AEMC

REVIEW

Australian Energy Market Commission

FINAL ADVICE

Energy market arrangements for electric and natural gas vehicles

Commissioners
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Spalding

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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 established the 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 enable the economically efficient uptake of these vehicles in the National Electricity Market (NEM), in Western Australia's electricity market and in the nation's natural gas markets.

With respect to EVs (both plug-in hybrid electric vehicles and battery electric vehicles), we found that, in general, there are appropriate energy market arrangements in place to enable the economically efficient uptake of EVs. However there are some areas for reform to incentivise efficient EV charging behaviour and to enhance 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 encourage efficient investment decisions for both consumers and providers 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 market arrangements were necessary.

Our final 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 enable the 'economically efficient' uptake of EVs and NGVs, we took guidance from the following key principles:

- to enhance consumer choice in the way these technologies are used;
- to appropriately allocate costs to the party that causes these costs, as far as it is efficient and practicable to do so;
- to maintain 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.

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. 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 and at different locations. 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).[1] 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 at non-peak times would avoid these extra costs being borne by all consumers.

In summary our key recommendations are as follows:

- Pricing signals (particularly network pricing signals) are a key means of facilitating efficient demand side participation (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. As stated in our power of choice review, we propose that cost reflective network pricing be phased in through a banding approach, with medium to large consumers transitioned to efficient and flexible network prices to begin with (for large residential and small business consumers such network prices would be mandatory). This should be set to capture a high proportion of EV consumers.

- All EVs should have a metering installation with interval read capability. These metering arrangements would enable the application of time varying tariffs and allow consumers to manage their electricity consumption. These metering installations should be compliant with the SCER endorsed minimum functionality specification.

- Controlled EV charging, where an EV owner delegates the right to charge its EV to another party, is a form of load management and we recommend technical standards to encourage arrangements that balance the need to maintain network security while enabling different providers to offer controlled EV charging services.

- New metering arrangements that enable the separation of load (or generation) for the purposes of DSP. This should enable 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.

1 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.

- 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. We note that there are divergent views and consider that the NERL should be amended to resolve this ambiguity.

- While our legal interpretation is that EV charging is covered by the NERL, we consider that as a matter of policy, EV charging in a commercial context should not be covered by the NERL by way of an exemption because of the contestable nature of these transactions. We therefore recommend that the Australian Energy Regulator (AER) review its retail exemption framework when applied to commercial EV charging.

- Certain aspects of Western Australia's electricity market arrangements could be reviewed at the appropriate time to enable 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 incentivise efficient EV charging behaviour	Implement pricing arrangements that reflect the underlying cost of supply.	SCER to review recommendations as expressed in the power of choice review.
Controlled EV charging	Propose that technical standards for load management be developed.	Some of these issues may be addressed in AEMC rule changes.
Metering arrangements	Proposing new metering arrangements to segment electricity load and enhance consumer choice.	SCER to review the AEMC's draft metering specification and may propose a rule change request to the AEMC.
Sale of electricity	Propose that SCER review section 88 of the NERL to remove ambiguity in interpretation.	SCER to review section 88 of the NERL.
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 when	The AER review its retail exemptions framework.

Issue	Recommendation	Proposed implementation
	applied to commercial (ie. non-residential) EV charging.	

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 DSP. Our view is that an EV is another form of DSP.

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1 Introduction

On 28 July 2011, the AEMC received a Request for Advice from the MCE (now SCER)[2] asking us to assess whether the energy market arrangements can enable the efficient uptake of EVs and NGVs. The Request for Advice forms the basis of our review.

In this final advice we:

- provide our final recommendations with respect to EVs; and
- provide our final recommendations with respect to NGVs.

We acknowledge all of the submissions we received to date from the Approach Paper, the Issues Paper and the Draft Advice.[3] All of these submissions have assisted us in developing our Final 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 enable the efficient uptake of EVs and NGVs. The SCER instructed the AEMC to identify the energy market arrangements needed to facilitate the uptake of EVs and NGVs.[4]

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 Electric Driveway Project.[5] The lessons emerging from these trials and research are important for setting out the context of our advice to the SCER.

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2 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.

3 Available at www.aemc.gov.au.

4 Available at www.aemc.gov.au.

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

Our work on the power of choice review is directly relevant to this Request for Advice.[6] 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 have coordinated these two reviews to provide consistent and comprehensive advice.

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.

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 final 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

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

assistance for these technologies are treated as out of scope.[7] Also, issues relating to technical and safety standards of low emissions vehicles are treated as out of scope for this review.[8]

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 driving 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:

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:

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.

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.

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

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

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. 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:

- enhance consumer choice in the way these technologies are used;
- appropriately allocate costs to the party that causes these costs, as far as this is efficient and practicable to do so;
- maintain 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.

Stage of Approach	Objective	Outcome
Step 4	Identify the appropriate electricity market or natural gas market regulatory arrangements necessary to enable the economically efficient uptake of EVs and NGVs.	Addressed in our draft and final 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 and final advice.

1.4 Our approach to the final advice

Our approach to the final 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 Final advice based on findings of EV and NGV uptake

Our final advice is based upon the evidence provided to us by AECOM relating to EV and NGV uptake.[9] 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 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 important that there are appropriate energy market arrangements in place to manage the impact of EVs on the electricity system. This final advice is developed with this imperative in mind.

We note that forecast uptake is uncertain. 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.

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

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. Stakeholder submissions from energy market institutions and participants affirmed this view.[10]

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.[11] It is conceivable that EV service provider business models could emerge to meet these consumer preferences. In fact, better place[12] (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.[13]

We recognise that in some circumstances specific energy market arrangements for EVs may be necessary (for example, network licensing exemptions for providers of EV charging). Generally, however, 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.[14]

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

To frame our final 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 final 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 incentivise efficient charging behaviour with respect to EVs by apportioning costs consistent with the causer-pays principle and enhancing benefits?

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10 Ausgrid, *Response to AEMC Draft Advice - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 1; Australian Energy Market Operator (AEMO), *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 11 October 2012, p. 1.

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

12 See www.betterplace.com.au.

13 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.

14 Available at www.aemc.gov.au.

2. What energy market arrangements are needed to enhance 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 enhance 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 facilitating efficient behaviour (question one) and enhancing consumer choice (question two).

Both of these questions have assisted us in structuring and conveying our final advice.

1.4.4 EV charging locations and EV service provider business models

When we developed our final 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 home, work and other commercial premises. From an electricity market perspective, EV charging generally occurs at two points on a network:[15]

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

- 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.[16] This occurs through an on-selling arrangement.[17]

We 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[18] (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.

In providing our final 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 final advice and its relationship with the National Energy Customer Framework

Our final 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

16 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.

17 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.

18 This occurs in international jurisdictions.

different times.[19] Given the slow uptake of EVs in the short term, it is appropriate that our final 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 the National Electricity Rules (NER) that sets out the framework for retail consumers connecting to the distribution network.

The aspects of the NECF that affect our final 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 final advice.

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

1.5 Structure of the final advice

This final advice is structured as follows:

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

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

This final advice also contains the following Appendices:

- Appendix A - Submissions summary table - draft advice; and
- Appendix B - Draft framework specification for metering arrangements.

1.6 Next steps after 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. If our recommendations are implemented through the AEMC's rule change process, then there will be further opportunity for stakeholders to participate.

2 Electric Vehicles - NEM arrangements to incentivise efficient charging behaviour

Given the uptake of EVs in Australia, if EV charging behaviour is unmanaged,[20] then this charging behaviour has the collective potential to have a significant impact on peak demand and impose substantial costs to the electricity system.[21] 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).[22] Of this amount, we estimated that approximately $3,000 - $3,500 of these costs would be paid for by the EV consumer.[23] The remainder of these costs ($6,500 - $7,000) would be borne by all consumers. Over a five year 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 incentivise 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[24] 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 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 that incentivises EV charging resulting in efficient market outcomes.

We are also recommending ways to realise the benefits that EVs can provide to the energy market.

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20 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.

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

22 AECOM (2012), Final Advice, p. ix. 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.

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

24 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

Final recommendation

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

To provide incentives for efficient EV charging behaviour and encourage an efficient level of DSP generally, our Power of choice review recommended that efficient and flexible retail energy options require a transition to cost reflective network prices. We propose that cost reflective network pricing be phased in through a banding approach, with medium to large consumers transitioned to efficient and flexible network prices to begin with (for large residential and small business consumers such network prices would be mandatory). This should be set to capture a high proportion of EV consumers. We consider that introducing efficient and flexible network prices would encourage the development of efficient and flexible retail tariffs.

To address the possible effects of EVs clustering at particular locations resulting in local network impacts, our power of choice review is recommending approaches to encourage locational network pricing subject to jurisdictional arrangements.

Finally, we recommend that all EV charging locations should be equipped with metering installations that have interval reading capability to enable the application of efficient and flexible tariffs and to make the EV load amenable to DSP. These metering installations should be consistent with the SCER endorsed minimum functionality specification as proposed in our power of choice review.

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

both system peak demand and local network constraints[25], particularly where EV charging is unmanaged. AECOM found that EVs would contribute to peak demand if charging is unmanaged. AECOM estimated that if charging is unmanaged, EVs could contribute an additional 7.3 per cent by 2020 or 36.5 per cent by 2030 of peak demand. 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. EV loads are typically flexible in nature because an EV can be charged at different times of the day. Also, in the future, it may be possible for an EV's battery to 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.[26] In the presence of dynamic pricing (that is, pricing that changes in real time in response to changing market conditions), an EV load can be used for network management, to manage wholesale price risk and for the efficient use of intermittent renewable generation.[27]

Importantly, our obligation 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.[28] 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 are developed in conjunction with 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.[29] For

25 Local network peak and system peaks may not be coincident.

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

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

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

29 Refer to Fact sheet 'retail tariff model -explained' on the power of choice review webpage at www.aemc.gov.au.

example, we estimated that if a consumer with a medium sized passenger EV was to 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 enable the application of these pricing signals; and
- it is in the consumer's interest to have meters with interval read capability 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 (particularly through network pricing signals) should be the principal means of encouraging efficient EV charging behaviour.[31] Some stakeholders argued that there should be general TOU pricing signals applied to the entire household load and therefore pricing signals should not apply specifically to EVs.[32] However, it was also recognised that EV specific tariffs may be offered by the market as a result of consumers exercising their preferences.[33]

The pricing signals that consumers face are composed of:

- energy prices (from the wholesale market);
- network prices (from the transmission and distribution network); and
- price associated with a retailer's costs and margin.

