System Design

Grid Connected System Design
Address: Lethbridge Vic 3332
Coordinates: 38°0.1’S, 144°7.7’E
Date: 29th March 2021

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1. Design Brief

This document is the product of results from several micro grid design simulations with the intent of identifying the most economically viable off-grid connect energy system given the energy demand data from the customer, for the residential site. Price point of possible components, labour and the renewable energy resources at the given location was also included in this design. NASA satellite data is used in conjunction with BOM data to provide accurate readings of daily solar irradiation and daily average winds speeds. The property location is 260 Scanlon Road, Lethbridge Vic 3332.

Figure 1: 260 Scanlon Road, Lethbridge Vic 3332.2.

Power Usage

2.1 Electric Load

Meter Interval data from your current electricity retailer from last 12 months in the smallest step possible (60minute interval) was reformulated and then imported into our software to calculate the year around electric load.

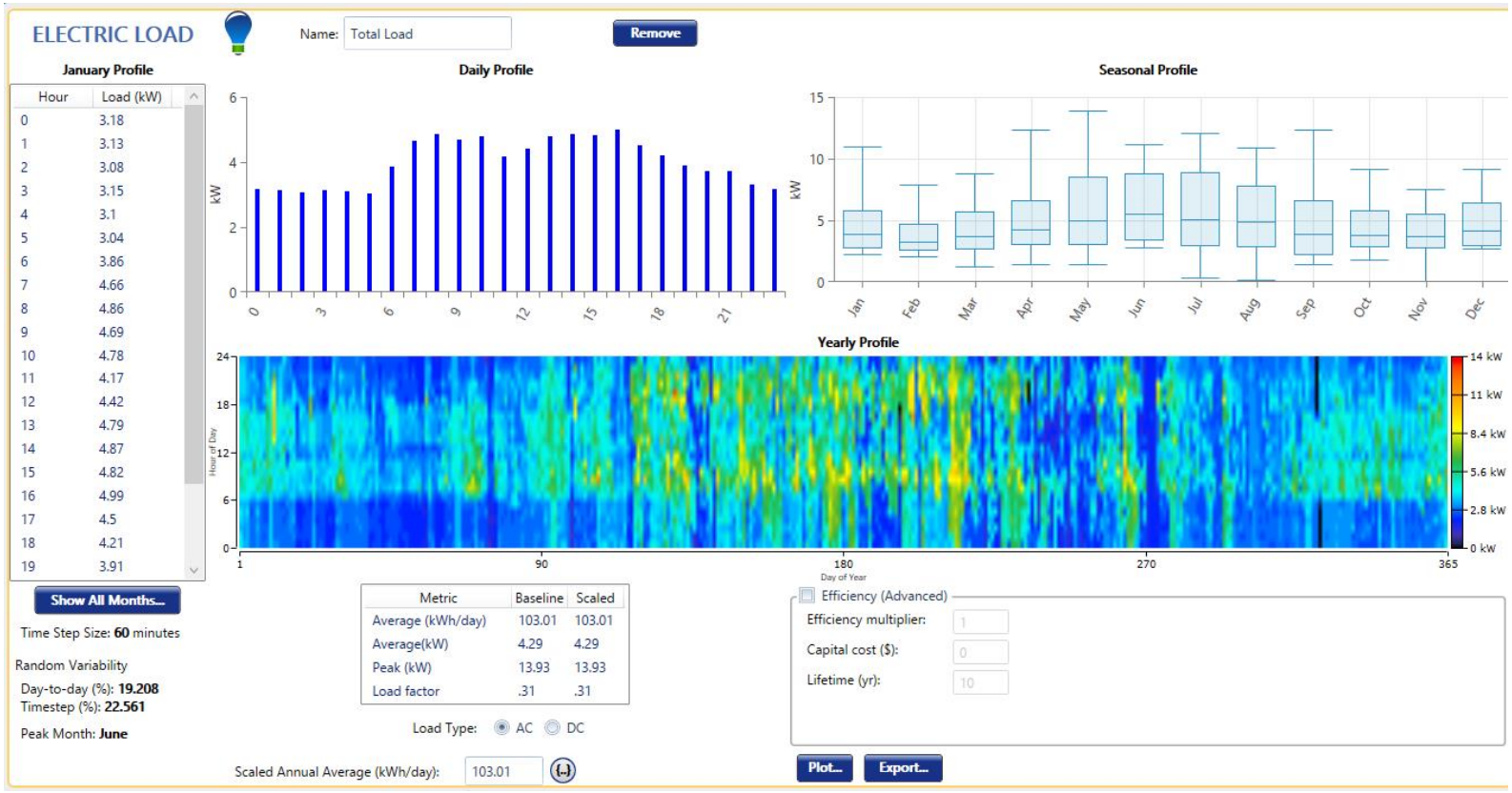

Figure 2: Daily, Seasonal and Yearly profile of House Load.

2.2 Load for each month

The graph below shows load for each month separately.

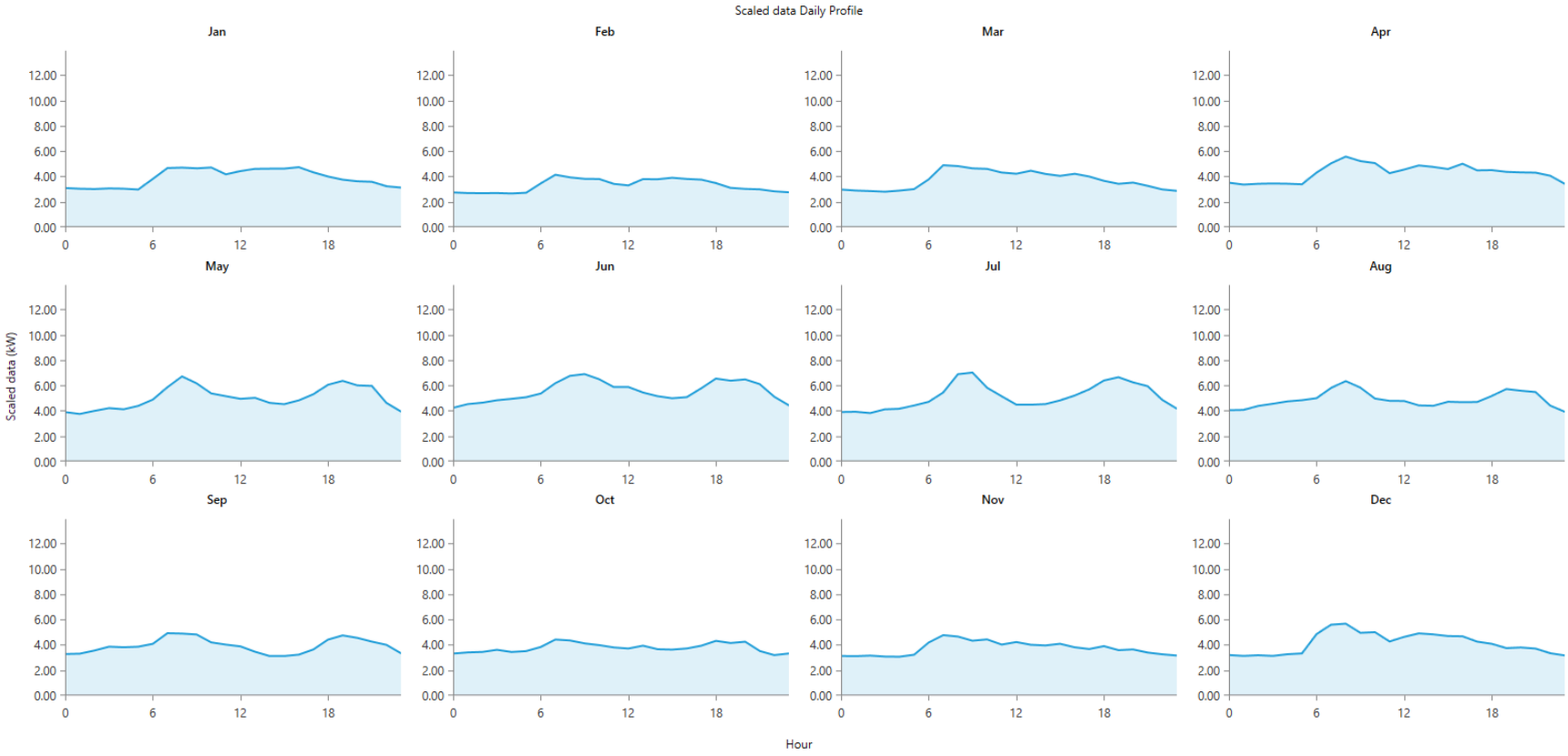

Figure 3: Load Data for Each Month- House Load

2.3 Grid Schedule Rates:

We have used your current grid schedule rates – Tango Energy.

