



# **NRMA Victor Harbor Beachfront Holiday Park, Smart EV Charging Trial**

Final Report

Victor Harbor Holiday Park

114 Victoria Street

Victor Harbor SA 5211

EV Charging Strategy – 114 Victoria Street, Victor Harbor

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**Project**

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**Minister of Energy and Mining,  
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# 1. Executive Summary

The Department for Energy and Mining South Australia engaged JET Charge to install EV charging equipment and to perform a trial at Victor Harbour. With construction beginning in July 2023, the EV charging equipment was installed and operational by the end of 2023, and the 12-month trial operated from January 2024 to January 2025, collecting data to evaluate the success of the project's objectives

The intention of the project was to install and commission smart EV chargers and to demonstrate the use of time of use tariff pricing models to encourage EV charging during periods of high renewable energy or low grid demand, and to facilitate large volumes of AC charging stations without compromising local grid assets.

In the site overview, this report details the full EV charging infrastructure at the Holiday Park site, including the construction and installation process, and the electrical infrastructure and equipment installed on the site. An evaluation of the construction process also reveals design changes and other decisions made during that phase of the project, and there is a discussion of the limitations imposed by the site's high existing loads.

In the second section, this report details the parameters of the trial and analyses the data that has been gathered prior to and over the 12-month trial period of the project from February 2024 to January 2025. The data collected included charging session information from Chargefox, interval data from the site's retail meters, and interval data from the site's solar inverter. In addition, feedback was directly sought from customer surveys and comments. Using this data, the operation of the charging stations is evaluated to determine key findings regarding the pricing model and AC charger operation.

Overall, the trial succeeded in collecting data about AC charger operation and customer behaviour, determining that with the pricing structure utilised, customers were likely still preferring to charge when convenient over when the cost was cheap, resulting in higher utilisation rates at periods of high electricity demand on both the site and the overall grid, rather than during the periods of renewable energy availability. Only 11.7% of total charging duration took place during the cheap midday period, with 26.8% taking place during the expensive afternoon-evening peak. It was also noted that customers had positive feedback about the EV charging facilities on the site regarding ease of use, accessibility, and convenience, suggesting that the installation and operation of the chargers was a success.

Due to the low utilisation rates of the chargers, the AC chargers and Load Management systems operated under low stress conditions that did not test the full capabilities of the system. The commercial feasibility of AC charging was also unconfirmed due to the aforementioned low utilisation rate, which resulted in a negative ROI in the trial year due to ongoing operational expenses. Although it is expected that this return will increase over time, it is unlikely that the chargers will see direct profitability. Instead, the main benefit of the chargers is the service that they provide to holiday park customers which is expected will draw future customers with EVs to the site. Several strategies have been identified to increase the commercial feasibility of future projects.

Due to delays in the approval of the DC V2G chargers, they were not operational during the trial, however the charging behaviour of the holiday park suggests that it is likely that there are favourable characteristics for V2G charging.

A total of 41% of the usage of the EV charging system was met by the solar system. The relatively low EV charging demand and relatively small size of the installed solar system meant that since most solar energy was consumed by the site, the solar system did not raise the available capacity for and therefore the utilisation rate of the EV charging system, however this would change under higher utilisation rates.

## 2. Background

The site chosen for this project was NRMA's Victor Harbor Beachfront Holiday Park, located at 114 Victoria Street Victor Harbor SA 5211. The location is approximately one hour and 20 minutes away from Adelaide's CBD, and is a popular tourist destination both within South Australia and from neighbouring states.

The project was coordinated between the South Australian Department of Energy and Mining, JET Charge, and NRMA, involving the installation of 28 x AC chargers and 2 x DC V2G chargers and all associated electrical and civil works, and a subsequent 12-month long trial.

The followings were the key project deliverables:

- To overcome the barriers facing EV owners travelling domestically on long road trips by installing EV charging infrastructure.
- To engage with consumers to promote awareness and understanding of the benefits of surge pricing and/or dynamic power delivery models and evaluating resulting charging behaviour adjustments.
- To quantify the business case for private sector investment on a commercial scale for regional deployment of rapid EV smart charging infrastructure using time-of-use and dynamic surge pricing models.
- To provide a modelled system on how V2G can be used to support Holiday Parks in periods of peak energy usage and how customers can be financially remunerated for this service. To analyse and report the impacts on consumer behaviour.
- To quantify the costs and benefits to consumers.
- To assess the effectiveness and benefits to Holiday Park owners.
- To evaluate the alignment of electricity demand for EV charging to periods of high renewable energy generation and low grid demand in South Australia.

The 28 x AC chargers were installed throughout the holiday park at a variety of different parking locations. Some were directly mounted to walls and dedicated to specific cabins on the site, while others were mounted on pedestals and located in shared or free parking spaces throughout the park.

As part of the trial, 30kW of Solar PV generation was installed on the site to assist power generation for the extra load introduced by the EV Chargers. The output of the solar system was expected to be absorbed into the site's consumption, as the site has a relatively high baseload during the expected periods of solar generation even outside of the site's peak demand periods.

The site utilised the JET Charge CORE Load Management System (LMS) in order to measure the site demand and limit the EV chargers to prevent exceeding site capacity. This was necessary as the site already had a high peak demand even prior to the added EV chargers that approaches its maximum available capacity.

All charging sessions were billed using Chargefox's third party online software, which allows operators to see number of charging sessions, duration, charger output, cost, and revenue. One of the key challenges of this trial involved working with Chargefox to set up a private site for billing customers for usage without opening the site up for all users to view on the app. Private groups were introduced where members could apply to join and the chargers would appear on their app, or they could use RFID cards for operation. This has now been rolled out across many other projects since validation on this trial.

## 3. Site Overview

### 3.1 Charging Locations

The charging sites were spread out throughout several different carparks on the site. A total of 28 x 7kW AC chargers were installed. In addition, 2 x 7.4kW DC chargers with V2G functionality were also included.

During the initial design stage, it was necessary to identify the best locations for the EV charging areas. The initial proposed layout included most chargers at the cheap studio cabins, a few located at dedicated power camping sites, and the remainder on the high-end cabins. This initial design prioritised ease of installation in order to minimise the cost of installation for NRMA.

Upon review however, this design was altered to increase the usage rate of the EV chargers – it was assessed that EV owners would be more likely to stay at the more expensive higher-end cabins. In addition, there were spare carpark bays in the middle of the park that could be used for shared general use parking, allowing for broader coverage. The final allocation became 5 x AC chargers on the studio cabins, 21 x AC chargers on the higher-end cabins, and 2 x AC chargers in the spare carparks for general usage. Although this increased the infrastructure cost for NRMA, it improved the EV charging distribution at the site.