With respect to energy prices, we acknowledge AECOM's report which 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 effectively 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, over time, defer network investments. Network pricing signals can better reflect the cost impacts that appliances, such as EVs,

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

31 For example, see Origin Energy, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 5; Energex, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 1 October 2012, p. 2.

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.

33 Australian Energy Regulator, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 2 October 2012, p. 3.

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. 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
- meters with interval read capability are necessary to enable consumers to be incentivised to behave in a manner that yields efficient market outcomes.[34]

As discussed in our Power of choice review, to support the transition of the energy market to efficient and flexible retail energy options for residential and small business consumers, we propose to introduce cost reflective electricity distribution network pricing structures. These pricing structures aim to signal the impact of consumers using the network at times of peak demand. These pricing structures aim to give DNSPs the flexibility to be innovative, including developing price signals based on the location of network constraints. We consider that cost reflective network prices would provide an incentive for electricity retailers to develop efficient and flexible retail tariffs.

In our Power of choice review we propose to phase in cost reflective network pricing by segmenting residential and small business consumers into three consumption bands and applying flexible (i.e. time varying) pricing options in different ways:

- Large residential and small business consumers above a defined threshold will be required to have a cost reflective network price as part of their retail tariff structure (Band 1);
- Residential and small business consumers below Band 1 and above a defined threshold that have a meter with interval read capability would transition to a retail tariff structure that includes a cost reflective network charge. These consumers would have the option to remain on their existing retail tariff structure (Band 2); and
- All other residential and small business consumers would remain on their existing retail tariff structure. These consumers (which have an interval or smart meter) are able to choose a cost reflective retail tariff structure (Band 3).

We recommend that large loads should be captured under consumption in band one where it would be mandatory for these loads to be on a cost reflective network price. These consumption bands would be designed so that large loads, such as an EV load, are priced to reflect the underlying costs of supplying electricity.

We note that these consumption bands are designed to target the overall consumption at a premise. We consider that a typical household with an air-conditioner and an EV should fall under band one and face a mandatory cost reflective network charge.

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34 The Power of choice review is exploring how high use consumers, such as EV consumers can be allocated smart meters to encourage efficient behaviour.

However, other households, even some households with EVs that do not require significant home charging, may have an annual consumption that results in that household falling under band two or band three.

In relation to the clustering of EVs at particular locations, we suggest that rules be developed to cater for some form of locational pricing. However, we note that such proposals are dependent upon jurisdictional arrangements. We acknowledge views in submissions where non-locational pricing arrangements have endured because of concerns regarding equity between regions (eg. rural/urban) within a jurisdiction.[35]

To subject EV loads (and other large loads) to efficient and flexible tariffs and to participate as a form of DSP, we consider that it is necessary for there to be metering installations with interval read capability. Such meters can measure electricity consumption in half-hourly intervals and can convey the varying costs of supplying electricity over time. A smart meter is therefore a prerequisite for the application of efficient and flexible tariffs. Moreover, a smart meter is a key means of incentivising efficient behaviour - that is, behaviour that yields least costs to the electricity system.

As stated above, it is possible that EV specific tariffs may be developed by industry, including EV service providers, retailers and networks. We favour an approach that does not mandate tariffs based on technological type but rather, that tariffs be applied to all forms of DSP more broadly. We acknowledge, however, that 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 enable 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 illustrates an example of a utility offering an EV-specific tariff.

Case study: Pacific Gas and Electric Company

Pacific Gas and Electric Company (PG&E) is a natural gas and electricity 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.[36] 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.

35 Energex, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles,* submission to the AEMC, 1 October 2012, p. 2; SP AusNet, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 5 October 2012, p. 7.

36 http://www.pge.com/myhome/environment/whatyoucando/electricdrivevehicles/rateoptions/ (accessed 15 November 2012)

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 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 cost 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 limits 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 also be equity implications of this approach. We recognise that while pricing incentives are necessary to encourage efficient behaviour, it may not always be sufficient to achieve intended outcomes given the existing market and regulatory context.

2.2 Connection to the distribution network

Final 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 for those jurisdictions that have adopted the NECF. 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.[37] 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.

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

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[38] set by the DNSP (and approved by the AER).

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 EV charging as a form of load management

Final recommendation

Controlled EV charging is a form of load management. We take load management to mean the management of a consumer's load by another party (network, retailer or a third party DSP provider, such as an aggregator) in accordance with an agreed contract with the consumer.

We propose the following principles for load management:

- the customer has the right to control its load;
- the customer may assign this right to another party to provide load management services; and
- decisions on load management require involvement of DNSPs to safeguard network security.

We recognise that technical standards for load management are necessary. We are assessing the *Connecting Embedded Generators* rule change request, which may provide technical standards (such as protocols for controllable load) for connecting to a distribution network.

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

We also recognise that a regulatory framework (including a dispute resolution process) for load management is necessary. We consider that Chapter 5A of the NER, which applies to jurisdictions that have implemented the NECF, provides a dispute resolution process between DNSPs and retail customers.

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 another party (such as a retailer, DNSP or aggregator). The party assigned the right to control EV charging 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 (and implicitly to the consumer in accordance with the contract) in the electricity supply chain. Controlled charging can be used to more accurately match intermittent renewable energy with EV load and for the EV load to participate as a form of DSP more generally.

2.3.2 Analysis

On a fundamental level, we consider that the right to control the charging of an EV is a right that is vested in the EV consumer. This means that the EV consumer enjoys the benefit while also having responsibility for the costs involved in the exercise of this right.

The EV consumer can assign this right to another party in exchange for a share of the benefits (such as through lower tariffs). The EV consumer can assign this right in a contestable manner; that is DNSPs, retailers and aggregators can compete to acquire this right from the consumer.[39] In assigning this right, it is necessary that there is sufficient education to equip the EV consumer to exercise this right in an informed manner.

We consider that controlled EV charging is effectively a form of load management. We have taken load management to mean the management of a consumer's load by another party (either a network, retailer or a third party DSP provider, such as an aggregator) in accordance with an agreed contract with a consumer.

However, load management in general, and controlled EV charging in particular, can impose risks on DNSPs. In the context of EV charging, these risks refer to concurrent switching or block charging where a significant number of EVs are charged at similar times leading to voltage impacts in the local distribution network. Submissions from DNSPs raised concerns with network security and power quality issues that could

39 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.

arise with controlled EV charging.[40] Energex argued that DNSPs and retailers/aggregators have differing interests in relation to controlled EV charging; the former were concerned with quality of supply whereas the latter were concerned with capacity.[41]

In balancing the right for a consumer (and its agent) to engage in controlled charging with the need to safeguard network security, we have distilled several principles pertaining to load management. These principles apply equally to the controlled charging of EVs, to other sources of direct load control (DLC) and to load management generally. These principles are:

- The consumer always has the right to control its load;
- The consumer may enter into a contract where it assigns this right to control its load to any party (eg. networks, retailers or 3rd party DSP service providers, such as aggregators) to engage in direct load control or load management;
- The DNSP does not have an automatic right to veto or block any load management on their system (unless recognised in technical standards or in accordance with a contract); and
- Clear and transparent technical standards should be developed in consultation with industry.

In relation to the content of these technical standards, it should, among other things, establish:

- situations where significant load management could cause a material network issue;
- situations where load management may cause issues for neighbouring premises;
- the threshold amount where the sum of Mega Watt (MW) load management contracts within a defined area of the network could put at risk the network's ability to meet its reliability and supply obligations;
- any metering requirements for the consumer to enter into load management based on consumer type (residential and commercial/industrial); and
- procedures for bringing back load into the network.

40 Energex, *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 February 2012, p. 12; SP AusNet, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas* vehicles, submission to the AEMC, 5 October 2012, p. 5; Ergon energy, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 1 October 2012, p. 1.

41 Ibid.

In addition, the regulatory framework more generally should specify:

- the set of liabilities under the NER;
- a dispute resolution process in the case of conflicts of coordination among multiple parties attempting load management on a network; and
- avenues of compensation for affected parties. For example, where a network inappropriately blocks a load management request or load block switching adversely affects a network.

We agree with submissions from DNSPs that the regulatory framework in relation to load management should be extended so that it applies to third party providers.[42] Equally, the regulatory framework should fairly apportion responsibilities among all parties and should be designed in a way that enables the efficient provision of DSP in the NEM.

We have considered how our recommendations can be implemented in relation to technical standards for load management and the regulatory framework to apply more generally. The AEMC is currently considering the *Connecting Embedded Generators* rule change request, which includes examining the requirements for technical standards for the connection of embedded generation to the distribution network.[43] If the outcome of this rule change request results in the introduction of any provisions for technical standards, these technical standards could apply to load as well as embedded generation connections. Therefore, without specifying the scope, this rule change may potentially address technical standards (and appropriate protocols) for controllable loads connecting to a distribution network.

In relation to the regulatory framework to apply between parties seeking to engage in managing load (including controllable load), we consider that the NECF would operate in the applicable jurisdictions. Specifically, Chapter 5A of the NER (which forms part of the NECF legislative package) sets out a dispute resolution process between DNSPs and retail customers.[44] Under this process, the AER is responsible for determining disputes between DNSPs and retail customers. This dispute resolution process would apply to parties managing load to the extent that they are considered to be retail customers under Chapter 5A of the NER.

