MultiPlus-II. SW1: down (off) = internal GND relay selected, up (on) = external GND relay selected (to connect ext GND relay: see E). Not available on MultiPlus-II SW2: No application. To be used for future features. Not available on MultiPlus-II

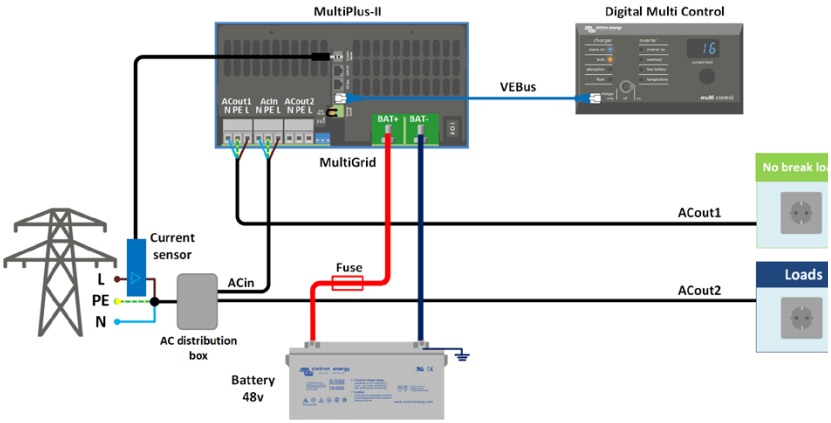
4

4 Installation suggestions

Basic with Digital Multi Control
ACout2 through Multi

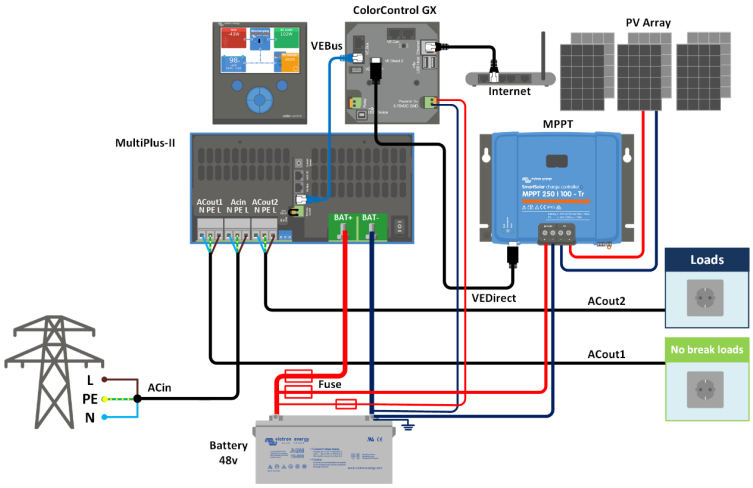


Basic with Digital Multi Control and current sensor

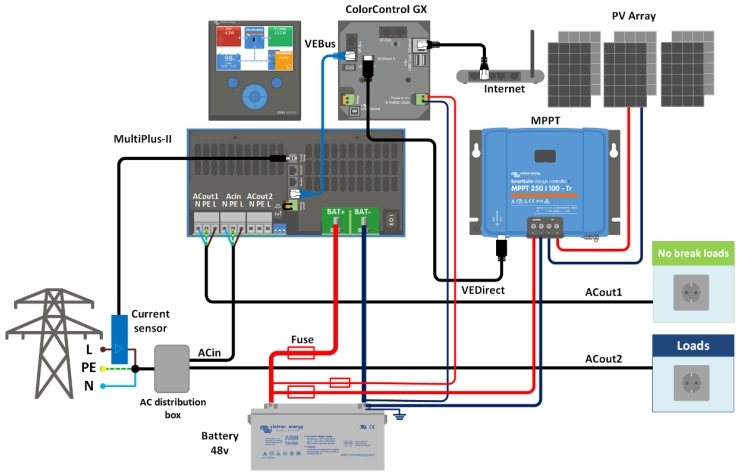


ACout2 from distribution box

ESS DC PV
ACout2 through Multi



ESS DC PV and current sensor (measuring range 0 - 32A)
ACout2 from distribution box