Figure 1: Overall Site Layout

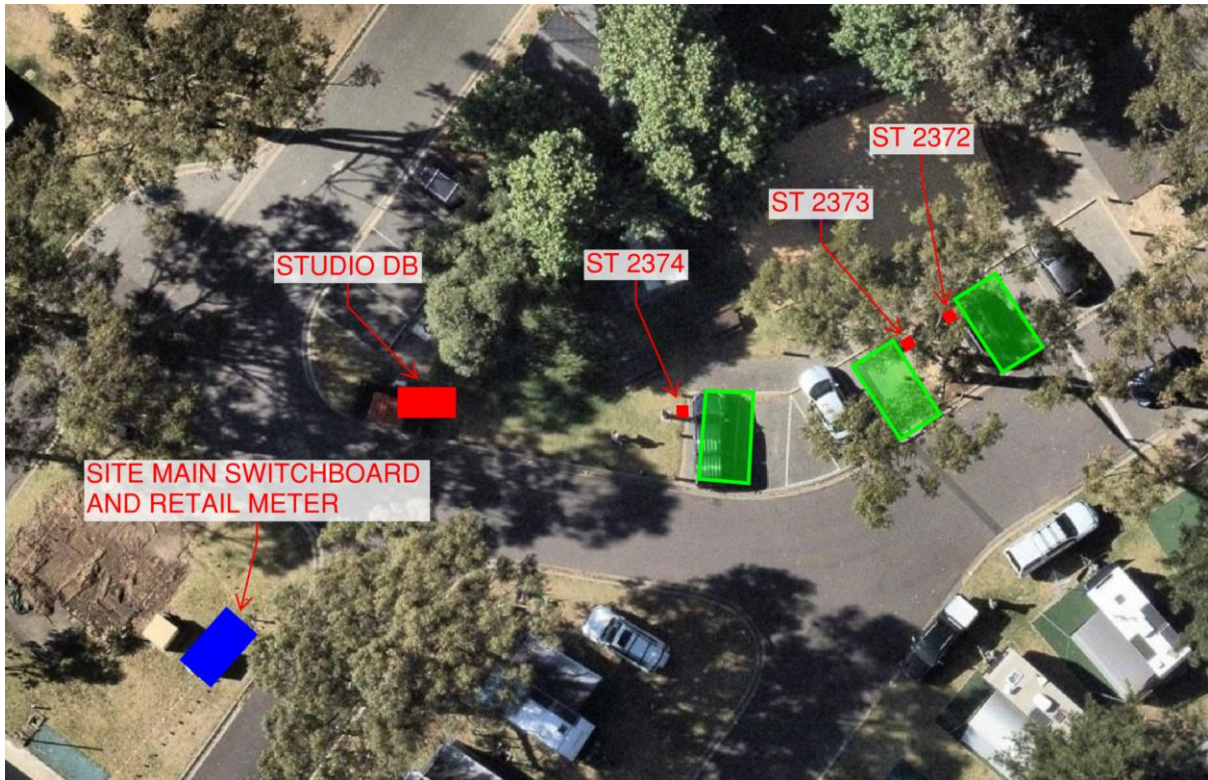


Figure 2: Studio Cabins



Figure 3: Ocean Breeze Carpark

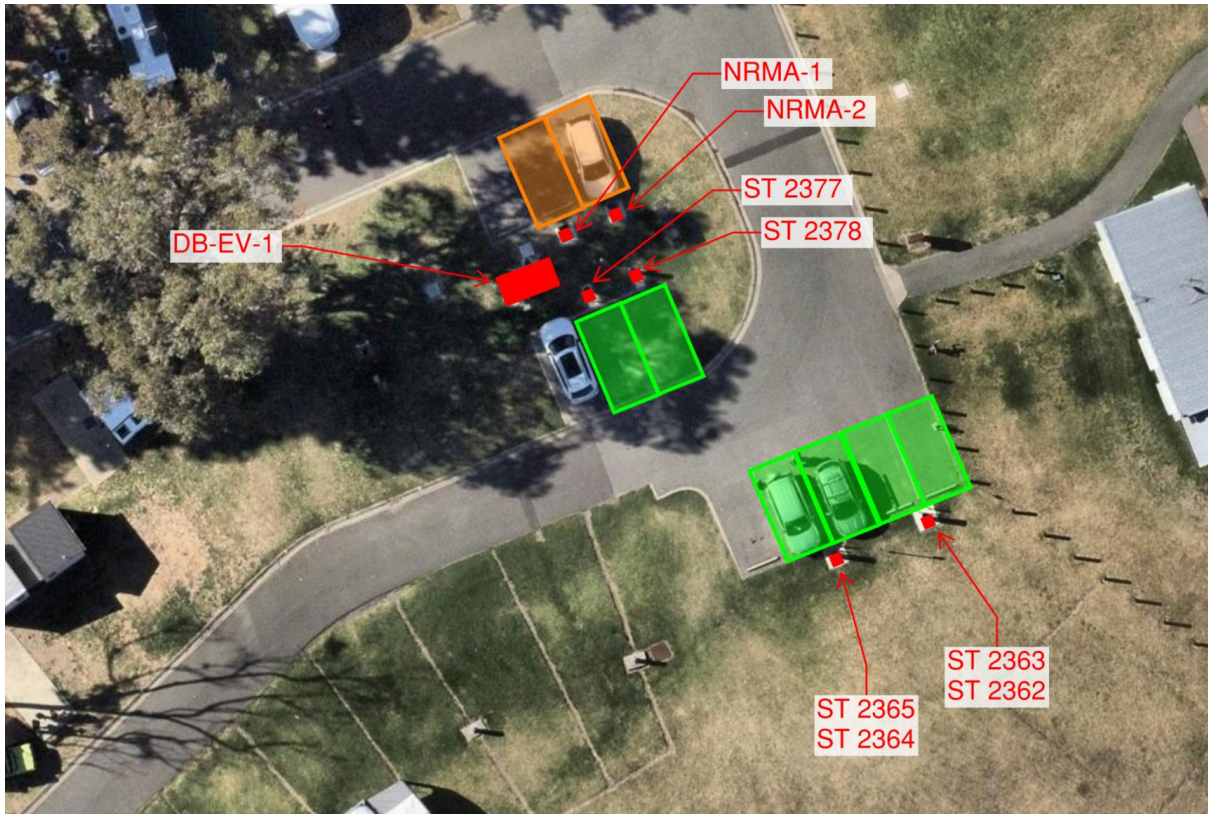


Figure 4: Seavilla Carpark



Figure 5: Safari Carpark

## 3.2 Equipment List

Charger Station	Port A	Location	Type of Charger	Maximum Charge Rate
Charger # 2356	CCS2	Ocean Breeze Villa Parking - Cabin 6	AC Charger	7 kW
Charger # 2357	CCS2	Ocean Breeze Villa Parking - Cabin 5	AC Charger	7 kW
Charger # 2358	CCS2	Ocean Breeze Villa Parking - Cabin 4	AC Charger	7 kW
Charger # 2359	CCS2	Ocean Breeze Villa Parking - Cabin 3	AC Charger	7 kW
Charger # 2360	CCS2	Ocean Breeze Villa Parking - Cabin 2	AC Charger	7 kW
Charger # 2361	CCS2	Ocean Breeze Villa Parking - Cabin 1	AC Charger	7 kW
Charger # 2362	CCS2	Seaview Villa Parking- Cabin 1	AC Charger	7 kW
Charger # 2363	CCS2	Seaview Villa Parking- Cabin 2	AC Charger	7 kW
Charger # 2364	CCS2	Seaview Villa Parking- Cabin 3	AC Charger	7 kW
Charger # 2365	CCS2	Seaview Villa Parking- Cabin 4	AC Charger	7 kW
Charger # 2366	CCS2	Safari Tent Parking - tent 6	AC Charger	7 kW
Charger # 2367	CCS2	Safari Tent Parking - tent 5	AC Charger	7 kW
Charger # 2368	CCS2	Safari Tent Parking - tent 4	AC Charger	7 kW
Charger # 2369	CCS2	Safari Tent Parking - tent 3	AC Charger	7 kW
Charger # 2370	CCS2	Safari Tent Parking - tent 2	AC Charger	7 kW
Charger # 2371	CCS2	Safari Tent Parking - tent 1	AC Charger	7 kW
Charger # 2372	CCS2	Studio Cabin parking – Cabin 9	AC Charger	7 kW
Charger # 2373	CCS2	Studio Cabin parking – Cabin 8	AC Charger	7 kW
Charger # 2374	CCS2	Studio Cabin parking – Cabin 5	AC Charger	7 kW
Charger # 2375	CCS2	Studio Cabin parking – Cabin 1	AC Charger	7 kW
Charger # 2376	CCS2	Studio Cabin parking – Cabin 2	AC Charger	7 kW
Charger # 2377	CCS2	Spare carpark- open park staying customer (C)	AC Charger	7 kW
Charger # 2378	CCS2	Spare carpark- open park staying customer (D)	AC Charger	7 kW
Charger # 2382	CCS2	Park View Cabin- 1- mounted on cabin	AC Charger	7 kW
Charger # 2383	CCS2	Park View Cabin- 2- mounted on cabin	AC Charger	7 kW
Charger # 2384	CCS2	Park View Cabin- 3- mounted on cabin	AC Charger	7 kW
Charger # 2385	CCS2	Park View Cabin- 4- mounted on cabin	AC Charger	7 kW
Charger # 2386	CCS2	Park View Cabin- 5- mounted on cabin	AC Charger	7 kW
NRMA-1	CHAdeMO	Spare carpark- open park staying customer (E)	DC V2G Charger	7.4kW
NRMA-2	CHAdeMO	Spare carpark- open park staying customer (F)	DC V2G Charger	7.4kW

### 3.3 Construction & Installation

As the work site was a holiday park, construction could only be completed during offseason periods to avoid disruption to site operations. In the case of Victor Harbor - a south coastal environment – this offseason was during the winter. As the new design required extensive trenching throughout the park, there were construction delays due to rain and the resulting soft ground.

In total, the project installation period was extended by 2 months, but the outcome and non-disruption to the park were accepted by NRMA. The works were initiated in August 2023, and by the October 2023 school holidays, all civil works had been completed, leaving only small work zones with minimal disruption on the site for the final EV Charger installation and fitting works. All of these works were subsequently completed prior to the Christmas period, and the site EV charging operation began in December 2023.

The total upfront cost of the project was equal to \$164,367. Of this total sum, \$78,019 was in EV charging hardware supply costs, while \$86,348 was in supporting hardware, infrastructure, and installation costs. In addition, there is an annual operational expenditure of \$12,452 per year in ongoing maintenance and software subscriptions. This does not include the cost of the solar system.

It should be noted that there were no upstream supply upgrades incorporated in this project, with the EV chargers instead utilising only the maximum power available through the existing site supply, and as such there are no associated site supply upgrade or network augmentation costs. This site should be considered representative of scenarios where chargers can utilise existing spare capacity with Load Management rather than other existing sites which require substantial upstream upgrades, or new sites where the provision for EV charging systems must be considered in the size of the new connection.

There may also be other undocumented costs associated with the project, such as site internal staff training and other costs associated with supporting the operation of the EV charging system, which are not included within this numbers.





*Figure 6. Civil Works & Trenching*

## 3.4 Electrical Capacity & Load Management

As this park contained largely older electrical infrastructure, electrical upgrades were required as part of the construction and installation works. The Distribution Board on the site previously designated Workshop Sub 1 was upgraded with a new board, with most of the EV chargers installed downstream of it. While existing local Distribution Boards (DBs) were utilised for some of the chargers, a new EV Charging Distribution Board (EVDB) was also installed.

Through the use of interval data (see Appendix I) and verbal confirmation from SAPN (SA Power Networks), it was identified that the site limitation was 400A and that it was already approaching the 400A limit during certain peak periods in the summer. As no mains upgrade was incorporated into this project due to the scope of the works that would be required, the issue of peak capacity was instead addressed through three actions:

- The JET Charge CORE Load Management system (LMS) was installed in order to monitor the site's full load and control the charger outputs, with a 10% buffer, to provide a hard limit preventing the site from exceeding its maximum available capacity. This system incorporated energy meters at DB1 and multiple downstream DBs and EVDB, to allow for sitewide monitoring and control.
- 30kW of Solar PV was installed to provide extra capacity to the park during periods of solar availability.
- A higher peak charging cost of 40c per kWh for EV charging was implemented during the 7-10AM and 3-9PM periods of the day, in order to encourage use of the chargers outside of this time. Similarly, the cheapest charging cost of 20c per kWh was reserved for between 10AM and 3PM, in order to encourage usage of the power generated by the Solar PV system and the general cheaper power prices during this time of the day.

Despite these strategies however, the vast majority of charging took place during the 4-9PM time period regardless of the increased cost. This is evaluated further in the data analysis in the next section.

A secondary challenge involving Load Management was the downstream limitation imposed by the 40A 3-phase supplies at the local cabin switchboards, which were shared between three cabins with one phase each. Due to the potential existing demand at each of the cabins created by electrical cooking and cooling infrastructure, it was also necessary to limit the maximum load at the point of the cabin supply.

To address this consideration, a secondary, smaller LMS based on the JET Charge CORE system was installed at each of the local cabin distribution boards, designed to operate independently of the site's main LMS. A local energy meter was installed on the submains to the cabin distribution boards and connected with an LMS controller and the local EV chargers. Much like the primary LMS, it monitored the load to the cabins and controlled the charger loads with a 10% buffer – if the combined load on an individual cabin would be greater than 28A, the charging would be delayed until more than 6A was available. From the perspective of the main LMS, the cabin loads were treated as an uncontrolled load.

The operation of this secondary LMS system was successful, limiting the load with minimal disruption to cabin guests, while also providing the option for faster charging if the cabin load is manually reduced. This system has now been implemented and utilised at other NRMA parks with similar electrical configurations.

# 4. Trial Operations & Results

## 4.1 Reporting Summary

The data for the 12-month trial covers the period from 01/02/2024 through to 31/01/2025 and was initially gathered in monthly blocks. In addition to the Chargefox data, interval data from the site retail meter and the solar system was also gathered. JET Charge also performed a survey of the EV charging customers to gather additional feedback.

The Chargefox data was used to quantify and evaluate consumer behaviour around a number of different variables impacting Charging Sessions, including Time, Duration, Number, Distribution, Cost, and Revenue.

For the purposes of this evaluation, only successful charging sessions longer than 1 minute were included. There is likely to be noise in the data entry for total number of sessions from interrupted sessions, i.e. sessions that were discontinued and then restarted and therefore should ideally be considered as a single larger session. As such, the total amount of charging at each station is considered a more effective indication of charging station utilisation. Due to low utilisation rates, only a total of 16 chargers were utilised during the trial period, while the remainder were unused. Of the chargers that were used during the trial, a substantial number also only saw one or two charging sessions. Due to lack of approval from SAPN, the V2G DC chargers were not connected and remained unused during this trial.

For this charging trial, the time-of-use pricing structure for EV charging was a key variable, with the goal to:

- Implement a Time-of-Use and/or Surge Pricing power delivery model
- Analyse and understand how the models affect consumer behaviour
- Engage with consumers to understand their reaction to the pricing models

As such, a four-part pricing tariff was set for the duration of the trial in order to promote daytime usage during periods of low price and renewable energy availability, and to attempt to shift charging away from the site's identified peak periods to either midday or overnight, or failing that to have a cost of charging during those periods more representative of the true cost of energy. This tariff was made clear to customers through the installation of stickers on the chargers and a handout available at the site's reception.

The retail cost of power on the site was a flat 19 cents per kWh, however this final retail cost is not necessarily an accurate representation of the market cost of energy, which varies significantly over time. If EV charging is able to achieve a lower cost of energy, there are multiple mechanisms that can be used to recover this value.