42 SP AusNet, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 5 October 2012, p. 5.

43 http://www.aemc.gov.au/Electricity/Rule-changes/Open/connecting-embedded-generators.html

44 Refer to Part G of Chapter 5A of the NER. An electronic version of the NER is available at www.aemc.gov.au.

2.4 Vehicle-to-grid

Final 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 contracts. There is a role for third parties to negotiate on behalf of consumers the set of benefits falling across multiple parties.

We recommend that all distributed generation units (even non-market generating units) should contain interval metering capability to enable the application of efficient and flexible tariffs and to enhance its participation as a form of DSP.

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 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.[45] 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.[46] Other studies have raised issues associated with the complexities faced by DNSPs 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.[47]

Separately, we note the development of energy storage devices that can store intermittent/renewable generation, such as zinc-bromide battery modules developed by Redflow.[48] These energy storage devices have similar issues to V2G.

We shall consider the energy market issues to enhance the use of V2G in the long term.

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45 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.

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

47 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.

48 www.redflow.com.au.

2.4.2 Analysis

Similar to our thinking in relation to controlled charging, we consider that the right over V2G (i.e. 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 reinforces 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.[49] This situation underscores the importance of commercial contracts between the parties, including consumers, to capture 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. In effect, this means that V2G would need to conform with any technical standards relating to distributed generation and ensure that network security and safety is maintained. Our discussion on load management in the previous section of this Chapter is also relevant here.

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 tariff (where retail tariffs are not cost reflective), which suggests that there are more incentives for vehicle to home (V2H) than V2G.[50] Consideration of feed-in tariffs is a jurisdictional matter and will not be addressed further within this review.

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49 SP AusNet, *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 February 2012, p. 9.

50 UNSW Centre for Energy and Environmental Markets, *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 6 March 2012, p.15.

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. However, we note that V2G is not commercially available at this time. Furthermore, views from submissions supported the position that this clause should remain in its current form.[51]

Finally, we consider that all generating units, even non-market generating units, should have smart meters to enable time varying prices and to enhance an efficient level of DSP. This metering technology enables the capture of the differing value of exported generation throughout the course of the day.

2.5 Identifying a large load (including an EV)

Final recommendation

We consider that it is not necessary to mandate requirements to identify EV loads or similar large loads through the National Electricity Rules because there are existing mechanisms for DNSPs to be informed of the nature of the loads on their networks.

2.5.1 Significance of the issue

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 an EV load or a similar 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 efficient and flexible tariffs to consumers to manage impact on system demand.

2.5.2 Analysis

There are a number of avenues whereby loads, including large loads, can be identified to the distribution network. These include:

51 See for example, Aurora Energy, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 2 October 2012, p. 7.

- DNSP's connection policies;
- jurisdictional safety and network management regulations; and
- Wiring Rules (AS/NZS 3000: 2007).

In addition, under the NECF, new or altered connections above a certain capacity (according to a threshold set by a DNSP and approved by the AER) would be liable for connection charges in accordance with Chapter 5A of the Rules.

We consider that it is not necessary to mandate specific requirements in the National Electricity Rules to identify large loads. Views from DNSPs in submissions also support this position.[52] We recognise that a degree of flexibility will be required of DNSPs as to how they capture local constraints.[53]

52 Ausgrid, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 4; SP AusNet, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 5 October 2012.

53 Australian Energy Regulator, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 2 October 2012, p. 4.

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

In this chapter we discuss our final recommendations with respect to the metering arrangements that are necessary to facilitate consumer choice and incentivise efficient EV charging. In the context of EVs, we consider that 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 option of separate metering of the EV load from other loads in the premise 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:

- enable subtractive metering[54] 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 settlements points, and associated financially responsible market participants, at one connection point.

Our policy objective is to enhance consumer choice, encourage efficient behaviour and promote innovation in energy services available to consumers by allowing two or more retailers to be financially responsible for different parts of a consumer's load. This would be achieved by enabling subtractive metering arrangements and clarifying the use of multi element meters at a consumer's premise.

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

In addition to the submissions received on our issues paper and draft report, the development of our metering proposals was informed by two industry workshops on the metering issues. At our first workshop[55] we focussed on the arrangements for separately metering an EV charging load. At our second workshop[56] we sought

54 Subtractive metering is also known as parent-child metering when it is used within an embedded network.

55 Held in Sydney on 29 February 2012.

56 Held in Melbourne on 16 May 2012.

feedback on our developing proposals, as well as on our proposed arrangements to promote further uptake of interval metering. In addition, we held bilateral meetings with interested stakeholders.

Draft framework specification

We have not attached detailed proposed rule changes to this report in relation to the recommended metering arrangements. Instead we have provided a draft specification of a set of rule change proposals for all our recommendations in Appendix B. The proposed recommendations are for the SCER to consider. Subject to the SCER's endorsement, these proposed recommendations may be implemented through rule changes and other regulatory mechanisms.

Roles of Responsible Person and Metering Coordinator

In the Power of choice review we recommended changes to the role of the Responsible Person, that is:

- replacing the term 'Responsible Person' in the NER with the new term 'Metering Coordinator'; and
- allow any entity that is accredited with AEMO to perform the role of metering coordinator.

In this chapter we have used the new term - 'Metering Coordinator' - when referring to the Responsible Person role. This provides consistency in terminology between this review and the Power of choice review.

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

Final recommendation

We recommend that the term 'connection point' in Chapter 7 and Rule 3.15 of the NER be replaced with 'settlements point'. The settlements 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[57] 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 the retail sale of energy be unbundled from demand side responses, as it considers that this would promote competition in the trading of demand side response at the spot price.[58]

The term 'connection point' has two different meanings depending on the context 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 generated or consumed energy 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 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

57 The Financially Responsible Person (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.

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

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 where the energy is metered.

We are proposing to include a new term 'settlements point' in the NER to define where the energy at a connection point is metered.[59] This would allow a consumer to use multiple meters to measure the consumption (or generation) of parts of its load while still only having a single connection point.

AEMO supports the proposal as it considers it will lead to a greater degree of flexibility in the metering arrangements and facilitate consumers having relationships with more than one FRMP. AEMO considers that this would potentially enhance competition in retail markets, as well as the provision of meter and data services.[60] Some stakeholders considered that the term 'metering point' be used when referring to the settlements point within with multiple FRMPs.[61] We did not use the 'metering point' because that term is already used in the NER for another purpose.[62]

In addition, Ausgrid noted creating a separate term for metering and settlements may require some consequential changes to the National Energy Retail Rules (NERR).[63] We agree that the NERR would need to be reviewed for consistency should this recommendation be adopted.

The following figure shows the situations where a premise 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 settlements point. The second diagram shows the arrangement where the load is subdivided into two parts with a settlements point defined for each part so that they can be separately metered.

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59 Note that in our draft advice we proposed the term 'supply point' be used. We changed this recommendation for the final advice because of the potential confusion caused with the term '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.

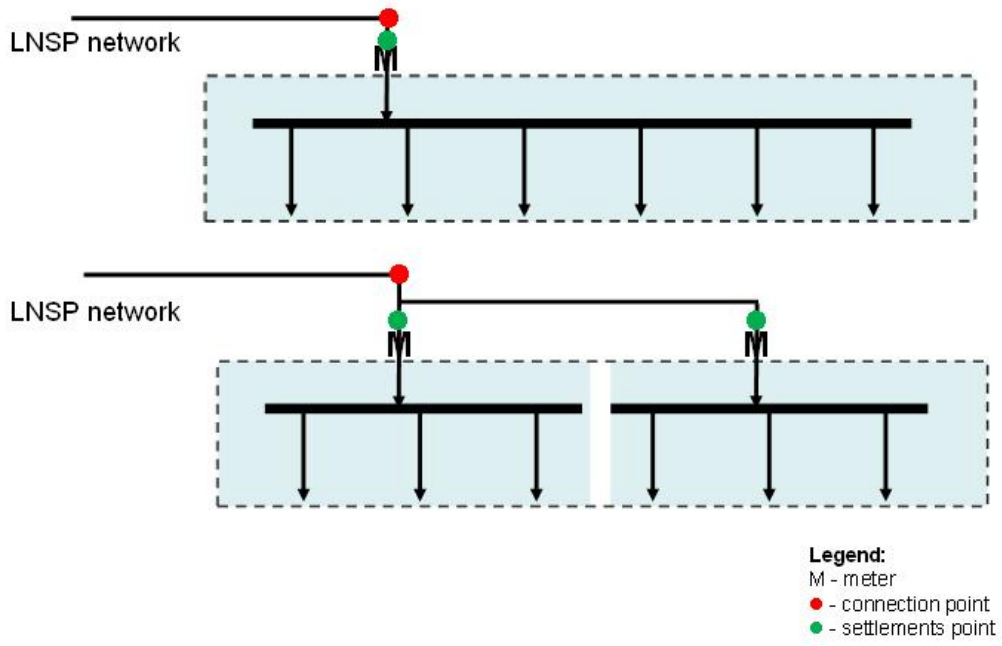
60 AEMO, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 11 October 2012, p. 2.

61 Aurora Energy, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 2 October 2012, p. 9; Energex, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 1 October 2012, p. 3; Alternative Technology Association, *Response to AEMC Draft Advice - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 5 October 2012.

62 Metering point is used to refer to the point where energy flows are metered. Some metering installations include multiple metering points, for example some large industrial sites or the connection point between two networks at. Also, some 'metering points' are located away from the connection point.

63 Ausgrid, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 5.

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



3.2 Subtractive metering at a site with a single consumer

Final recommendation

We recommend that a consumer be able to arrange for a 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:

- the subtractive metering arrangement would not constitute an embedded network;
- losses within the premises would be assigned to the upstream meter;
- all fixed Distribution Use Of System (DUOS) charges would be assigned to the FRMP for the upstream National Metering Identifier (NMI), unless

otherwise agreed with the consumer;

- the NMI for the downstream meter(s) would be assigned by the Metering Coordinator[64] for the downstream meter; and
- a different FRMP could be assigned to the upstream and each downstream metering installation.

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.[65] We have not verified these cost estimates.

