

Leading the Charge in Bidirectional Charging

Being a V2G Trailblazer:
Lessons for Mass Market Adoption



V2G in Australia: Insights from Early Adopters

In Australia, Vehicle-to-Grid (V2G) technology is emerging as a game-changer in the transition to a more sustainable and resilient energy system. V2G allows electric vehicles (EVs) to draw power from the grid and return stored energy back, supporting household energy needs and reducing strain during peak demand.

Despite its potential, the current journey to adopting V2G is difficult, with early adopters facing significant hurdles. There are a lack of compatible vehicles and bidirectional chargers, and complex regulatory and installation processes. Some of these barriers are being addressed by new standards, but others will take time and effort by government and industry to resolve.

As part of a research project, we spoke with five early adopters who are already using V2G in NSW and SA to understand their journey to get set up. Their stories showcase V2G's immense potential to improve the lives of users and benefit Australia's energy system. Their experiences also identify the challenges V2G adopters currently face. Addressing the challenges they've faced offers a pathway to accelerating V2G adoption for the general public.



What is Bidirectional Charging ?

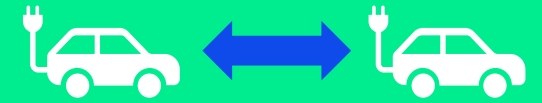
Bidirectional charging is EV charging that goes both ways, turning the EVs into “mobile batteries”.

It allows electricity to flow back out of cars to power appliances, homes, offices, and even sell electricity back to the grid.

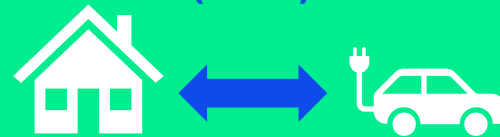
Vehicle-to-Load (V2L)



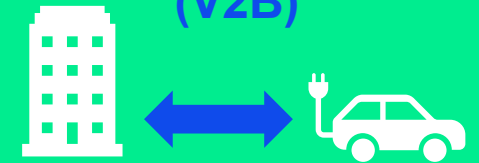
Vehicle-to-Vehicle (V2V)



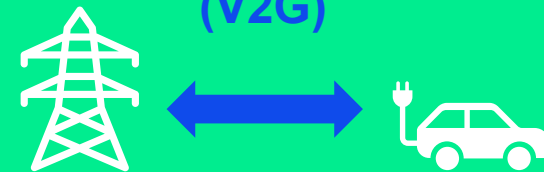
Vehicle-to-Home (V2H)



Vehicle-to-Building (V2B)



Vehicle-to-Grid (V2G)



The potential benefits of V2G

V2G maximises value for users

- Earn additional revenue from participating in the electricity market.
- Make bill savings from using your car battery instead of grid electricity.
- Maximise the value of any onsite-generated electricity from your rooftop solar.
- Help utilise the battery of your EV while it's parked at home.
- Removes the need to purchase a residential battery if you want to store energy from your rooftop solar.

V2G builds resilience

- Help households and businesses become more energy independent and self sufficient.
- Improve business resilience to climate change and contribute to net zero commitments.
- Provide power during power outages.

V2G supports the energy transition

- Power your home or business with renewable electricity even when the sun isn't shining (if solar energy is used to charge your EV).
- Support the greater integration of renewables on the grid through storing electricity when it's cheap and plentiful, then discharging when it's needed most.
- Help households and businesses avoid peak rates and demand charges.
- Contribute to bringing down the total cost of fleet ownership, helping organisations decarbonise their transport.

V2G supports the grid

- Potential to be a major and cost-effective source of flexible demand for those managing the grid.
- Ability to reduce the amount of expenditure grid operators need to invest for electricity infrastructure upgrades.



About the partners

Leading the Charge in Bidirectional Charging is a collaboration between research and industry organisations.

The fourth, unofficial, partner for the project is the Australian motoring public.



The Institute for Sustainable Futures (ISF) is a transdisciplinary research and consulting organisation within the University of Technology, Sydney. ISF conducts project-based research in line with our mission to create change towards sustainable futures. ISF works with a range of clients to support them in reaching their sustainability goals. ISF's Graduate Research Program, short courses and enterprise learning offerings equip individuals and organisations with vital skills and the knowledge they need to lead and enact positive change.



The NRMA is a member-owned organisation with over 3 million members and a 100-year history of advocating on behalf of motorists, and providing a range of member services across Road, Travel and Rewards. The NRMA is proud to co-fund this research as part of our commitment to 'accelerate the electric transition' in transport and tourism, along with building Australia's national electric vehicle (EV) charging network, offering a range of EV services from Roadside to Sixt car rental to EV-ready holiday parks, advocating for sustainable transport policy, and producing EV education and content via our EV Hub, Open Road magazine, and online channels.



iMOVE is the national centre for collaborative R&D in transport and mobility. It facilitates, supports and co-funds research projects that improve the way people and goods move in Australia. It has partnered with 70+ industry, government and academic partners and has over 260 projects completed or currently underway in a broad range of transport areas. Find out more about our work: www.imoveaustralia.com

01

Key findings



A day in the life of a V2G user

We conducted deep-dive interviews with 5 V2G 'Trailblazers' from NSW and SA about their experience of setting up and using V2G.

These Trailblazers were early adopters, who were prepared to put in significant time and effort to get V2G. At the same time, they share the same motivations as many Australians: wanting to save money, get value from their assets and help the environment.

Their typical behaviour once they had V2G was to plug in their car to charge from their solar during the day and discharge in the evenings, which maximised their cost savings and grid earnings. They monitored energy prices, solar output, and car battery levels to optimise their output.



