Australian Energy Market Commission

REVIEW

DRAFT ADVICE

Energy Market Arrangements for Electric and Natural Gas Vehicles

Commissioners

Pierce
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Draft Advice

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About the AEMC

The Council of Australian Governments (COAG), through its then Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005. In June 2011 COAG announced it would establish the new Standing Council on Energy and Resources (SCER) to replace the MCE. The AEMC has two principal functions. We make and amend the national electricity, gas and energy retail rules, and we conduct independent reviews of the energy markets for the SCER.

Executive Summary

On 28 July 2011, the Australian Energy Market Commission (AEMC) was directed by the Ministerial Council on Energy (MCE) (now the Standing Council on Energy and Resources or SCER) to review the energy market arrangements applying to an electric vehicle (EV) and to a natural gas vehicle (NGV). The purpose of this review is to advise the SCER on the appropriate energy market arrangements necessary to facilitate the economically efficient uptake of these vehicles in both the National Electricity Market (NEM), in Western Australia's electricity market and the nation's natural gas markets.

With respect to EVs, we found that, in general, there are appropriate energy market arrangements in place to facilitate the economically efficient uptake of EVs. However there are some areas for reform to facilitate efficient EV charging behaviour and to promote improved consumer choice. These areas are principally in relation to the role of pricing signals and metering arrangements. While there is uncertainty about the number of EVs in the future, we consider that it is important to put in place measures at these early stages of the EV market to facilitate efficient investment decisions for both consumers and providers going forward in the long term.

With respect to NGVs, we considered whether the natural gas market arrangements could support the uptake of NGVs utilising both Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG). We examined the arrangements for residential and commercial refuelling of these NGVs and found that no changes to the natural gas market arrangements were necessary.

Our draft advice to the SCER is anchored in our statutory duty to promote the achievement of the National Electricity Objective (NEO) and the National Gas Objective (NGO). Based on the NEO and NGO, when we proposed recommendations on energy market arrangements necessary to facilitate the 'economically efficient' uptake of EVs and NGVs, we took guidance from the following key principles:

- to facilitate consumer choice in the way these technologies are used;
- to appropriately allocate costs to the party that causes these costs, as far as is efficient;
- to facilitate the security, safety and reliability of the electricity system and the supply of natural gas by promoting efficient investment in network and pipeline services; and
- to foster competition and innovation, including innovation among business models, in the provision of services supporting these technologies.

In general, we consider that energy market arrangements should be technology-neutral in that they should apply across all types of consumer appliances and not specifically to EVs. This means that while our analysis was prompted by considering the impact of these vehicles on the energy market, our proposed changes to the energy market

arrangements apply broadly across all forms of demand side participation (DSP). Our view is that an EV is another form of DSP.

We identified a number of areas where amendments to market arrangements are appropriate. If EV charging is left unmanaged it could impose significant costs on the electricity system as EV uptake increases.[1] AECOM estimated that between 2015 and 2020, unmanaged EV charging could result in costs to the electricity system (in terms of both network and generation upgrades) in the order of $10, 000 per EV in the NEM (the actual amount varying by location and use profile).[2] Of this amount, we estimate that approximately $3,000- $3,500 of these costs between 2015 and 2020 would be paid for by the EV consumer. The remainder ($6,500 -$7,000) would be borne by all consumers if charging is unmanaged. Over a five year period, this equates to just over an extra $1000 per EV per year of costs that would be recovered from all consumers. Measures to better manage EV charging should be implemented to yield efficient market outcomes.

In summary our key draft recommendations are as follows:

- Pricing signals (particularly network pricing signals) are a key means of facilitating efficient DSP, including encouraging efficient EV charging behaviour. These pricing signals should be developed in a manner that reflects the underlying cost of supplying electricity so that EV consumers can charge at times that lead to efficient market outcomes. Interval metering is necessary to deliver these pricing signals to consumers. Further recommendations will be proposed in our power of choice review.

- To capture the diverse benefits of controlled charging and Vehicle-to-Grid (V2G), we are exploring how energy market arrangements can support commercial contracts as part of our power of choice review.

- We have devised new metering arrangements that enable the separation of load (or generation) for the purposes of DSP and this should facilitate efficient EV charging and greater consumer choice. We have specified arrangements for embedded networks, parent/child metering, multi-element meters and situations where there is more than one Financially Responsible Market Participant (FRMP) at a connection point.

- The supply of electricity for EV charging is generally the legal sale of electricity for the purposes of the National Energy Retail Law (NERL) and in Western Australia. However, we consider that commercial charging stations or any charging outside of a consumer's residence should not be subject to the NERL.

1 Unmanaged charging refers to the charging of an EV in the absence of a signal to reflect the costs of charging at times of peak demand.

2 AECOM, *Final Advice on Impact of Electric Vehicles and Natural Gas Vehicles on the Energy Markets*, report to the AEMC, June 2012. p ix. Available at www.aemc.gov.au.

- Certain aspects of Western Australia's electricity market arrangements such as the Balancing and Load Following Ancillary Services mechanisms could be reviewed to facilitate the participation of DSP, including EVs.

- Efficient uptake of NGVs requires no changes to the energy market arrangements.

The following table sets out how we propose to implement our key recommendations.

Table 1 Implementing our key recommendations

Issue	Recommendation	Proposed implementation
Role of pricing signals to facilitate efficient EV charging behaviour	Implement prices that reflect underlying cost of supply.	Recommendations being developed in the power of choice review.
Controlled charging and vehicle to grid	Facilitate effective commercial relationships to capture diverse benefits across the supply chain.	Recommendations being developed in the power of choice review.
Metering arrangements	Proposing new metering arrangements to segment electricity load and enhance consumer choice.	SCER to review recommendations and may propose Rule changes.
Bundled service providers and the sale of electricity	The AER or ERA to determine whether the supply of electricity offered by a bundled service provider constitutes the legal sale of electricity.	Propose that the AER or ERA have a role in regulating bundled service providers.
Retail exemptions framework	That the AER review its retail exemptions framework, particularly to cater for commercial (ie. non-residential) EV charging.	The AER review its retail exemptions framework.

We are keen to receive input from all stakeholders. We have drafted questions to facilitate detailed input on our draft advice. This stakeholder input will be used in the development of our final advice to the SCER.

We request that submissions be provided to us no later than Monday 1 October 2012.

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1 Introduction

On 28 July 2011, the AEMC received a Request for Advice from the MCE (now SCER)[3] asking us to assess whether the energy market arrangements can facilitate the efficient uptake of EVs and NGVs. The Request for Advice forms the basis of our review.

In this draft advice we:

- provide our draft recommendations with respect to EVs;
- provide our draft recommendations with respect to NGVs; and
- seek stakeholders' submissions to our draft recommendations.

We request that submissions to the draft advice be provided by 1 October 2012.

We acknowledge all of the submissions we received to date for both the Approach Paper and the Issues Paper.[4] All of these submissions have assisted us in developing our draft advice.

1.1 Context for the review

Amidst attempts to address environmental challenges and concerns about energy security, EVs and NGVs may play a greater role in providing Australia's transport solutions. Moreover, the economic viability of these vehicles is improving because of technological progress. Indeed, the development of low emissions vehicles in international markets signals the likely emergence of these vehicles in Australia.

With these forces at play, this is an opportune time to assess whether Australia's energy markets can facilitate the efficient uptake of EVs and NGVs. The Federal Government asked the SCER to instruct us to identify the energy market arrangements needed to facilitate the uptake of EVs and NGVs.[5]

Further, there are a range of related trials and programs currently underway across Australia. These trials and programs include the Victorian government's Electric Vehicle Trial; the Queensland government's development of an Electric Vehicle Roadmap; the South Australian government's Low Emission Vehicle Strategy; the Western Australia Electric Vehicle Trial; and the Australian government's Smart Grid, Smart City trial. We also note that the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is conducting research on electric cars through its

3 On 10 June 2011, the Council of Australian Governments (COAG) announced that it would amalgamate the MCE and the Ministerial Council on Mineral and Petroleum Resources and establish the Standing Council on Energy and Resources.

4 Available at www.aemc.gov.au.

5 Available at www.aemc.gov.au.

Electric Driveway Project.[6]The lessons emerging from these trials and research is important to consider in the development of our advice to the SCER.

Our work on the power of choice review is directly relevant to this Request for Advice.[7] The power of choice review aims to identify opportunities for consumers to make informed choices about the way they use electricity and to encourage efficient demand side participation in the NEM. EVs are a source of DSP; it is a source of extra demand that can be managed and also could become a potential source of storage of electricity, which could then be exported back into the grid. The power of choice review therefore has common issues with this review. We are therefore coordinating these two reviews together to provide consistent and comprehensive advice.[8] The power of choice draft report will be published on 6 September 2012.

1.2 Objective and scope of the review

Our objective in this review is to advise the SCER on how Australia's electricity and gas market arrangements can support the uptake of EVs and NGVs in the most economically efficient manner. This means that we have examined the NEM and the Western Australia (WA) electricity market arrangements as well as Australia's natural gas market arrangements. Any overlapping issues in electricity and gas markets have also been considered.

We have assessed the energy market implications for EVs that charge through the electricity system; namely, a battery electric vehicle (BEV) and a plug-in hybrid electric vehicle (PHEV). We have also assessed the energy market implications for NGVs; namely, NGVs powered by CNG and LNG.

While there are unique issues pertaining separately to EVs and NGVs, there are some common issues that we are required to investigate. These include (but are not limited to):

- the potential usage patterns and penetration rates, including any peak demand impacts;
- metering requirements, protocols and settlement issues;
- network protection/balancing requirements;
- connection and new network infrastructure implications; and
- potential implications for tariff arrangements.

6 http://www.csiro.au/resources/Electric-Driveway-reports.html

7 http://www.aemc.gov.au/Market-Reviews/Open/Stage-3-Demand-Side-Participation-Review-Facilitating-consumer-choices-and-energy-efficiency.html

8 Note this draft advice will be published before the power of choice review draft report.

The SCER has asked for a high level investigation into the energy market arrangements for EVs and NGVs. This means that not all of the detailed issues relating to how EVs and NGVs interact with energy markets are covered in our draft advice. We have focused on key issues in accordance with the Request for Advice.

We have not addressed broader economic issues relating to EV or NGV technologies. For example, arguments for rebates, tax concessions and other forms of government assistance for these technologies are treated as out of scope.[9] Also, issues relating to technical and safety standards of low emissions vehicles are treated as out of scope for this review.[10]

1.3 Our approach to the review

Our approach to this review is anchored in our statutory duty to promote the achievement of the energy market objectives: the NEO and NGO. We have used these energy market objectives to derive the key principles animating our review and in developing our analytical framework.

1.3.1 The National Electricity Objective and the National Gas Objective

Under section 32 of the National Electricity Law (NEL), we are required to have regard to the NEO. The NEO states:

Box 1.1: National Electricity Objective

The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—

(a) price, quality, safety, reliability and security of supply of electricity; and

(b) the reliability, safety and security of the national electricity system.

Under section 72 of the National Gas Law (NGL), we are required to have regard to the NGO. The NGO states:

Box 1.2: National Gas Objective

The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.

9 These arguments were raised in the submissions to the Approach Paper from General Electric (GE) and Westport Innovations.

10 EV technical standards are being addressed by Standards Australia under the AS Technical Committee EVO 001.

1.3.2 Key principles for the review

The NEO and NGO are founded on the concept of economic efficiency with emphasis on the long term interests of consumers. This encompasses not only the price at which services are provided, but also the quality, reliability, safety and security of the network and pipeline systems.

We have also taken the view that the scope of the NEO and NGO covers the means by which regulatory arrangements operate as well as their intended results. Hence, we seek to apply the principles of good regulatory design and practice in order to promote stability and predictability of the regulatory framework, minimise operational interventions in the market, and promote transparency. Therefore, regulatory design and practice will be a significant consideration for the review as it is important that any reforms are robust over the longer term.

In accordance with the NEO and NGO, we have developed and derived principles that are relevant in testing how the energy market arrangements can support the uptake of EVs and NGVs in the most economically efficient manner. These principles refer to the capacity for the energy market arrangements to:

- facilitate consumer choice in the way these technologies are used;
- appropriately allocate costs to the party that causes these costs, as far as is efficient;
- facilitate the security, safety and reliability of the electricity system and the supply of natural gas by promoting efficient investment in network and pipeline services; and
- foster competition and innovation, including innovation among business models, in the provision of services supporting these technologies.

In providing our advice in relation to the arrangements that promote the 'economically efficient' uptake of EVs and NGVs we aim to fulfil these principles.

1.3.3 Our analytical framework for the review

We have developed an analytical framework that sets out, step-by-step, how we have analysed the issues raised in order to provide complete and evidence-based advice to the SCER. The Table below describes our analytical framework and specifies the publications in which the key issues have been addressed to date.

Table 1.1 Analytical Framework

Stage of Approach	Objective	Outcome
Step 1	Identify and describe the technology (either EV or NGV).	Addressed in our Issues Paper.
Step 2	Assess the potential uptake of EVs and NGVs.	Completed by AECOM in its final advice to the AEMC.
Step 3	Identify the costs and benefits of EVs and NGVs to the energy markets.	Completed by AECOM in its final advice to the AEMC.
Step 4	Identify the appropriate electricity market or natural gas market regulatory arrangements necessary to facilitate the economically efficient uptake of EVs and NGVs.	Addressed in our draft advice.
Step 5	Identify the changes required to achieve the appropriate electricity market or natural gas market regulatory arrangements and propose recommendations.	Addressed in our draft advice.

1.4 Our approach to the draft advice

Our approach to the draft advice has been to assess the adequacy of the energy market arrangements to cater for EVs and NGVs. Where we have made recommendations to change these energy market arrangements, our recommendations attempt to be technology-neutral (that is, apply to all appliances and not only EVs) as far as is appropriate.

1.4.1 Draft advice based on findings of EV and NGV uptake

Our draft advice is based upon the evidence provided to us by AECOM relating to EV and NGV uptake.[11] We commissioned AECOM to analyse EV and NGV uptake to gauge the materiality of the impacts that EVs and NGVs could have on the electricity and natural gas markets, respectively.

The key conclusion from AECOM's analysis is that if charging an EV is unmanaged in the sense that there is an absence of signals to encourage EV consumers to charge away

11 AECOM's Final Advice is available at www.aemc.gov.au. Note our Information Sheet summarises AECOM's key findings.

from times of peak demand, then this could result in significant additional peak demand resulting in further costs to the electricity system. Given these findings, it is therefore important that there are appropriate energy market arrangements in place to manage the impact of EVs on the electricity system. This draft advice is developed with this imperative in mind.

We note that forecast uptake is uncertain and while we have modelled a set of uptake scenarios (low, central and high uptake). Actual uptake of these vehicles may vary from these scenarios. However, it is important that the energy market arrangements provide efficient outcomes whatever the uptake of these vehicles in the long term.

1.4.2 No EV specific energy market arrangements

From an energy market perspective, the general form of our recommendations is that there should not be specific energy market arrangements applying to EVs. While EVs have formed the catalyst for raising issues with the current arrangements, our recommendations are premised on the view that EV load is another form of demand side participation and that EV load should be treated in a technology-neutral manner. The weight of stakeholder submissions from government and energy market participants affirmed this view.[12]

We recognise that consumers may prefer to treat EV load separately from non-EV load. For example, an EV consumer might seek an EV specific tariff that is separate from its non-EV load.[13] It is conceivable that EV service provider business models could emerge to meet these consumer preferences. In fact, better place[14] (an EV services provider) argued for specific arrangements that enabled EV load to be separated from non-EV load. The better place business model seeks to directly manage electricity supply for an EV rather than through the incumbent retailer at a premise and it seeks to manage EV load as a load aggregator.[15]

We recognise that in some circumstances specific energy market arrangements for EVs may be necessary (for example, network licensing exemptions for providers of EV

12 Tasmanian Department of Infrastructure, Energy and Resources, *Response to AEMC Issues Paper -Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 28 February 2012; Government of South Australia, *Response to the AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 1 March 2012; Aurora Energy, *Response to AEMC Issues Paper -Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012; Ausgrid, *Response to AEMC Issues Paper -Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 12 March 2012; Citipower and Powercor, *Response to AEMC Issues Paper -Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012; Energex, *Response to the AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC,27 February 2012; Origin Energy, *Response to AEMC Issues Paper -Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012.

13 Non-EV load can refer to general household electricity consumption.

14 See www.betterplace.com.au.

15 better place, *Response to AEMC Issues Paper -Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012, p 3-4.

charging). However, generally, EV load should be treated consistently with other forms of demand side participation in a technology-neutral manner. This means that our recommendations on metering, pricing and controlled charging apply not only to EVs but also to other potential appliances. We have integrated our thinking in this review with our power of choice review.[16]

1.4.3 Our questions to frame the draft advice with respect to EVs

To frame our draft advice with respect to EVs and in accordance with the principles for this review, we developed two questions to categorise the issues and to structure how we would present this draft advice. In line with our thinking in Steps 4 and 5 of our analytical framework (as set out in our Issues Paper), these questions are:

1. What energy market arrangements are needed to encourage efficient behaviour with respect to EVs by apportioning costs consistent with the causer-pays principle and enhancing benefits?;

2. What energy market arrangements are needed to promote consumer choice with respect to EVs?

The first question assesses whether the interaction of EV charging with the energy market is efficient and is therefore ultimately in the long term interests of consumers. We consider that apportioning costs to energy market participants in a manner that is consistent with the causer-pays principle, can help address the impacts of EVs on peak demand and system infrastructure costs.

The causer-pays principle, in simple terms, means that the party that causes the costs should be the party that bears the costs. The causer-pays principle is intended to minimise cross-subsidies as far as practicable; that is, it minimises the extent that costs arising from EVs are smeared from EV consumers to non-EV consumers. We also consider what arrangements are required to enhance the benefits that EVs could provide to the energy market.

The second question recognises that the market for EVs is at an early stage of development. We seek to devise energy market arrangements that promote efficient consumer choice by fostering a competitive environment that support such choices. In the context of this review, consumer choice refers to the decisions consumers make with respect to charging an EV and using a range of EV-related services. Consumer choice is important because it empowers consumers to make consumption decisions in relation to EV services in a manner consistent with their preferences such that it drives efficient market outcomes.

We acknowledge that these questions can raise common issues. For example, our recommendations on metering are relevant to discussions on promoting consumer choice (question one) and facilitating efficient behaviour (question two).

16 Available at www.aemc.gov.au.

As the subsequent chapters attest, both of these questions have assisted us in structuring and conveying our draft advice.

1.4.4 EV charging locations and EV service provider business models

When we developed our draft advice, our recommendations were designed to be practical and comprehensive while acknowledging that EV technology is still at an early stage of development. We have therefore developed certain working assumptions related to EV charging locations to ascertain how EV charging interacts with the electricity system.

From a consumer perspective, an EV consumer would likely want the choice to charge its EV at both home, work and other commercial premises. From an electricity market perspective, EV charging generally occurs at two points on a network:[17]

- At a direct connection to the distribution network. This occurs at a connection point either via a retailer to the distribution network or directly to a distribution network.

- At a connection to an embedded network.[18] This occurs through an on-selling arrangement.[19]

We have also considered the types of EV service provider business models available and note that a range of business models may emerge in coming years. For example, it is possible for a Distribution Network Service Provider (DNSP) to operate EV charging infrastructure[20] (eg. operating a commercial EV charging station) or electricity retailers to offer these services. Irrespective of the diversity of business models possible, we consider that there are certain key types of services that could be provided, namely:

- EV infrastructure provision; and

- provision of electricity (at a range of locations).

EV service providers could provide one service only or both of these services. It is also possible for EV service providers to provide a range of related services, such as road side assistance, battery swap services or, conceivably, a range of non-EV related services.

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17 Connection of an EV can occur with transmission connected customers - for example at a car park at a major industrial customer.

18 An embedded network is a network connected to but not forming part of a transmission or distribution network and it provides electricity to a third party. Eg. a network within a shopping centre complex providing electricity to tenants.

19 Onselling means an arrangement where a person acquires energy from a retailer following which the person acquiring the energy sells this energy for use within the limits of premises owned, occupied or operated by the person.

20 This occurs in international jurisdictions.

In providing out draft advice, we have considered the effect on energy market arrangements of a 'bundled service provider'. We have defined a 'bundled service provider' as providing:

- the EV infrastructure;
- electricity to the EV consumer; and
- other services, which may or may not directly relate to the sale of electricity.

1.4.5 The draft advice and its relationship with the National Energy Customer Framework

Our draft advice is provided on the premise that the National Energy Customer Framework (NECF) will take effect in the NEM. We acknowledge the SCER's indication that the NECF will come into force in each of the NEM jurisdictions at different times.[21] Given the slow uptake of EVs in the short term, it is appropriate that our draft advice applies the NECF. This is because the NECF is intended to become the legislative architecture for the retail energy markets and consumer protection.

The NECF is designed to be a national framework for energy distribution and retail regulation. It is a legislative package that includes the NERL (and associated Rules) and adds new parts to the rules under the NEL and the NGL. In particular, there is a new Chapter 5A of theNational Electricity Rules (NER) that sets out the framework for retail consumers connecting to the distribution network.

The aspects of the NECF that affect our draft advice on EVs are the NERL and Chapter 5A of the NER. Specifically:

- the NERL is relevant to the question as to whether charging an EV is the sale of electricity and if so, it specifies the retail licensing (and exemptions) regime that applies; and
- Chapter 5A of the NER is relevant in understanding the regulatory framework that applies to EV customers connecting to the distribution network to recharge their EVs.

We have explored the EV implications of these aspects of the NECF in subsequent chapters of this draft advice.

We note that if the NECF does not come into force in certain jurisdictions, then our draft advice would apply to relevant jurisdictional arrangements. With respect to consumer protections, the Australian Consumer Law would apply.

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21 Currently the NECF is in force in Tasmania, the Australian Capital Territory and the Commonwealth jurisdiction. The remaining jurisdictions may introduce NECF at later dates.

1.5 Structure of the draft advice

This draft advice is structured as follows:

- Chapter 2 relates to EVs and the NEM arrangements to facilitate efficient charging behaviour;
- Chapter 3 relates to EVs and the NEM metering arrangements to facilitate consumer choice and efficient charging;
- Chapter 4 relates to EVs and the NEM arrangements to facilitate consumer choice;
- Chapter 5 relates to EVs in Western Australia;
- Chapter 6 relates to NGVs; and
- Chapter 7 concludes with a summary of our draft recommendations.

