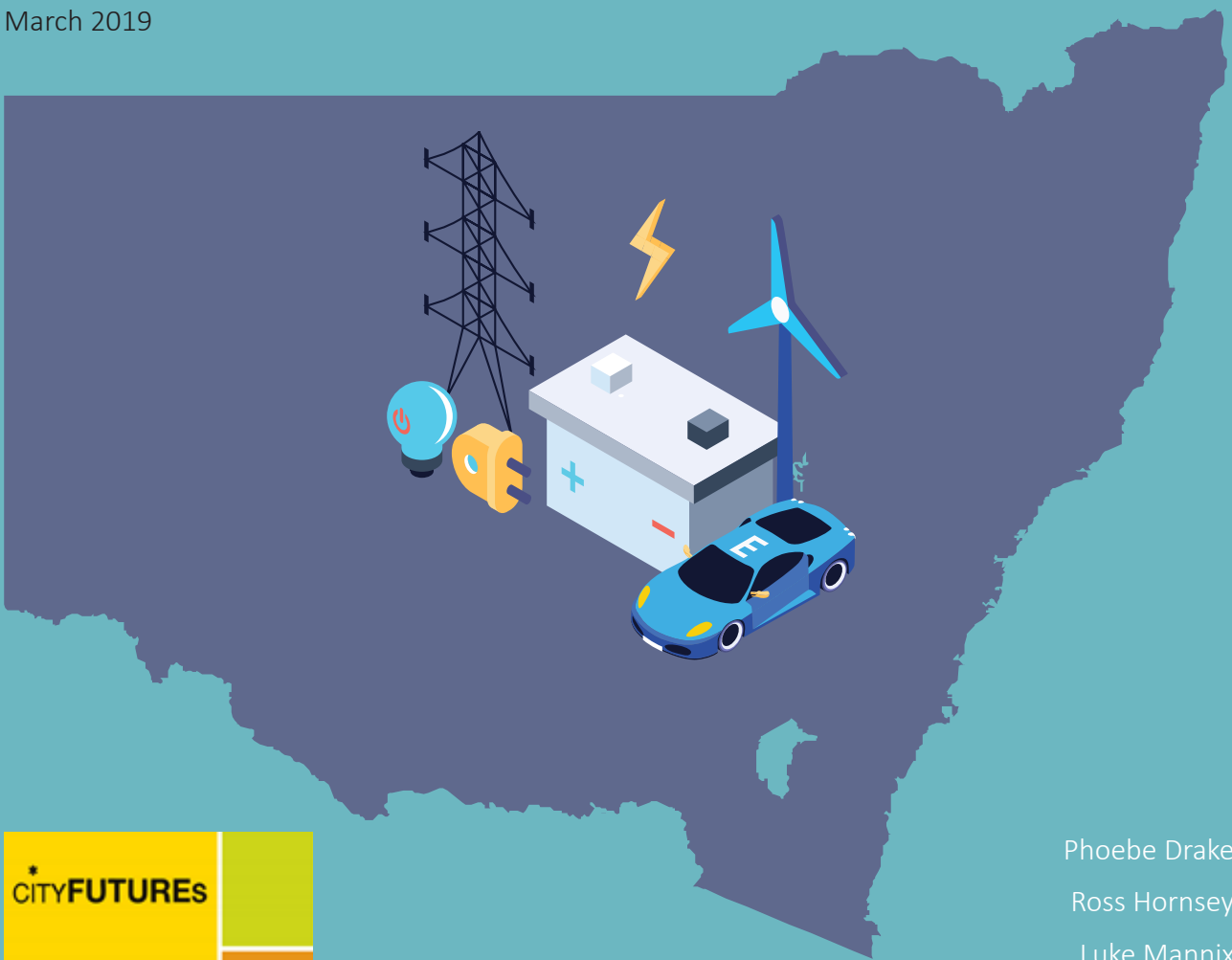


Research for Evidence Based Policy

ELECTRIC AVENUE:

Preparing the NSW planning system for electric vehicles

March 2019



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Acknowledgement

Prepared under the supervision of A.Prof Hazel Easthope as part of the Master of Urban Policy and Strategy (MUPS) at the University of New South Wales (UNSW) Sydney.

Disclaimer

This report has been prepared by the authors as students of UNSW. This report does not represent the views of the authors' employers, the project client, or UNSW.

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ELECTRIC AVENUE: Preparing the NSW planning system for electric vehicles

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Abbreviations

- ABCB- Australian Building Codes Board
- AC- Alternate Current
- the Act- The Environmental Planning and Assessment Act 1979
- ARENA- Australian Renewable Energy Agency
- BCA- Building Code of Australia
- BEV- Battery electric vehicle
- CEEM- Centre for Energy and Environmental Markets
- CEFC- Clean Energy Finance Corporation
- DC- Direct Current
- DCP- Development Control Plan
- EV- Electric Vehicle
- EVC- Electric Vehicle Council
- EVSE- Electric vehicle service equipment
- GSC- Greater Sydney Commission
- ICCT- International Council on Clean Transport
- kW- Kilowatt
- LEP- Local Environmental Plan
- NCC- National Construction Code
- NSW DPE- New South Wales Department of Planning and Environment
- NSW SCA- New South Wales Strata Community Association
- OCPP- Open Charge Point Protocol
- PEV- Plug-in electric vehicle
- PHEV- Plug-in hybrid electric vehicle
- RMS- Roads and Maritime Service
- SEPP- State Environmental Planning Policy
- TfNSW- Transport for New South Wales
- V2G- Vehicle to grid

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1.0 Executive Summary

Internationally, and particularly in the developed world, the Electric Vehicle (EV) market has grown significantly. However, demand for EVs in Australia is still relatively muted, which can be attributed to concerns stretching from range anxiety, fuelled by a lack of charging infrastructure, to high vehicle costs and insufficient government incentives.¹

As EVs reach cost parity and manufacturers begin to deliver a greater variety of EV models for consumers, it is expected that a greater uptake of this new transport alternative is inevitable.²

Further transport disruptions are also likely in the future through improved technological capabilities, such as shared and automated vehicles. Consequently, governments must recognise and respond to the challenges and opportunities that these disruptions present.

This report examines how the New South Wales (NSW) Planning System could adapt to provide for new and disruptive transport infrastructure using EV charging infrastructure as a case study. It assesses the role of the NSW Planning System within economic, societal, environmental and technological spheres of influence, whilst also considering the global, national, state and local context.

Research methods include desktop analysis of technical and academic literature, planning policy, government submissions, media review and international and interstate case studies, as well as interviews with specialists.

Whilst research identifies that the regulation of EVs is in its infancy, stakeholders in Australia are anticipating what needs to be done to pave the way forward.

There has already been movement within the NSW Planning System, with recent changes made to include EV facilities in policy instruments. Australia can also learn from attempts at regulation and implementation of charging infrastructure in other countries through various case studies, which are outlined in this report.

During the research process, challenges and opportunities were identified relating to EV charging infrastructure.

These are outlined under Section 8.0 and have informed the recommendations to the NSW Department of Planning and Environment (NSW DPE).

These recommendations include steps that NSW DPE can action directly, as well as opportunities for NSW DPE to participate in, inform and influence the provision of EV infrastructure in both the short and long-term.

“A global revolution in EVs is underway and with the right preparation, planning and policies- Australian consumers are set to be the big beneficiaries.”

Hon. Josh Frydenberg MP, January 2018

(then Federal Minister for Environment and Energy)







Figure 1. EV charger. Source: envatoelements

¹ Electric Vehicle Council & ClimateWorks Australia 'State of Electric Vehicles in Australia 2017', June 2018, p. 12.

² Ibid, p. 8.

Table 1 – Recommendations

	NOW			LATER
 ACTION	Amend the Infrastructure SEPP to include a definition of EV charging infrastructure.	Amend relevant Environmental Planning Instruments as necessary to ensure there is a standard interpretation of EV charging infrastructure. ¹	Develop a working group or task-force responsible for ongoing development of EV charging and other related emerging technologies. This should engage with relative groups outside of NSW DPE.	Following consultation regarding the provision of EV charging infrastructure for all new buildings, amend SEPP 65 to include detail around the provision.
	During the consultation and preparation of the standard DCP for local authorities, seek to add provisions for EV charging infrastructure within overall parking provisions.	Undertake an audit of available data on EV charging infrastructure in NSW.	Commence research into promotion of EV equipped car share spaces as concessions for reduced parking provisions in new development.	Once data audit has been completed, appropriate storage and open sharing e.g. NSW Open Data Portal
 PARTICIPATE	Working as part of the ACBC, update the BCA. This should include reference to AS3000:2018.	In conjunction with TfNSW and other road authorities, undertake discussions on implications of EV charging on congestion and other effects on transport policy with a view to minimise adverse impacts.	In conjunction with local authorities, RMS and utilities providers, undertake discussions regarding the provision of kerbside infrastructure.	Following additional updates to the infrastructure SEPP, prepare and release a planning circular to guide local authorities when assessing Development Applications and advising members of the public on EV charging infrastructure.
	In conjunction with local authorities and Department of Lands, identify opportunities to diversify land use on local and state owned land to accommodate EV charging infrastructure.	Commence consultation on how best to incorporate EV charging infrastructure provision in all new buildings with interested parties (developers, construction industry etc).	Develop partnerships with energy providers to plan for overlapping challenges as a consequence of EV uptake.	
 INFORM	Prepare information sheets accessible to the public to advise interested parties on how to implement EV charging within the NSW planning system.	Prepare best practice and opportunities guidance notes for retrofitting all buildings, including buildings under single or multiple ownership.		
 INFLUENCE	Support the national standardisation of EV public charging infrastructure based on international standards.			

“Its very infrequent you go through such a major technology change... similar as from horses to cars. Its rare they happen but even rarer to be able to see it and plan for it. [We have] an important opportunity in Australia to look at how charging might be coordinated.”

ARENA

¹ Alternatively, Environmental Planning Instruments may refer to a definition contained in other regulatory documents..

2.0 Introduction

Rapid innovation is transforming traditional modes of travel, both in Australia and internationally. This presents challenges and opportunities for all levels of government, including departments such as planning, transport and the environment, as well as the private sector. Planning systems, in particular, require adjustment to accommodate alternative transport and fuel sources in urban, regional and remote areas.

The challenge of adapting planning systems to accommodate new modes of travel is evident through the introduction of EVs to the Australian market. Based on international trends, it is likely Australia will experience a rise in the use of EVs as market choice increases and their costs reduce. In 2018-19 alone, an additional nine models of Plug-in Hybrid Electric Vehicles (PHEV) and Battery Electric Vehicles (BEV) are expected to enter the Australian market³ and it is anticipated that EVs will reach cost parity with internal combustion engine vehicles by 2025.⁴

Academic research on EV infrastructure to date has focussed largely on technical, rather than planning, issues. However, planning issues are important because they provide a means through which some key challenges associated with EV charging infrastructure can be both overcome and regulated.

It is essential that planning policy enable the orderly provision of EV charging infrastructure in both the public and private domain. Planning policy has the capacity to ensure that EV charging infrastructure is appropriately located and provide guidance on best practice. This ensures consistency instead of an ad hoc approach. NSW DPE is taking steps to identify the need for any changes to existing policies, strategies and regulations in this regard.

This includes NSW DPE's recent announcement that it will amend the State Environmental Planning Policy (SEPP) Infrastructure 2007 (Infrastructure SEPP) so that electric car chargers can be installed in car parks, depots and other 'vehicle related facilities' without needing planning approval.⁵ Similarly, around the nation, other states and territories are also taking action. A comparison of different steps taken in the states and territories is included in Section 5.3.

Given range anxiety has been identified as a key barrier to EV uptake in Australia,⁶ these steps are important. Planning systems also play a significant role in urban areas, where increased density presents challenges around future-proofing new developments and retrofitting existing multi-unit dwellings. Consideration must also be given to the energy challenges this raises, as well as how to best accommodate the portion of the market without dedicated parking.

2.1 Research Aims

The aim of this research is to examine how the NSW Planning system could adapt to the challenges and opportunities of new and disruptive transport infrastructure using the provision of EV charging infrastructure as a case study.

Specifically, the research:

- identifies and evaluates the significant opportunities and policy barriers relating to the provision of EV charging infrastructure; and
- recommends ways the NSW Planning System could enable the provision of EV charging infrastructure in new and existing buildings and kerbside locations in NSW.

2.2 Research Questions

The research is guided by six main questions:

- Q1. What infrastructure is required to facilitate EV charging in NSW?
 - Q2. What are the potential pathways to enable the delivery of EV infrastructure through the NSW Planning System?
 - Q3. What are some of the current strategies of local government and private sector stakeholders in planning for future EV infrastructure provision?
 - Q4. What have been the experiences of local government and private sector proponents in attempting to introduce EV infrastructure in NSW?
 - Q5. What options do NSW DPE have to facilitate public and private provision of EV charging infrastructure?
 - Q6. Which research outcomes might inform NSW DPE policy regarding the provision of new and disruptive transport infrastructure?
-

3 Electric Vehicle Council & ClimateWorks Australia 'State of Electric Vehicles in Australia 2018', June 2018, pp. 10-11.

4 Electric Vehicle Council & NRMA, 'New policy proposal: recharging the economy- accelerating electric vehicle adoption', 2018, p. 12

5 NSW Department of Planning & Environment 'Department supports clean energy future with changes to Infrastructure SEPP', press release, 5 September 2018, viewed 28 September 2018.

6 Electric Vehicle Council & ClimateWorks Australia 'State of Electric Vehicles in Australia 2017', June 2017, p. 9.

2.3 Scope

The research focuses on:

- EV charging infrastructure in new and existing residential and commercial buildings and kerbside locations;
- The state of NSW, paying particular attention to urban areas. Relevant interstate and international cases are reviewed as appropriate;
- An implementation period of 2019-2025 and a period of impact to 2056;
- Private vehicles, including fleet and car share, and;
- Interventions that can be initiated or participated in by NSW DPE.

2.4 Target Audience

The primary target audience is: NSW DPE and other planning approval bodies, including local councils and the Greater Sydney Commission (GSC); relevant EV industry stakeholders; and energy providers.

Other stakeholders likely to have an interest in the project are other NSW government agencies, consumers and consumer bodies, property managers, city advocacy organisations, electric car manufacturers and academics.

2.5 Approach

The research team used a two-part strategy to address the research aims and respond to the research questions:

1. Desktop research: A review of documents, including technical documents and reports; NSW planning policy, strategy and regulatory documents, media reports, government and private sector policy and strategy documents, and interstate and international case studies.
2. Fieldwork: Interviews with expert stakeholders, including local government, state government agencies, EV industry representatives such as the Electric Vehicle Council (EVC), representatives from the development and energy industries and other relevant stakeholders such as the NRMA.



Figure 2. EV charger maintenance. Source: envatoelements

3.0 Research Context

3.1 The Rise and Impact of Disruptive Transport

The way we travel is changing and, while its exact future is uncertain, there is compelling evidence of a global shift towards electrification and, potentially, subsequent automation of road-based vehicles.

Governments around the world have indicated a willingness to encourage this shift, with policy leaders in the United Kingdom, Germany, India and Norway announcing their intention to move to prohibiting non-EV vehicle sales from 2025.⁷

This is expected to represent a fundamental shift in transport equivalent to the mass-introduction of combustion engine vehicles in the early twentieth century. As Australian Renewable Energy Agency (ARENA) puts it:

“It’s very infrequent you go through such a major technology change... similar as from horses to cars. It’s rare they happen but even rarer to be able to see it and plan for it. [We have] an important opportunity in Australia to look at how charging might be coordinated.”⁸

Transition from traditional fossil-fuel based vehicles towards electric powered (via BEV, hybrid or PHEV) could bring benefits in terms of:

- Lower running costs, with an estimated reduction from nearly 18 cents per kilometre to drive a petrol vehicle to as little as 5 cents per kilometre in an EV,⁹

- Reduction in, and potential elimination of, vehicle exhaust emissions; and
- Reduction in negative human health impacts resulting from vehicle emissions, which the OECD estimated to cost the Australian economy close to \$6 billion in health costs in 2010¹⁰.

Uptake of EVs is growing internationally, particularly in markets where the consumer base has been incentivised to shift from traditional fuel vehicles. From 2016-2017, there was a 56 percent increase in EV sales globally with more than three million now in active use.¹¹ Vehicle manufacturers across the industry have also moved¹² to embrace new technology.

Most major suppliers have EV models either in development or in the market already, with plans in place to grow annual sales between twenty percent (Volkswagen) and thirty percent (Nissan-Renault-Mitsubishi) by 2022.¹³ Even traditional fossil fuel suppliers such as Caltex have signalled acceptance that EVs will likely succeed and are exploring incorporating EV charging into traditional service stations.¹⁴

Uptake of EVs is expected to accelerate exponentially throughout the next decade as consumer choice improves and falling battery costs result in price parity with traditional fuel vehicles by 2025.¹⁵

Industry studies suggest that governments have an important role to play in supporting EV uptake to around five percent of the market, seen as a tipping point from which consumer behaviour will then



Figure 3. Tesla Model S at Tesla factory in Fremont, CA. Credit: Steve Jurvetson, Flickr

⁷ International Energy Agency. 2018. Global EV Outlook 2018: Towards cross-modal electrification

⁸ Beltman, Scott (ARENA Policy Officer). Interview 19 September 2018

⁹ Infrastructure Victoria, Evidence Base Report: Advice on Automated and Zero Emissions Vehicle Infrastructure August 2018, p. 35

¹⁰ OECD (2014), 'The Cost of Air Pollution- Health Impacts of Road Transport', OECD Publishing, Paris.

¹¹ Electric Vehicle Council 'State of Electric Vehicles' June 2018, p. 3

¹² Grant, M; Lutsy, N; Wappelhorst, S; Zhou, H, 'Power play: How governments are spurring the electric vehicle industry', May 2018, p. 1

¹³ Electric Vehicle Council 'State of Electric Vehicles' June 2018, p. 10

¹⁴ Latimer, C 'Sydney Morning Herald' Caltex prepares for a low octane world', Sydney Morning Herald, 10 May 2018

¹⁵ Electric Vehicle Council & NRMA, 'New policy proposal: recharging the economy- accelerating electric vehicle adoption', 2018, p. 12

drive uptake organically.¹⁶ Norway is the most advanced country in terms of EV uptake, with 29 percent market share and a 100 percent target by 2025. It is noted that this would have been unlikely to occur without government intervention in the form of incentives.¹⁷

In contrast, Australia has been slow to embrace the transition to EVs. At only 0.2 percent of the market, penetration of EVs is low¹⁸ compared to other countries. Governments at local, state and federal levels have taken few substantive actions to proactively encourage, enable or prepare for transition.

Reasons cited for Australia's slow uptake¹⁹ include particular pressure on range anxiety due to the size of Australia and distances between major urban areas; absence of policies that actively encourage uptake; limited model choice; high purchase costs and limited charging infrastructure.

Governments at a state, federal and local level are now moving to actively prepare for EVs and identify appropriate ways to facilitate uptake. However, there is currently uncertainty as to how exactly the market will evolve in Australia compared to other countries as well as the particular challenges that will be faced, which may include:

- Additional demand on the energy network, with Infrastructure Victoria claiming necessary upgrades in Victoria could cost \$6.4 to \$8.8 billion;²⁰
- Increased demand for peak hour charging without incentives;²¹
- Range anxiety, particularly in regional or remote areas due to lack of appropriate infrastructure;²²
- Complexities in retrofitting charging infrastructure in existing strata properties;²³ and
- Reduced tax base through impacts fuel excise.²⁴

Provision of charging infrastructure has been found²⁵ to be an essential enabler in growing the EV market. To satisfy consumer behaviour, accessible charge points will be required in parking locations within private property (residential and commercial) as well as in publicly accessible locations (kerbside, public charging stations, consumer car parks, retail).