Pricing Structure – Stage 1	
Peak Rate (7AM – 10AM)	\$0.40 per kWh
Daytime Renewable (10AM – 3PM)	\$0.20 per kWh
Peak Rate (3PM – 9PM)	\$0.40 per kWh
Night Rate (9PM – 7AM)	\$0.30 per kWh

## 4.2 Total Charging Sessions and Length

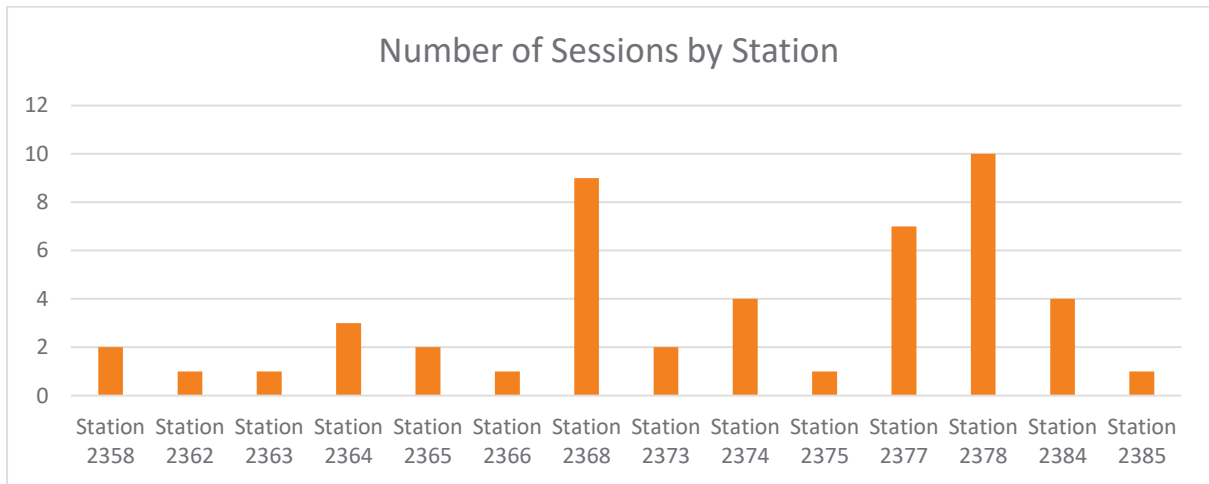


Figure 7. Number of Sessions Per Station

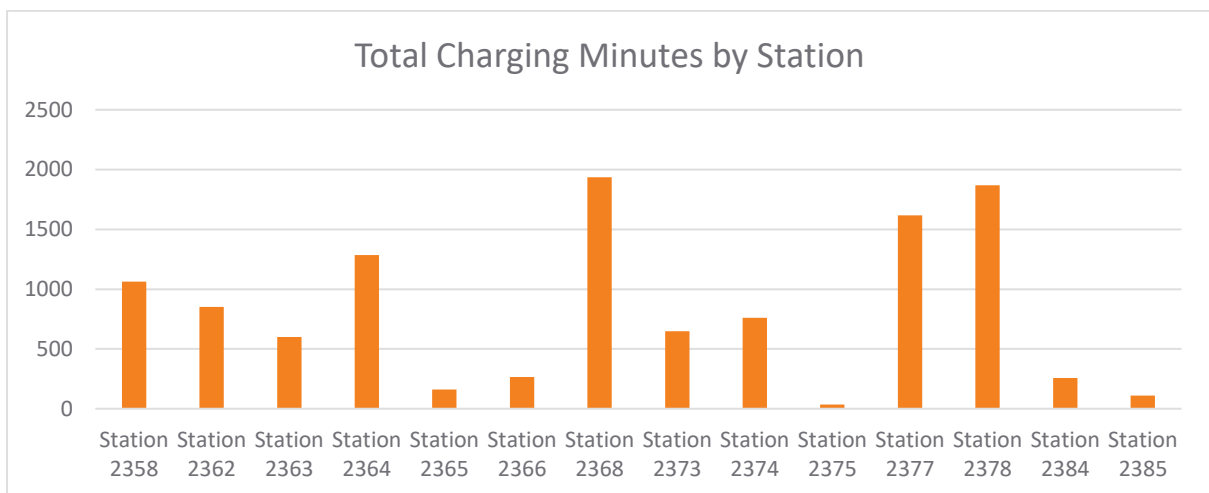


Figure 8. Total Charging Minutes Per Station

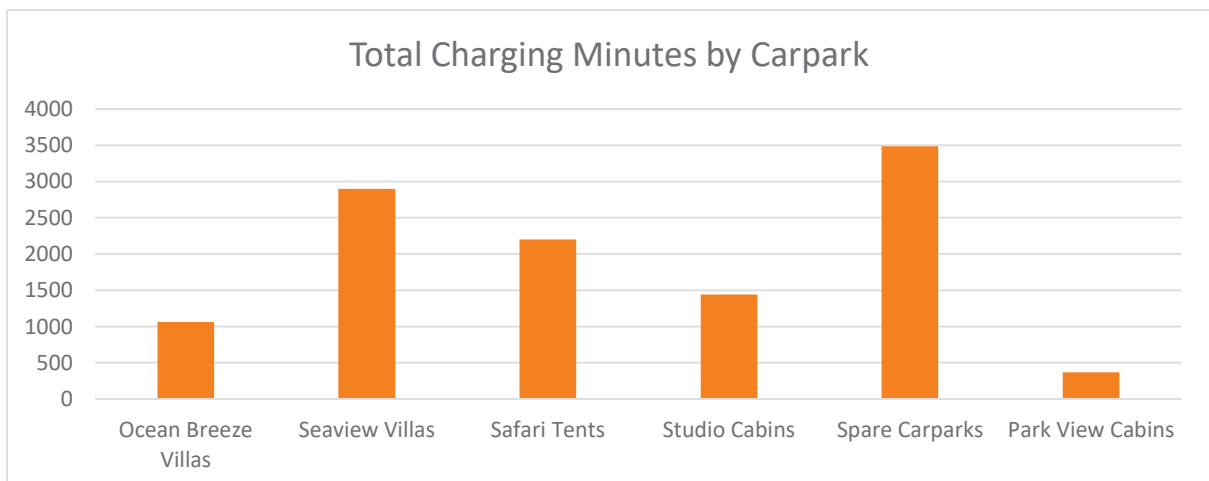


Figure 9. Charging Utilisation by Carpark

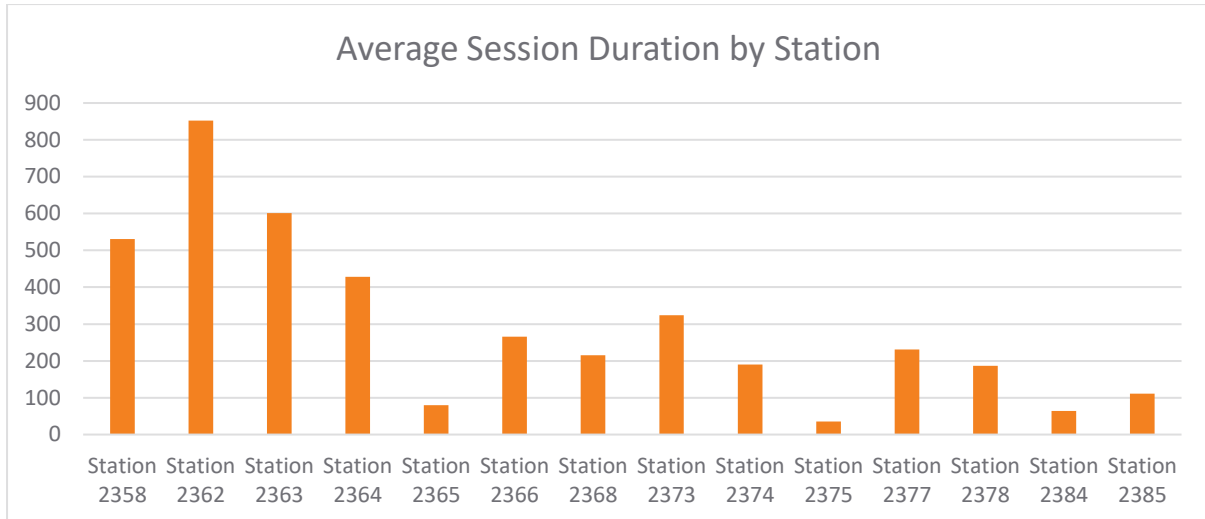


Figure 10: Average Session Duration Per Station

### Comments:

From an assessment of the data, it has been observed that a total of 49 charging sessions were delivered across the entire trial period:

- The chargers that were utilised the most were Stations 2358, 2364, 2368, 2377, and 2378, with each of them having a total charging duration above 1000 minutes over the trial period. Of these chargers, 2368, 2377, and 2378 had a high number of charging sessions, indicating repeated short usage, while stations 2358 and 2364 were dominated by one or two long duration charging sessions.
- Stations 2378 and 2377 are in the spare carpark location. It is likely that their high usage represents easy accessibility resulting in a larger number of users, especially as they are not dedicated to any specific cabins or villas on the site.
- Station 2368 is the central station at the safari carpark location. It is possible that the higher usage on this charger represents usage by customers at the Safari Tents who may be biased towards using the single space as it is at the centre of the carpark and nearest to the walkway into the tents.
- The remaining highly-utilised chargers are 2358 and 2364, which are in the Ocean Breeze Carpark and Seaview Villa Carpark locations respectively. Their utilisation however was due to individual long charging sessions, rather than repeated short usage, indicating that they may have only been utilised due to chance.
- Only 14 of the chargers were utilised during the trial period, all of which are shown in this data. It is however difficult to evaluate these alongside those chargers which were only utilised once or twice throughout the entire trial period, as it is possible that the no and low sessions chargers were simply utilised or not utilised due to chance.
- The most utilised chargers tended to be located in the shared areas at the Spare Carparks or Safari Tents, and the Seaview Villa Carparks which were directly adjacent to the Spare Carparks. By comparison, the chargers at the Park View Cabins and Ocean Breeze Villas saw comparatively less usage.