This draft advice also contains the following Appendices:

- Appendix A - Submissions summary table - Issues Paper; and
- Appendix B - Overview of Western Australia's electricity market.

1.6 Timeframes and consultation for the draft advice

We will prepare our advice in conjunction with our power of choice review. Therefore, the draft and final advice in relation to EVs and NGVs will coincide with the draft and final report of the power of choice review so that our advice is consistent and comprehensive. Accordingly, we intend to undertake this review to the following time frames:

Table 1.2 Proposed timeframes for this review

Publication Milestone	Date of Publication
EV/NGV review draft advice	29 August 2012
power of choice draft report	6 September 2012
EV/NGV review final advice and power of choice review final report	November 2012

The terms of our Request for Advice require us to consult with:

- The Australian Energy Market Operator (AEMO);
- The Australian Energy Regulator (AER);

- Industry groups and representatives from energy networks and energy retailers;
- The Cooperative Research Centre for Advanced Automotive Technology; and
- Relevant Commonwealth and jurisdictional departments.

We have consulted with these stakeholders during the course of our review.

All stakeholders have the opportunity to provide us with submissions on this draft advice. We would appreciate the receipt of submissions by 1 October 2012. Submissions should contain the project reference code **'EMO0022'** in the subject heading.

Submissions may be sent electronically through the Commission's website at www.aemc.gov.au or in hard copy to:

Australian Energy Market Commission

PO Box A2449

Sydney South NSW 1235.

1.7 Next steps after the publication of the final advice

Our final advice will be provided to SCER for their consideration. SCER will consider the recommendations in our final advice and are empowered to make decisions relating to the implementation of these recommendations. SCER may make policy announcements, review the relevant legislative frameworks or request that we consider particular rule changes. There will be further opportunities for stakeholders to participate in the development of the recommendations canvassed in our final advice.

2 Electric Vehicles - NEM arrangements to facilitate efficient behaviour

Given the uptake of EVs in Australia, if EV charging behaviour is unmanaged,[22] then this charging behaviour has the potential to collectively have a significant impact on peak demand and impose substantial costs to the electricity system.[23] In fact, AECOM's analysis found that if EV charging is left unmanaged, then the costs (in terms of network and generation upgrades) in the NEM could be in the order of around $10, 000 per EV between 2015 to 2020 (although the actual amount varies by location and use profile).[24]Of this amount, we estimated that approximately $3,000 - $3,500 of these costs would be paid for by the consumer.[25] The remainder of these costs ($6,500 - $7,000) would be borne by all consumers. Over a five yer period, this equates to just over an extra $1000 per EV per year of additional generation and network costs that would be recovered from all consumers. This implies that measures need to be put in place to yield efficient market outcomes.

We seek to facilitate efficient EV charging behaviour to manage the impact of EVs on the electricity system through the causer-pays principle. In other words, we seek to implement measures such that the party that causes the extra costs for EV charging should bear those extra costs. These extra costs refer to the additional system infrastructure - both network[26] and generation - needed to serve the additional electricity demand which results from the charging of EVs. The extent of these additional costs will be driven by decisions made by EV consumers on both the quantity, timing and location of the charging of EVs.

If the energy market arrangements are designed in a manner such that EV consumers bear these extra costs, then the EV consumer will be incentivised to make efficient decisions on when and how much to consume. If not, the extra costs will be smeared across all consumers. Given the potential magnitude of these costs, it is necessary for there to be energy market arrangements to incentivise EV charging leading to efficient market outcomes.

We are also proposing recommendations that facilitate the realisation of the benefits that EVs can provide to the energy market.

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22 Unmanaged charging refers to the charging of an EV in the absence of a signal to reflect the costs of charging at times of peak demand. In contrast, managed charging variously refers to time-varying (including Time Of Use -TOU) charging, smart meter charging and controlled charging.

23 This is one of the key findings of AECOM (2012) Final Advice available at www.aemc.gov.au.

24 AECOM (2012), Final Advice, p. ix. Available at www.aemc.gov.au. AECOM derived this figure by dividing the aggregate EV related electricity system costs ($3.1 billion) by the total EV stock (390,000) in 2020 and rounded up to the nearest significant number.

25 Assuming an annual bill of between $500-700 for the time period between 2015-2020.

26 Network costs will depend upon the location of the EV charging facility and local network characteristics, such as the extent of spare capacity.

Specifically, we discuss:

- pricing incentives for EVs as a form of demand side participation;
- connecting to a distribution network;
- controlled charging of EVs; and
- vehicle-to-grid capabilities.

2.1 Pricing signals to encourage efficient behaviour

Box 2.1: Draft recommendation

Our power of choice review found that the current network and retail tariffs do not necessarily reflect the cost of supply and the delivery of electricity. This means that most consumers currently do not have options to capture the value of DSP activities. Therefore, the current pricing arrangements are unlikely to promote efficient charging behaviour for EV consumers.

Although efficient behaviour requires high use consumers to face cost-reflective prices, we do not recommend mandating specific price structures for residential EV consumers because:

- EVs should be treated as other forms of large load and DSP and the power of choice review will provide advice on how the market could move towards more cost reflective prices; and
- retailers and networks can still develop their own EV specific tariffs to incentivise efficient behaviour.

Also, we recommend that:

- there may be merit in having some form of geographical variation in the DUOS charges to better focus the network costs onto the EV consumer and to address the effects of EV uptake clustering in particular locations at the early stages of the market; and
- meters with interval read capability are necessary to enable consumers to be incentivised to behave in a manner that yields efficient market outcomes. The power of choice review is exploring how high use consumers, such as large load consumers, can be allocated interval (or other time varying) meters to facilitate efficient behaviour.

2.1.1 Significance of the issue

From an energy market perspective, we are interested in encouraging efficient behaviour with respect to EVs to address the potential impacts that EVs could have on peak demand, particularly where EV charging is left unmanaged. AECOM found that EVs would contribute to peak demand if charging is unmanaged. AECOM's report found that the impact of EV charging on peak demand could be mitigated if managed charging is introduced.

EVs are a form of demand side participation. This arises from the fact that an EV load is typically flexible in nature (an EV can be charged at times different from the use of an EV), and in the future, it may be possible that an EV's battery may be a source of distributed generation (through vehicle-to-grid technology).

Pricing signals may also be used capture the benefits that EVs can bring to the electricity system. The AECOM report identified how an EV load can potentially be used to improve the load factor of networks through charging EVs at off-peak times.[27] AECOM also identified flexibility benefits of EVs if there is dynamic pricing (pricing that changes in real time in response to changing market conditions) where EV loads can be used for network management, to manage wholesale price risk and for the efficient use of intermittent generation (ie. wind, solar).[28]

Importantly, our duty under the NEO requires us to have regard to the efficient use of electricity services with respect to price in the long term interests of consumers. We are thus interested in promoting the causer-pays principle and ensuring that efficient outcomes apply to all consumers (EV and non-EV consumers).

We note that the causer-pays principle must be applied carefully so that the energy market arrangements are non-discriminatory and consistent.[29] This means that a causer-pays principle that applies to EVs should equally apply to other large loads. We believe that, where appropriate, the treatment of an EV load should be consistent with other forms of DSP. This is why our recommendations relating to EVs will be developed further in our power of choice review.

2.1.2 Analysis

We undertook some modelling where we examined the annual electricity bills for a typical EV consumer under various tariff arrangements: a flat tariff, TOU tariff and a Critical Peak Pricing (CPP) tariff. We found that if a TOU or CPP tariff was introduced and a consumer shifted its entire EV load to charge at off-peak times, then they could make a significant saving relative to charging at peak times on a flat tariff. For example, we estimated that if a consumer with a medium sized passenger EV was to

27 Improved load factor is not a new economic benefit but a financial transfer to non-EV electricity consumers.

28 AECOM report available at www.aemc.gov.au.

29 ChargePoint, *Response to AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012, p. 2.

switch from a flat tariff to a TOU tariff, then the EV consumer could potentially save around $250 per annum.[30] This implies that:

- appropriate metering is important to facilitate these pricing signals; and
- it is in the consumer's interest to have interval meters and for appropriate pricing signals to be available because it would save the consumer money and lead to efficient market outcomes.

Views from industry stakeholders and from jurisdictions provide strong support for the role of pricing signals. Stakeholders agree that pricing signals should be the principal means to encourage efficient behaviour.[31] Some stakeholders believe that there should be general TOU pricing signals applied to the entire household load (that is, non-EV specific).[32] However, it was also recognised that EV specific tariffs may be offered by the market as a result of consumer's exercising their preferences.

The pricing signals that consumers face are a composite of energy prices (from the wholesale market), network prices (from the transmission and distribution network) and the price associated with a retailer's costs.

With respect to energy prices, we acknowledge AECOM's report that found that if there is a significant uptake of EVs and unmanaged charging persists, then this could result in demand for additional generation capacity. Retailers have the flexibility to translate its energy costs into appropriate tariffs, subject to any jurisdictional price regulations.

We consider that efficient EV charging behaviour can be most appropriately incentivised through network pricing signals. These network pricing signals apply to all forms of DSP including EVs. When these network pricing signals are cost-reflective, these signals can help address peak load and defer network investments. Network pricing signals can better reflect the cost impacts that appliances, such as EVs, can have on network peak demand. In particular, we focus on Distribution Use Of System (DUOS) charges as a key means of facilitating efficient behaviour. We consider that there is merit in introducing some geographical variation in these DUOS charges to better focus network costs caused by EV consumers and to address the effects of 'clustering' - where EV uptake may 'cluster' at particular locations in the early stages of the market. Ensuring that these network pricing signals are effective would require:

- retailers to capture and pass through these network pricing signals in the retail tariffs they offer to their consumers; and

30 This analysis was based on a medium sized passenger EV travelling at medium VKT(vehicle kilometres travelled) consuming 2.4 MWh of energy per annum.

31 Tasmanian Department of Infrastructure, Energy and Resources 2012, submission to issues paper, p.3; Energex 2012, submission to issues paper, p.1.

32 See for example, SP AusNet, *Response to AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*,, submission to the AEMC, 27 February 2012, p.1.

- interval metering is necessary to enable consumers to be incentivised to behave in a manner that yields efficient market outcomes.[33]

Question 1 EVs and pricing

Do you agree that efficient EV charging behaviour should be incentivised through network pricing signals? If so, what arrangements are necessary to implement these pricing signals?

As stated above, it is possible that EV specific tariffs may be developed by industry, including EV service providers, retailers and networks. While we favour an approach that does not mandate tariffs based on technological type but rather, that tariffs be applied to DSP more broadly, we acknowledge that the consumers may ultimately choose to segment parts of their load and apply different tariffs to each part of their load. This assumes that appropriate metering arrangements exist to facilitate the segmentation of EV specific load (as discussed in the next chapter).

While our view is that EV loads, particularly through their impact on peak demand, should be managed through network pricing signals applying to all forms of DSP, we do not preclude EV specific tariffs being offered to retail consumers consistent with their consumer preferences. The case study below in Box 2.2 illustrates an example of a retailer offering an EV specific tariff.

Box 2.2: Case study: Pacific Gas and Electric Company

Pacific Gas and Electric Company (PG&E) is a natural gas and electric utility company incorporated in California. PG&E has developed EV specific tariffs (E-9A and E-9B) to manage its consumers' energy and charging costs.[34] These tariffs offer lower off-peak rates to attract consumers who are able to charge their vehicle during off-peak periods. Consumers may choose these tariffs or stay on their existing residential tariffs.

Tariff E-9A is a TOU tariff and provides a single meter for both home and EV. There is one baseline amount of consumption shared by both the home and the EV. The total energy rate ($/kWh) for summer baseline consumption is $0.30178 (peak), $0.09876 (part-peak) and $0.03743 (off-peak). This compares against the total energy rate for a standard flat residential tariff (E-1)of $0.12845.This tariff is attractive to consumers who will not significantly increase their daily energy use by charging an EV or whose current energy usage is mostly during non-peak hours. There are no specific costs to the EV consumer for this tariff but a panel and/or service upgrade may be required.

Tariff E-9B is a TOU tariff and provides two meters - one for the home (which

33 The power of choice review is exploring how high use consumers, such as EV consumers can be allocated interval meters to facilitate efficient behaviour.

34 http://www.pge.com/myhome/environment/whatyoucando/electricdrivevehicles/rateoptions/ (accessed 3 July 2012)

remains on the current residential rate) and a second meter for the EV. There are two baseline amounts of consumption: one for the home and one for the EV. The total energy rate ($/kWh) for summer baseline consumption is $0.29726 (peak), $0.09424 (part-peak) and $0.04479 (off-peak). This compares against the total energy rate for a standard flat residential tariff (E-1)of $0.12845. Tariff E-9B is attractive if EV charging significantly impacts daily energy usage or if current energy usage is mostly during peak hours. The costs to the consumer is $US250 per meter fee and second panel installation and a service upgrade may be required.

We acknowledge, however, that there are limitations to the extent that pricing signals are able to encourage efficient behaviour. With respect to energy prices, mass market consumers (which include EV consumers) may not want to be exposed to such volatile prices. With respect to network pricing signals, it may be difficult to define or measure the marginal cost of distribution services by time of use and by location at a sufficient level of granularity. There may be equity implications of this approach as well. We recognise that while pricing incentives are necessary to encourage efficient behaviour, it may not always be sufficient to achieve intended outcomes.

2.2 Connection to a distribution network

Box 2.3: Draft recommendation

We consider that the connections charging framework administered by the AER is appropriate for EVs connecting to a distribution network and we are not proposing any changes. The framework for setting upfront connection charges under Chapter 5A of the NER allows for the possibility of applying a connection charge to EVs connecting to a distribution network depending on the nature and size of the connection.

2.2.1 Significance of the issue

To recharge an EV, it must be connected to, and draw electricity from, a distribution network (or embedded network). This connection may cause both direct connection costs (such as the cost of an extension to the consumer's premises) and shared augmentation costs (that is, costs to augment the shared segments of a distribution network).

We focus on shared augmentation costs and seek to design arrangements where these shared augmentation costs are efficient by applying the causer-pays principle. In implementing the causer-pays principle, we seek to limit any cross-subsidies that non-EV users pay for EV users' connections to the distribution network. In practice, however, we acknowledge that the transaction costs (for example, it may be practically difficult for networks to identify individual impacts on the shared network) involved may constrain the application of the causer-pays principle.

These shared augmentation costs can be recovered through DUOS or through an upfront connection charge payable by a consumer to a distribution network. As discussed above, we think that the efficient way of recovering these costs is through DUOS signals. Connection charges have a role to play as well. That is, where the shared augmentation costs are not recovered through DUOS, then these costs may be recovered by DNSPs from retail consumers through upfront connection charges.

2.2.2 Analysis

The regulatory framework for retail consumers connecting to a distribution network is set out in Chapter 5A of the NER. This framework sets out the types of connection services and the circumstances where a connection charge is payable. This framework applies to retail consumers seeking either a new or altered connection to a distribution network.

EV consumers are retail consumers and therefore Chapter 5A of the NER would apply.[35] All EV charging facilities, including commercial EV charging stations, directly connected to a distribution network would be covered by Chapter 5A of the NER. The exception is for EV charging facilities connected to embedded networks. These EV charging facilities would be subject to the pricing terms in the AER's Network Service Provider Exemption guideline.

Under Chapter 5A of the NER, there are three types of connection services:

- basic connection services;
- standard connection services; and
- negotiated connection services.

Most retail consumers would be treated as a basic connection service under Chapter 5A of the NER. Solar PV (Photo-Voltaic) installations are also treated as a basic connection service.

Given the transaction costs involved, under this framework the causer-pays principle only applies to shared augmentation costs captured in an upfront connection charge to a limited extent. This is because retail consumers do not pay for shared augmentation costs where the connection is:

- a basic connection service; or
- a standard connection service below a capacity threshold[36] set by the DNSP (and approved by the AER).

35 Except if the EV user is a consumer of a bundled service provider who is not involved in the sale of electricity.

36 Generally, 25 kVA on single wire earth return lines or maximum capacity of a 100 Ampere 3 phase low voltage supply.

Rather, these shared augmentation costs are smeared across the class of consumers and recovered through DUOS charges.

Whether an EV charging facility has to pay an upfront connection charge due to shared augmentation costs depends on the nature of the connection. For example, an EV in a typical residential household connecting at a 15 Amp General Purpose Outlet (GPO) may qualify as a basic connection service (or a standard connection service below the capacity threshold) and therefore would not pay shared augmentation costs through an upfront connection charge. However, it is possible that an EV charging station may exceed the capacity threshold for a standard connection service and therefore be liable for an upfront connection charge.

2.3 Controlled charging

Box 2.4: Draft recommendation

We consider that the right to the benefits of controlled charging ultimately lies with the consumer. This right can be assigned by the consumer to other parties in exchange for benefits to the consumer.

To realise the benefits of controlled charging, effective commercial relationships (or contracts) between the consumer and potentially DNSPs, retailers and aggregators are required. We recognise the role that third parties (such as aggregators) can play in negotiating (on behalf of the consumer) the allocation of benefits between multiple parties.

To assist these third parties in negotiating the benefits of controlled charging so that it is captured in commercial contracts, it may be necessary to set some regulatory guidance on the steps to take in the negotiation process and possible measures to assess the value of DSP to aid the negotiations.

The power of choice review is exploring how the energy market arrangements should support these contracts.

2.3.1 Significance of the issue

Controlled charging offers another way of managing the impact of EVs on peak demand. Controlled charging refers to the delegation by the consumer of the right to control its EV charging to a third party (such as a retailer, DNSP or aggregator). That third party will determine the times when the EV is charged subject to the terms of the contract with the consumer. Controlled charging ensures that an EV is charged only at times which offer benefits to other participants in the electricity supply chain. Controlled charging can be used, for example, to more confidently match intermittent renewable energy to charge a controlled EV load.

From an energy market perspective, we are interested in how to implement controlled charging such that its costs and benefits are assigned to the right parties.

2.3.2 Analysis

We consider that the right to control EV charging should be vested in the consumer. This means that the consumer enjoys the benefit and contributes to the costs involved in exercising this right. Submissions from stakeholders were supportive of this position. For example, the University of New South Wales Centre for Energy and Environmental Markets argued that there should be contestability in assigning this right; rather than automatically assigning this right to DNSPs, other parties (eg. aggregators) should be able to compete for this right too.[37]

Energex pointed out that one needs to be mindful of all the market costs and impact on power quality and voltage where consumers delegate rights to control EV charging to third parties.[38] Energex noted the different interests of DNSPs compared to retailers/aggregators, with the former being concerned with quality of supply and the latter concerned with capacity.[39] Origin Energy argued that the costs and benefits of controlled charging can be apportioned between market, non-market participants and consumers through contracts, which are largely invisible to policy-makers.[40] Origin Energy suggested this could be made visible by including third parties in the NECF.

If an EV consumer assigns this right, then it should receive a benefit (eg. through lower tariffs). It is necessary that the consumer is educated about this right so that it may be exercised in an informed manner.

We consider that optimising the benefits of controlled charging should be left to the market to determine via appropriate commercial relationships (ie. contracts) between consumers and market participants. We acknowledge that there are difficulties for this to occur in practice. For example, if a contract for controlled charging was offered between a consumer and a retailer, this would constitute a reliable source of DSP. However, this contract between a consumer and retailer may make it difficult for other parties (such as a distribution network) to realise its share of the benefits of controlled charging. This situation arises because the additional (or residual) DSP benefits that could be offered to, in this example, the distribution network, are difficult to value because of the 'non-firm' nature of the additional (or residual) DSP benefits. This is similar to time varying pricing too.

To facilitate commercial relationships that capture the efficient value of controlled charging, we recognise that it may be necessary for third parties (such as aggregators) to play a role in negotiating (on behalf of the consumer) the set of benefits that fall to retailers, distributors, other energy service providers and consumers. To assist these

37 UNSW Centre for Energy and Environmental Markets, *Response to the AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 6 March 2012, p. 10.

38 Energex 2012, Submission to Issues Paper, p. 12.

39 Ibid.

40 Origin Energy 2012, Submission to Issues Paper, p.17.

third parties in negotiating the benefits of controlled charging, it may be necessary to set some regulatory guidance on the steps to take in the negotiation process and possible measures to assess the value of DSP (particularly the residual non-firm benefits) to aid the negotiations. The power of choice review is exploring the potential of multi-lateral contracts to promote efficient DSP and how the energy market arrangements could facilitate such contracts.

Question 2 Controlled charging

Do you have any suggestions on how to improve the method for valuing non-firm benefits and improving the negotiation process among multiple parties so that the diverse benefits of controlled charging are captured?

2.4 Vehicle-to-Grid

Box 2.5: Draft recommendation

We consider that the right to control the discharge of an EV back to the grid resides with the EV consumer.

The consumer can assign the costs and benefits of EV discharging to other parties (eg. retailers, DNSPs, aggregators) in exchange for consumer benefits through commercial relationships (ie. contracts). There is a role for third parties to negotiate on behalf of consumers the set of benefits falling across multiple parties.

2.4.1 Significance of the issue

Vehicle-to-Grid (V2G) refers to the capability of EV batteries to store electricity that may later be discharged or exported back to the electricity grid. In its submission to the power of choice review directions paper, the Energy Supply Association of Australia submitted a report it commissioned from its consultants - Deloitte - who made a preliminary estimate of the size (in megawatts) and value (in dollars) if V2G was used to address peak demand.[41] While V2G technology has upcoming potential, at present, there are technical issues and practical uncertainties surrounding the application of this technology. The AECOM report outlines some of these issues such as uncertainties on the impact of V2G on battery life, driver anxieties and the need to have a critical mass of EVs.[42] Other studies have raised issues associated with the complexities for DNSPs

41 Deloitte (2012), 'Energy Supply Association of Australian - Analysis of initiatives to lower peak demand', p. 45. Available at www.aemc.gov.au. Deloitte estimated the value of V2G from years 2012 to 2022 to be between $60-530 million in Net Present Value (NPV) terms.

42 AECOM's report is available at www.aemc.gov.au.

to incorporate V2G in their networks (such as smart grid technology) and question the economic case for V2G both from a utility and consumer perspective.[43]

From our perspective, we are concerned with the energy market issues that need to be addressed to facilitate the use of V2G in the long term. These are considered below.