There is debate²⁶ at a national level regarding the appropriate level of policy support for EVs in the form of subsidies, public funding or other incentives. Historical criticism of EV reliability, range, affordability and availability is beginning to reduce as major vehicle manufacturers make a strategic shift to electrification as the primary long-term method of power generation.²⁷

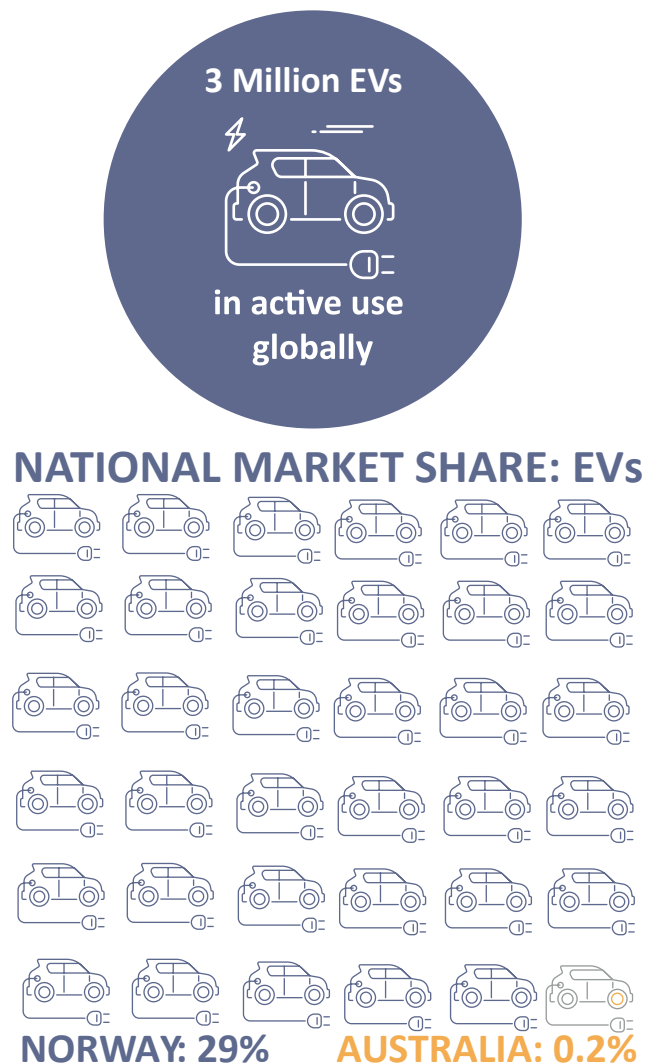


Figure 4. Infographic on global and comparative uptake of EVs

16 Jafari, Behyad (CEO Electric Vehicle Council). Interview 25 September 2018.

17 Infrastructure Victoria, Advice on Automated and Zero Emissions Vehicle Infrastructure August 2018, p. 31

18 Grant, M; Lutsy, N; Wappelhorst, S; Zhou, H, 'Power play: How governments are spurring the electric vehicle industry', May 2018, p.6

19 ClimateWorks Australia & Electric Vehicle Council 'The state of electric vehicles in Australia' June 201

20 Infrastructure Victoria, Advice on Automated and Zero Emissions Vehicle Infrastructure August 2018, p. 31

21 Ibid.

22 Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

23 Electric Vehicle Council, Jetcharge & Charge Fox, slide 28.

24 'What happens when electric cars run over fuel excise?' AFR, 15 April 2018

25 International Council on Clean Transportation- White Paper 'EV-charging-best-practices'

26 Hasham, N, 'Energy Minister Josh Frydenberg defies Coalition naysayers on electric cars', Sydney Morning Herald, 22 January 2018

27 Gray, D, 'Australia unplugged: why we're still lagging behind on electric cars' Sydney Morning Herald, 25 May 2018

3.2 Conceptual Framework

A market uptake of EVs will require major adaptations across a variety of policy fields including transport, energy, land use planning and taxation. This will take place in the context of a spectrum of factors which influence opportunities and constraints that occur at different jurisdictional levels.

This research focuses primarily on identifying planning policy interventions within NSW that can appropriately facilitate EV uptake. However, these opportunities will be influenced by, and should be coordinated with, wider factors that influence outcomes locally, nationally or globally across other spheres of policy.

To appropriately guide the research within this complex environment, a conceptual framework has been developed to help structure and focus both the investigations undertaken and the recommendations provided to NSW DPE.

This framework considers factors that may influence the EV environment at a global, national, state and local level under the following categories:

- Society;
- Economy;
- Environment; and,

- Technology.

It visualises the overlap of these factors in relation to EVs and the different geographic and jurisdictional scales of impact, from global through to local.

Where these factors overlap, at a state and local level, is identified as where planning interventions can meaningfully influence outcomes in NSW. This is highlighted in Figure 5. It is where primarily society and environment factors, and secondarily economy and technology factors, overlap at a state and local level. This area represents the focus of this research report.

It is acknowledged, however, that these wider factors are important to consider in the context of their influence on the relevance and appropriateness of potential actions by the NSW DPE, to support coordinated whole of government solutions in facilitating the uptake of EVs in NSW.

Table 2 – Factors

	SOCIETY	ENVIRONMENT	TECHNOLOGY	ECONOMY
LOCAL	Price sensitivity of consumer Equity of access	Congestion on local roads Concern for local character Reduction of street clutter	Lack of visible EV charging infrastructure	Council resources and capacity to invest in supporting new technology
STATE	NSW population growing to almost 10 million by 2036 Reduced reliance on cars as primary mode of transport.	Electrification of public transport and vehicle fleets Densification of inner urban areas Growth of western Sydney Integrated transport land use planning	Range anxiety due to lack of EV chargers between cities and towns Availability of EV charging infrastructure in homes and public domain	State finances and budget position Investment in infrastructure
NATIONAL	Debate on national settlement, population and immigration policies Current low levels of EV ownership Growing consumer choice and access to EV	Shift to renewable energy sources Vehicle emission regulation City deals	NCC standards Cross border consistency on infrastructure National grid impacts of increased demand Reduced cost of EVs Current level of consumer choice	National Energy Policy EV incentives Potential future loss of tax base from fuel excise Potential for future 'user pays' road charging High cost of EVs
GLOBAL	Aging population Small number of cities and countries driving EV uptake	Consequences of climate change Resource competition and depletion Paris Agreement targets Increased urbanisation	Accelerating technological change Efficiency improvements and reduction in battery costs Manufacturer uptake of EVs and greater model diversity Competing charging types	Global economic shift to asia and growth of developing world economies Price reduction in EVs Greater global connectivity Growth of share economy

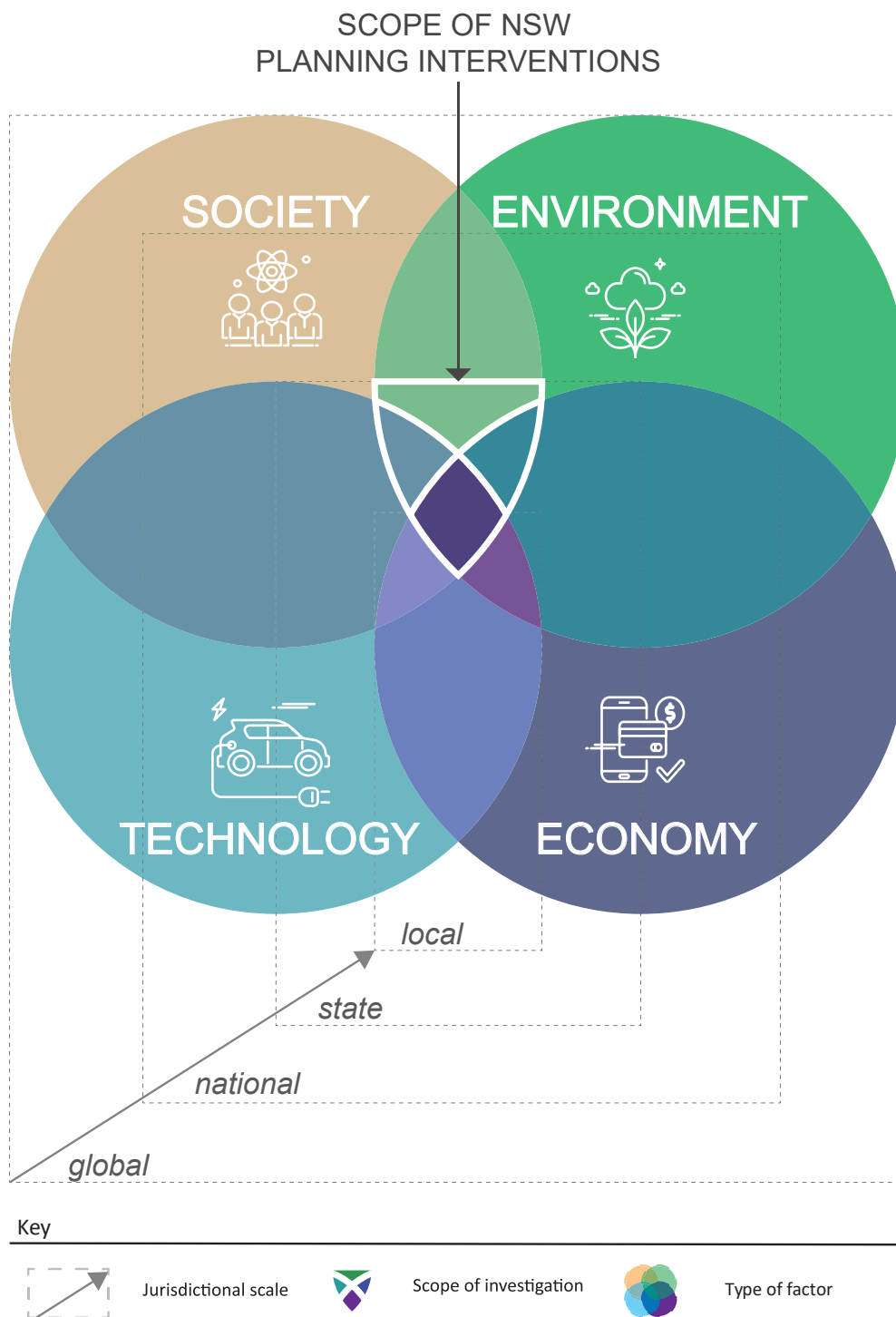


Figure 5. Conceptual Framework

4.0 Research Approach

Research conducted for this report followed a two-pronged approach. The first consisted of a desk-based review of existing materials related to EV charging infrastructure, such as technical documents, academic literature, international and national case studies, media publications and submissions to government enquiries. This review provided important context and background information on EVs and EV charging infrastructure relevant to the research questions, including insights on some of the existing challenges and opportunities. The second consisted of interviews with key stakeholders relevant to EV charging, located in NSW and overseas. The interviews built on the desktop research by exploring gaps in published materials that were identified during the initial desktop review. These interviews also allowed for a greater consideration and cross-referencing of the challenges and opportunities that stakeholders identified as impacting the provision of EV charging infrastructure in NSW.

4.1 Desk-based Research

The review of technical, academic and public opinion material focussed on the status of EV charging infrastructure in NSW. It also examined a number of interstate and international case studies. Documents that informed this research include academic reports, analyst and consulting firm forecasts, policy documents and submissions to government inquiries. A review of the instruments available to the NSW Planning System specific to EV charging infrastructure was also conducted.

4.1.1 Technical and Academic Review

To understand the EV charging infrastructure needs and challenges, the technical review explored key questions relating to:

- the type of EVs available in the Australian market;
- the charging infrastructure and connectivity required for these models;
- the differences in levels of charging;
- the specifications for PHEV versus BEV models;
- the electricity demands;
- the current options for private and public charging infrastructure; and,
- the future directions of charging technology.

To establish a baseline of knowledge on these topics, twenty existing technical reports were consulted across NSW, Australia and internationally. These include documentation and presentations by the Australian Electric Vehicle Council and ClimateWorks, technical reports on EV standards in Australia by consulting groups such as Standards and Rare Consulting, reports from industry partners such

as the ARENA Australian Electric Vehicle Market Study and guidance notes on plug-in EVs for business and consumers from the US Department of Energy.

The technical literature review was accompanied by an assessment of academic papers published in Australian and international journals since 2014, including the 'International Journal of Sustainable Transportation', the 'Renewable and Sustainable Energy Review', and 'Energy Policy and Transportation Research'. Sixteen articles that were suitably relevant to the research questions and some aspects of EV charging infrastructure were identified and reviewed. These technical and academic publications informed the fieldwork and provided additional support for the findings and recommendations that emerged from the interviews.



Figure 6. Tritium fast charger. Source: www.tritium.com.au

4.1.2 Review of Planning Policy

A thorough review of NSW planning policy was conducted to better understand the legislative and policy frameworks that could shape a planning system response for EV charging infrastructure. The review included an analysis of the relevant state, regional and local planning policies and strategies. At the state level, this included the *Environmental Planning and Assessment Act* of 1979 (the Act), relevant SSEPPs and Standard Local Environmental Plan (LEP), as well as broader strategies such as the NSW Future Transport 2056 strategy, NSW parliamentary briefs and the Roads and Maritime Services (RMS) guides. Other state non-policy related documents were reviewed, such as planning for local communities and, planning circulars..

At a regional level, the review included the Greater Sydney Regional Plan (the 'Metropolis of Three Cities') as well as the accompanying district plans. Locally, this review included a review of council policy responses such as Byron Bay (identified early on as an example of progressive planning for EV use). Where other primary research suggested that EV chargers had been installed, Development Control Plans (DCPs) prepared by local councils were also reviewed, including the City of Sydney, Randwick, Byron, Goulburn and Bathurst. These examples provided important information about potential planning opportunities and barriers relating to the provision of EV charging infrastructure in NSW.

Recent (September/October 2018) discussions by State government departments regarding a NSW Electric and Hybrid Vehicle Plan were identified during the interviews. In the absence of any formal documentation however, the researchers have not given this any further consideration in the report.

4.1.3 Government Submissions

Two EV specific government inquiries have been conducted in Australia since 2017. These are the 2017 Victorian Legislative Council Inquiry into Electric Vehicles and the 2018 Parliament of Australia's Senate Select Committee on Electric Vehicles. Submissions to these inquiries from a diverse range of stakeholders identified past, current

and future challenges and opportunities impacting EV uptake.

An initial scan of all submissions revealed a subset of eventeen submissions from government departments, automotive industry representatives, utilities, EV manufactures and special interest groups, that provided useful information in response to the research questions. Submissions were scanned to identify the positions of the various stakeholders specific to EV charging concerns or recommendations, which in turn informed the selection of interviewees.

4.1.4 Media Review

A media scan was undertaken to identify and understand the range of opinions and perceptions related to EVs in Australia. The review included 102 recent media pieces published between January and August 2018, which were sourced through online news platforms via the following search terms: "electric vehicles", "electric vehicle charging" and "electric vehicle planning." The search began with a systematic review of four mainstream Australian news sources published by both NewsCorp and Fairfax Media: the Daily Telegraph; Australian Financial Review; The Australian and; the Sydney Morning Herald. The researchers reviewed all news articles specific to EVs or EV charging infrastructure from these sources within the prescribed time frame. Additional relevant stories were then sourced via wider Google and UNSW Library searches using the same search terms. This included local news sources in Australia, trade and industry media and relevant articles on challenges from other countries.

The media review provided a sense of the current public debate and the interpretations of challenges and opportunities for the EV industry in Australia in general and NSW in particular. Each news article was rated as optimistic, pessimistic or neutral regarding the potential uptake of EVs in Australia. Each article was also rated on a five-point rating according to their perceived relevance to the research questions. The media review identified particular trends, problems or opportunities for planning and EV charging infrastructure across multiple levels of government or parts of the industry.



Figure 7. Mitsubishi CEO Mutsuhito Oshikiri, Minister for Urban Infrastructure Paul Fletcher, Minister for Environment and Energy Josh Frydenberg and AGL CEO Andy Vesey during an electric car event on the front lawn of Parliament House in Canberra on Monday 22 May 2017. Source: Sydney Morning Herald Photo: Alex Ellinghaus.

4.1.5 International and Interstate Case Studies

Existing comparative reviews of international case studies published in technical, academic or media documents were consulted in order to gather examples of existing EV charging practices in different jurisdictions. A primary scan included published material, such as the International Council on Clean Transportation (ICCT) 2017 White Paper,²⁸ the 2012 C40 Cities EV City Casebook,²⁹ a 2010 Harvard Kennedy School review of EV practices in C40 cities,³⁰ as well as comparative analysis within the 2018 Recharging the Economy report produced by the NRMA and EVC,³¹ and the NSW Parliamentary 2018 E-Brief on EVs in NSW.³²

A primary scan of this material identified the overarching picture of EV charging practices around the world and then focussed on some of the repeating ideas and practices highlighted across jurisdictions, such as providing economic and physical incentives and the construction of government or private-sector charging infrastructure. These repeating issues were identified across countries described as 'leading EV nations',³³ such as China, Norway, United Kingdom, the United States, Japan, France, the Netherlands, Canada and Germany. An additional review of these existing comparative analysis then focussed on specific planning challenges and opportunities, drawing out repeating issues identified in the published material that related to the NSW Planning System, such as implementing minimums in residential and commercial developments, charging stations in public car-parks, on-street charging facilities and partnerships with energy utilities.

A secondary analysis of the research focussed on specific experiences from five countries. Although all five had very different experiences with EV charging infrastructure, they all presented lessons relevant to the research questions and the NSW context, such as strategies to address range anxiety, charging in areas of high urban density and balancing public versus private provision of charging infrastructure.

The five countries included Canada, Germany, the Netherlands, the United Kingdom and several cities across the United States. The case studies focussed on major urban centres because of their higher EV market uptake in comparison to national averages.³⁴ National and local government policy documents, consulting firm reports, media articles and academic papers were reviewed for these cases studies, focusing on experiences relevant to the research questions, which revealed common lessons for kerbside charging, building codes, setting minimums for parking spaces, public-space concerns



Figure 8. Electric vehicles charging at kerbside, Netherlands. Source: www.econews.com.au

and working in public-private partnerships to roll out charging infrastructure to address range anxiety. The case study findings are integrated into various subsections of the report.

Ontario, Canada was identified as a particularly interesting example relevant to the NSW context, given the simultaneous challenges for providing charging infrastructure in dense urban areas as well as range anxiety concerns across the country. Further research into the experiences of Ontario identified a 2012 pilot program by the City of Toronto, which aimed to provide kerbside EV charging infrastructure. Local government documents for the City of Toronto were reviewed to determine challenges and opportunities impacting the implementation of this program. A representative of the City of Toronto was also interviewed (Section 7.0), which contributed to the recommendations.

The research also included identifying what steps other jurisdictions across Australia have taken in relation to facilitating EV charging. A Google search for materials relating to planning for EV charging infrastructure across Australia pointed to the experiences of Queensland, the ACT, Victoria and South Australia. State, regional and local strategy documents, action plans and media articles were consulted and in the case of Victoria, the Legislative Council Inquiry into Electric Vehicle and the 2018 Infrastructure Victoria Consultation were also reviewed. Specific consideration was given to prior and current attempts at enabling the provision of EV charging infrastructure.

28 Hall, D. & Lutsey, N 'Emerging best practices for electric vehicle charging infrastructure', prepared for the International Council on Clean Transportation, October 2017.

