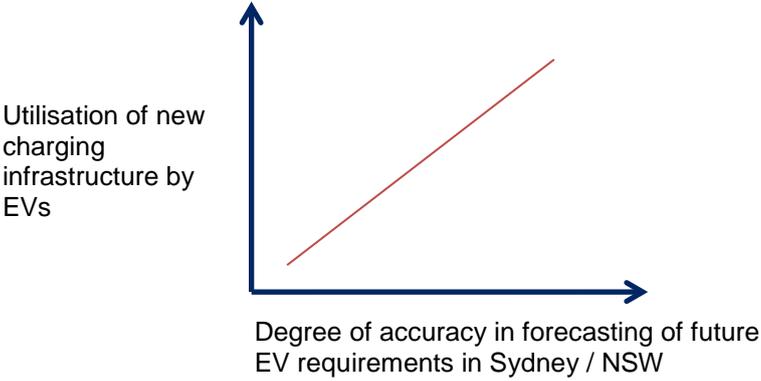


Problem Description

Question	Response
Description of the problem and purpose of the proposed research	<p>Electric Vehicles (EV) offer many potential societal benefits. However, EV uptake is very low in Australia, and much lower than in many other developed countries. One of the most likely and significant barriers to EV uptake has been the lack of EV charging infrastructure. It is therefore highly probable that an expansion of this infrastructure is necessary for a significant expansion in the EV fleet to occur.</p> <p>Both government and the private sector face a number of uncertainties around determining priorities for EV chargers. Transport for NSW (TfNSW) is interested in quantitative research/modelling that is able to answer the following questions:</p> <ul style="list-style-type: none">• How many public chargers would be needed in the Sydney metro and regional NSW to support the travel needs and patterns of NSW drivers?• At what locations will chargers be needed?• What types of EV chargers would be needed at the identified locations? <p>To provide informed answers to the above questions, research is required that informs TfNSW where greatest uptake of EVs has been to date and also an informed indication of where future uptake is likely to be.</p>

Hypothesis & Variables

Question	Response
<p>For explanatory research, please describe a clear hypothesis with variables for testing</p> <p>For exploratory research, please describe how the proposed research will contribute to future explanatory research</p>	<p>The purpose of the proposed research is to determine: 1) locations of greatest EV uptake across NSW/Sydney to date and 2) possible locations for increased EV uptake in the future. This research is broken up into two phases; findings from phase 1 will inform phase 2.</p> <p>Phase 1: Current Trends in EV Uptake</p> <p>An analysis will be conducted to determine the location and type of EVs already registered across Sydney/NSW.</p> <p>Phase 2: Future Trends in EV Uptake</p> <p>Analysis of future trends in EV uptake across Sydney and NSW. This would involve scenario forecasting/modelling, potentially using the following:</p> <ul style="list-style-type: none"> • An analysis of socioeconomic characteristics (e.g. income/wealth, level of education, age) and other factors that have resulted in certain places (e.g. suburbs) having higher EV vehicle uptake. • An analysis of travel patterns of current and likely future users. <p>It is hypothesised that the mapping of current EV uptake trends and analysis of future EV uptake trends will result in an accurate forecast of future EV needs in Sydney/NSW (e.g. number type and location of EV chargers).</p> 

Strategic Criteria & Alignment

Question	Response
<p>Alignment with strategic theme</p>	<p>This Problem Statement is aligned with the research theme of 'Sustainability'. As EVs have low or zero tailpipe emissions of greenhouse and noxious gases, they contribute to improving air quality, better community health and mitigating climate change. The quiet and clean operation of EVs also improves urban amenity.</p> <p>EVs significantly improve greenhouse gas emissions from road transport even when powered from the existing electricity grid. While most electricity in NSW is generated from coal, its share of generating capacity is falling, and environmental benefits of EVs are further increased as renewables progressively replace coal in the National Energy Market.</p> <p>The Strategic Theme of 'Technology' is also addressed. The development of EV infrastructure is necessary for a future of connected and automated vehicles (CAVs). Many CAVs will be electric because electric motors are easier for automated systems to control.</p>

Question

External driver of change analysis

Outline how the research will better position TfNSW to respond proactively to macro drivers of change

Response

We use PESTLE analysis to identify and describe the external drivers of change that this research would help TfNSW be in a better position to respond to.

Political

Since 2016, governments in France, Netherlands, the USA, the UK and India have announced that sales of internal combustion engine vehicles will be phased out and prohibited from a specified date (the same is proposed in other countries such as Norway, Germany and China). These announcements have typically followed major support programs designed to increase EV uptake. Australian governments' support for EVs has been measured but there is a discernible trend towards increasing action.

Economic

Technological advances have increased battery energy density and economies of scale enabled by mass production have seen battery costs fall by 80% since 2010. With further cost reductions expected in the near future, EVs are expected to be cost-competitive (whole-of-life cost) with internal combustion engine vehicles by 2020 and price-competitive by 2025. In addition, increased uptake and the associated reduced reliance on fossil fuels will help Australia's energy security and terms of trade.

