AGL SA Smart Charging Commercial Fleet Report

November 2025

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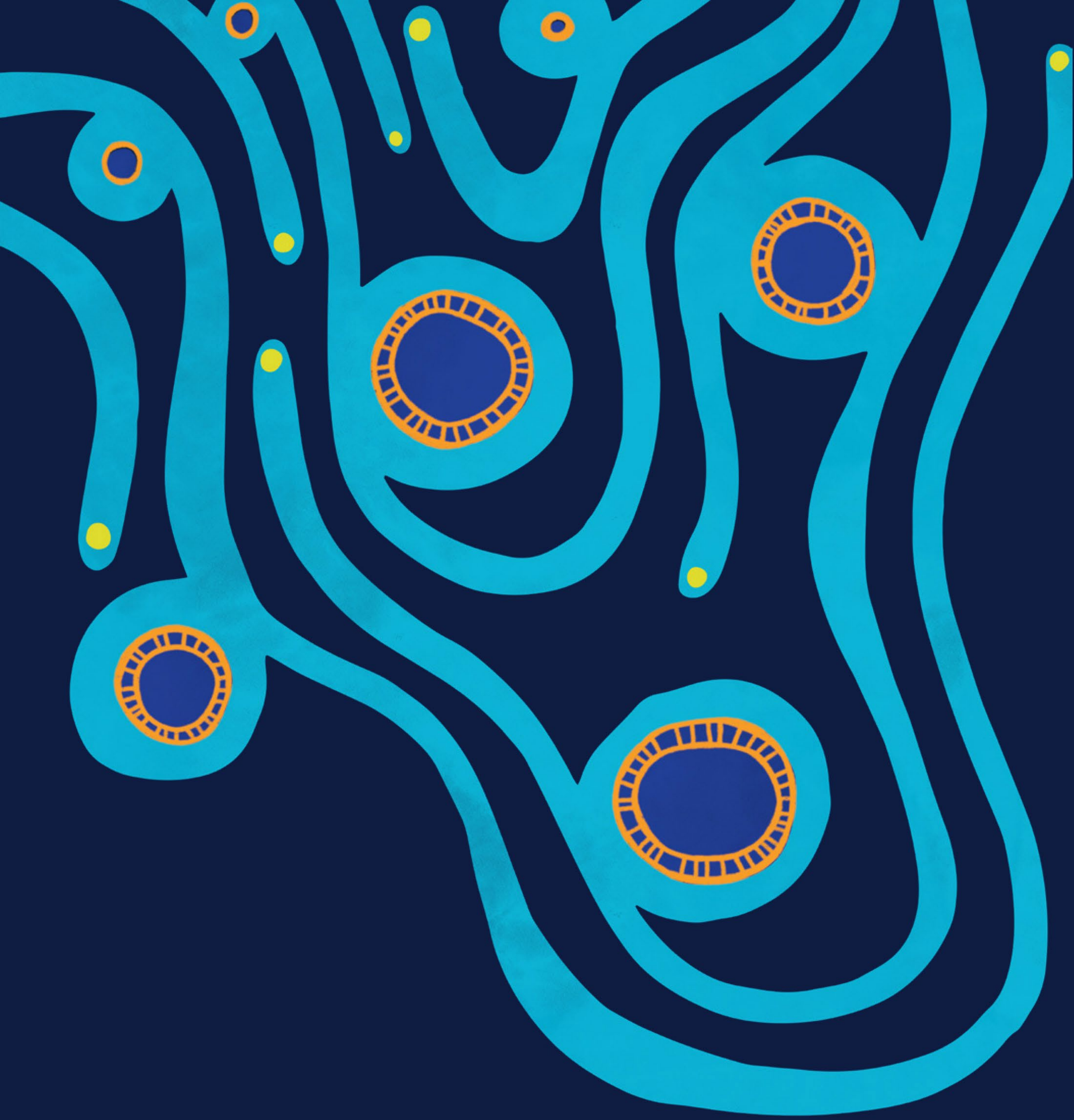

Acknowledgement of Country

AGL recognises the First Nations people as the Traditional Custodians of the lands on which we work, and acknowledges those communities' continuing connections to their lands, waters and cultures. We pay our respects to their Elders, past and present.

Acknowledgement of grant funding

AGL Energy Limited acknowledges the Department for Energy and Mining's contribution to the Smart Charging Trial through a Funding Agreement.

Some images included in this report are for illustrative purposes only.

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Executive Summary

AGL's South Australian Smart Charging Trial, conducted with funding from the SA Department for Energy and Mining, has provided a series of practical insights that will contribute to the successful roll-out of electric vehicle (EV) charging infrastructure in commercial fleet settings.

The trial reflects the importance of industry and government collaboration in developing real-world solutions, based on consumer insights, that will help reduce transportation emissions and achieve government and organisational net-zero goals.

Conducted over a two-year period, from 2022 to 2024, in Adelaide, the trial involved diverse settings in the not-for-profit sector at Uniting Communities and Centacare, as well as in the commercial sector at Wilson Parking. It included the installation of six charging stations to support a fleet of four EVs, with one vehicle charged overnight at an employee's residence.

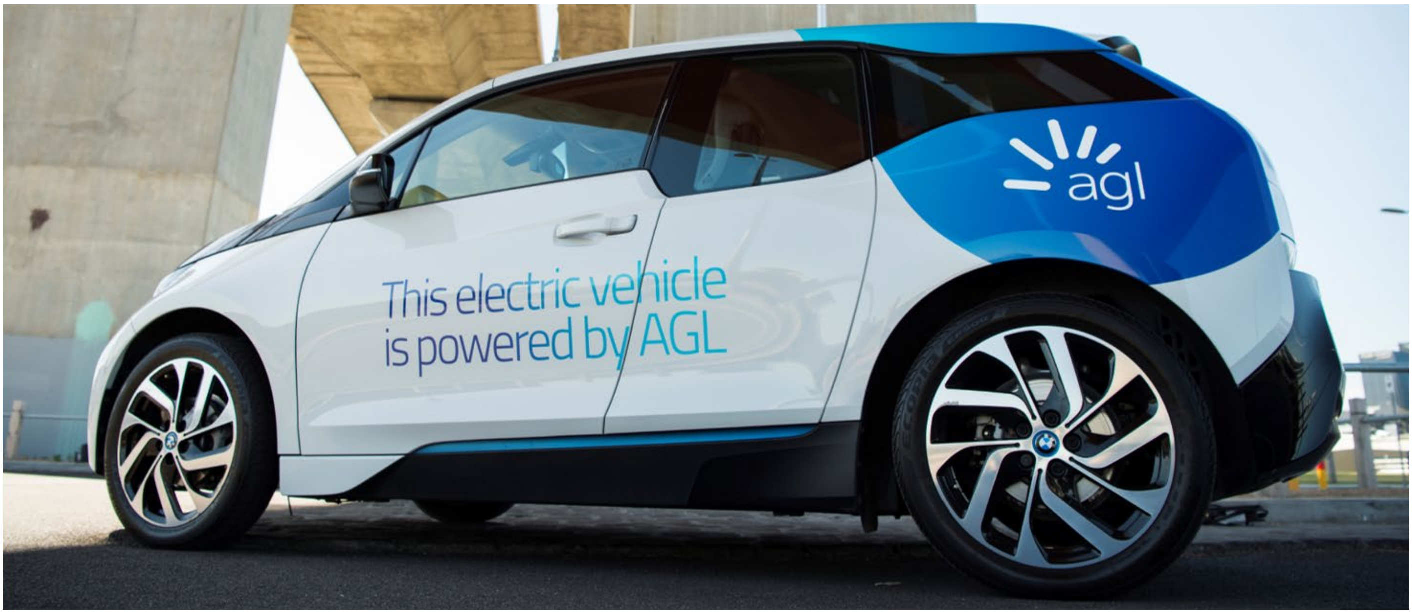
The objectives of the trial were to assess the most effective technical solutions for EV charging infrastructure, explore the impact of real-life behaviours on EV adoption and charging, and evaluate the organisational adjustments necessary for a successful shift to EV use.

Positive Energy Outcomes

The trial demonstrated considerable success in optimising electricity consumption through controlled charging strategies.

- When controlled charging was active, peak period charging decreased by up to 68%.
- "Solar sponge" period utilisation increased by 38% during optimal daylight hours.
- Off-peak charging adoption improved by 100% through controlled charging.

Importantly, these improvements were achieved without disrupting normal vehicle usage patterns, providing evidence that intelligent charging management can significantly enhance electricity efficiency while maintaining operational convenience.



Importance of Infrastructure

While there was significant success in optimising electricity consumption and cost, the trial highlighted a number of insights about EV charging infrastructure.

- Initial setup complexity, particularly switchboard upgrades, highlighted the importance of thorough prior planning.
- Reliable charging management systems and their integration with existing fleet management infrastructure are crucial for smooth operation.
- Standardised charging procedures and controlled charging profiles were key to optimising electricity consumption and managing peak load effectively.

Case Study Findings

Two participating organisations demonstrated different levels of success in EV integration, providing valuable insights into the factors that influence commercial EV adoption.

Uniting Communities emerged as a particularly successful case study, achieving over 88% EV utilisation. This success was attributed to:

- Prioritisation of EVs in their fleet booking system.
- Comprehensive employee training programs.
- Clear communication through multiple channels (intranet, fact sheets, personal walkthroughs).
- Strong alignment with organisational sustainability goals.

Centacare's experience, while showing lower utilisation rates of around 50%, provided important lessons about the challenges of EV adoption, particularly range anxiety and the need for robust support systems for new technology adoption.

Financial and Policy Learnings

Financial and policy considerations also emerged as significant factors in the successful adoption of EVs in organisational settings.

While high upfront infrastructure costs remain a barrier (ranging from $5,000 to $15,000 per charging station), the trial demonstrated that operating costs can be optimised through controlled charging strategies.

Government incentives, particularly FBT benefits, were crucial for encouraging employee adoption, highlighting the need for clear cost-benefit analysis frameworks and consistent policy support.

1. Introduction

The AGL SA Smart Charging Trial was initiated in December 2021 as part of the EV Smart Charging Trials that was funded by the SA Department of Energy and Mining. This project represented a collaborative effort, with AGL receiving funding support from the Department to implement and evaluate smart charging technologies and methodologies.

This report focuses specifically on the outcomes and learnings from the Commercial Fleet Charging Solutions and residential charging. Through detailed analysis of these streams, we can provide valuable insights into the practical challenges and opportunities associated with adopting EVs in commercial settings, while highlighting potential solutions for organisations considering similar transitions.

The findings from this trial will serve as a blueprint for organisations looking to transition their fleets to EVs, offering practical insights into infrastructure requirements, operational considerations, and change management strategies. Additionally, the data collected will inform future policy decisions and infrastructure planning at both organisational and governmental levels.

The objective of this trial was to:

1. Pilot a fleet transformation approach through business model innovation that will drive the adoption of EVs to support electrification and decarbonisation of South Australian commercial fleets by 2030.

2. Trial smart charging infrastructure in a commercial car park, business car parks and employee residences that introduces dynamic pricing and event signals; and

3. Demonstrate productisation of the EV car parking and commercial fleet offer to increase familiarity with smart charging infrastructure for commercial operators of car park infrastructure and corporate parking customers.

Using various supporting systems trial data was collected to understand the charging behaviour of commercial fleet drivers. Equipped with the insights, charger controls were then introduced based on dynamic factors including price and event signals designed to alter user charging behaviour.

The Trial is made up of two streams:

1. Off-Street Carpark: The installation of 18 smart EV chargers within Wilson Parking facilities throughout Adelaide's CBD provides convenient off-street charging options for the public. This component aims to address the critical need for accessible charging infrastructure in urban areas.

2. Commercial Fleet Charging Solutions: This stream encompasses the installation of six smart EV chargers at two commercial fleet businesses - Centacare and Uniting Communities. These organisations received EVs through a comprehensive EV lease model, enabling them to directly experience the benefits and challenges of EV fleet integration. This stream also incorporated residential fleet charging support, which included installation of a smart charger at an employee's residence, facilitating convenient at-home charging as part of the all-inclusive EV lease program. This integrated component explores the viability of supporting fleet vehicles through both commercial and residential charging infrastructure.

The trial incorporated controlled charging and simulated event signals to understand and influence charging behaviours. By collecting and analysing data from the installed EV chargers, the trial derived insights on commercial fleet drivers' charging patterns. This understanding is crucial for developing new, commercially viable solutions that will encourage broader adoption of EVs and smart charging practices.

Trial timeline

December 2021
DEM Grant Approval

February 2022
Quote on Installation of chargers at Uniting Communities and Centacare

August 2022
Installation of 2 chargers at Uniting Communities and 2 at Centacare completed

September 2022
City of Marion withdrawal from Trial

October 2022
Supply of 2 EV's to Uniting Communities

March 2023
EV rotation at Uniting Communities

April 2023
Installation of 2 chargers at Centacare Wakefield Street completed. Second EV charger site identified for Centacare

June 2023
Supply of 2 EV's to Centacare. Staff Change AGL Project Manager

July 2023
Installation of 2 chargers at Centacare Grange Road, Seaton completed

May 2024
Migration of chargers to Exploren Charger Management Platform. Commencement of Controlled charging

Baseline data collection period (October 2022 – May 2024)

July 2024
Trail completion at Centacare. EV rotation at Uniting Communities

August 2024
Installation of EV charger completed, and EV delivered to Uniting Communities employee

December 2024
Completion of Trial at Uniting Communities

2. Trial Participants

2.1. Uniting Communities

Uniting Communities joined the South Australian Government's EV Smart Charging Trials as a major participant. Through AGL's all-inclusive EV Subscription program, Uniting Communities (UC) incorporated two EVs into their fleet, with subscription rates matched to equivalent ICE vehicle operating costs to ensure cost neutrality.

The EVs were stationed at U City, UC's innovative vertical village in Adelaide CBD. This location was strategically chosen due to its strong environmental credentials including a 6 Star Green Star design and built rating that aligns with the organisation's commitment to minimising carbon footprint (First Whole Carbon Neutral Building in SA).

Key aspects of UC's participation:

- Fleet Composition: With a fleet size of 145, the two trial EVs represented 1.4% of UC's total fleet, complementing their existing vehicle mix of 78% hybrid and 21% ICE vehicles.
- Location: EVs were based at U City (43 Franklin Street), providing convenient access for employees conducting daily visits.
- Infrastructure: Two EV chargers were installed to support the trial vehicles.
- Environmental Alignment: The trial supported UC's broader sustainability initiatives (SA's first carbon neutral organisation with a Net Zero target by 2035) and their established green building practices.

2.2. Centacare

Centacare participated in the trial as part of their broader initiative to reduce carbon emissions across their operations. Through AGL's all-inclusive EV Subscription program, they integrated two EVs into their fleet, with subscription rates matched to equivalent ICE Internal Combustion Engine vehicle costs.

Key aspects of Centacare's participation:

- Fleet Composition: Centacare operated a fleet of 189 vehicles, primarily comprising 76% internal combustion engine vehicles (70% petrol, 6% diesel) and 23% hybrids. The two electric vehicles in the trial made up roughly 1% of their overall fleet.
- Infrastructure: Four commercial Smart Chargers were installed across two strategic locations:
  - Primary Location: 45 Wakefield Street (Adelaide CBD) - Main base for EV operations
  - Secondary Location: 415 Grange Road - Serving as a destination charging point
- Vehicle Base: The EVs were primarily garaged at 45 Wakefield Street, providing a central location for employee access and charging

2.3. City of Marion

The City of Marion initially committed to participating in the trial but ultimately withdrew before implementation. Their withdrawal stemmed from internal discussions regarding:

- Total participation costs
- Additional infrastructure requirements that emerged during planning
- Internal policy considerations regarding fleet management.

While AGL attempted to address the City of Marion's concerns through additional clarification and support, the organisation made the final decision to formally withdraw from the trial. Their planned participation would have expanded the trial's scope into local government fleet operations, which could have provided valuable insights into municipal EV adoption challenges and opportunities.

This withdrawal led to a reallocation of resources, with the chargers originally intended for City of Marion being redirected to support Centacare's operations at their 415 Grange Road location, where they served as destination chargers.

2.4. Wilson Parking

Wilson Parking, South Australia's largest private car parking operator, participated in the trial to support the acceleration of EV adoption and implementation of controlled charging solutions in South Australia.

Key aspects of Wilson Parking's participation:

- Vehicle Allocation: Two EVs were provided through the trial:
  - One EV was assigned to an employee for regular use.
  - Another one was branded with Wilson Parking and used as a marketing vehicle to showcase their commitment to sustainable transport.
- Infrastructure Integration: The trial aligned with Wilson Parking's broader strategy to expand EV charging capabilities across their parking facilities.
- Strategic Value: As a major parking infrastructure provider, Wilson Parking's participation helped demonstrate the feasibility of integrating EV charging into existing parking facilities.

3. Trial Setup

3.1. Controlled Charging

Controlled charging is a strategic approach to EV charging that optimises when and how EVs charge by adjusting charging schedules or power levels. This method benefits both customers and the electrical grid by avoiding peak demand periods and reducing grid strain. For this trial we have implemented controlled charging strategies based on SA Power Networks' different Time of Use periods listed below:

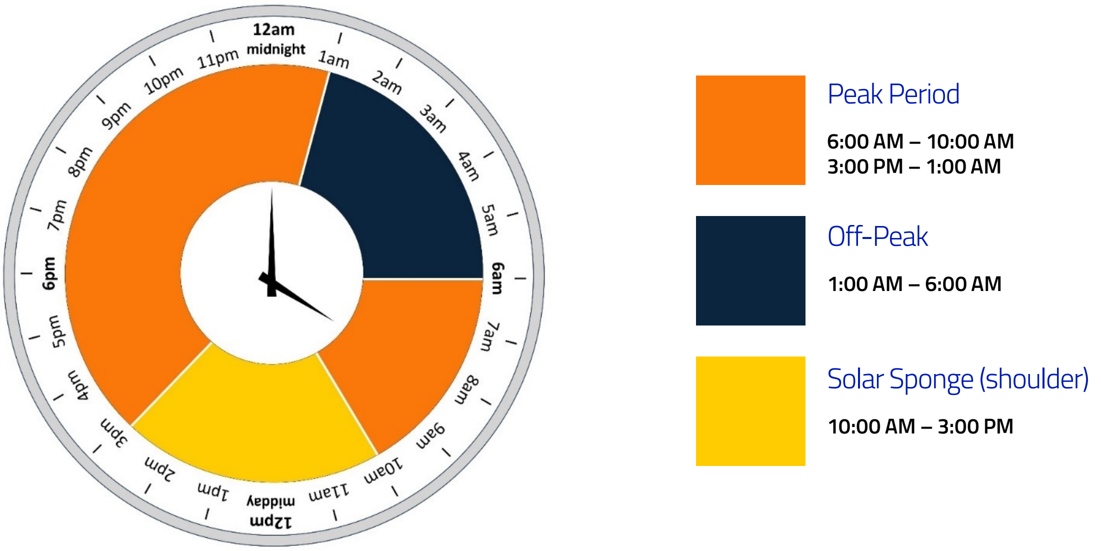


Figure 3.1: Tariffs applicable at different times of the day. [Source: SA Power Networks' different Time of Use periods.]
(Note: SAPN Solar Sponge changed from 9:30 AM – 4:30 PM as of 1 July 2025)

Peak Period

6:00 AM – 10:00 AM and 3:00 PM – 1:00 AM

These are traditionally the times of highest demand and when electricity costs the most.

Off-Peak

1:00 AM – 6:00 AM

Pricing applied for a five-hour off-peak block every day, usually overnight.

Solar Sponge

10:00 AM – 3:00 PM

Also sometimes known as 'shoulder': This is usually the cheapest time to use electricity - in the middle of the day when solar generation is typically at its highest.

Charging costs and potential savings outlined in the report as based on the AGL Time of Use Tariff Standing Offer price SA Power Networks distribution as of April 2025.

Peak Period	Off-Peak	Solar Sponge (Shoulder)
52.151 c/kWh	36.333 c/kWh	31.350 c/kWh

3.2. Smart Charging

At its most sophisticated, Smart Charging employs communication systems to continuously adjust EV charging based on live grid conditions. The platform actively modifies charging outputs and timing by analysing various factors, including vehicle performance needs, electricity cost, and electricity market pricing. This methodology can improve utilisation of renewable electricity.

By favouring cleaner electricity sources (Solar/Wind/Hydro) during charging sessions, Smart Charging can substantially minimise indirect carbon footprint impacts. This technology allows EVs to draw power when renewable electricity is plentiful and demand is minimal, supporting lower emissions and economically efficient charging. However, Smart Charging was not implemented in this Commercial Trial due to significant technological hurdles. These challenges included integrating with Electric Vehicle Supply Equipment (EVSE), incorporating real-time electricity market pricing, and accurately determining the specific electricity sources (Solar/Wind/Hydro/Coal/Gas) feeding the electrical grid at any given moment. These technical barriers highlight the sophisticated infrastructure requirements necessary to realise the full potential benefits of Smart Charging systems.

3.3. Site Selection

The success of the trial depended heavily on the careful selection of charging locations, with a focus on placing EV chargers to effectively support daily vehicle operations and ensure user accessibility. The following sites were chosen:

Uniting Communities:

Location: 43 Franklin Street, Adelaide CBD.

