



Western Australia Electric Vehicle Owners

Behaviours, Attitudes, and Policy

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October 2023





Electric Vehicles (EVs) are a key pillar to meet the Western Australian (WA) Government's commitment to achieving net-zero greenhouse gas emissions by 2050 but are poised to significantly impact the energy landscape.

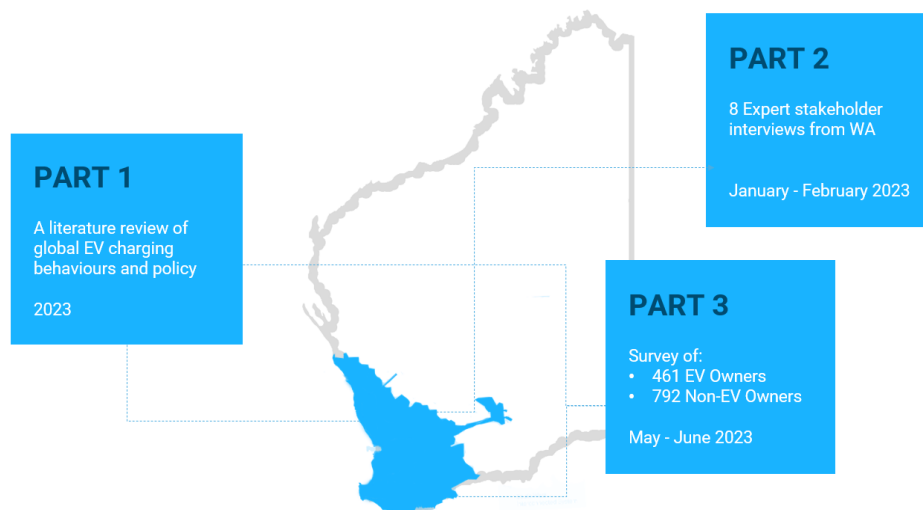
The electricity grid in WA is isolated from and unique compared to those in the eastern states, with high solar penetration, a large low-density demand footprint and distinct rules and regulations. This, coupled with the under-studied charging behaviours of WA's EV owners, creates a compelling need for dedicated research.

The Western Australian (WA) Government is proactively assessing strategies to mitigate potential grid challenges posed by EV charging. This study responds to Action 25 of the Electric Vehicle Action Plan¹ to understand EV consumer preferences and behaviours.

In this study, we conducted an online survey of 1,253 Western Australians, including 461 EV owners and 792 non-EV owners to understand their:

- demographics,
- purchasing decisions and motivations,
- charging behaviours², and
- views on different mechanisms to manage EV charging³.

We used these findings, as well as the insights from 8 interviews with energy and transport experts in WA and a review of global and Australian work in this space to form policy recommendations.



¹ *Electric Vehicle Action Plan, 2021*, Energy Policy Western Australia

² Only asked to current EV owners

³ Only asked to current EV owners



What charging behaviours should we incentivise?

EV uptake in Western Australia is still in its early stages but is growing rapidly, accounting for 2.8% of new vehicle sales in 2022, up to 7.5% for the first half of 2023⁴. Once uptake reaches the mainstream, EVs will create a material new electrical demand which if not managed could impact the electricity grid at the low- and medium-voltage networks in the South-West Interconnected System (SWIS).

EVs are a completely new type of distributed energy resource and have flexibility as to when they can recharge. Depending on where and when they charge, they can be both a threat to grid stability with the potential to exacerbate peak demand, or a significant opportunity to soak up excess solar generation during the middle of the day (and support peak times via Vehicle to Grid (V2G)).

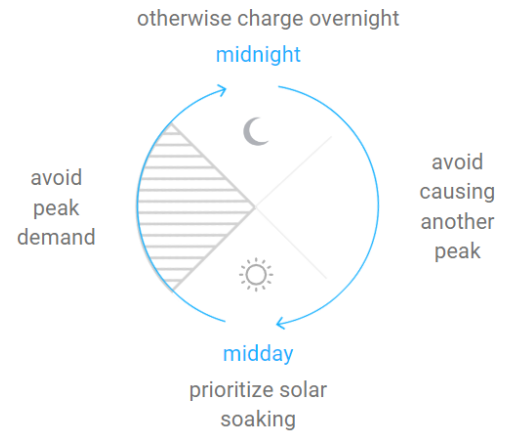
The following charging behaviours should be incentivised in order to avoid these issues and achieve the benefits⁵:

1. avoid charging during the 3pm-9pm peak demand period
2. shift charging to the middle of the day (when system load is low and output from rooftop solar is plentiful) or overnight
3. avoid creating additional coincident peak charging periods that result in localised network constraints
4. use Level 2 smart chargers (which offer charge rates of 7 kW single phase) with the ability to set charging schedules and can ramp up to take full advantage of ideal charging windows
5. consider local conditions to avoid reverse flows from high solar generation (*performed by an aggregator*)

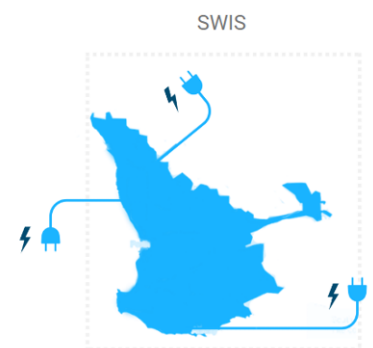
We found that the **EV Owners in WA are already broadly following these recommendations**: a high proportion are beginning their charging during the day and avoiding charging at the peak system demand time, and are using dedicated chargers to manage their consumption.

⁴ *State of Electric Vehicles, 2023*, Electric Vehicle Council.

⁵ Based on global and Australian research, expert stakeholder interviews, and Western Power modelling.



Use L2 dedicated smart chargers with remote energy management capabilities.
Use preset charging schedules



Consider local conditions:

- charge during periods of local low demand
- stop or reduce charging during periods of local high demand



Who are the WA early adopters?

EV owners in WA generally fit the early adopter profile that has been seen globally - they are predominantly male, 45-54 years of age, living in houses, full time or retired, and have a high household income. It is likely that the majority of these drivers are Tesla owners⁶.

WA EV owners are very likely to also own and use rooftop solar, just like the 75% of the survey respondents. They are also much more likely than the general public to use time of use tariffs (TOU), with approximately 43% of survey respondents on one compared to approximately 0.6% of the general population⁷.



As such the patterns and perspectives found in this survey may not be representative of future EV owners in Western Australia once EV uptake increases, and more work should be done to understand the patterns of poorly represented demographic groups which will be included in the subsequent waves of EV owners.

EV Owners in WA fit the early adopter profile and are more likely to be energy literate compared to the general population - also opting for rooftop solar and time of use tariffs.

⁶ This was not directly asked in the survey, but was rather extrapolated based on EV sales history.

⁷ There are approximately 6,000 residential customers under a Synergy TOU tariff compared to approximately 1 million residential customers in the SWIS.

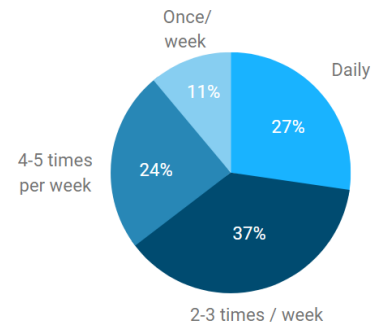


How are EV Owners in WA charging?

WA EV owners, like other Australian and global EV owners, overwhelmingly reported that they charge at home (84%), with some charging at public charging stations or at their workplaces. They primarily use their EVs to commute to work or perform work-related business, and travel for social and recreational reasons, completing trips under 30 minutes.

They are not all charging with the same regularity. Most of the respondents only charge as needed once to a few times per week, while around a quarter of respondents typically charge every day.

More than half (55%) of WA EV owners already use a dedicated charger to charge, and similar to international studies, the likelihood seems to increase with higher income levels. These chargers offer higher charge rates compared to the standard wall plug and likely include a combination of smart chargers (with charge management and charge scheduling abilities), and dedicated chargers (with limited functionalities). Level 2 EV chargers with smart charging capabilities are essential to enable charging which supports a high renewable energy system.



