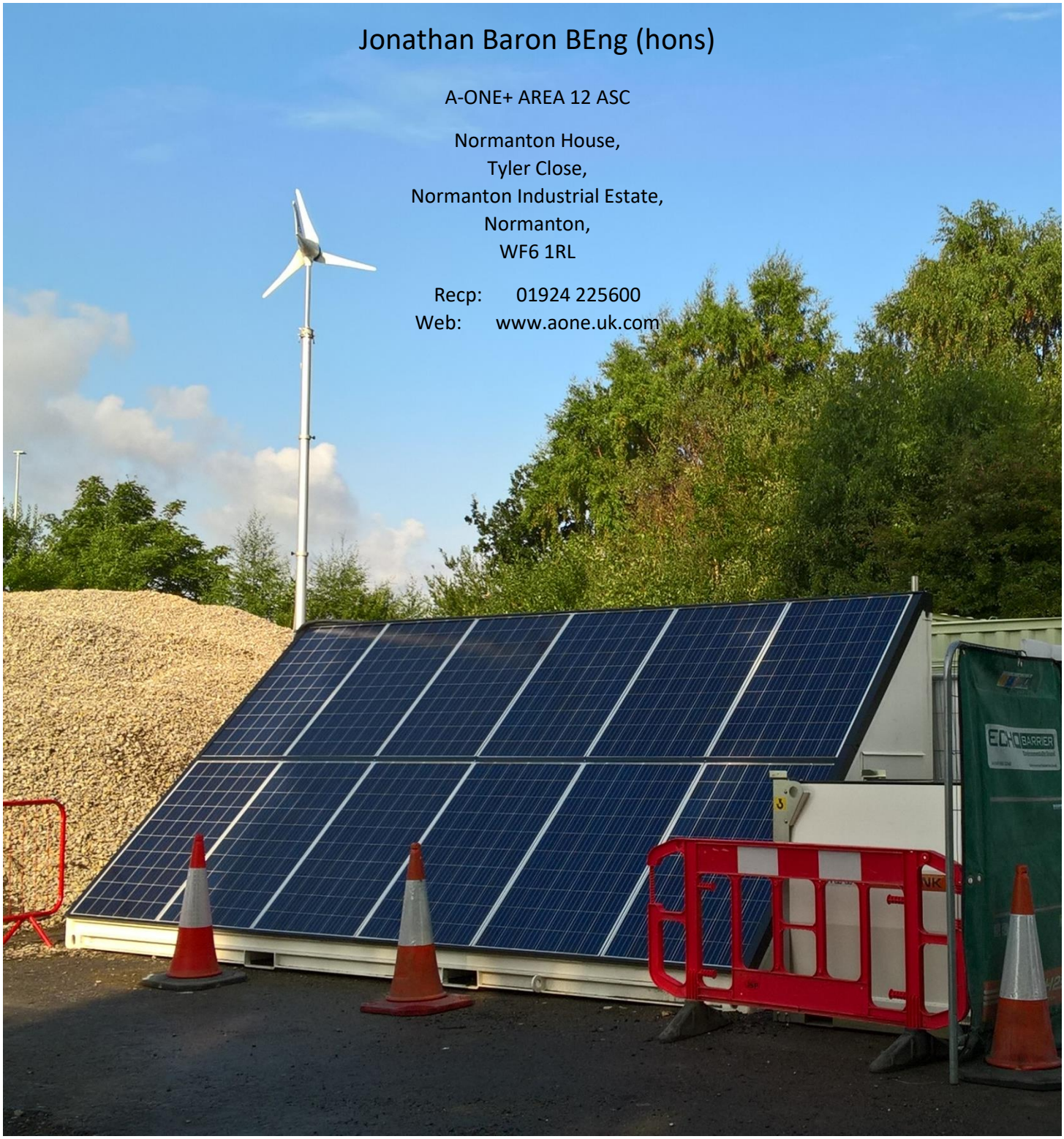
SOLATAINER SITE REPORT
12.09.18

Jonathan Baron BEng (hons)