29 International Energy Agency, Rocky Mountain Institute, the Implementing Agreement for Cooperation on Hybrid and Electric Vehicle Technologies and Programmes, the Electric Vehicles Initiative of the Clean Energy Ministerial, 'EV City Casebook', 2012

30 Wiederer, A. & Philip, R., 'Policy options for electric vehicle charging infrastructure in C40 cities', Government Innovators Network Harvard Kennedy School, 2010

31 Electric Vehicle Council & NRMA 'New policy proposal: recharging the economy- accelerating electric vehicle adoption', 2018

32 Gotsis, T, Electric Vehicles in NSW, NSW Parliamentary Research Service E-brief, May 2018

33 Ibid

34 Hall, D. & Lutsey, N 'Emerging best practices for electric vehicle charging infrastructure', prepared for the International Council on Clean Transportation, October 2017. pp. 16-17

Both the international and interstate case studies allowed the researchers to learn from the experience of other jurisdictions and to reflect on what has been tried, what works and what does not. This generated new ideas, created a context for recommendations and provided important cross-references to the subsequent findings from the fieldwork.

4.2 Fieldwork

4.2.1 Interviews

Following the desk-based review, interviews were conducted to gather detailed information related to the research questions. Possible interviewees were identified by the researchers during the initial review of the policy documentation, academic and technical literature as well as the national and international case studies. A short list of 25 participants was established, with seventeen participants specific to NSW, seven national-level organizations and one international. This included representatives from: automotive industry bodies; EV charging infrastructure installers; state government departments; local councils, energy utilities and providers; strata and building management bodies; and private and commercial developers. The initial list was revised, and participants prioritised based on their applicability to the research questions. Specific participants were then identified through the professional networks of the researchers and selected based on their experiences and expertise relating to EV charging infrastructure. The final list of fourteen interviews included representatives from:

- The EVC;
- The Federal Chamber of Automotive Industries (FCAI);
- The NRMA;
- ARENA;
- Energy Australia;
- Australian Gas Limited (AGL);
- NSW Strata Community Association;
- The Stockland Corporation;
- NSW DPE;
- Transport for NSW; (TfNSW)
- Byron Shire Council;
- EVSE Australia;
- Larry Parsons, Consultant for the the Infrastructure Victoria 2018 Evidence Base Report on Automated and Zero Emissions Vehicles Infrastructure;
- The City of Toronto.

Although six local councils within NSW were contacted with a request for an interview, only one, Byron Shire Council, responded.

The interviews were conducted over a five-week period and the researchers collectively agreed on a set of 5 to 10 questions tailored for each participant based on the overarching research objectives and additional questions that arose during the desktop research.

Interview transcripts were assessed by all researchers to determine whether key issues raised by the participant were challenges or opportunities for the NSW Planning System. Quotes from the interviews were highlighted and added to a table corresponding with the specific opportunity or challenge they represented. Commonalities and differences were assessed and combined under the headings “challenges” (Section 8.1) and “opportunities” (Section 8.2) and cross-referenced against the key themes of the conceptual framework: society, economy, technology and environment. An additional theme, governance, also emerged.

4.3 Developing Conclusions

In order to form recommendations relevant to the research objectives, the challenges and opportunities identified in the interviews were assigned under four categories related to the planning system and reflecting the research brief: charging in 1) new and 2) existing buildings, 3) kerbside charging and 4) private for profit (including commercial) charging. The researchers then workshopped these challenges and opportunities in order to identify potential recommendations that would address the challenges and embrace the opportunities identified. Some of these recommendations were made by interview participants while others were developed by the research team based on the written and interview material collected. The recommendations were then analysed for feasibility of implementation and timescale for delivery. The researchers thus categorized recommendations based on whether they would require NSW DPE to i) Action, ii) Inform, iii) Participate or iv) Influence, and whether there was scope for immediate implementation (‘now’) or whether recommendations were dependent on the success of other recommendations and therefore needed to be implemented ‘later’.

5.0 Research Findings

5.1 Introduction

The six research questions outlined in the introduction guided both the desktop research and the fieldwork. Consequently, the research findings detailed in this section are a response to these questions and have informed the recommendations, which are detailed at the conclusion of this chapter.

The first part of this section examines EV charging infrastructure in an international and Australian context. Key findings from this section include: that internationally, EV charging infrastructure provision is connected to EV uptake; and that within Australia, some states and territories have started to consider their role in facilitating the potential of EV.

The second part of this section examines the technical requirements for EV charging infrastructure, including plug standards, energy requirements, projected uptake in Australia and the anticipated impact of future technology on EVs.

The third section outlines how EV charging infrastructure intersects with the NSW Planning System, including through Strategic Plans, Environmental Planning Instruments and DCPs. It also looks at building codes and regulations, including at a national level, and who might be responsible for facilitating kerbside provision of EV charging infrastructure.

Finally, this chapter analyses what challenges and opportunities exist in the NSW Planning System for facilitating the provision of EV charging infrastructure, before outlining a suite of recommendations that could help achieve this.

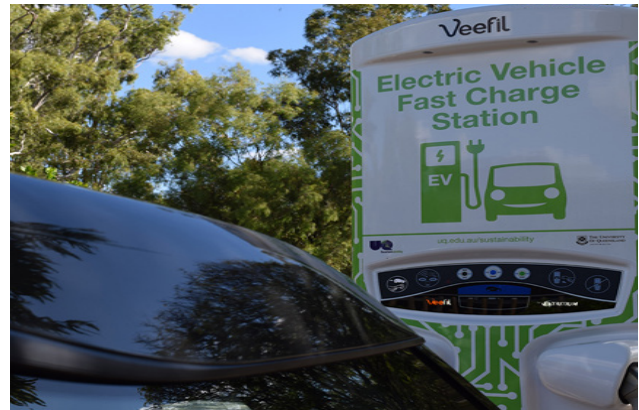


Figure 10. EV charging station.

5.2 EV Charging in the Global Landscape

The experiences of different cities, regions and countries in Germany, the Netherlands, the United Kingdom, Canada and the United States, can inform possible opportunities for learning and adapting ideas and challenges to the Australian (specifically NSW) context.

At an aggregate level, the international experience shows that EV uptake and the provision of EV charging infrastructure in Australia lags behind many other countries. Figure 11 shows data from the ICCT demonstrating the number of EVs sold in 2016 across the top fifteen markets around the world, and the number of chargers per

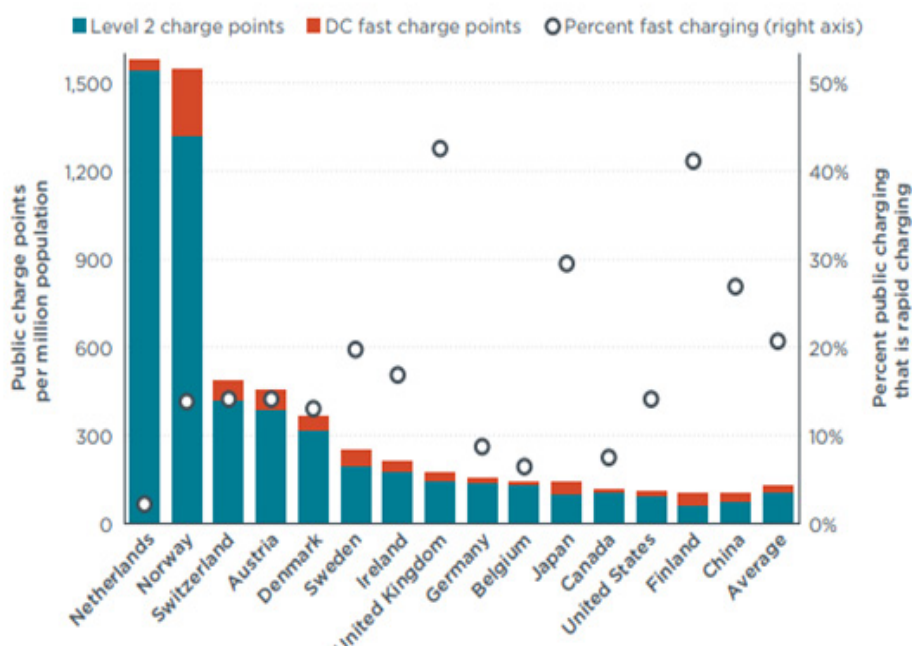


Figure 9. Number of chargers by population Source International Council on CLean Transportation

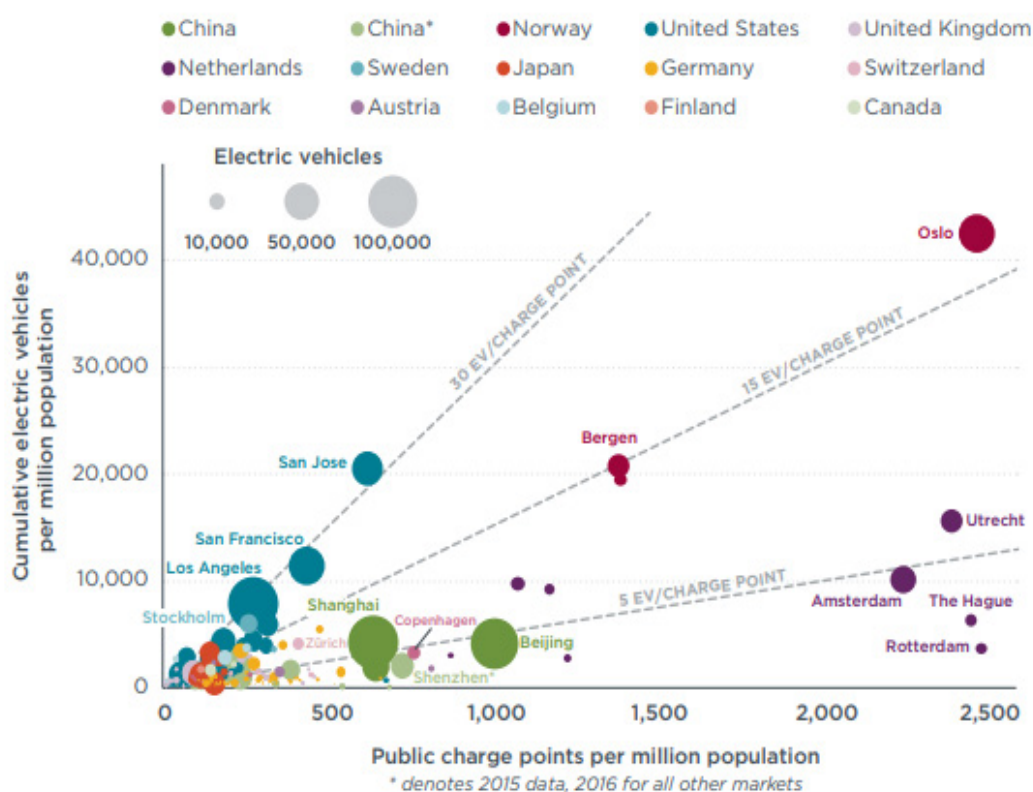


Figure 11. Number of EVs sold in 2016 across the top 15 markets around the world. Source International Council on Clean Transportation

population in those same markets.³⁵

The same ICCT review of fourteen localities suggests several key areas of exploration for successful EV implementation including:³⁶

- Financial incentives;
- Non-financial incentives;
- Community engagement, education and awareness raising; and,
- Availability of charging infrastructure.

Countries, regions, cities and municipalities have approached these four areas differently. This is illustrated in Figure 12.

The ICCT's analysis of over 300 cities finds that public charging infrastructure is "linked with greater electric vehicle uptake"³⁷ and concludes that public charging infrastructure is an

important part of the EV landscape, though levels of charging infrastructure required varies.³⁸ A review of case studies across Europe, the United States and Canada shows a range of key challenges and opportunities related to public charging infrastructure and planning, which include:

- Residential and commercial subsidy programs for charging installation;³⁹
- Government-led strategic placement and selection of public charging points;⁴⁰
- Provision and implementation of kerbside charging points;⁴¹
- Interoperability and standardization;⁴²
- Power supply and electricity grid impacts;⁴³
- Working in private-public partnerships;⁴⁴
- Creating cross-stakeholder working groups and partnerships;⁴⁵

35 Hall, D. & Lutsey, N 'Emerging best practices for electric vehicle charging infrastructure', prepared for the International Council on Clean Transportation, October 2017, pg. 16-17

36 Hall, D. & Lutsey, N 'Emerging best practices for electric vehicle charging infrastructure', prepared for the International Council on Clean Transportation, October 2017

37 Hall, D. & Lutsey, N 'Emerging best practices for electric vehicle charging infrastructure', prepared for the International Council on Clean Transportation, October 2017, pg. 19

38 Ibid.

39 For example in Germany and the Netherlands. Hall, D., Lutsey, N 'Emerging best practices for electric vehicle charging infrastructure', prepared for the International Council on Clean Transportation, October 2017; International Energy Agency, Rocky Mountain Institute, the Implementing Agreement for Cooperation on Hybrid and Electric Vehicle Technologies and Programmes, the Electric Vehicles Initiative of the Clean Energy Ministerial, 'EV City Casebook', 2012

40 For example in Toronto, Canada and California, USA. City of Toronto Transportation Services and Chief Corporate Officer, Preparing Toronto for Electric Vehicles, Public Works and Infrastructure Committee, 3 October 2017; National Renewable Energy Laboratory (NREL), 'Analysis Quantifies California's Electric Vehicle Charging Infrastructure Needs', 2 May 2018, viewed 25 September 2018

41 For example in California, USA and Toronto, Canada. Ibid

42 For example in Germany. German Association of the Automotive Industry, The German Standardisation Roadmap Electric Mobility 2020, 27 April 2017

43 For example in the Netherlands and the UK. Spoelstra, J. and Helmus, J, 'Public charging infrastructure use in the Netherlands: A rollout-strategy assessment,' European Battery, Hybrid and Fuel Cell Electric Vehicle Congress, Brussels Belgium, December 2015; Butcher, Louise; Hinson, Suzanna; Hirst, David, Briefing Paper Number CBP07480 "Electric Vehicles and Infrastructure," House of Commons Library, 20 February 2018

44 For example in China, Japan, and other initiatives such as the Ontario, Canada Electric Highway. Hall, D., Lutsey, N 'Emerging best practices for electric vehicle charging infrastructure', prepared for the International Council on Clean Transportation, October 2017; Ontario Ministry of Transport, 'Ontario Building More Electric Vehicle Charging Stations: Green Investment Fund Fighting Climate Change, Growing Ontario' Economy' News Release, 28 April 2016

45 For example in the Netherlands and California. The Netherlands Ministry of Economic Affairs, The Dutch Approach for the Deployment of Charging Infrastructure, Presentation for EEO Workshop, 9 October 2014; The State of California Governor's Office of Planning and Research, Zero-Emission Vehicles in California: Community Readiness Guidebook, 2013.

- Mapping trends and public-behaviour; forecasting and future planning;⁴⁶
- Providing opportunities for greater exchange of information and education;⁴⁷ and,
- Equity concerns.⁴⁸

For domestic and workplace charging, international case studies identify the following challenges and opportunities:

- Setting minimums in new residential and commercial buildings through building codes;⁴⁹
- Requiring new buildings to be “EV Ready”;⁵⁰
- Encouraging owners, boards, strata etc. from existing buildings to have a discussion about retrofitting for EV charging;⁵¹
- Promoting greater information and education surrounding EV charging infrastructure;⁵² and,
- Providing subsidies for the costs of charging infrastructure installation.⁵³

46 For example in California, USA. National Renewable Energy Laboratory (NREL), ‘Analysis Quantifies California’s Electric Vehicle Charging Infrastructure Needs’, 2 May 2018, viewed 25 September 2018

47 For example New York, USA ChargeNY initiative (NYSERDA, “Best Practice Guides and Cases,” Charge NY, 2018) and; public awareness practices across China, France, Germany, Japan, and many others (Electric Vehicle Council & NRMA ‘New policy proposal: recharging the economy- accelerating electric vehicle adoption’, 2018, p.34)

48 For example London, UK and California USA. London Assembly Environment Committee, ‘Electric Vehicles’, May 2018; Environment California, ‘California Senate Passes Bill to Speed Adoption of Electric Vehicles in Every Community’ News Release, 27 May 2014

49 Examples incl. the EU, under European Parliament legislation, and California’s Green Building Standards Code. Directive (EU) 2018/844 of the European Parliament of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency, PE/4/2018/REV/1, 19 June 2018; California Air Resources Board (CARB), Electric Vehicle Charging Infrastructure: Multifamily Building Standards, 13 April 2018

50 For example California’s EV-Ready Ordinance. The State of California Governor’s Office of Planning and Research, Zero-Emission Vehicles in California: Community Readiness Guidebook, 2013

51 For example in Toronto, Canada’s guidance to Condominium Boards. Ontario Ministry of Transport, ‘About Electric and Hydrogen Vehicles – Condo Boards and Property Managers,’ 12 July 2018

52 For example in Leeds, UK and the Community Readiness Guidebook in California. Leeds City Council, Guidance on Electric Vehicle Charging Points, 2016; The State of California Governor’s Office of Planning and Research, Zero-Emission Vehicles in California: Community Readiness Guidebook, 2013

53 For example in France, the UK and parts of the USA. Electric Vehicle Council & NRMA ‘New policy proposal: recharging the economy- accelerating electric vehicle adoption’, 2018; OLEV, Electric Vehicle Homecharge Scheme guidance for customers: version 2.2, 24 May 2018