There are two main charging patterns: top up every day -top up as needed (every 2-3 days). Both patterns could support good charging behaviours



84%

charge at home - consistent across all employment types



6%

charge at work



10%

charge at public chargers



55%

use a dedicated charger at home



42%

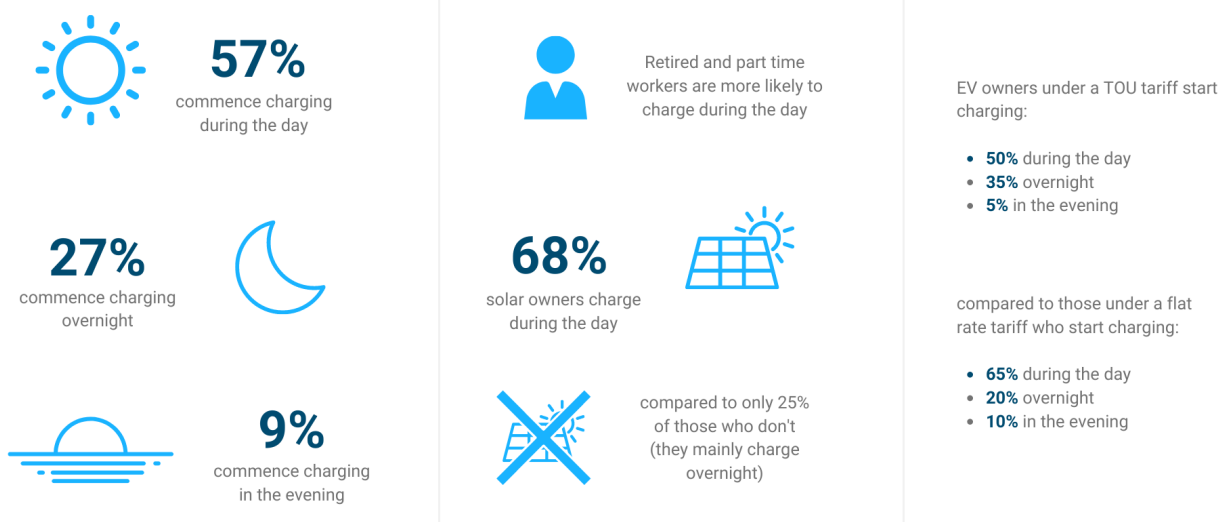
use a standard wall plug at home

Higher income is correlated with using a dedicated charger



Early adopters in WA are opting to start their charging during the day (57%) or overnight (27%) compared to during the peak evening period (9%). This is strongly driven by the proportion of EV owners who also have rooftop solar, with those who don't more likely to begin their charging overnight. This trend is aligned with other Australian studies⁸. Incentivising solar will likely have a positive carry-on effect on incentivising EVs to charge during the day.

Retired and part time workers are more likely to charge during the day than others, but a notable share of full-time and casual employees are also engaging in day-time charging behaviour. EV owners residing in houses are far more likely to start charging during the day than those in apartments and units, which may be coupled with the fact that solar owners are more likely to live in detached houses.



EV owners under a TOU tariff are less likely to begin charging in the evening during the peak demand than those under a flat rate tariff, and are more likely to charge overnight. The fact that the TOU tariff users charge less during the daytime may indicate that these users are on a legacy TOU plan rather than the current Synergy Electric Vehicle Add On plan, which has a super-off peak low tariff during the daytime (9 AM to 3 PM), or may indicate that these owners have an inability to shift charging to the middle of the day.

⁸ Including: *Driving and charging an EV in Australia: A real-world analysis*, 2022, T. Phillip, K. Lim, and J. Whitehead
EV SmartCharge Queensland insights report, 2023, Ergon and Energex
Insights into electric vehicle ownership: A survey of Tesla Owners Club Australia members in partnership with the Electric Vehicle Council, 2022, Electric Vehicle Council



Unlike the early adopters in other countries, WA EV owners seem to be largely charging in a way that is conducive to the operation of the SWIS - avoiding starting their charging in the peak demand period and instead shifting this to the day or overnight periods in the absence of direct charging management. WA EV owners also seem to actively manage their charging more than we might expect, are likely to have a dedicated Level 2 charger at home and are more likely to participate in TOU tariffs and have solar than the general population.

This is a highly encouraging finding, as early adopters will spread their EV experiences and influence subsequent waves of EV owners. However, given that early adopters fit one specific demographic, it is not a given that this behaviour will continue if left unmanaged. The WA government has a role to play to shape and guide the purchasing decisions and behaviours of the current and next cohort of EV buyers to ensure efficient interactions with the electricity grid moving forward.