A-ONE+ AREA 12 ASC

Normanton House,
Tyler Close,
Normanton Industrial Estate,
Normanton,
WF6 1RL

Recp: 01924 225600
Web: www.aone.uk.com



Introduction

Solatainer has been developed as an off-grid power supply for the construction industry. It has taken a 20ft shipping container and cut it diagonal in half to create a slope on which a PV array is mounted. Within the container a battery of lead-based cells, which store energy harvested from the PV array. Within daylight hours the site set-up can run directly from the PV array, with the generator providing energy for any peak demands. The battery acts as the backup supply for when demand outweighs supply from the solar array. The generator acts as 'insurance' for the battery, kicking in when battery is drained below a set level. The Solatainer unit used on the Ouse Bridge Bearing Replacement Scheme is the first of its kind to employ a wind turbine onto the unit. As the wind turbine is the first of its kind it has been closely monitored as part of its trial within industry.

Solatainer Set-up

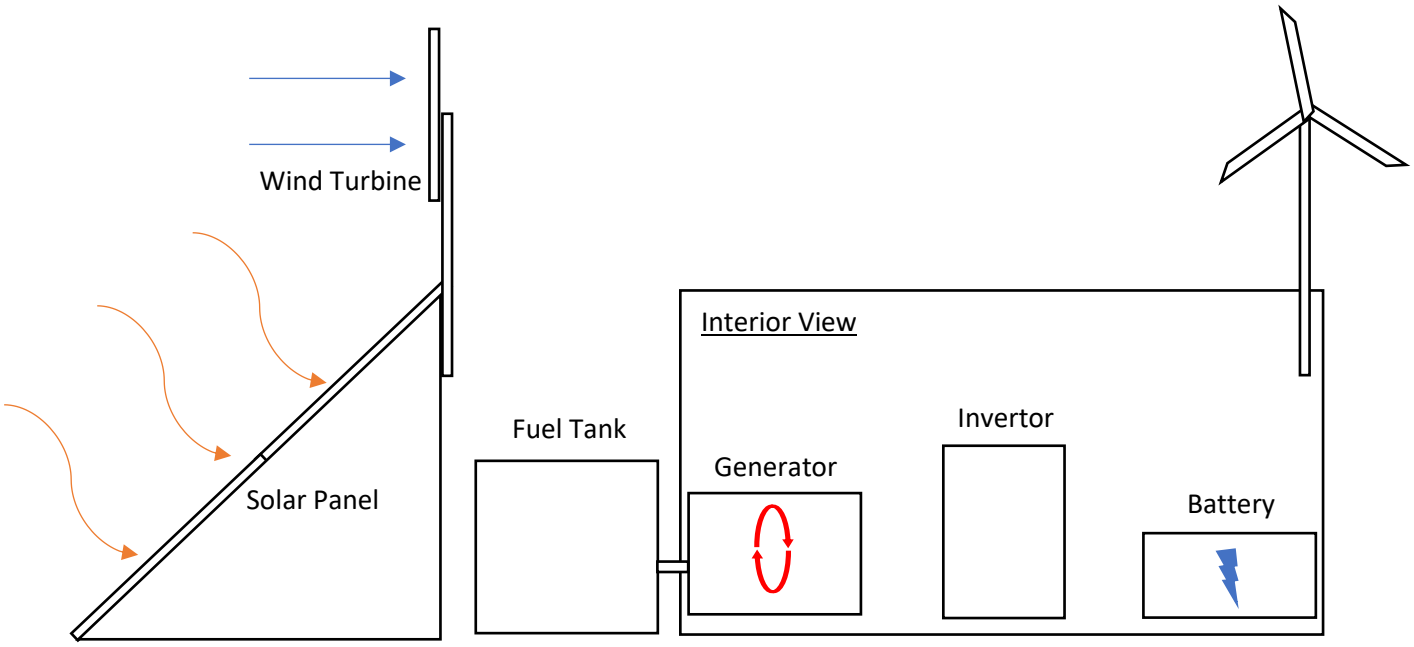


Figure 01 – Solatainer schematic

Environment

When burning carbon fossil fuels the weight of the CO_2 that is emitted is greater than the weight of the diesel going into the system. This is because during combustion Carbon atoms join with two Oxygen atoms forming the CO_2 molecule. The addition of these two Oxygen atoms results in 1g of Diesel forming 2.64g of CO_2, exact conversion depends on the quality of the fuel.