It's two assets in one.
You no longer look at it as your car to get from A to B.
It's a **generator on wheels.**"

Early adopter interviews, 2024



What they liked

Getting the maximum value from their electric vehicle

Saving energy and costs
Some participants covered all their energy and fuel costs and made an extra ~\$1000 a year

High battery capacity

Flexibility with using energy at home



What they didn't like

Manual process to control charging

Complex to optimise

Hardware and software issues with charger

Current charger did not supply the home during power outages

A Trailblazer's journey to getting V2G

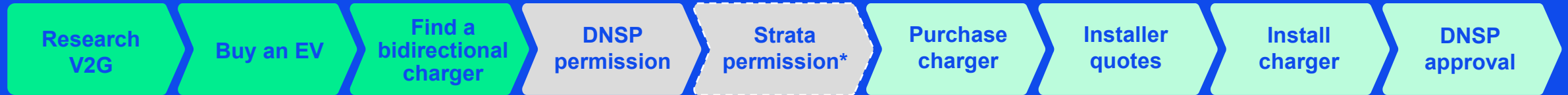
We mapped their journey from when they first heard of V2G to when they successfully started using it. While positive regulatory and commercial changes are in the works, the current reality of setting up V2G is complex, requiring patience, persistence and financial resources. We outline each step our Trailblazers took below, and the primary concerns they had at each stage.



Phase 1 Preparation

Phase 2 Permissions

Phase 3 Installation



Will this work for me and my home?

It was hard to find clear information about V2G and how to get it working.



Will a V2G-enabled car meet my needs?

Our early adopters knew they wanted V2G and sought out a car that would allow them to (Nissan LEAF).



Where can I buy a charger?!

There was only one bidirectional charger for sale in Australia and it was difficult to get hold of. For those purchasing later, it came without warranty or technical support.



How do I speak to the right person at my DNSP?

A common delay was DNSP approval of the bidirectional charger. This varied from months to years.



My neighbours don't understand the technology.

One early adopter lived in a strata scheme. Their strata committee initially refused the application due to concern about the charging load, but they appealed the decision.



This is pricey!

For our early adopters, the only V2G charger available on the market cost \$11,000.



Does the installer have the right expertise?

Quotes for installation varied widely, and installers were cautious due to lack of experience. Installation cost ranged from \$2,000-\$5,000.



It's finally happening!

The complexity of the install depended on the house layout. Installers often needed support from the customer or the charger manufacturer.



When can I start using my charger?

DNSPs conducted final inspections of most installations. This was either done at the time of install or 1-2 months afterwards.

* = step that could be skipped, only relevant to strata living

Four barriers and opportunities to accelerate V2G adoption

We identified four major barriers to the adoption of V2G. Our recommendations offer simple approaches to build on existing work to make the journey easy for consumers and accelerate uptake.



Barrier 1: Information and skills gap

Our Trailblazers found it was tricky to work out how to get V2G set up in Australia, what technology was available and if it was a good fit. They generally heard of V2G through travel or their professions. V2G is not familiar to most Australians, which can cause cautiousness and lack of trust.

Car dealers lacked expertise in V2G and were not able to answer questions from our early adopters or provide advice on how to get set up.



Barrier 2: Friction and time to set up

Our Trailblazers needed to invest significant time and effort finding the right people to speak with at charger retailers, DNSPs and installers. They then needed to negotiate with them to get access chargers and services.

DNSP permission: Our Trailblazers experienced long timescales and unclear processes, as there were no standards for bidirectional chargers.

Strata approval: A Trailblazer living in a strata scheme faced an additional layer of permissions from their strata body, who were uncertain about the technology.



Opportunity 1

What change is already underway?

V2G is being more widely talked about, increasing the familiarity of the general public with V2G.

What more is needed?

- More public conversations and clear, trustworthy information about what V2G is, its potential benefits and how to get set up.
- Increased expertise about V2G from those interacting with potential V2G adopters, such as car dealers and solar PV installers.



Opportunity 2

What change is already underway?

Updated standards (AS/NZ4777.2) for connecting and exporting to the grid by EVs means that in future this will be much easier and quicker. V2G chargers can be added to CEC's approved list, and the approval process will be streamlined.

What more is needed?

- Service offerings that help people get set up and make the most of V2G.
- People living in strata properties need materials that they can share with strata and guidance on how to navigate the approval process.

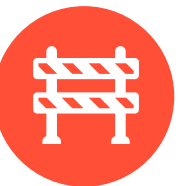
Four barriers and opportunities to accelerate V2G adoption, continued



Barrier 3: High upfront cost, limited products and services

Our Trailblazers were very limited in their choice of cars and chargers, as there was only one car model (Nissan LEAF) and one bidirectional charger (Wallbox Quasar 1) on the market that made V2G possible. This charger was priced at around \$11,000, significantly more than a unidirectional charger. These limits meant significant upfront costs and delays in getting equipment.

Our Trailblazers found it challenging to find electricians with expertise in installing EV chargers, and those with this expertise sometimes charged significantly more. They often ended up assisting electricians and reaching out to charger manufacturers for support.



Barrier 4: Manual and fractured digital user experience

Our Trailblazers used multiple apps to try to optimise their system to maximise financial earnings, which was difficult and time-consuming. There was no single app that optimised for Australian conditions and managed home energy use and V2G. Lack of optimisation decreased the value that our Trailblazers were able to get and increased the hassle factor.



Opportunity 3

What change is already underway?