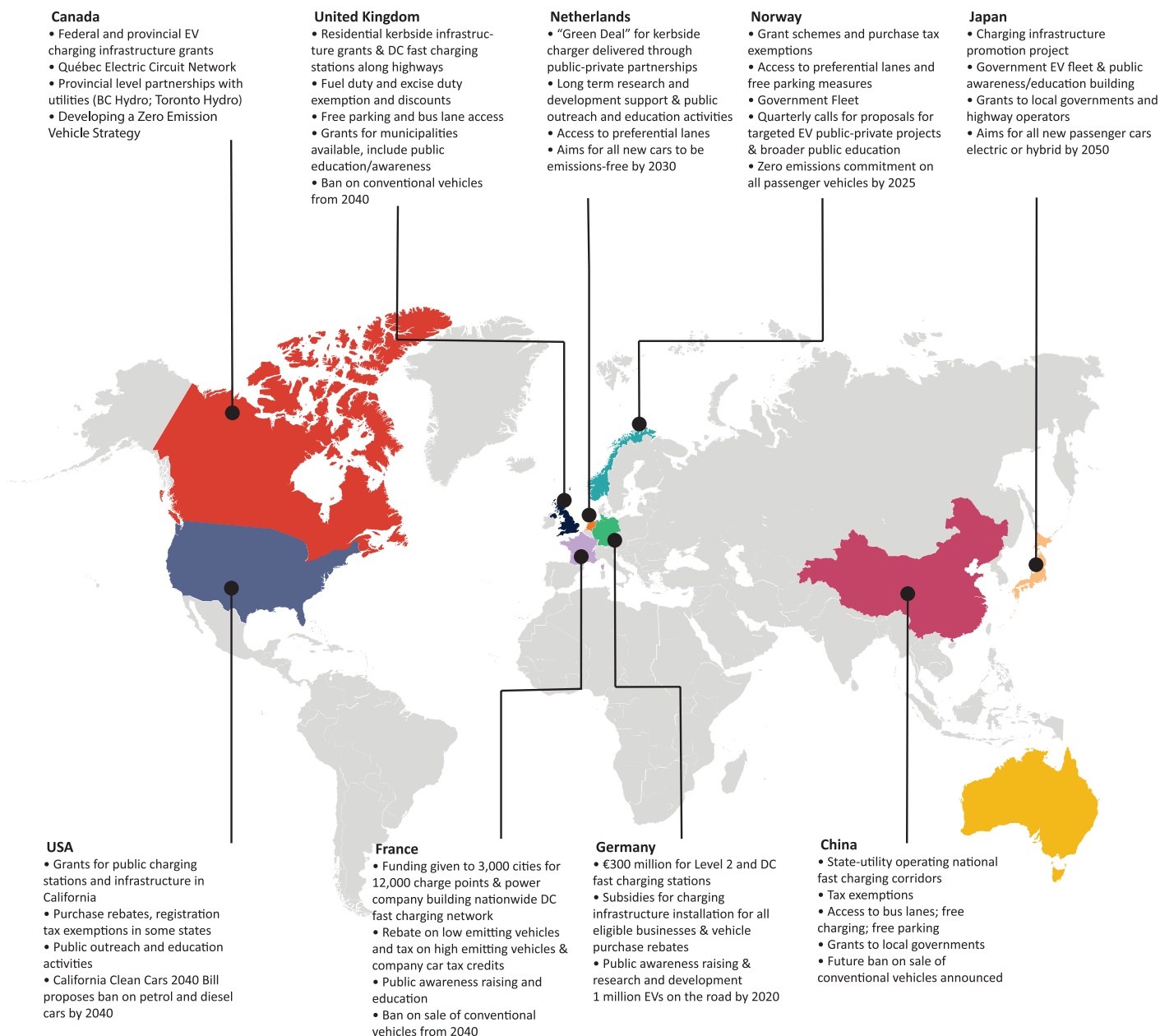


Figure 12. International review of EV charging market

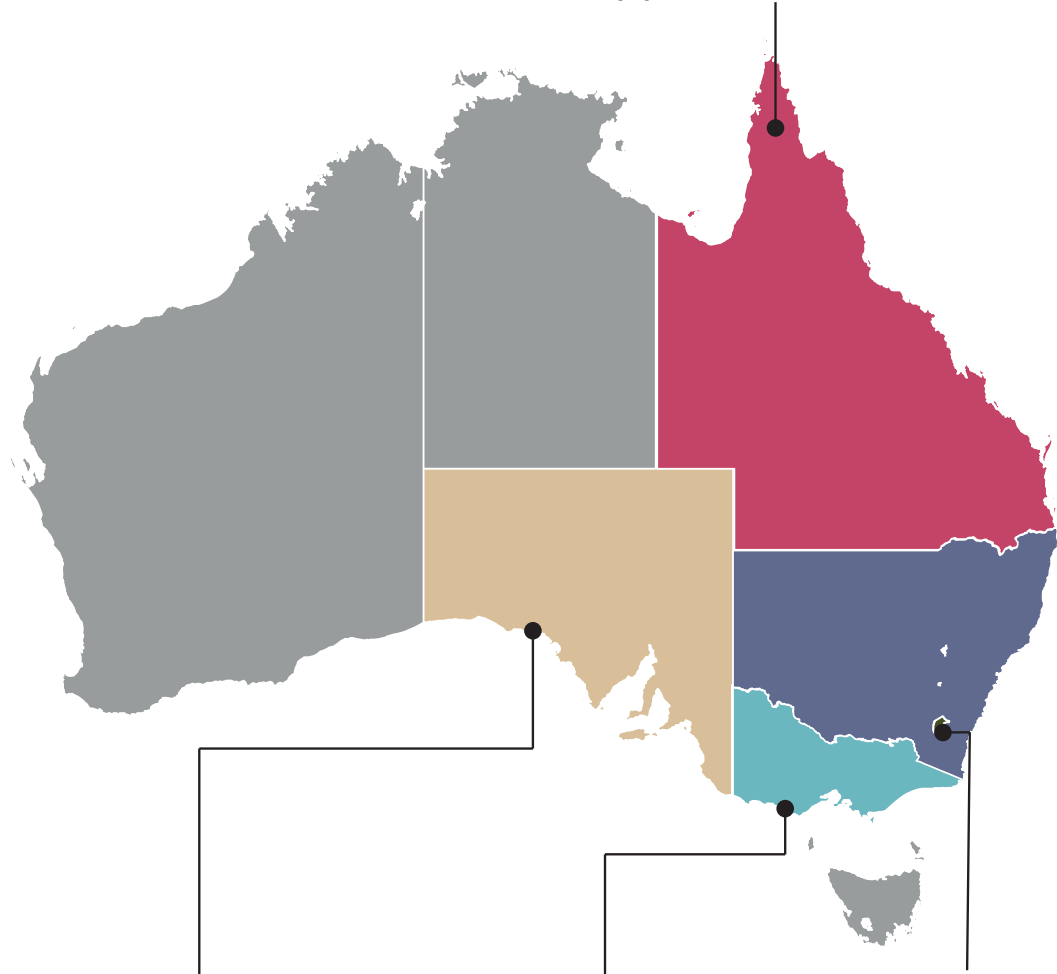
Sources: Hall, D., Lutsey, N ‘Emerging best practices for electric vehicle charging infrastructure’, prepared for the International Council on Clean Transportation, October 2017; Gotsis, Tom, Electric Vehicles in NSW, NSW Parliamentary Research Service E-brief, May 2018; Electric Vehicle Council & NRMA ‘New policy proposal: recharging the economy- accelerating electric vehicle adoption’, 2018; Germany Trade & Invest, Electromobility in Germany: Vision 2020 and Beyond, 2015/16; Reuters, Japan aims to have all new passenger cars be electric by 2050: panel report, Japan Times, 24 July 2018; Government of the Netherlands, Coalition Agreement 2018: Confidence in the Future (Regeerakkoord 2017: Vertrouwen in de toekomst), 10 October 2017

5.3 EV Charging Experiences Across Australia

Across Australia, various initiatives are underway to address EV uptake and facilitate EV charging infrastructure.

Queensland:

- 2017 Queensland EV strategy “The Future is Electric”
- EV charging stations installed as part of “EV Highway.”
- Strengthened access to information on EVs centralized government website and an ‘EV Charging Practice Guide’.



South Australia:

- Adelaide Carbon Neutral Action Plan 2016-2021
- Adelaide’s Low Emissions Vehicle Strategy
- Forty EV charging stations, including charging bays at Upark car parks.
- Smart EV parking system including contactless payment systems and occupancy sensors.
- Rebates of \$5000 on eligible EV charging stations.
- Collaboration between the Government of South Australia, the SA Power Networks, Mitsubishi Motors and Tesla to install chargers.

Victoria:

- May 2018 consultative process led by the Victorian Parliament.
- The Infrastructure Victoria 2018 report on Automated and Zero Emissions Vehicles.

ACT:

- ACT’s Transition to Zero Emissions Vehicle Action Plan 2018-2021.
- Variable motor vehicle stamp duty scheme where zero emissions vehicles registered for the first time are exempt from stamp duty.
- An annual vehicle registration discount of 20% for zero emissions vehicles.
- A trial of two battery electric buses and a hybrid bus.

Figure 13. Australian EV approach by state



Figure 14. State EV policies

5.3.1 Policies and strategies

- The Adelaide Carbon Neutral Action Plan 2016-2021⁵⁴ and Adelaide's Low Emissions Vehicle Strategy;⁵⁵
- The 2017 Queensland EV strategy "The Future is Electric";⁵⁶
- The ACT's Transition to Zero Emissions Vehicle Action Plan 2018-2021⁵⁷ building on the 2014 low emission vehicle strategy.⁵⁸

5.3.2 Financial Incentives

- Rebates of \$5000 available in Adelaide when installing an eligible EV charging station;⁵⁹
- In the ACT there is a variable motor vehicle stamp duty scheme where zero emissions vehicles registered for the first time are exempt from stamp duty.⁶⁰ There is likewise an annual vehicle registration discount of 20% for zero emissions vehicles.⁶¹

5.3.3 Investment in Physical Infrastructure

- In Adelaide, forty EV charging stations are being installed around the city, including charging bays at Upark car parks.⁶² In some instances, this includes the development of smart EV parking system including contactless payment systems, occupancy sensors with overhead indicator lights and other structures that minimise potential lost revenue from vacant spots;⁶³
- Collaboration between the Government of South Australia, the South Australia Power Networks, Mitsubishi Motors and Tesla to install chargers;⁶⁴
- EV charging stations installed in popular tourist locations across Queensland, including regional destinations in collaboration with local governments, utilities and business partners as part of the 2018 completed "EV Highway";⁶⁵
- The ACT is exploring amendments to parking and vehicle access general codes for new multi-unit and mixed-use development, facilitation of charging stations on major routes, as well as streamlining approval process for installation of publicly accessible

EV charging.⁶⁶

5.3.4 Research and Awareness Building

- The Queensland Government has strengthened access-to-information pertaining to EVs as well as EV charging, including a centralised government website⁶⁷ dedicated to information on EVs and an 'EV Charging Practice Guide'⁶⁸ with information on charging types, site selection and the process of charging infrastructure installation;
- ACT is trialling two battery electric buses and a hybrid bus;⁶⁹
- In Victoria, a May 2018 consultative process led by the Victorian Parliament reflected on opportunities and challenges for the State in support of EV uptake. This included the need for public charging stations as well as clear state guidelines for how local governments can provide amendments to their own planning schemes to provide charging infrastructure.⁷⁰



Figure 15. Acting QLD Energy and Main Roads Minister Steven Miles announced electric vehicle charging stations would be installed in regional Queensland towns. Pic: Geoff Egan, Gladstone Observer

54 Government of South Australia and Adelaide City Council 'Carbon Neutral Adelaide: Action Plan 2016-2021', November 2017

55 Government of South Australia 'South Australia's Low Emission Vehicle Strategy 2012-2016', July 2012

56 Queensland Government, 'The Future is Electric: Queensland's Electric Vehicle Strategy', 12 October 2017

57 ACT Government, 'The ACT's Transition to Zero Emissions Vehicles: Action Plan 2018-21', August 2018

58 ACT Government, 'Low Emission Vehicle Strategy: Discussion Paper', June 2014

59 City of Adelaide, 'Sustainability Incentives Scheme: Electric Vehicle 'fast' or 'super charge Charging Points'', 26 September 2018

60 ACT Government, 'The ACT's Transition to Zero Emissions Vehicles: Action Plan 2018-21', August 2018

61 Ibid

62 Electric Vehicle Council & ClimateWorks Australia 'State of Electric Vehicles in Australia 2018', June 2018, pg. 16

63 City of Adelaide, 'Electric Vehicles', September 2018, viewed 28 September 2018 <https://www.cityofadelaide.com.au/explore-the-city/city-travelling-transport/green-travel/electric-vehicle-charging-points>

64 City of Adelaide, 'Electric Vehicles', September 2018, viewed 28 September 2018 <https://www.cityofadelaide.com.au/explore-the-city/city-travelling-transport/green-travel/electric-vehicle-charging-points>

65 Queensland Government, 'Queensland's Electric Super Highway', 10 August 2018, viewed 28 September 2018, <https://www.qld.gov.au/transport/projects/electricvehicles/future/super-highway>

66 ACT Government, 'The ACT's Transition to Zero Emissions Vehicles: Action Plan 2018-21', August 2018

67 Queensland Government, 'Electric Vehicles', viewed 28 September 2018, <https://www.qld.gov.au/transport/projects/electricvehicles>

68 Queensland Government, 'Electric Vehicle (EV) Charging Infrastructure: Practice Note', March 2018

69 Ibid

70 Parliament of Victoria Economy and Infrastructure Committee, 'Inquiry Into Electric Vehicles', Legislative Council, May 2018

6.0 EV Charging Infrastructure: Overview of Technical Requirements

It is essential to understand the types and capacity of EV charging infrastructure so that appropriate interventions for the NSW Planning System can be identified. Several factors determine what type of EV charging infrastructure is installed, including whether it is in a private or public location, grid capacity, installation and operating costs and desired level of charging.⁷¹

Two varieties of plug standards feature on the market:

- Alternate Current (AC) Plug Standards: Type 1 (single phase) and Type 2 (three phase, Australian standard), and;
- Direct Current (DC) Plug Standards: CHAdeMO, Combined Charging System Type 1, Combined Charging System Type 2 and Tesla Supercharger.⁷²

The level of charging varies according to the infrastructure used:

- Portable charging: overnight, 2.4kW- 3.6kW;
- AC charging: hours 22kW; and,
- DC charging: minutes to 1 hour, 22kW- 350kW.⁷³

While the cost of installing EV charging infrastructure varies based on type, the NRMA estimates the following:

- Home installation: \$1,500 for 3.3- 6.6kW;
- Public chargers: \$3,500 for 3.3- 6.6 kW; and,
- Fast chargers: \$70,000- \$180,000 for 50- 350 kW.⁷⁴

Australian EV charging infrastructure manufacturer, Tritium, has established itself as an industry leader, and exports its product to the world.⁷⁵ The company's Veefil stations are located in multiple locations across Australia. This includes NSW, where the NRMA is installing an electric charging network using Tritium's Veefil-RT 50kW (DC) fast chargers.⁷⁶ Similarly, in QLD, the state government is using Tritium as a leading supplier to establish its EV Super Highway.⁷⁷ The Veefil-RT 50kW fast chargers enable drivers to fully charge their car to 80 percent within 30 minutes for any EV with a CHAdeMO or CCS2 socket.⁷⁸

Organisations including the Electric Vehicle Association⁷⁹ and the

Tesla Owners' Club⁸⁰ of Australia, have called on governments in Australia to implement a national standard for EV charging infrastructure. The FCAI, which represents manufacturers and importers of light passenger vehicles, has released a technical statement detailing its preferred standard⁸¹, which is outlined below.

FCAI proposed standards:

General IEC 61851-1	Electric Vehicle Conductive Charging System, General Requirements		
AC Charging AS IEC 62196-2	Plugs, socket-outlets, vehicle connectors and vehicle inlets Configuration Type 2		
DC Charging IEC 62196-3	Configuration AA Configuration FF	CHAdeMO CCS Type 2	or

Figure 16. Federated Chamber of Automotive Industries 'FCAI technical statement on EV charging standards for public charging infrastructure'.

This standard aligns with the Veefil-RT fast chargers that continue to be installed across the nation. FCAI members have agreed to ensure that vehicles and EVSE installers adopt these standards for EV charging infrastructure on all new models introduced from 1 January 2020.⁸² This proposal is supported by the NRMA and the EVC.⁸³



Figure 17. CHAdeMO charging equipment. Source: Wikipedia

71 Electric Vehicle Council, Jetcharge & Charge Fox 'Electric vehicles: Preparing for the future built environment', presentation, 2018, slide 10.

72 Electric Vehicle Council, Jetcharge & Charge Fox, slide 8.

73 Electric Vehicle Council, Jetcharge & Charge Fox, slide 9.

74 Electric Vehicle Council & NRMA, 'New policy proposal: recharging the economy- accelerating electric vehicle adoption', 2018, p. 6.

75 Tritium, 'Our story: expertise in e-mobility services', viewed 23 September 2018.

76 Tritium, 'NRMA orders 40 chargers for new network', press release, June 2018, viewed 23 September 2018.

77 Tritium, 'Tritium supplies QLD electric highway', press release, August 2017, viewed 23 September 2018.

78 Ibid.

79 Australian Electric Vehicle Association inc, Submission to the Senate Select Committee on Electric Vehicles, 2018, p. 3.

80 Tesla Owners Club of Australia, Submission to the Senate Select Committee on Electric Vehicles, 26 July 2018, p. 7.

81 Federal Chamber of Automotive Industries 'FCAI technical statement on EV charging standards for public charging infrastructure', 18 September 2017, viewed 23 September 2018.

82 Ibid.

83 Electric Vehicle Council & NRMA 'New policy proposal: recharging the economy- accelerating electric vehicle adoption', 2018 p. 15.

6.1 EV Charging Energy Requirements

When provisioning for EV charging infrastructure, a number of energy-related issues must also be considered. These include the availability of electricity, implications on the energy grid when EVs are charged directly and the source of electricity used to power the vehicle.⁸⁴

Comments provided in both the government inquiry submissions from energy providers and interviews with ARENA, AGL and Energy Australia suggest that there are no immediate concerns for the impact on the grid with a greater uptake of EVs. This is based on the assumption that economic drivers will help manage charging loads and allow for utilities to adjust to the demand as needed.⁸⁵ Nonetheless, the following quotes gathered from fieldwork and desktop research suggest that a strategy may be needed for managing potential future implications of EV uptake.

Energia finds that:

“as the largest single residential load, PEVs could have a significant cost impact on electricity grids. However, they could also help keep costs when used to help manage peak demand or over-generation of solar PV.”⁸⁶

TfNSW highlights that:

“there will be locations where you just can’t put a fast charger” ... however “there [are] a few myths out there that as electric vehicles come along that the electricity system is going to fall over. Clearly it isn’t going to fall over, but it will work a lot better if the electricity system is designed to optimise the use. Reduce the use or minimise the use at peak periods where we know the system is not all that far off capacity but maximize the use by EVs when there’s plenty of capacity available.”⁸⁷

ARENA is helping to fund a study in Adelaide, South Australia to:

“inform how, when and where network impacts, caused by groups of EVs charging together at the same time in the same location (hotspots), may occur in the early stages of the EV market.”⁸⁸

The Centre for Energy and Environmental Markets (CEEM) also highlights that new technologies and distributed energy resources such as rooftop PV and battery energy storage; provide new opportunities for energy consumers to: “more meaningfully participate in their energy service provision,” unmanaged electromobility technologies could be a challenge if they increase peak demand, expand the range of voltages needed to be managed in the network, and increase costs for potential grid augmentation⁸⁹



Figure 18. Tesla Super Chargers. Source: Wikipedia

84 Electric Vehicle Council & ClimateWorks Australia ‘State of Electric Vehicles in Australia 2018’, June 2018

85 Padman, Jessica (Strategic Planning Lead, Corporate, Energy Australia) Interview, 18 September 2018 and; AGL Energy Limited, Submission to the Commonwealth Parliament Senate Select Committee on Electric Vehicles 2018, 27 July 2018

86 Energeia ‘Australian electric vehicle market study’, prepared for ARENA & the CEFC, May 2018, p.36

87 Newman, David (Manager, Congestion Technology & Innovation, Transport for NSW) and Deniz Ortac (Senior Policy Officer, Congestion Technology & Innovation, Transport for NSW). Interview, 2 October 2018.

88 Australian Renewable Energy Agency (ARENA), Submission to the Select Committee on Electric Vehicles, July 2018 p. 2-3

89 Centre for Energy and Environmental Markets, Opportunities to Facilitate Electric Mobility in Australia, Submission in response to the Senate Select Committee on Electric Vehicles, University of NSW, July 2018, p.1-2

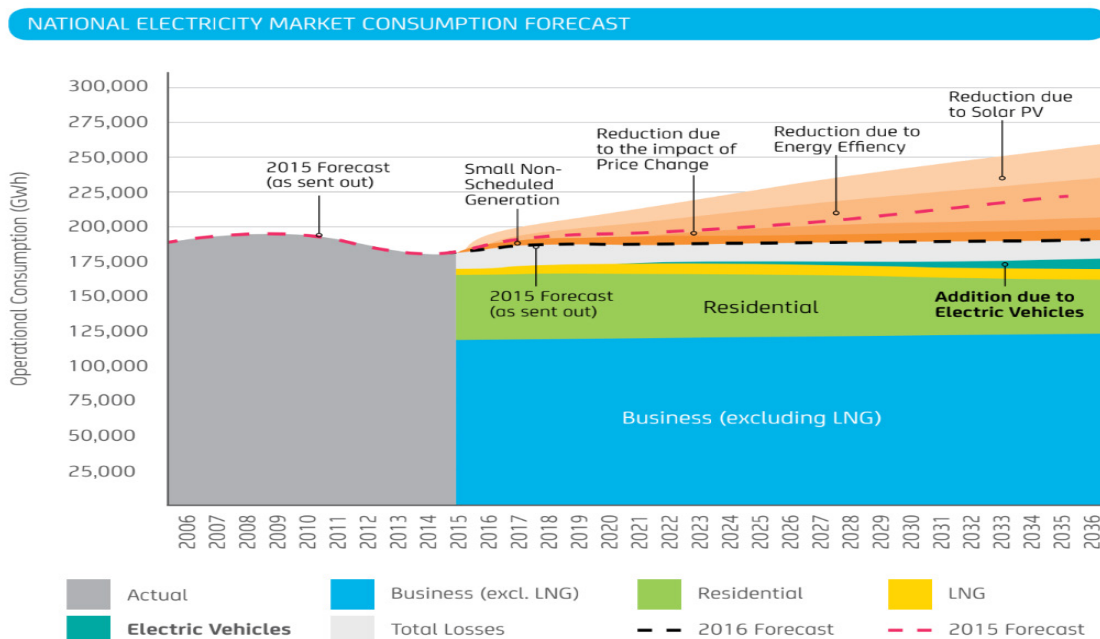


Figure 19. Source: NREMA

Examples from other jurisdictions around the world also suggest anxiety about overloading energy networks. For example, in the United Kingdom Members of Parliament have raised concerns that clusters of battery powered cars could result in unplanned drops in voltage and damage to electronic equipment if more is not done to transition users to smart chargers and encourage off-peak charging.⁹⁰

Electricity suppliers and grid operators play a significant role in many overseas EV markets. In Germany, power companies are building and operating most of the public charging facilities.⁹¹ In the Netherlands, a consortium of regional electricity grid operators (E-laad now EVnetNL) were some of the first to deliver EV charging infrastructure and the National Knowledge Platform for Charging Infrastructure is leading on work with distribution system operators, charging point operators and municipalities to explore how planning can reduce risks to overloading local power sources.⁹² The City of Toronto is working with Toronto Hydro, its main utility, to facilitate public charging infrastructure.⁹³ The National Grid in the United Kingdom is working on a 'capacity market' to ensure enough supply to meet energy demands from EVs and other technologies, along with other measures to balance the grid.⁹⁴ The City of London is working with Ofgem's Low Carbon Network Fund to investigate how EVs can better connect to a smart grid to deliver safe and secure supply.⁹⁵

Energia argues that electricity networks and energy retailers are in a strong position to help deploy Australia's future public charging network.⁹⁶ AGL, for example, has begun to provide support through an Electric Car Plan and has called for coordinated cross-government leadership through the COAG Energy Council to develop an EV roadmap that establishes a nationally agreed target and supporting policy initiatives.⁹⁷ However, CEEM suggest that new modelling tools and data may be needed to fully understand the impact of emerging technologies on the electricity sector.

