

Designing sustainable energy ecosystems for Council facilities

COUNCIL NAME

Lake Macquarie City Council

WEB ADDRESS

lakemac.com.au

SIZE

648 square kilometres

POPULATION

217,000

Overview

Lake Macquarie City Council has connected 375 kW of solar photovoltaic (PV) panels to Council's administration building to improve building energy resilience. To support the electrification of Council's fleet, the nearby fleet carpark is capable of connecting to a battery and is electric vehicle (EV) charging ready. Currently, Council has 6 charging stations installed and 3 bidirectional chargers to be installed in August 2022. The bidirectional charging will allow vehicle-to-grid (V2G) charging, meaning that the energy stored in the EV batteries can be used to support the demand of the building, and reduce electrical network charges.

Background

Council's objectives to reduce greenhouse gas emissions and implement sustainable transport options are detailed in the Environmental Sustainability Strategy and Action Plan 2020-2027. This project aimed to:

1. Increase renewable energy capacity at Council's administration building
2. Improve carpark security and prevent further safety incidents caused by vehicle tampering
3. Improve building energy resilience; enabling it to remain operational during grid outage events and disasters
4. Accelerate Council's electric vehicle transition
5. Trial and innovate new technologies

Implementation

A pre-feasibility study and business case was undertaken to ensure project viability. As well as internal stakeholder engagement, Council engaged Institute for Sustainable Futures (ISF) from University of Technology Sydney to monitor the integration of V2G chargers in the carpark in conjunction with onsite solar generation.

Council sought development planning consent and procured services and equipment through a tender process. A 200 kW rooftop solar photovoltaic (PV) system was installed on the administration building and 175 kW of ground mounted solar PV panels on cantilevered, steel structures was installed above Council's fleet carpark which double as shade structures. Both systems are connected back to Council's Administration Building main electricity board.

The carpark element required complete tree removal at the site, but Council established a replacement tree planting project site at a 2:1 ratio. The Natural Asset team selected higher value species to improve habitat and biodiversity in the neighbourhood. Ground disturbance works were kept to a minimum due to legacy heavy metal contamination on the project site. Cantilever solar shading structures were installed for minimal impact to existing carpark and maximising solar generation. Council capitalised on the works to provision future EV charging stations by installing power conduits, communications and electric distribution board connected back to the main facility.

Project partners include:

- HCB Solar – managed installation of ground mounted solar PV, carpark fencing and security, and provisioning of future EV charging capacity
- Origin – ARENA funded trial for fleet charging
- Jetcharge – supplier of bidirectional (V2G) charging stations
- LGNSW – research and innovation fund grant
- Quantic Security – installed and resolve data issues with number plate recognition camera

The project timeframe was 10 months for the main installation of solar, fencing and initial EV charging stations, at a cost of approximately \$935,000. Additional project works are still ongoing to install V2G charging stations.

Outcomes

The solar system has generated 500MWh of electricity in the period from May 2021 to June 2022. The charging infrastructure has supported the purchase of an additional nine EVs, whilst retiring two early model EVs, increasing Council’s total fleet of EVs from two to nine.

Longer term, Council is working towards reducing the building’s daily maximum energy profile and for the carpark to be capable of supplying electricity to the administration building during a grid supply failure through vehicle-to-grid (V2G) charging stations. As the electric fleet grows, so does the energy resilience of the building, which will utilise the growing amount of “batteries on wheels”. This will allow the electric vehicles to discharge their batteries to the administration building and so remain operational during times of natural disasters or grid outages.

The system design also supports the inclusion of a future large-scale battery to further reduce grid energy reliance and storing excess renewable energy. As the number of EVs increases towards 53, Council expects to demonstrate that the site will sustain the increased electrical loads through smart management of charging, the building’s air conditioning system and optimising the use of onsite solar generated electricity. This is also a demonstration project, showcasing beneficial upgrades to single level carparking areas. Council has received a number of enquiries from interested organisations that have seen the carpark and wish to replicate the benefits of solar generation on carparks and supporting transition of their fleets to electric.



Council trialled a number plate recognition camera to collect data on fleet vehicle movements and will be trialling V2G charging upon installation of bidirectional chargers late 2022. Council is also trialling charging scheduling to meet the travelling needs of the vehicles and minimising energy and cost impacts to Council operations.

Key Learnings

Council had some challenges in the delivery of the V2G component of this project:

- Significant delays receiving the bidirectional charging stations due to supply chain issues.
- Clean Energy Council approval has still not been obtained for the charging stations to operate bidirectionally as the certification and registration of these inverters is not yet complete.
- No data was available from the installed number plate recognition CCTV camera and poor data was recorded in Council's pool car booking system.

These issues have impacted Council's recovery of important data sources to draw insights into how existing fleet utilisation patterns may impact the availability of EVs to be used as energy resources to support the building load and decrease grid consumption during critical time periods (e.g. 2pm-8pm). Council overcame this challenge recently in partnership with the camera installer.

Council's next steps will be;

- Installation of the bidirectional charging stations and trialling V2G
- Installation of a stationary battery to support building load
- Formation of microgrid to allow the site to operate independently of the grid during disasters that affect the grid energy supply
- Engagement with staff about driver behaviour patterns, because the EVs are valuable as energy resources from 2pm onwards.

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This project was the 2022 Division C winner of the Sustainable Infrastructure Award at the LGNSW's Excellence in the Environment Awards