More EV models are becoming available in Australia and their prices are dropping. Many of them are expected to be V2G enabled offering customers choice. The price of bidirectional chargers is expected to significantly drop as more models are introduced and production scales in 2025

What more is needed?

- Advocacy for regulation that ensures cars capable of V2G have this functionality enabled.
- Expansion of supplier base to reduce cost and financing options for cars and chargers to help more people access V2G.
- Workforce training and development so that more electricians can install and maintain bidirectional chargers.



Opportunity 4

What change is already underway?

At least one Australian energy retailer (Amber Electric) is experimenting with software to optimise V2G, which is currently being tested. International companies have developed V2G optimisation software being used overseas (e.g. V2G Liberty, Netherlands).

What more is needed?

- Easy-to-use software optimised for Australian conditions
- Simple electricity retail plans designed to incentivise optimal V2G charging and discharging.

02

Context



What did we do?



Focus areas for research:

- The journey early adopters took to get V2G.
- Day-to-day experience using V2G.
- Behavioural analysis of pain points, enablers and opportunities to accelerate uptake of V2G.

Location	3 in NSW 2 in SA
Regionality	3 in metro areas 2 in regional areas
Energy retailer	3 with Amber Electric 2 with other retailers
Usage	1 using for home and business 4 for home only
Car	Nissan LEAF
Charger	Wallbox Quasar 1

Scope of Evidence



Scope of research

This study is unique in delving deeply into the lived experience of this first wave of Australian household V2G users.

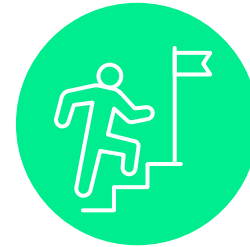
While the sample size for this research is small (based on five V2G charger customers), these individuals may represent around 50-75% of current Australian households using V2G today (based on an estimate of the number of V2G chargers sold to Australian households).



Persistent challenges

While some barriers to V2G are being addressed, such as the ratification of standards and the introduction of new EV and charger models, many challenges are likely to persist unless there is concerted effort to address them. The early adopter experiences shared in this study highlight enduring obstacles that future consumers are likely to face.

Other enduring issues beyond standards and products include availability and clarity of information for consumers on V2G, and knowledgeable and trained installers and car dealers.



Differences between early adopters and the general public

The early adopters interviewed for this report were patient and persistent, prepared to put in much more effort and financial resource than members of the general public. This meant they were able to succeed in a challenging environment.

However, the barriers they encountered would be similar for anyone and provide important lessons on how we can improve the system to make V2G uptake a smooth and straightforward process.



Different technology, same problems

Our research primarily covers experiences with an early bidirectional charger model, since discontinued and no longer supported by the manufacturer.

Although next generation models should offer improved features, the underlying issues of installation complexity, user support, and user optimisation are likely to remain relevant for other V2G chargers being commercialised.

03

A day in the life of a V2G user



A day in the life of a V2G trailblazer

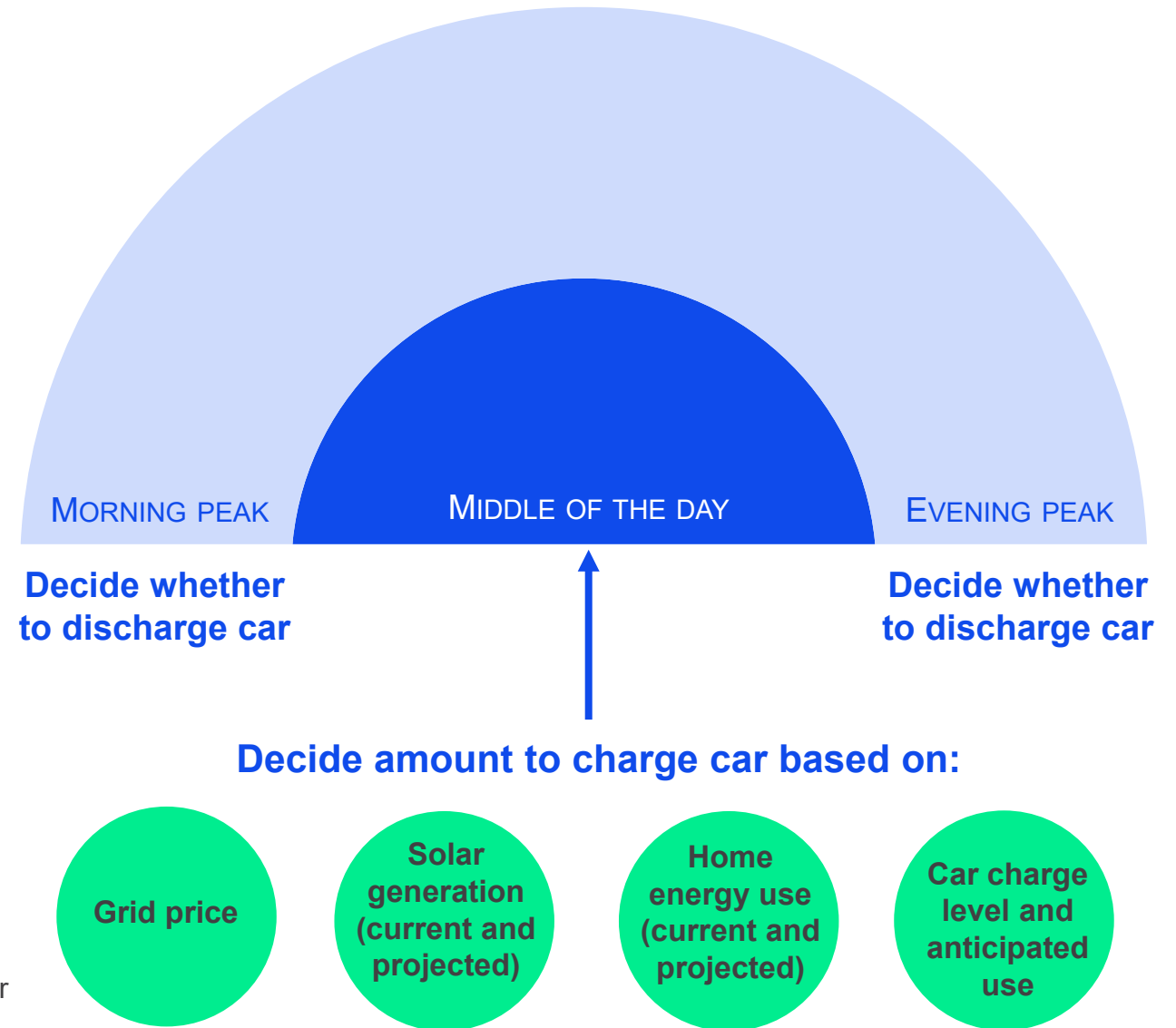
Each day our Trailblazers took several actions to coordinate their car usage and home energy usage with their tariffs. When they first got their V2G charger installed, most monitored their system many times a day, but over time they built routines and practices around charging and discharging.