2.4.2 Analysis

Similar to our thinking in relation to controlled charging, we consider that the right over V2G (ie. the right to control the discharge of an EV back to the grid) resides with the consumer. It is necessary that the EV consumer be informed of the nature of this right and how to exercise this right in a manner that serves their interests. This emphasises the role of energy market participants in engaging with consumers in a way where mutual benefits for both consumers, market participants and other parties can be realised.

While the right to control discharging of an EV should be vested in the consumer, the DNSP (or indeed other parties) should be given the opportunity to make payments for a share of the benefits of V2G (or charge for a share of the costs imposed by V2G). SP AusNet submitted that the party that should control EV discharging depends on the use of that electricity; that is, whether it is used for network load support or minimising generation costs.[44] This situation underscores the importance of commercial contracts between the parties, including consumers, in capturing the diverse benefits of V2G.

These contracts should capture:

- the relative costs and benefits that V2G would have on networks, consumers and other parties;
- the value to the EV consumer for providing use of its battery;
- the risk to the EV consumer for any deleterious impacts on its EV battery for providing network support; and
- any costs borne by the DNSP for connecting and using V2G in their networks.

V2G is also a form of distributed generation. Therefore, the energy market issues relating to distributed generation in our power of choice review and other AEMC work, including Rule changes, which are applicable to V2G.

We also note the problem of feed-in tariffs particularly where a household could face multiple feed-in tariffs (for example, from its PV, its EV etc). We note a view from submissions that current feed-in tariff arrangements are too low relative to the retail

43 N DeForest et al, 'Impact of Widespread Electric Vehicle Adoption on the Electrical Utility Business - Threats and Opportunities', Centre for Entrepreneurship and Technology, University of California, Berkeley, 2009.

44 SP AusNet 2012, Submission to Issues Paper, p. 9.

tariff (where retail tariffs are not cost reflective), which suggests that there is more of an incentive for vehicle to home (V2H) than V2G.[45] Consideration of feed-in tariffs is a jurisdictional matter and will not be addressed further within this review.

Finally, we note that clause 7.3.1(a)(7) of the NER requires that metering installations be capable of recording energy data in each direction where bi-directional flows of active energy could occur. This clause is relevant to metering installations associated with premises where V2G could be available. This clause implies that all EV meters should have bi-directional capability, which may not be appropriate at this stage given that V2G is itself at an early stage of development. It may therefore be necessary to amend this clause to allow some flexibility in the instance an EV metering installation does not have bi-directional capability.

On a related point, there may be benefit in considering whether this clause should be amended to require that metering installations have bi-directional interval metering capability to capture the differing value of exported generation through the course of the day.

Question 3 Vehicle to Grid

Should clause 7.3.1(a)(7) of the NER be amended to reflect the current early status of V2G? Should interval meters be required to have bi-directional capability?

2.5 Identifying a large load (including an EV)

While energy market arrangements should be technology-neutral, we recognise that there are important grounds for retailers and networks to be able to identify where a large load is in the electricity system. This would enable retailers and networks to manage these large loads (for example, through pricing signals and metering arrangements) to yield efficient outcomes for the electricity system.

Identifying a large load is important for the electricity system for two reasons:

- Network security - it enables the DNSP to be able to manage large loads on its network by being able to identify its location; and
- Pricing signals - it enables the DNSP and retailer to offer time varying tariffs to consumers to manage impact on system demand.

One way by which DNSPs could be notified of a large load at a premise is through the Wiring Rules (AS/NZS 3000:2007). These Wiring Rules could provide the basis for determining the maximum demand at a premise and provide the means by which an electrical contractor can notify a DNSP of a new or altered electrical installation that may affect maximum demand at a premise.

45 UNSW Centre for Energy and Environmental Markets 2012, Submission to Issue Paper, p.15.

We are interested in stakeholders views on whether measures for DNSPs to identify large loads, including EV loads, should be implemented.

Question 4 Identifying a large load (including an EV)

1. **Should any loads above a threshold (eg. 15 amps) be identified to the DNSP? Could the Wiring Rules (AS/NZS 3000:2007) provide the basis for determining the maximum demand at a premise and provide the means by which an electrical contractor can notify a DNSP of a new or altered installation affecting maximum demand at that premise?**

2. **If there are no requirements to identify particular appliances, should there be a total load threshold above which identification to a DNSP is required?**

3 Electric Vehicles - NEM metering arrangements to facilitate consumer choice and efficient charging

In this chapter we discuss our draft recommendations with respect to the metering arrangements necessary to enable market signals to facilitate consumer choice and efficient EV charging. In the context of EVs, we consider there would be benefits in having metering arrangements that enable the application of time varying prices (including TOU pricing) of the EV charging load and the separate metering of the EV charging load from other loads in the premises or network. In particular, we consider consumers may want to take advantage of TOU prices for parts of their load while retaining a flat tariff for the remainder.

Specifically, we propose to:

- define 'supply point' to separate metering of a load from the definition of connection point in the NER;
- create parent/child metering at a site with a single consumer;
- define the use of multi-element meters;
- define the metering arrangements in an embedded network supplying multiple consumers; and
- allow multiple supply points, and associated financially responsible market participants, at one connection point.

While we are proposing these changes in the context of this review, these changes are not specific to controlled charging of EVs and could apply to any situation where a consumer requires separate metering to take advantage of time varying tariffs. Therefore, we are also considering the NEM's metering arrangements as part of our power of choice review. The draft report for the power of choice review will expand on the metering issues addressed in this chapter to include ways of promoting the use of interval metering of loads to enable the capture of benefits from time varying price signals.

The development of our metering proposals was informed by two industry workshops on the metering issues. The first workshop was held in Sydney on 29 February 2012 and focused on the arrangements for separately metering an EV charging load. At the second workshop in Melbourne on 16 May 2012 we sought feedback on our developing proposals, as well as on our proposed arrangements to promote further uptake of interval metering.

3.1 Changing the definition of connection point and supply point for separate metering

Box 3.1: Draft recommendations

We recommend that the term 'connection point' in Chapter 7 and Rule 3.15 of the NER be replaced with 'supply point'. The supply point would be the point where part, or all, of the consumer's load would be metered.

In the remainder of the NER, the term 'connection point' would continue to refer to the point of physical connection between the network assets and the assets of the network user (consumer or generator).

This change would mean that a consumer that establishes an additional metering installation at its premises need not establish a second connection point.

3.1.1 Significance of the issue

We are aiming to increase the flexibility of the metering arrangements to allow consumers to more easily engage with more than one FRMP [46] for parts of its load or generation. Potentially this could increase the range of products and packages that can be offered to consumers, and hence increase competition in the provision of EV services and demand side options. For example, the Energy Efficiency Council proposes that energy retail be unbundled from demand side responses, as it considers that this would promote competition in the trading of demand side response to be traded on the spot price.[47]

The term 'connection point' has two different meanings in different contexts within the NER. That is:

- the connection of a generator or a consumer to a network (distribution or transmission); and
- the point where the associated energy that is generated or consumed is metered.

Therefore, under the current arrangements, a consumer, or generator that wishes to separately meter part of the load or generation in its premises must establish a second connection point. The establishment of second connection point at the same physical location in the network has the potential to cause unnecessary confusion in relation to

46 The FRMP is financially responsible for the costs relating to the provision of the metering installation and for metering data services. The FRMP is typically the retailer, but may be a generator or market customer depending on the connection point.

47 Energy Efficiency Council, *Response to the AEMC Directions Paper - Power of choice review*, submission to the AEMC,4 May 2012, p. 4-6.

network use of system charges and may be relatively expensive compared to other metering configurations.

3.1.2 Analysis

Throughout the NER the term 'connection point' refers to the physical connection between a consumer or generator to a network. When such a connection is negotiated the network service provider (NSP) and the network user negotiate:

- the nature of the connection and the associated connection assets;
- the technical performance of the network user's equipment; and
- the level of service provided by the NSP.

The physical connection also forms the basis for the network use of system charges that the NSP imposes on the consumer (or generator).

The connection point is also the place where energy is metered for the NEM settlements process. Currently, there is generally a one to one relationship between the physical connection and the point where the metering occurs. Therefore, when a consumer wants to meter a part of its load, or offer a demand side response from selected appliances, it needs to establish a second connection point to define this metering installation. This second metering installation is at the same physical location as its main connection point and does not serve any purpose other than defining the point energy is metered.

We are proposing to include a new term 'supply point' in the NER to define where the energy at a connection point is metered.[48] This would allow a consumer to use multiple meters to measure the consumption (or generation) of parts of its loads while still only have a single connection point.

Question 5 Changing the definition of connection point and supply point

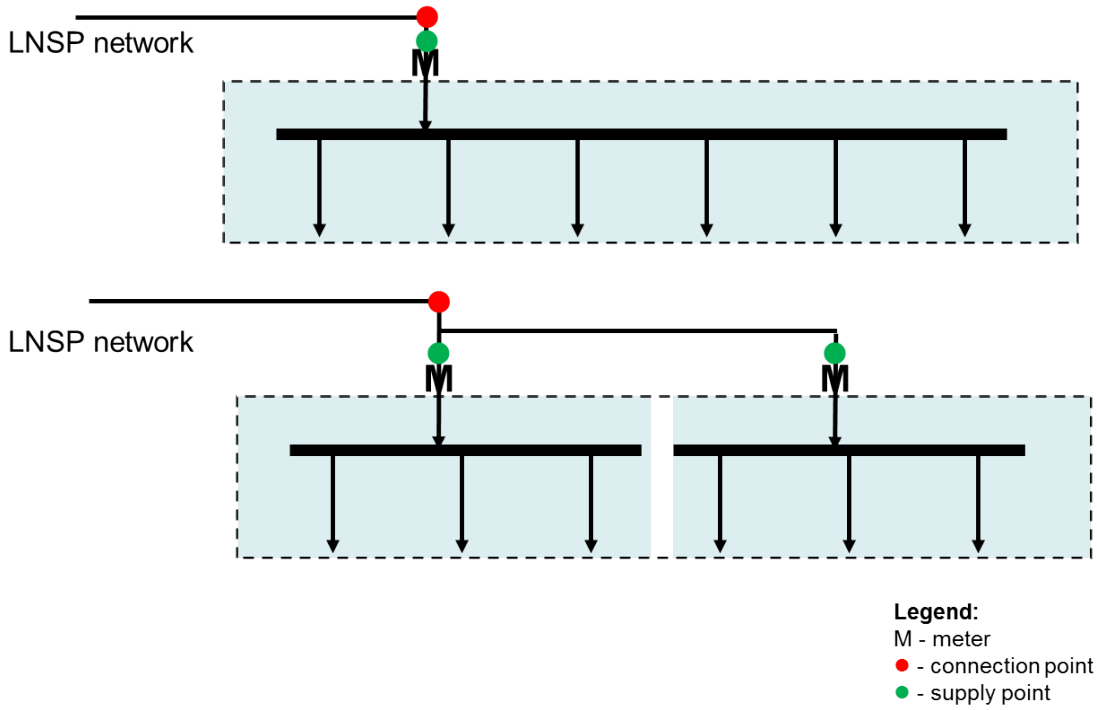
Do you agree that changing the definition of connection point and supply point in the NER should facilitate separate metering of loads (or generation)? Does the creation of this new definition produce any unintended consequences? Please provide reasons.

The following figure shows the situations where it has a single physical connection point. The first diagram in the figure shows the arrangement where all the load is metered by a single meter at a single connection point which is also the supply point. The second diagram shows the arrangement where the load is subdivided into two

48 Note that the 'supply point' is different from the 'point of supply' which is also used in the NER. The later is used in the context of power quality and refers to the point in the network where the network user is connected.

parts with a supply point defined for each part so that the parts of the load can be separately metered.

Figure 3.1 Difference between a connection point and a supply point for metering purposes



3.2 Parent/child metering at a site with a single consumer

Box 3.2: Draft recommendations

We recommend that a consumer be able to arrange for a parent/child (or subtractive) metering arrangement within its premises when:

- there is a single connection to the Local Network Service Provider (LNSP); and
- there is a single consumer at the premises (such as a residence or small business).

Under these arrangements:

- losses within the premises would be assigned to the parent meter;
- all fixed Distribution Use Of System (DUOS) charges would be assigned to the FRMP for the parent National Metering Identifier (NMI), unless otherwise agreed with the consumer; and
- the NMI for the child meter(s) would be assigned by the Responsible

Person[49] for the child meter.

3.2.1 Significance of the issue

A consumer that wishes to supply part of its load from a different retailer, such as for its EV charging, requires a separate metering measurement. This can be achieved with a separate meter at its switchboard but this can be relatively expensive. In fact, better place (an EV services provider) advised that installing a second metering installation at a premise costs between $1,000 and $8,000.[50] We have not verified these cost estimates.

A potentially cheaper alternative to installing a separate meter is to install a child meter for the separately measured load.[51] Installing a child meter is likely to be cheaper and more practical than a separate meter because it can be undertaken during a single visit to the premises and does not require an interruption of the supply to the remainder of the load at the premises.[52]

As well as installing the child meter, the Responsible Person[53] for the child metering installation would need to establish a subtractive relationship with the existing parent metering installation. The result is that the child metering installation records the energy consumption of the separately measured load while the energy consumption for the remainder of the consumer's load is calculated as the difference between the metering reading on the existing parent meter and the child meter.

We are aiming to increase the flexibility of the metering arrangements to allow consumers to more easily engage with multiple FRMPs for parts of its load or generation. This has the potential to increase the range of products and packages that can be offered to consumers, and hence increase competition in the provision of EV services and demand side options.

3.2.2 Analysis

The NER currently facilitates the possibility of parent/child (or subtractive) metering arrangements but there is uncertainty as to how these arrangements work in practice. Establishing a parent/child metering arrangement within a premise encounters a number of issues including:

- who should be financially responsible for losses within the premises;

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49 The choice of the Responsible Person is specified in the NER. We are considering the role of the Responsible Person, including who it can be, in the power of choice review.

50 better place, *Response to the AEMC Approach Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 October 2011, p. 12.

51 better place 2011, submission to the Approach Paper, p. 16.

52 Ibid.

53 The Responsible Person is a technical role; the Responsible Person is responsible for engaging a Metering Provider (MP) to provide, install and maintain a metering installation and engaging the Metering Data Provider (MDP) to provide metering data services.

- whether the consumer's premise needs to be considered as an embedded network;
- whether the existing metering installation is likely to include an accumulation meter that needs to be upgraded to an interval meter when it is associated with a child interval meter;[54] and
- the Local Network Service Provider (LNSP) is usually the Responsible Person for the existing parent meter but is usually reluctant to be the Responsible Person for the child meter because it is not connected to the LNSP's network.

We consider that the metering arrangements within a premise, such as a small business or a residence, should be designed so that they are not overly complicated. This is because there is a single consumer ultimately financially responsible for the total load.[55] For example, the losses within the premise can be arbitrarily assigned to existing parent metering installation (or any other metering installation with the agreement of the consumer).[56] Similarly, we consider that a consumer's premise should not be considered as an embedded network when the consumer is responsible for the electrical wiring within its premises and is ultimately financially responsible for the total combined load.

A single consumer at a premise is also in a good position to trade-off the cost of upgrading an existing accumulation metering installation to include an interval meter against the anticipated benefits of establishing a child metering installation for a part of its load. This trade-off would potentially be more difficult in an embedded network where different consumers and FRMPs are associated with the parent and child metering installations.

Like all other metering installations in the NEM, the child metering installation needs to be managed by a Responsible Person.[57] Currently the Responsible Person for a consumer's metering installation is either the LNSP or the FRMP (usually a retailer). In the case of a child metering installation the LNSP is usually reluctant to be the Responsible Person because this meter is not directly connected to its network. We are considering the role of the Responsible Person as part of our draft report for the power

54 The metering installations within a parent/child metering arrangement are required to be of the same type. This means that if the existing metering installation includes an accumulation meter, this must be upgraded to a type 4 or 5 metering installation if the consumer's new child metering installation is an interval meter. Note that it is most likely that when a consumer separately measures part of its load, this is to reduce its costs by managing this load in the presence of a time of use tariff that requires the load to be measured with interval meter.

55 The consumer is not directly financially responsible for the energy at its connection point, rather, it is indirectly responsible through the commercial contracts it has with the FRMPs associated with its connection.

56 The losses within the premises would be automatically assigned to the parent metering installation as this installation measures the total consumption within the premises, including losses, less the consumer at the child metering installation.

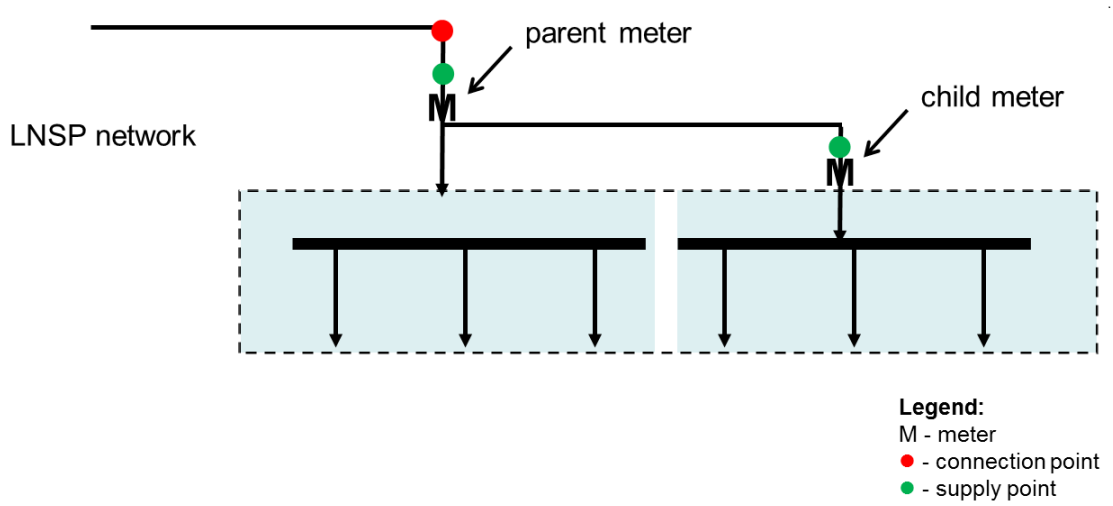
57 The role of the Responsible Person is defined in clause 7.2.1 of the NER.

of choice review, including who should be the Responsible Person for a child metering installation.

We consider that the proposed parent/child arrangements should be specified in the NER in order to provide greater certainty. Placing the arrangements in the NER would define the roles and responsibilities of the entity wishing to establish the child metering installation, the associated LNSP, any other FRMP at the site and AEMO. This would increase certainty for affected stakeholders and would be expected to reduce the costs associated with establishing the child metering installation.

The following figure shows an example of a parent/child metering arrangement for a consumer's load that is separated into two parts. The child metering installation meters the consumption of the load on the right. The consumption of the load on the left is determined by subtracting the child metering installation from the from the parent metering installation.

Figure 3.2 Example of a parent/child metering arrangement



Off-market sub-metering

We note that some stakeholders[58] indicated that separate metering can effectively be achieved by off-market arrangements. That is, the consumer's retailer would be the FRMP for the parent meter while the child meter would be settled outside of the market under a contract between the consumer and the entity responsible for charging the EV. We agree that this could be a valid arrangement when the consumer's retailer and the entity responsible for charging the EV can successfully negotiate suitable terms. We note, however, the NEM market settlement processes for sub-metering would not be contestable and consequently may limit consumer choice.

Therefore, we consider increasing the flexibility of the parent/child metering arrangements within a premise would reduce the reliance on off-market sub-metering arrangements. We note that this would not preclude the use of off-market

58 Energex 2011, Submission to the Issues Paper, p. 5.

sub-metering arrangements as they may be cheaper, provided that the associated market participants and the consumer can agree on suitable arrangements.

Question 6 Parent/child metering arrangements

Do you agree that our proposals address existing issues with parent/child metering arrangements? If so, how should these arrangements be specified in the NER? Please provide reasons.

3.3 Multi-element meters

Box 3.3: Draft recommendations

We recommend that, where a single metering installation has multiple measurement elements and assigned multiple NMIs (that is, a multi-element metering installation), there must only be a single Responsible Person for:

- all the components of the metering installation; and
- all the NMIs associated with each metering element.

We also recommend allowing individual measurement elements within a single device to be regarded as separate metering installations. This would allow individual measurement elements to be:

- assigned to different FRMPs by the associated consumer(s); and
- assigned different NMIs by the Responsible Person.

3.3.1 Significance of the issue

The role of the Responsible Person is to comply with the obligations in the NER in relation to metering.[59] This is an important role in the NEM in ensuring the integrity of the metering data that is used in the NEM settlement systems. For this reason, the role of the Responsible Person extends from the installation of the metering installation, including the meter, to the communication of the metering data to Market Settlement and Transfer Solution (MSATS).

In the case of a metering installation with a multiple element meter, the same physical metering installation and associated communications systems are used to convey the metering data from multiple metering elements. Therefore, it is not practicable for each stream of metering data to be associated with a different Responsible Person as no one person would have the ultimate responsibility for the integrity of the metering data.

The selection of the Responsible Person for multi-element meters is currently specified in clause 7.2.4 of the NER. It is also discussed further in section 4.5.

59 The role of the Responsible Person is defined in clause 7.2.1 of the NER.

3.3.2 Analysis

Most existing meters in the NEM have a single metering element and, hence, are only capable of measuring the energy flows to a single load. This means that separate or parent/child metering installations would be required when part of a consumer's load is separately measured. Therefore, the costs of metering at a residential premise may be sufficiently high to make it uneconomic for many consumers to separately measure the load in a part of their load. As discussed above, the cost of establishing a separate metering installation has been reported by better place to lie between $1,000 and $8,000, although this cost may be lower if a child meter is used. This cost may deter consumers from having the metering installations necessary to take advantage of the benefits from the tariffs that are potentially available to consumers and other stakeholders (such as the LNSP, retailers and EV service providers).

Meters with multiple metering elements are now more common and can be used instead of separate or parent/child metering installations. For example, we understand that multi-element meters are used in some locations in New South Wales for the control of hot water heating. The costs of metering installations that use multi-element meter are lower than equivalent arrangements with individual metering installations for each part of the load. Therefore, the cost of separately metering part of a consumer's load is likely to be lower using a multi-element meter within the metering installation. This is particularly the case for a new installation or when the existing metering installation includes an accumulation meter that would need to replaced as part of a parent/child arrangement. Therefore, the use of multi-element meters is likely to increase as more consumers perceive benefits in separately metering parts of their load.

