

Plugin: A One-Stop Shop for Vehicle-to-Grid Streamlining

A response to Challenge One

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Background

With Australia moving towards renewable energy sources with the aim to reach net zero emissions by 2050, vehicle-to-grid (V2G) systems supported by electric vehicles (EVs) could provide the energy storage needed to underpin such arrangements for a more balanced energy grid. However, V2G technologies and infrastructures are currently underdeveloped and the public remains insufficiently supportive.

Currently, the overarching goal is to increase public engagement with V2G technologies to ultimately provide more stability and balance to an increasingly greener and more sustainable energy grid. To achieve this, owners of EVs with V2G compatibility would leave their EVs plugged in for as long as possible to be ready to serve as electricity storage and supply when renewable energy generation is low. The question is, then, **how can we increase plugged-in time for EVs with V2G compatibility?**

Customer profiles

In the realm of EV adoption, de Rubens (2019) has identified a five-stage progression: innovators, early adopters, early majority, late majority, and laggards. Building on this framework, Mortimore et al. (2021) observed that the characteristics of early adopters of EVs in Queensland align closely with those of their international counterparts, primarily sharing a high-income profile. Machine learning models and comprehensive surveys found that the key determinant in expanding EV adoption to encompass mainstream customers, including the early majority, late majority, and laggards, is primarily pricing. Thus, in the Australian context, consumers can be categorized into two primary segments: **Current EV Owners**, encompassing innovators and early adopters typically with higher incomes, and **Prospective EV Owners**, which encompass the early majority, late majority, and laggards.

Behaviour Change Wheel

Given that we wanted to maximise targeting of all Australian citizens, we decided to target car owners at every point of a “car ownership timeline” to maximise target groups and continue our analysis based on this. We integrated the EAST and Behaviour Change Wheel framework to develop our behavioural intervention / solution.

First, we conducted a COM-B analysis to highlight barriers and facilitators (Michie et al., 2014) (see table below)

COM-B	Facilitators	Barriers
Physical C	-	-
Psychological C	All: Knowledge of environmental benefits and long term savings of green tech	All: Lack of knowledge on V2G, impact on battery life, warranty and long term cost benefits. Misconceptions on safety and data concerns
Physical O	-	Prospective: No EV, High initial startup cost, less than a third willing to pay more***
Social O	-	All: No social norm for V2G, EVs still a luxury item
Reflective M	53% of Australians plan to buy EV. Economic benefits more desirable than environmental ones	All: Anxiety and apprehension towards battery life concerns, high initial startup cost, fear of running out of battery while driving (due to consumption of battery during V2G plug in time)
Automatic M	Insate want to save money (loss aversion; Noremsky & Kahneman, 2005)	Prospective: Driven by short-term gratification when choosing delayed is beneficial (choosing cheaper fuel vehicles) All: habits interfere with intentions to perform behaviour (Theory of Intergroup Behaviour; Triandis, 1977)

We chose to target psychological capability and physical opportunity (tackling psychological capability will also have a knock on effect on reflective motivation → knowing more reduces anxiety)

Preferably, we also want to also target automatic motivation to reduce existing habits of gas vehicle usage

Secondly, we linked COM-B to their respective intervention functions (see table on right)

From this, we picked education, persuasion, incentivisation, coercion, training, environmental restructuring and enablement

We decided that the wide range of intervention functions was appropriate due to the wide range of individuals we would like to target.

	INTERVENTION FUNCTIONS								
	Educati on	Persuas ion	Incentivisat ion	Coercio n	Training	Restricti on	Environme ntal restructuri ng	Modelli ng	Enablen ent
Physical capability									
Psychological capability									
Physical opportunity									
Social opportunity									
Reflective motivation									
Automatic motivation									

	Communication/ marketing	Guidelines	Fiscal measures	Regulation	Legislation	Environmental/ Social planning	Service provision
Education	●	●		●	●		●
Persuasion	●	●		●	●		●
Incentivisation	●	●	●	●	●		●
Coercion	●	●	●	●	●		●
Training		●	●	●	●		●
Restriction		●		●	●		
Environmental restructuring		●	●	●	●	●	
Modelling	●						●
Enablement		●	●	●	●	●	●