Early adopter EV owners in WA are already charging aligned to the grid's needs and seem to be particularly motivated by solar, but the WA Government has a role to play to ensure these behaviours are retained as EV ownership becomes mainstream.

What do WA EV owners think about charging policy measures?

We asked the WA EV owners about their opinions regarding various mechanisms to manage EV charging and their willingness to change their existing behaviour in response to these mechanisms. While a significant 84% of respondents affirmed the belief that the power network should be equipped to accommodate EV charging at any moment, irrespective of the associated costs, a majority of respondents (82%) were willing to adjust their EV charging habits during periods of network strain, demonstrating a cooperative approach to power supply management.

Over 70% of WA EV owners agreed or somewhat agreed with all the key mechanisms to manage EV charging, while also being willing to change their behaviours in response to these mechanisms. This is a very encouraging finding for managing EV charging going forth, and is supported by other Australian studies⁹.

In particular, respondents overwhelmingly agreed they would change their charging behaviours in response to TOU tariffs and smart chargers. 90% of respondents either agreed or somewhat agreed that they are willing to change their charging behaviours for TOU tariffs, a trend that is consistent between income levels and employment types.

⁹ Like *AGL EV orchestration trial lessons learnt: Report Four*, 2021, AGL; *EV SmartCharge Queensland insights report*, 2023, Ergon and Energex; *Driving and charging an EV in Australia: A real-world analysis*, 2022, T. Phillip, K. Lim, and J. Whitehead



90%

are open to changing their charging behaviour in response to time of use tariffs

80%

agree that time of use tariffs are an effective way to price electricity

80%

are open to investing in smart chargers

73%

are happy for their charging to be remotely managed by their energy provider*

67%

would be open to their charging being halted or delays to avoid a power outage

* if it means it will be cheaper and as long as the EV has enough charge to meet their needs

Around 90% of EV owners think that automatic charge management through smart chargers is a good way to manage an EV and indicate that they would like one to receive the faster charge speeds, but fewer (80%) would be actually willing to purchase one. This discrepancy highlights that there is some need for education and incentives for smart chargers before purchase even for these early adopters.

When it comes to more direct forms of charging management, like direct messaging and external charge control, the majority of EV owners in WA are still positive, but there is a larger cohort which are either hesitant (somewhat agree or somewhat disagree) or disagree with this mechanism than for TOU tariffs and smart chargers.

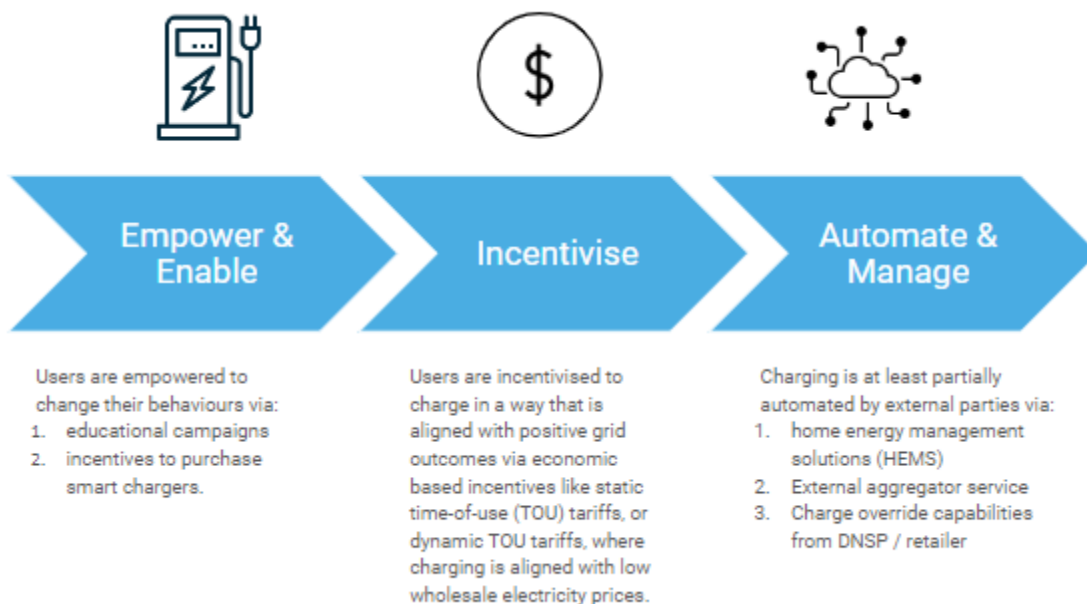
The idea of their energy provider remotely charging their EV was accepted by 73% of respondents, while a slightly lower 67% of respondents were open to interruptions or delays in their EV charging to prevent a power outage. Similarly, 76% of respondents agreed or somewhat agreed that direct messages to avoid charging during constraints would be an effective way to manage the power supply, but at the same time, 63% were concerned that such direct messages could negatively impact the convenience of EV ownership.