### 4.3 Time of Charging

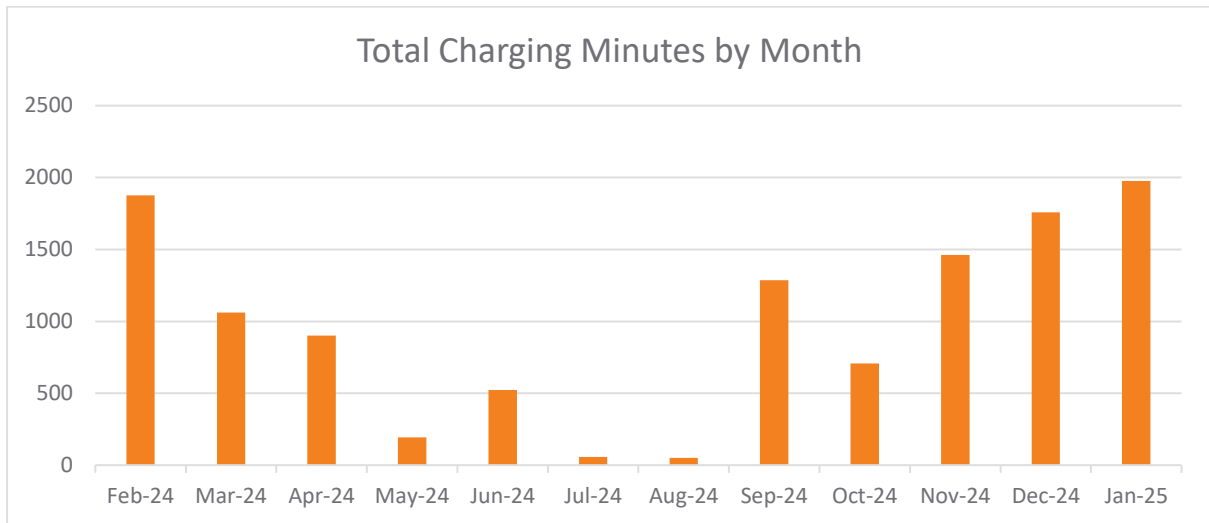


Figure 11. Total Charging Minutes by Season

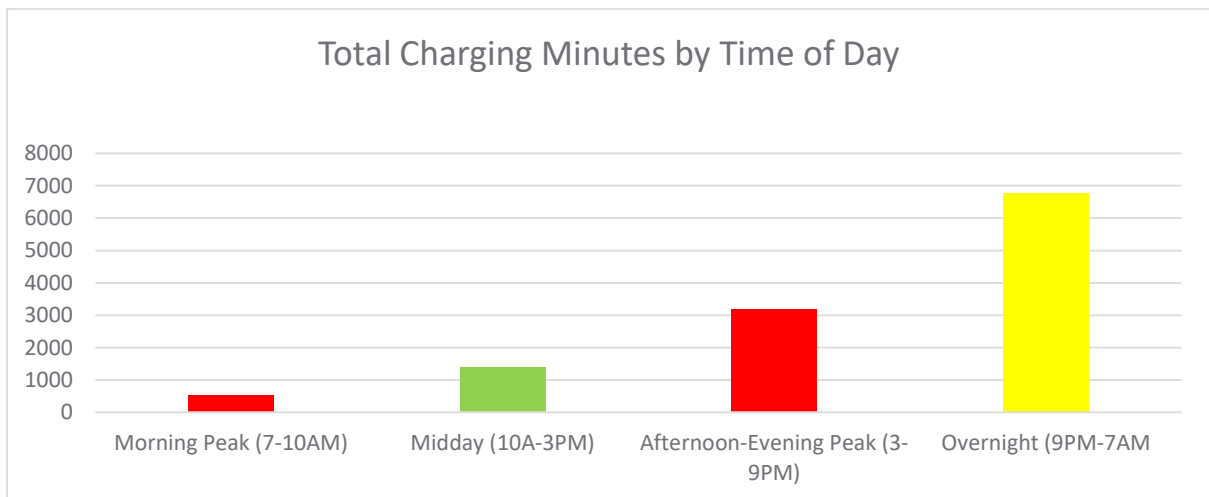


Figure 12. Total Charging Minutes by Time of Day

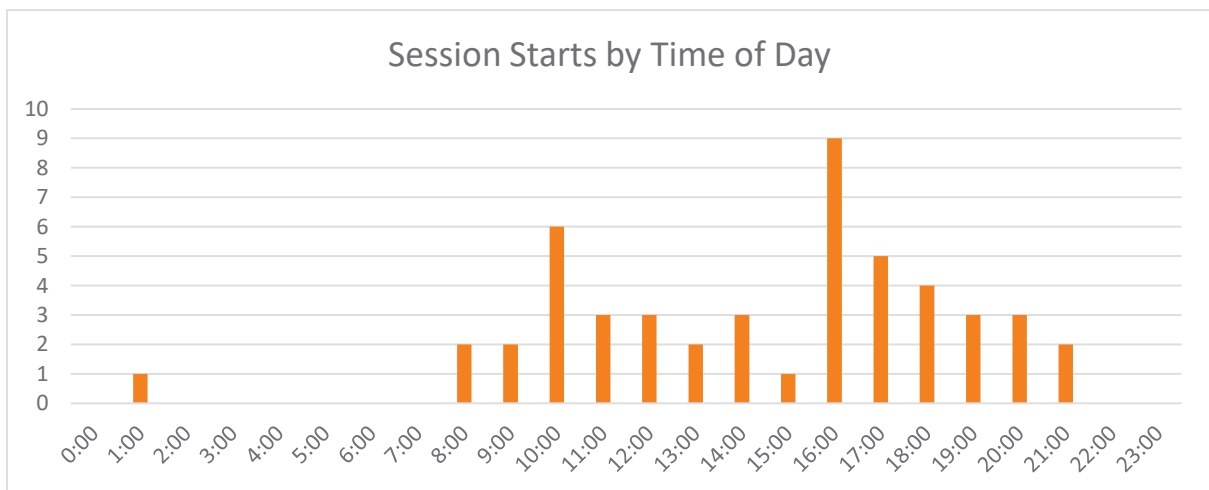


Figure 13. Session Starts by Time of Day

**Comments:**

From the data, it is clear that the highest utilisation of the charger is in the summer and spring months, and during the later parts of the day:

- The high utilisation of the chargers during the summer and spring months is expected given the expected customer usage pattern of the holiday site. In winter, the site’s EV charger usage dwindles to nearly zero.
- The majority of charging duration takes place overnight, which is a positive outcome as this is a period of lower electricity prices and lowest site demand. The second-highest preponderance of charging takes place during the afternoon peak, when power is most costly. There is however very little charging during the midday peak, when electricity is cheapest and solar energy is available. Only 11.7% of total charging duration took place during the cheap midday period, with 26.8% taking place during the expensive afternoon-evening peak.
- The vast majority of session starts take place at some point during the afternoon to evening, with a smaller number beginning in the morning or midday. This appears to indicate that customers are typically plugging in their vehicles as soon as they return to the holiday park later in the day, and the charging is initiated during this peak period, and continues into the overnight off-peak. As this would be the expected behaviour from customers, it does not seem that the peak pricing of the site has created a significant shift in customer behaviour.
- It should be noted however that the charging rate may not be evenly distributed across each charging session.

## 4.4 Cost of Charging & Revenue

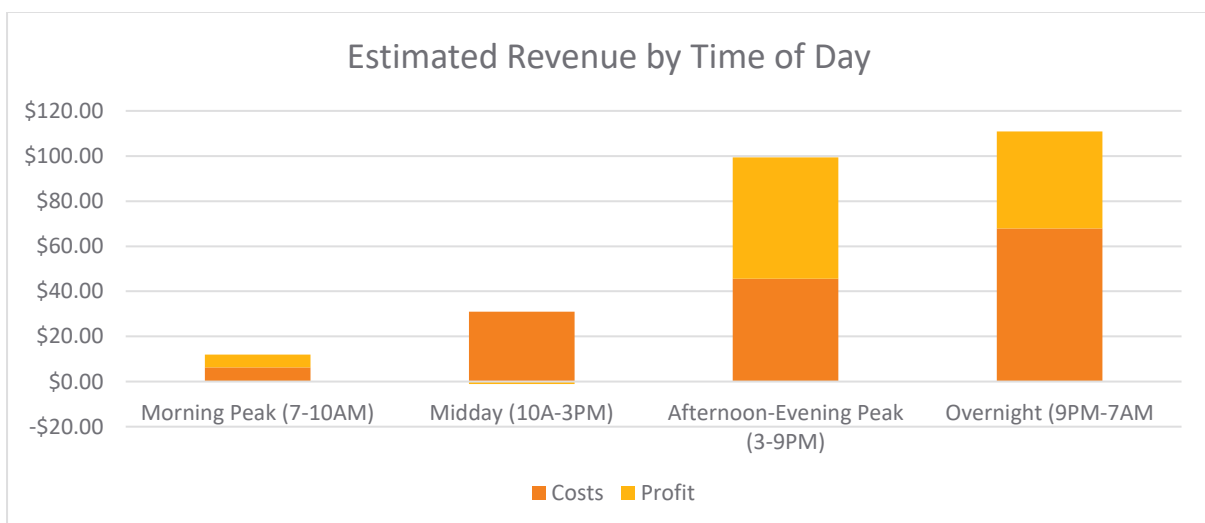


Figure 14. Estimated Revenue by Time of Day (profit only includes electricity costs and does not include other operational expenses)

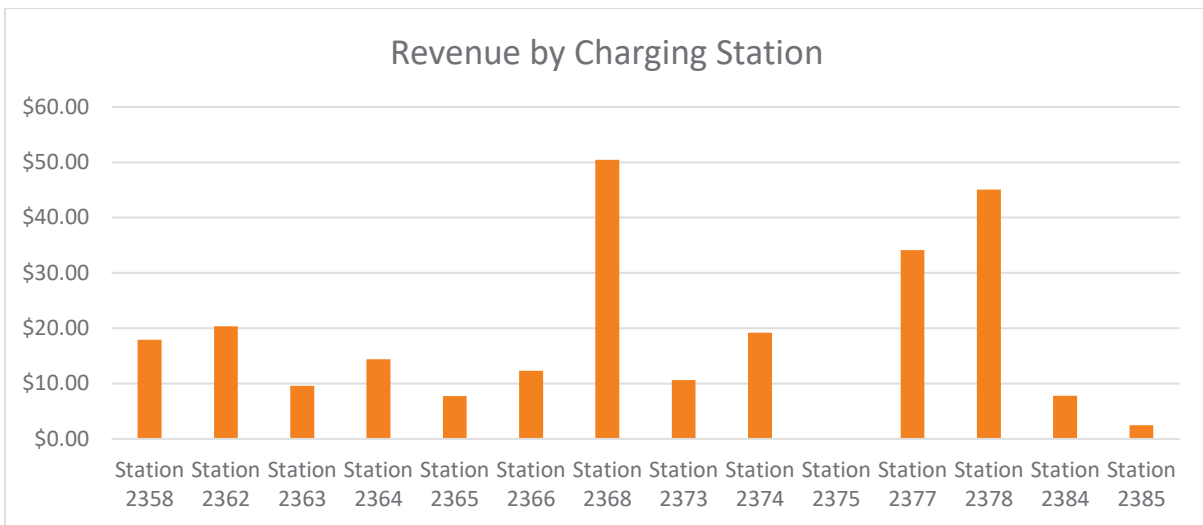


Figure 15. Revenue by Charging Station

#### Comments:

It should be noted that the revenue, costs, and profits are only estimated as no data is available for how charging is distributed across sessions, which may create inaccuracies for sessions that are split between peak and off-peak periods. For the purposes of this estimate, we have assumed that the charging rate is distributed evenly over the period. From an assessment of the data, the following has been observed:

- The revenue largely tracks with the duration of the periods of charging, adjusted by the varying rates per kWh that have been set for each different time interval in the pricing structure. Due to the higher prices during the peak periods, the afternoon-evening period's total revenue is close to the revenue of the overnight period despite a substantially lower total charging time.
- The cost of electricity is fixed at 19 cents per kWh regardless of the time of day. Because of this, the majority of profit is collected during the morning and afternoon-evening peak periods, where the highest set prices generate the highest proportion of profit. A smaller amount is collected during the overnight period, with its lower charging price.
- During the midday period, the revenue collected is minimal and the profit during this period is actually estimated to be negative. The reason for this is that selling power at 20 cents per kWh that costs 19 cents per kWh leaves almost no margin, and there are many shorter charging sessions during the midday period that do not meet the minimum threshold required to charge for the session.
- Overall, the chargers do not generate a substantial amount of revenue due to their relatively low usage, and it is unlikely that they will directly pay for their own installation cost from charging session revenue. Due to the nature of holiday park charging, this is an expected outcome.

## 4.5 Site Demand & Solar Usage

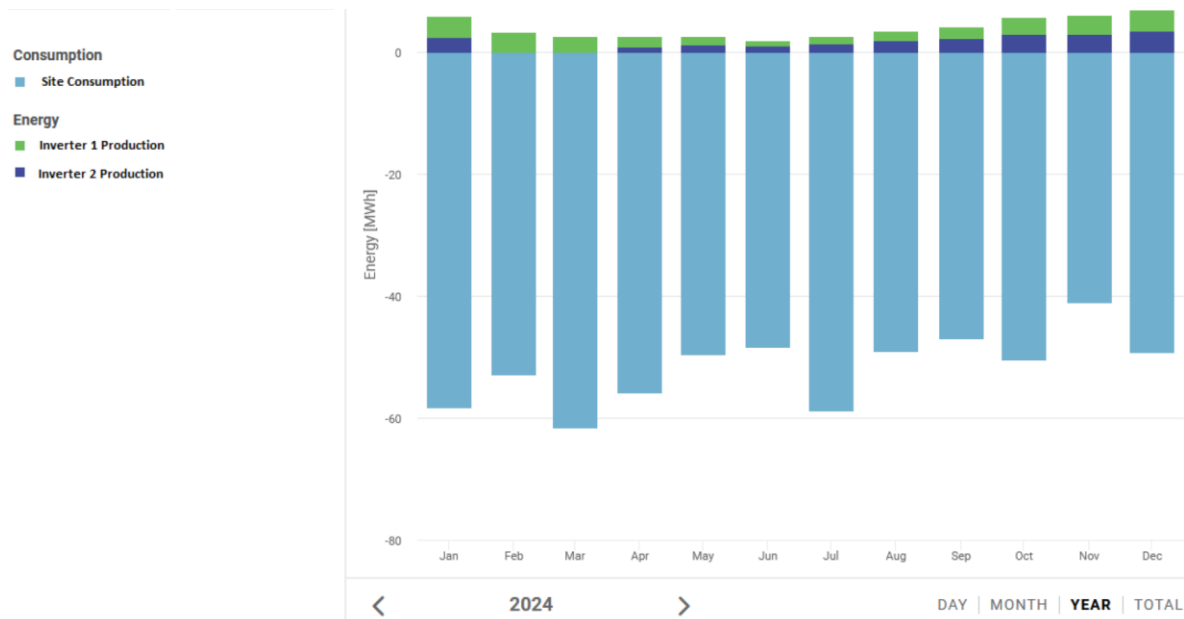


Figure 16. 2024 Site Consumption and Solar Production

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Site Usage (MWh)	58.24	52.84	61.58	55.78	49.58	48.32	58.85	49.07	47.01	50.39	41.04	49.17
Solar Prod. (MWh)	5.88	3.28	2.68	2.58	2.55	1.87	2.57	3.45	4.25	5.78	6.01	6.89
Site Imports (MWh)	52.36	49.56	58.90	53.20	47.03	46.45	56.28	45.62	42.76	44.61	35.03	42.28
% Solar	10.1%	6.2%	4.4%	4.6%	5.1%	3.9%	4.4%	7.0%	9.0%	11.5%	14.6%	14.0%

### Evaluation Prior to Installation:

A 30-kW solar system was installed on the site in order to augment the available site supply and support the EV charging system alongside the LMS, as the site demand prior to EV charger installation was already known to be close to the limit of 400A. For the full evaluation of the initial Interval Data, [see Appendix II](#).

