NOUMI LTD.

Food & Beverage/Manufacturing

Securing Operations and
Reducing Costs

AT A GLANCE

THE CHALLENGE

- Production operations highly sensitive to power fluctuations from the network
- Disturbances resulted in high-cost wastage and lost production

THE SOLUTION

- 2MWh of Tesla battery storage
- Voltage Optimisation
- 4MW of solar PV

THE IMPACT

In the first year:

- Protected critical operations from the impact of supply quality issues
- Offset of 5,589 tonnes of C02 emissions
- Electricity costs reduced

THE CHALLENGE

Noumi's production operations are highly sensitive to fluctuations in the quality of power from the network. Small and very short duration (sub one second) disturbances in voltage can disrupt critical processes resulting in high-cost wastage and lost production. Noumi was seeking a solution to isolate its critical production operations from these supply fluctuations. The challenge was compounded by the fact that the low voltage electrical system was at capacity, so any solution needed to operate on the high voltage supply.

Noumi was also looking to surpass the requirements set out in their internal sustainability plan to reduce the environmental impact associated with their business activities.

THE SOLUTION

Acacia Energy, with expert support from our Engineering Procurement and Construction partner AEES Group, completed a detailed analysis of Noumi's situation and developed a bespoke solution comprising:

- 2MWh of Tesla battery storage
- Voltage Optimisation
- 4MW of Solar PV

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THE SOLUTION CONT.

The Tesla Battery Storage system and Voltage Optimisation equipment work together to protect Noumi's critical production operations from supply fluctuations. This complex high voltage installation sits behind the meter but in front of the customers transformer, identifying and remediating power fluctuations before they enter the low voltage system.

Acacia Energy's analysis also identified that a 3.8MW solar system was ideally suited to Noumi's facility. This solar system provides charge for the Tesla Battery Storage as well as displacing expensive grid sourced energy, delivering significant operating cost reductions. The solar system also provides a substantial contribution to Noumi's CO2 reduction targets.

At the time of installation, 3.8MW of Solar PV was the largest behind the meter rooftop Solar PV installation in the country.

THE IMPACT

Acacia Energy's renewable energy solution for Noumi delivered a threefold impact in the first year:

1. The combination of the Tesla Battery and Voltage Optimisation equipment protected critical operations from the impact of supply quality disturbances on five occasions, substantially improving the operational efficiency of the plant,
2. The 3.8MW rooftop solar PV offset 5,589 tonnes of C02 emissions, and
3. Noumi's electricity costs were reduced.

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1. PROJECT SUMMARY

Project completion undertaken by Acacia Energy & AEES Group ty Ltd was achieved on 28 February 2020, for the supply, installation and commissioning of three core renewable energy and energy efficiency components at the dairy processing operations for Noumi Foods.

i. Solar PV

- 1.279MW PV installed, commissioned and independently inspected on 21 Nov 19 on the Boiler Plant & UHT processing Roof
- 1.282MW installed, commissioned and independently inspected on 19 Dec 19 on the Protein Building
- 1.217MW installed, commissioned and independently inspected on 3 Mar 20 on the Warehouse located at the southern side of the site
- Total Solar PV Installed - 3.778MW
- 414kW of Tigo DC High Efficiency Optimisation units installed on the Protein Shed to allow maximum efficiency on those modules identified as being shaded by the construction (proposed) of the new milk spray dryer towers
- Skid 1 - 1MW High Voltage (HV) Solar PV Inverter UHT skid design, constructed and delivered to site at 30/8/19
- Skid 2 - 1MW High Voltage (HV) Solar PV Inverter UHT skid design, constructed and delivered to site at 26/11/19
- Skid 3 – 1 MW High Voltage (HV) Solar PV Inverter UHT skid design, constructed and delivered to site at 7/2/20
- HV electrical infrastructure and non-destructive digging and backfilling undertaken to connect HV Skids to Electricity Transformer (TX) 4 & 5
- 5.5m Blast Wall constructed on the western boundary on north side located adjacent to Skid 2 including endreturns for safety
- 5.5m Blast Wall constructed on the western boundary on north side located adjacent to Skid 3 including endreturns for safety
- Roof Structural strengthening undertaken on the warehouse roof to secure Certificate of Compliance as Required under the Australian Standards and for Registering the Solar Embedded Generator with the Clean Energy Regulator (CER)
- Whole of system - Balance of System (BOS) Electrical Infrastructure installed
- ‘Ubiquity’ whole of site Internet Communications installed and enabled
- On-site Weather Station installed and commissioned for remote weather monitoring and recording

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1. PROJECT SUMMARY CONT.