From this, we picked policy categories Communication / Marketing, Fiscal measures, Environmental / Social planning

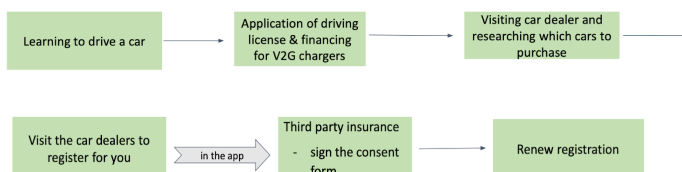
This decision was made considering a “car ownership timeline” and how each solution would target car owners at each and every point of this timeline

Given that most people own a smartphone, and we want to penetrate the majority of the population (for them to adopt V2G tech), a smartphone app was a very viable option (Environmental / Social planning).

The introduction of subsidies was also very appropriate given that secondary research identified that price is the main determinant in reaching mainstream customers (with taxes to fund the subsidies and discourage continued fuel car purchase)

Lastly, given the strong need for education on such available subsidies and the need to dispel current misconceptions, we decided to introduce advertising and marketing strategies (communication / marketing)

Timeline



Step 1: Dealerships

In the context of promoting V2G (Vehicle-to-Grid) charger adoption, dealerships play a crucial role in encouraging participation. To achieve this, posters displayed at dealerships are an effective means to counteract common misconceptions about V2G, thereby reducing loss aversion among potential users.

These posters should meet several requirements:

Sustainability: Emphasize sustainability by encouraging users to scan a QR code for information rather than distributing physical leaflets. This approach aligns with eco-conscious practices and reduces paper waste.

Educational Delivery: Focus on delivering key information about V2G benefits, addressing common misconceptions related to V2G battery impacts, and providing warranty statements for V2G-enabled cars' batteries. This educational content is crucial for dispelling doubts and building trust.

Easy to Remember: Incorporate a memorable slogan - "V2G Charger. Plug It. Save It." This catchy phrase reinforces the concept of V2G charging and emphasizes the potential for savings, making it more likely for users to remember and associate positively with V2G technology.

Another part of this initiative involves the introduction of deal packages aimed at prospective V2G EV owners. These packages come with several aspects that are beneficial for both the government and potential users. On the government spending front, there is a drive to provide more substantial financial incentives to incentivize prospective V2G EV owners. These incentives can extend beyond the existing benefit packages, such as the Sustainable Household Scheme, which offers financial perks related to registration and taxes for EV owners. These additional benefits aim to make V2G adoption more attractive and accessible to a wider audience. However, these incentives also open up opportunities for government revenue generation. One possibility involves funding these rebates through car emission taxation. By channeling revenue from car emissions into V2G adoption incentives, the government can encourage cleaner and more sustainable transportation while balancing its budgetary considerations. While the arrangement for such a package may require lengthy considerations, their potential benefits can be immense.

Step 2: A Digital Solution

We also propose the design and release of the "Plugin" application that includes a variety of functions which can improve the user experience of users who own EVs with V2G capability and of those who may be prospective owners. Specifically, the application provides all types of information related to the EV's battery such as the current battery level, battery health and warranty, helping to reduce uncertainty anxiety. Of these functions, the latter two are hidden away, as they may not require frequent access, thus reducing the likelihood of cognitive overload. Additionally, tailored information about how many trips can be taken with the current battery level and location-based notifications reminding users to plug their car in can be generated on personal data that have been collected with informed consent, increasing convenience.

One special feature of the application is the growth tree, a gamification product that may encourage users to engage more frequently with V2G technology (Floryan et al., 2020)—the more time that the user has had their V2G-capable vehicle plugged in, the stronger and faster their virtual tree would grow. Moreover, there is a community tab that displays the average tree height in the local community (e.g. neighbourhood), which can encourage the target behaviour via a social competition aspect. For users who do not own EVs with V2G capability, the tree section is blurred out with a bright warm yellow screen, which increases salience of V2G section, inviting users to explore.

The application also enables payments for all electricity bills and the location of charging ports, which helps to maximise ease. Additionally, users who do not own an EV but simply want to use the application to make bill payments will also see blurred out yellow sections for EVs and V2G, making them another potential group of audience.

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