It is important that the metering data from all installations is of sufficient integrity for the NEM settlement systems. This is achieved by making the Responsible Person accountable under the NER for the integrity of the metering data. Under the current arrangements, the Responsible Person is either:

- the FRMP for a type 1- 4 metering installation, unless the FRMP accepts an offer from the LNSP to perform this responsibility;[60] or
- the LNSP for a type 5 - 7 metering installation.[61]

In the case of a metering installation that includes a meter with multiple metering elements, each potentially with a unique FRMP, there is potential ambiguity over who should be the Responsible Person. Therefore, given the importance of the role, we recommend that a single Responsible Person be accountable for the whole metering installation and the communication of all the associated metering data.

60 Clause 7.2.2(a) and clause 7.2.3(a)(1) of the NER.

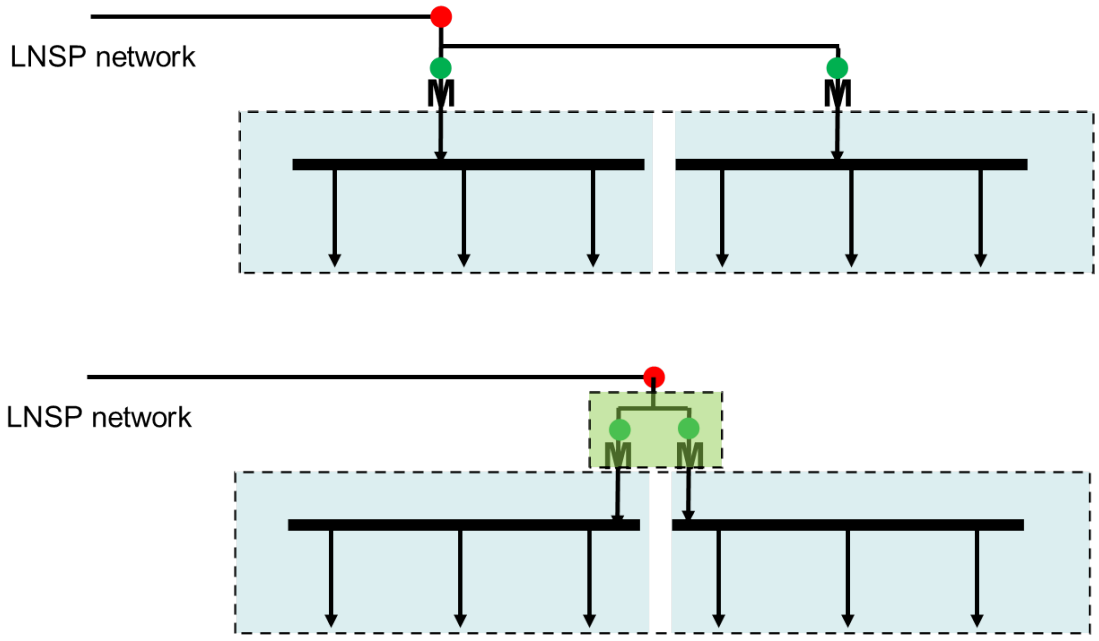
61 Clause 7.2.3(a)(2) of the NER.

Question 7 Multi-element meters

Do you agree that having one Responsible Person for multi-element meters is the efficient solution? Are there any other issues with multi-element meters that we should address?

The following figure shows the metering for a consumer's load that is separated into two parts. The first diagram shows the arrangement where each part of the load is metered by separate metering installations while the second diagram shows an equivalent arrangement where a two element meter is used within a single metering installation.

Figure 3.3 Example of a multi-element metering installation



3.4 Metering in an embedded network

Box 3.4: Draft recommendations

We recommend that the arrangements for metering within an embedded network be included in the NER. In particular, embedded networks should be brought into the metering and settlements frameworks in Chapter 7 and rule 3.15 of the NER by:

- defining connection points between the embedded network and the associated downstream consumers as connection points (and supply points) under the NER; and

- allowing these connection points (and supply points) to be settled in the NEM.

3.4.1 Significance of the issue

Commercial buildings and industrial sites contain their own distribution networks to convey electricity within the building or site. Such networks are called embedded networks when the owner of the network within the building or site supplies one or more consumers. The consumers embedded within this network are not directly connected to the LNSP's network so the usual metering arrangements for small consumers do not apply.

It is likely that some EV charging points will be installed in embedded networks, such as commercial buildings and industrial sites. Similarly, many opportunities for DSP will exist with premises that are supplied by embedded networks. Therefore, it is important that the metering arrangements for embedded networks are sufficiently clear and flexible so as to capture any benefits from metering EV charging points and from demand side opportunities within an embedded network.

At present, the metering arrangements for embedded networks are defined in an AEMO guideline[62] and by the AER's network service provider exemption guidelines.[63]

3.4.2 Analysis

Some stakeholders raised concerns with the current arrangements for embedded networks, including:

- Ausgrid considered there is ambiguity in relation to adequacy and appropriateness of the current rules to determine responsibilities within embedded networks, and this ambiguity is because embedded networks are not addressed in the NER;[64] and
- Ausgrid also considered that business models for EVs should, as a general principle, be developed to fit within the existing market arrangements, rather than amending the arrangements to fit a specific business model.[65]

We consider that clarifying the NEM metering arrangements for embedded networks would improve certainty for consumers and owners of embedded networks. Further, we consider that these arrangements should be flexible to increase competition for the provision of services to consumers, and hence lead to more efficient prices. We are also

62 AEMO 'Embedded Network Guideline' available on the AEMO website www.aemo.com.au.

63 AER 'Network service provider registration exemption guideline' available on the AEMO website www.aer.gov.au.

64 Ausgrid 2012, submission to Issues Paper, p. 3.

65 Ausgrid 2012, Submission to Issues Paper, p. 9.

concerned that the arrangements provide robust arrangements that preserve the integrity of the metering data.

Amending the definition of connection point

To increase the flexibility of the metering arrangements for embedded networks, without compromising the integrity of the metering data, we recommend that the metering and settlement arrangements for embedded networks should be brought into the existing frameworks in Chapter 7 and rule 3.15 of the NER. In order to achieve this we proposed the following change to glossary definition of connection point in the NER:

> "The agreed point of supply established between ~~Network Service Provider(s)~~ a network, which is connected to part of the National Grid, and another Registered Participant's network, ~~a person~~ network exempt by the AER or by the Rules ~~who~~ that would otherwise be required to be ~~a Registered Participant~~ registered with AEMO, the circuits of a Non-Registered Customer or franchise customer."

In effect, this change would mean that all agreed connection points in an embedded network would be classified as Connection Points.[66] Therefore, the metering arrangements in Chapter 7 of the NER and the settlements arrangements in Rule 3.15 of the NER would automatically apply to the connection points within an embedded network.[67]

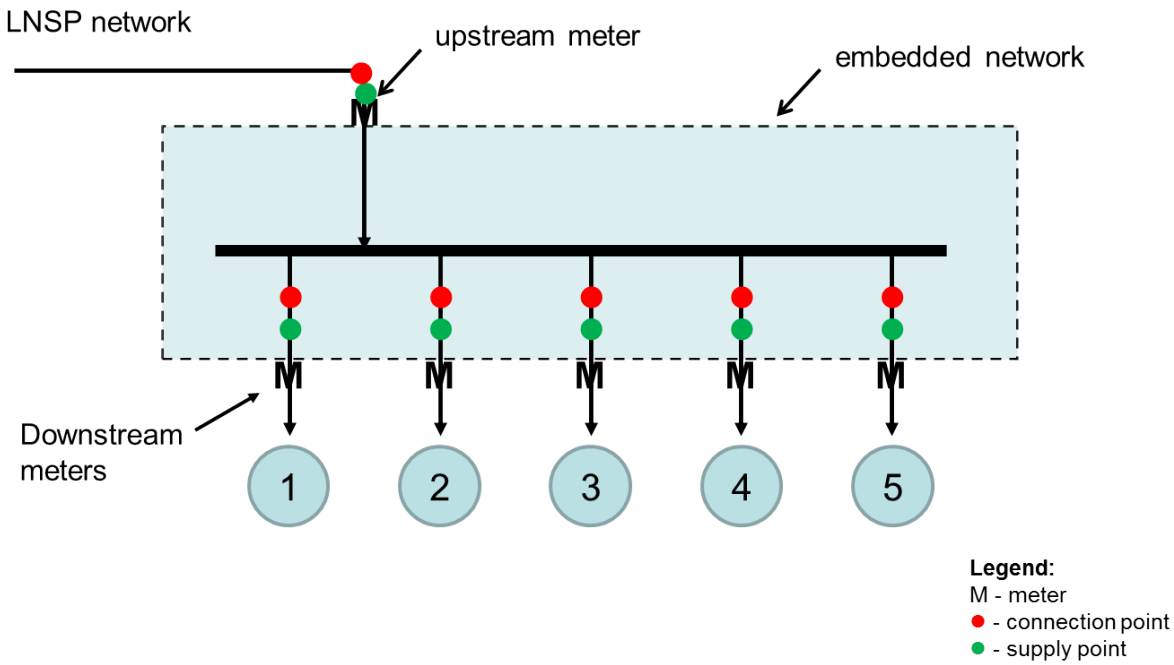
The following figure shows an example of an embedded network with one upstream connection to a distribution network and a number of downstream connection points.[68]

66 In all cases under the proposed arrangements the electrical network between an upstream connection point and the downstream connection points must be operated by a NSP or a person who is exempt from registering as an NSP by the AER. The exception is when the network is within the premises of a single consumer.

67 As discussed above, we are not recommending that a parent child arrangement within a premise need be regarded as an embedded network.

68 The glossary in the NER will also need to include definitions of upstream and down stream connection points.

Figure 3.4 Example of an embedded network



Including the downstream connection points in an embedded network means that the upstream connection point must have its electricity flows billed through the NEM settlements process. Further, each down stream connection point:

- must have its electricity flow billed through the NEM settlements process if the FRMP is different to the upstream Connection Point FRMP; and
- must not have its electricity flow billed through the NEM settlements process (it will be billed through an 'off-market' process) when the FRMP is the same as the upstream Connection Point FRMP.

Note that, as downstream connection points would become connection points under the NER, each downstream connection point could potentially have multiple supply points or include a parent/child metering arrangement.

Exemption of embedded networks

The AER has the power to exempt embedded networks from the requirements of the NER and has developed guidelines that it applies when exercising this power. Under our proposal, the connection points within an embedded networks would be under the metering and settlements frameworks in Chapter 7 and rule 3.15 of the NER, whether or not the AER had granted the network an exemption from the requirements of the NER.

Question 8 Metering in embedded networks

Do you agree that our recommendations address existing uncertainties with respect to metering in embedded networks? Please provide reasons.

3.5 Two or more financially responsible market participants at one connection point

Box 3.5: Draft recommendation

In situations where there are two (or more) FRMPs at one connection point, we recommend:

- where there is only one point of disconnection and a FRMP wants to disconnect the consumer, this FRMP can disconnect the total load at the connection point, including the load of other FRMPs;
- for multi element metering installations, we have specified ways to share the costs associated with the Responsible Person;
- access to the metering installation be managed by the Responsible Person;
- when a consumer changes one of its FRMPs, we have suggested ways of managing this process;
- assigning DUOS charges to FRMPs in a manner that is proportional to their impact on total DUOS;
- a process where a consumer or FRMP seeks to upgrade one of its metering installations; and
- ways for addressing situations where a consumer moves house or has a billing/metering query.

3.5.1 Significance of the issue

Currently, the NER is designed in the context of:

- a market participant or FRMP being associated with each connection point;[69]
- each connection point having a metering installation that is registered with AEMO;[70] and
- a unique National Metering Identifier (NMI) for each metering installation.[71]

That is, there is generally a one-to-one relationship between a connection point, the FRMP, the metering installation and a NMI. Nevertheless, in the future some consumers and generators are likely to want to be able to separately meter parts of

69 Clause 7.1.2(a) of the NER.

70 Clause 7.1.2(a)(1) of the NER.

71 Clause 7.3.1(e) of the NER.

their load or separately meter their generation from their load.[72] In addition, in some cases the consumer may wish to engage separate FRMPs for each metering installation.[73]

However, having multiple FRMPs at a single connection point raises several issues in the context of the current NER. These issues need to resolved before multiple FRMPs at a connection point are able to operate. This section discusses the main issues that arise with multiple FRMPs.

3.5.2 Analysis

What happens when only one FRMP wants to disconnect the consumer?

A FRMP can arrange to disconnect a consumer for non-payment of the energy and other services provided by the FRMP. The NECF and other consumer protections sets out a framework for disconnecting consumers by providing affected consumers with opportunities to resolve disputes and to address any hardship issues.

In the case of a single connection point with two FRMPs, it is possible that only one FRMP wishes to disconnect the consumer. If there are separate disconnection facilities for each FRMP then the present arrangements would apply and the associated part of the consumer's load could be disconnected, subject the NECF and consumer protections. We note that existing consumers are likely to only have a single disconnection point that would disconnect their whole premises, even though the consumer is only in dispute with one of its FRMPs.

On balance, we recommend that the most appropriate approach for a connection point with two or more FRMPs is for both FRMPs to have the power to disconnect the consumer's total load. That is, when the consumer fails to pay one if its FRMPs then, provided the requirements of the NECF and other consumer protections are met, the FRMP can direct that the consumer is totally disconnected. This situation is analogous to a consumer with a single FRMP that does not pay in full (ie. only part of its bill), which would also be grounds for disconnection.

An alternative approach would be to require each separately metered part of the load to be able to be disconnected separately. That is, each FRMP would only have the ability and power to disconnect its associated load. We consider that this requirement may cause additional costs that may deter the adoption of separately metering. In any case, if the consumer or one of the FRMPs is concerned about the need to discriminate between the parts of the load then they can arrange to install separate disconnection facilities.

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72 We note that for some large customer sites this already occurs where a customer wishes to sell the output of its generator to a different entity than the retailer of its load.

73 In the case of a multi-element meter the consumer may wish to engage separate FRMPs for each meter element.

In the event that either FRMP wants to disconnect its consumer, the normal disconnection process in the NECF would apply.

How are the costs of the responsible person shared?

The costs of the Responsible Person would only need to be shared in the case of a multi-element meter.[74]There are a number of ways of sharing the Responsible Person including sharing the costs:

- equally between the FRMPs;
- in proportion to the energy consumption (last financial year);
- as agreed between the FRMPs; or
- as specified by the consumer.

The simplest approach would be to assign the costs in equal proportions on the basis that both metering elements contribute equally to the need for the metering installation. The actual approach is unlikely to affect the behaviour of the FRMPs or the consumer as the costs of the Responsible Person are likely to be a fixed cost that is passed onto the consumer by the associated FRMPs.

How is access to the metering installation managed?

Access to the metering installation should be managed by the Responsible Person as it would be accountable for its operation.[75] For a single metering installation (with a multi-element meter) there is a single Responsible Person. For separate metering installations and for parent/child metering installations the two installations are independent and each has a Responsible Person who would manage access.

What happens when a consumer changes one of its FRMPs?

The implications of a consumer changing one of its FRMPs depend on the circumstances. For example:

- In all cases the new FRMP assumes the financial responsibility for the settlement of the associated NMI and any DUOS charges allocated to that NMI.
- If the old FRMP is not the Responsible Person for the associated metering installation, then the new FRMP would also pay its share of the costs of the Responsible Person. The new FRMP would recover the costs from the consumer as part of its tariff.

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74 In the case a separate metering arrangement there is a Responsible Person for each metering installation and FRMP. Similarity, a parent/child metering arrangements has a Responsible Person for each metering installation there.

75 Physical access to the consumer's premises would need to be arranged with the consumer. This would be in accordance with the existing metering access arrangements.

- If the old FRMP is the Responsible Person for the associated metering installation, the consumer would need to decide whether to continue to engage the old FRMP as the Responsible Person. If the consumer chooses to change Responsible Person, it would be required to pay any exit fees under the contract with the old FRMP.

It is also important that the AEMO metering processes and systems are examined so that when a consumer changes one of the FRMPs, the other FRMP(s) are unaffected. For example, when an incoming retailer obtains 'explicit consent' from the consumer switching to them, the consumer would be required to nominate the particular FRMP or FRMPs it is switching away from.

How are DUOS charges assigned to the FRMPs?

The way the DUOS charges are allocated to the two FRMPs would depend on how the DUOS charges are normally calculated.

If the LNSP is indifferent to the manner in which the consumer's load is split between the FRMPs[76] then its DUOS charges would be on the basis of a single connection point with a load equal to the sum of the two NMIs. In such a case the simplest and most efficient approach would be to allocate the costs to the FRMPs in proportion to their impact on the total DUOS, such that:

- the fixed component of DUOS would be shared equally between the NMIs;
- any energy (or postage stamp) component would be shared in proportion to these energies; and
- any peak demand component would be shared in proportion to the contribution that each NMI makes to the peak.

Such an allocation of DUOS would preserve incentives on the FRMPs to minimise the impact of their portion of the consumer's load on the total DUOS charges.

Each FRMP would recover its portion of the DUOS charges through its tariff agreed with the consumer. The consumer could choose different tariffs for each part of the load, depending on its preference and the tariffs being offered by the FRMPs.

More elaborate approaches for calculating the DUOS allocation for each FRMP could be possible and could possibly be negotiated with the LNSP. However, such approaches may be complicated to implement and care would be required such that appropriate incentives are placed on the associated FRMPs.

76 The LNSP should be indifferent to how the load is split as it would not have a direct relationship with the consumer, rather it would be concern with the impact the total consumption would have on its network.

What happens if the consumer or one FRMP wants to upgrade one metering installation?

The impact of a consumer or one FRMP wanting to upgrade its metering installation would depend on the nature of the installation. The following table includes examples of possible metering upgrades.

Arrangement	Meter to be upgraded	Meter upgraded to	Comment
Separate meters	one accumulation meter	single interval	Can be upgraded independently.
Separate meters	both accumulation meters	multi-element interval for both NMIs	Requires a single Responsible Person and an exit fee for old metering installation.
Parent/child meters	parent accumulation meter	parent interval	Requires an upgrade of child to interval meter. Both Responsible People affected.
Parent/child meters	parent accumulation meter	multi-element interval for both NMIs	Requires a single Responsible Person and an exit fee for old metering installation
Parent/child meters	child accumulation	child interval	Requires an upgrade of parent to interval meter. Both Responsible People affected.
Parent/child meters	child accumulation	multi-element interval for both NMIs	Requires a single Responsible Person and an exit fee for old metering installation
Multi-element interval meter	one element of the meter	a meter with greater functionality	Requires a single Responsible Person and an exit fee for old metering installation

In all cases the consumer would need a supply interruption to its whole load to electrically isolate the affected metering installation. A possible exception would be upgrading separate metering installation that can be individually isolated, or for a child meter where the parent already has an interval meter.

In most cases each Responsible Person would need to cooperate when part or all of the metering installations are upgraded. This means that there is the potential for one FRMP attempting to block the change to its meter. This situation could be managed by the NER requiring:

- each FRMP and Responsible Person to negotiate in good faith;

- a separate contract for a metering installation to be established by the Responsible Person;
- each contract for metering services to include details of the exit fees so that the consumer can make informed decisions regarding which tariffs to use and consequently the metering requirements;
- not allowing any of the associated FRMPs or Responsible Persons to block the upgrade, provided they are compensated any contracts agreed when the FRMPs or Responsible Persons were engaged;
- all costs of upgrading the metering installations to be borne by FRMP requiring the changes, although this FRMP could pass on these costs to the consumer in a transparent manner; and
- all changes and associated costs to be agreed with the consumer.

What happens when a consumer moves house?

Under the current arrangement, when a consumer moves into a existing premise the existing FRMP for that premises remains the FRMP unless the new consumer engages a new FRMP. This works because the metering services are provided by the LNSP or the FRMP. Where the LNSP provides these services, the costs are regulated (ie. not negotiable) and recovered via the FRMP along with DUOS charges.[77] Where the FRMP provides these services, the costs are recovered under the retail contract. When the retail contract is terminated, the metering installation may be replaced by the new FRMP.

If a consumer that had more than one FRMP for parts of its load moves house, then the existing FRMPs would remain unless the new consumer engages new FRMPs. The new FRMPs may choose to replace the existing metering installation.

Who should the consumer phone with a billing/metering enquiry?

Metering and billing inquiries would be associated with a specific metering installation. Therefore, the consumer would contact the FRMP for the meter reading and bill associated with the concern.

In the case of a problem arising from a multi-element metering installation, the consumer should contact a FRMP (or both FRMPs for each element) who would then communicate the consumer's concerns to the Responsible Person. Examples of these situations include: a loss of supply, a power quality issue or a meter communication problem with a multi- element metering installation.

77 In New South Wales, Queensland and Tasmania the metering costs are bundled up with the DUOS charges.

Question 9 Two (or more) FRMPs at a connection point

1. **Do you agree that our recommendations will enable two or more FRMPs to operate effectively at a connection point? Please provide reasons**

2. **In the event that one FRMP wishes to disconnect a consumer, do you agree that a FRMP should have the power to disconnect the consumer's total load, which includes the load from the other FRMP? Or do you think that each part of the load should be able to be disconnected independent of the other FRMP?**

4 Electric Vehicles - NEM arrangements to facilitate consumer choice

To facilitate consumer choice, we seek to devise energy market arrangements that facilitate the provision of a competitive range of EV charging services for the benefit of consumers and leading to efficient market outcomes. In particular, we examine the following aspects:

- circumstances where EV charging constitutes a sale of electricity;
- consumer protection and retail licensing - to assess whether there are appropriate consumer protections administered through the retail licensing regime;
- network licensing - to assess whether the regulatory framework for EV charging in distribution or embedded networks cater for EV charging services; and
- address the risk of EV service provider failure - to assess whether there are prudent measures in place to protect EV consumers.

We recognise that in specifying energy market arrangements there is a potential tension between increasing certainty for market participants and increasing the cost of compliance and potentially muting innovation.

Our draft recommendations on metering are an important set of energy market arrangement necessary to facilitate consumer choice. These recommendations are set out separately in the previous chapter.

4.1 Circumstances when EV charging constitutes a sale of electricity

Box 4.1: Draft recommendation

We consider that the supply of electricity for the purposes of EV charging would generally constitute a legal sale of electricity in the NEM under the NERL and in Western Australia under the *Electricity Supply Act 2004 (WA)*.

