System Report - yenhwa.hmr

Sensitivity case

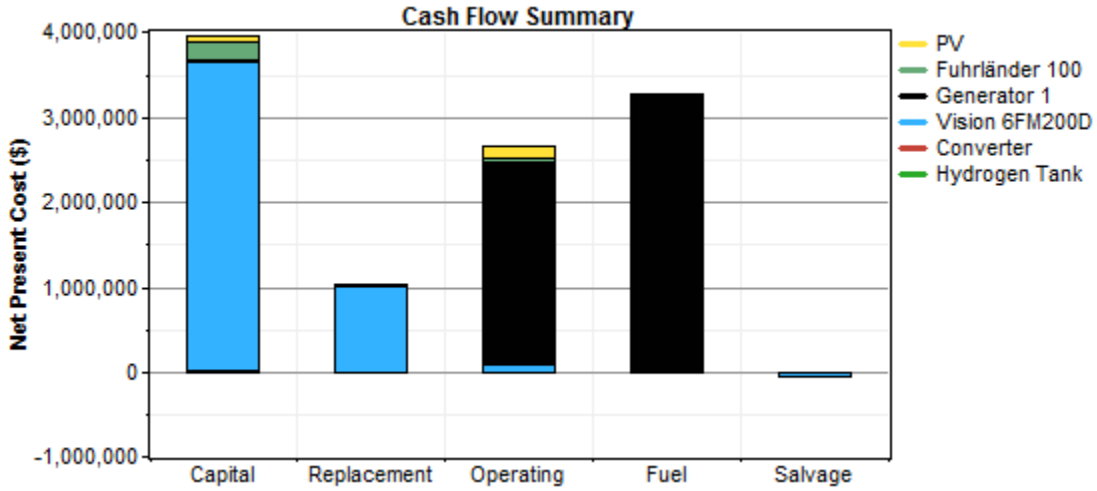
Solar Data Scaled Average: 3.79 kWh/m²/d
Wind Data Scaled Average: 6.18 m/s
Diesel Price: 1.7 $/L

System architecture

PV Array	200 kW
Wind turbine	15 Fuhrländer 100
Generator 1	150 kW
Battery	100 Vision 6FM200D
Inverter	100 kW
Rectifier	100 kW
Hydrogen Tank	2,000 kg
Dispatch strategy	Cycle Charging

Cost summary

Total net present cost	$ 10,843,879
Levelized cost of energy	$ 1.156/kWh
Operating cost	$ 538,167/yr



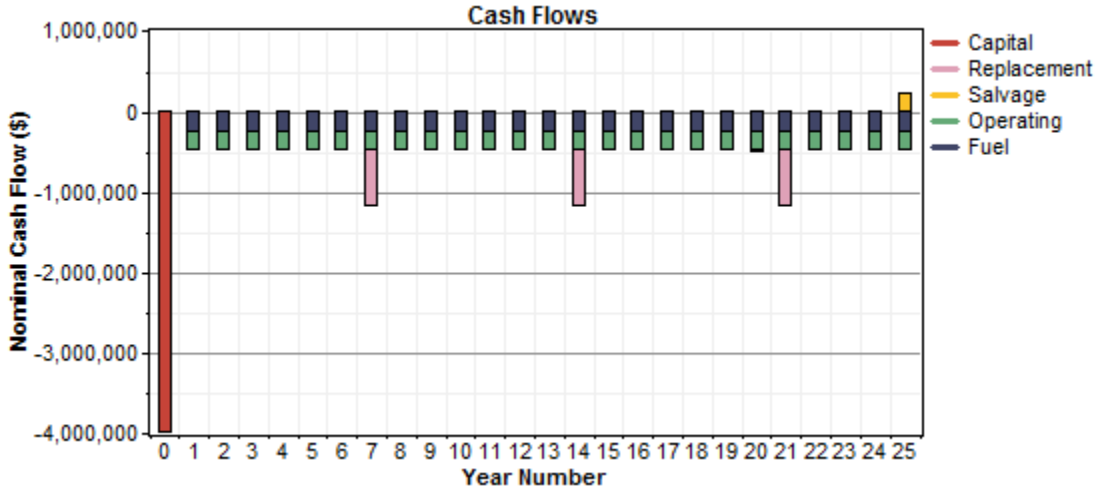
Net Present Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	($)	($)	($)	($)	($)	($)
PV	80,000	6,236	127,834	0	-3,495	210,575
Fuhrländer 100	225,000	3,755	57,525	0	-699	285,582
Generator 1	20,000	2,515	2,371,314	3,264,452	-423	5,657,858
Vision 6FM200D	3,636,300	1,006,874	89,484	0	-47,773	4,684,884
Converter	2,000	83	1,278	0	-16	3,346
Hydrogen Tank	1,000	0	639	0	0	1,639
System	3,964,300	1,019,463	2,648,074	3,264,452	-52,406	10,843,882