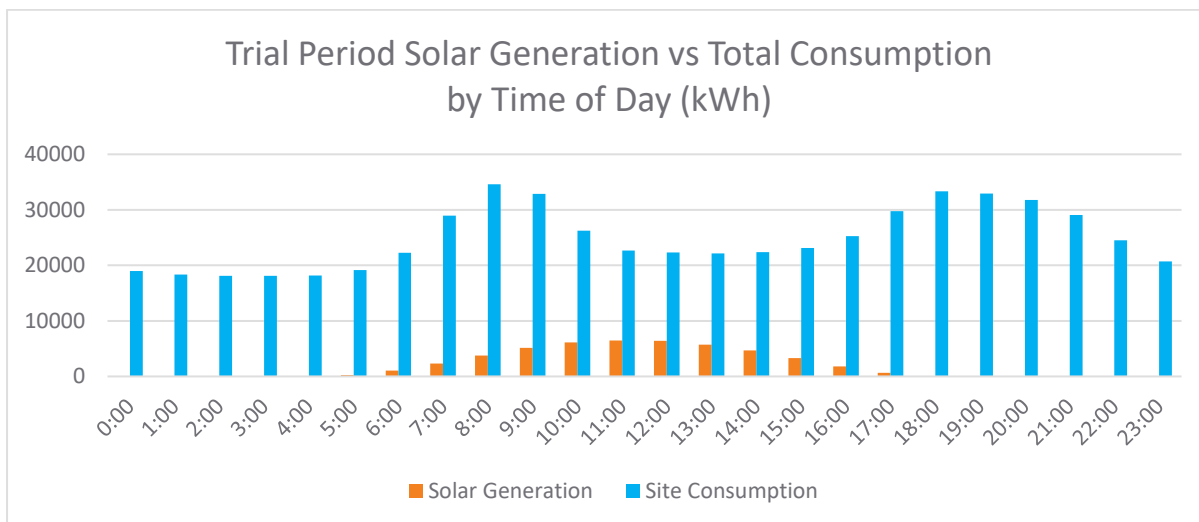
From that evaluation, it could be seen that the maximum demand of the site in 2020 was 396.6A, which was very close to the site limit of 400A as verified by SAPN. This indicates that there was little excess capacity available on the site and that any additional load would need to be load managed in order to avoid exceeding that limit. From the same data, it can be seen that in 95% of intervals, the site demand is below 152.4A. This indicates that if an LMS were to be utilised on the site, it could be reasonably expected that at least 247.6A of capacity would be available at most times.

From an evaluation of the initial Load Profile ([see Appendix III](#)) prior to installation, the site load was known to have a regular morning peak at 8-10AM and evening peak at 6-9PM, with both peaks typically at around 120A in the summer and 80A in the winter. Outside of these times, the site minimum load was typically around 40A in the winter and 60A in the summer.

**Trial Evaluation:**

A total of 28x 7kW AC chargers and 2x 7kW V2G DC chargers were installed to the site as part of this project, potentially adding a load of up to 320A to the site if all chargers were to be utilised simultaneously. However, during the trial period, the utilisation rate of the EV chargers was low and spread out, with only a single 17-minute period on 01/01/2025 from 12:45 to 13:02 where two chargers were utilised simultaneously – outside of this period, there was never more than a single charger operational. As such, the added load to the site from the EV charging system was negligible for the purposes of the site demand curve.

Due to the relatively high demand of the site, the relatively even demand curve, and the small size of the solar system in comparison, the vast majority of the solar system’s output was consumed on site, which is typically the idea scenario for rooftop PV systems. Out of 47,790 kWh of solar generation over the trial period, only 1,047 kWh was exported, approximately 2.2% of the total. Overall, the solar system supplied between 4% of the load in the winter months to up to 14.6% in November. The total solar generation by time of day compared to the site consumption can be seen in the following graph:



*Figure 17: Aggregate PV Production vs Site Consumption by Time of Day (kWh)*

It can be seen from this figure however that there is somewhat of a mismatch between the load profile of the site and the generation profile of the solar system. As indicated previously, the holiday park site tends to have two peaks in the morning at 8-10AM and in the evening at 6-9PM, with a trough in the middle, and this is consistent throughout the year.

The EV chargers themselves were utilised very sporadically, meaning an aggregate graph is an inaccurate depiction of the impact of the EV chargers on the site demand when they actually are utilised. The total EV Charging Consumption numbers were very small compared to the Solar Generation and Total Consumption numbers, meaning that it would not be effective to plot them together on the same graph. The EV Charging Consumption numbers alone can be seen in the graph as follows:

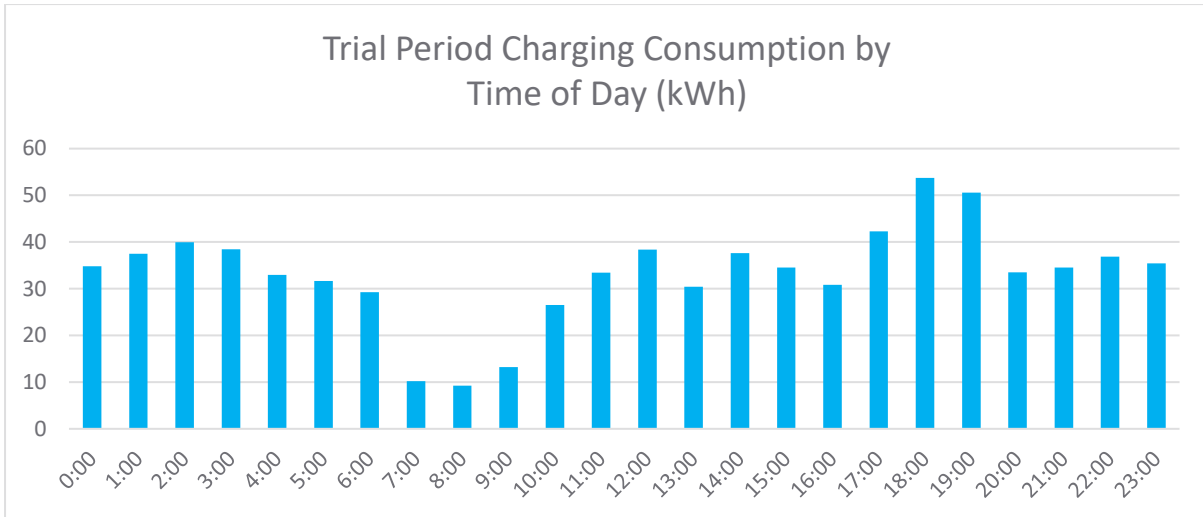


Figure 18: Aggregate EV Charging Consumption by Time of Day (kWh)

It can be seen here that the EV chargers were most utilised in the evening, with substantial use also overnight and around midday, with the only significant trough in the morning. This is likely because charging sessions that begin overnight would have been completed by the morning, and it is unlikely that customers are returning with uncharged vehicles at this time of the day.

There were no instances on site where there was an EV charger operating while the site demand, minus solar generation, was close to its maximum capacity. This indicates that the chargers with their current utilisation rate do not see any benefit from the solar system in terms of increasing the available capacity on the site. However, as utilisation rates increase, this is likely to change.

Out of the total 795.76 kWh of power utilised for EV charging over the course of the trial period, 468.78 kWh of this was supplied by imports from the grid, while the remaining 326.97 kWh was supplied by solar generation. This represents approximately 41% of the EV charging usage being supplied by the solar system. This lines up with the graphs above, where it can be seen that the EV charging consumption takes place throughout the entirety of the day, while solar generation is only available during the day.

As the majority of EV charging usage typically takes place later in the day, overlapping with the site's typical second peak, there is a potential that as the EV charging utilisation grows, the site's peak consumption peak later in the day could grow. It can already be seen that prior to the trial (see Appendix III) the majority of peak load intervals on the site were taking place within and around this time period. However, in 2024, the peaks actually became more balanced throughout the time of day.

While the solar system does partially alleviate this issue as the solar peak takes place at around midday, the solar tends to taper off in the evening just as the highest site and EV charging demand periods arrive. Further expansion of the solar system without batteries would deepen the trough in the middle of the day, potentially even flipping the site to exporting during that period of time, with a smaller effect on the afternoon and evening peaks where the sun is setting.

*Note: this solar PV data should only be considered approximate. Due to the format of the charging session data, the distribution of charging within an individual session is unclear and is assumed to be spread evenly throughout the session. In addition, difficulties with extracting solar data from the web platform mean that a simulated model of the solar production has been used.*

## 4.6 Feedback & Surveys

A QR code was installed on the chargers on Monday 18/12/2024 with a link to an online survey. The data collected from this survey has been utilised to analyse customer feedback with the following questions:

Customer Survey	
Q1. Overall, how satisfied are you with your charging experience today? (1-5 stars)	Average Rating: 3.3
Q2. It is easy to operate the charger. (Agree/Disagree)	Agree: 5 Disagree: 1
Q3. It is easy to pay for charging. (Agree/Disagree)	Agree: 6 Disagree: 0
Q4. Charging here is affordable. (Agree/Disagree)	Agree: 6 Disagree: 0
Q5. The charger is easy to access. (Agree/Disagree)	Agree: 5 Disagree: 1
Q6. Please rank the importance of the following to you as the user of this charger, from MOST IMPORTANT to LEAST IMPORTANT: (Location convenience, Cost to charge, Charging speed, Using Green Energy)	Total Score (Weighted Importance): <ul style="list-style-type: none"> <li>• Location Convenience: 3</li> <li>• Cost to Charge: 3</li> <li>• Charging Speed: 2.17</li> <li>• Using Green Energy: 1.83</li> </ul>

Location and cost of charging were indicated as priorities by customers, while the rate of charging and useful of green energy were somewhat less important. While nearly all of the responses were favourable, there was a negative review on accessibility and ease of operation. One explanation for this could have been due to an Optus outage, which is also mentioned in Plug Share reviews.

The average 3.3 star rating alongside the positive responses indicates that customers are satisfied by the chargers but are somewhat unexcited by the experience or find it unremarkable. This is an expected outcome if the chargers are reliable, as AC chargers become analogous to other “plug in and forget” devices.

JET Charge also obtained feedback from the holiday park operator after the end of the trial, which has been summarised and evaluated below:

- The construction process was smooth and there was minimal disruption from the installation works, even from the chargers that were mounted directly to the cabins, as the customers could be shifted around.
- There is some confusion from customers about the operation of the chargers, downloading the app, using the RFID cards, etc. Staff members have sometimes struggled to guide them, and they have needed to put in place processes in order to ensure that staff know how to guide customers.
- Customers are generally happy about being provided EV charging.
- Customers have seen and expressed curiosity and interest in the V2G chargers, but there has been no feedback regarding the time-of-use pricing on the ordinary AC chargers.
- There is not a large amount of utilisation of the chargers as of yet, but they are expecting it to increase over time as the number of electric vehicles increases.
- Due to the private Chargefox configuration, the site is not on public maps, which is a positive as outside drivers looking for charging may be disruptive to the holiday site. The site has however entered a private arrangement with an individual to utilise charging.

This feedback suggests that the specific implementation of Chargefox on this site using private groups has at times created some difficulty for customers, and staff struggled to guide them prior to the implementation of suitable internal procedures. This suggests that such projects could benefit from more established procedures and training to be implemented prior to commencement of operations. On this site, the holiday park operator has also developed handouts explaining the use of the site's EV chargers for customers that require their use. These procedures, staff training, and handouts, developed through the operational experience of this site, could be established into standardised resources to be replicated at other sites implementing similar EV charging system.