The Solatainer doesn't remove the need for a generator onsite. Instead it makes the production of electricity more efficient by running the background energy consumption off renewable sources, lights, computers, chargers, etc. The generator deals with peaks in energy demand, typically early morning and lunch, when heaters and kettles are used. As result the Solatainer generator does not need to be the size of a typical generator and does not run idle or at very low demand. On the Compound the generator has been running on average 5.5 hours per 24-hour period. The reduction in running time combined with the reduction in generator size has seen an 87% drop in CO_2 emitted when compared to the original generator onsite.

87.0% Reduction in CO_2	Total CO_2 emitted from 50kWh Genny: 12.97 tonnes
	Total CO_2 emitted from Solatainer: 1.68 tonnes

Figure 02 – Recorded CO_2 figures from report period

When the generator is not running the Solatainer runs silent, no noise is emitted from the set-up. This is a great bonus to have when sites are located near noise sensitive areas. There is the potential for further development within the system to reduce the noise emitted when the generator is running and is discussed in the development section of the report.

Environmental conditions make a massive impact on the amount of energy produced by the PV array. The PV array works best in the summer months; however, it is expected to have a reduced yield in the winter months when the weather turns. To combat this, for the first time in the UK, a wind turbine has been fitted to the unit to harness the increased power of the wind during the winter months.

Costs

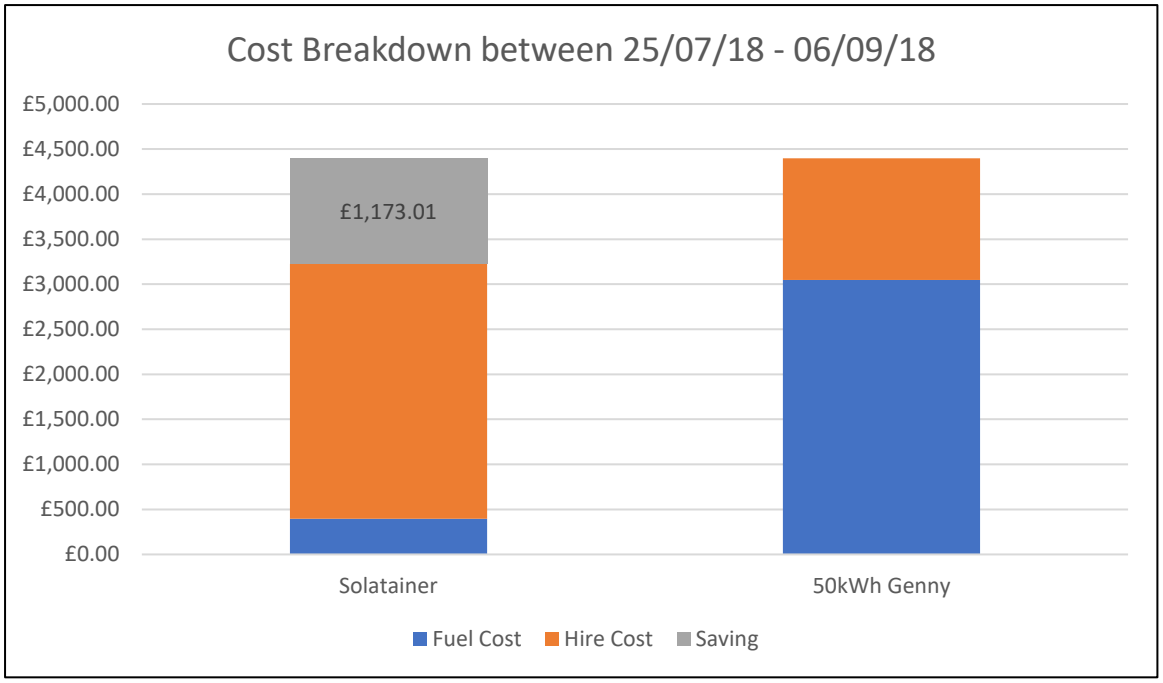


Figure 03 – Cost breakdown from report period

Cost have been calculated on data provided from Gaia (Solatainer manufacturer) and data recorded on site and confirmed by the commercial team. A spreadsheet with the calculations from this period is available upon request. It is worth noting that the analysis has been carried out on the system as a whole rather than a breakdown on each component part (Solar array vs Wind production, etc). Data has not been provided and is not easily accessible for wind production by the unit. This has been identified as an area for development and a cost analysis of the turbine is expected to be included in subsequent reports.

