Green Gathering Energy Audit 2023

Green Gathering is powered by solar energy. Each power provider is a separate unit managing their own equipment from installation to monitoring and use. A few of the larger systems load share the main festival utilities but mainly areas and venues are self powered with their own dedicated power system. This allows better management and tailored systems to suit loads.

Max rated power in kilowatts (kW)

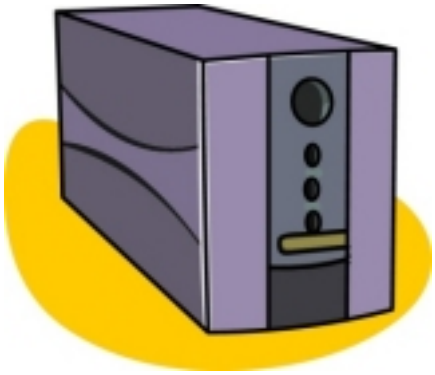
All of the recorded solar panels on site come to a total of **52 kW** peak power.

52 kW total solar PV capacity.

Max available output in kilovolt ampere (kVA)

All of the solar systems audited on site convert the DC solar energy to AC for the consumer, using an inverter. The size of the inverter determines how much energy can be supplied at any one time and is the rated capacity. This value can be compared to conventional generator sizes.

The total capacity recorded on site was **44 kVA**



44 kVA total inverter capacity

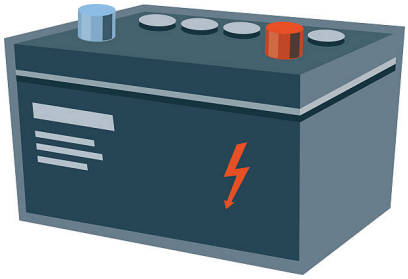
Energy Storage capacity in Amp hours (Ah)

Energy from the sun is stored in batteries to be used when there is not enough sunshine or at night. Batteries are rated in Amp hours (Ah) and the total energy available depends on the voltage (V) that the batteries are operating at. We can then use a simple calculation to convert the Amp hour (Ah) storage to Watt hours (Wh) and then dividing by 1000 to get kilo Watt hours (kWh) which is the unit that consumers buy their energy in.

$$(Ah \times V)/1000 = kWh$$

Each power system operates at different voltages so for a total storage capacity figure we need to convert. This is a rough estimation as the Amp hours available depends on the rate that the power is consumed at. The less energy used from the batteries the more that is available.

The total battery storage recorded on site was **384.5 kWh**



384.5 kWh total storage capacity

Conventional batteries are lead acid ranging from large duty traction cells used in light industrial machines to smaller leisure batteries used in mobile applications.

Out of the 13 power providers audited 4 are using lithium iron phosphate (LiFePO4) and one a hybrid.

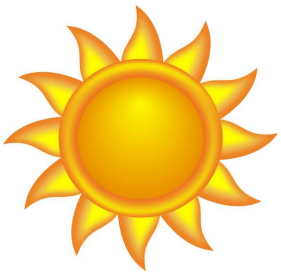
These batteries don't have nickel or cobalt in them which are rare and expensive, and there are environmental and ethical issues around mining them. This makes LiFePO4 batteries a greener battery type than other lithium iron batteries with less conflict associated with their materials.

These batteries are also able to be discharged to a lower capacity than conventional batteries so allow maximum usage of available storage.

Total Solar PV input and inverter output (kWh)

Most of the monitoring equipment used these days will record the amount of power generated and used so the power providers were asked to record these values for each of the days of the festival.