Annualized Costs

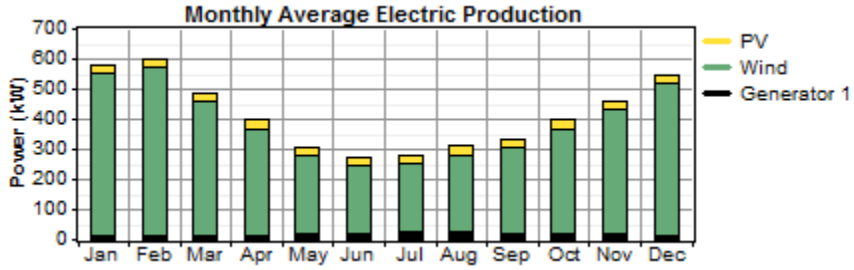
Component	Capital	Replacement	O&M	Fuel	Salvage	Total

	($/yr)	($/yr)	($/yr)	($/yr)	($/yr)	($/yr)
PV	6,258	488	10,000	0	-273	16,473
Fuhrländer 100	17,601	294	4,500	0	-55	22,340
Generator 1	1,565	197	185,500	255,367	-33	442,596
Vision 6FM200D	284,456	78,764	7,000	0	-3,737	366,483
Converter	156	7	100	0	-1	262
Hydrogen Tank	78	0	50	0	0	128
System	310,114	79,749	207,150	255,367	-4,100	848,281



Electrical

Component	Production	Fraction
	(kWh/yr)	
PV array	248,699	7%
Wind turbines	3,221,259	89%
Generator 1	155,664	4%
Total	3,625,622	100%



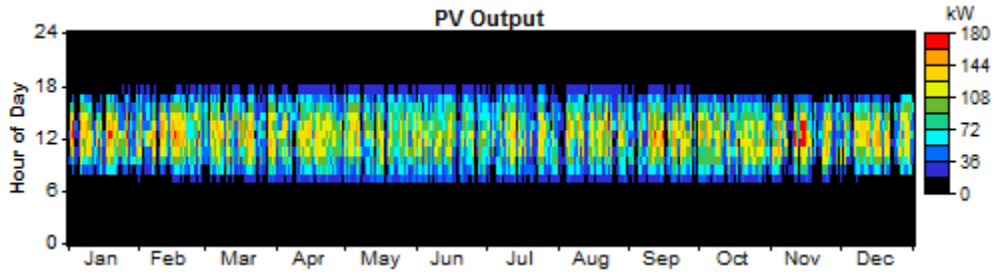
Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	733,561	100%
Total	733,561	100%

Quantity	Value	Units
Excess electricity	2,880,958	kWh/yr
Unmet load	93.1	kWh/yr
Capacity shortage	307	kWh/yr
Renewable fraction	0.957	

PV

Quantity	Value	Units
Rated capacity	200	kW
Mean output	28.4	kW
Mean output	681	kWh/d
Capacity factor	14.2	%
Total production	248,699	kWh/yr

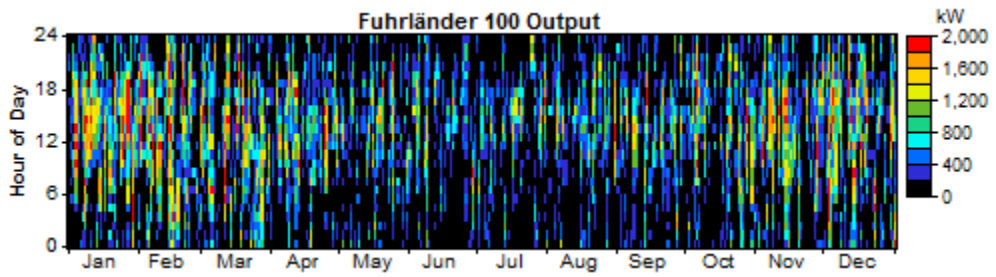
Quantity	Value	Units
Minimum output	0.00	kW
Maximum output	175	kW
PV penetration	33.9	%
Hours of operation	4,382	hr/yr
Levelized cost	0.0662	$/kWh



AC Wind Turbine: Fuhrländer 100

Variable	Value	Units
Total rated capacity	1,500	kW
Mean output	368	kW
Capacity factor	24.5	%
Total production	3,221,259	kWh/yr