Rationale: This location served as a central base for employees using EVs for their daily visits and offered a convenient point for vehicle return and charging.

Infrastructure: Two smart EV chargers were installed to support the two trial vehicles.

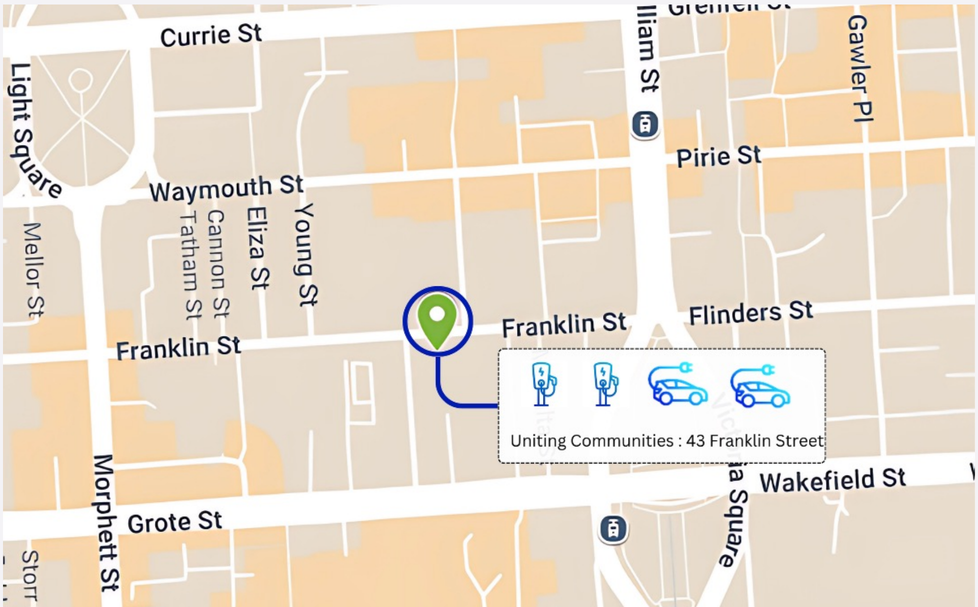


Figure: 3.3 (a): Location at 43 Franklin Street, Adelaide CBD, where two EV chargers were installed.

Centacare:

Primary Location: 45 Wakefield Street, Adelaide CBD. This was selected as the main operational base and was equipped with two smart EV chargers. It functioned as the primary location for employee vehicle pickup and return.

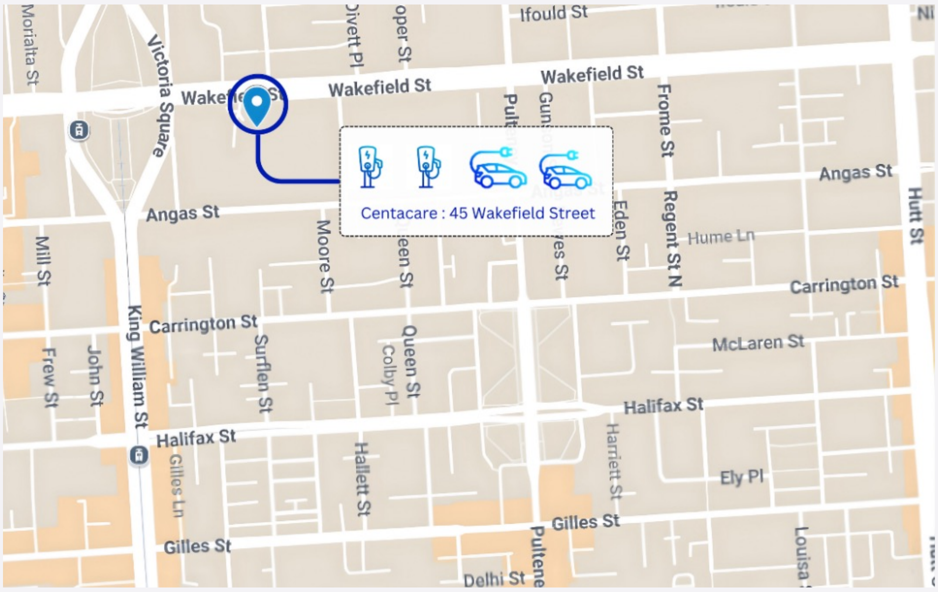


Figure: 3.3 (b): Location at 45 Wakefield Street, Adelaide CBD, where two EV chargers were installed.

Secondary Location: 415 Grange Road, Seaton. Repurposed from the City of Marion allocation, this site was equipped with two smart EV chargers and used as a destination charging point for extended trips.

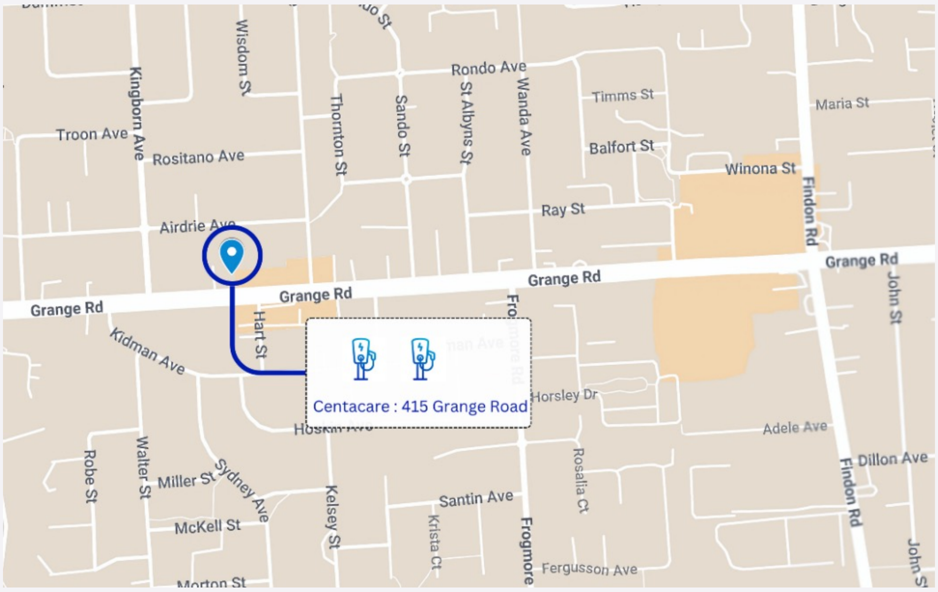


Figure: 3.3 (c): Location at 415 Grange Road, Seaton, where two EV chargers were installed.

3.4. Selection of EV Chargers

The trial required careful selection of charging hardware that would meet both technical requirements and user needs.

After comprehensive evaluation, the Ocular IQ Commercial 22kW charger was chosen for all commercial locations, as it met our key requirements listed below.

1

Technical Specifications

- Level 2 charging capability^
- Charging speed: 2.9-22 kW (adding up to 51 km/hr range)
- 22kW capacity charging cable
- Full OCPP 1.66J compatibility

2

Safety and Protection

- Overload protection
- Fault protection
- Commercial grade construction
- Outdoor rating

3

Connectivity Features

- RFID authentication
- Ethernet connectivity
- Wi-Fi capability
- Programmable charging schedules

4

Installation and Compatibility

- Flexible mounting options (wall or post)
- Universal compatibility with EV models
- Type 1, Type 2 connector or Type 2 socket options
- Support for both single-phase (7kW) and three-phase (22kW) power

^ Difference between different Levels of EV charging listed here.

Selecting the right charging equipment is a critical long-term investment. Getting it right the first time avoids costly replacements and operational disruptions.

3.5. Charging Management Platform Requirements

The selection of a suitable charging management platform was critical to the trial's success. This platform acted as the central control and monitoring system for the entire charging network. Our evaluation focused on identifying a platform that offered comprehensive control, reliable monitoring, and scalable operations.

The core functionality requirements included:

a) **Monitoring and Remote Management**

The platform needed to provide real-time visibility of charging operations across all sites, including live status monitoring, fault detection, and remote troubleshooting. This functionality proved essential during the trial, enabling the rapid identification and resolution of charging issues without requiring on-site visits, thereby significantly reducing operational costs and downtime.

b) **Load Management and Electricity Distribution**

A sophisticated load management system was crucial for optimising power distribution across multiple charging points. The platform was required to intelligently balance charging loads while respecting site power limitations. This capability facilitated efficient power utilisation, avoiding the need for expensive electrical infrastructure upgrades.

c) **Authentication and Payment Systems**

The platform needed to support multiple authentication methods and provide flexible access control. Although the trial primarily used RFID authentication, the system's ability to accommodate various payment and authentication methods ensured future scalability.

d) **Data Analytics and Reporting**

Comprehensive data collection and analysis capabilities were necessary to:

- Track charging patterns and usage metrics
- Generate detailed reports on electricity consumption
- Monitor charger utilisation rates
- Provide API functionality for charging profile management (using OCPP 1.6)

Implementation Experience:

- **During the trial, a transition to the Exploren platform occurred due to market changes. This transition highlighted the importance of vendor stability, data migration capabilities, API functionality, and platform reliability when selecting a charging management platform.**
- **The successful integration of suitable hardware, an intelligent platform, and a forward-thinking strategy is fundamental for effective EV charging operations.**

3.6. EV Lease

Vehicle Distribution and Management

- Total Vehicles: 5 EVs were provided through AGL's all-inclusive EV Subscription services
- Service Inclusion: Complete on-road service package covering registration, maintenance, insurance, and roadside assistance
- Vehicle Rotation Strategy: EVs were periodically swapped between organisations to maximise exposure to different models

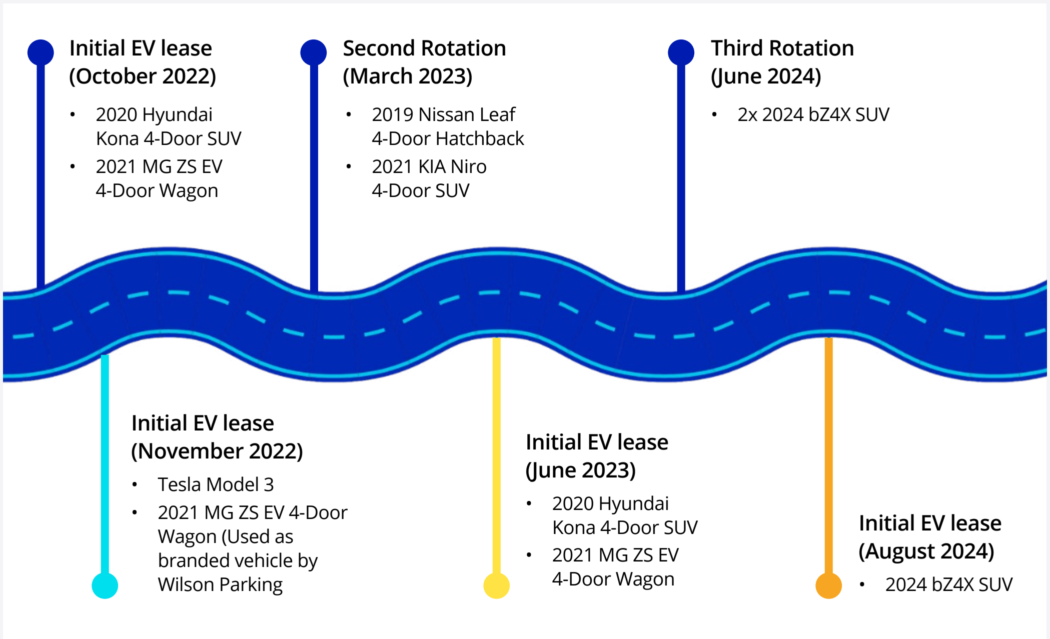


Figure 3.6: Times of EV lease and rotation of EV's.

Residential Program Addition (August 2024):

- One bZ4x assigned to employee with home charging installation
- The Ocular IQ Solar EV charger installation at employee residences leveraged existing photovoltaic (PV) systems, creating a seamless integration between home solar power generation and electric vehicle charging capabilities. Unlike standard commercial EV chargers, the Ocular IQ model features:
  - Solar optimisation technology that prioritises charging during peak solar production hours
  - Dynamic power management that balances household electricity needs with EV charging requirements
  - Intelligent load balancing to maximise utilisation of self-generated solar energy before drawing from the grid
  - Real-time monitoring and scheduling via smartphone application to align charging with solar production forecasts

3.7. EV Charging Power and Battery Capacity

The charging performance of EVs is determined by two critical factors: the vehicle's onboard charger capacity and the available AC power supply, with either one potentially becoming the limiting factor in the overall charging process.

At the commencement of the trial, EVs with 6.6-7.2 kW onboard chargers were the standard offering. As the trial progressed, newer models from various manufacturers, such as the Toyota bZ4X with 11 kW AC charging capability, were introduced to the fleet. In anticipation of this technological advancement, the charging infrastructure installed was designed to deliver up to 22 kW of power. This forward-thinking approach resulted in a significant 35% reduction in charging duration for compatible vehicles, demonstrating the importance of strategically matched charging infrastructure to vehicle capabilities.

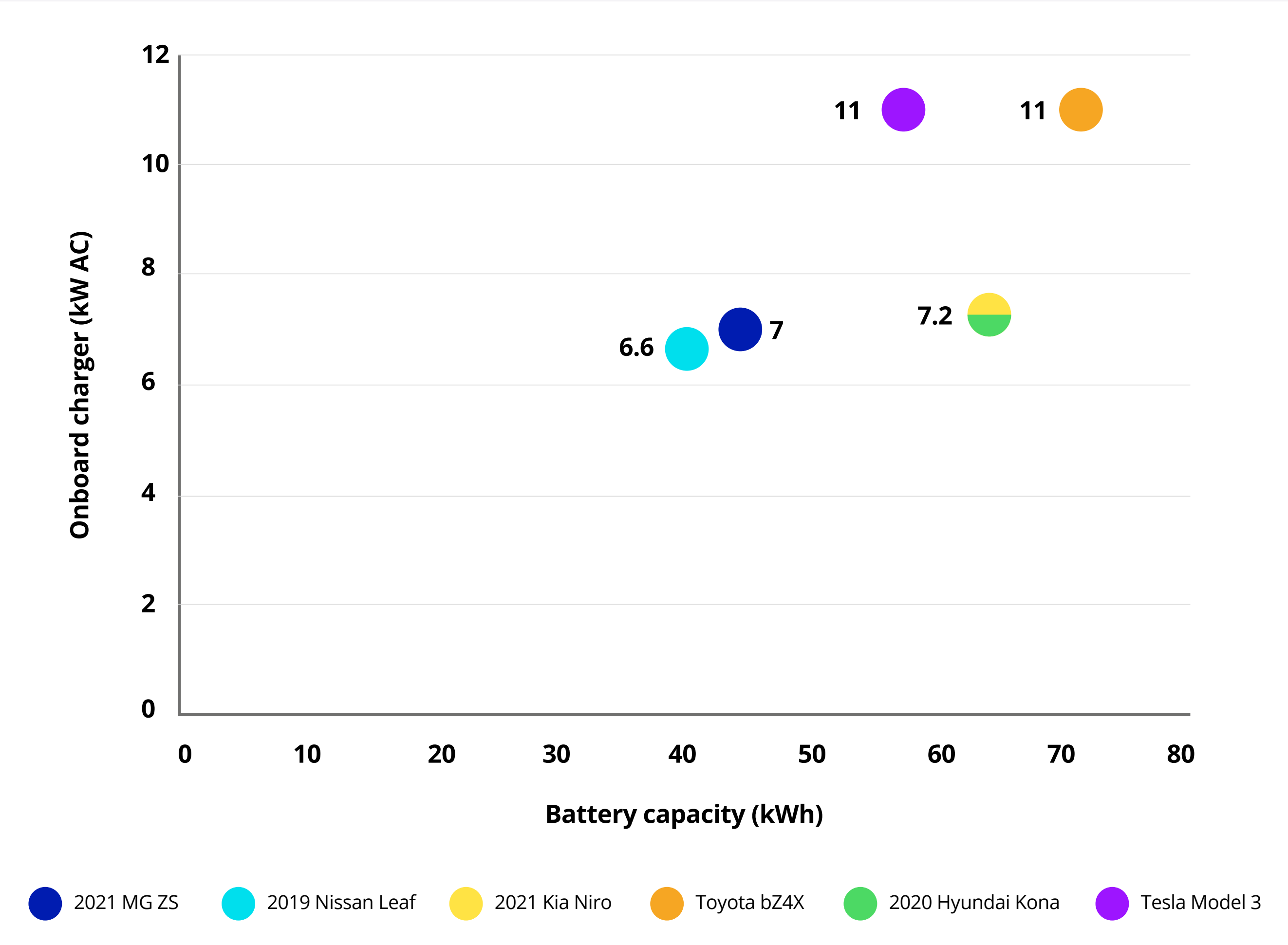


Figure 3.7: Comparison of onboard charger capacities (kW AC) and battery capacities (kWh) for EVs deployed by Uniting Communities, Centacare, and Wilson Parking in this trial.

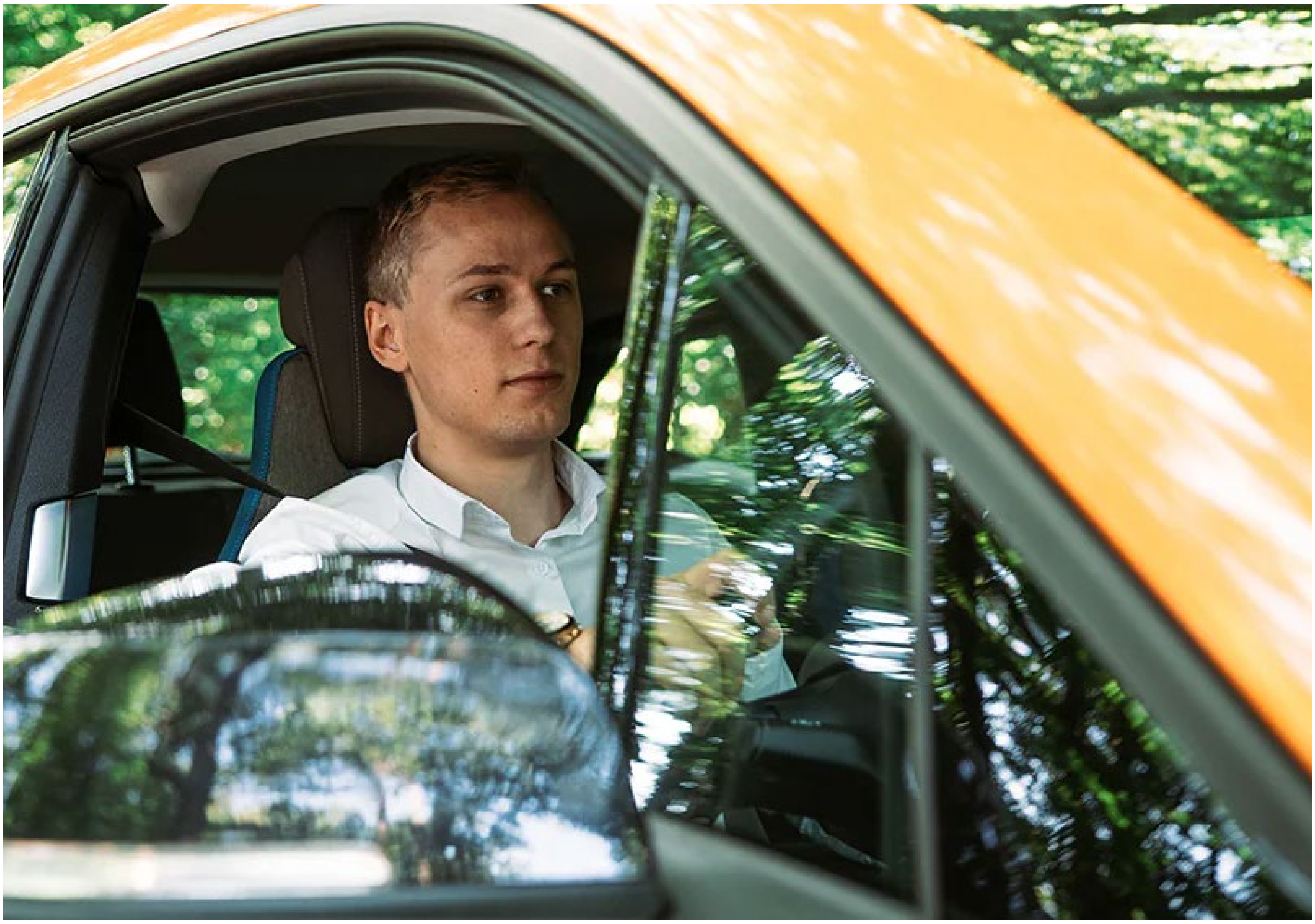
3.8. Employee Access to EV Chargers

Each participating organisation received two RFID cards to manage charging access. Uniting Communities and Centacare fleet managers distributed RFID cards based on EV bookings. At Wilson Parking, one card was assigned to an employee, and the other was shared among the team.

The charging process underwent few changes during the trial. Initially, employees had to follow a detailed sequence to begin charging ensuring all vehicle doors were fully closed, connecting the charging cable, and tapping the RFID card to authenticate and start the process.