Overall, the low utilisation of the chargers is unsurprising and is expected to increase over time. The private Chargefox implementation intentionally keeps the site away from public maps, reserving the chargers on the site for the use of holiday park customers only. This suggests an emphasis on the secondary commercial benefits of the chargers being on site, rather than a focus on the direct revenue generation of the chargers. Customers have also provided positive feedback about the presence of the chargers, indicating that there are customer satisfaction and therefore potentially commercial benefits from the presence of the chargers.

The lack of customer feedback regarding the time-of-use pricing suggests that customers may be uninterested in adjusting their charging behaviour to the pricing structure. This could be because customers are not paying attention to the stickers or the flyers handed out, or that the difference in price is not significant enough for them to consider adjusting their charging schedule, or that customers who are on holiday having a lower sensitivity to such changes in pricing.

Customer queries about V2G DC charging also suggest that there is interest among EV owners about this functionality. However, the V2G chargers were not functional over the trial period.

## 4.7 Future Projections

In order to evaluate the long-term outlook of the system, the trial period (2024-2025) has been evaluated and a model developed to project future EV charger utilisation rates. In the year-long trial period, the EV charging system produced a total revenue of only \$252.03, due to a very low utilisation rate. This value is expected to substantially increase in future years as EVs proliferate further:

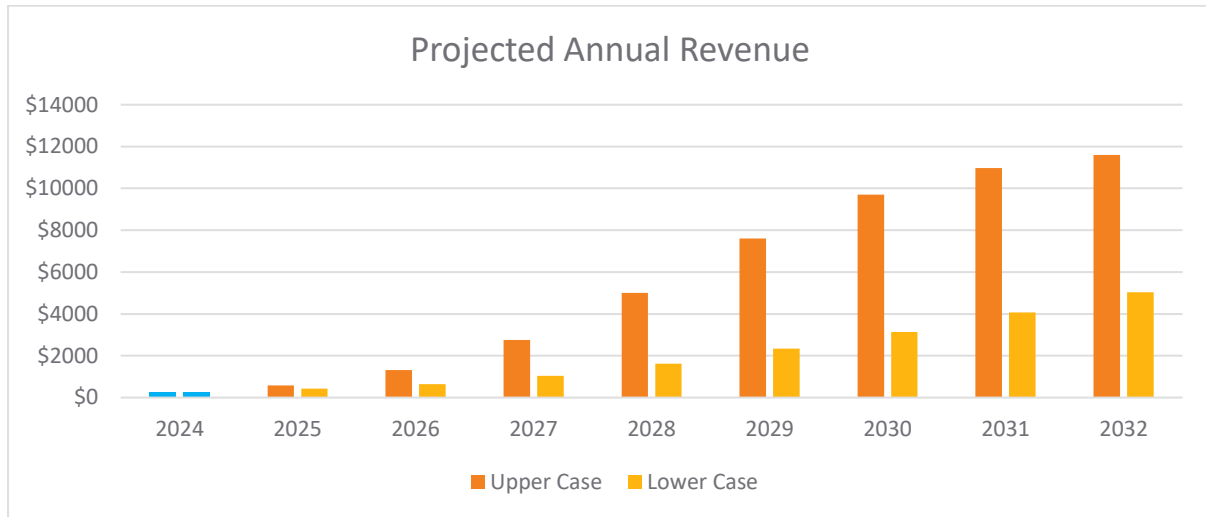


Figure 19. Projected Annual Revenue Through to 2032

These figures were generated by projecting the utilisation rate of the EV chargers to future years, considering the limitations imposed by the unique holiday park setup and customer usage patterns. Two different methodologies were utilised, with the “Lower Case” assuming a regular annual growth in utilisation in line with the projected increase in electric vehicle uptake<sup>[1]</sup>. The “Upper Case” instead assumes a more rapid growth in utilisation as the presence of EV chargers at the holiday park becomes a selling point that draws a disproportionate number of EV users, with a constraint towards the upper end from the number of holiday cabins and desirable periods of the year for holidays.

Overall, with regular operational expenses of \$12,452 per year, it is unlikely except in the most optimistic of cases for the EV chargers to directly return the upfront investment cost. In all cases, it is expected to run at a loss for the near future, while potentially breaking even as the utilisation rate increases.

These numbers are in real, present-day dollars. This does not however consider the cost of financing, or the opportunity cost and time value of money. The model also assumes that the real cost of future electricity will remain at current levels, as will the cost of charging. On the other hand, the secondary commercial benefits to the holiday park of the EV chargers has not been considered, and indeed this is likely to be the main benefit of such an EV charging project.

## 4.8 Business Case and Scaling

The commercial feasibility of future implementations of the project would be improved by utilising strategies to reduce the cost and/or increasing revenue. The following table compares several potential and identified strategies, assessing them by Impact (potential efficacy) and Effort (difficulty of implementation):

Reducing Costs			
Strategy	Comments	Impact	Effort
Reduce electricity tariff	The overall price of electricity is dependent on market conditions in an already-competitive industry. It is likely that alternate offers will only offer small cost reductions.	Low	Low
Use additional solar energy	Solar power is only available during the midday period.	Low	Low
Use batteries	Batteries would add substantial upfront costs.	Low	High
Shift charging periods	The evidence suggests that most charging takes place during peak periods despite higher pricing in the current sensitivity range. Under current tariffs, cost of power is single rate, although this does not represent wholesale costs at scale.	Low	Medium
Reduce hardware costs	EV charger hardware costs will reduce over time and from scale, but generally make up a smaller proportion of the overall total costs than installation.	Low	Low
Reduce other project costs	Most other costs depend on electrical and construction labour, an already-competitive industry. However, procurement at scale rather than in a trial format could see advantages.	Low to Medium	Low to Medium
Increasing Revenue			
Select for Utilisation Rate	Right-sizing systems and selecting more advantageous sites and design could substantially boost the utilisation rate.	High	Low
Increase EV Traffic	Increasing site and EV charger discovery could increase EV traffic in the short term, boosting utilisation rates.	Low to Medium	Low
Increasing pricing	Most charging already takes place during peak prices, indicating that the higher prices are not deterring customers, However, further increases may cause complaints and negatively impact business. Chargers will also compete with other public chargers.	Low to Medium	Low

A simulated case can be seen with the following strategies implemented:

- Reduce projects costs by utilising advantages in focused procurement and deployment, removing one-time costs (i.e. software development and other trial specific costs) and reducing installation.
- Assess sites for expected EV charger utilisation demand and right-size systems with potential for future expansion, installing common chargers rather than cabin-specific chargers. Target installations where chargers are expected to support 120 average charging sessions per year.
- Increase charging rates by 10 cents, while keeping the cost below typical DC fast charger rates.

Such a project could see modest reductions in cost and very substantial increases in revenue. In this model, the potential cost per charger (including all CAPEX – installation and infrastructure), has been reduced to \$4,230, while the estimated return (profit after operational expenses) has been projected to reach \$1,091 per year, once the site approaches the expected maximum utilisation rate.

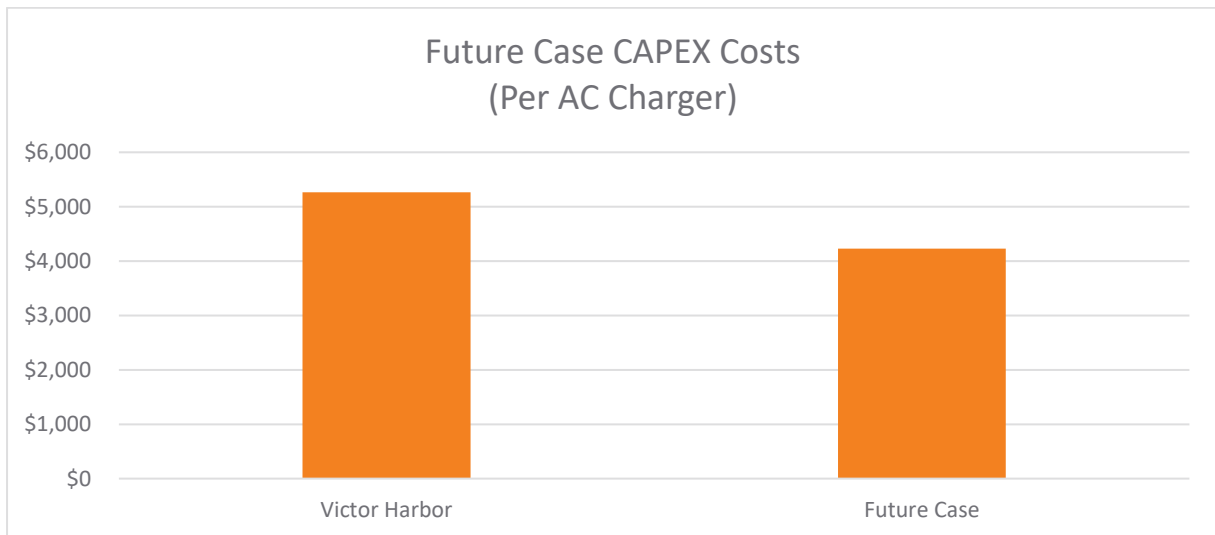


Figure 20. Future Case CAPEX Costs Versus Victor Harbor CAPEX Costs

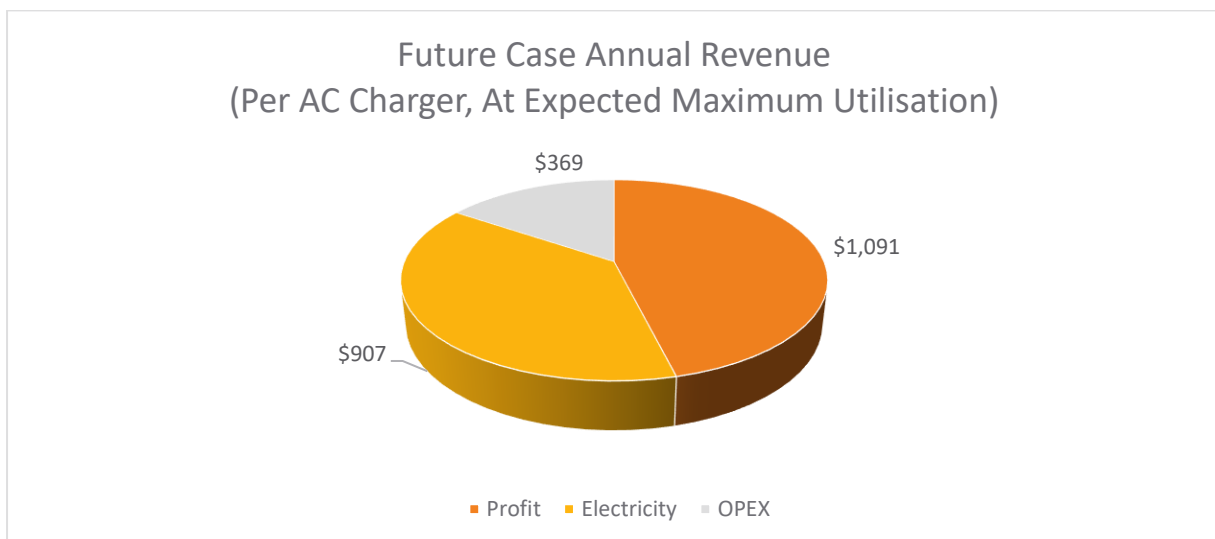


Figure 21. Future Case Annual Revenue (At Expected Maximum Utilisation)

## 4.9 V2G Discussion

One of the primary objectives of the trial was to demonstrate and evaluate the V2G chargers. During the trial however, the V2G chargers were not operational due to SAPN delays.

Initially, the Quasar 1 DC chargers were on the SAPN approved connection list during the site construction process. However, they were removed in December 2023 due to issues discovered during commissioning at a different site – namely, the Volt-Var capability of the chargers did not align with the requirements set out in AS4777. The chargers were not added back to the approved connection list until September 2024, near the end of the trial period for Victor Harbor – this then required another embedded generation application, with another application period. As such, they were not operational for the duration of the trial.