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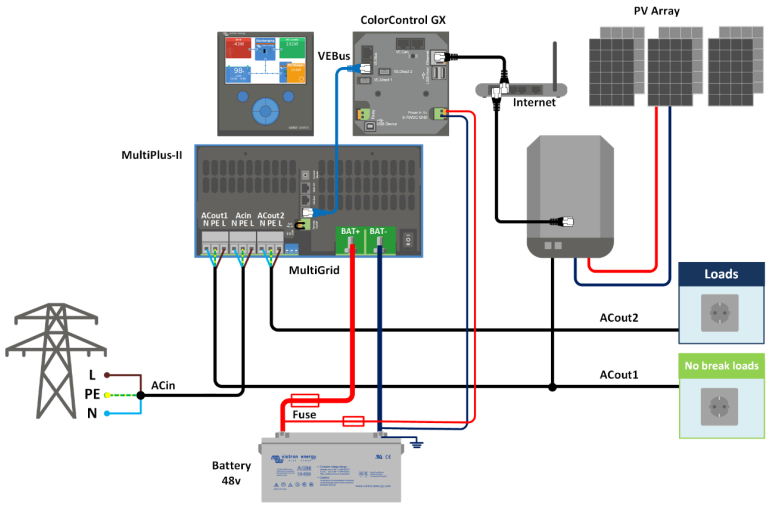
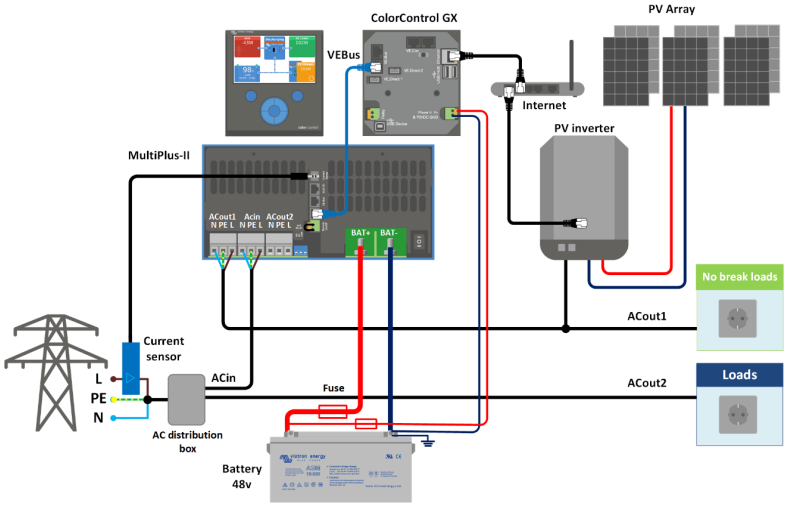
ESS AC PV on output1
ACout2 through Multi



ESS AC PV on output1 and current sensor (measuring range of the current sensor: 0 - 32A)
ACout2 from distribution box