Employee interviews revealed that this manual process frequently led to charging failures. A common issue was employees assuming vehicle doors were closed, which would prevent charging even after connecting the cable and tapping the RFID card. This necessitated verifying and properly closing all doors, disconnecting and reconnecting the cable, and re-authenticating with the RFID card.

The implementation of controlled charging simplified this process. Employees were then only required to ensure doors were properly closed, connect the charging cable, and authenticate with the RFID card. Charging profiles programmed on chargers ensured that EV were getting charged. Active monitoring provided by Exploren (CPMS) helped in monitoring of chargers and notifying Fleet Managers if the EV’s weren’t getting charged.



3.9. Vehicle Telematics Implementation

Telematics devices were initially deployed in the EVs which were provided to Uniting Communities and Centacare to capture essential operational data, particularly trip distances and vehicle usage patterns. This implementation was aimed to capture accurate data collection for comprehensive fleet analysis.

Implementation Challenges

The telematics system faced several significant technical and operational challenges:

Hardware Issues

One EV experienced 12V battery drainage due to the continuous power draw from the telematics device. This led to the removal of the device from that vehicle to prevent potential vehicle reliability issues. Similar concerns prompted a review of telematics deployment across the fleet.

Data Access and Provider Dependencies

Reliance on a third-party provider to capture telematics data created data accessibility limitations. The situation was further complicated when the telematics provider ceased operations in mid-2024. This disruption highlighted the vulnerabilities of depending on external data service providers.

Adaptation and Alternative Solutions

Following these challenges, the trial adapted data collection approach:

- Uniting Communities implemented a manual tracking system.
- Fleet managers developed a standardised process for trip logging.
- Employees recorded odometer readings at the conclusion of each journey.
- This manual system, while more labour-intensive, proved alternative to distance tracking.

Key Learning:

The telematics experience demonstrated the importance of:

- **Evaluating the impact of auxiliary systems on vehicle performance**
- **Maintaining alternate data collection methods**
- **Considering vendor stability in technology partnerships**

3.10. Costs Associated to Installation of EV Chargers

The implementation of EV charging infrastructure involved a range of upfront capital expenditures (CAPEX) and ongoing operational expenses (OPEX). Initial investments varied significantly based on site requirements, installation complexity, and equipment selection. Our analysis across trial locations revealed that total CAPEX ranged from $5,000 to $15,000 per charging station, while OPEX typically accounts for 10-15% of total costs annually. The breakdown of these expenses in figure 3.10 (a), shows that EV charging infrastructure costs varied across sites.

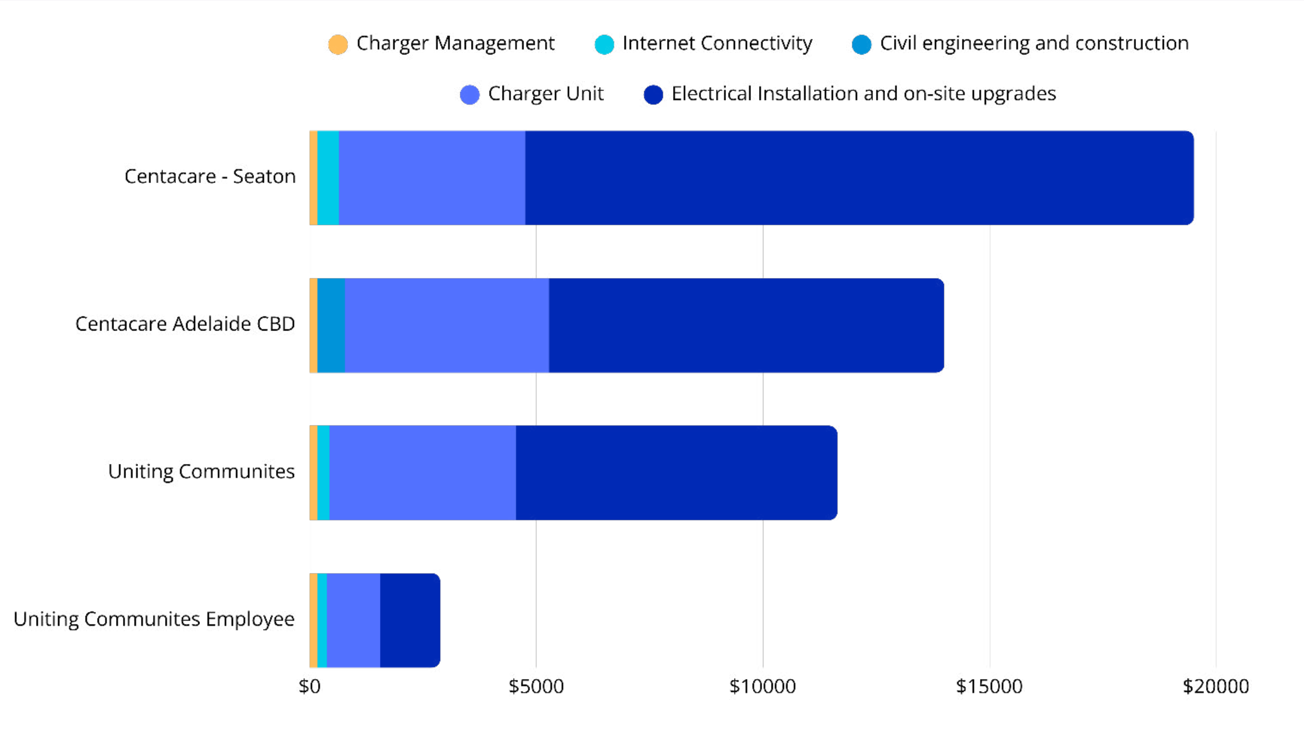


Figure 3.10 (a): EV charging infrastructure cost breakdown by installation location.

Civil Engineering and Construction:

- Prior to the installation of EV chargers at the Centacare Adelaide CBD location, it was necessary to perform civil construction work (i.e. trenching and boring). These works accounted for approximately 4% of the total project cost.
- The remaining three sites did not require any civil engineering or construction activities.

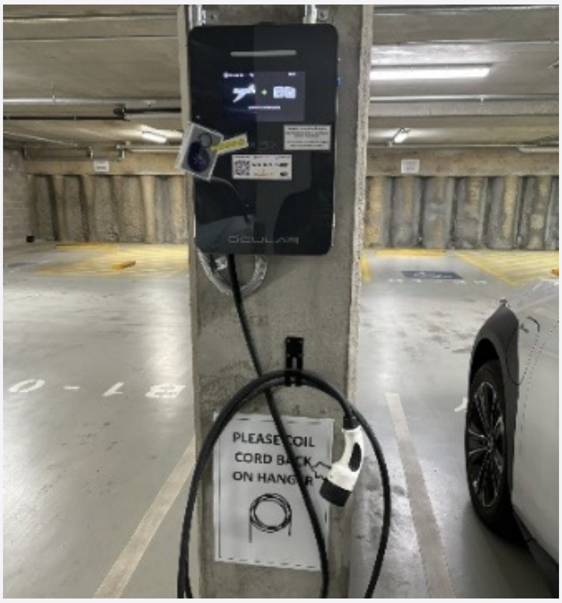
Electrical Installation and On-Site Upgrades:

- Electrical installation and onsite upgrades, such as panels, circuit breakers, new cables and wiring, and electrician labour, comprised between 60 - 75 % of the upfront costs for commercial AC chargers and 40 - 45 % for home AC chargers.
- At the Centacare Seaton location, these costs were 15% higher due to the charger location being distant from the switchboard, necessitating the installation of additional 3phase cables.

Charger Units:

- The Ocular IQ Commercial charger units were used across all three locations: Centacare Adelaide CBD, Seaton, and Uniting Communities Adelaide CBD. These units provided a dedicated 230V circuit with AC energy.
- Charger units accounted for 20 - 35 % of the total cost in commercial spaces. For residential installations, the Ocular IQ Solar was installed, factoring in the existing PV system for one employee, which accounted for 41 % of the total cost. When compared to the price of 22kW commercial chargers in 2022 to the time of this report's publication, costs have increased by 30%.
- As of April 2025, EV charging equipment costs have appreciated 10-15% relative to 2022 installation prices.

Charger 1 installed at Uniting Communities



Charger 2 installed at Uniting Communities

Key Learning:

- **Strategic placement of charges within facilities significantly reduces implementation costs.**
- **Legacy electrical systems drive higher expenses due to necessary infrastructure upgrades.**
- **Older wiring and outdated switchboards require costly modernisation to support charging equipment.**
- **Site assessment should prioritise locations minimising electrical modifications while maintaining accessibility.**

Images 3.10 (b): Showing the images of installed chargers at Centacare locations Wakefield Street & Grange Road

Charger Management:

To leverage the Smart Charging functionality, a charger management solution from Plugsurfing and Exploren were utilised during the trial period. Charger management costs were approximately 1% of the total cost for commercial installations and 7% for residential installations.

Internet Connectivity:

Internet connectivity was essential for data collection from the EV chargers and communication for smart charging features. The installation of an Internet Switch and 4G modem was required, accounting for 4 –7% percent of the overall cost.

4. Uniting Communities EV Journey

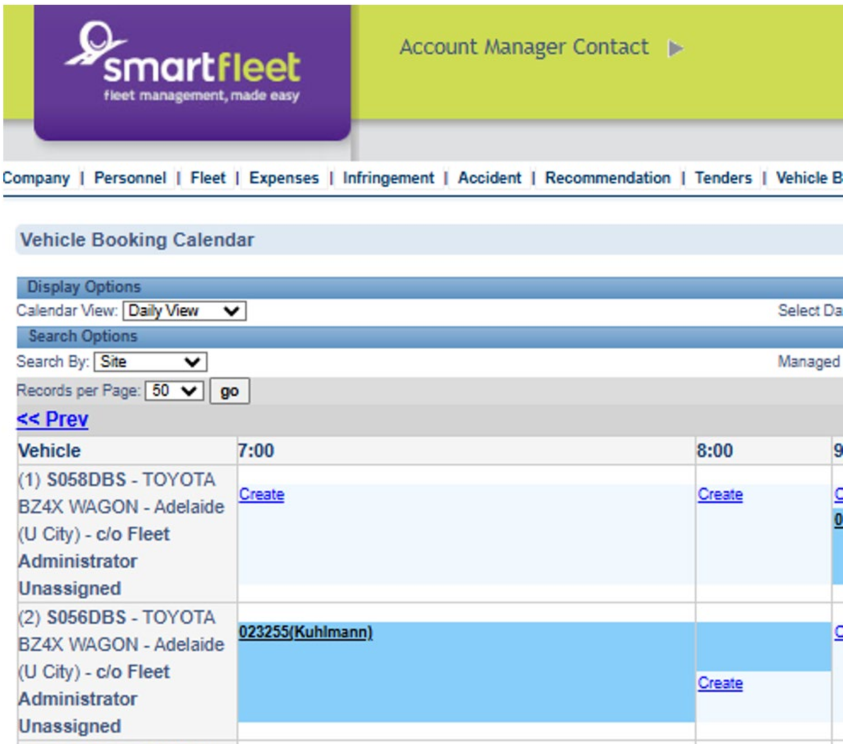
As part of this trial, UC added two EVs to their existing pool of vehicles. Uniting Communities successfully implemented a comprehensive strategy to encourage EV adoption among its fleet users.

Key factors contributing to the program's success included:

4.1. Training

Initially employees received training from external training provider (Austdrive). Additional training material in the form of videos and training manuals were also made available to employees. Employees also received in-depth training on EVs from fleet managers. Additionally, information was disseminated through the company intranet, fact sheets were placed in the EVs, and new users were given personalised walkthroughs by fleet manager. Subsequent interviews with employees confirmed that this holistic onboarding plan and training were crucial in alleviating concerns around how to drive an EV, how to charge the vehicle, as well as reducing range anxiety.

Employees booked these EVs via an online booking system (Smartfleet). EVs were marked as priority 1, making it easier for employees to book them first. Typically, employees used the EVs for customer visits and returned them to the office after completing site visits. Upon returning to the office, employees were encouraged to immediately plug the EVs into the chargers for charging. To ensure that the EVs were fully charged for the next day. Training and fact sheets played a role in promoting this practice, resulting in an 88% utilisation.



4.2. EV Utilisation

Upon Installation of chargers in August 2022, EVs were introduced to the Uniting Communities fleet in October 2022. Since then, their utilisation has consistently exceeded 88% during the baseline measurement period (October 2022 – May 2024). With EVs designated as Priority 1 in the fleet booking system, employees were encouraged to prioritise booking EVs over other vehicles. Interviews with the fleet manager and employees further confirmed that staff were eager to book EVs first, reflecting a strong preference for their use within the organisation.

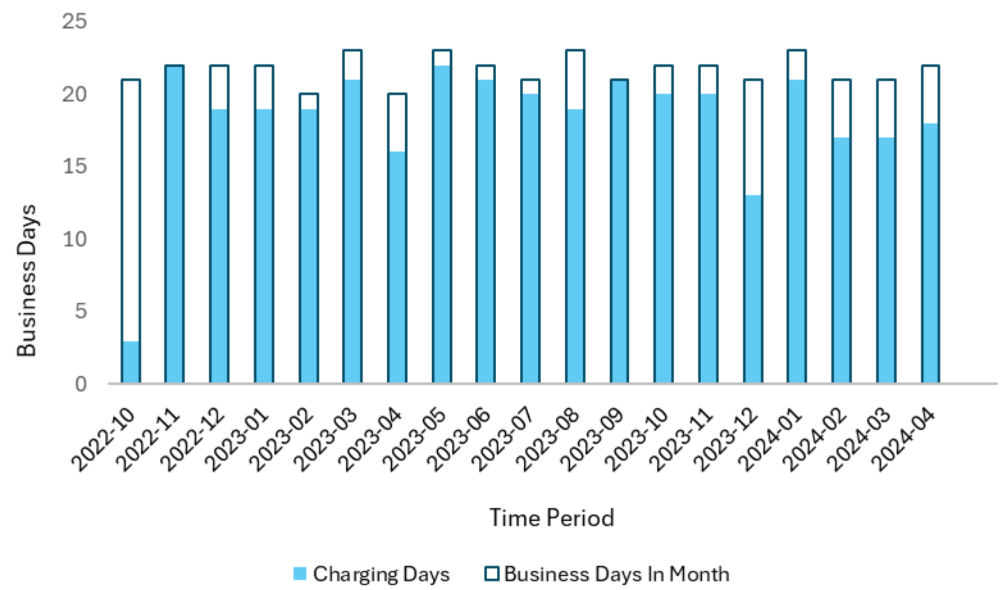


Figure 4.2: EV charger utilisation over time. X-axis: Month and year. Y-axis: Number of days. Light blue bars: Days chargers were used. White sections: Available business days per month.

4.3. EV Charging Analysis Framework

During baseline period (October 2022 - May 2024), the charger management platform, was able to provide session, start time (plug-in time), stop time (plug-out time), duration, electricity consumed, and ChargePoint name for each session.

One significant limitation in the dataset was the absence of charging time (i.e. actual time taken for EV to full charge as opposed to total connection duration). To address this gap, we established a standardised estimate of 7 kWh/h as our baseline charging rate, which aligns with the typical capacity specifications of onboard EV chargers as detailed in (3.7). This approximation allowed us to develop a more nuanced understanding of the charging dynamics.

For each individual charging session, we calculated a "synthetic charging timeline" through a methodical process. First, we determined the theoretical charging duration by dividing the actual recorded electricity consumption by our standardised 7 kWh/h power rate. This synthetic timeline was then distributed across hourly intervals according to a detailed algorithm:

- Initial hour: We calculated electricity delivery as the power rate multiplied by the available minutes remaining in that hour after connection.
- Subsequent complete hours: The full hourly electricity delivery potential (7 kWh) was applied.
- Final partial hour: We allocated precisely the remaining electricity required to match the documented total consumption for that session. (ref Figure 4.3)

An Example on how synthetic timeline calculation is performed:

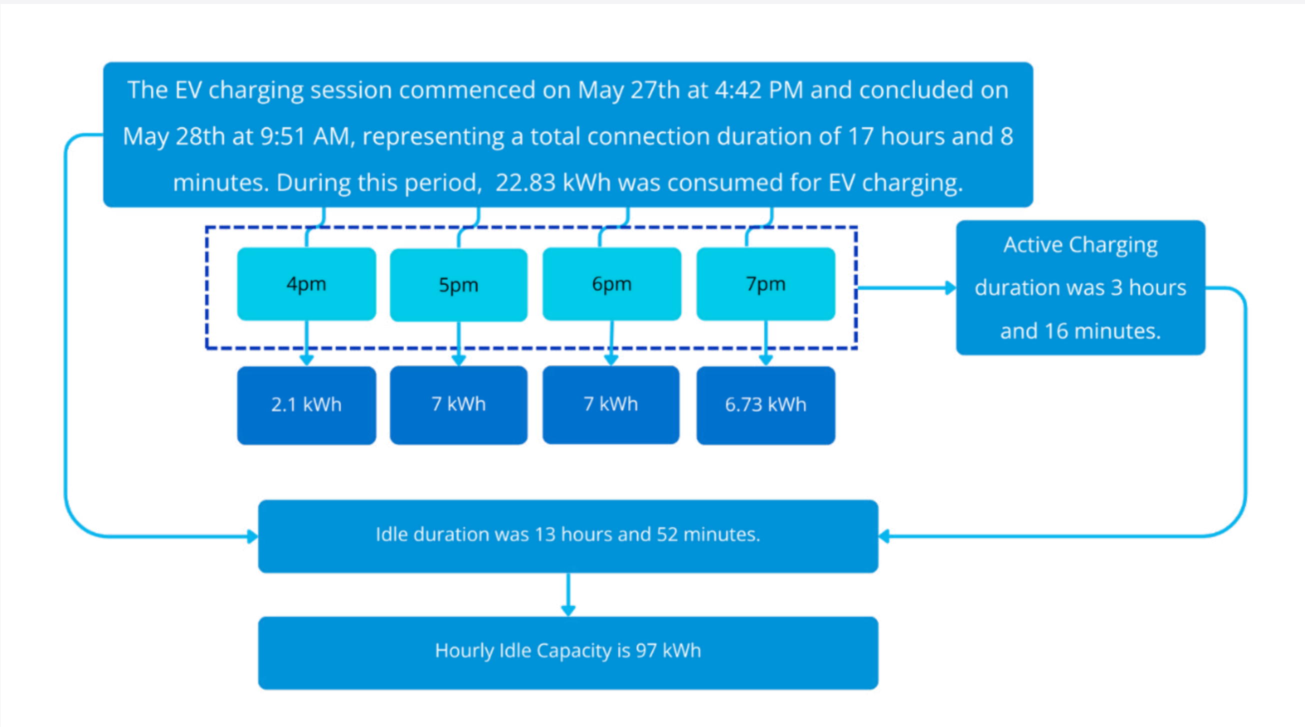


Figure 4.3: Electric vehicle charging session timeline with hourly breakdowns and electricity delivered per hour.

This approach assumed charging begins immediately after connection, which matched our baseline observations, employees and fleet manager confirmed this behaviour.

A key finding was quantifying the "idle capacity": the potential for delivering electricity when vehicles were plugged in but not actively charging. We calculated these idle periods by subtracting the synthetic charging duration from the total connection time. The untapped charging potential during these idle windows was then quantified by multiplying the idle hours by our standardised 7 kWh/h power rate.

This comprehensive analytical framework can be summarised through four fundamental equations:

1. Vehicle Connection Duration = Total time from plug-in to plug-out (complete session duration)
2. Active Charging Duration = Total electricity delivered ÷ Standardised charging power
3. Idle Duration = Connection duration - Active charging duration
4. Hourly Idle Capacity = Idle duration × Standardised charging power

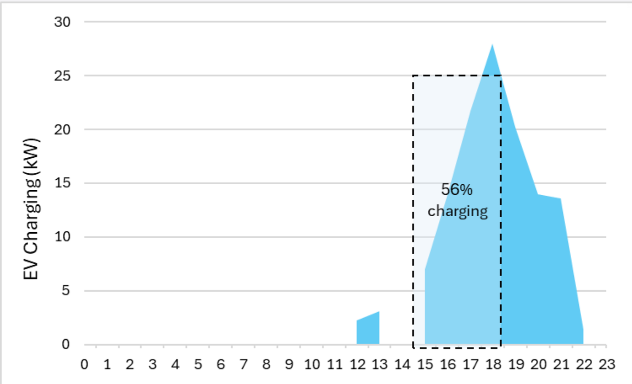
4.4. Analysing EV Charging Habits

The baseline period is October 2022 through May 2024 spanning initial EV-charger data collection to AGL's orchestration implementation. This foundational timeframe yielded several significant insights detailed below:

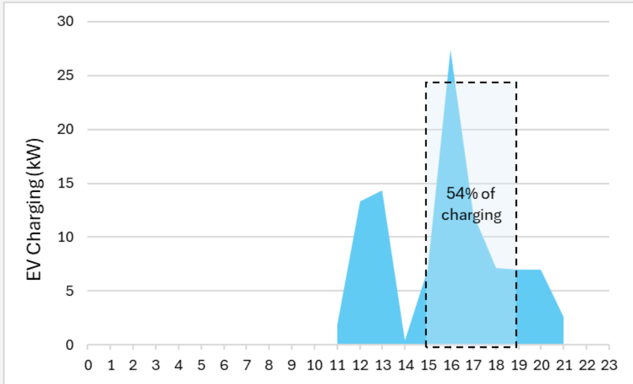
4.4.1. Charging Demand Time

During the base line period more than half of the daily EV charging load (53%) occurs within a concentrated four-hour time frame between 3:00 PM and 7:00 PM. This pattern emerges because employees typically drive the EVs back to the office in the mid-to-late afternoon, after finishing their customer visits for the day. Once the EVs are parked at the office, they are immediately plugged in to charge (Uncontrolled Charging). The charging continues for the rest of the day and overnight as well, ensuring the EVs have a full battery for the next day's usage.