Variable	Value	Units
Minimum output	0.00	kW
Maximum output	1,875	kW
Wind penetration	439	%
Hours of operation	7,998	hr/yr
Levelized cost	0.00694	$/kWh



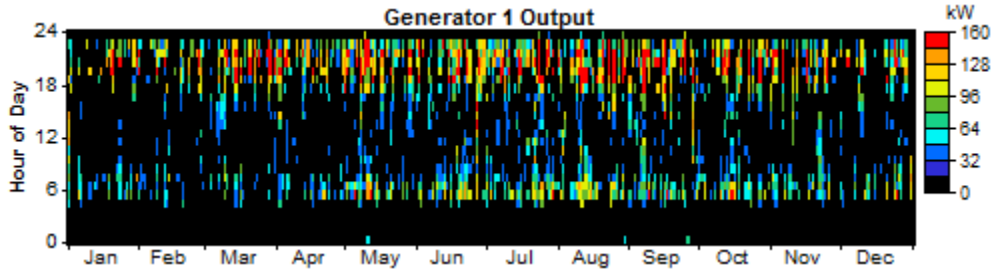
Generator 1

Quantity	Value	Units
Hours of operation	1,855	hr/yr

Number of starts	642	starts/yr
Operational life	8.09	yr
Capacity factor	11.8	%
Fixed generation cost	202	$/hr
Marginal generation cost	0.425	$/kWhyr

Quantity	Value	Units
Electrical production	155,664	kWh/yr
Mean electrical output	83.9	kW
Min. electrical output	45.0	kW
Max. electrical output	150	kW

Quantity	Value	Units
Fuel consumption	150,216	L/yr
Specific fuel consumption	0.965	L/kWh
Fuel energy input	1,478,126	kWh/yr
Mean electrical efficiency	10.5	%

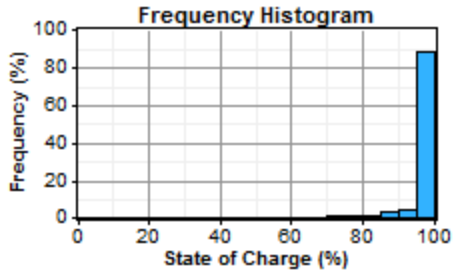


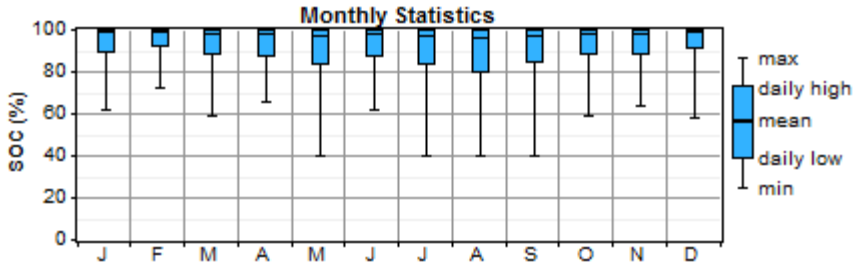
Battery

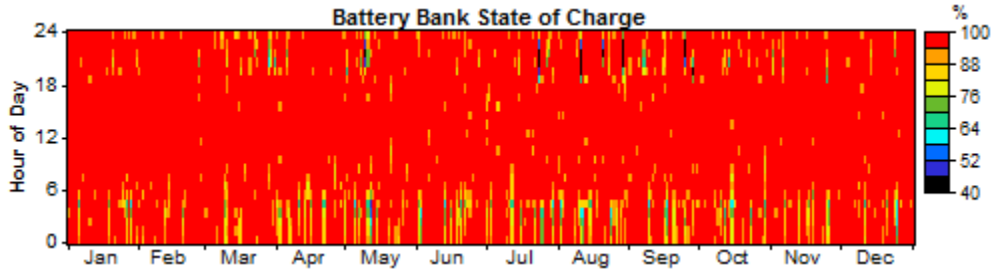
Quantity	Value
String size	2
Strings in parallel	50
Batteries	100
Bus voltage (V)	24

Quantity	Value	Units
Nominal capacity	240	kWh
Usable nominal capacity	144	kWh
Autonomy	1.72	hr
Lifetime throughput	91,700	kWh
Battery wear cost	8.535	$/kWh
Average energy cost	0.272	$/kWh

Quantity	Value	Units
Energy in	15,203	kWh/yr
Energy out	12,162	kWh/yr
Storage depletion	0.00	kWh/yr
Losses	3,040	kWh/yr
Annual throughput	13,598	kWh/yr
Expected life	6.74	yr