Analysis by Climate Works and EVC found that, "the average EV charging from the grid in 2016 emitted less than an average internal combustion engine vehicle in all states except Victoria."⁹⁸ As highlighted in the Intergovernmental Panel on Climate Change 2018 report, to ensure that Australia responds to the global effort to address climate change⁹⁹ and to meet its commitments under the Paris Climate Agreement, it will need to decarbonise its electricity and transport sector and increase renewables across the electricity generation network.¹⁰⁰ AGL and Energy Australia suggest that EVs in the Australian economy can promote a faster shift toward the benefits of decarbonisation of the electricity system and greater use of renewable energy.¹⁰¹

90 Vaughan, Adam, 'Is there enough electricity? National Grid reacts to fossil-fuel vehicle ban,' The Guardian, 27 July 2018

91 Eckert, Vera, 'Germany installs more electric car chargers, but still unprofitable,' Thompson Reuters 25 July 2018; Germany Trade & Invest, Electromobility in Germany: Vision 2020 and Beyond, 2015/16

92 Spoelstra, J. and Helmus, J., 'Public charging infrastructure use in the Netherlands: A rollout-strategy assessment,' European Battery, Hybrid and Fuel Cell Electric Vehicle Congress, Brussels Belgium, December 2015; The Netherlands Enterprise Agency, Electromobility in the Netherlands: Highlights 2015, June 2015

93 Sabo, Paul (Senior Engineer, Operational Planning & Policy, City of Toronto). Interview, 21 September 2018.

94 Butcher, Louise; Hinson, Suzanna; Hirst, David, Briefing Paper Number CBP07480 "Electric Vehicles and Infrastructure," House of Commons Library, 20 February 2018

95 Office for Low Emission Vehicles, Making the Connection: The Plug-In Vehicle Infrastructure Strategy, June 2011

96 Energiea 'Australian electric vehicle market study', prepared for ARENA & the CEFC, May 2018, p.10

97 AGL Energy Limited, Submission to the Commonwealth Parliament Senate Select Committee on Electric Vehicles 2018, 27 July 2018

98 Electric Vehicle Council & ClimateWorks Australia 'State of Electric Vehicles in Australia 2018', June 2018, p.15

99 The Intergovernmental Panel on Climate Change in their October 2018 report find that limiting global warming to 1.5 degrees would "require rapid, far-reaching and unprecedented changes in all aspects of society." IPCC, 'Summary for Policymakers of IPCC Special Report on Global Warming of 1.5 degree celsius approved by governments' IPCC Press Release, 8 October 2018

100 Electric Vehicle Council & ClimateWorks Australia 'State of Electric Vehicles in Australia 2018', June 2018, p.9

101 Energy Australia interview; AGL Energy Limited, Submission to the Commonwealth Parliament Senate Select Committee on Electric Vehicles 2018, 27 July 2018

6.2 Projected Need for EV Charging: Domestic & Public

In 2017, 23 EV models were available for sale in Australia, an increase of 44 percent from 2016. In 2018-19, another nine PHEV and BEVs are expected to enter the Australian market. Five of these models will cost less than \$60,000.¹⁰² The EVC estimates that there are currently 783 EV public charging stations in Australia, an increase of 64 percent from 2017.¹⁰³

Conservative estimates indicate that EVs will make up approximately 10 per cent of the passenger vehicle market by 2025.¹⁰⁴ This equates to 120,000 new vehicles each year between now and 2025.¹⁰⁵ Of these, at least 12,000 per year will be in strata titled properties.¹⁰⁶ This means demand for EV charging infrastructure, at both a domestic and public level, will continue to grow.

The EVC highlights¹⁰⁷ the important role government will play in facilitating the growth of this market in Australia, stating that

“zero to five percent [of market uptake is] very incremental and painful and then five to 95 percent being exponential. Where we see governments having a very important role to play is inside the incremental state, from zero to five percent where there’s a mix of uncertainty.”

The Australian Electric Vehicle Market Study, commissioned by ARENA and the Clean Energy Finance Corporation, anticipates that drivers with access to dedicated charging either at home or at work will make up approximately seventy per cent of the private vehicle transportation market and that these drivers will need public charging for ‘around one per cent of kilometres travelled and for long-haul trips’.¹⁰⁸

This leaves thirty percent of the market without access to dedicated charging. These vehicle owners will require 100 percent public charging, including at commercial sites such as shopping centres. However, the Australian Electric Vehicle Market Study expects that 99 per cent of the kilometres travelled can be serviced by using Level 2 public charging at work or public DC fast chargers.¹⁰⁹

These market segments were determined using parking data drawn



Figure 20. Karside chargers. Source: Google

from the 2016 UK National Travel Survey and have been applied to an Australian context.¹¹⁰ The NRMA similarly estimates that 80 percent of EV owners charge at home, with the other 20 percent relying on their workplace, shopping centres (commercial areas) or road-trip fast charging.¹¹¹

The EVC notes¹¹² that:

“in areas that have a lot of access to off street [parking], the electric vehicle to public charger ratio is somewhere around 1 to 25. So, one public charger being required for every 25 electric vehicles in that jurisdiction. Whereas in areas...where there’s not as much off street parking available, that ratio comes 1 to 5. So, it needs to be 1 public charger available for every 5 electric vehicles in the area...The Australian market will move from a car park that has 2 or 3 electric vehicle chargers to the expectation being that every car park has electric vehicle charging available in it.”

Consequently, new developments (single family homes and multi-unit) will need to consider how to build in future capacity, while pre-existing developments will need to consider how to best retrofit to meet demand. Strata dwellings, in particular, have a number of associated complexities including availability of parking space, monitoring use, grid capacity of the building and appropriate usage pricing and metering. EVSE installer Jet Charge suggests as a guide that twenty percent of residents should be able to charge at any one

102 Electric Vehicle Council & ClimateWorks Australia ‘State of Electric Vehicles in Australia 2018’, June 2018, pp. 10-11.

103 Ibid, p. 13.

104 Electric Vehicle Council, Jetcharge & Charge Fox, slide 18.

105 Electric Vehicle Council, Jetcharge & Charge Fox, slide 19.

106 Electric Vehicle Council, Jetcharge & Charge Fox, slide 20.

107 Jafari, Behyad (CEO Electric Vehicle Council). Interview 25 September 2018.

108 Energeia ‘Australian electric vehicle market study’, prepared for ARENA & the CEFC, May 2018, p.5.

109 Ibid.

110 Energeia ‘Australian electric vehicle market study’, prepared for ARENA & the CEFC, May 2018, p.5

111 Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018

112 Jafari, Behyad (CEO Electric Vehicle Council). Interview 25 September 2018.



PARTICIPATE

RECOMMENDATION

Develop partnerships with energy providers to plan for overlapping challenges as a consequence of EV uptake.

time, and that 100 per cent of residents should be able to access EV charging.¹¹³

The difficulty in predicting demand for EV charging needs is evident around the world and is subject to local considerations and factors¹¹⁴. The EVC states that:

“when we are looking at more mature markets than ours and recognising there’s no market that’s at anywhere near fifty or 100 percent [of EV uptake].”

This demonstrates the importance of strong, robust data. In the US, the California Energy Commission has partnered with the United States National Renewable Energy Lab. Together, they are addressing this challenge through an “EVI-Pro” tool.¹¹⁵ This uses real-world travel data alongside county, state and national data to anticipate consumer charging behaviour while capturing variations in housing type, vehicle adoption, user demographics, market adoption conditions and growth and EV travel and charging patterns to project the number of home, workplace and public charge points needed by 2025 in each Californian county.¹¹⁶ Further analysis using the EVI Pro Model alongside other data sources allows for real-time information on integration of charging loads with the utility grid.¹¹⁷



Figure 21. CHAdeMO socket. Source: Google

6.3 Preparing for the Future

EVSE technology continues to evolve with smart, rapid and wireless charging either already in use or on the horizon. Smart meters in particular are useful in multi-unit dwellings because they can restrict charging to specific times, such as off-peak periods, minimising use during surge price periods while maximising the energy efficiency of the building.¹¹⁸ Very rapid charging, which is more than 350 kW, will soon be adopted in Europe and the United States.¹¹⁹ Wireless charging is a relatively new phenomenon, and overseas companies such as US company Plugless have made this technology available for some EV models including the Tesla Model S, BMW i3, Nissan Leaf and first-generation Chevrolet Volt.¹²⁰ ARENA in its market study anticipates that this technology could become the standard within the next decade.¹²¹

In interviews conducted for this report industry groups urge a holistic and considered approach to allow for adaptability as technologies shift.

The President of the NSW SCA explains one of the key challenges is that:

*“we’re building today’s buildings and trying to provision them for tomorrow’s technology”.*¹²²

The FCAI highlights additional factors that require consideration, including disruptive technologies in fuel, with other zero emissions vehicles such as hydrogen fuel cells also on the market, as well as the potential of future technology “unknowns” with smart-grid connected and automated vehicles.¹²³

Energy Australia states that:

*“with multiple new technologies [such as] autonomous vehicles, hydrogen fuelled cars, drones, etc. on the horizon competing for a share of future mobility, investing large sums in EV charging involves considerable risk.”*¹²⁴

Summing up the need to prepare to be part of the advanced world’s technology, the FCAI explains:

*“you’re either part of the game or you’re completely out of it”.*¹²⁵

¹¹³ Electric Vehicle Council, Jetcharge & Charge Fox, slide 28.

¹¹⁴ Jafari, Behyad (CEO Electric Vehicle Council). Interview 25 September 2018.

¹¹⁵ California Energy Commission (CEC) and National Renewable Energy Laboratory (NREL), EV Infrastructure (EVI-Pro), 2017

¹¹⁶ Wood, Rames, Muratori, Raghavan and Melaina, National Plug-In Electric Vehicle Analysis, September 2017, US Department of Energy Office of Energy Efficiency and Renewable Energy; NREL, ‘Analysis Quantifies California’s Electric Vehicle Charging Infrastructure Needs’, 2 May 2018, pg 12

¹¹⁷ NREL, ‘Analysis Quantifies California’s Electric Vehicle Charging Infrastructure Needs’, 2 May 2018

¹¹⁸ Electric Vehicle Council & NRMA, 2018, p. 19.

¹¹⁹ Hall, D, Lutsey, N ‘Emerging best practices for electric vehicle charging infrastructure’, prepared for the International Council on Clean Transportation, October 2017, p. 24.

¹²⁰ Charlton, A ‘Wireless electric vehicle charging explained’, Techradar, 18 April 2018, viewed 23 September <https://www.techradar.com/au/news/wireless-electric-vehicle-charging>

¹²¹ Energeia, 2018, p. 5.

¹²² Duggan, C., NSW President Strata Community Association. Interview 12 September 2018.

¹²³ Webber, T (CEO, Federal Chamber of Automotive Industries) & Obradovic, L (Policy Director, Federal Chamber of Automotive Industries). Interview 10 September 2018.

¹²⁴ Padman, Jessica (Strategic Planning Lead, Corporate, Energy Australia) Interview 18 September 2018

¹²⁵ Ibid.

The challenge for promoting and preparing for future technology is also evident in a number of international cases. Germany, for example, has around 10,700 public charging points¹²⁶ and is pursuing a holistic electromobility approach that supports battery charging technology, as well as advanced charging and energy transition systems and an eventual full coverage charging infrastructure with grid integration and feedback.¹²⁷

Germany has developed a network of partnerships between the government, vehicle manufacturers, electricity providers, storage facilitators, electric grid installers and communication-based technology companies, in order to set standards, products and services that communicate with each other for a smart-grid system to be expanded as more EVs come on the market.¹²⁸ Smart grids through the “E-Energy: ICT Based energy system of the future” project¹²⁹ are using predictive systems to forecast power consumption and generation according to weather conditions and simultaneously reviewing pricing information.¹³⁰

Another consideration for the future is repurposing areas such as petrol stations for EV charging. Across Britain and the Netherlands for example, Shell has started to equip petrol service stations with fast EV chargers, with others such as Total in France reportedly considering the viability. Shell finds that they can accommodate a better user experience where a 15-20min fast charge to 75% can be accompanied by a sandwich and coffee.¹³¹



Figure 23. Source: Google



Figure 22. Artists impression of future urban environment with EVs and AVs. Source: Infrastructure Victoria

¹²⁶ Germany Trade & Invest, ‘Electric Vehicles Charging Infrastructure: Market Data and Trends’, 2018

¹²⁷ Germany Trade & Invest, Electromobility in Germany: Vision 2020 and Beyond, 2015/16

¹²⁸ Ibid.

¹²⁹ Federal Ministry of Economics and Technology, Germany, E-Energy: ICT-based Energy System of the Future, April 2008

¹³⁰ Germany Trade & Invest, Electromobility in Germany: Vision 2020 and Beyond, 2015/16

¹³¹ Ward, Andrew, Shell to install chargers for electric cars on European forecourts, Financial Times, 30 January 2017

7.0 The NSW Planning System and EV Charging Infrastructure

7.1 Introduction

The NSW Planning System has a hierarchical structure, with the the Act at the top, supported by the *Environmental Planning and Assessment Regulation 2000*. These very broad pieces of legislation primarily govern the processes of strategic and statutory planning in NSW. The objects of the Act are:

- a. *to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,*
- b. *to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,*
- c. *to promote the orderly and economic use and development of land,*
- d. *to promote the delivery and maintenance of affordable housing,*
- e. *to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,*
- f. *to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),*
- g. *to promote good design and amenity of the built environment,*
- h. *to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,*
- i. *to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,*
- j. *to provide increased opportunity for community participation in environmental planning and assessment.*¹³²

The Act also makes two important divisions, being; the creation of strategic planning documents and policy instruments under Part 3 and the pathways and processes of development assessment under Part 4.



Figure 24. Cable hazard ,UK. Credit: SpeakEV

7.1.1 Strategic Policy Instruments

Planning policy instruments under Part 3 include: Strategic Plans (being Regional and District Strategic Plans and Local Strategic Planning Statements); Environmental Planning Instruments (SEPPs) and LEPs; and DCPs.

7.1.2 Strategic Plans

Guided by Sections 3.3 and 3.4 of the Act, Strategic Plans are created by relevant authorities for regions and districts within NSW. It should be noted, however, that only the Sydney region has district plans, which are the responsibility of the GSC. Importantly, Strategic Plans must take into consideration Infrastructure Strategies, other relevant government policies and any matter as directed by the Minister, which includes the consideration of policies adopted by Infrastructure NSW. Focusing on Sydney, the 'Metropolis of Three Cities' was adopted in 2018 and from this the District Plans have been drafted and exhibited.

The 'Metropolis of Three Cities' identifies the need to keep up with technological change in areas such as mobility and makes specific mention of increasing EV and associated infrastructure.¹³³ For instance, objective 3 states that, "infrastructure to support Greater Sydney needs to be designed to adapt and transition with technological changes and mega trends. For example... design places for electric vehicle recharging..."¹³⁴ and from this, strategy 3.1 looks to "Consider the adaptability of infrastructure and its potential shared use when preparing infrastructure strategies and plans".¹³⁵ Also, more specific to planning, strategy 12.2 in objective 12 aims

¹³² Environmental Planning and Assessment Act 1979 (NSW) s. 1.3

¹³³ Greater Sydney Commission, 'Greater Sydney Region Plan - A Metropolis of Three Cities', March 2018 p. 30

¹³⁴ Greater Sydney Commission, 'Greater Sydney Region Plan - A Metropolis of Three Cities', March 2018 p. 40

¹³⁵ Ibid

 PARTICIPATE	RECOMMENDATION Commence consultation on how best to incorporate EV charging infrastructure provision in all new buildings with interested parties (developers, construction industry etc.)
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to incorporate charging stations for EVs when planning for precincts and centres.¹³⁶

Regional Plans adopted outside of Sydney fail to indicate any key objectives or strategies that focus on, or even mention, charging infrastructure for EVs. On the other hand, using the Hunter Regional Plan as an example, there are broader objectives relating to reduced emissions and transport infrastructure.¹³⁷ Therefore the promotion of EV use through fostering the provision of charging infrastructure would likely be consistent with these types of objectives.

Given the broad nature of Strategic Plans, they generally do not impact development at ground level (in other words the physical provision of EV charging infrastructure). However, to ensure they are given effect at local level, Strategic Plans are required to be considered when preparing LEPs and Local Strategies.

7.1.3 Environmental Planning Instruments

SEPPs relate to planning matters of state and regional significance and are prepared by NSW DPE and formally made by the NSW Governor via the Ministry. There are few requirements over the preparation of SEPPs within the Act.

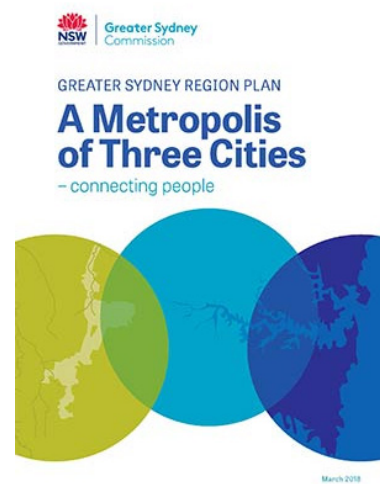
The SEPPs considered to be most relevant to the provision of EV charging infrastructure include:

SEPP (Infrastructure) 2007

- This SEPP aims to facilitate the effective delivery of infrastructure across the State,¹³⁸ as well as outlining certain development that may be completed as exempt and complying development, mostly by public authorities on public land but also by any land owner in prescribed zones.
- In August 2018, NSW DPE outlined amendments and additions to the Infrastructure SEPP, including adding provisions for EV charging under Part 3, Division 17, Subdivision 3. These provisions made the installation of EV charging infrastructure exempt development for all land owners or occupiers where used in a non-commercial basis, as well as in existing car-based development, such as car parks, bus depots or service stations. From discussions with the NRMA, it is understood that these recent changes have already provided benefits by clarifying some of the uncertainties regarding the approval pathway for EV charging infrastructure.¹³⁹

SEPP (Exempt and Complying Development Codes) 2008

- This SEPP provides the specific development standards for exempt and complying development¹⁴⁰ and has a state-wide application. Currently, there are no provisions that relate to the installation of electric vehicle infrastructure.