The majority of WA EV owners are positive towards managed charging measures. Measures that give the EV owner more control, like TOU tariffs and automated charge management using smart chargers are more accepted than external charge management measures like direct messaging and remote management by an energy provider.

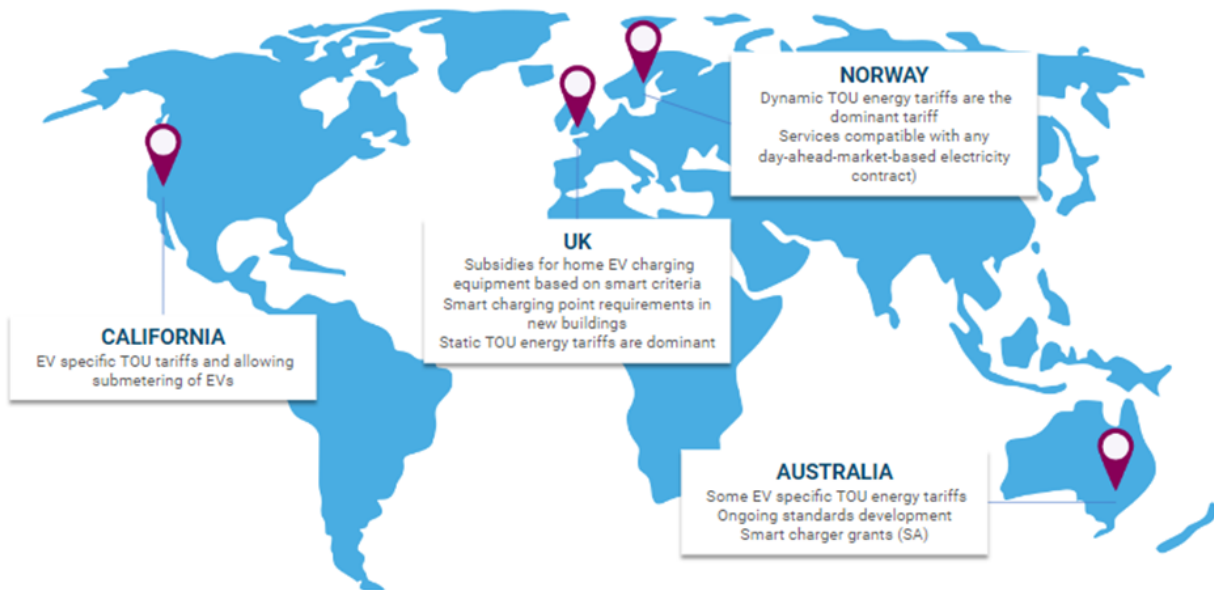


What charging policy is happening globally?

There are numerous different policy positions that have been used globally to influence EV charging behaviours. Broadly speaking, these positions fall across a spectrum of the level of intervention they enforce. At one end they are designed to empower and enable EV drivers to change their charging behaviours via education or enabling technologies like smart chargers, incentivising charging behaviours financially, at the other end they remotely control charging either by the user, an external aggregator service, or by a distribution network service provider (DNSP) or retailer.



Enabling and incentivising policies have been the most popular globally to date, including providing rebates or subsidies for smart chargers and promoting static TOU tariffs. Few jurisdictions are mandating automated charging, but there are many trials for charging aggregation both globally and in Australia, as well some instances of charge override capabilities. The following image shows examples of EV charging behaviour policy positions in selected markets.



What do the experts in WA think about charging policy measures?