A potentially cheaper alternative to installing a separate meter at the main switchboard is to install a downstream meter[66] for the separately measured load.[67] Installing a downstream meter is likely to be cheaper and more practical than installing a separate meter at the existing switchboard because it can be undertaken during a single visit to the premises, does not require an interruption of the supply to the remainder of the load at the premises[68] and does not require any LNSP involvement.

As well as installing the downstream meter, the Metering Coordinator[69] for the downstream metering installation would need to establish a subtractive relationship with the existing upstream metering installation. The result is that the downstream 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 readings on the existing upstream meter and the downstream 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

64 The choice of the Metering Coordinator is specified in the NER.

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

66 In the draft report we referred to existing meter at the main switchboard as the parent meter and the meter for the separate load as the child meter. For the final advice we are referring to the parent and child meters as the upstream and downstream meters respectively. This was done to avoid confusion with the use of parent and child meters in an embedded network, as discussed in section 3.4 of this final advice.

67 Better place, *Response to AEMC Approach Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 October 2011, p. 16.

68 Ibid.

69 The Metering Coordinator is a technical role; the Metering Coordinator 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.

can be offered to consumers, and hence increase competition in the provision of EV services and demand side options.

3.2.2 Analysis

The current metering arrangements facilitate the possibility of subtractive (or upstream/downstream) metering arrangements but there is uncertainty as to how these arrangements work in practice. Establishing a subtractive metering arrangement within a premise encounters a number of issues including:

- who should be financially responsible for losses within the premises;
- 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;[70] and
- the Local Network Service Provider (LNSP) is usually the Metering Coordinator for the existing upstream meter but may be reluctant to be the Metering Coordinator for the downstream 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.[71] For example, the losses within the premise can be arbitrarily assigned to existing upstream metering installation (or any other metering installation with the agreement of the consumer).[72] 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

70 The metering installations within a subtractive 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 downstream 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 an interval meter.

71 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.

72 The losses within the premises would be automatically assigned to the upstream metering installation as this installation measures the total consumption within the premises, including losses, less the consumer at the downstream metering installation.

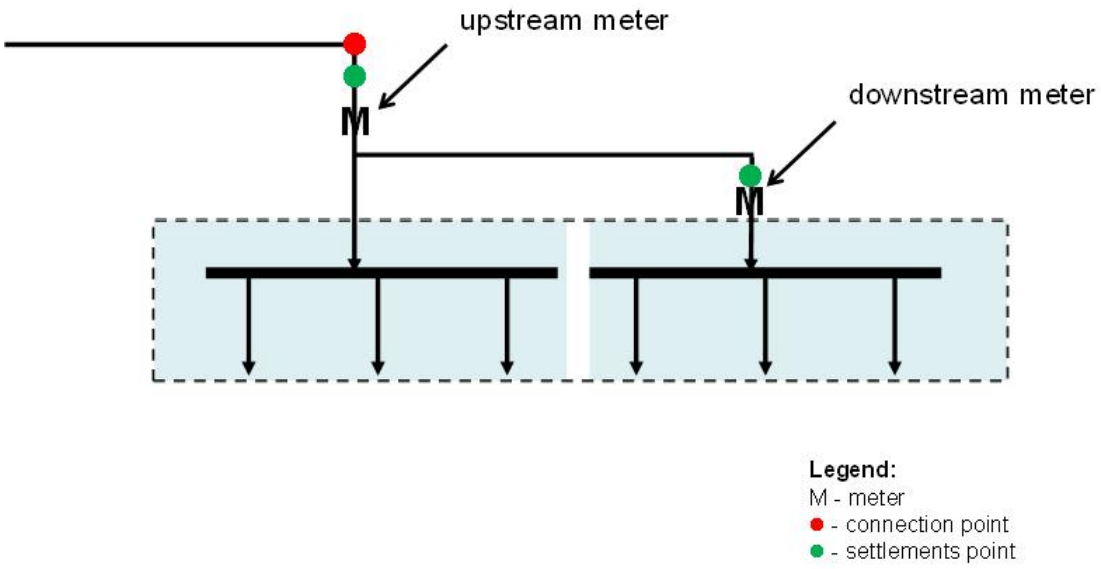
its load. This trade-off would potentially be more difficult in an embedded network where different consumers and FRMPs are associated with the parent and child metering installations.

Like all other metering installations in the NEM, the downstream metering installation needs to be managed by a Metering Coordinator.[73] Currently the Metering Coordinator for a consumer's metering installation is either the LNSP or the FRMP (usually a retailer).

We consider that the proposed subtractive 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 downstream 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 downstream metering installation. Appendix B provides further details of the proposed changes to the NER that we are recommending.

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

Figure 3.2 Example of subtractive metering arrangement



73 The role of the Metering Coordinator (Responsible Person) is defined in clause 7.2.1 of the NER.

Off-market sub-metering

We note that some stakeholders[74] indicated that separate metering can effectively be achieved by off-market arrangements. That is, the consumer's retailer would be the FRMP for the existing upstream meter while the downstream meter would be settled outside of the market under a contract between the consumer or the incumbent retailer 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 where the existing retailer cannot agree with the entity responsible for charging the EV.

Therefore, we consider increasing the flexibility of the subtractive 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 sub-metering arrangements as they may be cheaper, provided that the associated market participants and the consumer can agree on suitable arrangements.

Disconnection with a subtractive metering arrangement

We note that when the main load at the premises is disconnected then the load associated with any downstream metering will also be disconnected unless additional switching is installed in the main switchboard. This is a risk that a FRMP assigned to a downstream metering installation must consider when it established this settlements point. This issue is discussed further in section 3.5.2 below.

3.3 Multi-element meters

Final recommendation

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 Metering Coordinator for:

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

We also recommend that the metering arrangements in the long-term allow 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

74 Energex, *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 February 2012, p. 5.

- assigned different NMIs by the Metering Coordinator.

3.3.1 Significance of the issue

The role of the Metering Coordinator is to comply with the obligations in the NER in relation to metering. 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 Metering Coordinator 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 practical for each stream of metering data to be associated with a different Metering Coordinator as no one person would have the ultimate responsibility for the integrity of the metering data.

The selection of the Metering Coordinator for multi-element meters is currently specified in clause 7.2.4 of the NER. It is also discussed further in section 3.5.

Some multi element meters in the NEM have unused measurement elements. Therefore, where a consumer wishes to meter part of its load it would be desirable for it to be able to utilise any spare measurement elements if it has a multi element metering installation. The benefits of being able to utilise such spare measurement elements need to be weighted against the cost of upgrading participants' IT systems.

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 subtractive 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, better place reported that the cost of establishing a separate metering installation lies between $1,000 and $8,000,[75] although this cost may be lower if a subtractive metering arrangement is used. This high cost of separately metering part of a consumer's load may deter it from installing a second meter at its premises and hence it would not be able to obtain the potential benefits from a separate tariff.

Meters with multiple metering elements are becoming more common and can be used instead of separate or subtractive metering installations. For example, we understand that multi-element meters are used in some locations in New South Wales for the measurement of separately controlled hot water heating. The costs of metering

75 We have not verified these cost estimates.

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 be replaced as part of a subtractive metering arrangement. Therefore, the use of multi-element meters is likely to increase as more consumers perceive benefits in separately metering parts of their load.

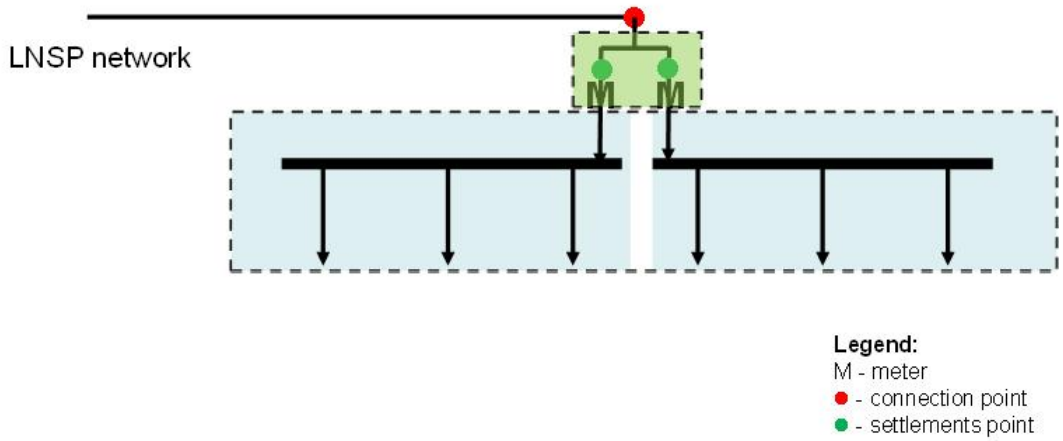
It is important that the metering data from all installations is of sufficient integrity for the NEM settlement systems. This is achieved by making the Metering Coordinator accountable under the NER for the integrity of the metering data. Under the current arrangements, the Metering Coordinator is either:

- the FRMP for a type 1- 4 metering installation, unless the FRMP accepts an offer from the LNSP to perform this responsibility;[76] or
- the LNSP for a type 5 - 7 metering installation.[77]

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 Metering Coordinator. Therefore, given the importance of the role and to maintain certainty, we recommend that a single Metering Coordinator be accountable for the whole metering installation and the communication of all the associated metering data.

The following figure shows a metering arrangement where a two element meter is used within a single metering installation to measure two parts of a consumer's load.

Figure 3.3 Example of multi-element metering installation



Various businesses and industry groups met with the AEMC to express their concern regarding the implementation costs of multiple FRMPs associated with different

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

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

measurement elements within a meter. These costs would arise in some participants settlements and metering IT systems because of the way that the systems are structured. A significant upgrade to these IT systems may be required to provide the flexibility for different elements within a meter to be assigned different National Metering Identifier (NMI) and to different FRMPs.

While we note the practical difficulties at present, we consider it would be desirable for the flexibility of these IT systems to be increased over time, especially if there is sufficient interest in consumers wishing to utilise spare elements with their meters. This issue will require further consideration if this recommendation is referred to the AEMC as part of a rule change request.