For bundled service providers, we recommend that the AER or the Economic Regulation Authority of Western Australia (ERA) determine whether the services offered constitute a legal sale of electricity. The AER or ERA should consider whether the sale of electricity is a primary or incidental part of the bundle of services provided.

We consider that EV battery swap services do not constitute the sale of electricity for the purposes of the NERL, and therefore the energy market arrangements do not apply to these services.

An important issue for this review is whether the supply of electricity for the charging of an EV constitutes a legal sale of electricity. If the supply of electricity for the charging of an EV is found to constitute a sale of electricity (as legally defined), then

the energy market arrangements relating to the electricity retail licensing regime would apply to the EV service provider. Also, the electricity market consumer protections would apply to these EV consumers. On the contrary, if the charging of an EV is not found to constitute a legal sale of electricity, then these particular energy market arrangements would not apply.

Submissions from electricity retailers asserted that the supply of electricity for the charging of an EV should constitute a sale of electricity, particularly from a consumer protection perspective.[78] A contrary view held that EV charging should not constitute a sale of electricity where it risks stifling innovation in the EV services market.[79]

We have considered both the current legal interpretation of the sale of electricity applicable to the NEM jurisdictions and WA and have set out our view on the correct approach.

Legal interpretation on EV charging as a sale of electricity

In the NEM jurisdictions, the NERL defines the sale of electricity as electricity that is supplied 'for premises'.[80] In Western Australia, the *Electricity Industry Act 2004 (WA)* states that a sale of electricity occurs where it is sold 'for the purpose of consumption'.[81]

For both the NEM jurisdictions and Western Australia, our interpretation of these legislative provisions is that the legal sale of electricity occurs 'for consumption at premises'. Based on this interpretation, we consider the following:

- The 'consumption' of electricity refers to the act of charging an EV battery. It does not refer to the depletion of the EV battery when the EV is in use.
- The 'premises' refers to all locations of EV charging. The EV itself is not a 'premise'.

Applying the above, we consider that the supply of electricity for EV charging would generally constitute a legal sale of electricity under both the NERL and in WA; that is, the supply of electricity for EV charging generally constitutes the sale of electricity 'for consumption at premises'. We reach this result by considering that it is the act of charging of an EV that constitutes the consumption of electricity and that this occurs at a premise, namely, at the EV charging facility.

The consequence of our legal interpretation is that the supply of electricity for charging an EV both at a residence and at a commercial charging station constitutes a legal sale

78 Energy Retailers Association of Australia, *Response to the AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012, p. 2; Origin Energy 2012, Submission to Issues Paper, p. 11-13; AGL, *Response to the AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, p. 1.

79 UNSW Centre for Energy and Environmental Markets 2012, Submission to Issues Paper, p. 7.

80 Section 88 of the National Energy Retail Law.

81 Electricity Industry Act 2004 (WA), s 3.

of electricity. This means that EV service providers would need to obtain a retail authorisation or a retail exemption. This also means that EV consumers would enjoy the specific consumer protections available as a consequence of the supply of electricity for EV charging being a legal sale of electricity

We accept that there may be divergent views of our legal interpretation. For example, it could be argued that the NERL does not apply because EV charging is not 'for premises', but rather is for the purposes of the transport sector, which would therefore be outside the ambit of the NERL. This position would be based on a view that the NERL was designed for the essential services nature of electricity supply and consequently it would not be appropriate for the NERL to cover commercial EV charging stations.

Our preferred approach on EV charging as a sale of electricity

Noting our legal interpretation above, we now consider what the preferred approach should be with respect to the supply of electricity for EV charging.

In a residential or business setting, we consider that the supply of electricity for EV charging should generally be the sale of electricity. This would preserve the principle relating to the essential nature of electricity supply that does not discriminate as to the type of use made of this electricity. It would ensure that a common set of energy market arrangements (that is, the NERL) would apply to EV and non-EV use in a residential setting and therefore make it simple for the consumer and reduce confusion.

In relation to commercial EV charging, such as at private/public car parks and including dedicated commercial charging stations, it is a different matter. We consider that the NERL should not apply to the supply of electricity for EV charging in these contexts because of the commercial and contestable quality of these transactions.

Battery swap services

We consider that the sale of batteries does not constitute the legal sale of electricity. This is consistent with the current treatment of a wide range of consumer goods that may be charged at premises but used elsewhere (eg. laptop computers and mobile phones) and the sale of charged batteries. We therefore consider that EV battery swap services do not constitute the legal sale of electricity.

Bundled service provider

In section 1.4.4, we raised the possibility of a 'bundled service provider' business model. We consider that it is possible for the supply of electricity for EV charging to be bundled with other goods and services, which are not related to a sale of electricity. This bundling of goods and services may reach a point where the bundled goods and services no longer comprise a distinct sale of electricity. That is, the bundled service provider may not be involved in a legal sale of electricity.

To determine whether a bundled service provider is involved in a legal sale of electricity, we consider that this should be the role of the AER in the NEM or the Economic Regulation Authority of Western Australia (ERA).

To ascertain whether or not the services offered by a bundled service provider constitutes a sale of electricity, the AER or ERA should assess whether the primary purpose of the EV charging service is the supply of electricity (as opposed to an ancillary or incidental purpose). This requires assessment of whether the bundling of other goods and services alters the EV charging service such that the primary purpose of the EV charging service may no longer be the supply of electricity. The bundling of other goods and services to the EV charging service may transform the EV charging service such that it no longer constitutes a sale of electricity.

The answer to these questions will depend on the specific circumstances of the supply of electricity for EV charging, including whether the supply of electricity is:

- separately measured in terms of the quantity of electricity supplied to the consumer; and
- separately charged for that electricity supply.

Question 10 Sale of electricity and the bundled service provider

Do you consider the AER should be required to specify how it will determine whether a bundled service provider is selling a good or service that constitutes a legal sale of electricity, for example, through a guideline?

We consider the implications for the retail licensing regime for bundled service providers in the next chapter.[82]

Summary

The following table summarises our current legal interpretation and proposed approach with respect to whether the supply of electricity for EV charging constitutes a legal sale of electricity:

Table 4.1 Supply of electricity for EV charging as the legal sale of electricity

Charging scenario	Legal interpretation	Proposed approach
Charging at a residence or small business premises	Yes, sale of electricity	Yes, should be covered by retail laws
Commercial charging	Yes, sale of electricity	No, should not be covered by retail laws

82 Please refer to Chapter 3 of this draft advice.

Charging scenario	Legal interpretation	Proposed approach
Battery swap services	Not sale of electricity	Not sale of electricity
Bundled service provision	Regulator to determine whether it is the sale of electricity.	If regulator determines it is the sale of electricity then retail law should apply for residential charging, but retail law would not apply for commercial charging.

4.2 Consumer protection and retail licensing

Box 4.2: Draft recommendation

We consider that the current consumer protection framework is appropriate for EV consumers. However, we recommend that the AER review its retail exemptions framework to clarify the status of EV charging services at commercial EV charging stations where onselling occurs.

4.2.1 Significance of the issue

Consumer choice is enhanced when consumers are confident that they have access to a sufficient level of consumer protection. We wish to assess whether the framework for consumer protections (principally exercised through the retail licensing regime) is appropriate for EV consumers. This is in accordance with our statutory duty to promote the achievement of the NEO which requires us to consider the long term interests of consumers.

In the NEM, the consumer protections are safeguarded in the NERL (and its associated National Energy Retail Rules or NERR). Consumer protections refer collectively to measures such as maintaining connection of supply, choice of retailer, payment/billing and customer hardship provisions. Implicit in these consumer protection measures is recognition of the essential nature of electricity services to the welfare of consumers.

Under the NERL, the sale of electricity is prohibited unless the seller obtains a retailer authorisation or an exemption.[83] Both the retail authorisation and exemption process are regulated by the AER in accordance with the NERL. This is the retail licensing regime.

If a seller obtains a retail authorisation from the AER, then it is a retailer for the purposes of the NEM and can participate in the wholesale electricity market as a retailer. The AER's Retailer Authorisation Guidelines sets out the criteria that the AER uses to determine an authorisation to be a retailer.[84] Similarly, if the AER grants a

83 Section 88 of the NERL.

84 Available at www.aer.gov.au.

retail exemption (and therefore the seller of electricity is an 'exempt seller'), it must do so in accordance with its Exempt Selling Guideline.[85]

An important difference between a retailer authorisation and a retailer exemption is that an authorisation authorises the sale of electricity across all classes of consumers across all relevant sites in all the NEM jurisdictions. An exemption, in contrast, applies only in specific circumstances at specific site(s).

Some stakeholders questioned the adequacy of the retail licensing regime and were critical of whether it was appropriate for the emerging market of EV services. The Centre for Energy and Environmental Markets at the University of New South Wales suggested that current retail licences are not well aligned with consumers seeking energy services, such as EV services.[86] Better place noted the findings of the California Public Utilities Commission which concluded that treating the EV charging services market as a regulated utility service would not be in the best interests of consumers. Better place notes that California's Public Utilities Commission found that regulating the EV charging services market could prevent market competition necessary for introducing new technologies and reducing cost to consumers.[87]

It is important to note that if the provision of EV charging is not found to be the sale of electricity, then the consumer protections embedded in the retail licensing regime would not apply. However, the provisions of the Australian Consumer Law would nonetheless apply.

4.2.2 Analysis

We assessed the effectiveness of the retail licensing regime in providing appropriate consumer protections for EV consumers. The extent to which the retail licensing regime applied to the supply of electricity for EV charging depends on whether or not the supply of electricity constitutes the legal sale of electricity.

As noted in the previous section, we consider that the supply of electricity for EV charging provided at residential or business premises should, as a legal interpretation and as our preferred approach, constitute a sale of electricity. Consequently, a retail authorisation or retail exemption would be required of the service provider.

Retail exemption for EV charging in cases of onselling

A retail exemption for EV charging would be required under the NERL in situations of onselling. Electricity onselling refers to situations where a person makes arrangements to acquire energy from an authorised retailer, and then onsells that electricity to a person within the limits of its embedded network. Examples of embedded networks where onselling occurs is at apartment buildings (with a body corporate), shopping centres or retirement villages.

85 Available at www.aer.gov.au.

86 UNSW Centre for Energy and Environmental Markets 2012, Submission to Issues Paper, p. 14.

87 better place 2012, Submission to Issues Paper, p. 16.

A retail exemption with respect to EV charging in situations of onselling was supported by stakeholders. The Tasmanian Department of Infrastructure, Energy and Resources considered that less stringent requirements may be appropriate. The South Australian Department of Manufacturing, Innovation, Trade, Resources and Energy highlighted that onselling would require an exemption.[88] The Alternative Technology Association stated that "EV charging in embedded networks needs to be classified as onselling with an automatic exemption".[89] Better place also outlined the need for an overall exemption class for EV charging providers.

Onselling would also occur at commercial EV charging stations (eg. at shopping centres and dedicated EV commercial charging stations). In relation to commercial EV charging stations, we note that our preferred approach was that this should not be the sale of electricity for the purposes of the NERL. To give effect to our preferred approach, there are two options that could be implemented:

- amend the NERL; or
- request the AER to clarify the status of EV charging under the retail exemptions framework.

We recommend the latter approach because it would be administratively simpler and consistent with the application of the current regulatory framework by the AER.

We therefore recommend that the AER review its retail exemptions framework to clarify the status of EV charging at commercial EV charging stations where onselling occurs.

Question 11 EVs and retail exemptions framework

Do you agree that the AER should review its retail exemptions framework to clarify the status of EV charging at commercial EV charging stations where onselling occurs? Please provide reasons.

Retail licensing regime for the bundled service provider

We are recommending that the AER determine whether the services provided by a bundled service provider constitute the sale of electricity. If the AER determines that the bundled service provider is selling goods or services that constitute the legal sale of electricity, it would then have to ascertain whether that bundled service provider must obtain a retail authorisation, or a retail exemption, in accordance with section 88 of the NERL.

If the AER determines that the bundled service provider is selling goods or services that do not constitute the sale of electricity, then the energy market arrangements

88 Tasmanian Department of Infrastructure, Energy and Resources 2012, submission to Issues Paper, p. 2

89 Alternative Technology Association, *Response to the AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 February 2012, p 5.

administered by the AER do not apply. In this circumstance, EV consumers would only avail themselves of the consumer protections in the Australian Consumer Law. In practice, this means that an obligation to supply electricity and customer hardship provisions found in the energy market arrangements would not apply because the bundled service provider is not involved in the legal sale of electricity. It therefore becomes important to educate consumers about the differing consumer protection frameworks available to them as a result of contracting with a bundled service provider who is not involved in the legal sale of electricity.

We recognise that a particular consumer who uses a bundled service provider for its EV load while using an authorised electricity retailer for its non-EV load could be subject to two sets of consumer protection regimes:

- the energy market specific consumer protections for its non-EV load; and
- (if the bundled service provider is not involved in the sale of electricity) the Australian Consumer Law for its EV load.

However, we consider that, in practice, this is not a material issue as these frameworks are complementary and attempt to achieve similar consumer protection objectives.

Battery swap services

In addition, we also recognise that the sale of EV batteries in the form of battery swap services would not constitute the sale of electricity. Therefore, the retail licensing regime and, more generally, the energy market arrangements would not apply to battery swap services.

4.3 Network licensing

Box 4.3: Draft recommendation

We consider that the network licensing regime administered by the AER is sufficiently robust to cater for EVs charged over a distribution network or over an embedded network and are therefore not proposing any changes. We note that the AER has developed a network exemption for EV charging in embedded networks, which would cover commercial EV charging stations.

4.3.1 Significance of the issue

An EV is charged through a supply of electricity from a network: either directly through a distribution network or through a embedded network.[90] . We are assessing whether the network licensing regime is sufficiently robust and flexible to cater for both EVs charged directly through a distribution network or through an embedded network.

90 An embedded network is an embedded network not directly connected to a distribution network.

4.3.2 Analysis

Under the NEL and the NER, a party (or its agent) that engages in an electricity distribution activity must either be registered with AEMO, as an electricity distributor, or gain an exemption from the requirement to be a registered network service provider from the AER.[91] A network exemption typically applies to an embedded network.

From a regulatory perspective, a network exemption means that the embedded network is not a network service provider for the purposes of the NER and this includes not having to comply with the requirements for network service providers in Chapter 5 of the NER. The AER's Electricity Network Service Provider Registration Exemption Guideline sets out the classes of deemed and registrable network exemptions and their associated minimum requirements.[92] This guideline also outlines the process for seeking an individual network exemption. Significantly, the AER has devised a deemed exemption for embedded networks containing EV charging stations.

The network licensing regime adequately caters for EV charging services. If an EV is charged through a direct connection to the distribution network, then the DNSP would already be subject to a network licence. If the EV is charged through a embedded network, then the deemed network exemption should apply. This adequately covers all the circumstances of EV charging.

4.4 Addressing the risk of EV service provider financial failure

Box 4.4: Draft recommendation

We consider that the current arrangements for addressing the risk of EV service provider financial failure are appropriate and therefore we are not proposing any changes. That is:

- if the bundled service provider is an authorised retailer, then the Retailer of Last Resort (ROLR) provisions would apply;
- if the bundled service provider is subject to a retail exemption, then ROLR does not apply, however, the AER may place conditions on the bundled service provider;
- if the bundled service provider is found by the AER not to provide services that constitute the legal sale of electricity, then the energy market regulatory arrangements do not apply and the risk of supplier failure become a general risk faced by EV consumers.

91 Section 11(2) of the NEL and clause 2.5.1(a) of the NER.

92 See www.aer.gov.au.

4.4.1 Significance of the issue

We have considered the degree to which EV consumers are protected in instances where an EV service provider faces financial failure. Having regard to the NEO, we have therefore considered the implications for consumers in the NEM if an EV service provider faces the risk of financial failure.

In the NEM, retail consumers are protected from the loss of access to electricity supply as result of the financial failure of their electricity retailer through the ROLR scheme. Under the NERL, the AER will have responsibility for the administration of the national ROLR scheme throughout the NEM. The ROLR scheme has a number of objectives including:

- ensuring continuity of supply to consumers in the event of the financial failure of a retailer;
- ensuring the integrity of the wholesale market arrangements; and
- ensuring the continuity of payments to suppliers of transmission and distribution network services.

We explore this issue for EV consumers with a bundled service provider.

4.4.2 Analysis

When a consumer chooses an EV, it would like access to the ongoing supply of electricity at prices, and on terms and conditions, that are considered to be fair and reasonable. This applies to all electrical appliances and not just EVs. A ROLR scheme can assist the economically efficient uptake of appliances, including EVs, through:

- making sure that there are no significant barriers to a range of EV providers potential business models, by providing the protection of a ROLR scheme if the provider fails;
- facilitating efficient EV charging arrangements through the supply of electricity at prices and on terms and conditions that are fair and reasonable; and
- and thereby enabling consumer choice and competition in both the EV market and the energy market.

In making sure that consumers will still have continuity of supply at prices, and on terms and conditions that are considered to be fair and reasonable, a ROLR scheme supports the NEO in the long term interests of consumers of electricity with respect to price, quality, reliability and security of supply of electricity.

It is important to note that the ROLR scheme only applies to consumers supplied by energy retailers. This means that ROLR would only protect consumers that receive goods and services from a bundled service provider if that provider has obtained a retailer authorisation from the AER.

If the bundled service provider is involved in the sale of electricity and is subject to a retail exemption, then ROLR would not apply, unless otherwise allowed for in the exemption. In this case, if the bundled service provider were to face financial failure, then it is similar to any business facing financial difficulties. The consequence might be that the EV consumer cannot charge their EV from its original provider. It is possible, however, that the consumer could charge at commercial charging locations or enter into a contract with another provider.

The AER could reduce the probability of this risk when setting conditions as part of a retail exemption. We note though that it is likely that the AER would not provide a bundled service provider involved in selling large quantities of energy, but rather would consider the appropriateness of a retail authorisation for that bundled service provider (in which case, ROLR would apply).

If the AER determines that the bundled service provider is not involved in the sale of electricity, then the energy market arrangements do not apply. The consumer would bear the risk (ie. that it cannot charge its EV) should the bundled service provider face financial failure. In this case, consumers could avail themselves of the general provisions of the Australian Consumer Law.

We note that if the bundled service provider fails, this could have consequential effects for other retailers if the EV consumer has the technology to obtain electricity for its EV from other retailers.

5 Electric Vehicles - Western Australia

In this Chapter we discuss the issues with respect to energy market arrangements for electric vehicles in Western Australia.

Western Australia's electricity system is not connected to the NEM. Western Australia's electricity supply industry is comprised of various electricity networks:

- South West Interconnected System (SWIS);
- North West Interconnected System (NWIS); and
- a set of Regional Non-interconnected Systems (RNIS).

The SWIS (centred around Perth and the south west of Western Australia) contains a Wholesale Electricity Market (WEM). Unlike the NEM, the WEM contains a Reserve Capacity Mechanism (RCM) that obliges retailers (or parties purchasing power in the WEM) to either secure adequate capacity bilaterally from generators or from the Independent Market Operator of Western Australia (IMO) to ensure that SWIS generation capacity requirements are met.

Further information on Western Australia's electricity market can be found in Appendix B.

5.1 Aspects of the WEM and EVs

Box 5.1: Draft recommendation

We recommend that certain aspects of the market rules governing the Balancing and Load Following Ancillary Services market may need to be reviewed to facilitate the participation of EVs (as a load or as energy storage) in the future, if appropriate.

5.1.1 Reserve Capacity Mechanism

We considered the implications for EVs with respect to the RCM in the WEM. The introduction of EVs and their future use as a source of energy from stored electricity (that is, through V2G) would impact the RCM process in two ways.[93] Firstly, the impact of EVs would need to be taken into account when determining the reserve capacity requirements and would inform the development of the Statement of Opportunities (SOO) by the IMO. This should not present any significant policy issues as the impact of EVs (through V2G) would simply be another additional factor to be taken into account by the IMO when preparing its SOO.

93 This is in addition to the issues identified for V2G in the NEM.

Secondly, to enable V2G to participate in the RCM process by offering its capacity, an appropriate certification process would need to be developed. The IMO administers a certification process for the purpose of ensuring that a particular 'facility' can meet its obligations to provide capacity when required. V2G is not currently an activity that is explicitly contemplated to provide capacity as part of the RCM. In practice, it is unlikely that an individual EV would satisfy IMO's certification requirement. Therefore for V2G to be appropriately certified, the individual EVs would need to be aggregated, in order for this aggregated capacity to be included in the RCM. Aggregation has the benefit of diversification and increases the firmness of the capacity provided.

However, we note that the IMO has made a decision on a rule change entitled 'Curtailable loads and Demand Side Programmes'[94], which should address these concerns. We note that the IMO can review these aspects of the RCM at an appropriate time.

5.1.2 Balancing and Load Following Ancillary Services

In 2012, new market arrangements for Balancing and Load Following Ancillary Services were introduced in the WEM. These arrangements were designed to enable greater competition in the provision of balancing by creating a half hour ahead market for balancing energy and a market for load following ancillary services.[95]These arrangements do not allow for the participation of loads (or energy storage) in balancing or ancillary services.[96] We recognise that the participation of EVs could add further complexities in the secure operation of the electricity market.

We note that the WEM arrangements for balancing or load following ancillary services can be reviewed by the IMO to enable the participation of EVs (as a load or as a form of energy storage) at an appropriate time.

5.2 Measures to facilitate efficient behaviour

In this section we consider various measures to facilitate efficient behaviour in the use of EVs in Western Australia's electricity markets. We seek to facilitate measures such that the charging of EVs occurs at times that minimise the impact of EVs on peak demand.

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94 IMO Rule change: RC_2010_29. Available at: http://www.imowa.com.au/n3181.html (accessed 1 August 2012).

95 Load following ancillary services is the primary mechanism in real-time to facilitate the balancing of both supply and demand. Load following accounts for the difference between scheduled energy and actual load and intermittent generation. Load following resources must have the ramping capability to pick up the load ramp between scheduling steps as well as maintain the system frequency.

96 Western Power, *Response to AEMC Approach Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 2 November 2011, p.5.

5.2.1 Pricing

Box 5.2: Draft Recommendation

To manage the impact of EVs on peak demand, we recommend that there be appropriate pricing signals faced by consumers. This is best achieved through network pricing signals that capture the cost of supplying electricity and by ensuring that these signals are reflected in retail tariffs.