5kW Export limit is considered in the design simulation.

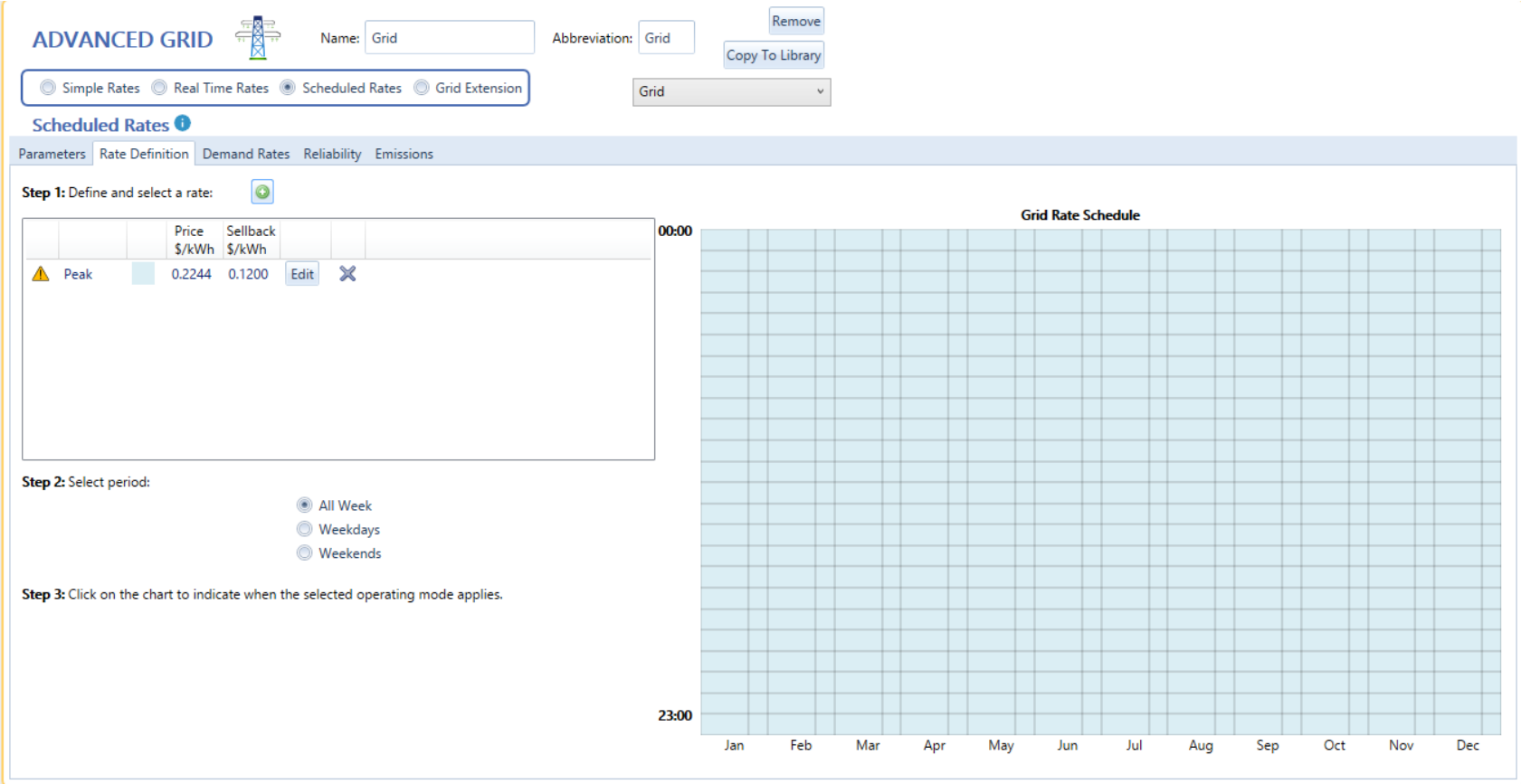

Figure 4: Grid Schedule Rates

3. Solar and Wind Resource data

3.1 Solar Resource

Data over a 22-year period obtained from the NASA Surface meteorology and Solar Energy database has been used to identify the solar resource for your site.