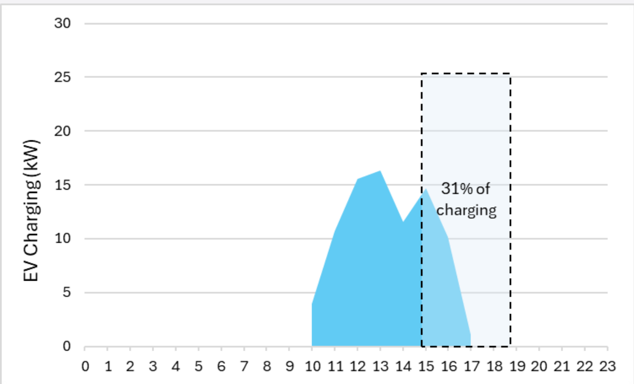
However, this charging schedule means that once the EVs are fully charged, they sit idle for an average of 16 hours before being used again. This presents an untapped opportunity to optimise the charging process. By shifting the charging times to periods when electricity grid demand is lower or charging with times of high solar energy production.



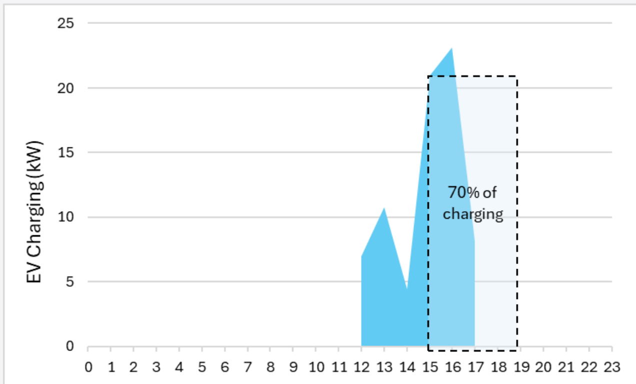
EV Charging Week Starting 23rd Jan 2023



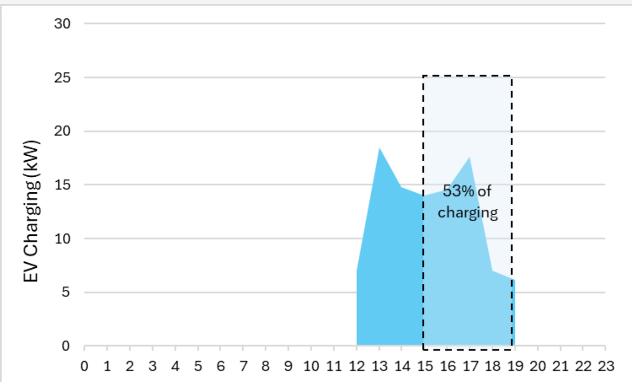
EV Charging Week Starting 15th May 2023



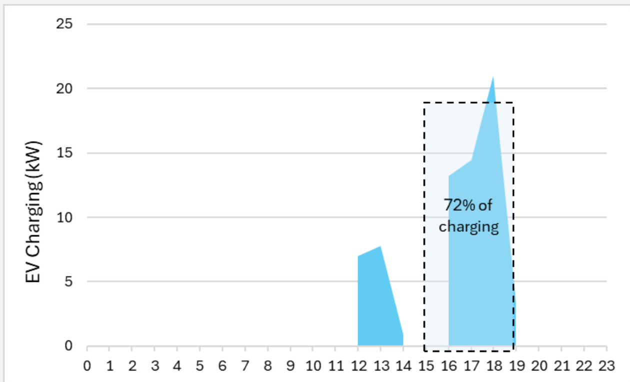
EV Charging Week Starting 17th July 2023



EV Charging Week Starting 20th Nov 2023



EV Charging Week Starting 26th Feb 2024



EV Charging Week Starting 6th May 2024

Figure 4.4.1: Uncontrolled EV charging over 24 hours. X-axis: Time of day. Y-axis: Power consumption (kWh). Highlights: Charging concentrated between 3:00 PM–7:00 PM.

4.4.2. Charging Behaviour Analysis

Analysis of EV charging data reveals a distinct operational pattern within the fleet. Majority of charging sessions (53%) are initiated during the afternoon period between 2:00 PM and 5:00 PM, coinciding with the conclusion of employees' workdays. Correspondingly, vehicle retrieval predominantly occurs during morning hours between 9:00 AM and 10:00 AM, accounting for 45% of all departures.

This consistent behaviour creates an advantageous overnight charging window where EVs remain connected to charging infrastructure for extended periods. Effectively, utilising the parking facilities as overnight charging hubs, connecting vehicles at the end of their workday and retrieving them the following morning.

This operational pattern presents a significant opportunity for optimised charging management. The extended overnight connection period enables shifting charging to off-peak hours when electrical demand is lower, reducing both charging cost and grid stress. Additionally, the pattern allows for potential utilisation of midday charging (periods of abundant solar energy enhancing both economic and climate benefits).

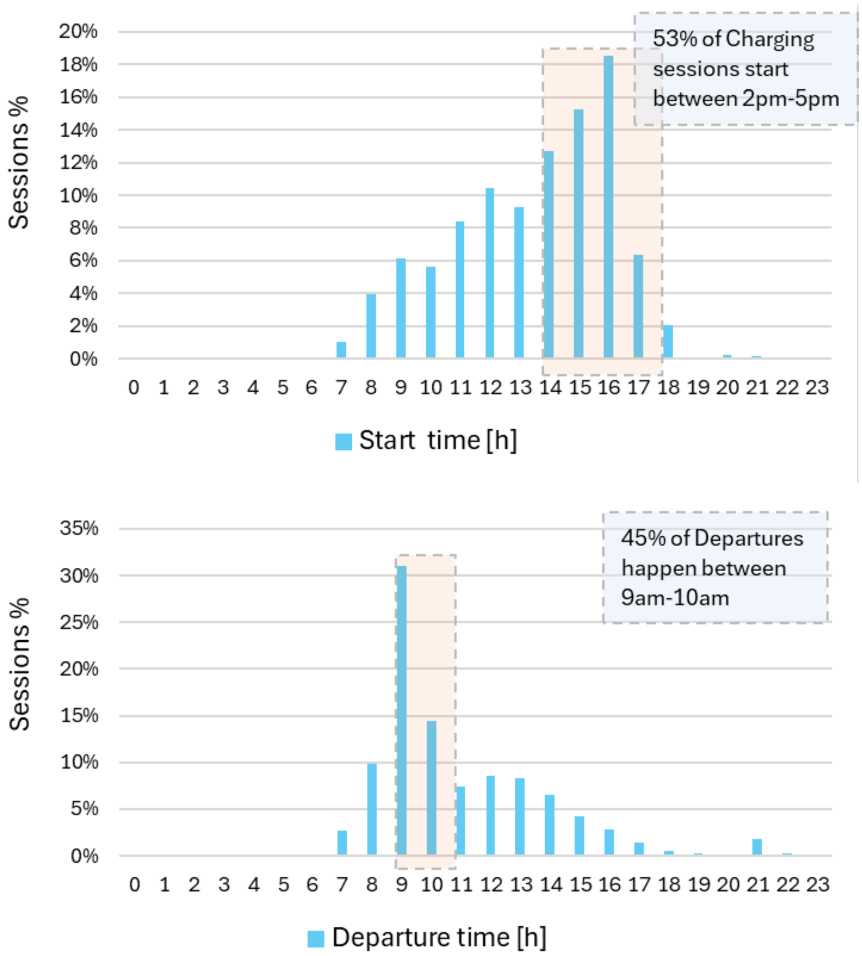


Figure 4.4.2: Distribution of sessions based on arrival and departure times.

4.4.3. Predictable Overnight Charging Patterns Support Controlled Charging Implementation

Starting time is an important predictor for the length of a charging session. Examples are, charging sessions starting between 14:00 and 17:00 usually end in the morning and therefore last between 11 to 16 hours, see the peak in Figure 4.4.3. This pattern shows we can use controlled charging, because EV's stay plugged in overnight, making sure drivers will have enough battery power for their trip the next day.

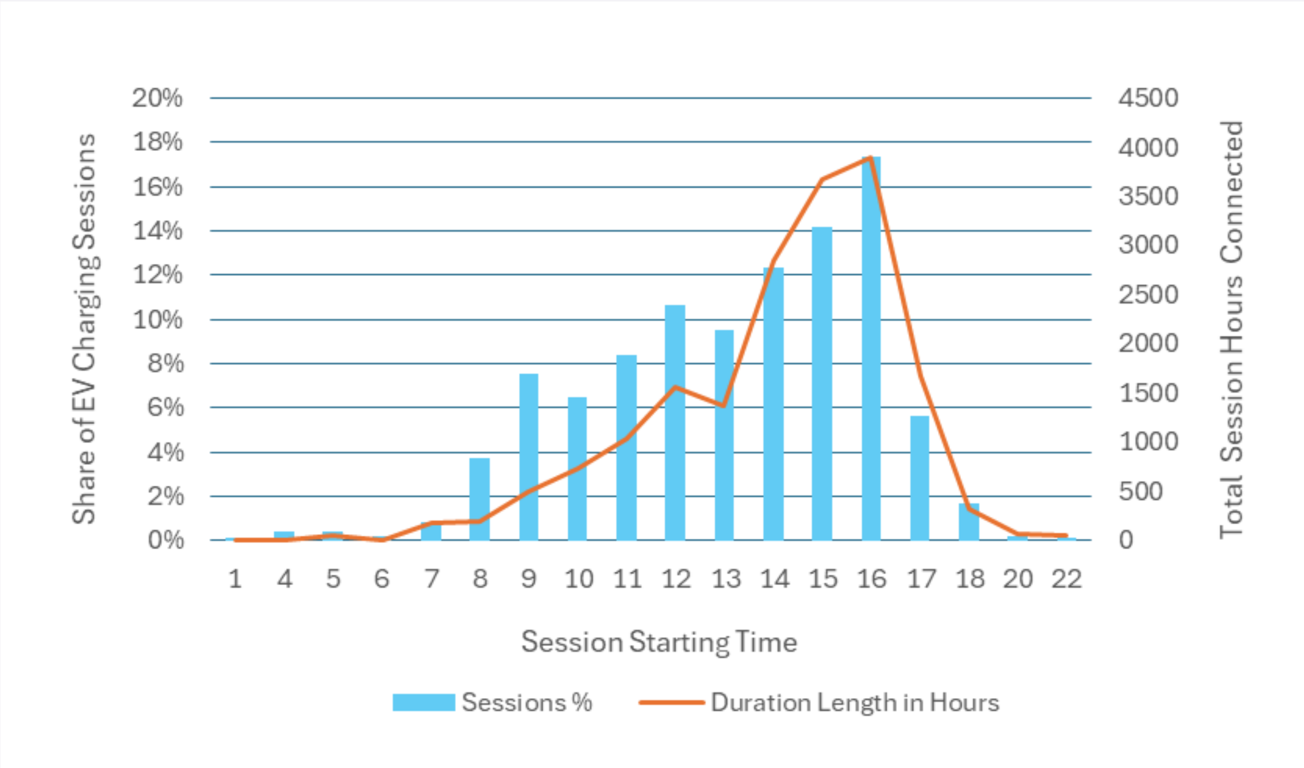


Figure 4.4.3: Charging session start times and connection hours. X-axis: Hour of day (1:00 AM–12:00 AM). Left Y-axis: Number of sessions (blue bars). Right Y-axis: Total connected hours (orange line).

4.4.4. Analysing EV Charging Session Durations: From Brief Connections to Weekend Charging

Additionally, we analysed the distribution of charging sessions based on their duration. The blue line represents the frequency of charging sessions per hour of connection time. Notably, about 24% of sessions are very short, lasting less than 10 minutes. Upon deeper examination of the underlying data, we discovered that many of these short sessions are due to employees double tapping their RFID cards on the charger or unplugging and re-plugging the charger, which registers as multiple sessions.

As seen on the far left side spike of the blue line this was done as the employees were not sure if the EV charger recorded the tap of RFID so that the charging would start, over time as employees started to use the EV chargers more and understand the messages on the chargers, they were able to authenticate in once instance.

Further analysis reveals distinct peaks in charging session durations. The first peak occurs between 15 and 23 hours, indicating that a significant number of EVs are charged overnight. This pattern suggests that users plug in their vehicles in the evening and disconnect them the following morning, ready for use.

The second notable peak appears between 64 and 72 hours, suggesting that employees leave their vehicles connected to chargers over the weekends (Friday evening to Monday morning).

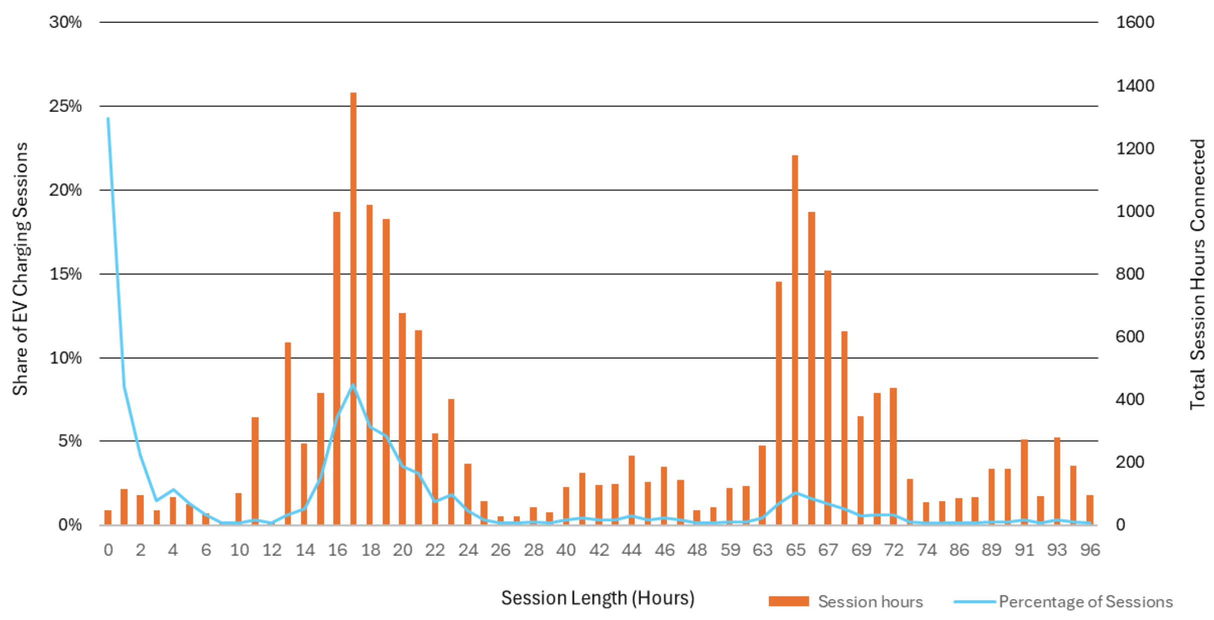


Figure 4.4.4: Charging session length and connected hours. X-axis: Session length (0–96 hours). Left Y-axis: Number of sessions (blue line). Right Y-axis: Total connected hours (orange bars).

When examining session lengths:

- Sessions lasting between 1 and 5 hours constitute 17% of all sessions. However, these sessions collectively accounted for only 2% of the total connection time. This suggested that these shorter sessions are often for quick charges during short trips.
- Sessions lasting between 13- 19 hours make up 31% of total connected hours. This pattern indicated that EV's connected overnight, disconnecting them the following day for use.
- Sessions lasting between 63 and 72 hours represented 9% of all sessions but accounted for 32% of the total connection time. This duration pattern strongly suggests that EVs are parked and connected to chargers over weekends.

4.4.5. Analysing EV Charging Data: Insights into Employee Vehicle Usage

The data provides valuable insights into how employees use company EVs. The charging patterns directly reflect the duration and distance of business trips employees make.

Short charging sessions:

After filtering out sessions under 10 minutes (which predominantly represented authentication errors detailed in Section 4.4.4), our analysis revealed that brief charging sessions under one hour constitute 50% of all charging events.

These short-duration sessions typically correspond to local travel patterns, where employees make brief trips to nearby locations and return to headquarters with minimal battery depletion. The high frequency of short-duration sessions (less than 1 hour) also suggests more trips and availability of EV's throughout the day.

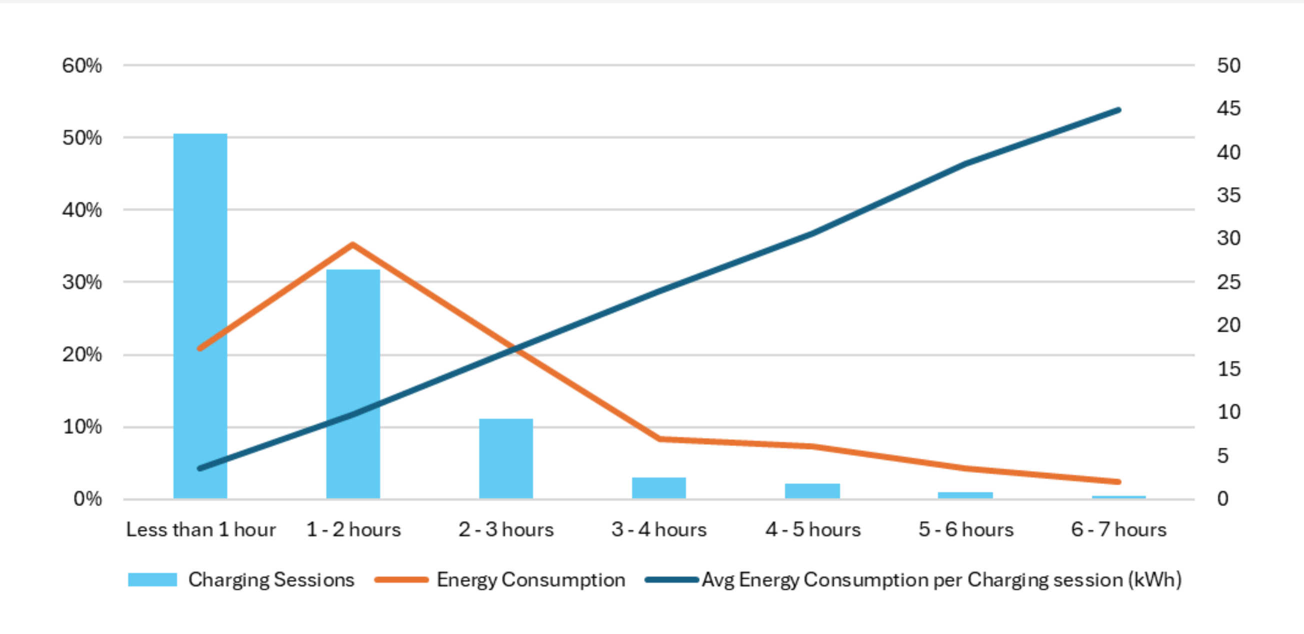


Figure 4.4.5: Charging session distribution and electricity consumption. Blue bars: Percentage of sessions by duration. Orange line: Percentage of total electricity consumption by duration category. Dark blue line: Average consumption per session (kWh).

Medium-Duration Trips Drive Electricity Consumption

The moderate-length charging sessions—those lasting between one and three hours—indicated employees making round trips to visit customers at locations approximately 50-80 km from base location. Though these medium-distance visits occurred less frequently than nearby appointments, they account for the largest portion of electricity consumption.

This pattern reveals an important insight: while most customer visits are local, a significant portion of visits (32%) require employees to travel further afield. These longer business trips naturally demand more substantial battery recharging upon return to prepare vehicles for subsequent use.

Extended Charging Reflects Full-Day Field Work

The rare instances of extended charging sessions likely represented full-day field work where employees have completed round trips of considerable distances (190 km – 220 km) to serve remote customers or made multiple stops during a single journey. These comprehensive customer visit itineraries, while infrequent (3% in total), required substantial battery replenishment when vehicles finally returned to base (on average require 38kW of charging).

The scarcity of these extended charging sessions suggested that hybrid vehicles are preferred by employees over longer durations as the max range provided was 275 km (Nissan Leaf)-455 km (Hyundai Kona), this was also mentioned during interview with employees.

Operational Implications for Workplace Charging

This charging behaviour created a healthy dynamic for the company's charging infrastructure. The preference for shorter sessions means EV's become available regularly throughout the day, allowing more employees to access them when needed. With 93% of all charging sessions concluding within 3 hours, the current infrastructure appears well-aligned with employee EV usage patterns. Concentration of electricity consumption in 1–3-hour sessions indicated periods where charging demand exceeds availability. While a one-to-many charger to EVs wasn't necessarily part of the trial, the 2 EVs were jockey parked and accordingly did rotate to both chargers at different times due to booking schedule and double parking.