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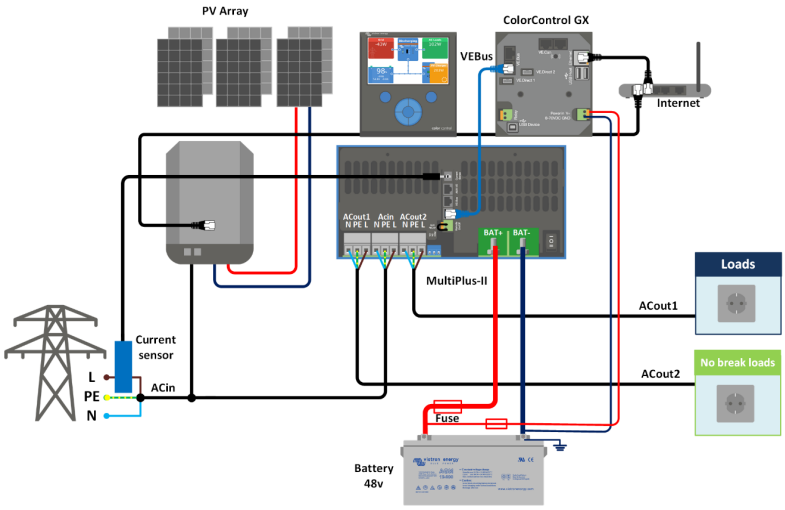
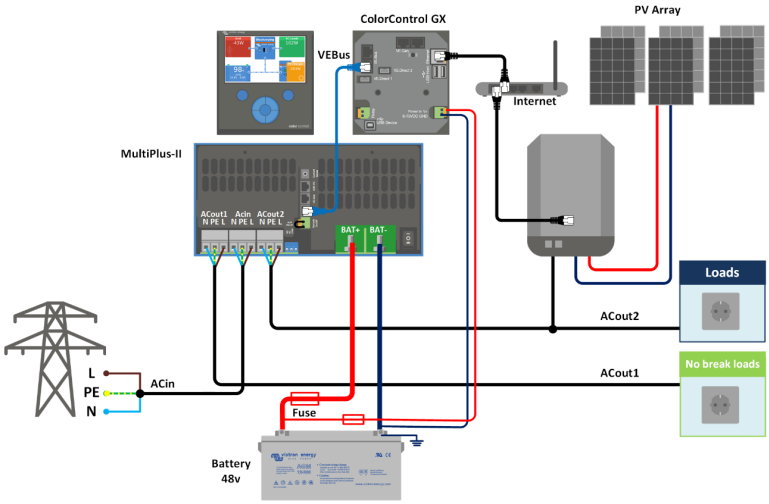
ESS AC PV on input (measuring range of the current sensor: 0 - 32A)
ACout2 through Multi



ESS AC PV on input (Output2) and current sensor
ACout2 from distribution box



8

C.4 Ladekontroller

victron energy
BLUE POWER

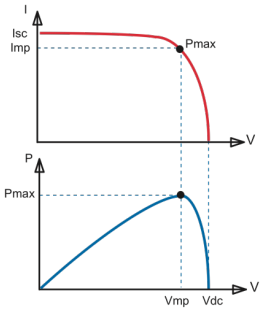
BlueSolar Charge Controllers with screw- or MC4 PV connection

MPPT 150/45, MPPT 150/60, MPPT 150/70, MPPT 150/85, MPPT 150/100

www.victronenergy.com

Solar Charge Controller MPPT 150/100-Tr

Solar Charge Controller MPPT 150/100-MC4



Maximum Power Point Tracking

Upper curve:
Output current (I) of a solar panel as function of output voltage (V).
The Maximum Power Point (MPP) is the point Pmax along the curve where the product I x V reaches its peak.

Lower curve:
Output power P = I x V as function of output voltage.
When using a PWM (not MPPT) controller the output voltage of the solar panel will be nearly equal to the voltage of the battery, and will be lower than Vmp.

Ultra-fast Maximum Power Point Tracking (MPPT)

Especially in case of a clouded sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30% compared to PWM charge controllers and by up to 10% compared to slower MPPT controllers.

Advanced Maximum Power Point Detection in case of partial shading conditions

If partial shading occurs, two or more maximum power points may be present on the power-voltage curve. Conventional MPPTs tend to lock to a local MPP, which may not be the optimum MPP.
The innovative BlueSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

Outstanding conversion efficiency

No cooling fan. Maximum efficiency exceeds 98%.

Flexible charge algorithm

Fully programmable charge algorithm (see the software page on our website), and eight pre-programmed algorithms, selectable with a rotary switch (see manual for details).

Extensive electronic protection

Over-temperature protection and power derating when temperature is high.
PV short circuit and PV reverse polarity protection.
PV reverse current protection.

Internal temperature sensor

Compensates absorption and float charge voltage for temperature.