Social

Globally, including in Australia, there has been a push amongst the community for cleaner vehicles and transport. There are significant health benefits related to reduced exhaust emissions and a reduction in noise pollution.

Technological

It is widely anticipated that there will be a convergence of electric traction technology with vehicle automation and other 'megatrends' that will revolutionise transport, connection and sharing.

Legal

The Australian Government, through the Department of Infrastructure and Regional Development, is investigating the introduction of vehicle efficiency (CO2 and noxious emissions) standards, and more stringent fuel quality standards.

Environmental

In 2016 the NSW Government released a Climate Change Policy Framework that sets an aspirational goal of net zero carbon emissions by 2050. This goal cannot be achieved without significantly reducing road transport emissions, which are the second largest and fastest growing source of emissions.

Forward looking

While a few battery EVs and plug-in hybrid electric vehicles are already on Australian roads, the transition to EVs is in its infancy. Internal combustion engines are likely to power a significant proportion of vehicles for some decades. However, the need to mitigate climate change, to improve urban air quality and to reduce our dependence on imported petroleum points to an inevitable transition to EVs in the longer term. Strategic planning of charging infrastructure is critical in preparing for this transition.

Question	Response
<p>Potential research impact</p>	<p>What has been termed a ‘three-way bind’ inhibits investment in EVs by consumers, vehicle manufacturers and charging providers.</p> <ol style="list-style-type: none"> 1. Consumers are reluctant to purchase vehicles as they cannot be easily refuelled; 2. Vehicle manufacturers are reluctant to produce vehicles that may not be purchased; and 3. Charge-point suppliers are reluctant to provide a service for vehicles that have not been deployed. <p>This research would have both public and private sector value as it would inform strategic decision-making by infrastructure providers, and allow government policy support for EVs to be properly targeted. Without it, there is a risk of continuing underinvestment in charging infrastructure or that the location and choice of chargers will be suboptimal, both of which could limit EV uptake.</p>

Technical Criteria

Question	Response
<p>Innovation</p> <p>Outline how the proposed research will result in new knowledge</p>	<p>EVs are a relatively new research area in Australia/NSW, particularly research around optimum levels and distribution of charging infrastructure. TfNSW is not aware of any such research currently being available.</p>
<p>Basis in completed research and/or observed practice</p>	<p>The importance of decisions about charging infrastructure for EV uptake is well-documented. See for example: https://www.theicct.org/sites/default/files/publications/EV-charging-best-practices_ICCT-white-paper_04102017_vF.pdf</p>
<p>Feasible data requirements</p>	<p>Some of the expected data requirements include:</p> <ul style="list-style-type: none"> • Locations of EV uptake across NSW/Sydney to date (potentially available through EV registrations). • Data on projected/forecast levels of EV uptake over time in NSW (or Australia) (available). • High-resolution EV charging and EV uptake data from other jurisdictions where EV uptake is more progressed (this would be ideal, although it may be difficult to find such a dataset). • Socioeconomic data, including age, income etc by suburb or local government area (both currently, and how that socioeconomic fabric is likely to change over time) (current data available [from Census]; future data probably more difficult to source).

Level of Collaboration & Resource Requirements

Question	Response
<p>Level of collaboration</p> <p>Please select the level of collaboration required to complete the proposed research</p>	<p>1. 'Quick-Fire' Research <input type="checkbox"/></p> <p>Intense bursts of research activity (e.g. under 8 weeks). Intended to make use of 'hackathon'-type environments, where students/researchers work collaboratively and intensely on particular problems involving data interrogation and visualisation.</p> <hr/> <p>2. Undergraduate Final-Year Research <input checked="" type="checkbox"/></p> <p>Suitable for final-year undergraduate students (e.g. capstone, Honours) as part of the research requirements for their undergraduate degree (i.e. 1 to 2 semesters).</p> <hr/> <p>3. Higher Degree Research <input checked="" type="checkbox"/></p> <p>Project may form whole or part of a postgraduate research degree (i.e. Masters, PhD), and contribute to new knowledge (i.e. 1 to 3 years).</p> <hr/> <p>4. Major Collaborations and Funded Research <input type="checkbox"/></p> <p>Project may form the basis for a significant collaboration agreement between TfNSW and the relevant research institution, including major competitive grant funding (e.g. Australian Research Council funding with TfNSW as an industry partner).</p>
<p>Comments</p>	<p>One-year research project suitable for final year or Honours thesis. This project could form all or part of a PhD or Master of Research.</p>
<p>Supporting TfNSW resources</p>	<p>TfNSW will facilitate access to subject matter experts and project support (up to 4 hours per week). TfNSW will also endeavour to help attain required data</p>