Total cost of running 50kWh Genny: £4396.34	26.7% Reduction in cost
Total cost of running Solatainer: £3223.33	

Figure 04 – Cost summary from report period

Areas for development

Location of lifting eyes

Figure 05 – Lifting eye location on the front of Solatainer

Lifting eyes on the front of the unit do not give enough clearance between the overhang of the PV array and the lifting chains. There is potential for interaction and therefore damage to the array, it may be worth considering moving the lifting eye further out to provide extra clearance.

Locations of electric plug points

Figure 06 – Electrical plug points on the side of Solatainer

The plug points for the unit are near to ground level which makes it difficult to connect the unit up during installation. For our installation it would be preferable for the plug points to point upwards and have clips on the side of the container to secure the leads tight to the sidewall. This would reduce the risk of trip hazard from the cables.

Noise insulation

Whilst having the Solatainer onsite we have received one noise complaint from our neighbouring resident about the sound coming from the generator. It is worth noting that the unit was brought onto the compound after initial mobilisation. Therefore, hasn't been placed in our desired location due to constraints within the compound. The unit will be moved further away from the residents. In the meantime, noise barriers have been erected around the air vent for the generator and no further complaints have been received. On inspection of the Solatainer it has been found that noise insulation has not been fitted to the interior. This might be a useful avenue for the Solatainer team to investigate.

Figure 07 – Interior of Solatainer

Integrated within Office cabins

The Solatainer on the Ouse Bridge site takes up 14.75m^2 which needs to be accommodated within the site set-up. The system could be developed to connect to the top of the cabins removing the footprint of the product on the site layout. Gaia offers another solar product in their range, the Solawedge. In essence this product is an array of single height solar panel mounted to an inflatable panel. The reduced height of the Solawedge compared to the Solatainer would make the Solawedge the favourable product to be top mounted to cabins.

The project operates two satellite compounds on each side of the Ouse Bridge, both have traditional generator powered groundhog units providing welfare facilities. Ground hog units are typically used in remote locations and run off fossil fuels. On the Ouse project all fuel is stored on the main compound in double bunded containers, resulting in double handling of fuel when refilling the groundhog units. Eliminating the groundhog refilling activity would not only remove the risks associated with handling the COSSH material but also the risks to the environment regarding fuel spills. There is an opportunity for a company such a Gaia to develop a self-sustaining ground hog unit.

Improved functionality of the online app

The online app is a very powerful tool and allows the user to gather data on the production of power through the PV array and the generator. It also allows you to track whether the harvested energy is being directly used or stored in the battery. However further development is required to allow the same tracker functions for the wind turbine that is on trial. It is also worth considering installing a digital fuel meter into the device. This would allow for an accurate representation of the fuel used in any given period which makes it easier for us to track cost and Carbon Dioxide production.