Real-time data display options

- Apple and Android smartphones, tablets and other devices: see the VE.Direct to Bluetooth Smart dongle
- ColorControl panel

BlueSolar Charge Controller	MPPT 150/45	MPPT 150/60	MPPT 150/70	MPPT 150/85	MPPT 150/100
Battery voltage	12 / 24 / 48V Auto Select (software tool needed to select 36V)				
Rated charge current	45A	60A	70A	85A	100A
Nominal PV power, 12V 1a,b)	650W	860W	1000W	1200W	1450W
Nominal PV power, 24V 1a,b)	1300W	1720W	2000W	2400W	2900W
Nominal PV power, 48V 1a,b)	2600W	3440W	4000W	4900W	5800W
Max. PV short circuit current 2)	50A	50A	50A	70A	70A
Maximum PV open circuit voltage	150V absolute maximum coldest conditions 145V start-up and operating maximum				
Maximum efficiency	98%				
Self-consumption	10 mA				
Charge voltage 'absorption'	Default setting: 14,4 / 28,8 / 43,2 / 57,6V (adjustable)				
Charge voltage 'float'	Default setting: 13,8 / 27,6 / 41,4 / 55,2V (adjustable)				
Charge algorithm	multi-stage adaptive				
Temperature compensation	-16 mV / -32 mV / -64 mV / °C				
Protection	Battery reverse polarity (fuse, not user accessible) PV reverse polarity / Output short circuit / Over temperature				
Operating temperature	-30 to +60°C (full rated output up to 40°C)				
Humidity	95%, non-condensing				
Data communication port and remote on-off	VE.Direct (see the data communication whitepaper on our website)				
Parallel operation	Yes (not synchronized)				
ENCLOSURE					
Colour	Blue (RAL 5012)				
PV terminals 3)	35 mm² / AWG2 (Tr models) Two sets of MC4 connectors (MC4 models up to 150/70) Three sets of MC4 connectors (MC4 models 150/85 and 150/100)				
Battery terminals	35 mm² / AWG2				
Protection category	IP43 (electronic components), IP22 (connection area)				
Weight	3kg			4,5kg	
Dimensions (h x w x d) in mm	Tr models: 185 x 250 x 95 MC4 models: 215 x 250 x 95			Tr models: 216 x 295 x 103 MC4 models: 246 x 295 x 103	
STANDARDS					
Safety	EN/IEC 62109-1, UL 1741, CSA C22.2				

1a) If more PV power is connected, the controller will limit input power.
1b) PV voltage must exceed Vbat + 5V for the controller to start.
Thereafter minimum PV voltage is Vbat + 1V.
2) A PV array with a higher short circuit current may damage the controller.
3) MC4 models: several splitter pairs may be needed to parallel the strings of solar panels.
Maximum current per MC4 connector: 30A (the MC4 connectors are parallel connected to one MPPT tracker)

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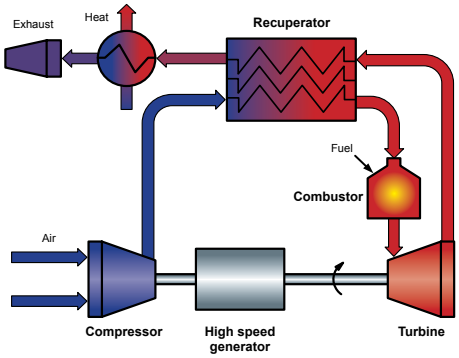
victron energy
BLUE POWER

C.5 Generator

Technology

Combined Heat and Power (CHP)

The objective of Combined Heat Power (CHP) is to generate electric power at locations where also a heat demand is present for either domestic or industrial heating. This way, CHP saves energy as the heat and transportation losses by large electric power stations are avoided.