Similar to the NEM, we consider that the primary means of encouraging efficient behaviour in the charging of EVs in Western Australia is through pricing signals. These pricing signals need to be set such that a consumer can be rewarded for charging their EV at off-peak times, and thus facilitating the efficient use of networks. Similar to the NEM, we consider that it is through distribution network pricing signals that EV consumers can best be incentivised to manage the impact of EV charging on peak demand.

The effectiveness of network pricing signals to encourage efficient behaviour also depends upon the extent that a retailer can pass through these signals in the retail tariffs it offers to consumers. In Western Australia, retail tariffs for residential electricity customers are regulated. We recommend examining the feasibility of offering tariffs for EV within the existing framework of regulated retail tariffs.

5.2.2 Connecting to the distribution network

Box 5.3: Draft Recommendation

In the SWIS, we consider that the connection charging framework seems to be designed to reflect the underlying costs of supply as far as is practicable and can cater for EV connections. In the NWIS and RNIS, further review of the impact of EVs on these networks may be required in the future, if appropriate. We are therefore not proposing any specific changes at this time.

In Western Australia, contributions for connections to the distribution network are primarily governed under the Electricity Networks Access Code and related legislation. The SWIS is owned and operated by Western Power and regulated by the ERA. The NWIS and RNIS are operated by Horizon Power and are not subject to economic regulation by the ERA.

Connection charges in the SWIS

In the SWIS, charges to connect to Western Power's network are captured through the 'contributions policy' set out in its access arrangement. Currently, Western Power's

access arrangement is being reviewed by the ERA.[97] Western Power is proposing a Distribution Low Voltage Connection Scheme (DLVCS) for those connections where:

- the proposed connection point is to the distribution system low voltage network and is within 25 kms of the relevant zone substation; and
- the applicant requires electricity capacity in excess of the existing capacity at a connection point for a brownfield development or the original design capacity for a greenfield development.

One of the objectives of the DLVCS is to be cost reflective such that it reflects the network user's utilisation of network capacity. The DLVCS:

- applies a set of standard charges to the load to reflect the average cost for the provision of capacity (in kilo Volt Ampere or kVA);
- differentiates between those connections involving direct supply from a transformer against those supplied from a low voltage street feed connection, with the latter being more costly; and
- differentiates between low (up to 216 kVA), medium (217-630 kVA) and high (631 kVA onwards) capacity connections. Most EV connections would be captured under low capacity connection.

We note that the DLVCS provides a framework for connection charges to the distribution network that are designed to be cost-reflective. This framework can cater for EV connections. This assumes that an EV charging location in the distribution network can be identified by the DNSP. Also, in practice, the costs of connecting an EV for new connections may be absorbed into the overall costs of construction and thus limiting the incentive to connect efficiently.

Connection charges in the NWIS and RNIS

In the NWIS and RNIS, connections to Horizon Power's networks are not regulated by the ERA. There are no connection costs to the consumer if an individual customer is on a standard supply and 1) the point of supply is a new underground single phase connection located no further than 60 metres from an existing distribution network and 2) the consumer's mains cable are terminated by an authorised electrical contractor.[98] Additional costs for the connection and related metering equipment would be incurred for a three phase standard supply.

Noting the above, we consider that the network impacts of EV use in the RNIS and NWIS should be further investigated to ascertain their impacts on these networks. This

97 http://www.erawa.com.au/3/1181/48/_western_powers_proposed_revised_access_arrangemen.pm (accessed 18 July 2012).

98 Western Australian Distribution Connections Manual 2012, p. 131.

will assist in developing appropriate connection charges that takes into account these network impacts. We concur with Horizon Power's submission in this respect.[99]

5.2.3 Controlled charging and V2G

Box 5.4: Draft Recommendation

We note that the rights to controlled charging and V2G and the benefits it provides can be apportioned between parties. Third parties such as aggregators can assist in negotiating these benefits among parties. In the NWIS and RNIS, we note that the market structure may result in the ready formation of contracts to capture and apportion the benefits of controlled charging and V2G. We are not proposing any specific changes at this time.

Similar to our views in the NEM, the rights over controlled charging and V2G should reside with the EV consumer. However, controlled charging and V2G can offer benefits to other parties, such as networks, retailers, aggregators and consumers themselves. These benefits are thus dispersed among a range of parties along the electricity supply chain. To capture these benefits, there may be a role for third parties (such as aggregators) who are able to act on behalf of the consumer to capture these diverse benefits.

This is particularly the case for the SWIS which has a disaggregated market structure. Similar to the NEM, to facilitate these relationships, it may be necessary to put in place guidelines to assist negotiations among parties and develop measures to capture the 'non-firm' residual benefits that V2G and controlled charging provide.

It seems apparent that the problem of split incentives for V2G and controlled charging would not arise in the NWIS and RNIS. This is because a vertically integrated supply chain structure exists. That is, Horizon Power is responsible for all aspects of electricity supply. It would therefore seem relatively straight-forward for the consumer to engage in a contract with Horizon Power to capture the benefits of controlled charging and V2G.

5.3 Measures to promote consumer choice

In this section, we discuss various measures to promote consumer choice with respect to electric vehicles in Western Australia. We consider consumer protections and the retail/network licensing regimes that underpin these consumer protections. We also consider the energy market measures to address financial failure of retailers and its applicability to EV service providers.

99 Horizon Power, *Response to AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012, p. 2.

For a discussion on our position in WA with respect to circumstances when the supply of electricity for EV charging constitutes the legal sale of electricity, please refer to section 4.1 of this draft advice.

5.3.1 Consumer protection and retail licensing

Box 5.5: Draft Recommendation

We consider that the retail licensing and exemptions framework, including the consumer protections embedded in this framework, is adequate to cater for the charging of EVs and we are therefore not proposing any changes at this time. The WA government has approved a retail exemption for EV charging that appears to cover a broad range of EV charging scenarios.

In Western Australia, under the *Electricity Industry Act 2004 (WA)*, there is a retail licensing and exemptions framework that applies to parties seeking to sell electricity. Electricity-specific consumer protections are achieved through licence obligations administered by the ERA.

The WA government has approved a recommendation to grant retail licence exemptions for operators of EV charging stations for a period of three years. There were no specific conditions associated with the licence, including no requirements in relation to pricing or consumer protection. This exemption appears to cover all charging locations at both private and public charging locations. The period of three years was chosen to allow operators of charging stations to participate in the current trials without contravening the *Electricity Industry Act 2004 (WA)*.

The retail exemption available for EV charging stations is sufficiently broad to cover all EV service provider business models, including the bundled service provider.

5.3.2 Network licensing

Box 5.6: Draft Recommendation

We consider that the network licensing and exemptions framework is adequate to cater for the charging of EVs and we are therefore not proposing any changes at this time. The WA government has approved a network exemption for EV charging that appears to cover a broad range of EV charging scenarios.

In Western Australia, under the *Electricity Industry Act 2004 (WA)*, parties seeking to construct or operate an electricity distribution system must obtain a licence or seek an exemption.

The WA government has approved a recommendation to grant network exemptions for operators of EV charging stations. This network exemption is to have a duration of three years, which is consistent with the duration of the retail exemption.

We consider that the network and retail exemptions for EV service providers are consistent with our proposed approach in the NEM.

5.3.3 Risk of EV service provider financial failure

Similar to the NEM, we consider the risk of financial failure of an EV service provider. We are motivated by ensuring that the long term interests of consumers are addressed.

Box 5.7: Draft Recommendation

We consider that the current arrangements are adequate to address the risk of being unable to supply electricity to an EV user should a bundled service provider face financial difficulties in WA. We are therefore not proposing any changes.

In Western Australia, the holder of a retail licence can be designated as a Supplier Of Last Resort (SOLR). The ERA designates the SOLR. If the ERA does not designate another SOLR, then Synergy is the SOLR for the SWIS and Horizon Power is the SOLR outside the SWIS. These arrangements demonstrate that there are mechanisms in place to address the risk of a retailer facing financial failure. This means that where an EV service provider is licensed as a retailer, then these SOLR arrangements would apply.

Where a bundled service provider is licensed as a retailer, then it is likely that SOLR arrangements would apply. Similar to the NEM, if the bundled service provider is subject to a retail exemption, or if the ERA found that the bundled service provider is not involved in the sale of electricity, then SOLR would not apply. In this case, the consumer would bear the risk of not being able to charge its EV and the Australian Consumer Law would apply. It is possible, however, that the consumer could charge at commercial charging locations or enter into a contract with another provider.

5.3.4 Metering

Box 5.8: Draft recommendation

Given the market structure in Western Australia, we are not making any recommendations with respect to metering at this time.

Western Australia's Electricity Industry Metering Code sets out the rights, obligations and responsibilities of metering code participants associated with the measurement of electricity and the provision of metering services. The Metering Code was reviewed by the Western Australian Office of Energy (as it then was) and a Final Recommendations Report was submitted to the Minister of Energy in August 2011.[100]

Western Australia's market structure does not cater for retail contestability. In the SWIS, Synergy is the incumbent retailer and residential/small consumers cannot

100 http://www.finance.wa.gov.au/cms/content.aspx?id=14551 (accessed 3 August 2012).

choose their retailer. Outside the SWIS, Horizon Power is the incumbent retailer. The results of this market structure is that our proposals to facilitate consumer choice such as two retailers at a connection point bear less relevance. However, should greater retail contestability be considered in Western Australia at a later date, then further analysis of the appropriate metering arrangement should be made. It is anticipated that our findings in relation to EVs and metering in the NEM contained in this draft advice and our findings in the power of choice review would inform this analysis.

Question 12 Western Australia

What are your views with respect to our recommendations to facilitate the efficient uptake of EVs in Western Australia?

6 Natural Gas Vehicles

We are required to provide advice on the energy market arrangements necessary to facilitate the efficient uptake of natural gas vehicles (NGVs). We consider vehicles that utilise both CNG and LNG in both passenger and commercial contexts.

6.1 Uptake of NGVs

We asked AECOM to forecast the uptake of passenger NGVs, CNG buses and LNG trucks in Australia. AECOM recognised that markets for NGVs are still developing and there is uncertainty as to how these markets will develop.

In relation to passenger NGVs, AECOM found that life cycle costs of these vehicles are only competitive against internal combustion engine (ICE) vehicles and EVs for those drivers who travel large distances. However, these advantages of passenger NGVs diminish over time due to improvements in the competitiveness of EVs.

In relation to CNG buses and LNG trucks, AECOM found that the uptake of these vehicles is more likely as they typically travel longer distances and benefit from reduced operating costs. AECOM found that CNG buses do not offer significant financial benefits, but may have greenhouse gas emissions benefits. In addition, AECOM found that the viability of LNG trucks is highly dependent on distance travelled, particularly where they are used primarily for long haul freight.

AECOM then used three scenarios of uptake (low, central, high) to estimate the amount of gas demanded by CNG buses and LNG trucks and to assess the implications for current natural gas market arrangements. Scenarios were based on the percentage of new bus/truck sales in projected years. AECOM found that under the central scenario, the total gas required for CNG buses and LNG trucks would be around 65 Peta Joule (PJ) by 2015 rising to around 120 PJ by 2020 and around 215 PJ by 2030.

6.2 Energy market arrangements for NGVs

Box 6.1: Draft Recommendation

We consider that no significant changes need to be made to the energy market arrangements to cater for the efficient uptake of NGVs and are therefore not proposing any changes at this time.

According to both AECOM's analysis and views contained in submissions, the impact of NGVs on energy markets is not likely to pose significant issues for the gas market arrangements. For example, the Energy Networks Association considered that major issues connecting NGV related infrastructure were unlikely.[101] Indeed AECOM's

101 Energy Networks Association, *Response to AEMC Issues Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012,p. 2.

analysis found that given the take up of passenger NGVs, the impacts on distribution networks were likely to be low.

We consider that, with respect to CNG buses and LNG trucks, the refuelling stations for these vehicles are likely to be connected to the transmission and sub-transmission networks. The impacts of these refuelling stations on gas transmission networks are also likely to be low for the following reasons:

- LNG facilities are likely to already require high capacity connections to transmission or sub-transmission pipelines.
- There are clear price signals in withdrawing gas from high capacity connections. Also any additional load is likely to be predictable based on daily gas balancing[102] and there is adequate scope for line-pack within high capacity gas networks.
- Facilities will require storage for CNG and LNG prior to distribution for refuelling and will thus be able to manage withdrawals to reduce network impacts and costs.
- Metering and billing issues were unlikely as this would be dealt with under commercial consumer arrangements.[103]

In addition, SP AusNet argued that the growth in NGVs will likely be concentrated in fleet vehicles where network augmentations are likely to be funded by the consumer. In this sense, impacts on residential consumer tariffs are unlikely to be affected.[104]

We also note that there are current market processes and regulatory arrangements to monitor the adequacy of gas supply to respond to emerging needs, such as NGV technologies. AEMO publishes an annual Gas Statement of Opportunities (GSOO) which assesses the supply/demand balance for gas as well as the adequacy of gas reserves to meet demand. Also, the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) published detailed data and projections for gas resources.[105]

6.2.1 Residential NGV refuelling

Our analysis of the energy market regulatory arrangements suggests that gas markets are suitable to meet the needs of consumers seeking to refuel their NGV at their home. We reached this conclusion by assessing whether there are processes and regulatory

102 Energy Networks Association 2011, *Response to AEMC Approach Paper - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 October 2011, p. 6.

103 Energy Networks Association 2011, Submission to Approach Paper, p. 6.

104 SP AusNet, *Response to AEMC Approach Paper - Energy market arrangements for electric and natural gas vehicles,* submission to the AEMC, 27 October 2011, p. 22.

105 www.daff.gov.au/abares/about.

arrangements in place that could facilitate the installation of NGV related infrastructure and service provision at a consumer's residence.

Our assessment is based on the following:

- If gas is already connected to the home, then existing processes and regulatory arrangements in relation to the installation of new gas appliances will facilitate the installation of NGV related infrastructure. Existing arrangements encompass processes to upgrade the meter for a consumer (should this be required) as well as arrangements to assess any gas pressure or other technical delivery requirements. We note that submissions identified that the installation of refuelling equipment at a consumer's home may require a modification to a consumer's gas infrastructure.[106]

- If gas is not already connected to the home, then existing processes and regulatory arrangements will facilitate gas connection. These arrangements encompass connection timeframes, connection costs and, where the consumer's connection requires a non-standard connection to the network, a framework to recover network augmentation costs. If gas is unavailable in the consumer's area, then the inability to refuel an NGV would be equivalent to a consumer being unable to utilise gas cooking or gas water heating.

- NGV connections at the home are unlikely to cause material impacts on the local gas network. Submissions also argued that the additional load from NGVs is likely to be predictable in the context of daily gas balancing and the demand for new network infrastructure is not likely to be significant.[107]

- If a consumer purchases gas for refuelling from its existing gas retailer, then it would not be necessary to introduce new billing, metering or tariff arrangements. This is because the current regulatory arrangements adjust to changes to consumers' loads due to the installation of new appliances.

- If a consumer purchases gas for refuelling a NGV from a service provider than is not its gas provider, then this can also be accommodated:

  - The consumer / service provider can request a new meter to be installed at the consumer's premise to facilitate the separate recording of gas consumption. There are existing processes and regulatory arrangements to facilitate this connection and the associated cost recovery.

  - If the NGV service provider is not already a gas retailer, the service provider could either obtain a gas retail licence or seek an exemption from the AER through the exemptions framework.

106 Australian Automobile Association, *Response to AEMC Approach Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 October 2011, p. 4.

107 SP AusNet 2011, Submission to Approach Paper, p. 6.

– Once the consumer is connected and the required licences or exemptions are obtained (if required), then the current regulatory arrangements for billing, metering and settlement can facilitate the provision of the refuelling service.

6.2.2 Commercial NGV refuelling

We considered whether there were any issues concerning commercial NGV refuelling. Our assessment is that no significant changes need to be made to the energy market arrangements to facilitate commercial NGV refuelling. We explain our position further below.

Network aspects of commercial NGV refuelling

Dedicated commercial refuelling facilities may be located on a transmission pipeline or connected to a distribution network. Also, in the case of LNG, alternative methods of receiving and storing fuel to service consumers may be used, for example, by transporting fuel in tankers and storing it on-site.

Existing pipeline regulation for both transmission and distribution pipelines provides a model for connections, extensions, augmentations and consumer contributions where the existing network requires modification to meet consumers' demands. SP AusNet indicated in their submission that any network augmentation requirements for commercial refuelling would be funded by the consumer.[108]

For LNG, competition between modes of fuel delivery - by pipeline or alternative methods - could be expected to act as a constraint on the connection and shipping costs chargeable by a transmission pipeline or distribution network. This suggests that existing regulatory arrangements are unlikely to require significant change.[109]

Retail aspects of commercial NGV refuelling

The current gas market regulatory arrangements enable a larger commercial consumer to choose to source its fuel from a retailer, producer or the relevant local gas market. These choices are available to all commercial consumers: a consumer's preference for one over the other is a function of the consumer's size, the significance of the fuel cost in their total costs and the costs of using an intermediary, among other things. Relationships between gas suppliers – either retailers or gas producers – and larger commercial consumers are typically not subject to material energy market regulation. This is because the contractual relationship is transactional and competitive in a commercial context.[110] We therefore do not consider there to be a need for energy market arrangements governing the retail aspects of commercial NGV refuelling.

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108 SP AusNet 2011, Submission to Approach Paper, p. 22.

109 To the extent that LNG and CNG are substitutes, this option for LNG will provide competitive pressure on arrangements for CNG.

110 iGas Energy submitted that major energy users would have gas supply contracts with wholesalers/producers or be spot market traders. iGas Energy, *Response to AEMC Issues Paper -*

Question 13 NGVs

Do you agree that no significant changes need to be made to the energy market arrangements to facilitate the efficient uptake of NGVs? Please provide reasons.

Energy market arrangements for electric and natural gas vehicles, submission to the AEMC, 23 February 2012, p. 5.

7 Summary of recommendations

In this chapter, we consolidate our recommendations conveyed throughout this draft advice.

7.1 Electric Vehicles - NEM arrangements to facilitate efficient behaviour

In this draft advice:

- Our power of choice review found that the current network and retail tariffs do not necessarily reflect the cost of supply and the delivery of electricity. This means that most consumers currently do not have options to capture the value of DSP activities. Therefore, the current pricing arrangements are unlikely to promote efficient charging behaviour for EV consumers.
- Although efficient behaviour requires high use consumers to face cost reflective prices, we do not recommend mandating specific price structures for residential EV consumers because:
    - EVs should be treated as other forms of large load and DSP and the power of choice review will provide advice on how the market could move towards more cost reflective prices; and
    - retailers and networks can still develop their own EV specific tariffs to incentivise efficient behaviour.
- Also, we recommend that:
    - there may be merit in having some form of geographical variation in the DUOS charges to better focus the network costs onto the EV consumer; and
    - meters with interval read capability are necessary to enable consumers to be incentivised to behave in a manner that yields efficient market outcomes. The power of choice review is exploring how high use consumers, such as large load consumers, can be allocated interval (or other time varying) meters to facilitate efficient behaviour.
- We consider that the connections charging framework administered by the AER is appropriate for EVs connecting to a distribution network and we are not proposing any changes. The framework for setting upfront connection charges under Chapter 5A of the NER allows for the possibility of applying a connection charge to EVs connecting to a distribution network depending on the nature and size of the connection.
- We consider that the right to controlled charging ultimately lies with the consumer. This right can be assigned by the consumer to other parties in exchange for benefits to the consumer. To realise the benefits of controlled

charging, effective commercial relationships (or contracts) between the consumer and potentially DNSPs, retailers and aggregators are required. We recognise the role that third parties (such as aggregators) can play in negotiating (on behalf of the consumer) the allocation of benefits between multiple parties. To assist these third parties in negotiating benefits of controlled charging so that it is captured in commercial contracts, it may be necessary to set some regulatory guidance on the steps to take in the negotiation process and possible measures to assess the value of DSP to aid the negotiations. The power of choice review is exploring how the energy market arrangements should support these contracts.

- Regarding V2G, we consider that the right to control the discharge of an EV back to the grid resides with the EV consumer. We consider that the consumer can assign the costs and benefits of EV discharging to other parties (eg. retailers, DNSPs, aggregators) in exchange for consumer benefits through contractual relationships. There is a role for third parties to negotiate on behalf of consumers the set of benefits falling across multiple parties.

7.2 Electric Vehicles - NEM metering arrangements to facilitate consumer choice and efficient charging

In this draft advice:

- We recommend that the term 'connection point' in Chapter 7 and Rule 3.15 of the NER be replaced with 'supply point'. The supply point would be the point where part, or all, of the consumer's load would be metered. In the remainder of the NER the term 'connection point' would continue to refer to the point of physical connection between the network assets and the assets of the network user (consumer or generator). This change would mean that a consumer that establishes an additional metering installation at its premises need not establish a second connection point.

- We recommend that a consumer be able to arrange for a parent/child (or subtractive) metering arrangement within its premises when:

  - there is a single connection to the LNSP; and

  - there is a single consumer at the premises (such as a residence or small business).

- For parent/child (or subtractive) metering arrangements, we recommend:

  - losses within the premises would be assigned to the parent meter;

  - all fixed DUOS charges would be assigned to the FRMP for the parent NMI, unless otherwise agreed with the consumer; and

- the NMI for the child meter(s) would be assigned by the Responsible Person[111] for the child meter.

- We recommend that, where a single metering installation has multiple measurement elements and assigned multiple NMIs (that is, a multi element metering installation), there must only be a single Responsible Person for:
  - all the components of the metering installation; and
  - all the NMIs associated with each metering element.
- We also recommend allowing individual measurement elements within a single device to be regarded as separate metering installations. This would allow individual measurement elements to be:
  - assigned to different FRMPs by the associated consumer(s); and
  - assigned different NMIs by the Responsible Person.
- We recommend that the arrangements for metering within an embedded network be included in the NER. In particular, embedded networks should be brought into the metering and settlements frameworks in Chapter 7 and rule 3.15 of the NER by:
  - defining connection points between the embedded network and the associated downstream consumers as connection points (and supply points) under the NER; and
  - allowing these connection points (and supply points) to be settled in the NEM.
- In situations where there are two (or more) FRMPs at one connection point, we recommend:
  - where there is only one point of disconnection and a FRMP wants to disconnect the consumer, this FRMP can disconnect the total load at the connection point, including the load of other FRMPs;
  - for multi element metering installations, we have specified ways to share the costs associated with the Responsible Person;
  - access to the metering installation be managed by the Responsible Person;
  - when a consumer changes one of its FRMPs, we have suggested ways of managing this process;

111 The choice of the Responsible Person is specified in the NER. We are considering the role of the Responsible Person, including who it can be, in the power of choice review.