It may be that consumers do not need to consider using a multi-element meter if a subtractive metering arrangement can be implemented at a reasonable cost. This is discussed further in section 3.6.

3.4 Metering in an embedded network

Final recommendation

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 settlements points under the NER; and
- allowing these connection points and settlements 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. To capture these benefits it is important that the metering arrangements for embedded networks are sufficiently clear and flexible.

At present, the metering arrangements for embedded networks are defined in an AEMO guideline[78] and by the AER's network service provider exemption guidelines.[79]

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;[80] 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.[81]

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 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."

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

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

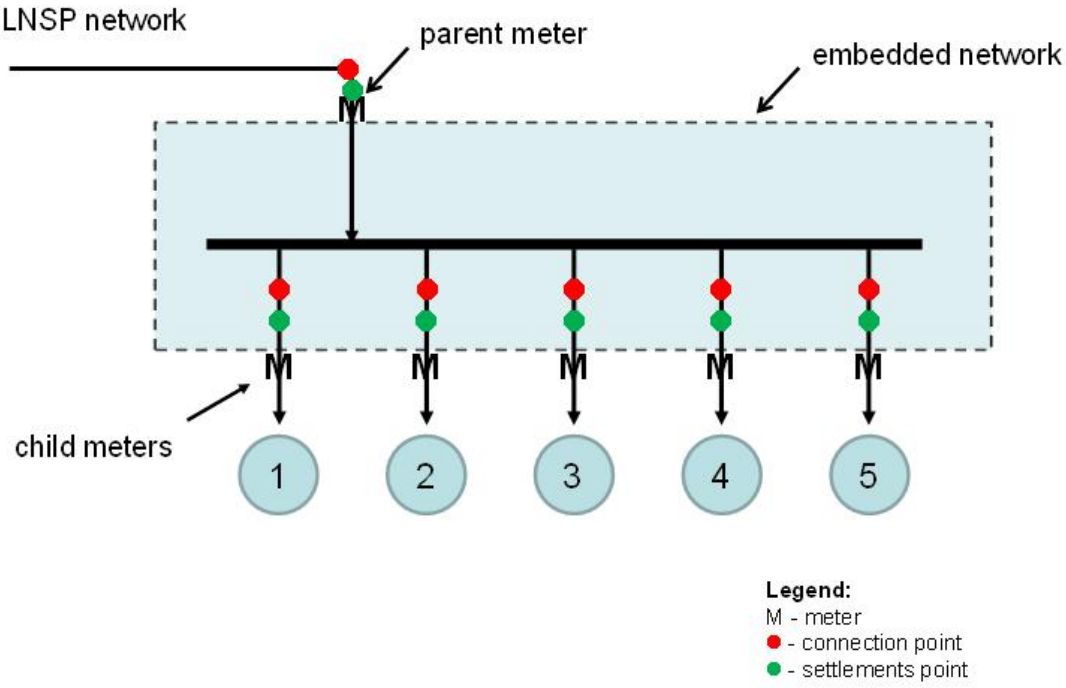
80 Ausgrid, *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 12 March 2012, p. 3.

81 Ibid at p. 9.

In effect, this change would mean that all agreed connection points in an embedded network would be classified as Connection Points.[82] 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.[83]

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.[84]

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 FRMP for the upstream connection point; and

82 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.

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

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

- 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 FRMP for the upstream connection point.

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

AEMO considers that including the downstream connection and settlements in the NEM settlements systems resolves the existing gaps in the metering arrangements for embedded networks.[85] Ausgrid[86] and SP AusNet[87] suggested further consideration of some operational issues is required before the proposal can be fully implemented. We consider that such issues would need to be resolved by AEMO in the metrology procedure.

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 network 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 other requirements of the NER.

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

Final recommendation

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

- that the load associated with each FRMP should be able to be individually connected and disconnected, except in the case of a subtractive metering arrangement, unless all the FRMPs and the consumer agree;
- the costs associated with the Metering Coordinator for a multi element metering installation should be shared by the FRMPs;
- access to the metering installation be managed by the Metering Coordinator;

85 AEMO, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 11 October 2012, p. 4.

86 Ausgrid, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 22.

87 SP AusNet, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 5 October 2012, p. 23.

- the implementation of the process we developed for when a consumer changes one of its FRMPs;
- assigning DUOS charges to FRMPs in a manner that is proportional to their impact on total DUOS;
- the implementation of the process we developed for where a consumer or FRMP seeks to upgrade one of its metering installations;
- the adoption of the processes we developed for addressing situations where a consumer moves house or has a billing/metering query; and
- all metering installations include the full functionality recommended in the Power of choice review.

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;[88]
- each connection point having a metering installation that is registered with AEMO;[89] and
- a unique NMI for each metering installation.[90]

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 their load or separately meter their generation from their load.[91] In addition, in some cases the consumer may wish to engage separate FRMPs for each metering installation.[92]

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

88 Clause 7.1.2(a) of the NER.

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

90 Clause 7.3.1(e) of the NER.

91 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.

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

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 to 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. Several stakeholders were concerned that a single FRMP could be able to disconnect the whole consumer's load, including parts of the load supplied by other FRMPs.[93]

We agree with stakeholders that each FRMP should only have the ability and power to disconnect its associated load. That is, when a FRMP is in dispute with a consumer it cannot use the threat of the disconnection of the whole consumer's load. In the case of a multi-element meter, a separate disconnection switch would be required for each measurement element, either internal or external to the metering installation.

The exception to this principle is under a subtractive metering arrangement where it may be impractical to disconnect the upstream load while maintaining supply to the downstream load. Under these circumstances the FRMP associated with the upstream meter should have the ability and power to disconnect the whole load. The FRMP associated with the downstream load will need to consider this risk when choosing whether to employ a subtractive metering arrangement for its portion of load.

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 Metering Coordinator shared with multi element meters?

The costs of the Metering Coordinator would only need to be shared in the case of a multi-element meter.[94] There are a number of ways of sharing the Metering Coordinator including sharing the costs:

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93 AGL, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 4 October 2012, p. 3; Origin Energy, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 11; Energy Supply Association of Australia, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 4 October 2012, p. 2.

94 In the case a separate metering arrangement there is a Metering Coordinator for each metering installation and FRMP. Similarity, a parent/child metering arrangements has a Metering Coordinator for each metering installation there.

- 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 Metering Coordinator 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 each metering installation should be managed by the Metering Coordinator as it would be accountable for its operation.[95] For a single metering installation (with a multi-element meter) there is a single Metering Coordinator. For separate metering installations and for parent/child metering installations the two installations are independent and each has a Metering Coordinator 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 Metering Coordinator for the associated metering installation, then the new FRMP would also pay its share of the costs of the Metering Coordinator. The new FRMP would recover the costs from the consumer as part of its tariff.
- If the old FRMP is the Metering Coordinator for the associated metering installation, the consumer would need to decide whether to continue to engage the old FRMP as the Metering Coordinator. If the consumer chooses to change Metering Coordinator, 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.

95 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.

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[96] 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.

We consider that efficient behaviour by the FRMPs at a connection would be encouraged if:

- a new FRMP at a connection point faces the same incremental costs as an incumbent FRMP; and
- the FRMPs pay a variable component of DUOS that is in proportion to their impact on the total DUOS at the connection point.

We consider that this behaviour can be achieved if:

- the incumbent FRMP is responsible for the fixed component of DUOS charges at the connection point; and
- each FRMP at a connection point is responsible for the variable components of DUOS in proportion to its contribution to the total component of variable DUOS.

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, while maintaining competitive neutrality between existing and new FRMPs at a consumers premises.

To account for situations where there is no clear incumbent FRMP, such as a new connection, AEMO would be required to amend the metrology procedure it publishes under the NER to determine the primary FRMP. This primary FRMP would be responsible for the fixed component of DUOS charges at the connection point. When amending the metrology procedure, AEMO must consider which settlements point supplies the majority of a consumer's general appliances.

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.

96 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.

Table 3.1 Metering installation 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 Metering Coordinator 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 Metering Coordinator 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 Metering Coordinator 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 Metering Coordinator 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 Metering Coordinator 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 Metering Coordinator to negotiate in good faith;
- a separate contract for a metering installation to be established by the Metering Coordinator;
- 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 Metering Coordinators to block the upgrade, provided they are compensated for any contracts agreed when the FRMPs or Metering Coordinators 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 an 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.[97] 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 Metering Coordinator. Examples of these situations include: a loss of supply, a power quality issue or a meter communication problem with a multi- element metering installation.

Does each meter need to meet the minimum functionality specification?

In section 4.3.3 of the final report for the Power of choice review we recommend the Smart Meter Infrastructure Minimum Functionality Specification developed by the National Smart Metering Program[98] is included in the NER for all new and future meters to support commercial investment in metering services. This recommendation is made in the Power of choice review as it is likely to provide consumers with a

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

98 "Smart Metering Infrastructure Minimum Functionality Specification version 1.3", National Smart Metering Program, published 18 March 2012. The document is available at http://share.aemo.com.au/smartmetering/Pages/BRWG.aspx

greater range of DSP options and end use services. In addition, consumers moving premises to those that have a smart meter installed are also less likely to need to upgrade that existing meter.

Where a premise already has a meter that meets the minimum functionality specification, additional meters (such as a downstream metering installation or a separate meter) may not need to include all these functions, particularly those related to monitoring the supply to the consumer.[99] An exemption from the minimum functionality specification may need to be considered for a site with multiple metering installations.

3.6 Cost-benefit assessment of recommended changes to the metering arrangements

Comment

We have not performed a detailed cost benefit analysis when considering the proposed changes to the metering arrangements.

3.6.1 Significance of the issue

In this final report we are recommending significant changes to the metering arrangements in the NER. These changes are intended to increase the flexibility of the metering arrangements in the NEM. We consider that the flexibility of the recommended metering arrangements would allow consumers to more easily engage with more than one FRMP which is likely 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.

We also acknowledge that the recommended changes could result in significant IT costs for some market participants.