Daily behaviours:

- Monitoring energy prices, solar output, and car battery levels using different apps.
- Charging from their solar during the day and discharging in the evening to maximise cost savings.
- Deciding what charge, they need for driving on the following day, in coordination with other household members.
- Plugging and unplugging their car as needed (physically or digitally via app).

Pre-requisites:

- Own their own home.
- Access to private off-street parking.
- Own a V2G-enabled EV.
- Own a bidirectional charger.
- Have a schedule that allows EV to be parked at home during the day most days (e.g. retired, work from home, commute to work via another means).



What Trailblazers like about V2G

Utility



It's two assets in one. You no longer look at it as your car to get from A to B. It's a generator on wheels."

Capacity



I tell everybody that we run our [business] system off the car and they say, "Isn't the car empty in the morning?" They don't realise it's a 40-kilowatt-hour car and on average I'm using maybe 15 kilowatt-hours of that."

Comfort



...My favourite part of it is that we can put the heater on [at home in the evening]. We had Amber (Electric) before we had the charger, but you're so limited with just solar. Sure, you've got solar pumping out, but there's nothing you can do with it [without a battery] because you already heated your water up. Then you get to the evening, and you think, well, we're going to sit here in the cold. All that solar is gone."

Savings



It is just lovely having a car that you don't need to pay for. You can pass the service station and know it's costing you ***** all."



What Trailblazers don't like about V2G

Technical issues



We did have a lot of trouble with the charger. Amber Electric came on board and started to program using OCPP. And I then corrupted the firmware, and it took us three months to get the reset codes.”

High effort

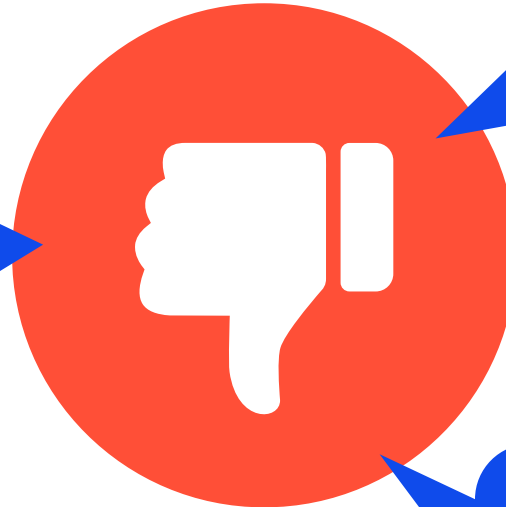


Probably just that it's so manual. And that you can therefore forget. People might accidentally let it run flat, you know?”

Complex to optimise



That is one of the problems – all the systems need to be integrated by someone.”



Generating income and covering energy use

For most of our Trailblazers, covering their energy use was their main priority. However, they were also often able to make a small income.

- Four out of five users were able to cover their home energy and fuel costs over the year. They found the car had plenty of power and could easily run the house and still have charge left for driving.
- These users were also able to make a small income as well (on average \$1000 a year). The amount of income V2G users made varied across our sample.
- For several, this depended on capitalising on price spikes passed on through the retailer Amber Electric. They fully discharged to the grid when prices were high.
- One participant found they were not able to cover their household and car needs. They were running two EVs and were less likely to charge during the day.



It's changed my behaviour in being aware of spikes because you know if energy spikes at \$20 a kWh. It's rather attractive to get as much in as possible.”

Case study: In a price spike, one user earned \$565 in two hours

“On May 8 there was an even bigger power spike where the wholesale price hit the unheard of level of over \$20/kWh!

Amber Electric had advised me by SMS, and I was ready for this, I set both the car and Tesla home battery to full discharge at 11kW. In about two hours I earned \$564, the highest FiT that Amber had ever recorded. I earned a total of \$759 for the month and look forward to more such events.”

Choosing an energy retailer

Participants chose energy retailers based on their needs and preferences. Energy plans that provided wholesale pricing provided the potential for more savings but required more active involvement and higher risk.