ii. Battery Storage

- Detailed data logging undertaken on Boiler Plant Operations and plant critical load(s)
- Procurement RFQ for selection of battery storage manufacturers. Project awarded to Tesla 500 KW & 1250kWh “Powerpack” delivered to site 22/11/19
- Whole of project “critical load” electrical design complete, to be tied to PD200 MSB
- Design and commissioning of critical load electrical Distribution Board (DB) delivered and installed on 29/1/20
- All electrical infrastructure to support critical load terminated to the Critical Load DB on 4/2/20
- Delivery and Energisation undertaken on 4/2 during whole-of-site planned electrical shutdown.

iii. Voltage Optimisation (VO)

- Electrical design undertaken and approved, with installation commencing in November 2019 on Transformer (TX) 1
- VO equipment delivered to contractors engineering works for construction of IP65 rated housing and assembly 31/8/19
- All electrical non-destructive digging (NDD) undertaken in preparation for conduits and VO cabling and con mentioned to PD100 switchboard in Jan 20
- VO delivered to site 23/1/20 and installed during the whole of site electrical shutdown on 4/2/20.

The renewable energy and energy efficiency project has been completed with all major capital works procurement being delivered. A whole of site electrical shutdown occurred on 4/2/20, allowing termination of the 3 x components to be connected to the relevant site electrical Main Service Board (MSB) or Transformers. Approval has been secured, following extensive provision of electrical drawings and technical information, from the District Network Service Provider (DNSP) Powercor for the Connection of the System to the electricity grid.

The **Solar PV** component was reduced marginally in size from initial proposal to accommodate the impact of shading from the new spray dry milk tower proposed for installation. Tigo DC optimisation was installed on 414 kW of Solar PV to ensure that any loss of power was kept to a minimum.

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The **Battery Storage** system supplied by Tesla has been intricately designed to ensure power quality from the electricity grid (measured in milliseconds) protects the sterilisation/boiler unit(s) and subsequent UHT/protein operations from costly production failures. These are assessed at approximately $110,000 per hour with the duration of around 2 hours over 6 events per year. The battery is designed to align with the critical load and provide sub- 2-sec to 4 hours of critical load operations. The battery is also designed to support other revenue earning opportunities in line with the future prospects of this technology. They include; peak demand shaving/frequency control ancillary services/pool price pass through.

The **Voltage Optimisation** is Tied to Transformer 1 and aimed at providing stable voltage, power factor and harmonics to the UHT shed. This technology complements the battery (critical load) operations connected to Transformer (TX) 2

2. PROJECT COMPLETION EVIDENCE

Below are selected photos of system components and the respective (independently inspected) Certificate of Electrical Safety (CES) for each of the three Solar PV installation phases. The original copies are also be attached. Three buildings were installed with Solar PV; UHT, Protein Operations and Warehouse. All 3 buildings had High Voltage (HV) Transformers Installed in a Skid to Support 6 ABB PVS 175 Inverters. The 500 KW/1232 KWh Tesla Battery Pack and the Voltage (VO) Photos Included.

Solar PV - Ariel View 1

Solar PV - Ariel View 2

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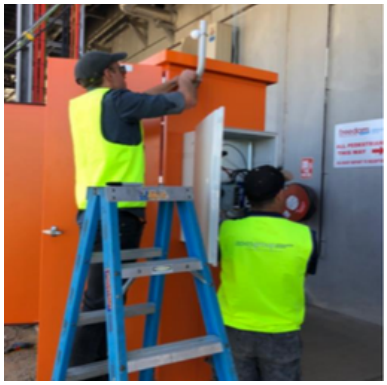
Solar HV Skid One - 1.1279MW

Solar HV Skid Two - 1.282 MW

Solar HV Skid Three - 1.217MW

Tesla 500kW/1232kWh Battery Pack



Battery Critical Loads Board Installation

Voltage Optimisation - 1st reading at
Start-up

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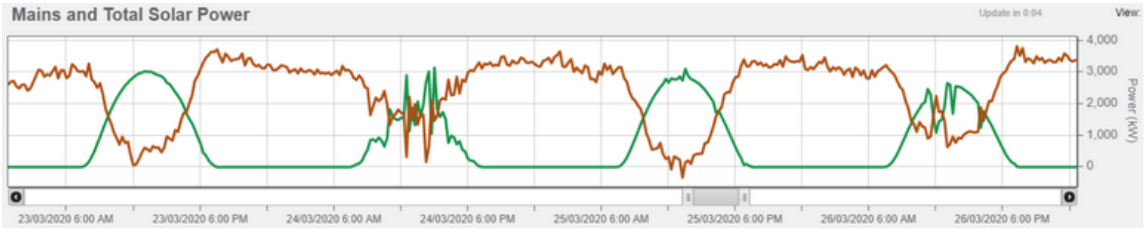
3. ACHIEVEMENT OF PROJECT OUTCOMES

i. The installation of 3.778MW Solar PV has significantly reduced site grid consumption during daylight hours.

Below is a chart illustrating real power output of the solar PV system (green line) and the site's power draw from the mains grid (brown line) for a period in late-March. As solar PV production peaks in the middle of the day, grid power draw dips to approach 0kW. At 0kW grid draw, the site's power consumption is being totally supplied by the solar PV system.