September 2018 update
to Infrastructure SEPP

Part 3,
Division 17,
Subdivision 3.

EV charging
infrastructure
exempt
development

¹³⁶ Greater Sydney Commission, 'Greater Sydney Region Plan - A Metropolis of Three Cities', March 2018 p. 76

¹³⁷ NSW Department of Planning and Environment, 'Hunter Regional Plan', NSW Government, October 2016.

¹³⁸ State Environmental Planning Policy (Infrastructure) 2007 (NSW) s. 1.2

¹³⁹ Conoplia, B & Giltinan, R, The NRMA. Interview 7 September 2018

¹⁴⁰ State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 (NSW) s. 1.3

 ACTION	RECOMMENDATION Following consultation regarding the provision of EV charging infrastructure for all new buildings, amend SEPP 65 to include detail around the provision.
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SEPP No. 65 Design Quality of Residential Apartment Development

- This SEPP relates to the construction of residential apartments, including mixed use development. It aims to improve the design and quality of apartment development and includes apartment buildings constructed by social housing providers or public authorities.¹⁴¹ Development must be considered against the design quality principles under Schedule 1 and the Apartment Design Guide, which is prepared separate to the SEPP by the NSW DPE. There is also a provision that relates to the installation of EV infrastructure¹⁴².
- In terms of provisions for EV charging infrastructure in all new apartment buildings, it could be considered that this instrument might provide the best opportunity. However, from discussions with NSW DPE, there are concerns over whether this would be appropriate in capturing the provision of EV charging infrastructure in new development, considering they focus on design aspects of apartments. Another option for the provision of EV charging in new buildings includes updating the National Construction Code (NCC), however, as discussed below, the NSW Planning System has no legislative power and there are challenges involved with timeframes. Subsequently, there are significant issues that remain to be resolved.

In addition to SEPPs, LEPs are instruments used at a local level to influence development. Whilst generally prepared by local councils, LEPs follow the form of the Standard Instrument template which is under the care and control of NSW DPE. Importantly LEPs provide land use zones within Local Government Areas, and these zones include development that is exempt, development permitted with consent and development that is prohibited. The standard instrument includes a number of land use definitions that are included in all LEPs and, importantly, there is no means for defining EV charging infrastructure.

Changes made to the standard instrument may also have the effect of automatically amending LEPs. Through this, NSW DPE has the means to make quick, broad-stroke changes to land-use planning provisions.

7.1.4 Development Control Plans

Whilst DCPs give effect to the aims of SEPPs and LEPs, in terms of the hierarchical nature of planning policy, they have the least power to affect development. In other words, whilst the policy provisions within DCPs may be applicable, where they are non-compliant with SEPPs or LEPs, these other instruments prevail. Furthermore, given they relate to the local level of development, they are generally prepared by councils with minimal input from NSW DPE.

As a result, DCPs and the requirements within them vary from council area to council area, and therefore there is little certainty that any provision would be uniform across the state. Although most, if not all, DCPs provide parking standards and new development is generally required to show compliance with these standards.

Whilst we were not able to view the DCP of every Local Government Authority, from those we did view, as well as our interviews, we were unable to identify any DCP provisions that relate to the installation of EV charging infrastructure in new development. Notwithstanding this, NSW DPE are currently looking at preparing a standard DCP document.¹⁴³ Subsequently, there could be an important opportunity to provide input for specific standards on EV charging infrastructure within new development. When asked whether planning provisions for EV infrastructure requirements should be at a local level or a state level, Byron Shire Council acknowledged that councils need to have that input, but better uniformity would be provided from state led involvement.¹⁴⁴




Figure 25. Dedicated EV parking. Credit: Vanleeuwen o plaad, Netherlands

141 State Environmental Planning Policy No 65- Design and Quality of Residential Apartment Development (NSW) s. 1.3

142 SEPP 65, Objective 3J-2 states that 'Conveniently located charging stations are provided for electric vehicles, where desirable'.

143 Dumford S, Kanaley M & Miller S, NSW Department of Planning and Environment. Interview 20 September 2018

144 Harper D, (Sustainability Officer, Byron Shire Council) Interview 26 September 2018

 <p>ACTION</p>	<p>RECOMMENDATION</p> <p>During the consultation and preparation of the standard DCP for local authorities, seek to add provisions for EV charging infrastructure within overall parking provisions.</p>
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7.2 Development Pathways under Part 4 of the Act

Under Part 4, the Act creates three pathways for approval of development: exempt development, complying development and development requiring consent. Exempt development is comprised of the most minor works with minimal environmental harm and as such does not require any form of consent prior to construction. Complying development includes more significant work that is likely to have greater impacts, but providing the development is compliant with provisions under the relevant instrument, no significant harm is likely. Whilst no planning or construction approval would be required for this form of development, a Complying Development Certificate would be required from a Private Certifying Authority or Council. Development that is not compliant with these provisions would require consent.

Development requiring consent is mostly determined by local councils.. However other consent authorities include the Minister (directed by NSW DPE), the Independent Planning Commission, district or regional planning panels or any other public authority, as determined by provisions in the Act or another instrument. The process for assessment includes the lodgement of development applications with the consent authority, with public consultation generally undertaken in accordance with the legislation or a DCP before a determination.



Figure 26. Kerbside charging. Source: Shutterstock.

Under Section 4.15 of the Act, when determining a development application the authority is to take into consideration the following:

- (a) *the provisions of:*
- (i) *any environmental planning instrument, and*
 - (ii) *any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and*
 - (iii) *any development control plan, and*
 - (iiia) *any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and*
 - (iv) *the regulations (to the extent that they prescribe matters for the purposes of this paragraph),*
- that apply to the land to which the development application relates,*
- (b) *the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,*
 - (c) *the suitability of the site for the development,*
 - (d) *any submissions made in accordance with the Act or the Regulations,*
 - (e) *the public interest.*¹⁴⁵

Work to include EV charging infrastructure under exempt development is demonstrated in the amendments to the Infrastructure SEPP. However, for other forms of development that do not meet the requirements of the SEPP, consent would be required from local authorities. These would need to be assessed against applicable SEPPs, the relevant LEP and DCP policies as well as community submissions.

¹⁴⁵ Environmental Planning and Assessment Act 1979 (NSW) s. 4.15



RECOMMENDATION
Commence research into promotion of EV equipped car share spaces as concessions for reduced parking provisions in new development.

It is also apparent that conditions of consent will play an important role in guiding the private sector, but this needs to be managed in the context of competition between conventional vehicles and EVs. Stockland notes that:

“it raises an interesting question for us because we know the one thing that the planning authorities do require from us is a certain number of car spaces... what I don’t think has hit the radar yet with the planning authorities is in the mix of...car spaces [EV car spaces against fossil fuel car spaces]”.¹⁴⁶

Discussions with the NRMA suggest that there is an important opportunity to plan for future growth of EVs where:

“commercial and residential buildings can be enabled for EV charging by providing reserved parking bays with Level 2 AC chargers. Some buildings may also opt for higher power Level 3 DC charging. The number of bays required will grow with uptake of EVs. Allowance for growth should be a consideration for planners and developers.”¹⁴⁷



7.3 Other Policy/Strategies within the Remit of NSW DPE

In addition to the statutory measures under the Act, NSW DPE has other means of providing policy guidance to development.

7.3.1 Planning for local communities

A number of locations have been identified by the NSW DPE across greater Sydney that have good access to existing or planned public transport connections and are suitable for rejuvenation with new homes and jobs. The department will work with the relevant local councils to prepare strategies for the development of the area, which eventually feeds into statutory changes such as land use re-zoning and DCP preparation.¹⁴⁸ Through their involvement, NSW DPE has the ability to facilitate EV charging when planning for precinct development. An example of this includes the collaborative planning done for Ingleside in the Northern Beaches Council. The plans and strategies seek to create a sustainable community and includes the preparation of a DCP which will include provisions for EV charging stations.¹⁴⁹

7.3.2 Planning system circulars and other forms of guidance

Circulars relate to planning and policy matters with the intention of guiding developers and planners. Other, more informal, guidance has also been prepared by NSW DPE in the past and could also be used to inform the general public and developers on the requirements of installing EV charging infrastructure.

7.4 Building Regulations and EV Charging Infrastructure

Outside of the NSW Planning System, the regulation of the design, construction and performance of buildings is governed by the NCC, which also includes the Building Code of Australia (BCA). The NCC is published and maintained by the Australian Building Codes Board (ABCB) on behalf of and in collaboration with the Australian Government and state and territory governments.¹⁵⁰ Whilst the BCA is administered in NSW by NSW DPE, and is referenced and given effect though the Act, the ABCB operates at a federal level and

¹⁴⁶ Johnson, Greg (National Sustainability Manager) Interview 25 September 2018.

¹⁴⁷ Conoplia, Bernhard & Giltinan, Rob (NRMA). Personal Communication, 16 September 2018

¹⁴⁸ NSW Department of Planning and Environment, 'Planning for Local Communities: How we're planning for a growing Sydney', press release, viewed 10 September 2018

¹⁴⁹ NSW Department of Planning and Environment, 'Ingleside: Draft land use and infrastructure strategy', November 2016 p. 24

¹⁵⁰ Dumford S, Kanaley M & Miller S, NSW Department of Planning and Environment. Interview 20 September 2018.

therefore the power to implement changes by state agencies are limited. Nonetheless, there are avenues for instigating change to the BCA and NCC through the ABCB, which NSW DPE sits on,¹⁵¹ but there would be time restrictions with changes to the NCC occurring every three years.

Specific to the installation of charging infrastructure in buildings, AS/NZ3000 is the standard applicable to electrical installations. In July 2018, the standard has been updated to include, amongst other things, requirements for EV charging stations.¹⁵² Whilst the new and amended standards show a willingness for the industry to move towards standardising the production and installation of EV charging infrastructure, as yet the building regulatory bodies are yet to formally adopt these measures within the BCA so that all new buildings should conform to the standard.

Subsequently, the question remains as to whether the regulation of charging infrastructure for EVs should sit within the planning or building sphere of influence¹⁵³. This presents opportunities for NSW DPE to step-up and take a leadership role in guiding the progression of EV in NSW.

Experiences across Europe, Canada and the United States point to a variety of pathways for integrating EV charging within new and existing buildings. For example, the Toronto Green Standard¹⁵⁴ requires the provision of EV supply equipment in all new mid- to high-rise residential developments and all industrial and commercial developments where excess parking is provided above the number of parking spots required by the zoning by-laws.¹⁵⁵

Furthermore, existing multi-residential buildings in Toronto are required to discuss retrofitting for EV charging by recent changes to the Ontario Condominium Act.¹⁵⁶ Following initial proposed changes to the London Plan in 2009¹⁵⁷, all new residential developments that include car-parking are required to provide EV or ultra-low emission vehicle charging points in twenty percent of the spaces, with passive charging readiness for all remaining spaces.¹⁵⁸

The California Building Standards Code requires that three percent of all parking spaces in multifamily housing developments include EV charging stations¹⁵⁹ with costing and analysis underway suggesting a higher ten percent requirement.¹⁶⁰ There has also been a trickle-down effect to various localities, for example San Francisco has included an EV-Ready mandate for all new buildings to be 100 percent EV ready for electric connectivity with ten percent of new parking spaces dedicated to EV charging.¹⁶¹

151 Dumford S, Kanaley M & Miller S, NSW Department of Planning and Environment. Interview 20 September 2018.

152 Wheeler Brendan, EVSE Australia. Interview 10 September 2018.

153 Dumford S, Kanaley M & Miller S, NSW Department of Planning and Environment. Interview 20 September 2018.

154 City of Toronto City Planning Division, Toronto Green Standard Version 3, May 2018

155 City of Toronto Transportation Services and Chief Corporate Officer, "Preparing Toronto for Electric Vehicles", Report for Action PW24.7, 3 October 2017, pg. 9

156 Sabo, Paul (Senior Engineer, Operational Planning & Policy, City of Toronto). Interview 18 September 2018.

157 Office for Low Emission Vehicles UK, Making the Connection: the Plug-In Vehicle Infrastructure Strategy, Department for Transport, June 2011, pg. 29

158 Mayor of London, Consultation Draft New London Plan, 1 December 2017. Policy T6.1 Residential Parking; T6.2 Office Parking

159 California Department of Housing and Community Development, 2016 California Green Building Standards Code (Workshop Presentation), 9 April 2018, slide 6

160 California Air Resources Board (CARB), Electric Vehicle Charging Infrastructure: Multifamily Building Standards, 13 April 2018

161 Office of the Mayor of the City & County of San Francisco, "Mayor Lee and Supervisor Katy Tang Introduce Legislation Requiring All New Buildings to be 100% "Electric Vehicle Ready", Press Release, 28 February 2017



1.1.1 In-depth case study: Exploring Kerbside Charging in Toronto¹

In 2012, the City of Toronto approved a pilot program to provide on-street EV parking and charging, which was implemented as a partnership between the City of Toronto and Toronto Hydro, the public utility. The pilot provided for level 2 EV charging points at two locations in downtown Toronto. The aim of this project was to address EV demand and understand impacts on existing infrastructure and services to businesses and residents. Such impacts include: feasibility and rationale of providing on-street EV charging; space selection; operational criteria; revenue opportunities; regulation; and enforcement.

In 2017 the City approved the Residential On-street EV Charge Station Pilot. The City implemented this pilot in coordination with the utility Toronto Hydro to provide EV charge stations in residential permit parking areas with either no or a limited opportunity for charging personal EVs on private property.

“Many Torontonians do not have on-site parking and rely on the City’s residential permit parking system to be able to park on-street close to their place of residence. This presents a major challenge... Some EV owners in such circumstances have been observed to extend cords over or under sidewalks or affix unauthorized devices to public infrastructure in order to charge their vehicles. Not only is this illegal, violating City bylaws and Provincial Electric Code Regulation, but it constitutes a serious public safety hazard.”²

The strategy is to be achieved by deploying EV charging stations on electrical and street light poles owned by the electrical utility, with direct access to on-street spaces that would be designated for this purpose. The objective is to: understand the technical constraints associated with installing EV charging on or very near poles in these areas; understand usage patterns and optimal locations for use; and test payment systems and infrastructure. Pilot sites were selected based on significant resident interest.

Considerations for implementation include:

- **Constraints on site selection:** including the location of hydrants, driveways, pre-committed spots for loading zones or pay-and-display parking, bus routes or arterial roads. In residential areas where charging was to be placed on the side of light poles, the pole had to be next to the kerb, not at the back of a sidewalk where cables could cross pedestrian paths. The sites had to be in a permit parking area with available permits and on a street with no daytime parking restrictions. Selected sites could not require additional infrastructure or tunnelling, would ideally have two parking spots available for every charging point (ideally end-to-end without encroaching on driveways, intersections etc.) and had to have the appropriate energy distribution required at the site. From a potential 200 sites inventoried, the feasibility analysis narrowed down two locations in the downtown pilot and seven locations in the residential pilot.
- **New regulations:** provide police with the right enforceability tools regarding EV charging parking spots. The creation of new fines for: i) a non-EV parked in an EV charging spot; ii) an EV parked but not charging; and iii) an EV parked, charging but overstaying its time.
- **Electricity requirements:** A need for known, measured, quantities. Meters providing an interface for usage were required for downtown kerbside sites.
- **Development approvals:** these changed for sites alongside potential kerbside charging points. As a result, charging point site feasibilities changed and from five possible downtown pilot sites, only two to three remained viable.
- **Charging levels:** Level 2 chargers were selected, acknowledging that level 3 fast chargers are forthcoming but that these will have implications for infrastructure and the grid.

As of September 2018, two downtown pilot locations were equipped with a meter and electricity and are currently awaiting the physical charging infrastructure. Two charging stations in the residential program are also ready but awaiting appropriate signage and pavement markings. The remaining sites are expected to be implemented and operational over the coming months.

The City of Toronto has adapted to unforeseen hurdles and will continue to navigate challenges throughout the development, implementation and operation phases. These experiences have already produced important lessons and will undoubtedly provide more as the pilot continues.

¹ The Toronto Case study has been informed by an interview with the Operational Planning and Policy Office in the City of Toronto, as well as City of Toronto City Council considerations: PW16.4 (11 July 2012); TE18.68 (11 September 2012); TE33.50 (26 June 2018); TE33.49 (6 June 2018) as well as the Preparing Toronto for Electric Vehicles 2017 report and the TransformTO Climate Action Report 2017.

² City of Toronto Transportation Services and Chief Corporate Officer, “Preparing Toronto for Electric Vehicles”, Report for Action PW24.7, 3 October 2017, p. 6



PARTICIPATE

RECOMMENDATION

Following additional updates to the Infrastructure SEPP, prepare and release a planning circular to guide local authorities when assessing Development Applications and advising members of the public on EV charging infrastructure.



PARTICIPATE

RECOMMENDATION

Following discussions with local authorities, RMS and utility providers, prepare guidance to assist road authorities in determining locations for kerbside EV infrastructure.

7.5 Kerbside Installation of EV Charging Infrastructure

The provision of EV charging infrastructure within off-street parking supply has been addressed. A separate question, though, is how the installation and use of kerbside charging infrastructure can be provided for and regulated and what influence NSW DPE can have on this.

There are currently no policy measures within any of the relevant planning instruments outlined above to regulate the provision of charging stations on the roadside. However, the Infrastructure SEPP includes provisions along road corridors¹⁶² and so it may be possible that further amendments could be made within this instrument. On the other hand, there are other significant factors to consider when determining whether to introduce regulations for kerbside charging, such as road ownership.¹⁶³ In the majority of cases road owners are likely to be the local council, while on major road networks the owner would be RMS. The decisions of these owners can be significantly affected by matters outside of the remit of NSW DPE, such as street clutter and parking conflicts. Other legislation, such as the *Roads Act 1993*, which is not the responsibility of NSW DPE, will also play a role in defining and regulating works within the road corridor. These factors would potentially limit any measures the department may seek to implement to facilitate kerbside parking.

Notwithstanding the above, there may still be opportunities for discussions between road owners and the NSW DPE around additional amendments to the Infrastructure SEPP to facilitate these works, should they be minded to. Furthermore, discussions with other governmental departments in this area would be beneficial to understand and facilitate amendments within other legislative areas to enable kerbside charging, should it be considered desirable to do so.

A number of other cities and regions around the world have started to implement kerbside EV charging and their experiences provide some ideas and lessons to consider within the NSW context. In the United Kingdom, the Office for Low Emission Vehicles (OLEV) provides grants for on-street residential chargepoint schemes. Local authorities can submit applications for 75 percent of the capital costs of procuring and installing the chargepoint and associated parking

bays, predicated on meeting criteria that includes accessibility to local residents, meeting current or future demand and adhering to OLEV's technical and information-sharing specifications.¹⁶⁴ Various cities across California are also implementing kerbside charging programs. For example, in 2018 the City of Berkeley extended its Residential Kerbside Electric Vehicle Charging Pilot, where the city evaluates new on-site spaces for EV charging based on identified need by residents. Successful participants in the pilot will be granted a kerbside permit but need to purchase and install the charging stations themselves.¹⁶⁵ The Netherlands "Green Deal"¹⁶⁶ approach allows the central government to work with companies, community organisations and other government bodies to overcome government barriers for electric mobility, including public-private partnerships that provide publicly accessible kerbside EV charging infrastructure.¹⁶⁷



Figure 27. Kerbside charging in Balmain, NSW. Credit RHorsey

¹⁶² State Environmental Planning Policy (Infrastructure) 2007 (NSW) Division 17

¹⁶³ Dumford S, Kanaley M & Miller S, NSW Department of Planning and Environment. Interview 20 September 2018.