- **Wholesale exposure:** One residential energy retailer business model provides exposure to wholesale energy prices for a monthly subscription fee. Several users opted for this model due to the benefits of capitalising on price spikes, allowing them to earn higher returns during peak demand. While there was no specific V2G tariff or plan, they manually monitored price spikes and lows to select the best times to charge and discharge at the best rates.
- **Traditional tariffs:** Those with abundant excess solar and lower risk appetite preferred more traditional energy plans with a fixed feed-in tariff (FiT). This had the benefits of maximising returns on solar exports and providing more security about what they would earn.



Over the month of May, I made \$800 in feed-in tariffs, which is going to cover power bills for quite some time for me. So, I got very keen on that. Amber Electric have now automated the system and while it doesn't [start discharging] the instant a power spike comes, it starts within five or 10 minutes."



I was not keen on sitting in my cold garage checking the five-minute variations in the wholesale price and then setting the car to discharge when the price was over 60c/kW, using Bluetooth."

Early adopters

Troubleshooting issues

When our Trailblazers first set up their home and vehicles for V2G, they went through a significant learning curve, experimenting with how the technology worked and exploring its capabilities.

- The chargers were early models so could be more prone to technical issues. Some encountered problems with both hardware and software, and two users had to replace their chargers entirely.
- Support for the charger was discontinued when the manufacturer stopped producing that model, which frustrated users and left them without assistance. Troubleshooting required technical skills and persistence to resolve issues independently.
- Those in non-metro areas also faced additional challenges in accessing support where a physical site visit was required.
- Most of these issues will hopefully be addressed with future bidirectional chargers. But this can serve as an important lesson to those planning to launch these products in future.



To get [the charger] to work, you have to have a Bluetooth thing and know how to operate it, and an assistant. We're out here so no one's going to come out and use their Bluetooth to set the thing up. So, I've got to do it myself. And that's been quite challenging at times."

Early adopter

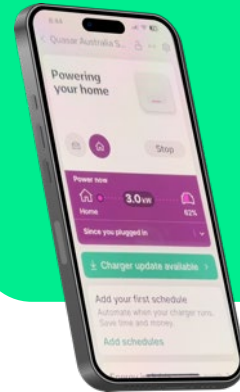
The user experience of V2G can be clunky and manual

Once their vehicle was set up to export energy to the grid, several users attempted to optimise manually, using multiple apps to monitor the energy market, weather, home energy use, solar generation, and car charge level.

The charger included basic software, but without more advanced optimisation tools, users had to monitor multiple data sources to get the information they needed.

This resulted in a difficult and labour-intensive experience for them. It was time-consuming and prone to mistakes if users forgot to adjust settings.

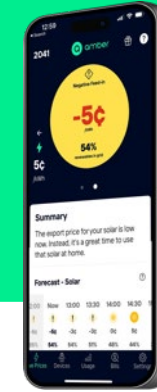
Example set up of one user



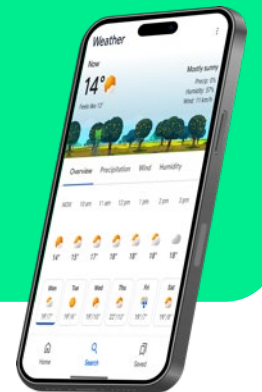
Wallbox app:
Changing power source
between car and grid



WattWatchers:
Monitoring household
energy usage and solar
generation
(data point every 5 seconds)



**Energy
retailer app:**
monitoring prices
(data point every 5
mins)



Weather app:
Predict anticipated solar
over next 1-2 days

Optimisation and automation

Some of our early adopters used trial software from an Australian energy retailer to control when to charge or discharge their vehicles, while others turned to overseas software.

However, overseas software was not calibrated for an Australian home and energy market so this required additional effort from the users.

Effective use of V2G systems required significant technical knowledge and attention to detail, making it challenging for those without a tech-savvy background.

Some users were hesitant to rely on automated systems, preferring to manually control charging and discharging due to a lack of trust in optimisation software.

Using some form of orchestration software was found to make the process significantly easier.



Opportunity

Optimising software for Australia: Easy-to-use software that orchestrates the flow of electricity between the house, vehicle, solar PV system, and the grid.



I just hit “I want the car by this date and this time and at this state of charge” and it is all automatic from there. [the app] is a simple system. Anybody could use it.”

One V2G Trailblazer

Spillover effects of V2G adoption

Spillover refers to the positive, unintended impacts of V2G adoption. Several of our early adopters became advocates, helping others navigate the technology, while also shifting their mindset to see their EV as an energy resource.

Becoming champions for V2G

Several Trailblazers said the biggest surprise for them was how few people knew about V2G and why it wasn't being taken up more.

They became passionate about V2G, assisting in the development of commercial software and helping other V2G users.

“

The actual experience is relatively easy and I don't know why people aren't adopting it and why cars aren't being made V2G compatible?”

“

Because I've been tinkering a lot, [the charger retailer] had a customer in SA with a Vehicle to Grid charger who was having issues and they couldn't solve it because they didn't have a good charger to test. But because I had one of those, I knew what that problem was. So I drove out to his house and helped him sort it all out.”

From 'car first' to 'battery first'

Several people described a gradual shift from seeing their car primarily as vehicle to seeing it primarily as battery.

They developed new routines and changed their energy usage to try and maximise the value they got from V2G.

“

You originally think of it as a car you can also use to power your house. I didn't realise until a couple weeks in that I thought about the other way around. It was a house battery you can drive around.”

“

Since getting V2G I've just left the car in the driveway most of the time. When I go out I take the bike. So, I still drive occasionally, but not as much as I thought I would.”

04

Who are current
V2G users?



V2G Trailblazers are persistent and prepared to experiment

Our V2G Trailblazers are driven by the potential cost savings, self-sufficiency, and environmental benefits. These users are generally persistent, resourceful, and willing to experiment, which helps them navigate the complex setup process.