> Quote from Fleet Manager: "99% of what we do can be done with an EV"

- Electricity Distribution:
  - Charge time 1-2 hour: 35% of total electricity (despite being only 32% of sessions)
  - Charge time Less than 1 hour: 21% of electricity (despite being 50% of sessions)
  - 2–3-hour charge time: 22% of electricity (from just 11% of sessions)
- Efficiency Metrics: The data shows a linear relationship between charge time duration and electricity consumption per session:
  - Brief charging time (<1 hour): 4 kWh per session
  - Mid-length charging time (2-3 hours): 17 kWh per session
  - Extended charging time (6-7 hours): 45 kWh (over 11× the electricity of short sessions)
- Electricity Concentration: Sessions lasting 1-3 hours, while representing only 43% of charging events, account for 57% of all electricity consumed.

Key Insight:

For vehicle allocation planning, the data suggests companies could benefit from a tiered approach — maintaining a larger pool of vehicles for quick local visits while ensuring adequate availability of fully-charged vehicles for the less frequent but energy-intensive medium-distance client visits.

- Based on charger utilisation patterns and EV driving behaviours, maintaining an equal ratio between EVs and available chargers is recommended. In a shared charging model for fleet operations, EVs can achieve sufficient charge levels; however, this approach requires manual intervention to relocate fully charged vehicles from charging bays and connect the next vehicle in queue for charging.

4.5. EV Charging Analysis: Controlled vs Uncontrolled Charging

Implementing EV Charging Profiles

The implementation of charging profiles for EV chargers was successfully accomplished using the Exploren API. While programming these charging profiles through Charger Management Platform, we encountered several technical challenges that required diligent problem-solving and iterative development. After multiple refinements, the charging profiles were successfully configured as per the requirements.

Technical Implementation of Controlled Charging

The programming of customised charging profiles proved more complex than initially anticipated and required significant technical expertise. Our approach centred on configuring the chargers handle varied charging schedules.

We created a schedule that tells the charger when to charge the EV and when to stop. It looks like a list of instructions with times and power levels. Example below:

```
"chargingSchedulePeriod": [
  {"startPeriod": 0, "limit": 0},
  {"startPeriod": 3600, "limit": 32},
  {"startPeriod": 25200, "limit": 0},
  {"startPeriod": 36000, "limit": 32},
  {"startPeriod": 54000, "limit": 0}
]
```

The schedule works in time periods measured in seconds from midnight:

- 0 seconds = midnight (12:00 AM)
- 3600 seconds = 1:00 AM
- 25200 seconds = 7:00 AM
- 36000 seconds = 10:00 AM
- 54000 seconds = 3:00 PM

The "limit" number controls charging speed:

0 = no charging allowed, 32 = charging at 32 amps

This is like telling the charger: "Don't charge at first, then start charging after one hour, stop charging after seven hours, start again at ten hours, and finally stop at fifteen hours."

An important consideration during implementation was accounting for daylight saving time adjustments, which required updates to the charging profiles to maintain accurate scheduling.

Implementation Process

We established a systematic workflow for deploying charging profiles across the charging infrastructure. This process was iteratively applied to configure various charging schedules tailored to different operational requirements:

1. Construct required charging profile payload
2. Clear-charging-profile on the charge point
3. Set new charging-profile on the charge point
4. Verify if charging profile was successful implemented

Steps 1 to 3 were repeated multiple times to set different charging profiles on the chargers.

Impact of State of Charge Limitations on Trial Implementation

Throughout the trial period, State of Charge (SOC) data for electric vehicles was not accessible due to several structural limitations. The leasing arrangement for the electric vehicles placed vehicle ownership with the leasing company, which consequently restricted the creation of additional accounts necessary for data access.

The EV charging infrastructure installed for the trial was compliant with Open Charge Point Protocol (OCPP) 1.6 standards. However, SOC data was not accessible due to several structural limitations associated to OCPP 1.6J. This represented a significant constraint.

The inability to access SOC data had notable implications for the comprehensive implementation of smart charging strategies, limiting the trial's capacity to optimise charging based on vehicle battery status. This constraint affected the full realisation of the smart charging potential within the established trial parameters.

To address this limitation in future implementations, upgrading to OCPP 2.0.1 would be necessary. Unlike the current protocol version used in the trial, OCPP 2.0.1 natively supports SOC data capture from connected vehicles, enabling more sophisticated charging optimisations based on real-time EV battery status information, which would significantly enhance smart charging effectiveness.

4.5.1. Controlled Charging Implementation 1

In the week commencing 10 June 2024, a charging schedule from **10:00 AM to 4:00 PM**, and **12:00 AM to 6:00 AM** with a **32amp maximum power** output was implemented.

The table below is comparing two different scenarios for EV charging: "Controlled Charging" and "Uncontrolled Charging".

"Controlled Charging" represents data from the week of 10 June 2024 (whole week).

"Uncontrolled Charging" represents data from the week of 3 July 2023 (whole week).

Charging Type	Period	Electricity Consumption (kWh)	Solar Sponge Period (10:00 AM – 3:00 PM) (kWh)	Peak- Period (6:00 AM – 10:00 AM and 3:00 PM – 1:00 AM) (kWh)	Off-Peak Period (1:00 AM – 6:00 AM) (kWh)
Controlled Charging	Week 10 June 2024	61	36 (↑ 38.0 pp*)	7 (↓ 67.6 pp*)	18(↑ 29.5 pp*)
Uncontrolled Charging	Week 3 July 2023	62	13	49	0

* Percentage point

Analysing the results

The Controlled Charging scenario consumed 61 kWh of total electricity, resulting in a cost of $21.48 based on the Time-of-Use (TOU) rates. In comparison, the Uncontrolled Charging scenario consumed 62 kWh at a total cost of $29.63. Implementing controlled charging achieved cost savings of $8.15, equivalent to approximately 13¢/kWh in reduced charging expenses. (ref: Figure 4.5.1 (c))

Solar Sponge Period (10:00 AM – 3:00 PM)

- In Controlled Charging, 59% of the total electricity (36 kWh) is consumed during this period.
- In Uncontrolled Charging, only 21% of the total electricity (13 kWh) is used in this window.
- There has been a 177% increase during the Solar Sponge period, effectively capitalising on optimal renewable electricity generation timeframes.

Peak Period (6:00 AM – 10:00 AM and 3:00 PM – 1:00 AM)

- In Controlled Charging, electricity consumption during peak hours was significantly reduced (-86%) compared to the Uncontrolled scenario. Only 7 kWh was used in peak period.
- In contrast, the bulk of the charging in the Uncontrolled scenario (49 kWh out of 62 kWh total, being 79%) occurred during peak period.

Off-Peak Period (1:00 AM – 6:00 AM)

- The controlled charging strategy directed 18 kWh of consumption to off-peak hours, representing a 100% increase compared to the baseline uncontrolled scenario, which recorded no consumption during these periods.
- This strategic redistribution successfully shifted 30% (18 kWh) of total electricity consumption to overnight hours, capitalising on reduced electricity rates and lower grid demand.

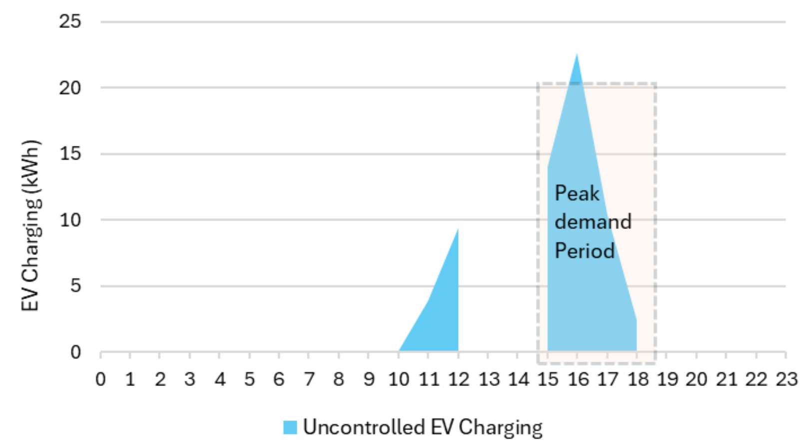


Figure 4.5.1 (a):

Power consumption (kWh) over a 24-hour period for the week starting 3 July 2023. EV charging occurred in an uncontrolled manner (vehicles parked at the office and plugged in).

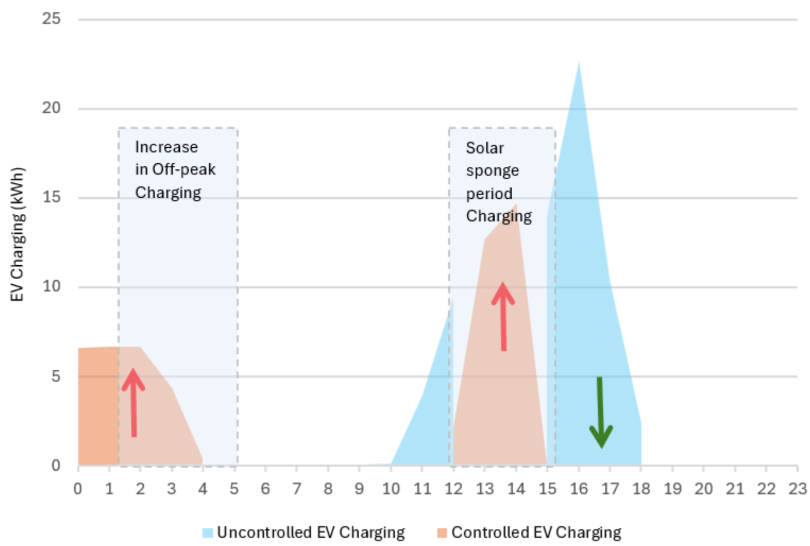


Figure 4.5.1 (b):

Power consumption (kWh) over a 24-hour period for two weeks: Week starting 3 July 2023 – uncontrolled charging (vehicles parked and plugged in) and week starting 10 June 2024 – controlled charging using a defined profile.

X-axis: Time of day. Y-axis: Power consumption (kWh).

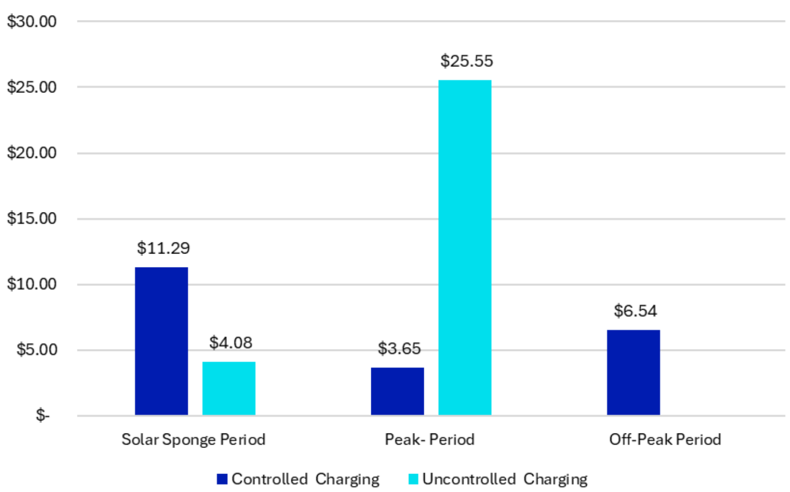


Figure 4.5.1 (c):

Comparison of costs between controlled and uncontrolled EV charging across three different time periods.

4.5.2. Controlled Charging Implementation 2

By working with Uniting Community Fleet Manager, in the week commencing 16 September 2024, a charging schedule from **10:00 AM to 4:00 PM**, and **2 AM to 6 AM** with a **32amp maximum power output** was implemented.

The table compares charging patterns and electricity consumption for two specific weeks: one in September 2024 under a "Controlled Charging", and one in May 2023 with "Uncontrolled Charging". While the total electricity consumed is similar in both cases (103 kWh vs 100 kWh), the distribution of that electricity across the day is strikingly different.

Under Controlled Charging, a significant portion of the charging (54 kWh, or about 52% of the total) was shifted to the "Solar Sponge Period" from 10:00 AM to 3:00 PM. This is an 80% increase compared to the Uncontrolled scenario. Why is this important? Well, this mid-day window typically aligns with solar sponge period, when solar energy production is at its highest. By concentrating the charging during this period, the Controlled strategy was able to harness more renewable solar power.

Charging Type	Period	Electricity Consumption (kWh)	Solar Sponge Period (10:00 AM – 3:00 PM) (kWh)	Peak- Period (6:00 AM – 10:00 AM and 3:00 PM – 1:00 AM) (kWh)	Off-Peak Period (1:00 AM – 6:00 AM) (kWh)
Controlled Charging	Week 16 Sep 2024	103	54 (↑ 22.4pp*)	12 (↓ 58.3 pp*)	37(↑ 35.9 pp*)
Uncontrolled Charging	Week 15 May 2023	100	30	70	0

* Percentage point

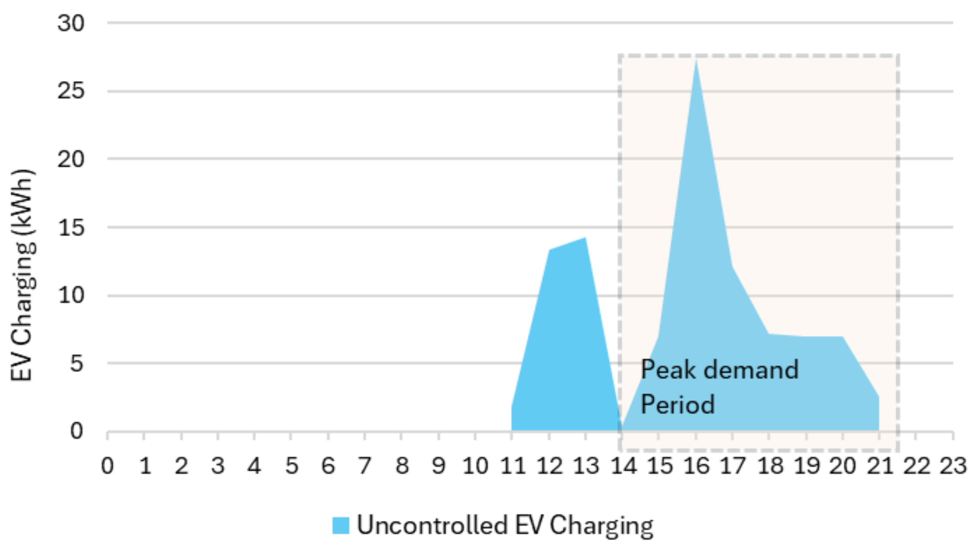


Figure 4.5.2 (a): Power consumption (kWh) over a 24-hour period for the week starting 15 May 2023. EV charging occurred in an uncontrolled manner (vehicles parked at the office and plugged in).

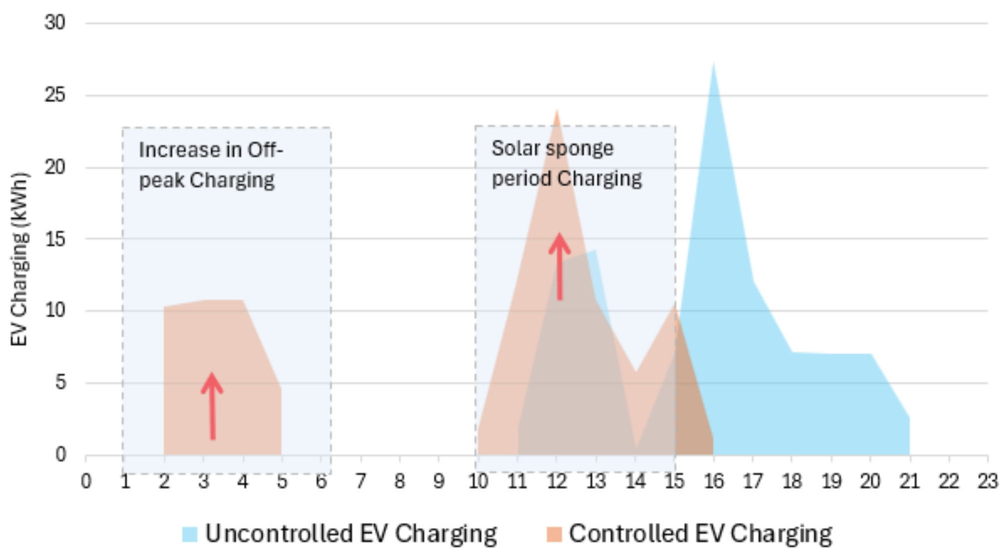


Figure 4.5.2 (b): Power consumption (kWh) over a 24-hour period for two weeks: Week starting 15 May 2023 – uncontrolled charging (vehicles parked and plugged in) and week starting 16 September 2024 – controlled charging using a defined profile.

X-axis: Time of day. Y-axis: Power consumption (kWh).

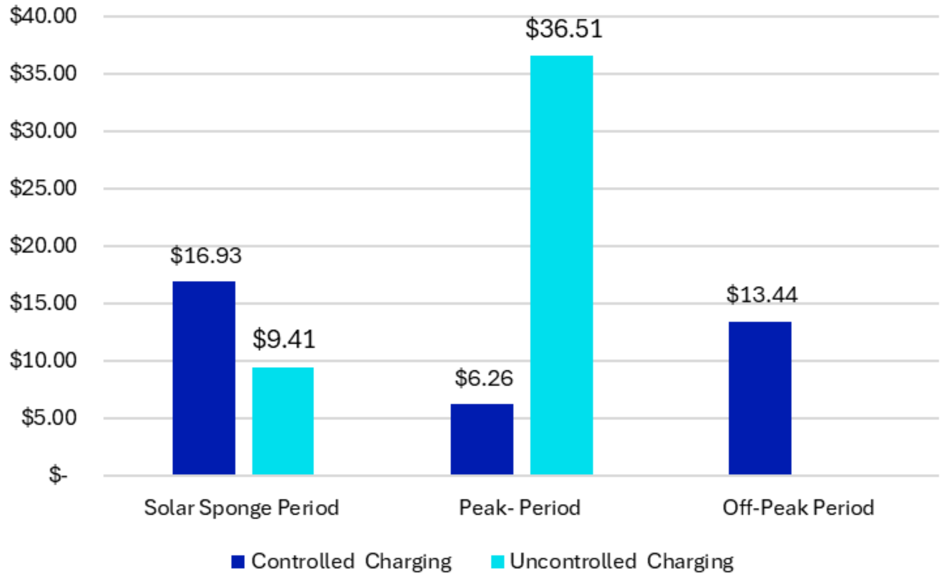


Figure 4.5.2 (c): Cost comparison between controlled and uncontrolled EV charging across three different time periods. There was an 83% reduction in Peak-Period charging costs because of controlled charging.

4.5.3. Controlled Charging over Multiple Weeks

Implementation of different charging profiles across the periods mentioned in the Figure 4.5.3 (a) was achieved by communicating with the charger management software APIs.

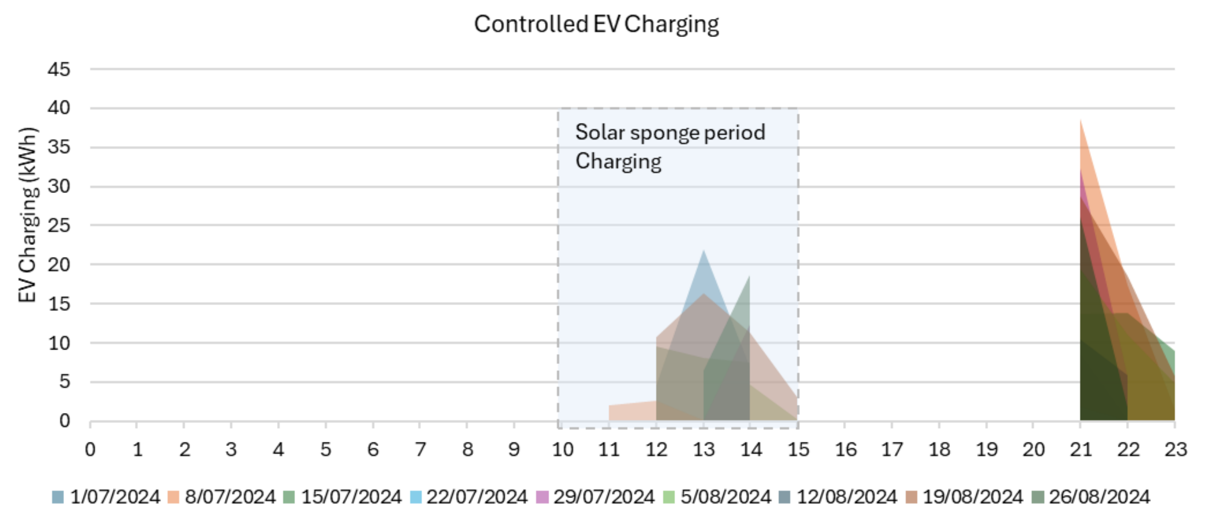


Figure 4.5.3 (a): Power consumption (kWh) over a 24-hour period across multiple weeks with a defined charging profile.
Charging windows: 10:00 AM–4:00 PM and 9:00 PM–6:00 AM. Maximum power output: 32 amps.
X-axis: Time of day. Y-axis: Power consumption (kWh).