The variation in solar PV output power is caused by local variations in weather. Jagged lines illustrate the result of local cloud movement, blocking solar radiation from reaching the solar modules over short time periods. As of 23/04/2020, the system is estimated to have produced 2.13GWh of electricity, since the period of commissioning Phase 1 of the project (Solar Skid 1).

ii. The reduction in site power draw from the main grid corresponds to a significant reduction in electricity costs, in addition to a reduction in carbon emissions.

The site has a Peak levelised cost of energy (LCOE) of $0.156/kWh, which considers all usage, network, environmental and retail charges that the site incurs during 'peak' periods. Considering the total system production of 2.13GWh, which would largely offset peak grid consumption, the system has saved approximately x in electricity costs to date. This does not consider any benefits from charging and discharging the battery, such as during back-up supply events as discussed below. Additionally, the consumption of this renewable electricity has offset approximately 3.9 kilo-tonnes of CO2 emissions. This is accompanied by other benefits to the environment, as the image below displays.

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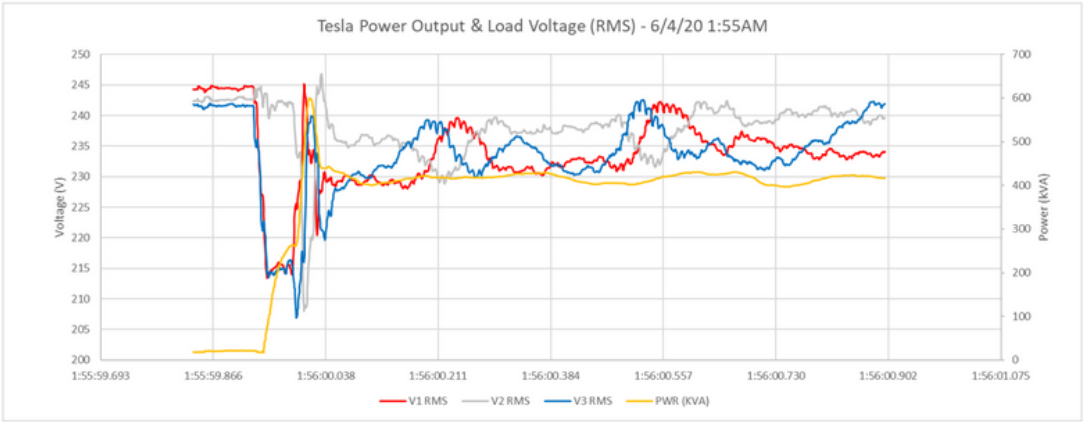
iii. The Tesla Powerpack battery storage system has supplied load to critical processing equipment during grid disruption events, where the site would have otherwise lost power.

As previously disclosed, grid disruption events have resulted in failures of critical plant equipment and the subsequent interruption of the production capability of the site. These have proven to be costly outages, assessed at approximately $110,000 per hour, with a total duration of around 2 hours over 6 events per year. The battery storage system was intricately designed to ensure power quality and supply to the critical plant equipment during these grid disruption events, avoiding production outages.

Such an event was experienced recently on the 06/04/2020. This occurred at approximately 1:56AM, where the Powerpack battery responded to a sudden drop (within milliseconds) in grid line voltage, shown by the red, blue and grey lines in the chart below. The yellow line displays the output power (kVA) of the battery over the same millisecond period, illustrating the rapid response time in stabilising the load voltage to the critical 230/240V range. The battery effectively islanded from the grid and supplied power to the critical loads, avoiding the impacts of a total grid loss event as discussed above. This grid loss event occurred for 33 seconds.



iv. The installed whole-of-site Internet Communications system allows for historical and real-time system performance analysis, including system fault and maintenance detection and alarms.

The installed and operating Communications system provides an avenue for continual monitoring of the Project Outcomes, allowing for the preceding analysis on Energy Efficiency and Productivity.

The above charts and analysis subsequently provide evidence that the equipment infrastructure is correctly operating as designed and capable of achieving the Recipient Commitments.

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4. RETENTION OF BASELINE ECONOMIC ACTIVITY

i. Economic Activity

As previously described, grid outage events can be quite disruptive and costly to business operations, up to $110,000 per hour, and potentially more if electrical damage were to occur to plant equipment as a result of grid disturbances. The project components have already proven to provide support during such an event, allowing for a seamless transition to supply from the Tesla Powerpack and continual site operations for critical plant equipment.

The battery is also designed to support revenue earning opportunities in line with the Acacia Energy Services utilising IP technology as market participants on the NEM. They include peak demand shaving; frequency control ancillary services; and spot market pool price pass through. These opportunities will continue to be explored, with the aim of maximising operational and economic benefits to x. See attached Acacia Energy Introduction and Services guide.

Battery 500kW Inverter

Solar PV - Ariel View

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