Shared motivations

The motivations of these Trailblazers are not unique, they are shared with many members of the broader Australian community. They include:

- Energy bill savings and income.
- Value for money (compared to home battery).
- Making the most of their existing resources by getting more value from their car and solar.
- Helping the environment and reducing their emissions.

Unique early adopter traits

Our Trailblazers had some unique traits that helped them persist and succeed in getting V2G. They are:

- Desire to try something new and show what can be done.
- Persistence and patience.
- Financial capital.
- Interest in self-sufficiency/getting off grid.



V2G user typologies: how early adopters differ

The early adopters of V2G technology can be categorised into distinct typologies based on their motivations, usage patterns, and attitudes. Understanding these user profiles helps tailor support and solutions to accelerate wider adoption.



I got the charger so I started tinkering with it to see what I could make it do.”

Early adopter

Homebody – Have car at home most of the time. Have the most freedom in choosing when to charge and discharge their car's battery to the grid.

Wanderer – Drive their EVs frequently. Require more consideration to make V2G work for them.

Maximiser – Active optimisers of their system and behaviour for maximum cost savings. Enjoy monitoring and tinkering.

Satisficer – Content with making modest savings if this means they don't need to invest significant time or effort. Prioritise 'setting and forgetting' over value.

High effort,
higher return

Lower effort,
lower return

What drives the choice to adopt V2G?

Five factors influenced the choice of our early adopters to become V2G Trailblazers: Value, Knowledge, Effort, Identify, and Fit.

- Private transport requirements.
- Availability of off-street parking.
- Other household member preferences
- Suitable driving patterns (times away and at home).
- Unperturbed by range anxiety.

- Desire to take action on climate change.
- Attracted to self-sufficiency.
- Interest in novelty and optimisation.



- Access to the necessary capital needed.
- Cost of EV and charger within budgetary limits.
- Desire to make bill savings and income.
- Preference for a mobile battery over a stationary one.
- Want to get maximum value from their solar.

- Knowledge of what it is.
- Knowledge of how it works.
- Knowledge of how to get it.
- Exposure to others using it successfully.

- Access to available products (chargers, vehicles, software).
- Perceived complexity of setting up and using.
- Number and extent of barriers encountered.

05

The journey to getting V2G

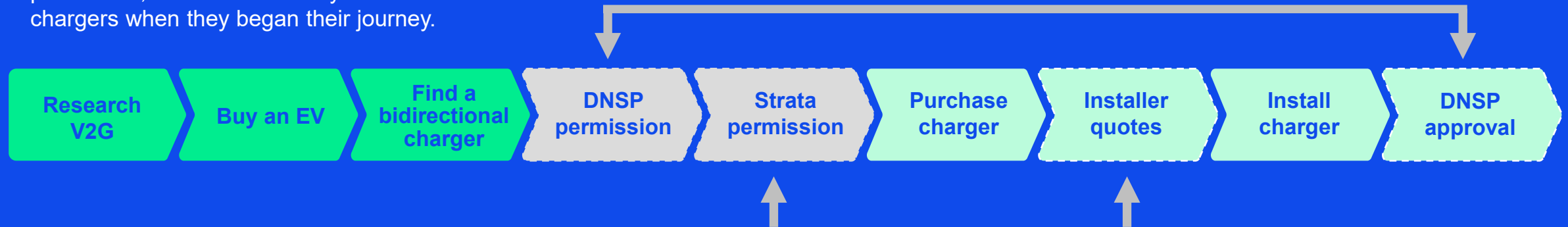


Trailblazer journeys varied in complexity and difficulty

The difficulty of each of our trailblazer's experience getting V2G depended on multiple factors, including whether the charger retailer coordinated the process (liaising with DNSP and installing the charger), their location, the need for strata permission, and the availability of cars and chargers when they began their journey.

Liaising with DNSP:

When the charger retailer liaised with DNSP, or the DNSP provided the charger, consumers did not have to find contacts at DNSP and go through a lengthy approval process.




Strata approval:

One participant was in a strata scheme and faced extra barriers in getting strata approval, which added months to the process. They also had a more complex installation due to the complex layout.

Simplified install:

When the charger retailer or DNSP coordinated the installation, consumers did not need to find installer quotes or liaise with installers who were unfamiliar with the technology.

 = step that could be skipped in ideal conditions

Research
V2G

Buy an EV

Find a
bidirectional
charger

DNSP
permission

Strata
permission

Purchase
charger

Installer
quotes

Install
charger

DNSP
approval

Step: Awareness and research about V2G

The first step our Trailblazers took was to discover that V2G exists and begin to investigate it. As they became familiar with the technology, they decided it was a good fit for them.

Findings

- Most participants first heard of V2G by seeing it in action through work or overseas travel. They were inspired and curious after seeing it was possible.
- Participants began to investigate V2G, performing actions like looking for information about the technology and vehicles online, reaching out to industry (car companies, charger installers), and joining online communities to talk with others (e.g. “V2H UK” Facebook group).
- They worked out if it was feasible for them, calculating payback and comparing it to other options, such as home batteries.
- All participants had a solar PV system prior to getting V2G. Their excess solar capacity was a strong motivation for getting V2G. Participants also had off-street parking, with the ability to regularly charge their car during the day.