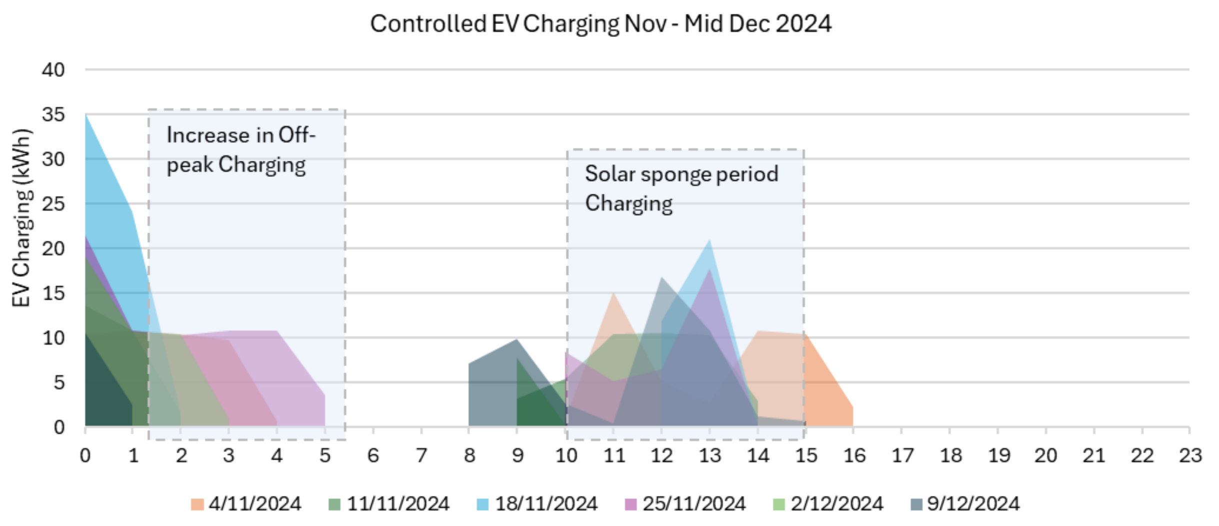


Figure 4.5.3 (b): Figure 4.5.3 (b): Power consumption (kWh) over a 24-hour period across multiple weeks with a defined charging profile.
Charging windows: 8:00 AM–5:00 PM and 12:00 AM–6:00 AM. Maximum power output: 32 amps.
X-axis: Time of day. Y-axis: Power consumption (kWh).

4.5.4. Event Based Charging

Event-based charging was implemented using a similar methodology to controlled charging. A simulated approach was used to define charging profiles based on forecasted RRP pricing. This involved the following steps:

- Constructing the required charging profile payload.
- Clearing the existing charging profile at the charge point.
- Setting the new charging profile at the charge point by defining the 'From when the charging starts' and 'To when it needs to be stop' periods.
- Verifying successful implementation of the charging profile, charging profile was set with a one-day validity.

Charging Type	Period	Electricity Consumption (kWh)	Solar Sponge Period (10:00 AM – 3:00 PM) (kWh)	Peak- Period (6:00 AM – 10:00 AM and 3:00 PM – 1:00 AM) (kWh)	Off-Peak Period (1:00 AM – 6:00 AM) (kWh)
Controlled Charging	15 June 2024	24	.15 (↓ 38pp)	6.51 (↓ 35pp)	18(↑ 73pp)
Uncontrolled Charging	15 June 2023	22	8.60	13.5	0

* Percentage point

This charging strategy eliminated most peak charging and moved it to off-peak overnight (+73 pp).

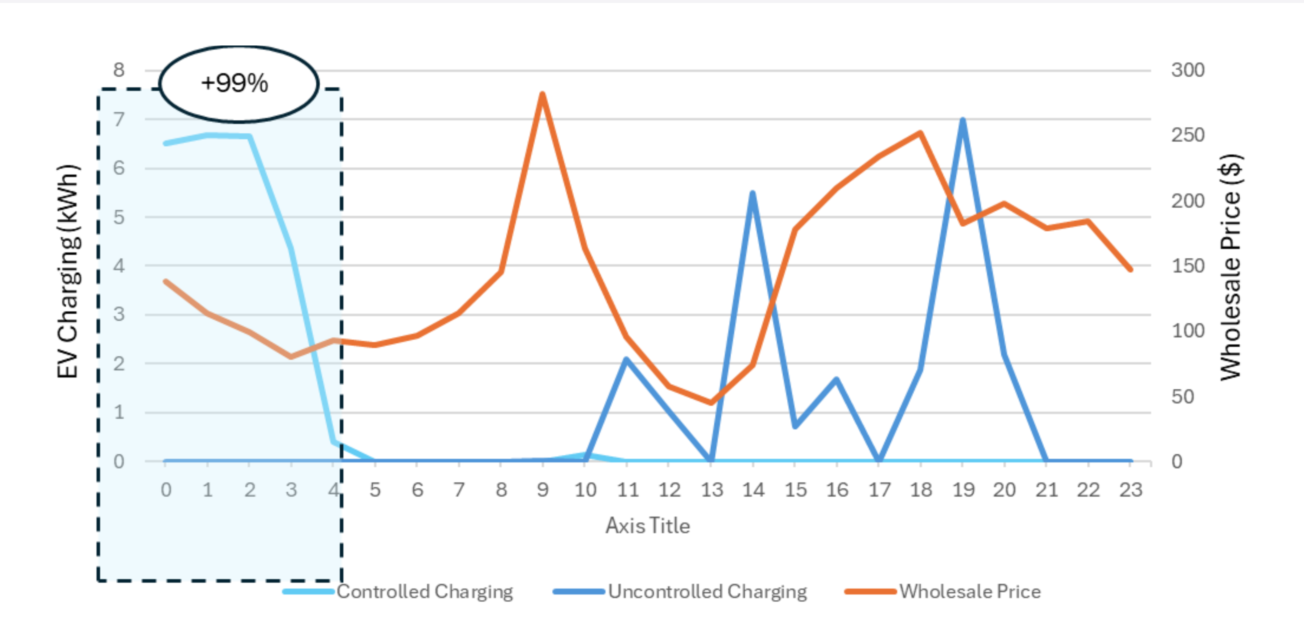


Figure 4.5.4: Power consumption and wholesale RRP price over a 24-hour period with a defined charging profile.
Charging windows: 10:00 AM–2:00 PM and 12:00 AM–6:00 AM. Maximum power output: 32 amps.
X-axis: Time of day. Left Y-axis: Power consumption (kWh). Right Y-axis: Wholesale RRP price.

Key Takeaways

By strategically shifting charging times to better align with electricity costs, renewable electricity production, and grid demand, significant improvements in cost, sustainability, and grid stability can be achieved. The Controlled Charging scenario demonstrates the potential of such an approach.

Feedback from fleet users indicated that they did not notice any differences or experience any inconvenience when their charging times were adjusted. The success of implementing the new charging schedule relied heavily on clear communication. The Fleet Manager at Uniting Communities was informed about the changes to the EV charging periods, and employees followed a systematic process by plugging in the chargers at the end of each trip, ensuring that power was supplied according to the programmed schedule.

Interviews with employees revealed that fact sheets placed in the EVs, along with comprehensive training, played a crucial role in ensuring that all essential steps were followed at the end of each trip. This ensured smooth operations and compliance with the new charging profile.

4.6. Qualitative Insights and Participant Feedback

Interviews were conducted with fleet users, General Manager & Fleet manager to understand experiences and perspectives during the EV trial. The questions aimed to explore their motivations, daily use patterns, and challenges related to EV adoption, as well as broader topics like charging infrastructure and government policy.

Theme 1: Motivation for Using EVs

Participants' motivations for using EVs were driven by a combination of organisational goals and personal interests. Some were motivated by their company's strong push towards sustainability, particularly its commitment to achieving net zero by 2035. This organisational directive encouraged many to take part in the trial as a way to align with the company's climate goals.

Several participants also expressed personal motivations, including an established interest in EVs. One participant has been using a personal EV for work commuting since March 2020, making them an early adopter. For them, the trial naturally aligned with their existing practices. Others were motivated by a desire to explore EV technology for both professional and personal reasons, seeing EVs as the future of the automotive industry. While some had initial hesitation due to concerns about range limitations, particularly for longer trips, their participation was generally positive and driven by both curiosity and commitment to sustainability.

For example, one of the participants was primarily motivated by the company's drive to use EVs, and his involvement reflected a combination of interest and curiosity about the technology.

Insights:

Company-Driven Motivation: The motivation to participate was largely company-driven, with many participants joining the trial to support their organisation's climate goals. Initial range anxiety for longer trips was a common concern.

Sustainability Goals: The trial was aligned with the organisation's long-standing sustainability goals, particularly in reducing carbon emissions and achieving net zero by 2035.

Practical and Personal Use: Some participants, already familiar with EVs, were motivated by practicality and personal interest, with established habits around using EVs for commuting.

Forward-Looking Interest: Participants were also motivated by the long-term outlook of EVs becoming a dominant part of the automotive landscape, seeing the trial as an opportunity to prepare for the future.

Quotes:

> "There was a little bit of hesitation in the beginning because a lot of the times I use our fleet vehicles is to travel a bit further out."

> "My organisation is strongly committed to net zero by 2035. I am a member of the net zero committee and we are doing what we can in this space to alleviate or make life better for marginalised communities."

> "I do own an EV myself; I use it as much as two or three times a week."

> "We've been carbon neutral since 2015. The transition to full EV and zero-emission vehicles is obviously the next step, so that's why we were really keen to pilot it."

> "I'm really keen to look into the electric vehicle, I guess technology and examine it from a zero-emissions perspective—for work, but also for home purposes."

Theme 2: Daily Usage and Charging Behaviour

Participants had varying experiences with daily EV use, primarily involving short trips. One participant used the EV regularly for commuting to locations like Mount Barker, covering 90-100 kilometres round trip. They developed a habit of plugging in the EV upon arrival to ensure it was ready for the next use, avoiding the inconvenience of finding an uncharged vehicle. However, they mentioned that certain models, like the Nissan Leaf, required additional steps to unlock the charger.

Another participant used the EV for a long drive once and had to familiarise themselves with the charging process. Despite this, the overall experience was smooth, and they completed their tasks without issue. Some participants emphasised that the pool of EVs allowed multiple employees to trial the vehicles. The back-to-base charging system worked well, and over time, employees became comfortable with the system.

Insights:

User-Friendly Integration: Even with limited prior experience, participants were able to integrate EVs into their workflow smoothly, highlighting the user-friendly nature of the EV trial.

Established Charging Habits: Routine charging behaviours developed quickly, and the system worked well for shorter trips. However, different EV models required users to learn specific charging processes.

Infrastructure Challenges: Regular EV usage was practical for shorter trips, but gaps in public charging infrastructure, particularly in urban areas and apartments, posed challenges.

Widespread Adoption: The organisation's trial system allowed many employees (across multiple departments) to experience EVs, which normalised their use across the organisation and exposed more people to the technology.

Routine and Accessibility: Participants' EV usage was well-integrated into both their work and personal routines, with charging infrastructure readily accessible at the organisation's base.

Quotes:

> "I rely on the public chargers. They are often broken or there are often problems with them."

> "Putting them in the pool here at our head office allowed a number of different people to come through and trial the EVs."

> "It was pretty much natural for me to plug the vehicle in, because we don't like coming down to the car park and finding that the vehicle's not charged."

> "It was a one-time use. I hadn't rented or used a fleet vehicle for over 12 months, so I had to figure out how to use it again. But it worked pretty smoothly."

> "I think the average kilometres I would do would be anywhere between 50 and 100, and that would be potentially two or three times a week."

> "We have the EVs set up as the first ones to go out, so if any car gets booked, those two are the first to go out."

Theme 3: Charging Accessibility and Convenience

Initially, participants experienced some 'range anxiety' and 'charging anxiety' particularly for longer trips. One participant recounted almost running out of charge during a trip to Mannum but later grew more comfortable with the available range for daily city use. Another participant, supported by access to a fact sheet and personal research, felt more confident using the EV, as it was connected to a charger overnight, easing any concerns about running out of power.

For many, the transition to EVs was met with initial nervousness, especially concerning charging. However, training, communication through bulletins, and regular updates on the intranet helped employees become more comfortable with the process over time. One participant highlighted using EVs for city trips was done without any issues. However, for longer trips to places like York Peninsula, they preferred using a hybrid or internal combustion engine (ICE) vehicle due to range limitations and uncertainties about charging infrastructure.

Another participant mentioned that some users hesitated to take EVs on longer trips because they didn't want to deal with charging on the go. Another participant noted that their experience with EVs exceeded expectations in terms of driving range and the ease of charging, both at home and in public stations. They found the EV controls smooth and similar to their hybrid vehicle, making the transition easier than expected.

Insights:

Overcoming Range Anxiety: Initial range anxiety subsided as participants became familiar with the charging process and the vehicle's range capabilities, particularly for city driving.

Supportive Resources: Access to resources like fact sheets and clear communication helped alleviate concerns about charging, making the transition smoother for participants.

City vs. Long Trips: While EVs proved reliable for regular city commuting, range anxiety and infrastructure limitations persisted for longer trips, leading some participants to prefer hybrids or ICE vehicles for those journeys.

Training and Communication: The success of EV adoption was largely attributed to ongoing training and communication, which helped address initial concerns about charging and using the vehicles.

Base Charging Convenience: Charging at the base was convenient for most participants, but some remained hesitant to use EVs for longer trips due to concerns about charging on the road.

Exceeded Expectations: For many, the EV surpassed expectations in terms of range and ease of use, providing a positive experience overall, especially for daily commuting and short trips.

Quotes:

> "For longer trips, we specifically ask not to use EVs because one of EV might just make it if you manage to charge a little bit at Yorketown."

> "It gave me more confidence to give it a try. I knew the vehicle had been sitting there overnight and had been connected to a charger, so I wasn't worried about running out of battery."

> "I wasn't sure where or how to charge it at first, but since then, I haven't had any issues."

> "There was some initial hesitation, but once people started using the cars regularly, they got comfortable with them pretty quickly."

> "People don't want to deal with charging, which can be an issue, but all the charging is done here at the base, so it's manageable."

> "'It exceeded my expectations in terms of how far you can travel and how easy it was to charge. I found it really easy to drive."

Theme 4: Charging Infrastructure and Operational Challenges

One of the participants mentioned minor issues with unlocking the charger when connected to one of the EV, which caused delays when removing the charger. Another participant encountered difficulties using specific EV features like cruise control, highlighting the learning curve for advanced functions.

Additionally, during the trial, employees had to follow instructions to avoid charging at specific times. This process was managed well, and most employees complied with the guidelines.

Another participant mentioned that no significant barriers were encountered because charging was done primarily at the base. Limiting charging to a controlled environment helped avoid potential issues with infrastructure compatibility.

Insights:

Guidelines and Compliance: Clear guidelines on charging schedules were crucial in preventing conflicts over infrastructure use, and compliance from employees was high.

Model-Specific Challenges: The primary challenges involved specific EV models and features, such as the EV specific charging process or learning to use advanced functions like cruise control.

Home Charging Limitations: The lack of home charging options in apartment complexes was a significant barrier, forcing users to depend on unreliable or overcrowded public charging stations.

Adaptation to EV Features: While infrastructure posed no major challenges, users had to adjust to the varying driving characteristics of different EV models, such as brake and acceleration controls.

Base Charging Benefits: Limiting charging to the base helped avoid infrastructure compatibility issues, ensuring a smoother trial experience within a controlled environment.

Quotes:

> “There was a difficulty with one EV , where you had to unlock the connection using the key fob. I got caught up in the ‘it won’t come out’ situation.”

> “The cruise control drove me nuts. I couldn’t figure it out. I’m just waiting for a speeding fine.”

> “I live in an apartment block where there is no EV charging infrastructure. The only chargers that are free are the ones on Franklin Street near the bus station.”

> “We had a small part of the trial where we said, if you come back at certain times, don’t plug in. Everyone was compliant.”

> “Understanding the regenerative braking control—whether the car halts immediately or whether it has a little bit of roll.”

Theme 5: Business Role in EV Adoption

Across multiple participants, there was a strong belief that Uniting Communities and similar organisations play a crucial role in supporting EV adoption, driven by their commitment to climate sustainability and carbon neutrality. Uniting Communities, in particular, has set a beyond-carbon-neutral target and has been proactive in planning the infrastructure needed to support a growing EV fleet. This includes installing solar panels and offering EV charging to ensure that the transition to EVs is not only environmentally sound but also practical.

Participants praised their organisation's focus on reducing its carbon footprint, achieving climate active accreditation, and using renewable electricity to power their building and EV charging stations. Leading by example, Uniting Communities was the first South Australian non-profit Organisation and first registered charity in Australia to achieve carbon neutrality. This leadership role highlights the importance of businesses in ensuring a smooth transition to EVs and sustainable energy.

Insights:

Leadership in Sustainability: Uniting Communities plays a key role in promoting EV adoption through its strong environmental commitment and long-term planning for an all-electric fleet.

Business Responsibility: Businesses have a critical role in driving EV adoption by incorporating sustainability into their long-term goals and investing in the necessary infrastructure to support EVs.

Integration of Renewable Electricity: Leading by example, businesses can promote EV adoption by integrating renewable electricity solutions, such as solar panels and GreenPower, into their operations, aligning with broader climate strategies.

Collaboration with Government: Successful EV adoption requires businesses to collaborate with governments and other stakeholders to ensure that charging infrastructure is adequately available at strategic locations.

Quotes:

> "We were the first NGO in Australia to be Climate Active accredited. Our building is green-certified, so the charging process for these vehicles is environmentally sustainable too."

> "We have a beyond carbon neutral target, and we're committed to being as green and clean as possible."

> "Our building runs on renewable electricity, which means the charging process for our EVs is green as well."

> "We were the first South Australian organization to achieve carbon neutrality and the first registered charity in Australia to do so."

> "It's critical to ensure that every car park where the EV is stationed has a charging station."

> "We see EVs as a keyway to reduce our overall carbon footprint. The more we transition to EVs, the cleaner and smaller our footprint will be."

Theme 6: Positive or Negative Interactions Regarding EV Charging Facilities

Participants highlighted a few logistical challenges with EV charging during the trial. One participant mentioned that tandem parking for EVs sometimes created complications. If one vehicle was blocked by another, it required managing two sets of keys to move both cars in and out of the charging spots (This problem existed for non-EV pooled vehicles as well). Another participant encountered a small inconvenience where the vehicle unlocked itself while charging, causing a brief disruption.

For participants using public charging facilities, there were concerns about the cost of parking at commercial spots like U-Park, where parking fees added to the expense of charging. Additionally, some charging infrastructure in Adelaide was reported as frequently broken or overused, adding to the inconvenience.

However, most participants spoke positively about the trial's back-to-base charging infrastructure, particularly the integration of solar power for charging.

While there were minor technical issues with chargers, such as error messages, these were generally resolved quickly and did not significantly disrupt the trial.

Insights:

Parking Logistics: Tandem parking added complexity to the charging process, particularly when managing multiple vehicles, but it was a minor logistical challenge.

Locking Mechanism: Minor inconveniences with vehicle locking mechanisms were noted, but overall, the charging process remained positive.

Cost and Convenience: The added cost of parking at public charging spots deterred some participants from frequent use, and issues with overused or broken chargers also posed occasional challenges.

Technical Issues: While some technical issues with chargers were noted, they were manageable and did not significantly impact the trial's success.

Quotes:

> "The downside is if the car on the inside is blocked, you have to move the car on the outside and then put it back."

> "I walked toward the lift, but the car unlocked itself because I was holding the key. It stopped the charging process, so I had to go back and fix it."

> "I don't want to spend an extra $10, $15, or $20 to park in a U-Park just to charge the car. There are only six charging ports, and they're often in use."

> "We've got solar here, so when the cars are plugged in, they're charging when the panels are generating the most energy, which is definitely a good thing."

> "Once it's plugged in, you can lock the doors, which locks the plug and secures the charging process."

> "We've had some issues with the chargers giving error messages and not being sure if the car would be charged by morning, but otherwise, no major problems."

Theme 7: Government Policies and Incentives

Participants emphasised the critical role that government policies and incentives play in promoting EV adoption. One of the participants noted that incentives such as rebates, tax benefits, and Fringe Benefit Tax (FBT) are essential for encouraging both individuals and organisations to transition to EVs. However, they pointed out that these incentives are not always well-advertised or clear, which can hinder their effectiveness.

Several participants highlighted the importance of government-funded education and awareness programs, particularly for disadvantaged communities, to help them understand the climate and financial benefits of EVs. In addition to direct subsidies for EVs, they advocated for subsidies aimed at charging infrastructure and electricity costs, arguing that these would have a longer-lasting impact.

Local government initiatives, such as those offered by the City of Adelaide, were praised for providing sustainability incentives that help businesses install EV charging stations. Participants noted that infrastructure support, alongside tax incentives, is key to facilitating wider EV adoption, particularly for organisations.

Another participant acknowledged the importance of FBT incentives but noted that uncertainty around the tax delayed the assignment of EVs within organisation. Expressed optimism that clearer and more substantial government incentives would accelerate the adoption of EVs, particularly in corporate fleets.

Insights:

Clarity and Communication: Government incentives are necessary, but there needs to be better communication and clarity around how these incentives apply, especially regarding tax benefits like FBT.