If the recommendations in this chapter are progressed, this would be through a rule change process. At that time we would need to assess the impact of the recommendations against the NEO.

3.6.2 Analysis

Some stakeholders raised concerns about the cost of implementing our recommended changes:

99 A more detailed description of the functions included in the minimum functionality specification is provided in the Draft Specifications published with the final report of the power of choice review.

- Origin consider that a cost-benefit assessment should be performed before the recommended changes are implemented in the NER;[100] and

- Energy Australia[101] and SP AusNet[102] also consider that the recommended changes would cause significant costs to participants from modifying their metering, settlements and billing systems, and that these costs are likely to outweigh the benefits to a relatively small number of EV owners.

We consider that the benefits from allowing multiple FRMPs at a connection point can arise over a range of circumstances, including:

- residential consumers with direct load control, controlled EV charging, embedded generation (without the need to rely solely with the incumbent retailer);

- industrial and commercial consumers that want different tariff structures for different portion of their load, including engaging with multiple retailers and ESCOs;

- industrial and commercial consumers separately metering their embedded generation so the output can be aggregated or sold separately.

We consider that the long term benefits from enhancing consumers choice by increasing flexibility and providing a framework for innovative products are likely to outweigh the costs. In addition we consider that most of the recommendations could be implemented at modest costs to participants. We also note that the IT costs for assigning different FRMPs to multi element meters appear to be high and that initially only a small number of consumers may choose to employ this arrangement. In the longer term this may change if this arrangement is cost effective for many consumers. We recommend that assigning different FRMPs to multi element meters be a long term policy objective but that at present it may be too soon for it to be required by all market participants. Also, it may be that consumers do not need to consider using a multi-element meter if a subtractive metering arrangement can be implemented at a reasonable cost.

We note that the costs to distribution businesses can be recovered through DUOS (to the extent that the changes are not required to provide a contestable service). Retailers are likely to need to make these changes where their customers demand the flexibility canvassed by our recommendations.

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100 Origin Energy, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 8.

101 TRUenergy, Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles, submission to the AEMC, 3 October 2012, p. 5.

102 SP AusNet, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 5 October 2012, p. 13.

3.7 Australian Standards and jurisdictional guidelines

Final recommendation

In light of our proposed metering arrangements, we recommend that each of the jurisdictions review their metering arrangements including their policies, procedures and licensing conditions.

Review of the Australian Standards and jurisdictional guidelines

The long term policy for DSP is to encourage investors and consumers to engage in new and innovative ways of responding to both high spot prices and network limitations. Whilst these situations have different response times, their pending occurrence can be communicated to consumers via price signals. Both retailers and DNSP's can provide these price signals, so their individual and combined effects must be meaningful to both the investor and consumer. Meaningful price signals occur when consumers' consumption changes by the application of metering data. We consider that the long term interests of consumers will be efficiently served by providing them with improved consumer information and choice. To achieve this requires the integration of competition through multiple service providers, pricing innovation and smart metering functionality.

Multiple service providers and smart metering functionality at a connection point for a single consumer premise introduces challenges to the existing metering arrangements for a premise. The existing arrangements, and their guiding instruments, will require overhaul to ensure that they accommodate the recommended policy principles, including multiple FRMPs, multiple meters, multiple Metering Coordinators, varied locations for meters, flexibility in the housing of a meter, and remote electronic metering data collection.

The long term interests of consumers will only be served if they (either on their own or via their retailer) can influence the cost / benefit trade-off between the quality of the information they receive (including its timeliness) and their need for electricity at the going price. The quality and timeliness of the information will be improved by access to more than one retailer at any one site, and access to their electricity consumption data in a timely manner. Their need for electricity will be a personal decision based on their ability to understand its price and determine its subjective value (such as security lighting vs the drying of clothes). Consumers in other markets in general have shown themselves to be adept at making these personal decisions if they have the right information at the right time.

Further, to support the NEO and provide metering arrangements that would support efficient demand side participation, we recommend that the relevant Australian Standards and jurisdictional guidelines, including the Standards Association of Australia (SAA) Wiring Rules and Service/Installation policies, be reviewed (and rewritten where necessary) to reflect new metering technology and to align with the principles in this report. We recommend that these documents be updated within 2 years of the commencement of the new rules recommended in this report.

Location of meters

This final advice recommends that more than one FRMP be permitted to service a single consumer premise where there is only one connection point. For this principle to be enacted, the one connection point is permitted to contain more than one settlements point, with each FRMP engaged by the consumer being registered against a unique settlements point (where that settlements point has a unique metering installation). Consequently, the principle of multiple FRMPs at a connection point implies that multiple metering installations will be employed at that location.

We have recommended that these settlements points (and hence metering installations and their meters) to be independent of each other or interconnected via a cascading relationship. In the cascading chain of settlements points, the one closest to the connection point is the 'upstream' settlements point, and the one furthest away electrically is the 'downstream' settlements point. These settlements points and hence their metering installations will participate in the NEM wholesale settlements process.

The upstream settlements point would most likely be located in the main switchboard. The downstream settlements point may be located in that switchboard, or at another location on the premise. Whilst current arrangements expect a meter at 'another location' to be mounted on a panel of some sort, they do not envisage the meter to be included in a vendor's product. The location of the downstream metering installation in a consumer's premise would be partly governed by the AS 3000 "SAA Wiring Rules" and partly by each jurisdiction in a stand-alone document that covers connection of a premise to the distributor's network ('jurisdictional guidelines').[103]

The SAA Wiring Rules provides detailed instructions on the location of a 'main switchboard' and the nature of the electrical wiring within that switchboard from a safety perspective. In regard to switchboards other than the main switchboard, the SAA Wiring Rules provides little restriction on their location, so long as hazardous situations are not present at the chosen location.

The jurisdictional installation policies generally provide detailed instructions in relation to installing a meter, including:

- details on the location of the main switchboard at a consumer's premise (generally based on manual meter reader access requirements);
- conditions around the purchase and supply of the meter;
- the relationship of the meter on that switchboard to the main fuse and main switch;
- the ownership of the meter once the meter is placed in service,
- the skills that can be deployed to install the meter;

103 An example of such as jurisdictional guideline would be the "Service and Installation Rules of NSW".

- the location of meter panels in locations other than the main switchboard; and
- conditions to be observed when remote reading of metering data is required.

The recommendations in this final advice would allow consumers and investors to have greater flexibility in choosing metering solutions for more active involvement in DSP. These metering solutions may embrace meters in locations not yet experienced by past practice. From a policy perspective, it is envisaged that greater flexibility will introduce opportunities for new business models and consumer needs. These opportunities will have an impact on current arrangements, such as, but not limited to:

- multiple meters being installed on a main switchboard with independent relationship to the main fuse, implying multiple main switches under the current arrangements;
- downstream meters being located in buildings isolated from the main switchboard but in the proximity of an appliance to be serviced, such as an electric vehicle or its charging unit;
- multi-element meters being aligned to more than one retailer;
- a meter being accommodated within a vendor's stationary product, rather than on a stand-alone meter panel;
- skills in installing meters being aligned to the nature of the product housing the meter;
- remote communication being installed on all meters within a premise removing the need for manual meter reader access arrangements, except under inspection/ test situations where one-off access arrangements would be initiated; and
- ownership of meters being with parties other than the distributor.

The alignment of the Australian Standards and jurisdictional guidelines with the recommendations in this final advice needs to be addressed.

4 Electric Vehicles - NEM arrangements to enhance consumer choice

To enhance consumer choice, we seek to devise energy market arrangements that enable the provision of a competitive range of EV charging services for the benefit of consumers and lead 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;
- address the risk of EV service provider failure - to assess whether there are prudent measures in place to protect EV consumers; and
- EV infrastructure provided by a DNSP and operable by multiple retailers.

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

4.1 Circumstances when EV charging constitutes a sale of electricity

Final 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)*. We note that there are divergent views on legal interpretation as to whether EV charging is covered by the NERL and therefore consider that the SCER should clarify the drafting of section 88 of the NERL to remove any ambiguity.

Notwithstanding our legal interpretation of the NERL, we consider that as a matter of policy, the NERL should apply to residential EV charging but that there should be an exemption for commercial EV charging. The AER should review its exemptions framework when applied to commercial EV charging.

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. We recommend that the AER or ERA develop guidelines to determine whether the sale of electricity is a primary or incidental part of the bundle of services provided by reference to such criteria as whether the sale of electricity involves the:

- separate measurement in terms of the quantity of electricity supplied to the consumer; and
- separate charge or payment for the electricity supplied.

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.[104]A contrary view held that EV charging should not constitute a sale of electricity where it risks stifling innovation in the EV services market.[105]

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'.[106] 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'.[107]

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.

104 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.

105 UNSW Centre for Energy and Environmental Markets , *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 6 March 2012, p. 7.

106 Section 88 of the National Energy Retail Law.

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

- 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 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 are 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 - an external, mobile purpose - which would therefore be outside the ambit of the NERL.[108]

Our recommended approach on EV charging as a sale of electricity

Noting our legal interpretation above, we now provide our recommended approach 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 consumers and reduce confusion.

In relation to commercial EV charging, such as at private/public car parks and including dedicated EV 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.

Notwithstanding our recommended policy approach, we note that there are divergent legal interpretations of the NERL insofar as it applies to EV charging. For the purposes of clarity, we therefore recommend that the SCER review section 88 of the NERL to clarify whether the sale of electricity 'for premises' (as stated in the NERL) should properly be interpreted as being 'for consumption at premises' or otherwise.

108 Australian Energy Regulator, *Response AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, p. 4.

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). We note that the application of energy market regulation to market participants is the appropriate role of these energy market institutions.

However, to assist the AER or the ERA in the regulation of bundled service providers, we have attempted to provide policy guidance. 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. To assist with this assessment, the AER or ERA should consider 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.

We recommend that the AER or ERA consider drafting a guideline where it sets out how it will assess bundled service providers in accordance with our policy guidance provided here.