Touchpoints

- Friends and family, colleagues, observing others in public spaces, media, internet and online groups



Barriers

- **Lack of information:** It was difficult to find out how to get V2G set up in Australia, what technology was available and if it was a good fit.
- **Unfamiliar technology:** Our Trailblazers only heard of V2G through travel or work. It is not familiar to most Australians, which can lead to cautiousness.
- **Working alone:** Our Trailblazers figured it out alone, as they didn’t know anyone else using V2G. They reached out to companies and communities overseas.



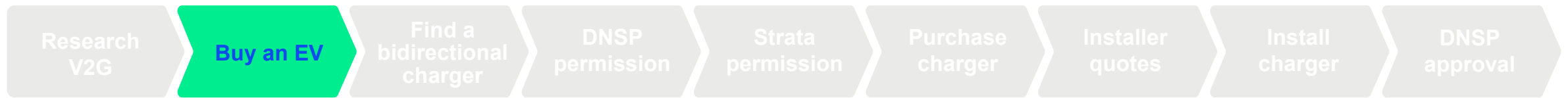
Opportunity

- Increase comfort with V2G by increasing its familiarity so people know what it is and how it works.
- Provide clear, simple information about how to get V2G in Australia and tools to help people work out if it is a good fit for them.
- Advocacy to expand battery subsidies to include bidirectional chargers.



Why would I buy a Powerwall when I can use my car?”

Early adopter



Step: Buying an EV

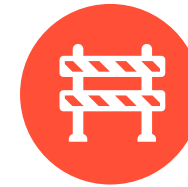
Once our Trailblazers decided they wanted to get V2G, they sought out cars that were compatible with bidirectional charging. They could only find one model.

Findings

- When investigating which EV to purchase, participants were assessing whether the car met their needs (e.g. for early adopters in regional areas, it needed to do a trip into the nearest major city) and had enough battery capacity for their home/business.
- Automakers and dealers did not communicate about V2G and were not able to answer their questions. Salespeople knew the car could do V2G but could not provide any specific information.

Touchpoints

- Dealers, car retailers, manufacturers, other consumers.



Barriers

- **Dealers lack expertise:** Automakers and dealers are not familiar with V2G technology and cannot provide advice.
- **Limited choice of vehicles:** For our Trailblazers, there was only one V2G enabled car (Nissan LEAF) and if it was not available, they needed to wait.
- **Cost of car:** The cars were expensive than comparable petrol cars. Our Trailblazers were able to offset this in some cases by purchasing secondhand cars.



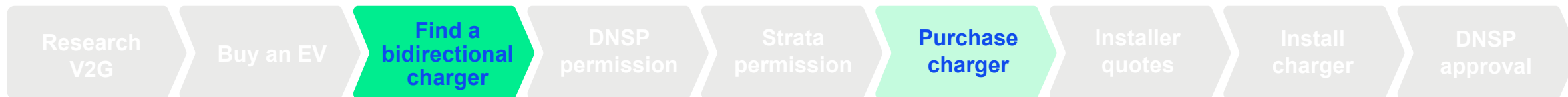
Opportunity

- Advocacy for making Australia the easiest place to do V2G in the world.
- Support for regulatory frameworks that introduce more V2G-enabled EVs.
- Encourage and support car dealerships to train salespeople in V2G.



[The dealer] had no clue. They knew it was V2G-compatible because they knew all the features of the car, but nothing else whatsoever.”

Early adopter



Step: Finding and purchasing a bidirectional charger

Our Trailblazers knew they needed a bidirectional charger, but getting one was a challenge.

Findings

- Our Trailblazers began their search for chargers online. Some found multiple companies advertising chargers. However, when they spoke to those companies most were pre-sale or in development.
- Only one type of charger was available in Australia through one retailer. When participants reached out to the retailer they had mixed responses. It often took multiple requests, going on waitlist and registration as a trial before the retailer agreed to sell them a charger.
- Purchasing a charger was conditional on getting approval from the DNSP.
- People often waited months or longer for chargers. In 2023, the manufacturer stopped making and supporting the charger, which made it harder to access.

Touchpoints

- Charger retailers (Australia and overseas), DNSPs, government.



Barriers

- **Lack of chargers:** for our Trailblazers, there was only one bidirectional charger on the market, with low supplies (now no longer available).
- **Complex system with multiple players:** our Trailblazers had to interact with and negotiate with multiple parties including retailers, DNSPs and installers.
- **Cost of charger:** the only charger available retailed at \$11,000 (without installation), which was significantly more than a one-directional EV charger.



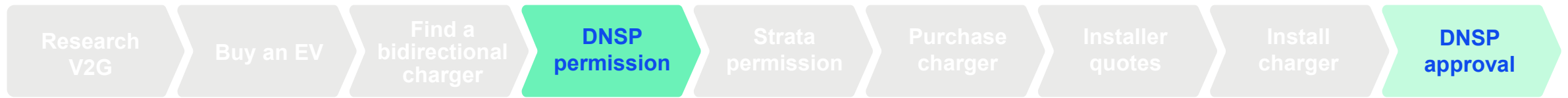
Opportunity

- Advocacy for making Australia the easiest place to do V2G in the world
- More bidirectional chargers and V2G-enabled EVs need to be brought to market in Australia.
- Service offerings that can help people to get set up and use V2G quickly and easily.



I got lucky and there was one in stock. I don't know how it happened. Maybe someone cancelled an order.”

Early adopter



Step: DNSP permission and approval

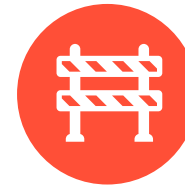
Our Trailblazers needed permission from their DNSP to install the charger. Some made direct contact with the DNSP, while for others the charger retailer liaised with the them. Once installed, the DNSP then had to inspect it at their home.