¹⁶⁴ OLEV, Grants to provide residential on-street charge points for plug-in electric vehicles: Guidance for Local Authorities, January 2018 – Version 1.1

¹⁶⁵ City of Berkeley Office of Energy & Sustainable Development, 'Residential Curbside Electric Vehicle Charging Pilot', 2018

¹⁶⁶ The Netherlands Enterprise Agency, 'Green Deals', 2018

¹⁶⁷ Netherlands Enterprise Agency, Electromobility in the Netherlands: Highlights 2015, June 2015

8.0 Lessons to Date in NSW

Stakeholders were interviewed about their experience in relation to EV charging infrastructure provision: seven from NSW; six from elsewhere in Australia; and one from overseas. This section focuses on perceived and actual challenges and opportunities revealed through the interviews.

These challenges and opportunities can be grouped according to four key categories relating to the NSW Planning System: new buildings; existing buildings; kerbside; and private for profit (this includes commercial spaces such as shopping centres and petrol stations). Some of the challenges and opportunities identified are shared across all four categories.

Each of these challenges and opportunities fall within the scope of the conceptual framework (any additional issues that were raised but are out of scope are not included) and are organised according

to their most dominant factor.

These are:

- Society;
- Economy;
- Environment; and,
- Technology.

The purpose of applying the conceptual framework is to identify potential planning interventions in NSW. The issue of governance also emerged through this process and is listed as an additional factor. An analysis of the challenges and opportunities informs the recommendations provided in this report.

8.1 Challenges

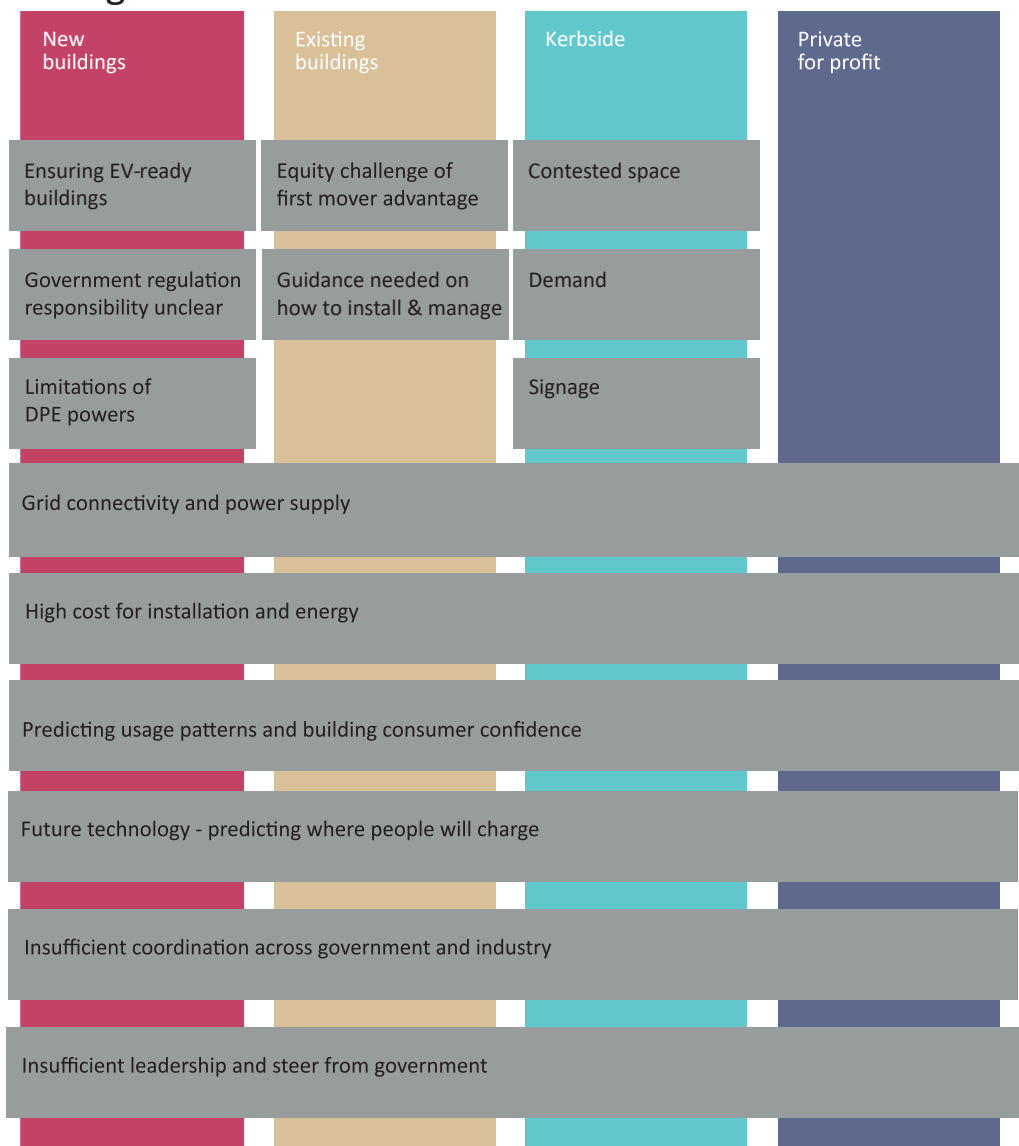



Figure 28. Challenges matrix

 <p>PARTICIPATE</p>	<p>RECOMMENDATION</p> <p>In conjunction with local authorities, RMS and utilities providers, undertake discussions regarding the provision of kerbside infrastructure.</p>
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8.1.1 Society

Given this report focuses on planning policy interventions that would facilitate an increase in EV charging infrastructure, and enable greater uptake of EVs, consideration must be given to the arising distributional benefits. Awareness of equity issues is evident in interviews with NSW SCA, TfNSW and Energy Australia.

NSW SCA identifies that for existing strata titled buildings, first-mover advantage could block the ability of later EV owners to install charging infrastructure:

“The first three or four people for example that go down that path and install (charging infrastructure) maybe then the people who take the building to a capacity in terms of electrical infrastructure or cabling infrastructure or sizing or whatever it may be then you’ve effectively closed out the opportunity for future owners”.¹⁶⁸

The tyranny of distance is raised as another equity challenge by TfNSW:

“One of the things that we’re thinking about is equity and, for example, people in peri-urban and regional areas are less likely to have access to, let’s say, fast chargers”.¹⁶⁹

Energy Australia also highlights this point:

“With Australia being a huge landmass with population concentrated in capitals and on the coast, there will be low traffic to support EV charging stations in remote and regional areas, where they are most needed”.¹⁷⁰

The FCAI identifies that perception could also play a role in determining EV uptake:

“Once again it just becomes whether the vehicle has the flexibility to provide what consumers are looking for. So, one is the reality of whether these are an appropriate vehicles to buy, given my circumstances and two, is the perception of reality. Some people will perceive that they could well be isolated in rural areas because they can’t recharge and recharging times on their vehicles”.¹⁷¹

Another social challenge for existing and future residential buildings is contested space. NSW SCA identifies that this is already a problem likely to be exacerbated by the introduction of EV charging infrastructure:

“Moderating and managing visitor parking is a challenge and it’s a massive education piece at the best of times. You overlay then potentially a requirement that only certain people can use that space at certain hours and then it also becomes a far more practical managing issue”.¹⁷²

The challenge of contested space and equity in the built environment is also evident in EV charging experiences in overseas jurisdictions. For example, in the United Kingdom, the London Assembly Environment Committee found that some EV charging points installed on pavements take significant space away from pedestrians, especially those with wheelchairs or buggies.¹⁷³ The Committee underscores the potential equity issues and advocates for the installation of chargers on the street or as part of streetlamps rather than on pedestrian sidewalks.¹⁷⁴

¹⁶⁸ Duggan, C., NSW President Strata Community Association. Interview 12 September 2018.

¹⁶⁹ Newman, David (Manager, Congestion Technology & Innovation, Transport for NSW) and Deniz Ortac (Senior Policy Officer, Congestion Technology & Innovation, Transport for NSW). Interview, 2 October 2018.

¹⁷⁰ Padman, Jessica (Strategic Planning Lead, Corporate, Energy Australia). Interview, 18 September 2018.

¹⁷¹ Webber, T (CEO, Federal Chamber of Automotive Industries) & Obradovic, L (Policy Director, Federal Chamber of Automotive Industries). Interview 10 September 2018.

¹⁷² Duggan, C., NSW President Strata Community Association. Interview 12 September 2018.

¹⁷³ London Assembly Environment Committee, ‘Electric Vehicles’, May 2018, p.5

¹⁷⁴ Ibid



PARTICIPATE

RECOMMENDATION

In conjunction with TfNSW and other road authorities, undertake discussions on implications of EV charging on congestion and other effects on transport policy with a view to minimise adverse impacts.

With respect to contested space within the road reserve, NSW DPE highlights that this challenge would also need the input of local road authorities:

“There are a number of considerations around the provision of kerbside electric vehicle charging which need to be taken into account, including (but not limited to) land use planning requirements, land ownership, and design elements such as accessibility, safety, location and siting within the public domain and alongside our roads.

Such a program would require a government response, including involvement from local councils, RMS, the Department of Planning and industrial bodies.”¹⁷⁵

Other international experiences point to strategies that address possible socioeconomic inequalities associated with EVs. Environment California, for example, partnered with numerous community groups to launch the Charge Ahead California Initiative in 2014, a bill that aims to improve consumer incentives and rebates to make it easier for low and moderate income motorists to access clean transportation.¹⁷⁶ The initiative includes electrifying state buses, trucks and cars; offering incentives such as vouchers to replace traditional fuel cars; and establishing car sharing programs including the provision of charging stations in low-income apartment complexes¹⁷⁷ such as the Sacramento ‘Our Community Car Share.’¹⁷⁸

As identified earlier in this report, a lack of consistent and robust data on consumer behaviour, both now and into the future, presents a significant challenge. This dearth of available information only serves to enhance uncertainty about where people are likely to charge their vehicle, EV usage patterns and consumer confidence.

ARENA notes there is a lack of data regarding the proportion of vehicle owners who may have access to parking at home versus those that park in the street and will consequently rely on public charging:

“If you’ve got a house with a garage, you’re going to charge there. But we don’t have good numbers

on how many people that is ... people are going to charge where it’s most convenient but there will be plenty of people who don’t have a driveway. People in apartments, people in townhouses people, in inner cities that just park on the street. And where are they going to charge? The Energiea report says that’s about 30 percent [extrapolated from UK studies] but that’s a very rubbery number because we just don’t know.”¹⁷⁹

Additionally, TfNSW and the NRMA identify that guidance on how and where EV charging infrastructure could be installed and managed is limited. This potentially hampers the capacity of developers to install EV charging infrastructure as well as the confidence of potential consumers.

TfNSW identifies as a key challenge:

“A lack of accessible consolidated and accurate information about electric vehicles out there”.¹⁸⁰

The NRMA reflects on the variability of land ownership by state and local authorities, and the difficulty this presents to providing infrastructure on that land:

“There are questions about crown land, community land, road reserve and operational land... [and] how to deal with land that may have title claim over it”.¹⁸¹

8.1.2 Economy

While market forces play a significant and independent role in shaping EV use in Australia, research identifies that the provision of EV charging infrastructure can grow demand.¹⁸² This is supported by the NRMA, which states:

“There is a minimum critical infrastructure required [to address range anxiety], and until you hit that minimum, then people won’t consider buying vehicles”.¹⁸³

ARENA also reinforces this point:

“No one wants to put in charging until there are

175 Ibid

176 Environment California, ‘California Senate Passes Bill to Speed Adoption of Electric Vehicles in Every Community’ News Release, 27 May 2014

177 Ibid.

178 Sacramento Metropolitan Air Quality Management District, Our Community CarShare, 2018

179 Newman, David (Manager, Congestion Technology & Innovation, Transport for NSW) and Deniz Ortac (Senior Policy Officer, Congestion Technology & Innovation, Transport for NSW). Interview, 2 October 2018.

180 Beltman, Scott (ARENA Policy Officer). Interview 19 September 2018. Conoplia, Bernhard & Giltinan, Rob (NRMA). Interview 7 September 2018.

181 Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

182 Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

183 Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

vehicles and no one wants to buy vehicles until there is charging. So it's sort of who moves first...it's very hard to make a business case stack up when there's no vehicles on the road".¹⁸⁴

This also leads to challenges regarding building grid capacity to accommodate future demand, which AGL raises as relevant to its interests:

"Distribution networks are really unable to make investments in anticipation of EV because they can only address existing network constraints based upon expected demand which generally reflects historical trends".¹⁸⁵

However, in a scenario where EV charging infrastructure is significantly increased, stakeholders expect further challenges to emerge, specifically in relation to power supply and grid capacity.

For instance, NSW SCA notes:

"If you've got five to fifty to 100 units... you start to assume that the majority of the people into the future will want to utilise an EV charging station. There's a mass of issues around overloading the power supply and the buildings are just not sized and nor is the infrastructure (particularly to basement areas) sized to accommodate that type of power draw".¹⁸⁶

Energy Australia also identifies the high cost of installation and energy use:

"Car manufacturers and charging networks seek to boost EV uptake through free or low charging cost, which further worsens the payback periods of charging infrastructure".¹⁸⁷

In addition the EVC notes the implications for Australia of not keeping up with the global shift to EVs:

"The possibility of becoming a dumping ground for older technology vehicles has been the reality for Australia for the past several decades. Without having fuel efficiency standards in place... we do get older technology, we do get less efficient vehicles as a result of it. Once that time [of expected EV cost parity] comes in 2025, we're going to have to go through a painful period of transitioning. It's not like it's going to be a pretty pass for us".¹⁸⁸

8.1.3 Environment

Where EV charging infrastructure is placed matters. Protecting the built environment is significant, not just because people value aesthetic public and private spaces but also because of the practical implications.

Consultant Larry Parsons highlights the importance of quality urban design:

"In terms of EV they should be very much trying to make sure that provision is made possible within development, private facilities, rather than having another impediment on the street".¹⁸⁹

Comments from TfNSW reflect the need for common-sense principles:

"You need to make sure road safety isn't compromised"... "we've developed a number of principles around that. One of them is about safety. Another one is about open access".¹⁹⁰

Inconsistent signage and parking restrictions also have a flow on effect to the environment. This is noted by the NRMA, which states:

"The sign that is available right now is "no parking, EVs accepted only while charging" and what some places would like is a combination of no parking except for EVs and then have those vehicles have a time limit as well. You may not want an EV to stay there all day and the sign does not exist [for that]".¹⁹¹

184 Beltman, Scott (ARENA Policy Officer). Interview 19 September 2018.

185 Handberg K (AGL EV Lead). Interview 19 September 2018.

186 Duggan, C., NSW President Strata Community Association. Interview 12 September 2018.



187 Padman, Jessica (Strategic Planning Lead, Corporate, Energy Australia). Interview, 18 September 2018.

188 Jafari, Behyad (CEO Electric Vehicle Council). Interview 25 September 2018.

189 Parsons, Larry (Consultant for the Infrastructure Victoria 2018 Evidence Base Report on Automated and Zero Emissions Vehicles Infrastructure). Interview, 25 September 2018.

190 Newman, David (Manager, Congestion Technology & Innovation, Transport for NSW) and Deniz Ortac (Senior Policy Officer, Congestion Technology & Innovation, Transport for NSW). Interview, 2 October 2018.

191 Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

 <p>INFORM</p>	<p>RECOMMENDATION</p> <p>Prepare best practice and opportunities guidance notes for retrofitting all buildings, including buildings under single or multiple ownership.</p>	 <p>INFORM</p>	<p>RECOMMENDATION</p> <p>Prepare information sheets accessible to the public to advise interested parties on how to implement EV charging within the NSW planning system.</p>
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In an effort to respond to this challenge the City of Toronto developed the following system:

“To properly enforce EV parking space utilisation, three \$60 offences were created for those that: park non-EV in a designated space; park EV in a designated space but don’t actively connect; and park EV in a designated space but exceed maximum allotted time”.¹⁹²

In reference to the feasibility selection of a kerbside charging site, the City of Toronto highlights the long list of criteria that needs to be considered:

“Placing EV charge stations downtown required not only adequate charge station connection location and power source, but also needed locations that were not on major roads, transit routes, and areas where ‘No Parking’ was permitted even through peak periods. It became a real challenge to find suitable locations that were not in conflict with corners, driveway entrances, hydrants, loading zones, taxi stands, vending areas, and space previously dedicated for other activities”.¹⁹³

Based on the City of Toronto’s experience and information provided in the interviews, it is likely that it will be more difficult to implement EV charging infrastructure in kerbside locations than in pre-existing and future buildings.



8.1.4 Technology

As highlighted in Section 6.3 “Preparing for the Future”, the evolving nature of technology makes it difficult to predict future consumer behaviour. In turn this affects the task of ensuring EV-ready buildings (both future and pre-existing). Stakeholders including the FCAI, the NRMA and SCA NSW raised this challenge in the interviews. This includes an anticipation of AV and a rise in car-sharing, particularly in urban areas, which could make car parking redundant.

In addition, NSW SCA raises the limitations of technology when it comes to grid capacity and metering:

“There’s practical limitations around making sure it can be metered back to that particular lot’s meter... Once you get to a degree of scale, there’s just a straight out spatial issue as well in trying to fit and accommodate all this infrastructure into these spaces”.¹⁹⁴

The NRMA highlight the importance of allowing for future growth:

“Commercial and residential buildings can be enabled for EV charging by providing reserved parking bays with Level 2 AC chargers. Some buildings may also opt for higher power Level 3 DC charging. The number of bays required will grow with uptake of EVs. Allowance for growth should be a consideration for planners and developers.”¹⁹⁵

The NRMA further highlights the opportunities available, if the right technology is in place:

“As the number of parking bays increases, the power requirement may exceed the capacity of the building power connection. It may be necessary to upgrade the power connection to the building, or manage demand to ensure peak load is within the existing capacity. Technology exists today that makes this possible. Furthermore, as vehicle to grid technology becomes more prevalent, the battery capacity of the vehicles could also be used to feed energy back to the grid at peak times. To take a next step beyond, if you look at the battery capacity through vehicles, that distributed battery capacity dwarfs anything else you could build in terms of grid infrastructure.”¹⁹⁶

¹⁹² Sabo, Paul (Senior Engineer, Operational Planning & Policy, City of Toronto). Interview, 21 September 2018.

¹⁹³ Ibid.

¹⁹⁴ Duggan, C., NSW President Strata Community Association. Interview 12 September 2018.

¹⁹⁵ Conoplia, Bernhard & Giltinan, Rob (The NRMA). Personal Communication, 16 September 2018

¹⁹⁶ Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018 and Personal Communication, 16 September 2018.



ACTION

RECOMMENDATION

Amend relevant Environmental Planning Instruments as necessary to ensure there is a standard interpretation of EV charging infrastructure



ACTION

RECOMMENDATION

Amend the Infrastructure SEPP to include a definition of EV charging infrastructure

8.1.5 Governance

During the interviews a number of stakeholders, including ARENA, the NRMA and Stockland, raised challenges associated with ‘governance’. For this reason, the research team developed governance as a new theme in order to capture the recommendations that would fall inside the scope of the project, but outside the original conceptual framework.