While the chargers are now approved for use by SAPN, there are several reasons that they will be unlikely to achieve a successful trial. The Quasar 1 DC chargers only have CHAdeMO capability, severely limiting the pool of available vehicles. It is unlikely that enough vehicles will utilise the chargers to gather useful information on their operation. While V2G functionality is still yet to be enabled on the majority of CCS2 vehicles, any future V2G charging implementations would likely need to use CCS2-compatible hardware in order to accommodate the vastly larger pool of vehicles in this category. Additionally, the Quasar 1 DC chargers have had operational and control difficulties that impose difficulties on site operations and management staff.

V2G chargers are likely to have substantial future potential as the number of electric vehicles and therefore their associated collective battery capacity rises, but this requires having the correct charging hardware in place, software enabled on the electric vehicles and enough of them to utilise the V2G charging facilities, and coordinated approvals in place with SAPN.

A future operational V2G charger with full CCS2 capabilities is likely to see significant advantages when installed at this sort of site. Due to the nature of a holiday park, there is likely to be a higher proportion of vehicles parked in place at peak times for their batteries to be utilised by the grid while vehicle owners are away or participating in holiday activities. In addition, the usage of chargers, and hence the presence of plugged in electric vehicles, at this holiday park can be seen to be primarily in the summer and spring – this aligns directly with the critical peak periods of electricity usage as designated by DNSPs, and as can be seen in the higher wholesale prices of electricity.

## 4.10 Evaluation

The time-of-use pricing structure demonstrated mixed outcomes on this site. Although the majority of EV charging did take place outside of the two main peak periods, it is unclear if this was a direct response to the pricing structure or simply a result of expected charging behaviour. The majority of charging sessions began during the afternoon-evening peak period – while some of these sessions began later in the period and went overnight, others began much earlier and often finished quickly. This resulted in the afternoon-evening peak period having the second-highest proportion of charging, suggesting that these customers are most likely simply plugging in their vehicles whenever they return to the holiday park. The midday charging period, which had the lowest tariff and is the targeted period for charging, also saw low utilisation rates, while the morning period saw the lowest, primarily sessions rolling over from the previous night.

While customers did emphasise in the survey that cost to charge was one of the most important factors, this does not seem like it resulted in a shift in charging to the midday period as the data demonstrates. One likely explanation that a larger delta between prices during preferred and non-preferred time periods is required before it is possible to elicit desired customer behaviour – i.e. that the cost of peak charging needs to be even higher to discourage charging during this period. This is supported by:

- The survey, where all six responses indicated that the charging was affordable. While this is a positive for customer satisfaction, it also means that the pricing during peak periods was not high enough to result in an active change in behaviour.
- The operator's feedback that there was no customer feedback regarding the time-of-use pricing, indicating that it was not a major consideration to them.
- It is also possible that although customers are aware of the price difference, electricity price arbitrage is typically not a normal behaviour for regular people who are accustomed to on-demand electricity.

The sessions beginning in the afternoon peak could also potentially be addressed by a functionality that could automatically delay charging into the late evening as long as it is still fully charged by the time it is needed.

The revenue generated by EV charging was low during the trial period and would not directly cover the cost of the EV charging equipment and installation from a commercial perspective, with the revenue being insufficient to cover even the operational costs. While this is due to the current low utilisation rates, which would be expected to grow as the number of EVs on the road increases, even a very substantial growth is unlikely to result in overall direct profitability outside of the most optimistic scenarios. Instead, the primary commercial argument for the chargers is their derived commercial benefit in providing a service to customers with EVs and drawing them to the site. The simulated future case highlights scenarios where the commercial feasibility could be significantly improved with higher utilisation rates from more targeted deployment, procurement cost reductions, and an increase in the price of charging.

Customer feedback regarding the chargers themselves was very positive, indicating that the chargers were easy to operate, pay for, accessible, and affordable. This indicates that the installation of the chargers for the purposes of providing charging access was successful, allowing customers to take their EVs on their holidays with minimal difficulty. Negative feedback was received however due to the one instance of the EV chargers losing connectivity from an Optus outage. Due to the importance of charging to EV operators, it is important to ensure high charging uptime. Some of the operational teething issues raised by the site operator also suggest that charger operations could benefit from additional training and established procedures.

The trial was unable to validate the operation of the DC V2G chargers due to delayed approval of their connection to the grid by SAPN, resulting in them being left out of the trial. However as indicated by the operator, customers have expressed interest, and the site has favourable conditions for V2G implementation.

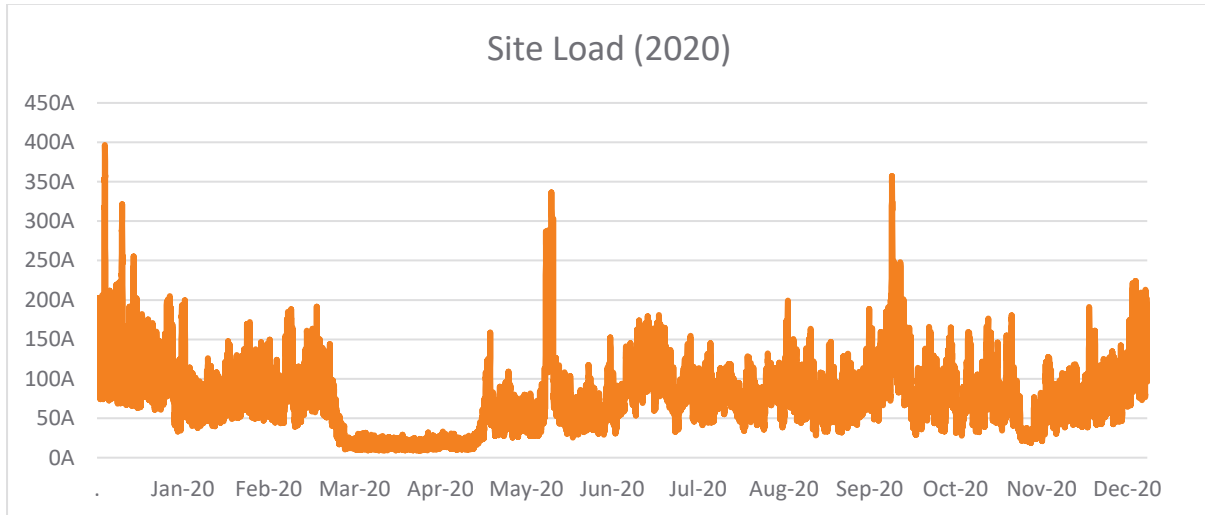
The solar system and overall site demand saw the vast majority of the solar generation consumed by ordinary operation of the site. Due to the low utilisation rates of the EV chargers, the solar did not result in a direct increase in available capacity for the chargers, as the EV chargers were not in use at the only recorded instance during the trial period where the site was near maximum capacity. From evaluation of the interval data over the trial, the solar system did offset a substantial portion of the EV charging usage, around 41%, indicating that there is some alignment between the generation and usage profiles. However, due to the trough in site usage around midday and the larger peak in the afternoon, it is possible that directly increasing the size of the solar system alone without batteries or other strategies to support a larger EV charging system would result in low value solar exports in the middle of the day and an increased peak later in the day.

## 5. References

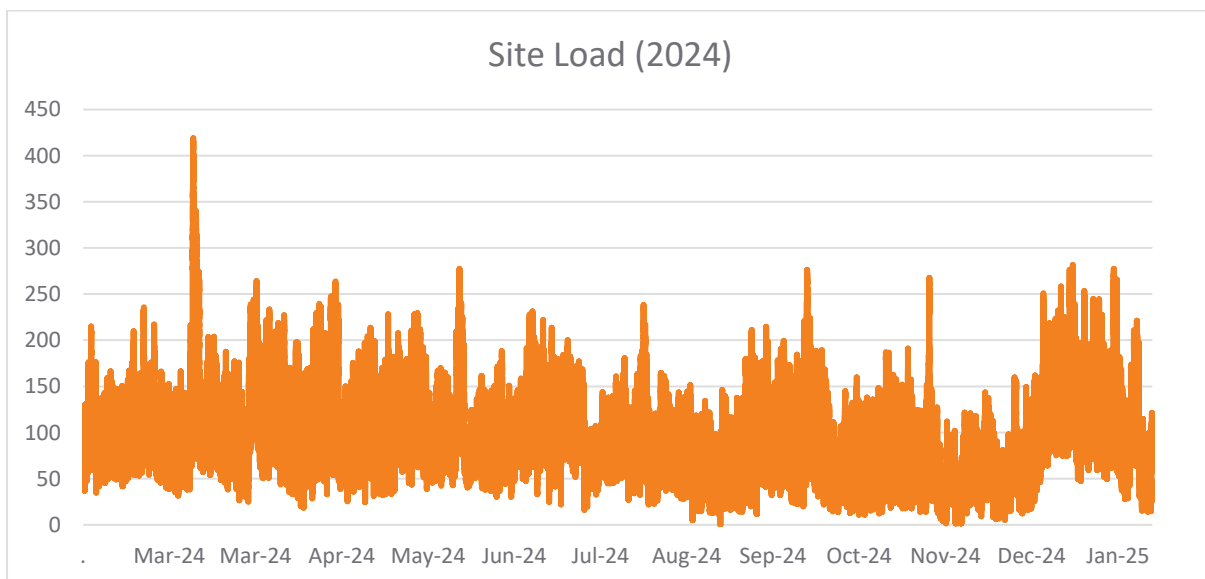
1. Graham, P., Mediwaththe, C. and Green, D. 2025, *Electric vehicle projections 2024*. CSIRO, Australia.

## 6. Appendices

### Appendix I: Site Interval Data

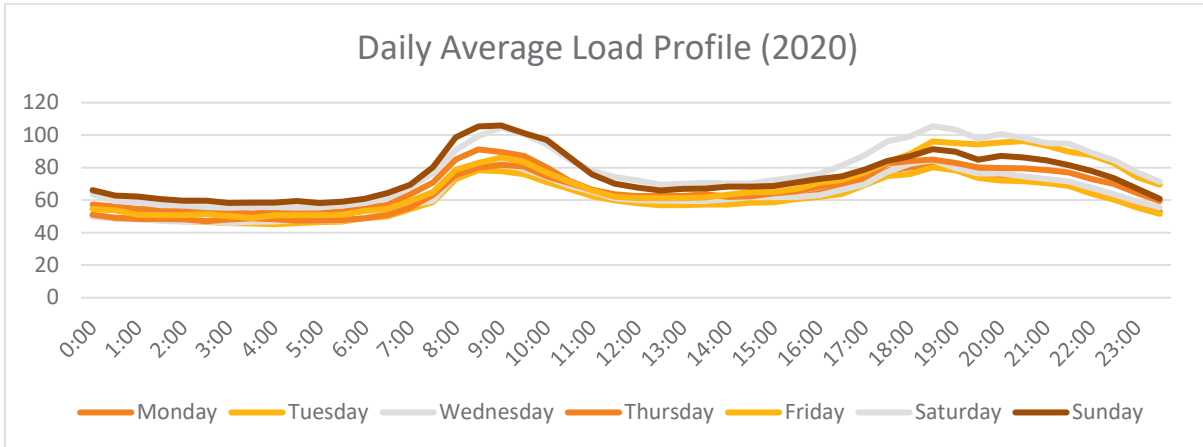


This figure shows the full site load for the entire year of 2020. The data consists of 30-minute intervals. The peak demand in any interval is equal to 396.6A, which took place at 03/01/2020 5:00 PM. The 95% peak demand (the demand is below this value 95% of the time) is equal to 152.4A