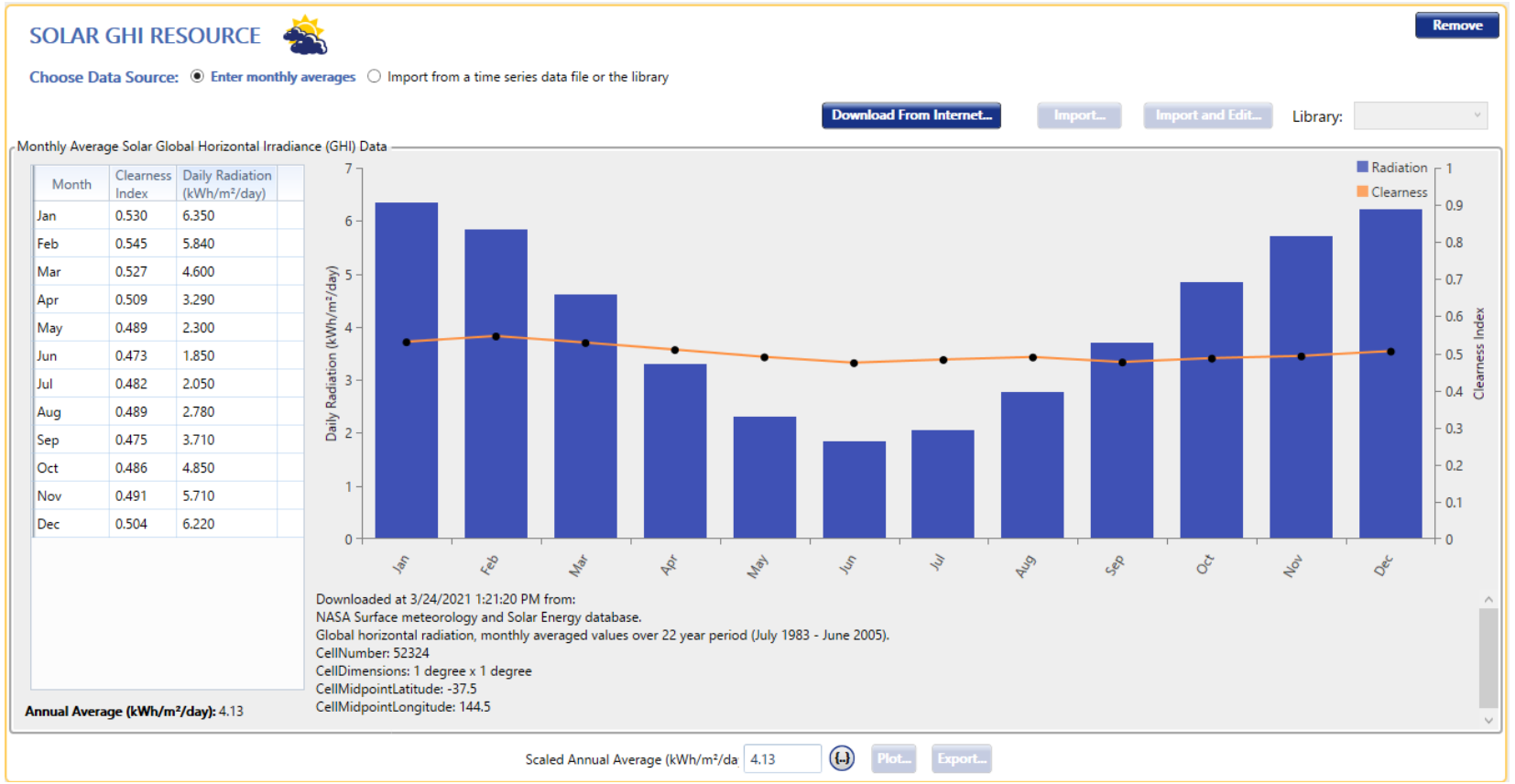

Figure 5: Solar GHI resource

3.2 Wind Resource

Data over a 10-year period obtained from the NASA Surface meteorology and Solar Energy database was retrieved as shown below. This average data is taken at 50m above the ground. For the purpose of this analysis, these figures are scaled down to a turbine hub height of 12m (standard tower height) to show indicative wind speeds.