Focus on Education: Government policies should not only focus on financial incentives but also prioritise educating communities, particularly disadvantaged ones, about the climate and economic benefits of EV adoption.

Infrastructure Investment: Long-term investments in charging infrastructure and electricity subsidies may have a greater impact on EV adoption than vehicle subsidies alone, particularly for businesses.

Support for Charging Infrastructure: Government incentives that support charging infrastructure are seen as crucial in encouraging the widespread adoption of EVs, both for individuals and businesses.

Tax Incentives and FBT: Tax incentives, particularly around FBT, are viewed as essential in driving EV adoption within organisations, but uncertainty around these policies can slow progress.

Quotes:

> "There's an issue with fringe benefits tax and how this would affect salary sacrificing arrangements."

> "Governments can fund education and awareness. It's not just about funding cars, but also about raising awareness so that people understand the real benefits."

> "Money going to better charging infrastructure—perhaps even subsidising the actual electricity—would help more than giving money to people buying the car."

> "Our City of Adelaide Council has had sustainability incentives. They might give you some funding toward installing chargers."

> "The sooner the government recognizes fringe benefits tax exemptions on EVs, the better. I would think a high percentage of staff who currently have assigned vehicles would opt for the EVs."

> "FBT has been a concern and a reason why we haven't moved more quickly to assigned vehicles."

Theme 8: Lessons Learned from the EV Trial

Several key lessons emerged from the EV trial. One of the most important takeaways was the need for clear and consistent communication, especially when onboarding new users or providing updates on EV usage. Reminders about EV training and fleet policies would help ensure smooth operations. Additionally, clearer instructions on specific features like cruise control and charging procedures could enhance the user experience and reduce confusion.

One of the participants emphasised the importance of convenient charging solutions and suggested that offering incentives, such as free or reduced-cost charging at work, could be a powerful way to encourage broader EV adoption.

Another lesson learned was the value of piloting new initiatives. By starting small, addressing concerns, and solving issues in a controlled environment, the organisation was able to confidently expand the trial. Ensuring that there are enough charging points for future expansions was also seen as critical.

Lastly, fleet manager pointed out that 99% of the organisation's activities could be accomplished with EVs. However, future focus should be on evaluating the cost and exploring different EV models to find more financially feasible options.

Insights:

Clear Communication: Consistent communication and regular reminders are essential for successful EV adoption, particularly when new employees join or processes change.

User Experience: Providing clear, upfront instructions about vehicle features and charging profiles would improve the overall user experience and reduce confusion during usage.

Incentives: Workplace incentives like free or discounted charging could significantly boost EV adoption, helping overcome cost and convenience barriers.

Piloting for Success: Piloting new EV initiatives allows organisations to address challenges in a controlled environment, building confidence before a broader rollout.

Quotes:

> "99% of what we do can be done with an EV. The main thing now is looking at costs and comparing different models."

> "I think just as clear communication as possible reminders like, 'Hey, you guys need to do this fleet refresher.'"

> "I wish I had read more about the car itself. I didn't look into the other features because I thought I could jump in and figure it out."

> "If there was some way of incentivizing UC employees to own EVs—maybe free parking or free charging—that would be massive."

> "Starting small and doing some pilots and trials builds confidence for everybody. We've made this work, now we can roll it out more broadly."

> "We could easily transition to EVs, I think, but we just have to make sure we've got enough charging points where they're stored."

Theme 9: Opportunities and Challenges for Expanding EV Adoption in Commercial Places

Participants identified several key challenges and opportunities for expanding EV adoption in commercial places. One of the main challenges is the availability of charging infrastructure, both at work and home. Ensuring that parking spaces have enough charging points and making home charging accessible are critical needs.

Another challenge is the cost of electricity versus fuel, as well as the environmental impact of charging EVs with non-renewable electricity. Powering EVs with renewable electricity will also be key to delivering emissions reductions benefits. Additionally, range anxiety and the cost of implementing charging infrastructure, particularly for businesses with large fleets or those operating in remote areas, remain significant concerns.

The high whole-life costs of EVs and uncertainty around their resale value (residual risk) are also barriers to adoption. Leasing is seen as a short-term solution, with the potential to shift toward purchasing as costs become more predictable.

Despite these challenges, there are significant opportunities, especially in reducing the carbon footprint of organisations. Comprehensive training programs, including both in-person and virtual inductions, are seen as important for easing the transition to EVs.

Insights:

Charging Infrastructure: Expanding EV adoption will require addressing the logistical challenges of installing sufficient charging infrastructure, both in commercial settings and residential areas.

Renewable Electricity Integration: A key opportunity lies in ensuring that charging infrastructure is sourced from renewable electricity, aligning with the goal of reducing carbon emissions.

Feasibility for Daily Operations: EV adoption is feasible for most day-to-day operations in commercial settings, but businesses must address infrastructure challenges for longer trips and remote locations.

Financial Considerations: The high upfront costs of EVs and uncertainties around their resale value are major barriers to adoption. Leasing provides a viable interim solution until purchase costs become more manageable.

Training and Support: Comprehensive training, including both face-to-face and virtual induction programs, can ease the transition to EVs and help employees adjust to the new technology.

Environmental and Financial Balance: Expanding EV adoption offers potential emissions benefits, but financial challenges, particularly related to costs and resale value, must be carefully managed.

Quotes:

> "The challenge is finding enough space for charging opportunities and also being able to park your car there—or equipping every home with a home charger."

> "The only motivation is saving the planet. If the power you're plugging into is coming from coal, what's the benefit?"

> "EVs are convenient for 99% of use cases, but for anything more than a 400 km drive, an ICE car is more convenient."

> "Whole-of-life costs are still on the high side, so we thought let's start with a bit of leasing."

> "Having an initial face-to-face induction, but then after that having an opportunity to refresh through a virtual online induction—I think it's really useful for staff."

> "The main opportunities would be reducing the footprint. The main challenges would be financial."

Theme 10: Personal EV Ownership

Participants expressed varying levels of readiness for personal EV ownership.

Several respondents indicated that they do not currently own an EV and do not plan to purchase or lease one in the next 12 months, primarily due to concerns about charging infrastructure and advancements in technology. One participant noted that the charging infrastructure in South Australia was not yet robust enough to justify purchasing an EV, but they might reconsider in 24 to 36 months. Another respondent mentioned that they are waiting for advancements in battery technology to support EV use at their off-grid property.

Among those already owning an EV, one participant has an EV through a novated lease and is considering buying the vehicle at the end of the lease or exploring fringe benefit tax options for a new lease. Another participant, while not owning an EV, is driving a hybrid and feels prepared to bring an EV home soon, given that they already have the necessary infrastructure, such as solar panels, in place. One of the participants, while interested in EVs, is holding off on purchasing until the market and technology mature further.

Insights:

Infrastructure Concerns: Personal EV adoption is delayed due to concerns about charging infrastructure, but participants are open to making the switch once the network improves.

Battery Technology: Some participants are waiting for advancements in battery technology to support EV ownership, particularly for off grid living.

Existing EV Ownership: For those already owning an EV, there is a commitment to continuing use, with plans to evaluate tax incentives and leasing options in the future.

Growing Interest: While some participants do not currently own an EV, they are open to adopting one in the near future, reflecting a growing interest in transitioning to EVs.

Prepared for Future Ownership: Even though some participants do not yet own an EV, they have prepared their homes with the necessary infrastructure, such as solar panels, to support future EV ownership.

Quotes:

> “I don’t think we’re going to have enough solar and battery capacity in our off-grid house to support an EV right now. We’re waiting for new battery technology to be released.”

> “I don’t think the infrastructure in South Australia is robust enough. Maybe in 24 or 36 months, that would be a different story.”

> “Potentially, when my three-year lease expires, I’ll buy off the balloon payment and just keep the car.”

> “I don’t personally own an EV, but I’m hoping I’ll be able to step into one in the future.”

> “I could easily plug in one or two EVs at my house, and I’ve got the infrastructure.”

> “I think I might get one more hybrid, then in five or six years, I’d be happy to go EV.”

5. Centacare

As part of this trial, Centacare added two EVs to their existing pool of vehicles.

Key factors contributing to the Centacare program's success included:

5.1. EV Bookings

The two EVs (2020 Hyundai Kona 4-Door SUV, 2021 MG ZS EV 4-Door Wagon) provided through the AGL EV Subscription were integrated into the existing vehicle pool.

Employees booked these EVs by submitting requests to the Fleet Manager.

Typically, the EVs were used for morning trips, such as site visits, with employees returning them to the office afterward. Upon their return, the EVs were promptly plugged into the charging stations at the designated charging bay to ensure they were recharged for the next use.

5.2. Analysing EV Charging Habits

To analyse charging behaviours, data from September 2023 to April 2024, has been collected, leading to the following insights. Significance of Dates is that Centacare received two EVs (Hyundai Kona and MG ZS) in September 2023.

4 EV chargers have been installed at two Centacare locations: 415 Grange Road & 45 Wakefield Street

From the data which has been collected from EV chargers, only two chargers located at 45 Wakefield Street recorded charging activity. This data has been used to analyse charging behaviours.

5.2.1. Charging Demand Time

During the baseline period from September 2023 to April 2024, charging patterns were more distributed, with on average 73% of charging occurring during evening hours (3:00 PM to 7:00 PM).

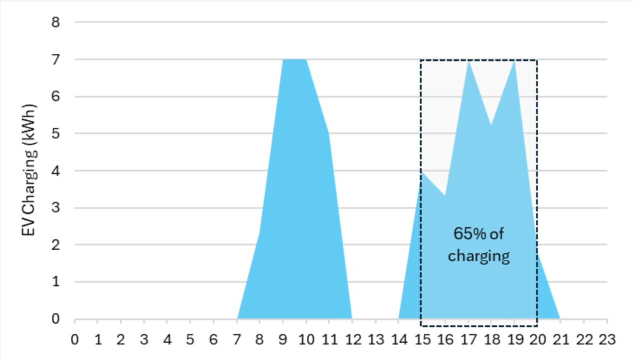
This concentrated evening charging occurs primarily because employees return EV to the base location after completing their daily activities. Once plugged in, these vehicles continue charging through the evening and overnight, ensuring full battery capacity for the following day's needs.

However, this charging schedule reveals a significant inefficiency: after reaching full charge, these vehicles remain idle and connected for extended periods—often 12-16 hours—before being used again. This presents a substantial opportunity to optimise charging processes by:

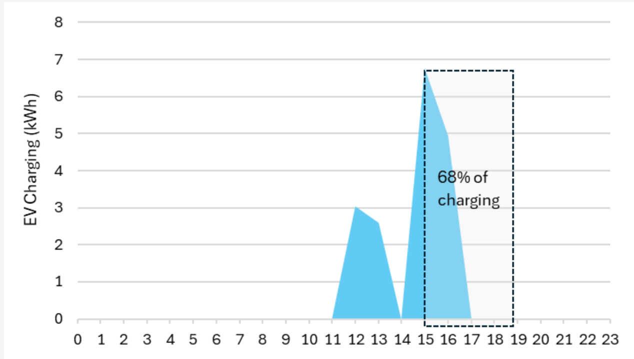
1. Shifting charging to overnight hours when electricity grid demand is typically lower

2. Aligning charging times with periods of high renewable electricity generation

3. Implementing smart charging systems that could distribute the load more evenly throughout low-demand periods



EV Charging Week Starting 18th Sep 2023



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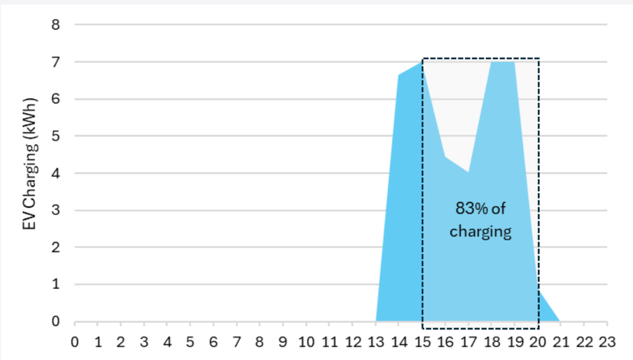

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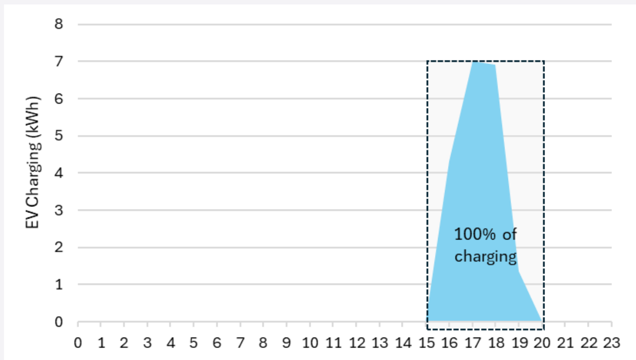
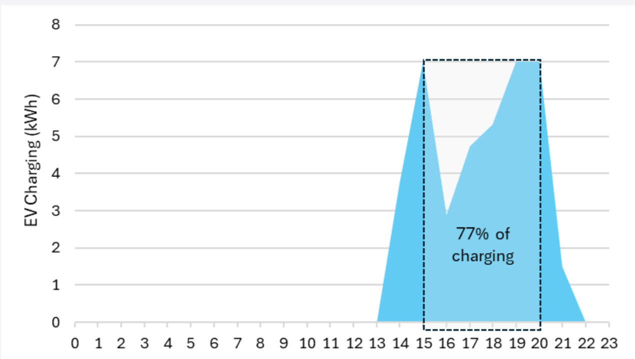
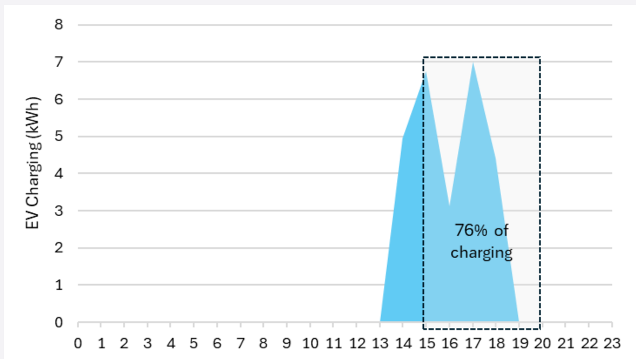


EV Charging Week Starting 15th Jan 2024



EV Charging Week Starting 12th Feb 2024



EV Charging Week Starting 8th April 2024

Figure 5.2.1: Charging demand time. The x-axis represents time of day; y-axis represents weekly average power consumption in kilowatt-hours (kWh).

5.2.2. Fleet Utilisation Analysis: EV Movement Patterns

By analysing session start and end times, we've gained insights into the Centacare EV fleet movement patterns.

The afternoon return cycle is notable, with 47% of charging sessions initiating between 4:00-6:00 PM. This significant end-of-day wave reflects employees completing their site visits and diligently connecting vehicles to chargers upon returning to the office.

The morning deployment pattern is equally defined, with 44% of vehicles being disconnected and taken out between 8:00-9:00 AM. This concentrated morning activity reveals how employees strategically schedule their field visits to maximise productive time on location.

The resulting 14-15 hours overnight charging window creates an optimal maintenance rhythm, ensuring each vehicle receives a full charge before the next day's operations without creating disruptions to next day schedules.

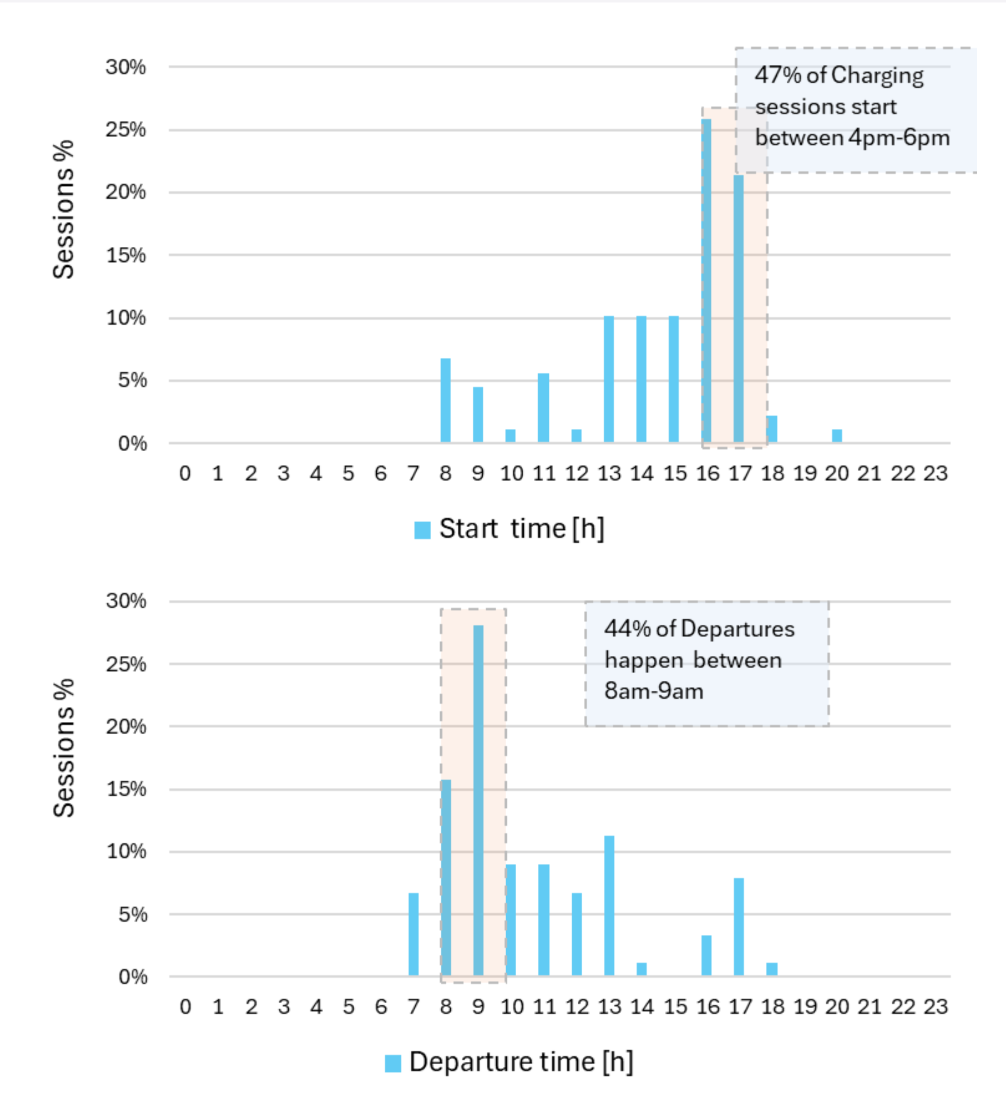


Figure 5.2.2: Distribution of sessions based on Start and Departure Times. Top graph: Morning arrival peak. Bottom graph: Evening departure peak.

5.2.3. Predictability of the Length of a Charging Session

a) The graph illustrates the relationship between session starting times and the duration of charging sessions. A clear pattern emerges, where most charging sessions begin between 2:00 PM and 5:00 PM, with the highest number of sessions occurring at 4:00 PM. During this peak period, the duration of charging sessions is also the longest, with total session hours connected close to 1084 hours which constitutes to 28% of total sessions connected hours, followed by 5 PM which takes 25% (973 hours) of total session connected hours.

This insight suggested that EVs are frequently plugged in for extended periods starting in the late afternoon. The duration of these sessions supported the implementation of a controlled charging, ensuring that vehicles are connected long enough to optimise charging during off-peak hours (1:00 AM to 6:00 AM). This also ensured sufficient charging for next-day use.

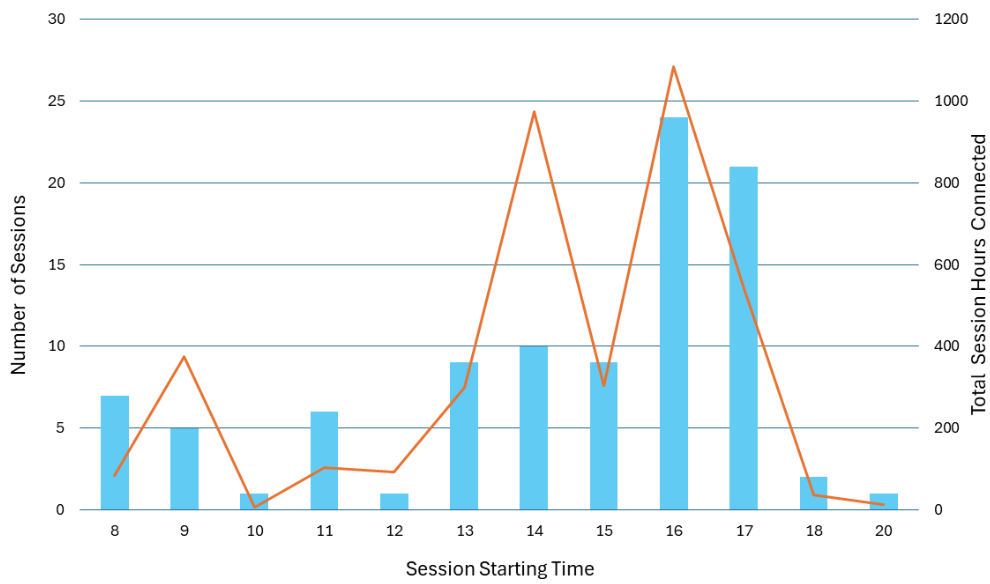


Figure 5.2.3 (a): Charging session start times and connection hours. X-axis: Time of day (8:00 AM–8:00 PM). Left Y-axis: Number of sessions (blue bars). Right Y-axis: Total connected hours (orange line).

b) Additionally, we analysed the distribution of charging sessions based on their duration. The data is represented by the blue line, which indicates the frequency of charging sessions by the number of hours EVs remained connected.