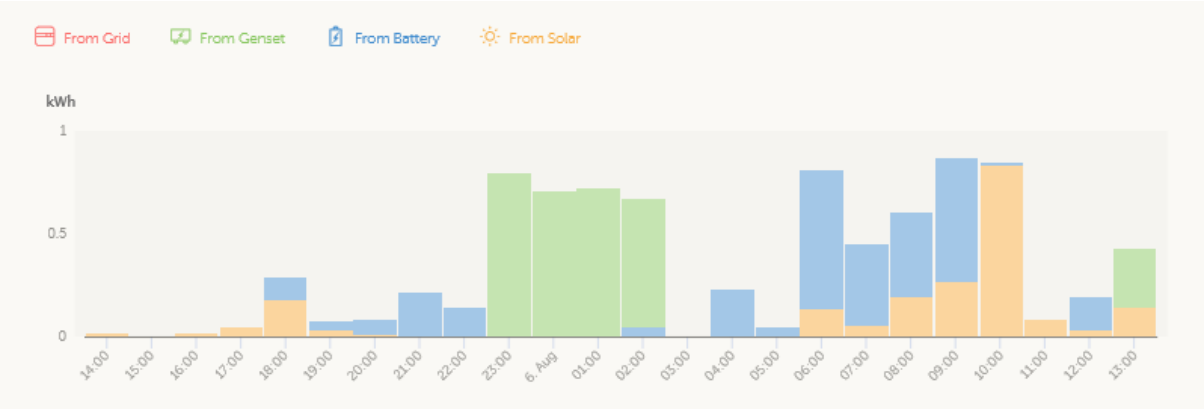


Figure 08 – Dashboard of energy produced from component part over typical 24hour period

Smart Energy usage – Night running

It has been observed that the energy produced by the PV array does not match the energy demands placed on the unit over the typical 24-hour work day. Therefore, typically the generator runs for 5.5 hours every day to make up the energy. When the generator kicks in it produces electrical energy, the excess power produced is stored within the battery. A typical overview of the system on any given work day can been seen in figures 8 and 9. It is observed that as the sun sets in the evening power is drawn out of the battery, which as shown does not last the night and the generator starts up during unsociable hours. Developing the software to instruct the generator to charge the battery to full capacity just before the end of the work shift should allow the site to run silent overnight.

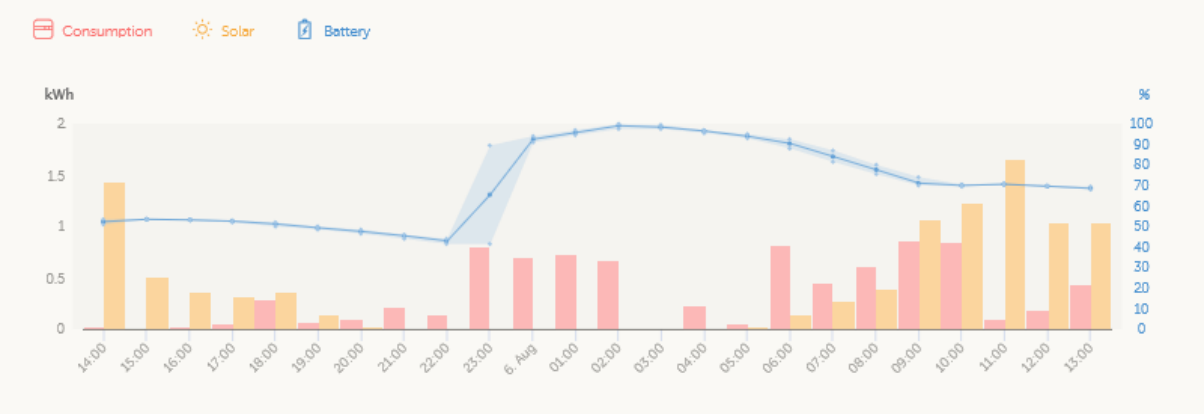


Figure 09 – Overview of energy usage over a typical 24hour period

Conclusion

During the first month on site the Solatainer has proven to be an effective replacement for the 50kWh Generator that was previously powering the site. A reduction of 27% and 87% has been seen in total cost and CO_2 respectively, which is a favourable result. The turbine that has been trailed on the unit for the first time is yet to prove it's worth. No data has been produced by Gaia, therefore a fair assessment cannot be made in this report. It will continue to be monitored and judgement passed in future report. The unit charge out rate is roughly double that of the old style generator however it is in the fuel where the saving is made. From the figures read in this report period it can be concluded that the Solatainer would need to run for over 90% of the time for the cost to be greater than that of old 50kWh generator. Considering the unit as a whole, we have observed reductions in cost and environmental impact and would recommend the unit to similar compound set-ups and look forward to continuing our partnership with Gaia and Solatainer.

We have met with Gaia (Solatainer Manufacturer) and ThinkHire (Solatainer distributer) and discussed this report and the Solatainer performance to date. It was concluded they will investigate bringing additional PV arrays, wind turbines and introduce car charging points onto site to increase power production and functionality. Also, we are working together to increase intelligent use of data collected. These actions will be discussed in future reports.