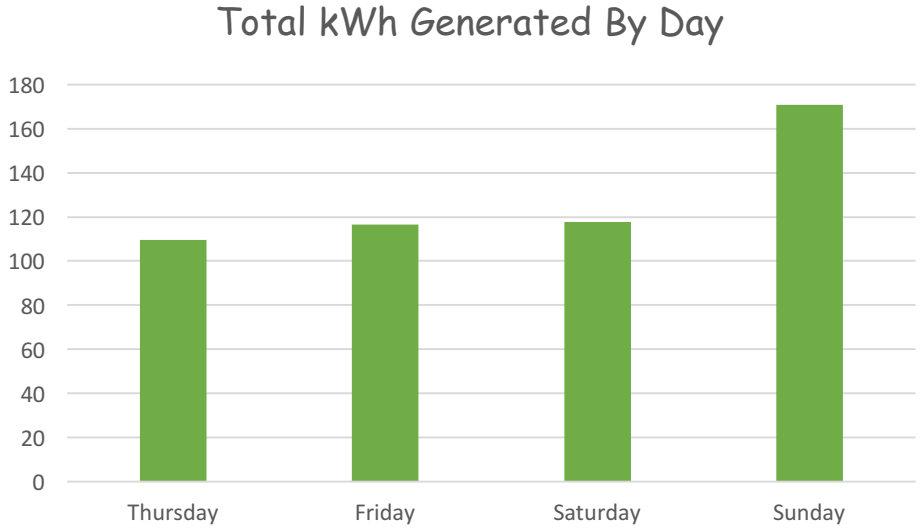
The total amount of solar energy generated by the 13 power systems audited at Green Gathering was **514 kWh** and the total amount of energy used was **488 kWh**. Therefore more than enough was generated to cover the usage.



514 kWh
solar
generated

488 kWh
inverter output

The following chart show the kWh of solar energy generated each day at the Green Gathering.



Data Collection

In 2023 the power providers were given a form to fill in with the data themselves instead of one person collecting it all over the weekend. This presented a few issues but was mainly an improvement of the data collected.

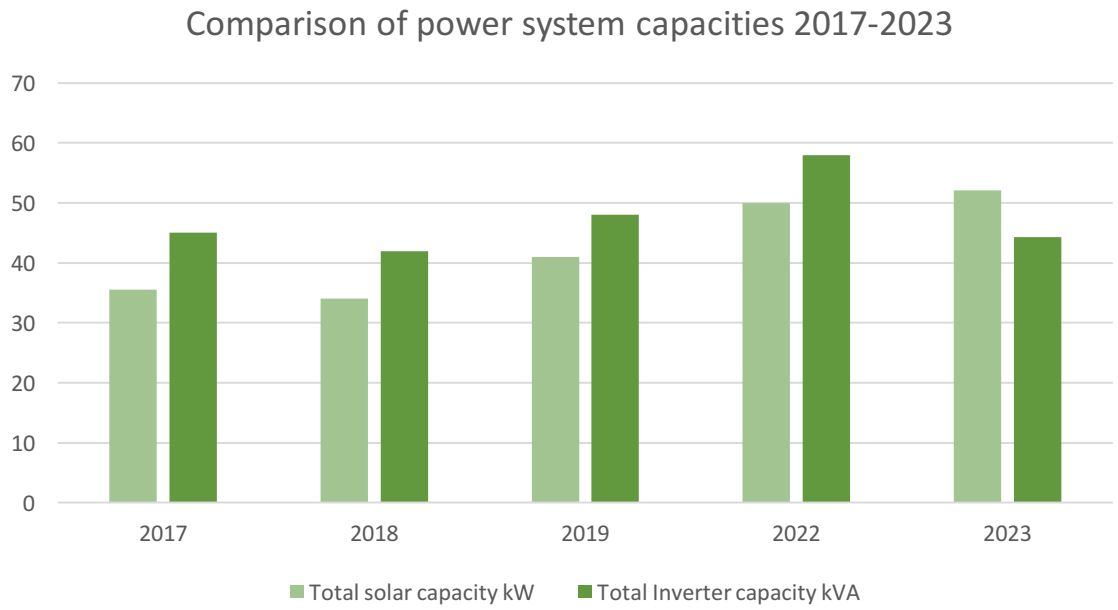
The benefits of this system was a more accurate estimation of the energy generated, especially if the manager of the power system was made aware of the necessary readings before the event began. As stated previously with most current equipment the monitoring is displayed and recorded so data can be retrieved easily.

The value of the energy used from the monitoring equipment is more accurate and compared to the value of energy used using the figures of loads and hours of loads estimated by providers shows a massive over estimation of 120 kWh.