We interviewed eight experts in the WA and Federal Governments and community advocacy groups. Specifically, the discussions focused on their concerns if EV charging behaviour is not regulated, and their recommendations to manage EV charging behaviour. The experts' concerns largely fell into the following categories:

Grid impacts of unmanaged charging

Including network constraints during peak demand and the need for high-cost infrastructure upgrades.

Regulatory challenges

The non-contestability of EV customers in the SWIS which may not incentivise innovative EV charging solutions through third party aggregation.

Behavioural resistance

EV owners may resist policies to shift EV charging behaviour due to lack of understanding, trust barriers or inconvenience.

Balancing management with user experience

Finding an equilibrium between accommodating customer demands and ensuring the reliability of the power grid.

The experts raised multiple strategies to manage these concerns that align with the literature, including the adoption of time-of-use or peak/off-peak pricing structures, promoting smart chargers and providing a clear direction on what types of charging behaviour should be encouraged, and education campaigns.



How can we support future EV owners to follow good charging practices?

The charging behaviours and perspectives of WA early adopters is highly encouraging; however, it is not a given that this behaviour will continue if left unmanaged. The WA government has a role to play to shape and guide the purchasing decisions and behaviours of the current and next cohort of EV buyers to ensure efficient interactions with the electricity grid moving forward.

EV charging policy should keep supporting the levers currently incentivising good charging behaviours (e.g. rooftop solar, smart charger and ToU adoption) and introduce new levers to prevent new EV owners adopting poor charging behaviours.

Everenergi recommends seven key action items in two tranches as per the following figure, based on the global policy positions, opinions of WA expert stakeholders, and the behaviours and perspectives of WA EV early adopters.

The first tranche contains three policy mechanisms which together will largely drive EV charging behaviours into the periods of the day that will suit the grid and support the consumption of surplus solar on the grid. They include **education programs, encouraging smart chargers, and refining and promoting time of use tariffs**. This tranche can be implemented in the near term to support current and subsequent cohorts of EV owners.

The second tranche contains three policy mechanisms which will drive knowledge gathering and inform future policy. These actions are designed to be implemented in the near to mid-term to support future EV owners. **Gathering more data** by conducting periodic user behaviour surveys and measuring charging data is a vital step to informing future policy. More intelligent energy management systems including charging control, aggregation services and home energy management had widespread approval but there is a proportion of EV owners and expert stakeholders who were hesitant and therefore we recommend **trailing direct messaging and aggregation services**.

The final and seventh recommendation is to continue to **shape national standards and policy**. Consistent national standards for charging equipment that are thoughtfully integrated into broader policy for distributed energy resources and infrastructure planning and development are needed to realise the benefits of EVs and avoid their challenges. This should include bi-directional charging standards and policies as well as building standards for EV readiness.



TRANCHE 1

1 EDUCATION PROGRAMS

EV owners seem happy to adopt smart charging behaviours and TOU tariffs when they understand the benefits this can provide to themselves and the grid.

Educate future EV owners on the benefits of and how to use smart chargers and TOU tariffs.



2 ENCOURAGE SMART CHARGERS

Encouraging the continued high level of 7kW (or higher) smart chargers is a fundamental requirement to enable EV owners more flexibility in when they can charge.

Financial incentives should be considered for early adopters to mitigate the higher upfront costs of smart chargers as part of EV trials (see Tranche 2).



3 REFINE AND PROMOTE TIME OF USE TARIFFS

Implementing TOU tariffs for educated EV owners was almost unanimously accepted and could be made an opt-out requirement for those who access the smart charger incentive program without material impact on EV adoption or sentiment of EV owners.



TRANCHE 2

4 GATHER MORE DATA

Conduct periodic user surveys and in-depth charging pattern studies to provide insights that shape future EV strategies

5 TRIAL DIRECT MESSAGING

to customers during localised network constraints to either stop or start charging to determine effectiveness.

6 TRIAL AGGREGATION SERVICES

To build consumer understanding and explore the potential benefits to the EV owner and the grid, including external EV charging management via smart chargers and bi-directional charging aggregation services.

7 CONTINUE TO SHAPE NATIONAL STANDARDS

Continue to work with federal and state governments to shape national standards for EV charging infrastructure and grid policy.