Recuperated micro turbine in a CHP configuration

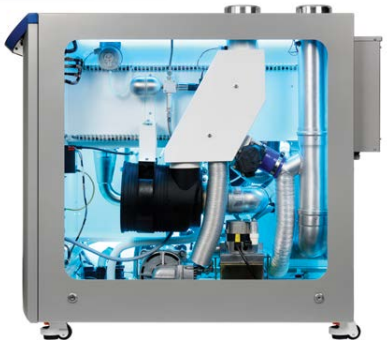
Micro gas turbines

The EnerTwin CHP system generates electric power using a 4 kW micro turbine. Gas turbines are known for their high power to weight ratio and low maintenance costs. Using off-the-shelf turbocharger technology leads to low production costs. The turbomachinery components are optimized for the turbogenerator application.

Driving a high-speed generator at 240,000 rpm, the EnerTwin micro CHP system has a net electric efficiency of >16% (20% shaft power efficiency on the turbogenerator). The limited turbo-machinery cost and their very low maintenance requirements offer great potential for cost effective micro-CHP systems. The generator is coupled to the micro turbine by a unique in-house developed compact rotor concept. Due to the recuperator, part load efficiency can be kept close to the design point maximum.

Recuperator

The recuperator is an advanced heat exchanger recovering exhaust heat into the gas turbine working cycle, saving almost 50% of fuel compared to a system without a recuperator and providing a substantial increase in efficiency.



EnerTwin micro-CHP system

Generator

An efficient high-speed permanent magnet generator converts the mechanical power from the micro turbine into electric power. The generator is fully integrated in the micro turbine rotor system, avoiding costs and losses of additional bearings and couplings.

Heat exchanger

The efficient heat exchanger transfers heat from the micro turbine exhaust to the micro-CHP heating system circuits.

Operation profile

The EnerTwin has a rapid (< 2mins) start-up capability. Moreover, power can be modulated down to about 30% without significant loss of efficiency.

Monitoring and control

The EnerTwin micro-CHP system has an on-line control and monitoring capability for remote operation, Virtual Power Plant and smart grid applications. This offers excellent installation and operation flexibility in cascade and other configurations.

Noise

Micro turbines emit only high frequency noise that can effectively be damped. Compared to alternative concepts, the EnerTwin has very low noise emissions.

Benefits for the environment

The EnerTwin micro-CHP system offers a substantial contribution to CO_2 emission reduction. With MTT's clean low-NO_x combustor, other exhaust gas emissions levels are minimal.

Specifications

		Max.	Min.	
Performance at ISA *	Net electric power	3.2	1.0	kW
	Net thermal power	15,6 **	6.0	kW
	Power to heat ratio at max power	20		%
	Net grid output efficiency (electrical)	16		%
	Total efficiency	> 94 **		%
	iaw EcoDesign (EU 813/2013)	> 110		%
	Rotor speed	240,000	180,000	rpm
	Fuel flow (H gas, 38.5 MJ/nm^3)	1.87	0.84	nm^3/h
Fuel	Natural gas H, E and L			
Operating conditions	Ambient air pressure	0.8 .. 1.1		bar
	Inlet air temperature	-20 .. 40		^{0}C
	System room temperature	5 .. 40		^{0}C
Heating system	Water flow rate	3 .. 21		l/min
	Water return temperature	5 .. 60		^{0}C
	Water out/buffer vessel temperature	5 .. 80		^{0}C
	Water pressure	0,7 .. 4		bar
Maintenance	Service interval	> 5000		hours
Emissions	NO_x	< 27		ppm @ 15% O_2
	CO	< 50		ppm @ 15% O_2
	CO_2 savings	3 – 6 ***		tons/year
	Noise	55		dB(A) 1m
Control	OpenTherm heating control interface			
	RS-485 Modbus remote control interface			
	0-10V building management system interface			
	MTT proprietary cascade operation control interface			
Installation	Dimensions (h x w x d)	995 x 600 x 1170		mm
	Weight (empty/with water/oil)	205 / 215		kg
	Natural gas connector	¾"		
	Water connector	¾"		
	Inlet air and flue gas pipes	DN 100 (parallel)		
	Grid connection	230 / 50		VAC / Hz

* *ISA conditions are 15 ^{0}C and 1.01325 bar dry air.*
** *Depending on heating system operating conditions such as water return temperature.*
*** *Depending on operating profile.*

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