A key observation is that a substantial number of sessions are relatively long, typically exceeding 62 hours. Notable peaks around the 34, 38, and 89-hour marks account for 28% of the total charging duration.

When examining session lengths:

- Overnight sessions (less than 19 hours) represent 56% of all sessions but contribute only 22% of the total connection time. This indicates that EVs are commonly plugged in overnight and disconnected late in the morning.
- Extended sessions (over 24 hours) represent 30% of all sessions but account for a significant 66% of the total connection time. This suggested that EVs are frequently parked for extended durations, which negatively impacted overall utilisation, as further demonstrated by the utilisation graph (Section 5.2.4).

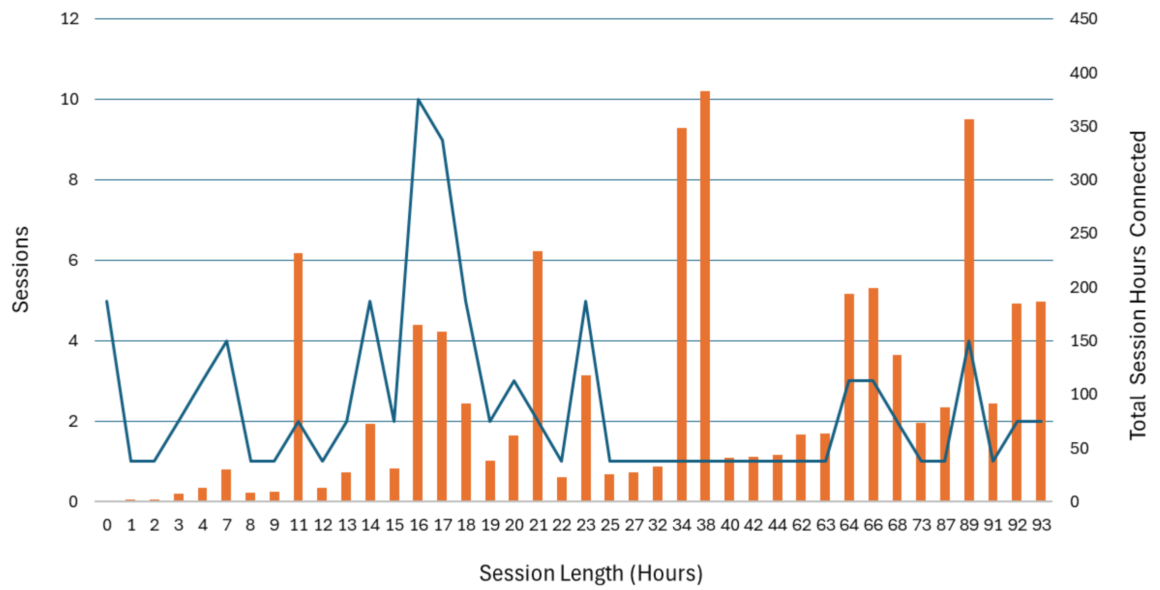


Figure 5.2.3 (b): Charging session length and connected hours. X-axis: Session length (0–93 hours). Left Y-axis: Number of sessions (blue line). Right Y-axis: Total connected hours (orange bars).

5.2.4. EV Utilisation

Centacare introduced EVs to their fleet in September 2023. During the initial baseline measurement period, these vehicles have achieved an average utilisation rate of approximately 50%.

In discussions with the Fleet Manager, the primary factor contributing to this underutilisation was identified as range anxiety among staff. Additionally, specific technical issues were encountered with one of the EV models in the fleet.

A notable challenge arose with one EV, the12-volt battery experienced accelerated power depletion beyond expected parameters. Multiple troubleshooting measures were implemented, including the removal of the vehicle's telematics device. Despite these interventions, the battery drainage issue persisted until the installation of a new 12-volt battery ultimately resolved the problem.

This technical difficulty negatively impacted staff confidence in the particular vehicle and contributed to its lower utilisation rate within the fleet. The experience has provided valuable insights into potential maintenance considerations when transitioning to electric vehicles in a fleet environment.

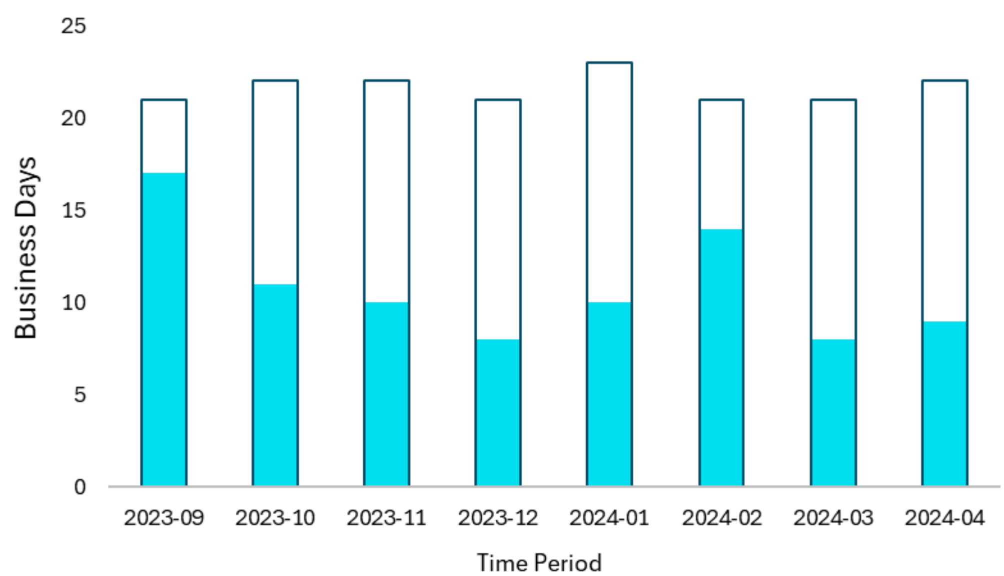


Figure 5.2.4: EV charger utilisation. The x-axis displays months, while the y-axis shows business days (0-25). Light blue bars represent days when chargers were used, and white sections show unused business days.

5.3. Qualitative Insights and Participant Feedback

To understand experiences and perspectives during the EV trial, we were able to conduct interview with fleet manager. The questions were aimed to explore motivations, daily use patterns, and challenges related to EV adoption, as well as broader topics like charging infrastructure and government policy. Employee interviews couldn't be arranged as one the employee who was using the EV left the organisation by the time we could arrange an interview.

Theme 1: Motivation for Participating in the EV Trial

Fleet manager mentioned that they were motivated by the opportunity to experience new EV technology and the shift in the automotive industry toward EVs. They were eager to learn about the charging infrastructure and how EVs fit into a commercial fleet.

> "The motivation at the start, from my point of view, was really around the new technology of the electric vehicle and what the future vehicle fleet in the world looks like."

Theme 2: Daily Usage and Charging Behaviour

EVs were kept at the main office, primarily used by teams requiring outreach work. However, not all employees utilised EVs consistently, and range anxiety affected their willingness to use the vehicles for longer trips.

> "I thought employees would be keen to try an EV, but most of the time, they would just play it safe and pick one of the petrol variants."

Theme 3: Experience vs. Expectations

Charging accessibility and the time required to charge fully were noted challenges. The charging infrastructure in South Australia was limited at the start of the trial, affecting their ability to rely solely on EVs.

> "If the EV's are not charged overnight, then it puts a bit of pressure on the next day. The infrastructure wasn't quite there at the start."

Theme 4: Barriers or Challenges with Charging Infrastructure

Early challenges included charging stations without supplied cables, requiring users to have their own. Range anxiety and the lack of reliable charging locations also posed challenges.

> "I was surprised; you had to have your own charging cable."

Theme 5: Role of Businesses in EV Adoption

Businesses have a critical role in supporting EV adoption through fleet purchases, which helps create a market for second-hand EVs, thus influencing the broader vehicle landscape.

> "If fleets don't prioritise safety or new technology, it just makes the Australian vehicles on the road poorer quality."

Theme 6: Lessons Learned from the EV Trial

The trial highlighted the need for better education and training on EV usage, as well as understanding the technical challenges of charger installations, such as managing power supply and connections.

> "The whole installation of the chargers was all new… a real learning curve for me."

Theme 7: Government Policies and Incentives

Fleet manager acknowledged that current government policies are helpful, especially with emissions standards improving. Felt that government fleet transitions to EVs set a positive example.

> "As they adopt and change their vehicles, it's only going to be better for the Australian fleet."

Theme 8. Opportunities and Challenges for Expanding EV Adoption

The primary challenges include vehicle costs, reimbursement logistics for home charging, and infrastructure requirements. The opportunity lies in improving infrastructure and educating employees.

> "We're probably waiting to see some of the other not-for-profits, how they do things, and we'll follow suit."

Theme 9. Personal EV Ownership Plans

Cautious about committing to new EV brands that lack an established reputation, especially when compared to long-standing brands like Toyota and Subaru.

> "There's still a little bit of, uncertainty about new manufacturers, they haven't built up trust yet."

6. Residential Fleet Charging Support

6.1. Uniting Communities

In August 2024, Uniting Communities successfully implemented a pilot program to evaluate employee-based EV charging infrastructure. Despite initial hesitation due to fringe benefit tax implications limiting broad employee participation, the trial proceeded with one participant who expressed strong interest in transitioning to an EV. This trial provided valuable insights into residential charging patterns and demonstrated the potential for peak load management through controlled charging protocols.

6.2. Uptake of EV's by Employees

Employee uptake of EVs as assigned vehicles was hindered by financial disincentives related to home charging. Specifically, the installation of a charger at an employee's home triggered Fringe Benefit Tax (FBT) implications, adding the charger's cost to their total remuneration and increasing their tax burden. In addition to this, there was a lack of clarity regarding the financial impacts on employees with pre-existing salary sacrifice arrangements if they were to install charging infrastructure at their homes.

6.3. Installation Overview

The residential installation featured an Ocular IQ Solar charging unit with a 7kW output capacity, fully compliant with OCPP 1.6 protocols. The system's connectivity was enabled through a Smart 4G module utilising a Telstra M2M 4G SIM card. For monitoring and programming capabilities, we utilised the Exploren EV Charging platform, which provided comprehensive data collection and charger management functionality.

6.4. Technical Implementation

The installation process was straightforward, requiring no significant modifications to the existing residential switchboard. At the participant's request, we installed a 10-meter charging cable to ensure optimal parking flexibility. The charging unit's integration with the home's electrical infrastructure was seamless, allowing for immediate deployment and testing.

6.5. Data Collection and Analysis

Our monitoring approach consisted of two distinct phases:

1. Initial Observation Phase: We first monitored natural charging behaviours without implementing any controls, allowing us to establish baseline usage patterns.

2. Controlled Charging Phase: Based on the observed patterns, we implemented optimised charging profiles through the Exploren API.

Key Findings:

The trial location's proximity to the Uniting Communities office (less than 5km) resulted in relatively modest charging requirements. However, the data revealed significant insights into charging behaviours:

1. Uncontrolled Charging Period:

- The predominant charging activity occurred during peak periods
- Charging patterns closely followed end-of-workday arrival times

2. Controlled Charging Period:

- Peak period charging kWh decreased by 38%
- Off-peak charging utilisation went from 0 to 42 kWh
- Solar-optimal charging was enabled between 10:00 AM and 4:00 PM to maximise the benefit of the participant's existing PV system

Controlled charging in residential setting, demonstrated that intelligent charging management can significantly shift charging loads to more favourable periods while maintaining user convenience.

Charging Type	Period	Electricity Consumption (kWh)	Solar Sponge Period (10:00 AM – 3:00 PM) (kWh)	Peak- Period (6:00 AM – 10:00 AM and 3:00 PM – 1:00 AM) (kWh)	Off-Peak Period (1:00 AM – 6:00 AM) (kWh)
Controlled Charging	2 Weeks (2 to 15 September)	81	0	81	0
Uncontrolled Charging	2 Weeks (14 to 27 October)	92	0	50 (↓ 46pp)	42 (↑ 46 pp)

* Percentage point

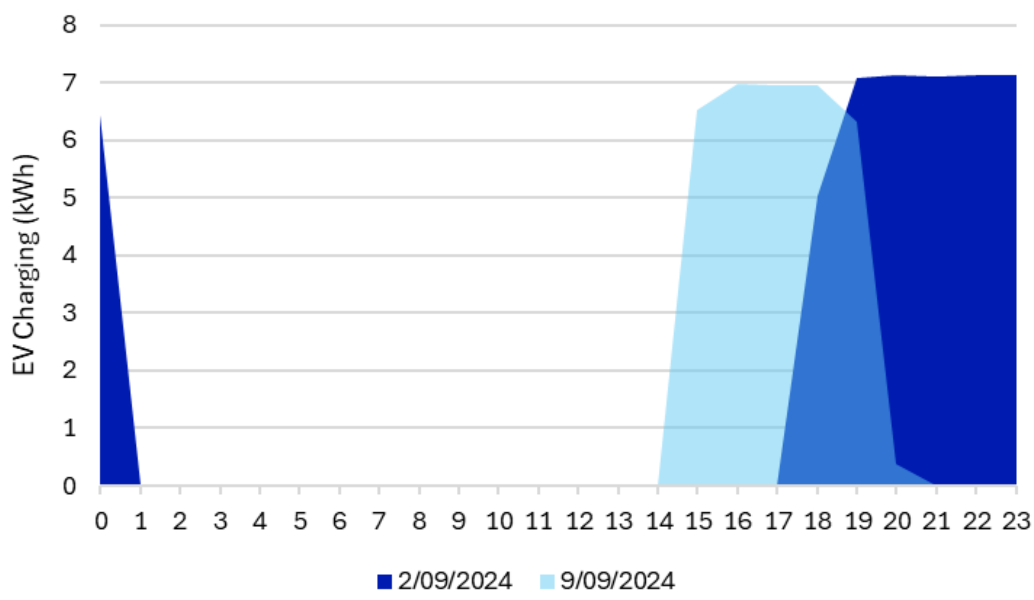


Figure 6.5 (a): Power consumption (in kWh) over a 24hour period over two time periods where EV happened in an uncontrolled manner (charging commenced after plugin). The x-axis represents the time of day, while the y-axis represents the power consumption in kWh.

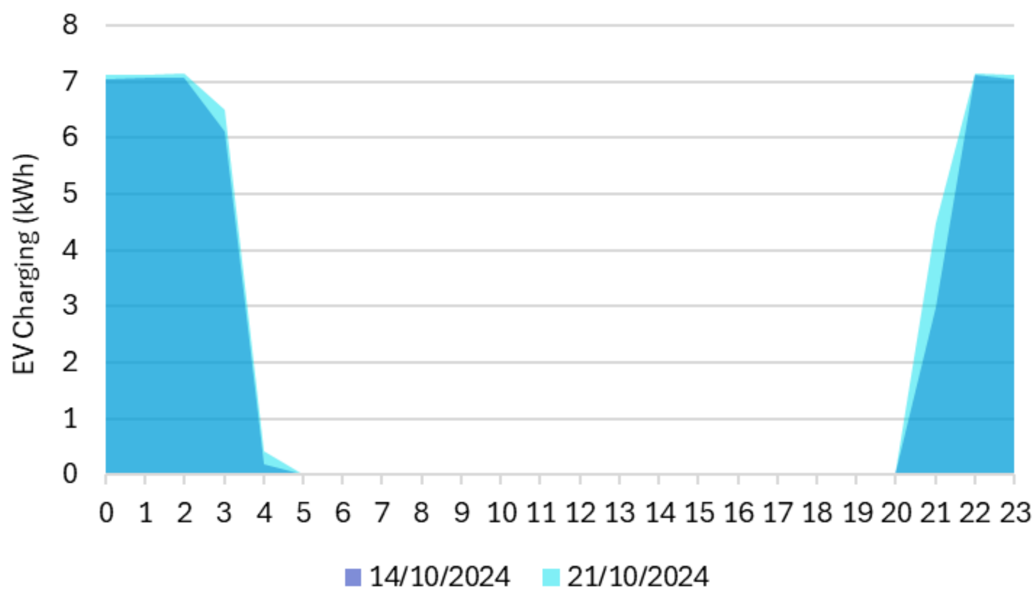


Figure 6.5 (b): Power consumption (in kWh) over a 24hour period over two time periods where EV happened in a controlled manner. The x-axis represents the time of day, while the y-axis represents the power consumption in kWh.

6.6. Wilson Parking

Wilson Parking received two EVs in November 2022:

- **EV1:** 2021 Tesla Model 3 (assigned to an employee)
- **EV2:** 2021 MG ZS (used as a pool vehicle)

6.6.1. Charging Infrastructure and Usage Patterns

Assigned Vehicle (EV1)

One employee used a Type 1 charger at home and Wilson Parking EV chargers when the vehicle was parked at Wilson Parking office location. Due to the Type 1 home charger used at home, charging behaviour at home could not be monitored directly.

Pool Vehicle (EV2)

This vehicle served operational purposes and was charged opportunistically at various available Wilson Parking stations installed as part of this trial. With charging events distributed across multiple chargers, it was not possible to establish consistent charging patterns for this vehicle.

Vehicle telematics data was unavailable for both vehicles due to the limitations outlined in Section 3.9.

Key Findings

Dedicated charging bay assignments proved crucial for effective data collection. When charging bays are consistently assigned to specific users, individual charging behaviours and customisation of charging profiles based on specific usage patterns can done accurately.

Two EVs were returned back by Wilson Parking in June 2024, as a result of this controlled charging experiments could not be implemented.

7. Future Areas of Exploration

Based on key insights derived from the Commercial Fleet SA Smart Charging Trial, the following actionable steps have been identified to address current limitations and challenges. Implementing these steps is crucial for accelerating the adoption of electric vehicles within commercial fleets across South Australia.

7.1. Expand Implementation and Scale

- Broader Fleet Transition: Expand the number of EVs across participating organisations, building on the success of the pilot program, particularly at Uniting Communities with their 88% utilisation rate.
- Extend Smart Charging Infrastructure: Install additional charging points at key locations to support a larger EV fleet and ensure charging accessibility.
- Include more Organisations: Recruit additional commercial and government fleet operators to diversify the implementation scenarios and gather more comprehensive data.

7.2. Technology Enhancements

- Upgrade to OCPP 2.0.1: By upgrading to newer charging protocols, it would enable State of Charge (SOC) data collection much simpler, which would significantly improve charging optimisation capabilities.
- Improve Data Collection Systems: Develop more reliable telematics solutions that do not drain vehicle batteries and provide consistent data access.
- EV Charging Knowledge Base: Establishing a comprehensive EV Charging Knowledge Base, focused on detailed documentation and best practice dissemination, can significantly mitigate the learning curve associated with EV charger interaction and smart charging strategy implementation.

7.3. Financial and Policy Development

- Develop Cost-Benefit Models: Create detailed financial models for organisations to evaluate the total cost of ownership for EVs versus conventional vehicles, including smart charging benefits.
- Address FBT Implications: Allow organisations to work with government stakeholders to clarify and potentially reform Fringe Benefit Tax implications for home charging infrastructure to encourage employee uptake.
- Incentive Programs: Design and propose targeted incentive programs for commercial fleet operators that specifically support charging infrastructure investments.

7.4. User Experience and Training

- Standardised Training Program: Develop a comprehensive training package based on successful approaches from Uniting Communities so that other organisations can implement the best practices.
- Charging Process Simplification: Streamline the charging authentication and connection process to reduce user errors and improve adoption.
- Address Range Anxiety: Create educational materials and tools to help fleet managers and employees better understand actual range requirements versus perceived needs.

7.5. Advanced Smart Charging Development

- Dynamic Price Response: Explore more sophisticated charging controls that respond to real-time electricity pricing and grid conditions.
- Vehicle-to-Grid (V2G) Pilot: Explore bidirectional charging capabilities where appropriate, to test the potential of fleet vehicles for grid services.
- Renewable Integration: Further optimise charging schedules to align with on-site renewable electricity generation, potentially incorporating weather forecasting data. (Uniting Communities has a 55kW Solar System installed)

7.6. Monitoring and Reporting Framework

- Automated Reporting Tools: Create user-friendly dashboards for fleet managers to track EV utilisation, charging patterns, and cost savings.
- Climate Impact Assessment: Implement more detailed tracking of carbon emissions reductions through smart charging to quantify sustainability benefits.

7.7. Knowledge Sharing and Industry Engagement

- Case Study Development: Create detailed case studies from Uniting Communities and Centacare that highlight both success factors and challenges.
- Industry Workshops: Host knowledge-sharing sessions for fleet managers and sustainability officers from other organisations.
- Policy Recommendations: Develop a comprehensive set of policy recommendations for government stakeholders based on trial findings.

AGL recently launch its innovative Vehicle-to-Grid trial which aims to help customers maximise the potential of their electric vehicles by using them not only as a form of transport but also as a source of energy to power their homes.

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