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
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

Final 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 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.[109] 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.[110] Similarly, if the AER grants a retail exemption (and therefore the seller of electricity is an 'exempt seller'), it must do so in accordance with its Exempt Selling Guideline.[111]

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.[112] 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.[113]

It is important to note that if the provision of EV charging services is not found to be the sale of electricity, then the consumer protections embedded in the electricity market's retail licensing regime would not apply. However, the general consumer protections contained in the Australian Consumer Law would be available.

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.

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109 Section 88 of the NERL.

110 Available at www.aer.gov.au.

111 Available at www.aer.gov.au.

112 UNSW Centre for Energy and Environmental Markets, *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 6 March 2012, p. 14.

113 better place, *Response to AEMC Issues Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 23 February 2012, p. 16.

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.

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.[114] The Alternative Technology Association stated that "EV charging in embedded networks needs to be classified as onselling with an automatic exemption".[115] 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. Stakeholders expressed support for this approach too.[116] We recommend that the AER review its retail exemptions framework to clarify the status of EV charging at commercial EV charging stations where onselling occurs.

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114 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, p. 2.

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

116 Alternative Technology Association, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 5 October 2012; better place, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 1 October 2012, p. 8; Origin Energy, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p .13.

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 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.

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

Final 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 the supply of electricity from a network: either directly through a distribution network or through an embedded network.[117] 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.

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.[118] 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.[119] 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

Final 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

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

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

119 See www.aer.gov.au.

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 becomes a general risk faced by EV consumers.

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
- 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 the ROLR scheme 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 that it is likely that the AER would not provide an exemption to a bundled service provider if they are 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.

4.5 Possible role of DNSP in infrastructure provision

In overseas jurisdictions, we note that an emerging infrastructure model is where a DNSP builds and owns the EV charging infrastructure at public EV charging stations.[120] Under this model, while the DNSP provides the infrastructure, it is mandatory that there are 'multivendors' (or retailers) that provide customers with EV charging services using the DNSP infrastructure. The EV charging infrastructure is therefore 'open access' - it is available to a range of retailers.

Importantly, under this model, the DNSPs do not have an exclusive role in developing recharging infrastructure; rather, competition by other providers is possible. Also, the cost of building the infrastructure is not included in the DNSP's regulatory asset base.

120 Schiavo L et al, 'Changing the Regulation for Regulating the Change: Innovation-driven regulatory developments in Italy: smart grids, smart metering and e-mobility' Working Paper n 46, November 2011.

We believe that this scenario for DNSP provided infrastructure could be arranged under the current NER. If DNSPs were to be involved in the provision of EV charging infrastructure, this may require regulatory approval from the AER. In addition, AEMO's settlement processes and AER's ring-fencing guidelines may need to be reviewed.

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 a set of 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.

5.1 Aspects of the WEM and EVs

Final 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 enable 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.[121] 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.

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

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

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 V2G 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'[122], 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.[123] These arrangements do not allow for the participation of loads (or energy storage) in balancing or ancillary services.[124] 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.[125]

5.2 Measures to incentivise efficient charging behaviour

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

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

123 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.

124 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.

125 Western Power, *Response to AEMC Draft Advice - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 1.

5.2.1 Pricing

Final 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.

Submissions to our draft advice supported this position. Western Power supported the desirability for retail pricing signals to manage the impact of EVs on peak demand.[126] Also, the Energy Supply Association of Australia argued that the key issue for Western Australia to facilitate the efficient uptake of EVs was to move towards cost-reflective pricing.[127]

5.2.2 Connecting to the distribution network

Final 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.

126 Western Power, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 3 October 2012, p. 1.

127 Energy Supply Association of Australia, *Response to AEMC Draft Advice – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 4 October 2012, p. 3.

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. On 5 September 2012, the ERA released its final decision with respect to Western Power's access arrangement.[128] Western Power has a Distribution Low Voltage Connection Headworks Scheme 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 scheme is to be cost reflective such that it reflects the network user's utilisation of network capacity. The scheme:

- 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 Distribution Low Voltage Connection Headworks Scheme 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

128 http://www.erawa.com.au/access/electricity-access/access-arrangements/western-powers-proposed-revised-access-arrangement-aa3/ (accessed 7 November 2012)

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.[129] 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 will assist in developing appropriate connection charges that takes into account these network impacts. We concur with Horizon Power's submission in this respect.[130]

5.2.3 Controlled charging and V2G

Final 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. We recommend that any technical standards for load management include controllable loads and embedded generation (such as V2G) connecting to the distribution network. 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 our recommendations for the NEM it may be necessary to put in technical standards for load management to apply to controllable loads and embedded generation (such as V2G) seeking to connect to the distribution network.

It seems 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 possible for the consumer to engage in a contract with Horizon Power to capture the benefits of controlled charging and V2G.

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

130 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.

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.

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 final advice.

5.3.1 Consumer protection and retail licensing

Final 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 Minister of Energy 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

Final 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 recommended the approval of 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.

Final 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

Final 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.[131]

Western Australia's market structure does not cater for retail contestability. In the SWIS, Synergy is the incumbent retailer and residential/small consumers cannot choose their retailer. Outside the SWIS, Horizon Power is the incumbent retailer. The results of this market structure is that our proposals to enhance 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 final advice and our findings in the Power of choice review would inform this analysis.

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

6 Natural Gas Vehicles

We are required to provide advice on the energy market arrangements necessary to enable the efficient uptake of natural gas vehicles (NGVs). We have considered 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

Final 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 we 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.[132] In a submission to our

132 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.

draft advice, APA Group also generally supported our recommendation for no changes to the gas market arrangements at this time.[133] Indeed AECOM's 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.[134] 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.[135]

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.[136]

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.[137]

133 APA Group, *Response to AEMC Draft Advice - Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 1 October 2012.

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

135 Ibid at p. 6.

136 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.

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

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 arrangements in place that could enable 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 there are existing processes and regulatory arrangements in relation to the installation of new gas appliances, including 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.[138]

- If gas is not already connected to the home, then there are existing processes and regulatory arrangements that would enable 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 a 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.[139]

- 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 that 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 enable the separate recording of gas consumption. There are existing processes and regulatory arrangements to enable this connection and mechanisms for cost recovery.

138 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.

139 SP AusNet, *Response to AEMC Approach Paper – Energy market arrangements for electric and natural gas vehicles*, submission to the AEMC, 27 October 2011, p. 6.

- 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.

- 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 enable 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 enable 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.[140]

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.[141]

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 detailed energy market regulation. This is because the contractual relationship is transactional and competitive in a

140 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.

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

commercial context.[142] We therefore do not consider there to be a need for energy market arrangements governing the retail aspects of commercial NGV refuelling.

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

7 Summary of final recommendations

In this chapter we consolidate our recommendations conveyed throughout this final advice.

7.1 Electric vehicles - NEM arrangements to facilitate efficient charging behaviour

In this final advice:

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

- To provide incentives for efficient EV charging behaviour and encourage an efficient level of DSP generally, our Power of choice review recommended that efficient and flexible retail energy options require a transition to cost reflective network prices. We propose that cost reflective network pricing be phased in through a banding approach, with medium to large consumers transitioned to efficient and flexible network prices to begin with (for large residential and small business consumers such network prices would be mandatory). This should be set to capture a high proportion of EV consumers. We consider that introducing efficient and flexible network prices would encourage the development of efficient and flexible retail tariffs.

- We recommend that all EV charging locations should be equipped with metering installations that have interval reading capability to enable the application of cost reflective tariffs and to make the EV load amenable to DSP.

- 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.

- Controlled EV charging is a form of load management. We take load management to mean the management of a consumer's load by another party (network, retailer or a third party DSP provider, such as an aggregator) in accordance with an agreed contract with the consumer.

- We propose the following principles for load management:

  - the customer has the right to control its load;

- the customer may assign this right to another party to provide load management services; and

- decisions on load management require involvement of DNSPs to safeguard network security.

- We recognise that technical standards for load management are necessary. We are assessing the *Connecting Embedded Generators* rule change request, which may provide technical standards (such as protocols for controllable load) for connecting to a distribution network.

- We also recognise that a regulatory framework (including a dispute resolution process) for load management is necessary. We consider that Chapter 5A of the NER, which applies to jurisdictions that have implemented the NECF, provides a dispute resolution process between DNSPs and retail customers.

- 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 contracts. There is a role for third parties to negotiate on behalf of consumers the set of benefits falling across multiple parties. We recommend that all distributed generation units (even non-market generating units) should contain interval metering capability to enable the application of time varying tariffs and to facilitate participation in DSP.

- We consider that it is not necessary to mandate requirements to identify EV loads or similar large loads through the National Electricity Rules because there are existing mechanisms for DNSPs to be informed of the nature of the loads on their networks.

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

In this final advice:

- We recommend that the term 'connection point' in Chapter 7 and Rule 3.15 of the NER be replaced with 'settlements point'. The settlements 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).

- We recommend that a consumer be able to arrange for a 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)

- Under these arrangements:
  - the subtractive metering arrangement would not constitute an embedded network;
  - losses within the premises would be assigned to the upstream meter;
  - all fixed DUOS charges would be assigned to the FRMP for the upstream NMI, unless otherwise agreed with the consumer;
  - the NMI for the downstream meter(s) would be assigned by the Metering Coordinator for the downstream meter; and
  - a different FRMP could be assigned to the upstream and each downstream metering installation.
- 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 Metering Coordinator for:
  - all the components of the metering installation; and
  - all the NMIs associated with each metering element.
- We also recommend that the metering arrangements in the long-term allow 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 Metering Coordinator.
- 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 settlements points) under the NER; and
  - allowing these connection points (and settlements points) to be settled in the NEM.
- In situations where there are two (or more) FRMPs at one connection point, we recommend:

- that the load associated with each FRMP should be able to be individually connected and disconnected, except in the case of a subtractive metering arrangement, unless all the FRMPs and the consumer agree;
- the costs associated with the Metering Coordinator for a multi element metering installation should be shared by the FRMPs;
- access to the metering installation be managed by the Metering Coordinator;
- the implementation of the process we developed for when a consumer changes one of its FRMPs;
- assigning DUOS charges to FRMPs in a manner that is proportional to their impact on total DUOS;
- the implementation of the process we developed for where a consumer or FRMP seeks to upgrade one of its metering installations;
- the adoption of the processes we developed for addressing situations where a consumer moves house or has a billing/metering query; and
- all metering installations include the full functionality recommended in the Power of choice review.