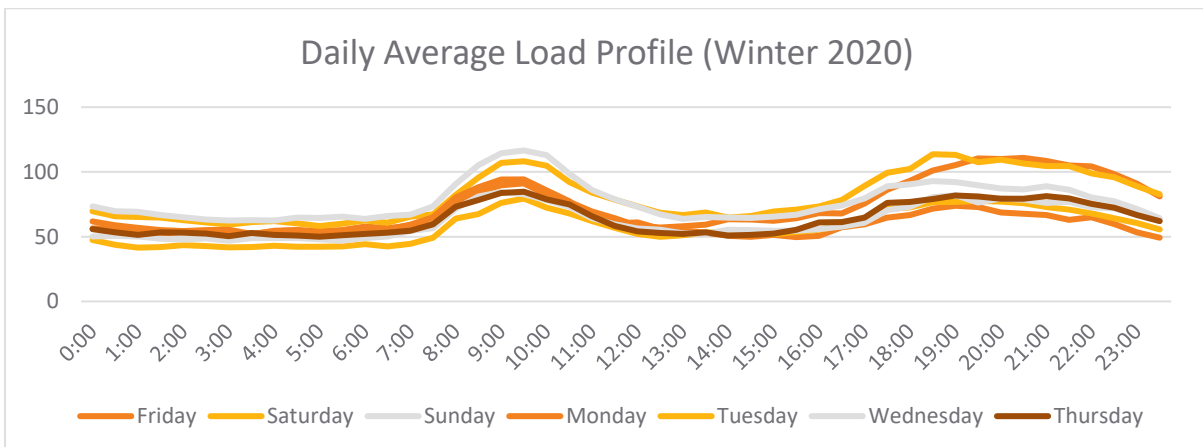
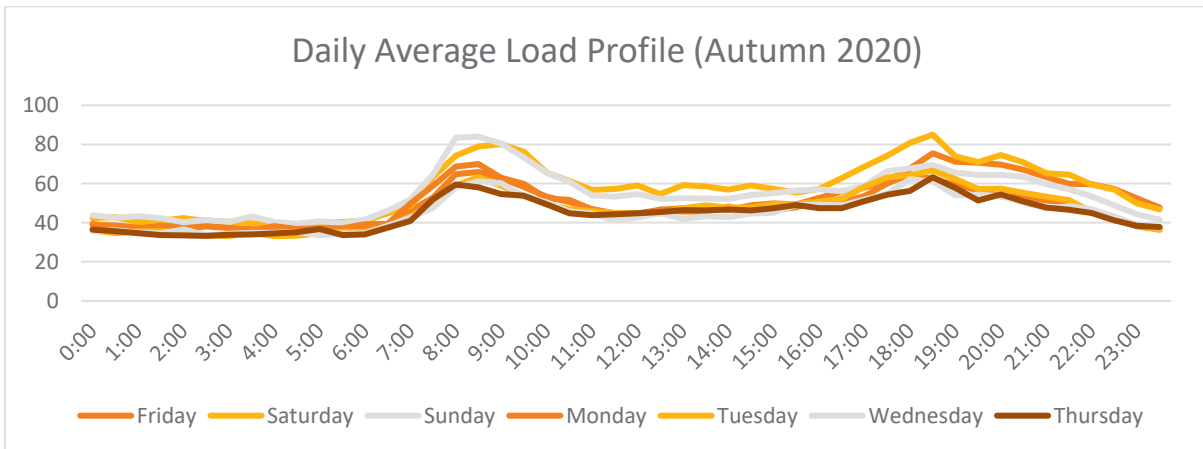


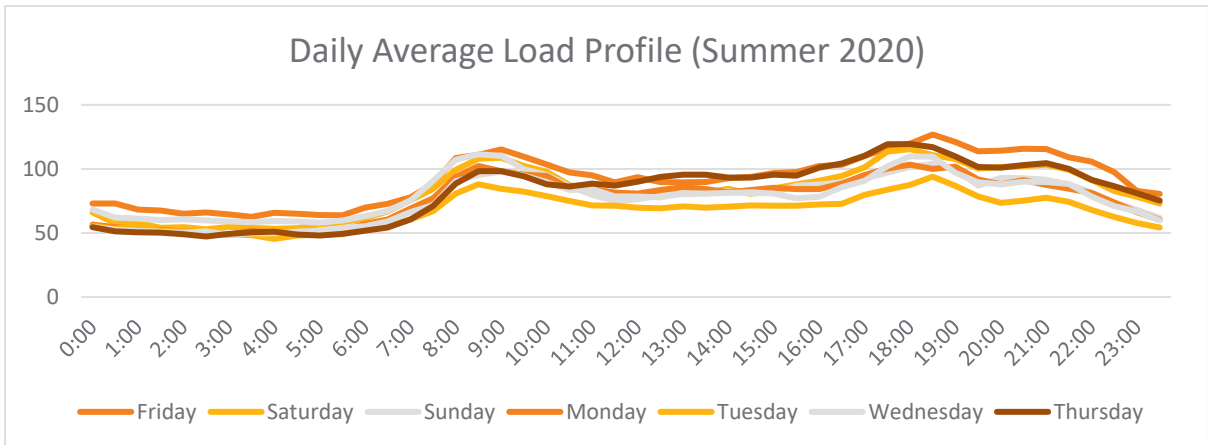
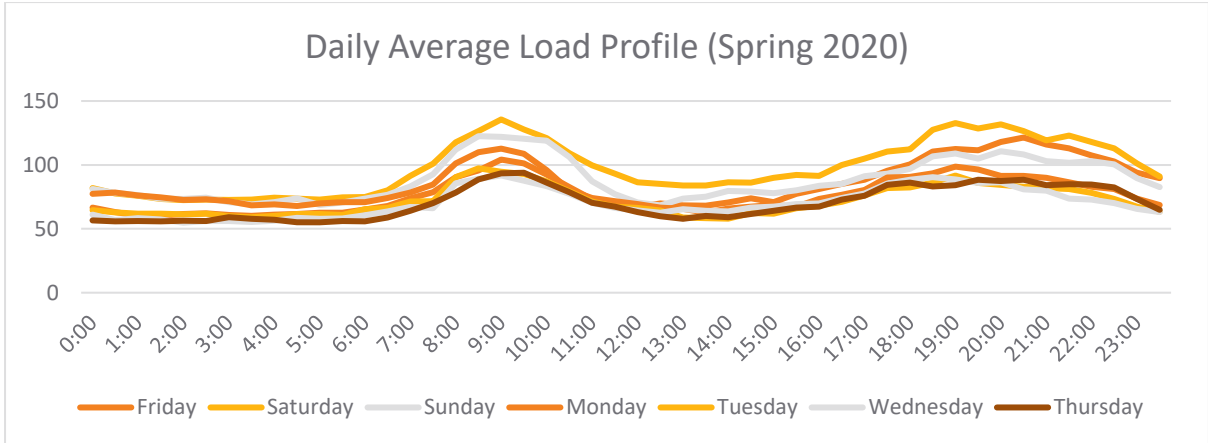
This figure shows the full site load for the entire year of 2024. The data consists of 30-minute intervals. The peak demand in any interval is equal to 418.7A, which took place at 09/03/2024 5:00 PM. The 95% peak demand (the demand is below this value 95% of the time) is equal to 166.3A

## Appendix II: Site Load Profile



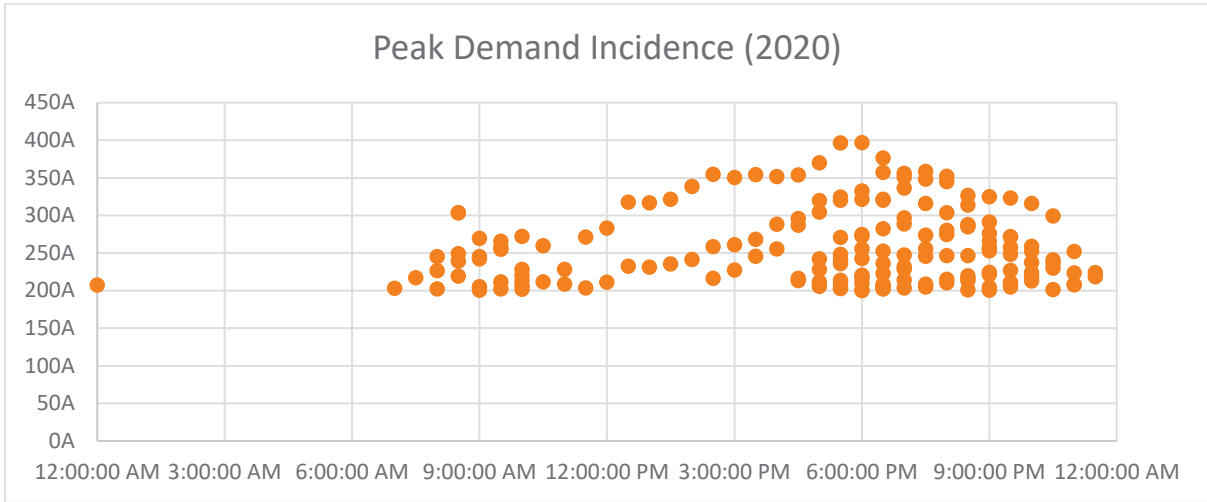
This figure shows the average daily load profile in 2020. It can be seen that there is a fairly strict pattern consisting of two peaks in the morning (8-10AM) and evening (6-9PM) with a consistent baseload outside of these peaks. The site consumption is substantially higher on the weekends and on the single Friday evening peak than it is during the rest of the time.



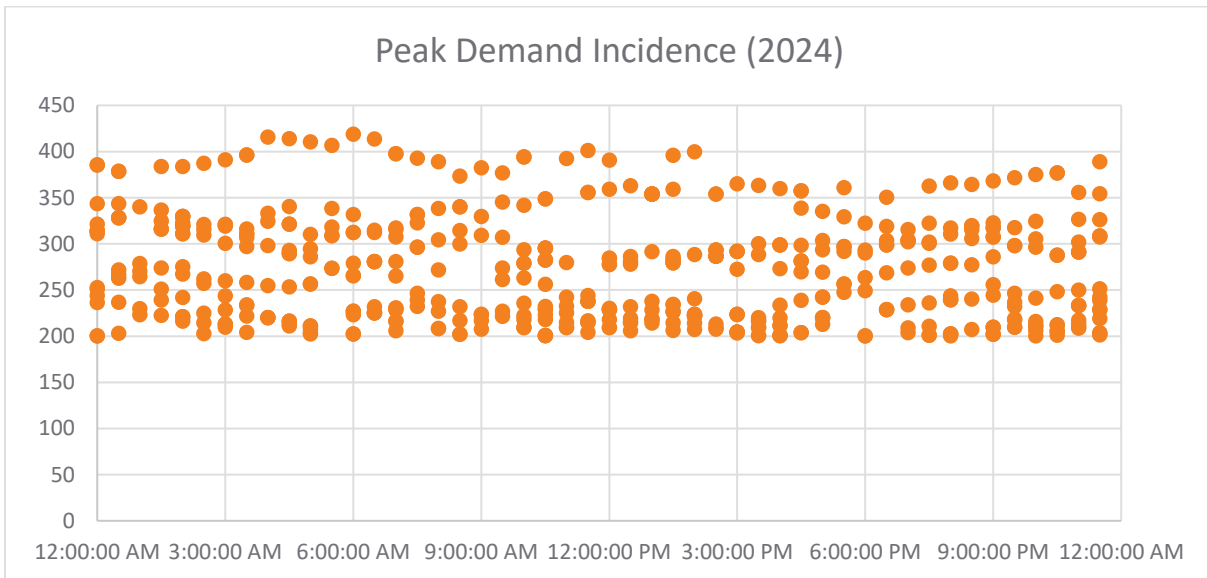


When separated by season, the daily average load profiles remained remarkably consistent. While the peak and baseload values vary across seasons (from 40A baseload in the autumn to 60A baseload in the summer and spring, and from 70A peaks in the autumn to 120A peaks in the summer and spring), the double peak pattern remains obvious in all four seasons. Additionally, weekend load and the Friday evening peak are always noticeable greater than the rest of the week, except during the summer where the days seem to blend together, likely due to the holidays in this period.

## Appendix III: Maximum Demand Incidence



This figure depicts the incidences of all of the 200A or greater intervals, in order to identify when the site’s peak demand occurs. It can be seen that the majority of these and the largest of them, the ones at 350A-400A, take place during the evening peak, while there is also a smaller incidence in the morning peak.



This figure depicts the incidences of all of the 200A or greater intervals, in order to identify when the site’s peak demand occurs. It can be seen that in 2024 these happen throughout the day with some of the larger peaks taking place earlier in the morning.