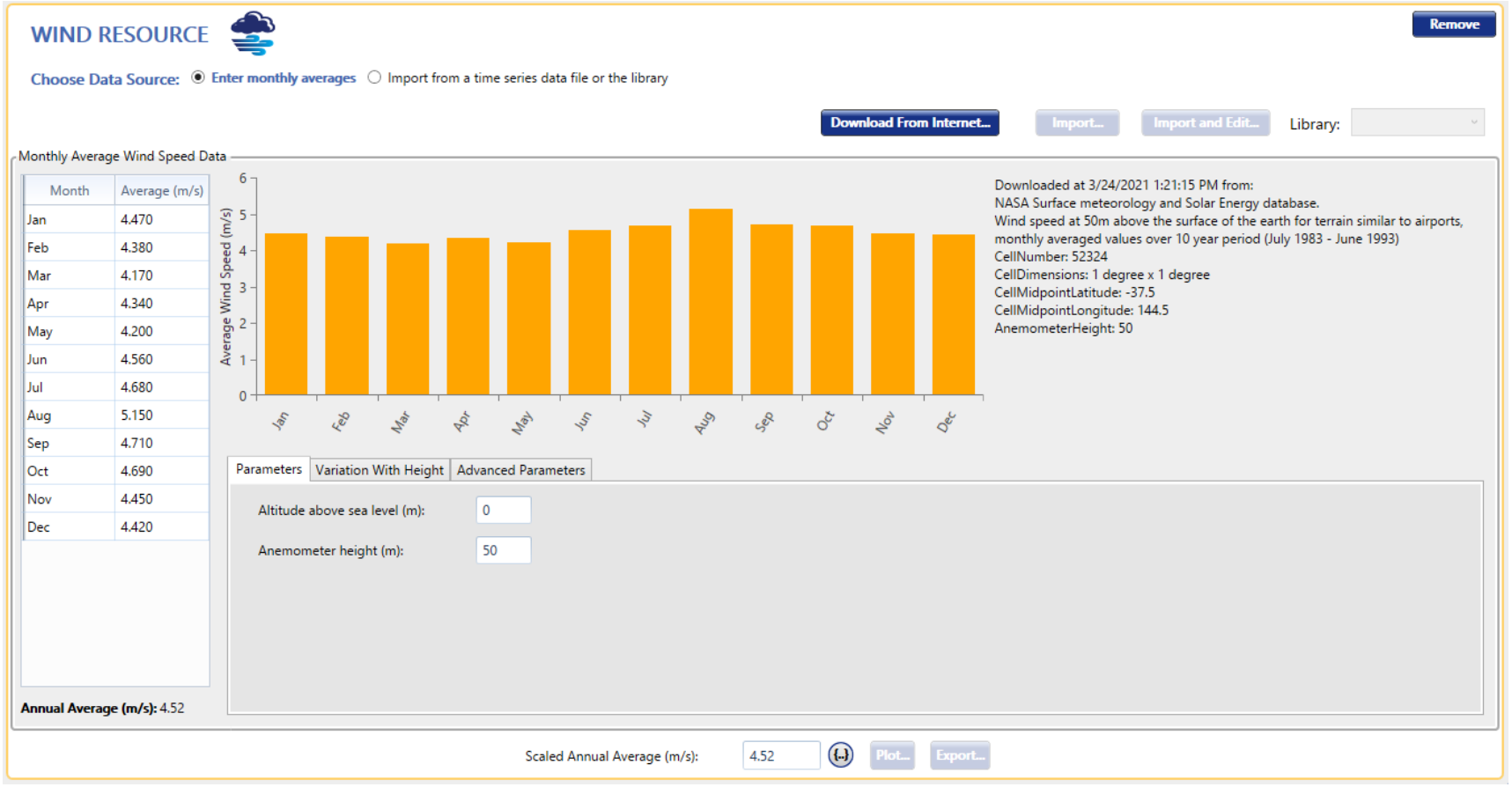

Figure 6: Wind Resource Data

4. Design Schematic

The following design schematic represents the design for the on-grid farm. The Grid represents the electricity distributor and the AC line is the main Bus bar. The load represents the overall farm load (detailed information about the load is provided in Section-2 of this report). The solar represents the 30.340kW Solar system and the AWS5.1kW is the 2 x 5.1kW HC Series wind turbines. The converter is 2x Selectronic 7.54kW units and the BYD 15.4 Prem LVL represent 3 x 15.5kWH battery sets.

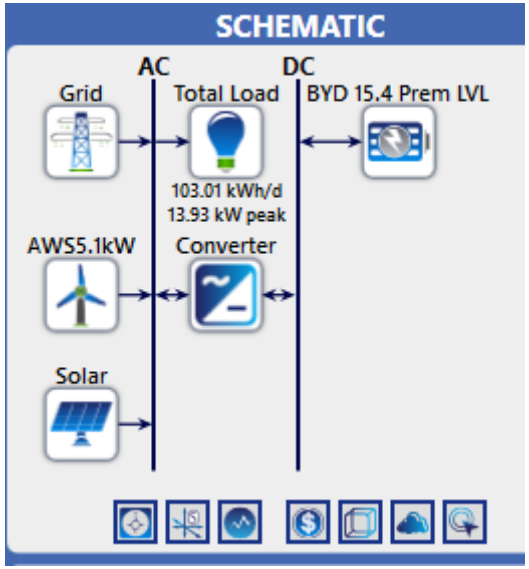

Figure 7: System Design Schematic

4.1 Electricity production:

The installed system would generate a total power of 51,714 kWh/yr, with Solar accounting for 70.1% of the total energy generation and 17.2% by the wind turbine. The annual electricity produced would be 12.6% of the total energy needs.

Production	kWh/yr	%
Solar	41,511	70.1
AWS HC 5.1kW Wind Turbine	10,203	17.2
Grid Purchases	7,475	12.6
Total	59,189	100

Consumption	kWh/yr	%
AC Primary Load	37,600	72.3
DC Primary Load	0	0
Deferrable Load	0	0
Grid Sales	14,425	27.7
Total	52,025	100

Quantity	kWh/yr	%
Excess Electricity	4,875	8.24
Unmet Electric Load	0	0
Capacity Shortage	0	0

Quantity	Value	Units
Renewable Fraction	85.6	%
Max. Renew. Penetration	558	%

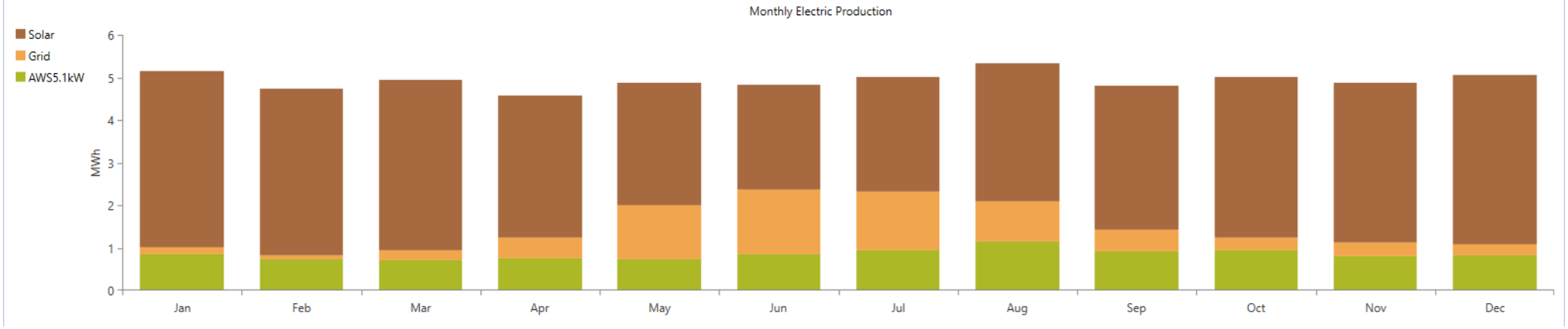

Figure 8: Breakdown of electrical generation for System

4.2 Solar Panels Electrical Production

30.34kW of solar array will produce 41,511kWh/yr.