- assigning DUOS charges to FRMPs in a manner that is proportional to their impact on total DUOS;
- a process where a consumer or FRMP seeks to upgrade one of its metering installations; and
- ways for addressing situations where a consumer moves house or has a billing/metering query.

7.3 Electric Vehicles - NEM arrangements to facilitate consumer choice

In this draft advice:

- We consider that the supply of electricity for the purposes of EV charging would generally constitute a legal sale of electricity in the NEM under the NERL and in Western Australia under the *Electricity Supply Act 2004 (WA)*.
- For bundled service providers, we recommend that the AER or the ERA determine whether the services offered constitute the legal sale of electricity. The AER or ERA should consider whether the sale of electricity is a primary or incidental part of the bundle of services provided.
- We consider that EV battery swap services do not constitute the sale of electricity for the purposes of the NERL, and therefore the energy market arrangements do not apply to these services.
- We consider that the current consumer protection framework is appropriate for EV consumers. However, we recommend that the AER review its retail exemptions framework to clarify the status of EV charging services at commercial EV charging stations where onselling occurs.
- We consider that the network licensing regime administered by the AER is sufficiently robust to cater for EVs charged over a distribution network or over an embedded network and are therefore not proposing any changes. We note that the AER has developed a network exemption for EV charging in embedded networks, which would cover commercial EV charging stations.
- We consider that the current arrangements for addressing the risk of EV service provider financial failure are appropriate and therefore we are not proposing any changes. That is:
  - If the bundled service provider is registered as a retailer, then the Retailer of Last Resort (ROLR) provisions would apply.
  - If the bundled service provider is subject to a retail exemption, then ROLR does not apply however the AER may place conditions on the bundled service provider.

- If the bundled service provider is found by the AER not to provide services that constitute the legal sale of electricity, then the energy market regulatory arrangements do not apply and this become a general risk faced by EV consumers.

7.4 Electric Vehicles - Western Australia

In this draft advice:

- We recommend that certain aspects of the market rules governing the Balancing and Load Following Ancillary Services market may need to be reviewed to facilitate the participation of EVs (as a load or as energy storage) in the future, if appropriate.

- To manage the impact of EVs on peak demand, we recommend that there be appropriate pricing signals faced by consumers. This is best achieved through network pricing signals that capture the cost of supplying electricity and by ensuring that these signals are reflected in retail tariffs.

- In the SWIS, we consider that the connection charging framework seems to be designed to reflect the underlying costs of supply as far as is practicable and can cater for EV connections. In the NWIS and RNIS, further review of the impact of EVs on these networks may be required in the future, if appropriate. We are therefore not proposing any specific changes at this time.

- We note that the rights to controlled charging and V2G and the benefits it provides can be apportioned between parties. Third parties such as aggregators can assist in negotiating these benefits among parties. In the NWIS and RNIS, we note that the market structure may result in the ready formation of contracts to capture and apportion the benefits of controlled charging and V2G. We are not proposing any specific changes at this time;

- We consider that the supply of electricity for the purposes of EV charging would generally constitute a legal sale of electricity in WA under the *Electricity Supply Act 2004 (WA)*. For bundled service providers, we recommend that the ERA determine whether the services offered constitute the legal sale of electricity. The ERA should consider whether the sale of electricity is a primary or incidental part of the bundle of services provided.

- We consider that the retail licensing and exemptions framework, including the consumer protections embedded in this framework, is adequate to cater for the charging of EVs and we are therefore not proposing any changes at this time. The WA government has approved a retail exemption for EV charging that appears to cover a broad range of EV charging scenarios.

- We consider that the network licensing and exemptions framework is adequate to cater for the charging of EVs and we are therefore not proposing any changes

at this time. The WA government has approved a network exemption for EV charging that appears to cover a broad range of EV charging scenarios.

- We consider that the current arrangements are adequate to address the risk of being unable to supply electricity to an EV user should a bundled service provider face financial difficulties in WA. We are therefore not proposing any changes.

- Given the market structure in Western Australia, we are not making any recommendations with respect to metering at this time.

7.5 Natural Gas Vehicles

In this draft advice:

- We consider that no significant changes need to be made to the energy market arrangements to cater for the efficient uptake of NGVs and are therefore not proposing any changes at this time.

Abbreviations

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BEV	battery electric vehicle
CNG	Compressed Natural Gas
COAG	Council of Australian Governments
CPP	Critical Peak Pricing
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSO	community service obligation
DLVCS	Distribution Low Voltage Connection Scheme
DNSP	Distribution Network Service Provider
DSP	demand side participation
DUOS	Distribution Use Of System
ERA	Economic Regulation Authority of Western Australia
EV	electric vehicle
FRMP	Financially Responsible Market Participant
GPO	General Purpose Outlet
GSOO	Gas Statement of Opportunities
ICE	internal combustion engine
IMO	Independent Market Operator of Western Australia

LNG	Liquefied Natural Gas
LNSP	Local Network Service Provider
MAC	Market Advisory Committee
MCE	Ministerial Council on Energy
MDP	Metering Data Provider
MP	Metering Provider
MSATS	Market Settlement and Transfer Solution
MWh	Mega Watt hour
NECF	National Energy Customer Framework
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NERL	National Energy Retail Law
NERR	National Energy Retail Rules
NGL	National Gas Law
NGO	National Gas Objective
NGV	natural gas vehicle
NMI	National Metering Identifier
NPV	Net Present Value
NSP	network service provider
NWIS	North West Interconnected System
PHEV	plug-in hybrid electric vehicle
PJ	Peta Joule
PV	Photo-Voltaic

RCM	Reserve Capacity Mechanism
RNIS	Regional Non-interconnected Systems
SCER	Standing Council on Energy and Resources
SOLR	Supplier Of Last Resort
SOO	Statement of Opportunities
STEM	Short Term Energy Market
SWIS	South West Interconnected System
TEC	Tariff Equalisation Contribution
TOU	Time Of Use
V2G	Vehicle-to-Grid
VKT	vehicle kilometres travelled
WA	Western Australia
WEM	Wholesale Electricity Market

A Appendix A - Submissions to the issues paper

In this Appendix, we summarise the key comments raised in stakeholders' submissions to the issues paper. We received 29 submissions in total. We thank stakeholders for their thoughtful submissions. All these submissions have helped inform our thinking in preparing the draft advice.

The key comments made in submissions are summarised under the following tables:

- EV general comments;
- EV comments on energy market arrangements to promote consumer choice;
- EV comments on energy market arrangements to encourage efficient behaviour; and
- NGV comments.

Please note that stakeholders' submissions that are related to issues or matters arising from AECOM's Initial Advice are addressed by AECOM in Appendix B of AECOM's Final Advice.[112]

112 Available at www.aemc.gov.au

Table A.1 Electric Vehicles - general comments

General Issue	Stakeholder	Comment
Energy market framework and EVs	Tasmanian Department of Infrastructure, Energy and Resources	An appropriate regulatory framework should be established to the best extent possible at the earliest opportunity (p.1).
	Aurora Energy	Notes that EV technology still immature and future requirements uncertain so regulatory framework should not be overly prescriptive (p.2).
	Ausgrid	Altering market arrangements to manage peak demand from EVs not required at this time because likely adoption will be slow enough for networks to adapt (p.1).
	Ausgrid	The business models of EV service providers should be designed to fit with an efficient overall electricity market regulatory framework rather than the regulatory framework designed to fit with the particular business models of EV service providers (p. 2).
	Origin Energy	Premature to make significant changes to energy market arrangements and work should be done in parallel with AEMC's DSP3 review (p.1).
	ActewAGL	Regulation should only be introduced where there is clear evidence of market failure and does not prejudice security or reliability etc (p.2).
	Energex	It is timely that the AEMC assess current arrangements in light of EVs, DSP and embedded generation. To this end, changes to energy market arrangements should be made in the context of overall energy usage, including peak demand, rather than specific appliance types (p.1).
	better place	Regulation of EV charging services need to reflect early stage of the market and encourage innovation and competition among business models and providers (p.16).
	better place	There is a case for a regulatory regime to streamline the interaction between aggregators/EV charging providers with DNSPs and reduce transaction costs (p.16).

General Issue	Stakeholder	Comment
	Australian Electric Vehicle Association	Energy markets sufficiently strong and flexible to allow efficient integration of EVs at expected rates of uptake. Important that EVs not treated differently to other loads(p.1).
	UNSW Centre for Energy and Environmental Markets	The key efficiency challenge for the NEM is dynamic efficiency. Energy service companies are the key missing institutional players under the current market arrangements (p.1).
EVs and Demand Side Participation	Tasmanian Department of Infrastructure, Energy and Resources	EV should be considered as another form of DSP (p.1).
	UNSW Centre for Energy and Environmental Markets	EV charging can enhance the role of DSP (p.2).
	SP AusNet	Rules incentivising DSP should be revisited (p.1).
Causer-pays principle	Aurora Energy	Supports causer-pays principle (p.1).
	Citipower and Powercor	Supports causer-pays principles to ensure inefficient cross-subsidies are minimised.
	ActewAGL	Any non-standard costs incurred by NSPs be paid by EV user/charging service provider rather than through general consumer base through higher network charges (p.3).
	ChargePoint	Causer pays principle should be applied in a non-discriminatory manner across all loads (p.2).
Special arrangements for EVs	Government of SA	Pricing regime should not focus solely on Evs, but take into account other loads (p.2).
	Tasmanian Department of Infrastructure, Energy and Resources	EV loads should not be treated differently to other loads - all loads at a site are considered in determining network/market impacts (p.2).

General Issue	Stakeholder	Comment
	Australian Energy Regulator	Supports cost reflective pricing to encourage shifting from peak to off peak periods. But it is inappropriate for EV technologies to be treated specifically; rather, there should be a common approach to load management.(p.3)However, may be a basis for EV loads to be treated differently. Factors for separate EV network tariffs include: demand management potential of EV batteries; for load management (where price signals are insufficient); for not preventing innovative business models (p.3).
	Aurora Energy	Introducing a requirement to differentiate between the end uses of various loads upon the network adds complexity for both network planning and tariff design.
	Origin Energy	Supports an outcome where EVs are part of an integrated smart home solution with market arrangements (eg pricing) that are consistent across all forms of DSP. Does not support exclusive EV arrangements (p.2).
	Ausgrid	No compelling reason to treat EVs or EV charging services differently from other loads. Metering and control of EVs can be accommodated within existing and emerging arrangements and with grid-side and customer applications for smart grids (p.6).
	Citipower and Powercor	EV businesses should not be given preferential treatment over other loads (p.2).
	Energex	Special EV arrangements not necessary. In principle, EVs should be treated the same as any other load or distributed energy resource (p.4). All loads should be subject to the same electricity tariff under a single market NMI; tariffs for specific loads would be expected to increase complexity/cost.
	SP AusNet	Special treatment of EV load unnecessary (p.1). EVs should be treated similarly to other loads provided all loads can be subject to cost reflective tariffing. However, given current constraints on pricing arrangements, EVs may need to be treated differently to better reflect impact on the network so that other customers do not subsidise a minority of EV users (p.4). If there are EV load tariffs, there needs to be a way of detecting EV load and rectifying infringements (p.5).
	better place	EV should be treated differently because it is a large, mobile, flexible load, able to be

General Issue	Stakeholder	Comment
		managed by aggregators, and person responsible for EV fuel costs may not be the party who is the retail electricity customer for the premises where charging occurs (pp. 3-4).
	ChargePoint	Treating EV loads differently is driven by commercial business model requirements and not driven by regulatory market arrangements. By separating loads, will introduce greater complexity and cost to the market (p.1).
	Alternative Technology Association; Australian Electric Vehicle Association	EVs should be treated the same as other loads. Beneficial qualities of EVs (deferrable, controllable and potentially reversible load) should be taken account in DSP strategies (p.3).
	UNSW Centre for Energy and Environmental Markets	The arrangements with respect to EVs should translate to other loads amenable to demand response, aggregation and delivery via an energy service business model.
EV charging as sale of electricity	Australian Energy Regulator	Section 88 of the NERL prohibits the sale of electricity 'to a person for premises' and therefore applies to home or small business. But less clear whether it applies to commercial charging stations and whether, in that context, consumer protections would apply (p.2).
	Energy Retailers Association of Australia	ERAA supports that EV charging is the sale of electricity (p.2).
	AGL	AGL supports the view that EV charging is the sale of electricity and should be subject to the NECF. Electricity is an essential service and should be subject to regulatory frameworks which provide for consumer protections (p.1).
	Origin Energy	All forms of electricity consumption should be classified as a sale of electricity (p.11). The AER retail exemption framework seems not to be developed with EVs in mind. If EV electricity different, then there will be confusion when some consumers covered by consumer protections and others not. Current regulations do not distinguish between essential and non-essential use and any changes to this paradigm are radical. In future EV could be an essential use and retailer hardship programmes may apply (p. 13).

General Issue	Stakeholder	Comment
	ChargePoint	A charging service is first and foremost a sale of electricity and extra services are value added (p.5).
	Alternative Technology Association; Australian Electric Vehicle Association	Charging service providers are not required to charge EVs; can recharge under standard residential electricity agreements (p.3).
	UNSW Centre for Energy and Environmental Markets	Concerned about the 'sale of electricity' may impose a regulatory burden and reduce competition/consumer choice for energy service companies (p.7).
	Verdant Vision	Strongly refute that EV charging service should be automatically classified as a sale of electricity as it would serve to stifle innovation and competition in an emerging EV charging services market (p.21).
	Energex	Not an issue for DNSPs as long as they can recoup the cost of supply to the primary connection point to the premise (p.4).
Smart technology and Australian standards	ActewAGL	EV related load can be managed through TOU structures, enabling capacity for EV charge management, through smart network/smart meter infrastructure (p.2).
	ChargePoint	Technical barriers to EV charging dealt with through use of smart appliances to manage residential load (p.1).
	Commonwealth Department of Climate Change and Energy Efficiency	The Equipment Energy Efficiency (E3) committee work with Standards Australia to develop a set of demand response standards for electrical products. AS/NZS 4755 describes the physical and functional requirements of a simple demand response interface which can be built into any large electrical product. Every charging device should have a demand response interface built in so that EV charging proves to be a general (or local) problem, the utility or aggregator can approach the owners to participate in cost-limiting arrangements, which is also low cost to consumers ($10 retail price) (p.2).
	Tasmanian Department of Infrastructure, Energy and Resources	EVs should have regard to concurrent work in the development of Australian EV standards (p.5).

General Issue	Stakeholder	Comment
Jurisdictional issues for EVs (including WA)	Tasmanian Department of Infrastructure, Energy and Resources	Noted a number of factors why EV uptake could be more favourable in Tasmania: eg. small physical size and extensive electricity grid coverage, wind generation capacity, no capacity constrained electricity generation system (p.6).
	Horizon Power	Horizon Power (WA based) managed the North West Interconnected System (NWIS) and other interconnected systems. Encourages the exploration of EV infrastructure with ongoing discussion of smart meters (p.1).
	Alternative Technology Association; Australian Electric Vehicle Association	As WA has a capacity market as well as an energy market, the benefits of EV offering V2G capacity should be made available, perhaps through third party aggregation (p.6).
Other	AGL	Energy sources for EV (ie. renewable) should not be mandated and besides, this is difficult/complicated to enforce in practice (p. 1).
	Energex	It may be necessary to have arrangements in place at the point of sale, both at dealerships and for private sales, or through registration statistics, whereby the retailer is notified of the customer's purchase of the EV (p.9).

Table A.2 Electric Vehicles - comments on energy market arrangements to promote consumer choice

Issue	Stakeholder	Comment
Metering	Australian Energy Regulator	Notes jurisdictional differences in the regulatory treatment of the provision of meters. But EVs can request a non-standard meter with a DNSP or third party provider and pay for the meter and costs of connection (p.4).
	Energy Supply Association of Australia	Metering and settlement for charging away from home can be addressed through pre-payment credit card facilities (eg. Melbourne CBD parking fees) (p.4).
	Energy Supply Association of Australia	Efficient price signals and enabling metering infrastructure are a necessary condition for integrating significant EV numbers (p.5).
	AGL	Does not support mandated metering arrangements solely for EVs. Sub-metering with an off-market NMI may be easier/cheaper outcome for an EV customer (p.2).
	Ausgrid	Concerned about applying the existing arrangements for embedded networks to EVs. There is ambiguity in relation to embedded network arrangements (particularly in relation to obligations for metering, registration, activation and maintenance of NMIs and other related data) (p.3)
	Origin Energy	Does not support parent-child NMIs as it would increase system costs and complexity with little benefit to the consumer (p.3).
	ActewAGL	No single solution can be imposed given the diversity of household metering configurations. Depends on customer switchboard configuration, the number of appliances and overall household load to determine whether a second meter, a dual element meter or alternative metering configuration is suitable (p. 3).
	SP AusNet	A single multi-element meter would provide an appropriate metering solution to allow identification of separate loads with incremental increases in metering costs rather than a multiple meter option (p.2).

Issue	Stakeholder	Comment
	better place	Two FRMPs should have the right to share a connection and metering installation if the premises occupant authorises it (p.6). The premises occupant should have the right to choose the features of its metering installation - this right resides with the retailer/distributor (p.7). Allow access to alternative meter installers if the premises occupant authorises it (p.8). Direct distributors to offer a network tariff for small load sites that doesn't bundle metering service charges with network use of system (NUOS) charges (p.9). Amend metrology arrangements to allow on-market sub-metering for sites like apartment buildings and corporate office parks (p.19).
	better place	Clear the barriers to establish separate metering and a NMI for EV charging load to enable load aggregators to participate actively in the NEM. Open up consumer access to metering data (p.11).
	Tasmanian Department of Infrastructure, Energy and Resources	Actual metering arrangements will be dependent on the type and mix of retail packages that an end user chooses and innovation/diversity should be encouraged (p.3). Roaming NMI problematic and prefers a 'fixed' metering solution.
	Energy Retailers Association of Australia	Does not support parent/child NMIs and if so, a full cost-benefit analysis be undertaken (p.1).
	Aurora Energy	The 'back office' system costs for mobile NMIs may not be easily apportioned.
	Ergon Energy	Supports single NMI/multiple meter solution. Does not support an embedded network parent/child solution (p.1).
	Origin Energy	Supports EV should be treated as a standard appliance load using a form of sub-metering without a separate NMI. Opposed to parent-child NMIs and separate metering given complexities. Note, no existing barriers to this approach for EV charging agencies as long as they obtain licences or exemptions. Roaming NMIs are unworkable (p.15).
	Energex	Does not consider it essential to have EVs separately metered from other loads. To keep market metering costs to a minimum, EV installation in residential premises be

Issue	Stakeholder	Comment
		under existing NMI and supports off-market sub-metering. Using these arrangements, metering costs recovery would be same as current arrangements and no need to change meter data confidentiality arrangements (p.5).
	SP AusNet	Approach to EV metering depends upon tariff arrangements. If appropriate tariffs cannot be applied to all loads, then separate identification of EV loads may be required with an appropriate tariff for Evs. Separate metering could be achieved using a meter with multiple elements. Concerned about use of embedded network framework and raised concerns with roaming NMIs (p.5).
	ChargePoint	Parent/child metering has settlement issues if parent (accumulation) and child (interval meter). Roaming NMI will encounter commercial/logistic issues between NMI owner and multiple retailers/suppliers. Roaming NMI barrier to entry for start-up or new retailers (p.8).Confidentiality of data arrangements are appropriate as long as customer has access to this data (p.9).
	Australian Electric Vehicle Association; Alternative Technology Association	No need for EVs to be separately metered. It should be up to charging service providers to capture these benefits and the value of these benefits in their business models - costs should not be recovered through general distribution network tariffs (p.3).
	UNSW Centre for Energy and Environmental Markets	Metering arrangements are critical for 1) customer choice through contestability of loads within a premise; 2) visibility as to the impact of EV charging on network costs and augmentation; 3) ability to effectively harness the full flexibility benefits of EVs providing controlled load (p.6). While arrangements should not prohibit use of an 'integrated home solution', arrangements which do not allow dedicated metering appear contrary to goals to enhance customer choice (p.7). Supports parent/child metering for EVs and other demand response loads.
	Verdant Vision	The key is to promote a competitive marketplace that does not preclude options such that the market can exhibit its own preferences (p.21). A separate analysis could be undertaken to evaluate the anticipated costs vs benefits of various EV metering arrangements (p.22).

Issue	Stakeholder	Comment
Retail licensing and consumer protections	Government of SA	Commercial charging is a form of on-selling of electricity and should apply for an exemption under the NECF (p.2).
	Energy Retailers Association of Australia	There should be a framework through NECF relating to the role of third parties regarding consumer protections expected to apply to a consumer (p.2).
	Tasmanian Department of Infrastructure, Energy and Resources	Licensing requirements should be reflective of the nature of the services provided so differing conditions on retailers that offer commercial EV charging versus those that only offer 'traditional' retail services (p.2).
	Origin Energy	EV charging is sale of electricity and all EV charging agencies should be subject to the NECF to ensure standardised level of consumer protection (p.2).
	Origin Energy	EV charging should require retail authorisation and not an exemption. Retail exemptions within embedded networks is not ideal because consumers are invisible to regulatory oversight and difficult to guarantee equal consumer protections (p.2).
	Origin Energy	Retailer and NSP exemptions should not apply for home EV connections, but may be appropriate for public charging and existing arrangements cater for this (p.24).
	Origin Energy	Jurisdictional licensing irrelevant with NECF in place. EV charging agencies should be covered by the NECF (p.25). Retailer authorisations are required for EV charging agencies.
	Origin Energy	Need to develop a policy framework that includes third parties involvement in a regulated market for an essential service more generally and this should be approached through NECF (p.3). NECF authorisation regime should be reassessed in light of third party and consumer requirements (p.4).
	SP AusNet	Aggregators will play a role in the future market (p.9). Issues paper acknowledged that appropriate obligations/arrangements are in place to ensure safe network operation/protection of consumers (p.9).