Previously consumption figures have been modelled using these estimated values of loads and hours of loads and so as the power providers become used to filling in the form the data collected will be more accurate.

In 2017 and 2018 the total solar energy generated was estimated using the REsource Living generation values and extrapolating those values to estimate other power provider's generation figures based on the amount of solar PV they had. With the new forms we can have more accurate generation data collection.

Here is a chart comparing the capacities of all the power systems on site over the years 2017-2023.



It is interesting to note the gentle rise in capacities but a reduction this year. This is in part to three independent power systems being left out of the audit and also to a loss of some older power systems with larger but less efficient inverters.

Table of Daily PV Generation of Each power provider

	PV kWh input				
	Thurs	**Fri**	**Sat**	**Sun**	**Total**
Coltek	22	19	19	30	**90**
Lost Horizon	19	16.2	16	24.5	**75.7**
Richie	11.1	12.4	12.8	16.5	**52.8**
REsource Living	5.8	11.3	11.4	17.1	**45.6**
Soundscape	2.6	8.1	8.2	13.9	**32.8**
Off grid installations	1.6	6.1	5.9	7.6	**21.2**
William Jenkins	6.5	6.5	7.5	10	**30.5**
Gary Wacky	8.9	7.1	7.2	9.3	**32.5**
Zia	7	7	6.5	9.2	**29.7**
Silent	7	6	6.5	10.5	**30**
Triban	6.7	6	6	10	**28.7**
Small World	5.4	5.8	5.6	5.2	**22**
Kit 'n' kaboodle	6	5	5	7	**23**
Total	**109.6**	**116.5**	**117.6**	**170.8**	**514.5**

Table of Daily Inverter Output of Each Power Provider

	Inverter output kWh				
	Thurs	**Fri**	**Sat**	**Sun**	**Total**
Coltek	20	20	15	20	**75**
Lost Horizon	19	21.25	14	20.5	**74.75**
Richie	11.5	14.6	9.5	11.6	**47.2**
REsource Living	3.4	13.3	11	10.1	**37.8**
Soundscape	9.2	9.2	9.2	9.2	**36.8**
Off grid installations	3.5	6.2	5.4	5.9	**21**
William Jenkins	7.93	7.93	7.93	7.93	**31.72**
Gary Wacky	7	7	7	7	**28**
Zia	6.5	6.5	7	7.9	**27.9**
Silent	6.5	6.5	6.5	6.5	**26**
Triban	9	9	9	9	**36**
Small World	4.5	6.2	4.5	6.2	**21.4**
Kit 'n' kaboodle	6	6	6	6	**24**
Total	**114.03**	**133.68**	**112.03**	**127.83**	**487.57**

Table of Power Providers and Power System Specifications

			Batteries			
	Solar PV kW	**Inverter kVA**	**ah**	**v**	**kWh**	
Coltek	10	4.5	2000	24	48	
Lost Horizon	6	5	400	48	19.2	liFePo4
Richie	6	5	800	48	38.4	
REsource Living	4.5	4.6	700	48	33.6	
Soundscape	4.2	3	700	48	33.6	
Off grid installations	3.6	2.4	280	48	13.44	liFePo4
William Jenkins	3.6	6	400	48	19.2	liFePo4
Gary Wacky	3	3	560	24	13.44	liFePo4
Zia	2.7	2.3	2000	24	48	
Silent	2.46	2	1000	24	24	
Triban	2.2	2.5	900	48	43.2	
Small World	2	3	1250	24	30	
Kit 'n' kaboodle	1.8	1	850	24	20.4	hybrid
Total	**52.06**	**44.3**			**384.48**	
Unaudited self powered caterers	Figures from 2022 audit					
Buddafield Café	0.32		770	12	9	
Ice Green	2	3	220	24	5	
Veggies	1.25	3	50	48	2.4	
sub total	**3.57**	**6**			**16.92**	
Total	**55.63**	**50.3**			**401.4**	

Data collected via forms handed out to each power provider and report written by Tessa Stewart from REsource Living.

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