Stockland identifies insufficient leadership from government generally as an issue:

“I see an absence of government on the issue...It’s a challenge- probably a missed opportunity as well. To my knowledge, I haven’t seen any approach, a government-led approach or necessarily, even an industry-led approach”.¹⁹⁷

In addition to insufficient leadership, ARENA raises the challenge of insufficient coordination across the different levels of government and with the relevant agencies:

“There’s a lack of coordination in Australia about this...Energy people are worried about energy, planners are worried about how you put them in, transport people are worried about travel numbers... There’s no consistent view, which is fine, but there is also no coordination, inter and intra-state from a COAG point of view”.¹⁹⁸

The NRMA notes that coordination is required in order to adequately prepare for an increase in EVs:

“Those three sectors [planning, transport and energy] need to come together to harmonise how we are actually going to approach this and get us ahead of the curve”.¹⁹⁹

Others have identified a lack of clarity related to the leadership of government agencies in this space, who suggest that there is significant value in agencies coming together, which they see now happening as part of the development of the NSW Electric and Hybrid Vehicle Plan:

“In terms of [a] strategy for a charging network, a range of agencies need to be involved. Of course, commercial companies will be making decisions based on what looks like good commercial sense”.²⁰⁰

Additionally the NRMA note a need for clearer regulations to encourage EV charging infrastructure provision, particularly in multi-unit dwellings:

“It seems there are no planning controls that require them [councils] to enforce a minimum [number of EV charging spots] in apartment block developments”.²⁰¹



Figure 29. Kerbside chargers. Source: Google

¹⁹⁷ Johnson, Greg (National Sustainability Manager) Interview 25 September 2018.

¹⁹⁸ Beltman, Scott (ARENA Policy Officer). Interview 19 September 2018.

¹⁹⁹ Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

²⁰⁰ Newman, David (Manager, Congestion Technology & Innovation, Transport for NSW) and Deniz Ortac (Senior Policy Officer, Congestion Technology & Innovation, Transport for NSW). Interview, 2 October 2018.

²⁰¹ Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

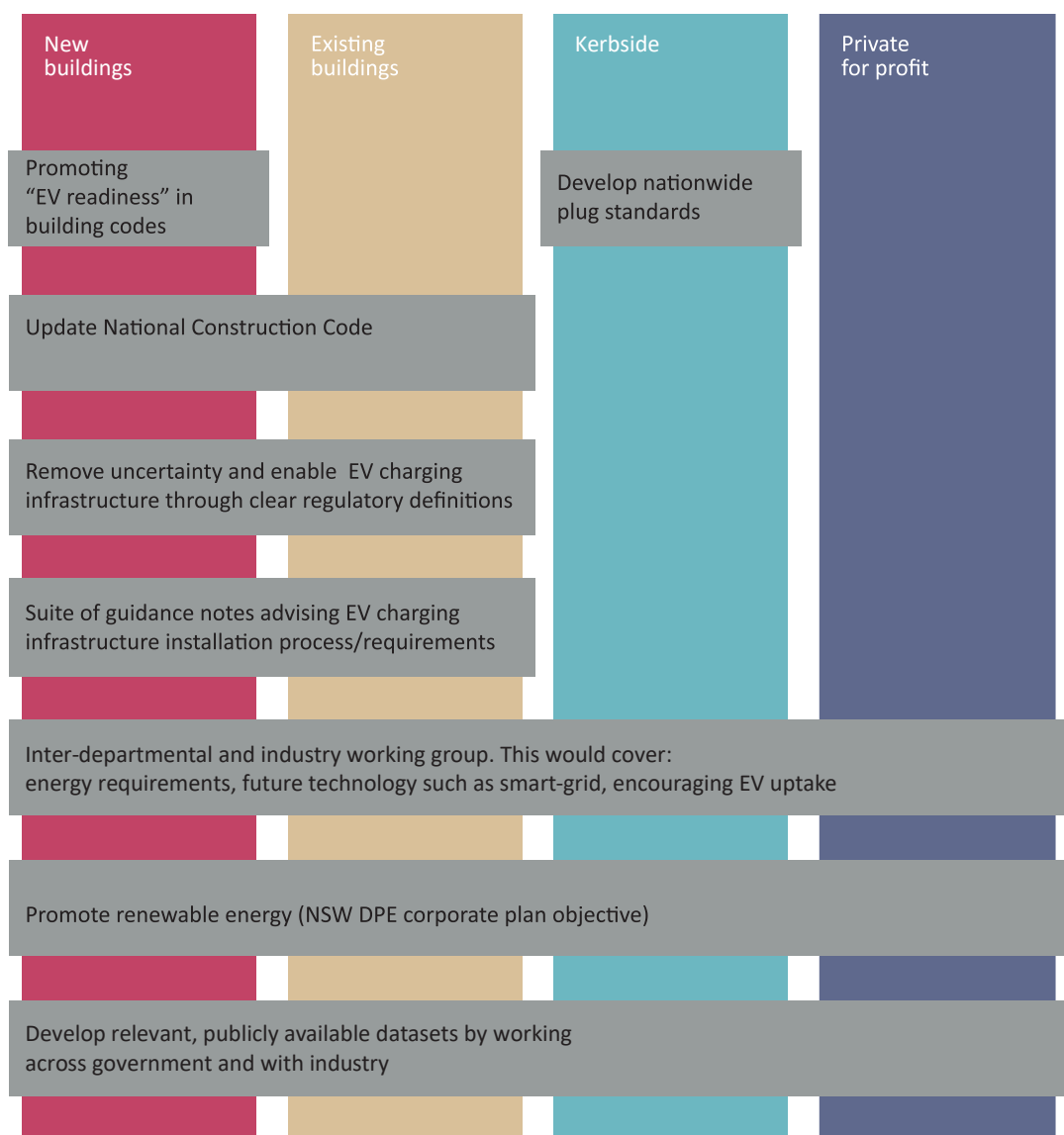


Figure 30. Opportunities matrix

8.2 Opportunities

8.2.1 Society

A number of opportunities are reflected in the challenges identified in the previous section. For instance, in their interviews NSW SCA, TfNSW and Energy Australia identify that the distributional benefits may not be shared proportionally across the state. Consequently, if governments wish to ensure a broad uptake of EVs, consideration must be given to the impact that the placement of EV charging infrastructure has on urban, regional and remote communities.

This should focus on reducing socio-economic and geographical challenges. Additionally, both the NRMA and TfNSW identify in their interviews that consumers, installers, developers and existing strata companies would benefit from consistent, clear and readily available information. This could be achieved through the production of a suite of guidance notes advising on EV charging infrastructure installation processes and requirements.

The NRMA suggests that there is a lack of information available to local councils on the definitions and requirements for installing EV charging infrastructure and find that:

“High level guidelines would be helpful”.²⁰²

TfNSW highlights that accessible information to the consumer could be improved:

“If you’re a consumer and you want to find out what’s the running cost of an electric vehicle, what’s available, what’s its real range, what are its real capabilities, you need to be able to go fairly easily to one point of truth on this... Government together with industry can make it easier for people to get accurate information about these things.”²⁰³

²⁰² Conoplia, Bernhard & Giltinan, Rob (The NRMA). Interview 7 September 2018.

²⁰³ Newman, David (Manager, Congestion Technology & Innovation, Transport for NSW) and Deniz Ortac (Senior Policy Officer, Congestion Technology & Innovation, Transport for NSW). Interview 2 October 2018.



RECOMMENDATION
Working as part of the ACBC, update the BCA. This should include reference to AS3000:2018.

8.2.2 Economy

NSW DPE has levers at its disposal to encourage investment in EV charging infrastructure and consequently facilitate greater EV uptake. Energy Australia identify these as an opportunity, stating that:

“Policy support is a key driver of investment in EVs, as seen in markets with highest EV uptakes. Same applies to charging infrastructure”.²⁰⁴

Similarly, NSW DPE identifies that clearer regulatory definitions could facilitate the provision of EV charging infrastructure in both pre-existing and future developments.

“In some respect that is what the ISEPP does, gives it a permissibility pathway for charging infrastructure. What it doesn’t do is define what EV charging infrastructure is so there is an opportunity there”.²⁰⁵

The NRMA highlights that different definitions of EV charging infrastructure can have a significant impact where if it is interpreted “like a petrol station,” then certain rules apply, but if it is interpreted to “be ancillary to an existing car park that is there... then it’s a complete different set of rules that apply”.²⁰⁶

8.2.3 Environment

NSW DPE includes in the 2015-17 corporate plan a description of its role as, ‘creators of innovative and effective built environments for the benefit of current and future generations’.²⁰⁷ Facilitating EV charging infrastructure through planning policy initiatives is directly aligned with this vision.

There is an opportunity to build greater awareness about the benefits that EVs can bring to the environment through a reduction in emissions from petrol and the use of renewable energy, which ARENA states should be seen as a significant advantage:

“What we don’t want to see is networks seeing EV as an impost and pushing back. They should know what EVs are going to do and be an enabler. We don’t want them saying no you can’t put that in. We are in the early enough stages to avoid that”.²⁰⁸

Similarly Energy Australia argues:

“Increased EVs can really help to balance out the grid and even support the use [and] increase the use of renewable energy”.²⁰⁹

The EVC and the NRMA’s joint policy report titled, ‘The Future is Electric’ highlights the direct link between EVs and renewable energy, suggesting that governments should take advantage of this to ‘accelerate electric vehicle adoption’.²¹⁰

8.2.4 Technology

Despite the challenges that come with the unknown potential of future technology, governments can still take steps now to prepare. Stakeholders identified an opportunity to include “EV readiness” in building codes to ensure a greater take up of EVs. NSW SCA argues this is necessary because:

“What we’re not seeing yet is the big leap required between the availability of electric vehicles from a marketing perspective to the bona fide full fit out of the infrastructure to accommodate each and every resident or each and every subsequent resident wanting to take that up now or at some point in the future”.²¹¹

Similarly, the EVSE Australia suggests that building in the technology now will make it easier to introduce more EV charging infrastructure in the future:

“The main thing buildings should be doing is having sort of capacity in their system to be able to add these things in, or do some of the pre-wiring, just making the buildings more easily ready.”²¹²

204 Padman, Jessica (Strategic Planning Lead, Corporate, Energy Australia). Interview, 18 September 2018.

205 Dumford, Stephen, Kanaley, Meagan & Miller, Sabina (NSW Department of Planning and Environment). Interview 20 September 2018.

206 Conoplia, Bernhard & Giltinan, Rob (NRMA). Interview 7 September 2018.

207 NSW Department of Planning and Environment, ‘Corporate plan 2015-2017’, NSW Government, date not specified. p.7


208 Beltman, Scott (ARENA Policy Officer). Interview 19 September 2018.


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 <p>ACTION</p>	<p>RECOMMENDATION</p> <p>Undertake an audit of available data on EV charging infrastructure in NSW</p>
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 <p>ACTION</p>	<p>RECOMMENDATION</p> <p>Once data audit has been completed, appropriate storage and open sharing e.g. NSW Open Data Portal</p>
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Energy Australia suggests that developments in technology could even be leveraged to reduce costs for the consumer:


“We see EVs as mostly fitting into the Smart Home Strategy, or Smart Energy Management [and want to make sure we] leverage the technology to make sure we are charging at the right time, to deliver the lowest cost of energy to the consumer at the end of the day”.²¹³

Overcoming range anxiety in Australia is a significant challenge, even with the development of faster charging levels. A consistent national public charging infrastructure network could assist in overcoming this. The FCAI has developed national plug standards and suggests these should be adopted:

“It [the technical statement] effectively draws on international plug standards with regard to charging systems, plugs and socket outlets and the configuration of the DC charging infrastructure which is important for the public infrastructure charging as well”.²¹⁴

However, lessons from the experiences of the City of Toronto highlight that:

“It [is not] as simple as bringing a cable down the side of the pole and placing a charger there and calling it a day. Competition for kerbside space, especially in the downtown core, is intense and not all candidate locations neatly line up with a suitable utility pole. Also, the public electrical utility has to assess power needs, available line capacity and new safe power line draw connection points above/below ground for candidate locations. We found we would start out reviewing hundreds of locations and we would end up with far, far fewer”.²¹⁵

 <p>ACTION</p>	<p>RECOMMENDATION</p> <p>Develop a working group or task-force responsible for ongoing development of EV charging and other related emerging technologies. This should engage with relative groups outside of NSW DPE</p>
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8.2.5 Governance

Stakeholders identified that at both a state and a national government level a number of relatively simple steps could be taken to facilitate EV charging infrastructure through improved governance.

This includes in the area of research and data, which ARENA identifies as a significant gap that makes it difficult to ascertain the actual need for EV charging infrastructure:

“We don’t have good data and the insurance agencies might be the best source because they actually ask people where you park your vehicle overnight”.²¹⁶

Energy Australia also believes that this would be of use, for both consumers and government agencies, providing an evidence base to guide decision-making in relation to EV charging infrastructure:

“Sharing that sort of information [data on EV use] would end up being in the greater good of all EV users... all infrastructure is being built in the right place and they [users] are being offered the right products and services to support how they actually want to use their vehicles”.²¹⁷

In addition, the NRMA argues that a cross-agency and a cross-industry working group would also benefit the development of future policy responses in this space:

“We’ve been calling on governments across all levels to contribute to that national productivity benefit.... We have called for the establishment of an intergovernmental group” (energy, transport and planning).... “That’s really important, there are major opportunities if we do this properly”.²¹⁸

There is also an opportunity to update the NCC. Consultant Larry Parsons suggests that:

“In the same way that you have minimum sizes of parking spaces you can have minimum requirements for providing electric charging and that could be done nationally, because it is a technical thing, it’s not a state by state variable”.²¹⁹

²¹³ Padman, Jessica (Strategic Planning Lead, Corporate, Energy Australia). Interview, 18 September 2018.

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²¹⁹ Parsons, Larry (Consultant for the Infrastructure Victoria 2018 Evidence Base Report on Automated and Zero Emissions Vehicles Infrastructure). Interview, 25 September 2018.

9.0 Recommendations





As outlined in Section 4.3, we have provided recommendations based on the research findings identified during the desktop assessment and interviews. The recommendations, which are shown in the Table 4, are presented in four categories:

- **Action-** as measures that can be performed under the NSW Planning System, these are recommendations that can be directly acted on by DPE NSW;
- **Participate-** as a valuable contributor to regulatory reform and governmental operations, these are recommendations involving discussions/working groups that DPE NSW can be actively involved in to achieve increased EV uptake and consumer confidence;
- **Inform-** DPE NSW are a valuable source of facts and information relating to planning processes and the NSW Planning System in general. Recommendations listed under this category may assist in other governmental agencies, local government, developers, industry and the general public in understanding the NSW Planning System when considering EV charging infrastructure; and,
- **Influence-** utilising the influence of DPE NSW, these recommendations aim to sway others in discussions over EV uptake both in NSW and nationally.

Some recommendations can be actioned immediately with no, or very little, preparation. These recommendations are defined under a 'now' category and could be achieved within a 1-3 year period. The remaining recommendations are labelled 'later', as their successful implementation may rely on the progress of other recommendations, or may be undertaken as part of an ongoing process. As such, these 'later' recommendations are achievable in 3+ years and could inform NSW DPE's long-term vision for EV charging infrastructure provision.



Table 1 – Recommendations

	NOW			LATER
 ACTION	Amend the Infrastructure SEPP to include a definition of EV charging infrastructure.	Amend relevant Environmental Planning Instruments as necessary to ensure there is a standard interpretation of EV charging infrastructure.	Develop a working group or task-force responsible for ongoing development of EV charging and other related emerging technologies. This should engage with relative groups outside of NSW DPE.	Following consultation regarding the provision of EV charging infrastructure for all new buildings, amend SEPP 65 to include detail around the provision.
	During the consultation and preparation of the standard DCP for local authorities, seek to add provisions for EV charging infrastructure within overall parking provisions.	Undertake an audit of available data on EV charging infrastructure in NSW.	Commence research into promotion of EV equipped car share spaces as concessions for reduced parking provisions in new development.	Once data audit has been completed, appropriate storage and open sharing e.g. NSW Open Data Portal.
 PARTICIPATE	Working as part of the ACBC, update the BCA. This should include reference to AS3000:2018.	In conjunction with TfNSW and other road authorities, undertake discussions on implications of EV charging on congestion and other effects on transport policy with a view to minimise adverse impacts.	In conjunction with local authorities, RMS and utilities providers, undertake discussions regarding the provision of kerbside infrastructure.	Following additional updates to the infrastructure SEPP, prepare and release a planning circular to guide local authorities when assessing Development Applications and advising members of the public on EV charging infrastructure.
	In conjunction with local authorities and Department of Lands, identify opportunities to diversify land use on local and state owned land to accommodate EV charging infrastructure.	Commence consultation on how best to incorporate EV charging infrastructure provision in all new buildings with interested parties (developers, construction industry etc).	Develop partnerships with energy providers to plan for overlapping challenges as a consequence of EV uptake.	
 INFORM	Prepare information sheets accessible to the public to advise interested parties on how to implement EV charging within the NSW planning system.	Prepare best practice and opportunities guidance notes for retrofitting all buildings, including buildings under single or multiple ownership.		
 INFLUENCE	Support the national standardisation of EV public charging infrastructure based on international standards.			

10.0 Conclusion

Predicting the future is impossible, but preparing for disruption, particularly across the transport sector, is not. While the market will certainly shape EV uptake in Australia, as well as the shift to a shared, connected and automated future, governments must take steps to ensure this occurs in an orderly and equitable manner.

Given the potential impact of EV charging infrastructure in public space and the built environment, the planning system has a particularly important role to play in providing a framework through which a sensible charging network can be developed and implemented in urban, regional and remote areas.

This report has examined how the NSW Planning System can facilitate the provision of EV charging infrastructure and is in response to NSW DPE's research brief. Through desktop research and fieldwork, this report has identified and evaluated the opportunities and challenges relating to the provision of EV charging infrastructure. Findings from this process have enabled the research team to develop a series of recommendations for NSW DPE relating to the provision of EV charging infrastructure in new and existing buildings, as well as kerbside locations in NSW.

10.1 NSW DPE's Role

NSW DPE has the opportunity to provide leadership and steer-working across agencies, such as transport and energy, and engaging industry- to deliver quality outcomes for consumers and facilitate greater EV uptake. An alternative approach would see NSW DPE take a more participatory role, by aligning its work with other government agencies and following their lead. Regardless of which path NSW DPE chooses, it is evident from the research that planning must play some part in the roll out of EV charging infrastructure, given its potential impact on public space and the built environment.

Consequently this report has grouped its recommendations according to four categories: action; participate; inform; and influence. This allows NSW DPE to choose its path- taking on one category to implement or all four.

10.2 Facilitating EV Charging Infrastructure in NSW

Across these four categories a number of recommendations stand out as particularly necessary. This includes collaborating with the industry and, given that energy requirements are not well understood, this process should also include utilities. The development of a working group would take advantage of existing expertise and could position NSW as a leader within Australia- setting a strong example of cross-sector collaboration that could provide an important framework in response to future disruptive technologies.

In addition to creating a cross-government agency and cross-industry working group, this report has identified a number of other key opportunities. For example, establishing a strong evidence-base could help guide decision-making and ensure the appropriate placement of EV charging infrastructure. This collection and provision of data to government agencies, industry and consumers would allow for greater understanding as to what is required to fully prepare for the anticipated uptake of EVs in Australia.

Similarly, there is appetite from the sector for NSW DPE to provide guidance on how to install and manage EV charging infrastructure. This is relevant to existing and future developments, and would also provide clarity for private for profit spaces such as shopping centres and petrol stations as well as any kerbside providers.

Following extensive consultation, this report recommends the prioritisation of EV charging at home and work, which would be in addition to rapid charging stations at places like petrol stations and along highways, as is already occurring, to reduce range anxiety.

On street charging should be considered as a last priority (after existing and future developments as well as private for profit) because of its high costs and challenges of implementation. The return on investment and effort is also minimised by how fast technology advances, which means that this public charging infrastructure could quickly become outdated.

10.3 Future Research

A number of issues such as mapping and diversifying land use, the role of the national road network and policy interventions unrelated to EV charging infrastructure were not explored in this report and have been identified as gaps. Future investigations on these points would be a welcome addition to the ongoing policy debate.

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