Issue	Stakeholder	Comment
	better place	Australia has sufficient consumer protection legislation and does not see a strong case for additional electricity market regulation of EV service providers for protecting consumer rights (p.16).
	better place	Suggests a new deemed class under AER's exempt selling guideline for EV service providers (p.20).
	Alternative Technology Association; Australian Electric Vehicle Association	EV charging in an embedded network should be classified as on-selling with an automatic exemption (p.5).
	Alternative Technology Association; Australian Electric Vehicle Association	Automatic exemptions should apply for low capacity or ad-hoc charging arrangements. For example, charging at motels/hotels/car parks etc (p.5).
	UNSW Centre for Energy and Environmental Markets	Deeming all EV charging services as the 'sale of electricity' would not seem to appropriate the nature of an energy service agreements (eg EV charging) (p.13).
	UNSW Centre for Energy and Environmental Markets	Electricity retail licenses are not well aligned with the sale of energy services and this should be focus of NEM reform processes, including EV deployment (p.14).
Network licensing and exemptions	Ausgrid	Does not support use of embedded networks for EV charging (p.9).
	SP AusNet	Concerns with embedded networks due to complexity and costs if large scale deployed (p.9).
	Energex	Does not support embedded networks with child NMIs (p.12).
Settlements	Energex	Use of embedded networks and sub metering creates difficulties for market settlement arrangements. Considers that there should be one NMI for site with off-market sub metering if necessary (p.13).
	Alternative Technology Association;	No wholesale settlement issues (p.5).

Issue	Stakeholder	Comment
	Australian Electric Vehicle Association	

Table A.3 Electric Vehicles - comments on energy market arrangements to encourage efficient behaviour

Issue	Stakeholder	Comment
Connection and use of a distribution network	Tasmanian Department of Infrastructure, Energy and Resources	Effectiveness of new Chapter 5A in relation to EVs should be monitored (p.4).
	Tasmanian Department of Infrastructure, Energy and Resources	There are two relevant categories of shared augmentations: shared augmentations caused by new connections or connection alterations (appropriately covered by chapter 5A and no issue with these arrangements); shared augmentations caused by incremental load growth is postage stamped NUOS paid by all consumers- may be a case for reexamining these arrangements (p.4). Eg an appliance which adds significantly to peak load could trigger a contribution of shared augmentation costs if threshold exceeded. Also DNSPs in their Annual Planning Reports should identify spare network capacity (p.5).
	Australian Energy Regulator	All networks should be cost reflective to extent feasible. The AER's proposed guideline on Chapter 5A of the Rules specifies that retail customers should not be required to pay for specific network augmentation charges if the customer's maximum demand are below default level prescribed in guideline. Level 1 and 2 would not generally cause this to be exceeded. However, commercial charging facilities (Level 3) may exceed and would require to pay for augmentation charges (p.5).
	Ausgrid	No specific issues in regard to connection services for EVs that are materially different to other loads (p.8).
	Ausgrid	Network reinforcement and augmentation to support EV charging should be part of overall framework (eg RIT-D) (p.8).
	Horizon Power	The network impacts of EVs in non-interconnected systems, such as those in Horizon Power's networks, should be studied (p.2).
	Origin Energy	If separate connection points are required, the network may charge the additional connection point costs for upgrading the network. Customer would pay for network

Issue	Stakeholder	Comment
		costs associated with increased usage but not network reinforcement (p.23).
	Energex	Where a customer adds a significant load, these customers should pay appropriate contribution towards cost of connection to upgrade shared distribution asset upgrades (in line with AER charging guidelines) (pp.1-2).
	Energex	There should be a clear distinction between responsibility of DNSPS and other parties. DNSP responsibilities should only extend to the primary point of supply to the premises and any downstream arrangements should be the responsibility of third parties (p.10).
	Energex	Notes the proposed NER (and AER's connection charging guideline) for retail customers to be excluded from deep system network augmentation charges which means that it is possible that EV charging installations will not exceed thresholds in guideline. But is it appropriate for EV consumers to affect network charges for all consumers? There is a case for EV users to be on appropriate tariffs (p.11). Notes asset stranding issue. While with respect to tariffs there should be no differentiation between EV and non-EV households, this does not apply to connection services (p.12).
	SP AusNet	SP AusNet considers appropriate flexible tariff arrangements should provide appropriate signals. Additional augmentation costs should be levied against highest users both total and peak (kVA) load (p.8).Whether EV connections are incorporated into house values and whether if specific network connection/augmentation costs are levied on a property that they continue regardless of change of ownership (p.9).
	better place	Supports limiting cross-subsidies. Where a customer seeks to increase capacity of their network connection the distributor can make customer either pay an upfront network capital contribution charge or switch to an EV specific network tariff (eg. critical peak, TOU) (p.11).
	better place	There is merit in EV households being known to distributors and being service with metering and tariff options which support DSP (p.20).
	better place	Network connection issues arising from Vic govt EV trial include, double handling for establishing separate metering, duplication of service charges, uncertainty and

Issue	Stakeholder	Comment
		inconsistent interpretation of service installation rules, lack of choice for small customer in connection and metering configuration (p.19).
	Alternative Technology Association; Australian Electric Vehicle Association	New connections should take into account EV charging (p.5).
	Alternative Technology Association; Australian Electric Vehicle Association	Best way to apportion costs of network reinforcement and augmentation is not based on connection capacity but via dynamic pricing (p.5).
	UNSW Centre for Energy and Environmental Markets	Charging below a threshold should be a 'basic connection service' under the proposed Chapter 5A of the Rules. Charge control arrangements should be taken into account by DNSPs in calculating augmentation costs and assigning responsibility to the AER is likely to facilitate efficient uptake by preventing unreasonable connection charging. Clarify language so that definition of micro-embedded generator to include export under V2G arrangements from EVs (p.12).
	UNSW Centre for Energy and Environmental Markets	Economically efficient network pricing needs to be implemented in a fair and transparent manner rather than imposed on new technologies. Powers should be given to AER to oversee allocation of network costs with respect to new connections for EV charging (p.13)
Pricing	Tasmanian Department of Infrastructure, Energy and Resources	Regulatory arrangement must ensure cost reflective price signals are passed through to consumers in a way that encourages efficient uptake of DSP responses (p.2).
	Tasmanian Department of Infrastructure, Energy and Resources	Premises should be obliged to adopt cost-reflective tariffs (for all loads at the premises) before EVs are able to be charged at the premises. This can be extended to all large appliances for DSP generally (p.3).
	Energy Supply Association of Australia	Open, competitive energy markets free from distortions such as retail price regulation encourage prices to be efficient through the development of competitive market offers (p.5).
	AGL	TOU pricing is critical for EVs (ie. cost reflective critical peak prices) (p.2).

Issue	Stakeholder	Comment
	Aurora Energy	TOU tariffs are the most appropriate approach for EV charging (p.2).
	Origin Energy	Supports TOU but should not be mandated. Supports retail price deregulation (p.3).
	Energex	EV customers should be required to move onto a tariff with appropriate price signals and, where possible, combine this with demand management capability (p.1).
	SP AusNet	Price signals most efficient facilitator of efficient uptake of EVs (p.1).
	SP AusNet	Dynamic tariffs that do not differentiate between an EV and normal load offer best prospects for efficient deployment of EV charging load (p.1).
	SP AusNet	While an EV specific tariff is less palatable option compared to treating all loads equivalently and recognises this option needs to be considered (p.2).
	better place	Cap the maximum power of EV chargers which can be installed at premises under regulated flat network tariffs (p.12).
	ChargePoint	Incentivising EVs to minimise impact on peak demand. Through appropriate tariff structures applied across all types of EV charging (including commercial and business users) (p.2).
	Saturn Corporate Resources	If large numbers of PHEVs eventuate, TOU pricing is unlikely to sufficiently manage EV loads. Smart charging capability would appear to be an essential function to enable load management of PHEVs, as TOU pricing alone is unlikely to provide a firm limit on peak demands (p.8).
Pricing - retail	Ergon Energy	Sale of electricity should be dependent on the cost to provide electricity rather than purpose for which it is used. EV specific tariffs justifiable if there are specific network or market benefits for such sale (p.2).
	Ergon Energy	Consider what pricing measures need to be put in place when EVs are only means of

Issue	Stakeholder	Comment
		transport for a consumer especially in emergency situations (p.2).
	Origin Energy	Sale of electricity to EVs should not be treated differently to other load. Note do not need separate meter to measure an EV load, can use multi-element meters to separate loads and apply tariff differentiation (p.17).
	Energex	EV customers should not be permitted to remain on a tariff structure that does not incentivise charging (eg flat rate, inclining block) but rather should have TOU or controlled load tariff that applies to the entire premise load. If not there is a risk of convenience charging (p.7). These market and regulatory arrangements will affect the investment decisions of electricity infrastructure suppliers (p.7). For example, if no incentives for off-peak charging, then expected impact on peak demand is higher and resulting in higher forecasts of investment requirements (p.7).
	Energex	To ensure that uptake of Evs does not repeat air-conditioning experience, it is imperative if a customer has an EV there is a requirement to take up a more appropriate tariff that ensures they pay the efficient price for their impact on network infrastructure. This may require upgrade in metering infrastructure with electronic metering for TOU tariffs. If customers remain free to access regulated tariffs (eg flat rate) then a requirement for EV charging be controlled (p.8).
	SP AusNet	Appropriate flexible tariff arrangements should provide appropriate signal for both general and EV loads (p.6).
	better place	better place does not seek to be a retailer, rather a large multi-site business customer outside of the retail price regulation regime for that load (p.17).
	ChargePoint	There is a case for different tariffs to be applied against the total load of the household but this should not require separate NMI metering (p.10).
	Alternative Technology Association; Australian Electric Vehicle Association	Where electricity prices are still regulated, a regulated off-peak option should be available (p.4).

Issue	Stakeholder	Comment
	Alternative Technology Association; Australian Electric Vehicle Association	Advocates for innovative tariff structures (including dynamic and critical peak) to assist demand management (p.4).
	UNSW Centre for Energy and Environmental Markets	Given the slow rate of EV uptake, retail price regulation should not be a concern to AEMC in considering long term arrangements with respect to EV charging (p.9).
	UNSW Centre for Energy and Environmental Markets	Reforming current NEM retail markets requires a careful, transparent and fair restructuring process that doesn't discriminate against particular technologies. EV are an opportunity to explore challenges and opportunities in transition. (p.10). Innovation to enhance competition, consumer choice and efficient market outcomes might well come outside the electricity industry (new market players) (p.10).
Pricing - networks	Government of South Australia	Supports incentives on DNSPs to encourage charging during off-peak periods (p.2).
	Energy Supply Association of Australia	Victorian moratorium on TOU network pricing means there is little incentives for retailers to develop innovative pricing products/services (p.5).
	Aurora Energy	With regards to distribution services, Aurora considers that the pricing principles in clause 6.18.5 of the NER in conjunction with appropriate classification of distribution services for EV charging will ensure causer pays principle is met (p.1). Proposes a 'TOU specified demand' tariff where if the customer's demand exceeded a specified threshold, then a significantly higher rate would apply (p.2).
	Ausgrid	Ausgrid's current network TOU tariffs already provide strong price signals for off peak charging of EVs. Pricing should be considered as part of AEMC's power of choice review (p.8).
	Ergon Energy	Network pricing should be left to a DNSP to determine as they are responsible for managing peak demand (p.2).
	Origin Energy	New or bespoke network tariffs are not warranted for EV charging (p.18).

Issue	Stakeholder	Comment
	Origin Energy	If separate connection points are required, the network may charge the additional connection point costs for upgrading the network (p. 23).
	Energex	Does not consider new or bespoke network tariffs are required for EVs. Need for capacity based TOU network tariffs that apply to whole premise load and that these capacity charges are explicit in the retail tariffs. Also may be a case for discounted TOU tariffs where the premise has loads controlled by DNSPs (p.9).
	SP AusNet	Flexible tariffs should provide appropriate signals for both general/EV loads, but in lieu of a general tariffs, then interim tariffs to manage EV loads prior to wide scale adoption of flexible tariffs (p.7). This will need, at a minimum, a two element meter. If a network controlled load, this will require dedicated circuit for control. An appropriately structured EV tariff should be provided for clear messaging to consumers of appropriate charge times (p.7). But regulations need to be in place so that EVs are not part of a general consumption tariff or prevent gaming (pp.7-8).
	better place	Supports critical peak tariff structures to incentivise active management of EV charging load (p.18).
	Alternative Technology Association; Australian Electric Vehicle Association	NSPs should be allowed to offer innovative tariff structures to retailers (p.4).
	UNSW Centre for Energy and Environmental Markets	Agree that capacity based rather than volumetric based network pricing would send clearer signals to end users regarding impact of their decisions to invest in/operate loads on the network. But pricing should not be targeted at EVs and imposed on all end loads which contributes to network demand/expenditure (p.10).
Controlled charging	better place	Consumer research experience suggests few customers interested in distributor load control for EV charging as EV central to consumer's lives (p.12).
	Origin Energy	Costs and benefits of controlled charging can be apportioned between market and non-market participants and customers through contracts, but this is by case-by-case and invisible to policy makers. This should be made visible through third party NECF

Issue	Stakeholder	Comment
		inclusion (p.17).
	Energex	Need to be mindful of all market costs and impact on power quality and voltage where customers elect to allow third parties to control EV charging (p.6). DNSPs concerned with quality of supply whereas retailers, load aggregators and EV service providers concerned with capacity - need to ensure that market setting keep apace with technology and market developments (pp. 6-7).
	SP AusNet	Some controls may be required to ensure a random distribution of vehicle charging during off peak periods unless full dynamic pricing available (p.6). The primary consideration for controlling load on the network is continuing stability so all customers receive power and this lies best with DNSPs (p.6).
	ChargePoint	TOU and controlled charging through a smart appliance does not require separate metering arrangements or extensive commercial/admin arrangements. Controlled charging requires management and metering capabilities and cooperation between retailers and distributors. But rights to controlled charging can be assigned by an EV driver in return for lower tariffs (p.10). Decision making for smart charging has tensions between retailers and distributors, so appropriate control of charging requires involvement of both parties (p.10).
	UNSW Centre for Energy and Environmental Markets	TOU and controlled charging through a smart appliance does not require separate metering arrangements or extensive commercial/admin arrangements. Controlled charging requires management and metering capabilities and cooperation between retailers and distributors. But rights to controlled charging can be assigned by an EV driver in return for lower tariffs (p.10). Decision making for smart charging has tensions between retailers and distributors, so appropriate control of charging requires involvement of both parties (p.10).
Vehicle to Grid/Home	Ausgrid	V2G unlikely to emerge as a viable option in next 10 years (p. 9).
	Origin Energy	V2G exports, consumer would need a connection agreement with the network to ensure safety requirements etc (p.23). Issues of on-site small scale generation apply to EV discharging. Note, solar PV units do not use separate NMIs and discharge to grid

Issue	Stakeholder	Comment
		via home and EV should be managed this way (p.27). Complex policy and technical issues with V2G combined with solar PV etc (p.28).
	Energex	Energex notes the options for V2G being: 1) vehicle to premise (emergency supply) 2) vehicle to grid (constant discharge rate); 3) vehicle to grid (load following) (pp.13-15).
	SP AusNet	Control of discharging schedules will depend upon the function that EV supply used such as VAR support, network load support or minimising generation costs (p.9). This can be determined by contracts between parties to determine responsible controller of these functions. Note EV supply has availability issues and issues relating to the firmness of network support (p.9).
	better place	better place has no current plans to offer V2G or V2H to customers in Australia (p.21).
	Alternative Technology Association; Australian Electric Vehicle Association	Should encourage all types of DSP, including V2G/H (p.6).
	UNSW Centre for Energy and Environmental Markets	With respect to V2G/V2H current low level of feed-in tariffs (relative to retail tariff) more incentive to use it for within the home rather than export. (p.15) From a power quality perspective, V2H does not present particular issues, but V2G is a different matter. For V2G/V2H, note the financial implications under metering configurations (eg. parent-child) (p.16).

Table A.4 Natural Gas Vehicles comments

Issue	Stakeholder	Comment
General	Energy Networks Association	Unlikely to be any major issues in terms of connecting NGV related infrastructure (p.2).
	Energy Networks Association	CNG refuelling facilities are subject to gas retail licensing which adds a compliance burden without any benefit. Propose to expand exemptions from minimum ring-fencing arrangements for the manufacture and sale of CNG and LNG (p.2).
	Envestra; APA Group	Advocates establishing an innovation allowance to facilitate adequate funding for the deployment of evolving NGV technologies (Envestra, p.6; APA Group, p.2).
	APA Group	The Issues paper finding that EVs would establish as the dominant emerging technology is premature. The Issues paper seems to conclude that there exists a simple choice between technologies. This could reduce competition through 'picking winners' and diminish consumer choice (p.1).
Commercial re-fuelling: network	iGas Energy	CNG trucks fitted with iGas systems will be refuelled directly adjacent to high pressure transmission pipelines. There will be issues related to off-pipeline storage, use of line pack and load factor considerations, but these should be able to be managed through gas haulage and supply contracts (p.4). Do not believe that significant changes are necessary at this time, but it would be wise to observe the rate of change in other gas rich countries (p.4).
Commercial re-fuelling: retail	iGas Energy	Major energy users would have gas supply contracts with wholesalers/producers or be spot market traders (p.5).

B Appendix B - Overview of Western Australia's electricity market

Western Australia's electricity supply industry is comprised of several distinct systems, none of which are interconnected to the NEM. The South-West Interconnected System (SWIS) around Perth and the south-west of the State is by far the largest of these, and is the only system in Western Australia to support a wholesale market. Western Australia introduced the Wholesale Electricity Market (WEM) into the SWIS in September 2006. This reform was designed to provide consumers with choice of competitively priced energy products and services, and to attract private investment into the market.

B.1 Governance and market structure

Several key governance bodies exist in the WEM:

- Independent Market Operator (IMO) - the market operator who maintains and develops the Market Rules and procedures, registers Rule Participants and operates the Short Term Energy Market (STEM) and the Reserve Capacity Mechanism;
- System Management – a ring-fenced entity within Western Power responsible for operating the power system to maintain security and reliability;
- Economic Regulation Authority – the jurisdictional regulator, responsible for economic regulation and market monitoring; and
- Market Advisory Committee – an industry and consumer group convened by the IMO to advise on changes to Market Rules and procedures.

In terms of market structure, while there are numerous market participants registered as market generators, market customers or as both, the dominant participants in the market are:

- Western Power networks - responsible for operating the transmission and distribution system;
- Synergy – the incumbent retailer and is the only retailer allowed to serve customers that do not have an interval meter;
- Verve Energy – the largest market generator in the SWIS. In addition, it is required to make its capacity available to System Management to provide ancillary services and must balance the entire system in real time; and
- Horizon Power - is responsible for all of the functions of generating or procuring, transmitting and retailing electricity to customers outside of the SWIS.

B.2 Key WEM mechanisms

B.2.1 Reserve Capacity Mechanism

Unlike the NEM, which is an energy only market, the WEM has a Reserved Capacity Mechanism. This Reserve Capacity Mechanism is administered by the IMO and its purpose is to ensure adequate generation capacity exists to meet expected demand in a given time period. In basic terms, the Reserve Capacity Mechanism obliges retailers (or parties purchasing power in the WEM) to either secure adequate capacity bilaterally (from generators) or from the IMO to ensure that the SWIS generation capacity requirements are met.

B.2.2 Bilateral contracts

Bilateral trades of energy and capacity occur between Market Participants and the IMO has no interest in how these trades are formed. However, Market Participants are required to submit bilateral schedule data pertaining to bilateral energy transactions to the IMO each day so that the transactions can be scheduled.

B.2.3 Short Term Energy Market

The STEM is a daily forward market for energy that allows Market Participants to trade around their bilateral energy position, producing a net contract position. The combined net bilateral position and STEM position of a Market Participant describes its net contract position.

B.2.4 Balancing

Balancing refers to the settlement process to address the cost of the difference between the net contract position of Market Participants and their actual supply and consumption levels, allowing for dispatch instructions issued by System Management.

B.2.5 Ancillary Services

Ancillary Services are services required to support the energy market but which are not traded as part of the energy market and are procured by System Management.

B.2.6 WEM mechanisms operating together

These market mechanisms are designed to operate together. Most energy is traded outside the IMO administered market via bilateral contracts between Market Customers and Market Generators. These bilateral contracts can have energy and capacity components. Market Customers and Market Generators can modify their bilateral energy position through trading in the STEM. Finally, buying or selling energy via the Balancing process is the last resort in the circumstances where actual

energy supplied or consumed differs from that contracted in the day-ahead mechanisms. Further, System Management is required to secure ancillary services, the costs of these services are passed on to those participating in the market.

B.3 Market Evolution Program

The Market Evolution Program was designed to improve aspects of the WEM. The Market Rules Evolution Plan was endorsed by Market Participants on the Market Advisory Committee (MAC). Key changes will include:

- more cost reflective balancing pricing and opportunities to provide competition for balancing services;
- a greater ability to use more accurate information in the operation of the STEM;
- a more "real time" targeted reserve capacity refund system;
- more opportunities for competition in the provision of Ancillary Services; and
- a more adaptable IT system supporting the current WEM.

In April 2011, the IMO board approved the new Balancing and Load Following Ancillary Services market arrangements. These new arrangements will enable greater competition in the provision of balancing by creating a half hour ahead market for balancing energy and a market for load following ancillary services. Rule drafting and system development is now underway with the aim of the new rules coming into operation in April 2012.

B.4 Retail pricing in Western Australia

In Western Australia, all residential electricity customers remain on standing offer contracts.[113] Also, the prices that customers pay are significantly lower than the actual cost of providing these services as the Western Australian government provides a tax payer funded community service obligation (CSO) payment to the retailers to fund the difference between the actual cost of supplying energy in the SWIS and the price paid by consumers.

In addition to the CSO payment provided by the WA government, customers in the SWIS also pay a contribution, namely, the Tariff Equalisation Contribution (TEC). The TEC is used to fund the difference between the costs of supplying electricity in the SWIS and the cost of supplying electricity outside the SWIS.

113 Australian Energy Market Commission, *Future Possible Retail Electricity Price Movements: 1 July 2010 to 30 June 2013*, final report, AEMC, 30 November 2010, Sydney