Quantity	Value	Units
Rated Capacity	30.3	kW
Mean Output	4.74	kW
Mean Output	114	kWh/d
Capacity Factor	15.6	%
Total Production	41,511	kWh/yr

Quantity	Value	Units
Minimum Output	0	kW
Maximum Output	31.3	kW
PV Penetration	110	%
Hours of Operation	4,375	hrs/yr
Levelized Cost	0.0974	$/kWh

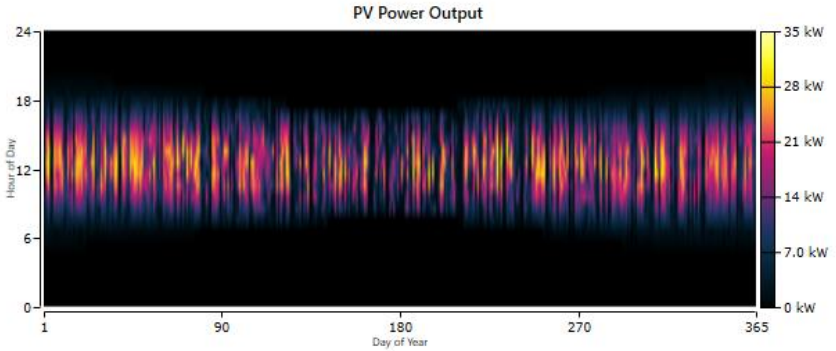

Figure 9: PV output data for System

4.3 Wind Turbine Electrical Production

2x AWS 5.1kW HC series wind turbine will produce 10,203 kWh/yr.

Quantity	Value	Units
Total Rated Capacity	10.2	kW
Mean Output	1.16	kW
Capacity Factor	11.4	%
Total Production	10,203	kWh/yr

Quantity	Value	Units
Minimum Output	0	kW
Maximum Output	12.3	kW
Wind Penetration	27.1	%
Hours of Operation	6,692	hrs/yr
Levelized Cost	0.345	$/kWh

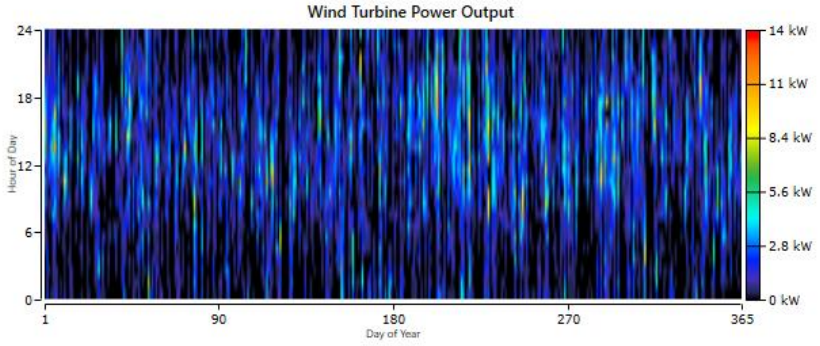

Figure 10: Wind output data for System

4.4 Battery

The following graph shows the battery cycles for (3 x BYD 15.4kWh) for each month.

Quantity	Value	Units
Batteries	3.00	qty.
String Size	1.00	batteries
Strings in Parallel	3.00	strings
Bus Voltage	51.2	V

Quantity	Value	Units
Autonomy	7.51	hr
Storage Wear Cost	0	$/kWh
Nominal Capacity	46.1	kWh
Usable Nominal Capacity	41.5	kWh
Lifetime Throughput	157,097	kWh
Expected Life	15.0	yr

Quantity	Value	Units
Average Energy Cost	0	$/kWh
Energy In	11,137	kWh/yr
Energy Out	9,931	kWh/yr
Storage Depletion	37.8	kWh/yr
Losses	1,244	kWh/yr
Annual Throughput	10,473	kWh/yr