Findings

- This was the longest step for most of our Trailblazers – it took months to years for DNSP approval. It was difficult for our Trailblazers to find the right person at DNSP to talk to and to understand their policies.
- There was no standard for bidirectional chargers, which meant DNSPs needed to treat each application as an exception. Some DNSPs did not appear to have a clear approach for how new chargers would be approved.
- For several people, their case was referred to as a trial by the DNSP, but no official paperwork was provided.
- DNSPs needed to address safety concerns due to the unfamiliar bidirectional technology. These included concerns about ventilation, interaction with household battery and need for central grid protection.
- Once chargers had blanket approval, the process became easier and quicker, as happened in South Australia.
- During final inspection of the charger, DNSPs sometimes raised safety concerns to be addressed. If they couldn't come during installation, there was sometimes a delay, which added months to our Trailblazers being able to use their chargers.

Touchpoints

DNSPs, charger retailers.



Barriers

- **Difficult to get DNSP permission:** It was hard to find the right person to talk to at the DNSP and there was a lack of transparency about processes and waits.
- **DNSPs unfamiliar with technology:** This led them to raise concerns that had been addressed in another state or by similar technology.



Opportunity

- Updated standards (AS/NZ4777.2) for connecting and exporting to the grid by EVs should make the process simpler.
- V2G chargers can be added to CEC's approved list and charger owners will have a streamlined process for charger approval (similar to current solar and home battery processes).



(The installation company) had to get [the charger manufacturer] in Europe to respond and convince [the DNSP] that this is safe, it's not going to create a fire or create a risk to the grid."

Early adopter



Step: Strata permission

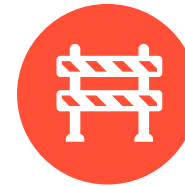
For the V2G Trailblazer living in a strata scheme, obtaining permission to install bidirectional chargers was a major hurdle. They faced delays and resistance, for example due to concerns about increased electrical load.

Findings

- Successful installation required negotiation, technical evidence, and proposals to address concerns.
- The Trailblazer applied to their strata committee to install the V2G charger. They were concerned and commissioned a consultant to do a study. However, the study did not account for smart charging and predicted high extra loads. This slowed down the application.
- The Trailblazer reapplied with extra information and proposed monitoring, at which point their strata approved.
- They had a special requirement of central grid protection, due to size of system in their complex.

Touchpoints

Strata committee, neighbours, energy consultant.



Barriers

- **Navigating strata approval:** Residents in strata complexes face an additional layer of permissions from bodies that may be risk averse.



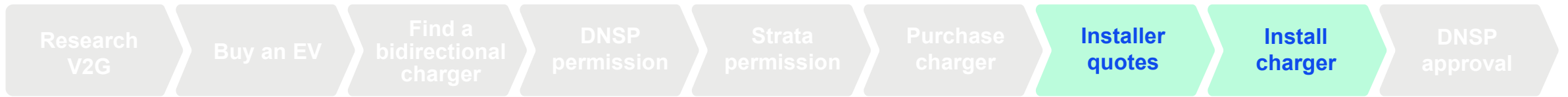
Opportunity

- People living in strata properties need materials that they can share with strata and guidance on how to navigate the approval process.
- Consultants working with strata committees need to be upskilled in V2G and how it might apply to multi-family dwellings and strata titles.



My neighbours all got confused and said we don't understand it, you know? We had to deal with that lack of knowledge and suspicion.”

Early adopter



Step: Get installer quotes and install a charger

Our Trailblazers often found the installation process for V2G systems was complex, due to the limited experience of local electricians with bidirectional chargers.

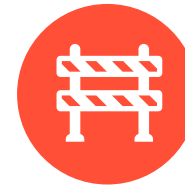
Findings

- Installations were smoother and quicker when managed by the charger retailer, who provided their own skilled installers.
- Local electricians were more cautious and unfamiliar with V2G systems, requiring additional support from our Trailblazers or the manufacturer.
- Installation costs ranged from \$2,000 to \$5,000*, with extra expenses where there were challenging home layouts. However, once arranged, installations typically took less than a day.

Touchpoints

Electricians, charger retailers, DNSPs.

* As compared to an average \$500 to \$1000 for standard smart charger installation.



Barriers

- **Lack of workforce experience:** It was difficult to find electricians with expertise, and those who had this charged significantly more.



Opportunity

- Workforce training and development so that more electricians can install and maintain bidirectional chargers.
- Upskilling and training of solar installers in V2G.



We hooked it all up. It was all self-explanatory, how to install it. The booklet's pretty simple. The physical installation was pretty straightforward, but there were a couple of software issues.”

Early adopter

Glossary

DNSP	Distribution Network Service Provider. The grid/electricity company.
V2G	Vehicle to grid.
EVSE	Electric vehicle supply equipment. In this report it primarily refers to the V2G charger.
CEC	Clean Energy Council. They oversee certifying V2G chargers and adding them to an approved list.
OEM	Original equipment manufacturer.
ISO 15118-20	An international set of standards defining EV-EVSE communications. This standard applies to CCS-based V2G.
OCPP 2.1	Open Charge Point Protocol framework that is required for <i>standardised</i> V2G interoperability.
AS/NZ 4777.1:2024	Australia's installation standard for grid-connected inverters. This includes bidirectional chargers.
AS/NZ 4777.2:2020	Australia's product standard for grid-connected inverters . This includes bidirectional chargers.

INSTITUTE FOR SUSTAINABLE FUTURES

University of Technology Sydney
PO Box 123 Broadway, NSW, 2007
www.uts.edu.au/isf