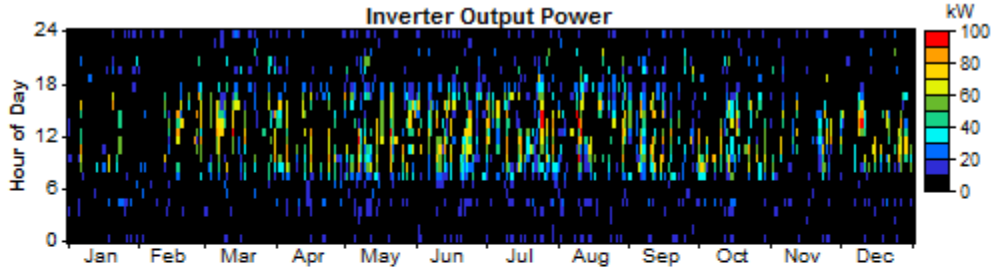


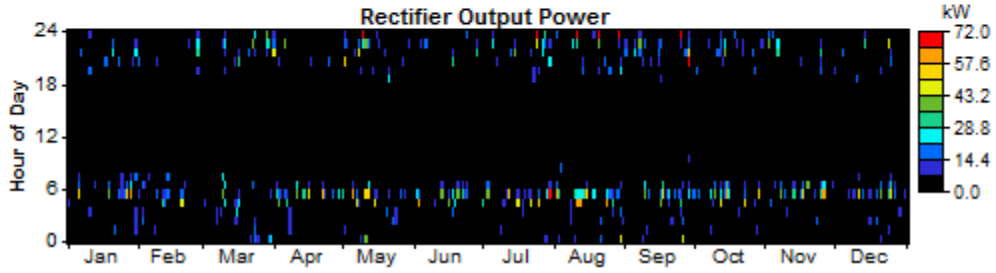


Converter

Quantity	Inverter	Rectifier	Units
Capacity	100	100	kW
Mean output	6	1	kW
Minimum output	0	0	kW
Maximum output	100	72	kW
Capacity factor	6.3	1.3	%

Quantity	Inverter	Rectifier	Units
Hours of operation	2,071	2,056	hrs/yr
Energy in	61,413	12,914	kWh/yr
Energy out	55,272	10,977	kWh/yr
Losses	6,141	1,937	kWh/yr

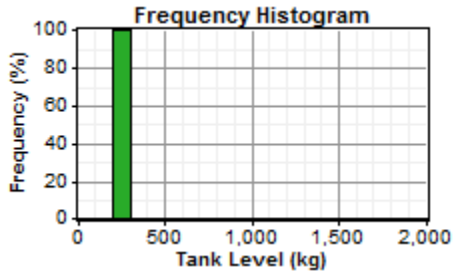


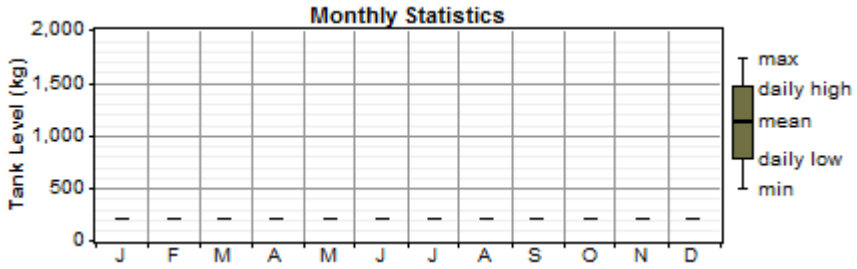


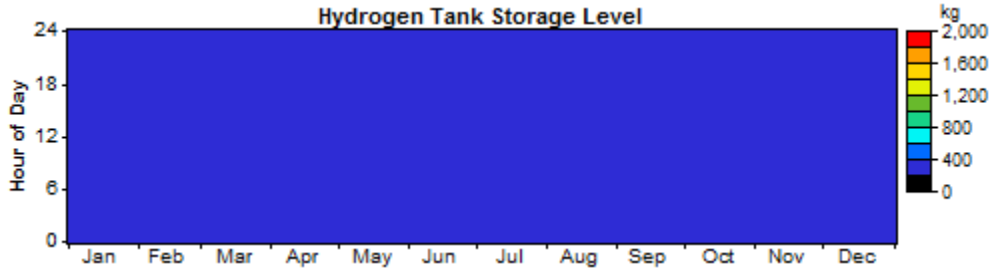
HydrogenTank

Variable	Value	Units
Hydrogen production	0	kg/yr
Hydrogen consumption	0.00	kg/yr

Hydrogen tank autonomy	796	hours







Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	395,568
Carbon monoxide	976
Unburned hydocarbons	108
Particulate matter	73.6
Sulfur dioxide	794
Nitrogen oxides	8,713