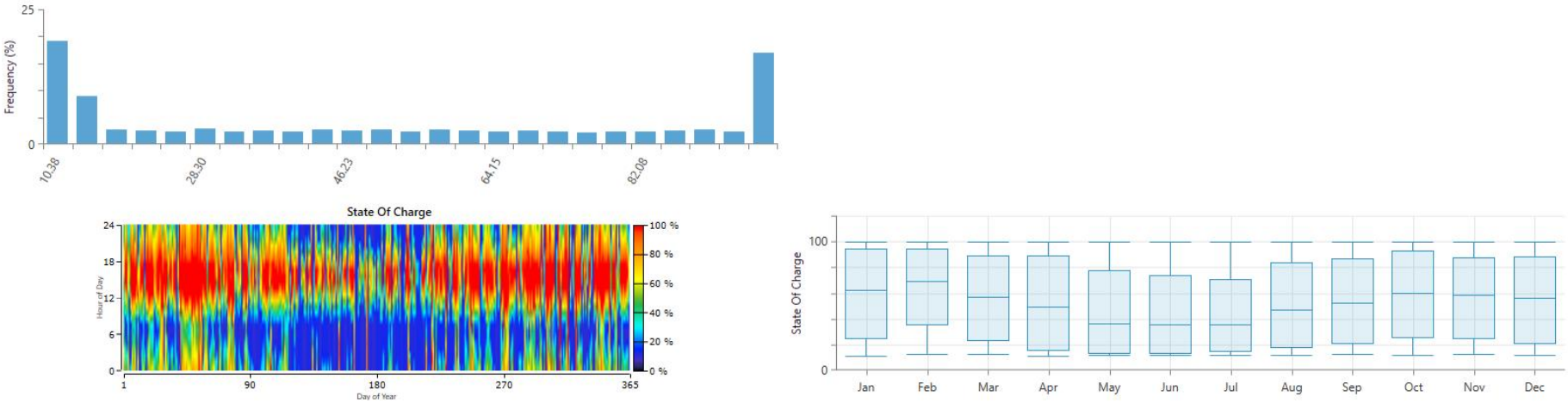

Figure 12: Battery Autonomy

4.5 Grid Energy Purchased/Sold:

With the current designed system, the annual energy purchased from the grid would be 7,475kWh and the energy sold to the grid would be 14,425kWh. You will get a credit of $53.51/yr (approx.)

Please note at this moment we have assumed 10kW of export limit per phase back to the grid. These figures might change once we get a pre-approval from the distributor. Also, the electricity rates might also change after the installation of the system.

Month	Energy Purchased (kWh)	Energy Sold (kWh)	Net Energy Purchased (kWh)	Peak Load (kW)	Energy Charge $	Demand Charge $
January	160	1,496	-1,336	8	($143.63)	$0
February	105	1,632	-1,527	5	($172.34)	$0
March	233	1,391	-1,157	7	($114.51)	$0
April	469	1,069	-600	7	($22.99)	$0
May	1,270	791	479	11	$190.01	$0
June	1,531	561	969	10	$276.09	$0
July	1,370	783	587	10	$213.51	$0
August	930	1,042	-112	9	$83.61	$0
September	502	1,235	-733	9	($35.50)	$0
October	318	1,508	-1,191	6	($109.73)	$0
November	329	1,493	-1,163	5	($105.22)	$0
December	258	1,423	-1,165	5	($112.81)	$0
Annual	7,475	14,425	-6,949	11	($53.51)	$0

Figure 13: Grid Purchase/Sales

5. Conclusion

1. After the installation of 2x 5.1kW Wind Turbines, 30.34kW Solar and 3x 15.5 BYD Battery sets, your net electricity bill will be zero.

2. The current simulation uses the current electricity rates and a 10kW Export limit. The results might change, if the approved capacity is below 10kW or any change in electricity tariffs.

3. The net CO2 emissions without the renewable energy system are 23,763kg/yr. The emission will reduce to 4,724kg/yr after the installation of the system.

4. All the inverters and batteries will be installed in the AWS Power cube. Location of the Power cube will be determined after a site visit.

5. With the current system the ROI is 1.9yrs and a simple payback period is 12.34yrs. (Payback will be less if eligible for Tier-2)