- In light of our proposed metering arrangements, we recommend that each of the jurisdictions review their metering arrangements including their policies, procedures and licensing conditions

7.3 Electric Vehicles - NEM arrangements to enhance consumer choice

In this final 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)*. We note that there are divergent views on legal interpretation as to whether EV charging is covered by the NERL and therefore consider that the SCER should clarify the drafting of section 88 of the NERL to remove any ambiguity.

- Notwithstanding our legal interpretation of the NERL, we consider that as a matter of policy, the NERL should apply to residential EV charging but that there should be an exemption for commercial EV charging. The AER should review its exemptions framework when applied to commercial EV charging.

- For bundled service providers, we recommend that the AER or the ERA determine whether the services offered constitute a legal sale of electricity. We recommend that the AER or ERA develop guidelines to determine whether the

sale of electricity is a primary or incidental part of the bundle of services provided by reference to such criteria as whether the sale of electricity involves the:

  - separate measurement in terms of the quantity of electricity supplied to the consumer; and
  - separate charge or payment for the electricity supplied.

- 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 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; and
  - 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 becomes a general risk faced by EV consumers.

7.4 Electric Vehicles - Western Australia

In this final 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 cost 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. We recommend that any technical standards for load management include controllable loads and embedded generation (such as V2G) connecting to the distribution network. 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 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 final 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 we 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
CATS	Consumer Administration and Transfer Solution
CNG	Compressed Natural Gas
COAG	Council of Australian Governments
CPP	Critical Peak Pricing
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DLC	direct load control
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
MCE	Ministerial Council on Energy
MDP	Metering Data Provider
MP	Metering Provider
MSATS	Market Settlement and Transfer Solution
MW	Mega Watt
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
ROLR	Retailer of Last Resort
SAA	Standards Association of Australia
SCER	Standing Council on Energy and Resources
SOLR	Supplier Of Last Resort
SOO	Statement of Opportunities
SWIS	South West Interconnected System
TOU	Time Of Use
VKT	vehicle kilometres travelled
WA	Western Australia
WEM	Wholesale Electricity Market

A Appendix A - Submissions to the draft advice

In this Appendix, we summarise the key comments raised in stakeholders' submissions to the draft advice. We received 19 submissions in total. We thank stakeholders for their thoughtful submissions. All of these submissions have helped to inform our thinking in preparing the final advice.

Table A.1 Electric vehicles

Issue	Stakeholder	Comment
General	Australian Energy Market Operator	EV charging should be treated as any other load and subject to being incentivised by TOU tariffs similar to any other load. (p.1)
	Australian Energy Regulator	Supports AEMC's position that energy market arrangement should attempt to be technology neutral.
	AGL	Advocates removal of retail price regulation and introduction of price monitoring where competition is deemed to be effective and introduction of smart meters and dynamic pricing with appropriate safeguards for hardship customers. (p.1) Considers that the AEMC's recommendations are not technology-neutral. (p.2)
	Ausgrid	Agrees that energy market arrangements should be technology neutral. (p.1) Concerned that changes proposed do not sufficiently address identified problems and would result in significant costs to the NEM. (p.1)
	Aurora Energy	Supports causer pays principle in allocating costs associated with new and altered connections.(p.1) Difficult to attribute costs arising from market-compliant IT systems to accommodate 2 or more FRMPS directly to EV customers. (p.1)
	Ergon Energy	Regarding EV uptake/demand, a US study

Issue	Stakeholder	Comment
		shows charging demand of only 1 kW across EV population, which is less than 3.6kW in Draft Advice. US experience finds that peaks are much later in the evening, suggesting it is less than assumed in Draft Advice. (p.1)
	Alternative Technology Association	To realise the potential benefits of EVs, EV-specific pricing, control and other market arrangements are required. (p.2)
	Energy Retailers Association of Australia	EVs should be treated as any other load. (p.1) Robust and transparent cost-benefit analysis before changes to energy market, as there are many indirect costs. Whilst the goal of increasing customer choice is welcomed, it is not welcomed at any cost. (p.4)
Pricing	Australian Energy Regulator	Needs to be a significant change in network tariff structure to influence EV charging behaviour. (p.3)
	Australian Energy Regulator	Notes that consumers may choose to exercise their preferences (e.g. EV specific tariffs, controlled charging) and considers merit in ensuring that market arrangements do not prevent consumers from pursuing this option. (p.3)
	AGL	Supports AEMC's conclusion regarding pricing signals and interval metering to facilitate DSP. AEMC has not addressed issue of retail price regulation in some NEM states. (p.3)
	Origin Energy	Agrees that EV charging behaviour should be incentivised through network pricing, but causer pays principle should apply to both operating costs and set up costs required to change existing market

Issue	Stakeholder	Comment
		arrangements. (p.5)
	TRUenergy	Believes TOU pricing will drive efficient charging behaviour. Supports interval metering. Reversion policies and formation of tariff structures may inhibit innovation.
	Aurora Energy	Agrees that price structures should not be mandated and supports the introduction of interval metering. Concerned about the practical application of locational DUOS pricing (limited by locational TUOS signals and difficult to calculate in an interpenetrated network, also equity implications). (p.4-5)
	Ausgrid	Not clear how geographical variation in DUOS would work in practice. Note, there is a capital contributions regime for new/modified connections. Also under current network pricing determination, large load and rural customers may be required to fund network augmentation costs. (p.3) Appropriate metering capability a prerequisite to provide cost reflective pricing.
	Energex	Agrees that for efficient introduction of EVs, network pricing signals need to take into account impact on network infrastructure. (p.2) But does not consider locational pricing to address specific load is a feasible option as 1) administrative costs 2) non-EV users may face higher DUOS charges simply due to their location. (p.2)
	Ergon Energy	Agree that network pricing signals should incentivise efficient charging behaviour. (p.1)
	SP AusNet	Regarding geographic pricing, the present

Issue	Stakeholder	Comment
		structures of 'postage stamp' prices have endured because of the ongoing government views regarding urban/rural price differentiation and strict limitation and controls in the NER on how prices can be adjusted. Interval metering is fundamental to efficient pricing. (p.7) Network pricing signals only part of the price signal delivered through TOU tariffs. (p.8)
	Alternative Technology Association	Supports cost-reflective network pricing signals. (p.2) It is appropriate for DNSPs and retailers to offer EV-specific tariffs; nodal or location pricing may be appropriate and effective; DNSPs should be required to retain more knowledge of consumers with major loads. (p.2)
	Energy Supply Association of Australia	Encouraged by AEMC proposed market-based solutions to pricing. Supports geographical variation of network costs. (p.1)
	better place	Supports network pricing (time of use and critical peak pricing). (p.3)
Metering	Australian Energy Market Operator	Supports AEMC's proposal. Recommends use of the term 'metering point' (subject to changes) rather than changing 'supply point' definition. (p.3)
	Australian Energy Market Operator	Regarding parent/child metering arrangements: it should be clear that these apply to within a premise and is distinct from embedded networks. Regarding multi-element meters - supports single RP. (p.3)
	Australian Energy Market Operator	Regarding embedded networks: supports embedded network connection points classified as connection points.

Issue	Stakeholder	Comment
	Australian Energy Market Operator	Notes that changes will require significant change to all industry participants/AEMO. Considers risk of fraud and theft of energy in general. (p. 4) Opposed to disconnection unless there are processes and technology solutions that allow for separate disconnection of individual measurement elements and safeguard confidentiality of data. (p.4)
	AGL	Metering issues cannot be effectively addressed without also considering Responsible Person roles and responsibilities and how these relate to other stakeholders. (p.3) Concerned about proposal for FRMP to disconnect the consumer's total load. (p.3)
	Origin Energy	Concerned about the creation of an uneven playing field where 'secondary retailers' downstream of the supply point free-ride on existing connection metering infrastructure and upstream customers. (p.6) Risk of customer gaming between supply points. (p.7) Notes the requirements associated with an upgrade of an accumulation meter at the customer's premise in order to allow subtractive metering for downstream metering points. (p.7) Not clear how ROLR would apply in multiple FRMP scenarios. Origin recommends costs and benefits of changes be evaluated ahead of any rule change. (p.8)
	Origin Energy	Regarding embedded networks, concerned about uncertainty and risk of dispute in such networks. (p.10)
	Origin Energy	Regarding parent/child metering arrangements, considers that a second

Issue	Stakeholder	Comment
		meter will create additional costs and administrative arrangements required to settle energy and allocate losses. Concerned about AEMC's proposal to not evenly apportion costs between the parent and child FRMP - creates an uneven playing field between retailers and aggregators. (p. 9)
	Origin Energy	Regarding two or more FRMPs at a connection point, recommends a full cost-benefit assessment is required (p.10) and notes that significant system changes required.
	Origin Energy	Regarding multi-element meters, agrees that multi-element metering is often more cost effective than separate single element meters however notes the costs of wiring specific loads may offset these costs. (p. 10)
	Origin Energy	Regarding disconnection where there are two or more FRMPs, disagrees that any FRMP at a multi-FRMP premise should have to disconnect the consumer's total load. It is inappropriate that any service provider can disconnect a consumer's household load and not be subject to the requirements of the NECF. (p.11)
	Origin Energy	Origin recommends that retail price regulation be a pre-requisite for the introduction of multiple FRMPs at a single connection point. This can be applied at a jurisdictional or premise by premise basis where a customer who introduces multiple FRMPs are required to forego the right to regulated tariffs. (p.4)
	Simply Energy	Urge the AEMC undertake a thorough cost-benefit

Issue	Stakeholder	Comment
		analysis of metering arrangements in the draft advice as there are more cost-effective solutions. (p.1) Opposed to having another retailer disconnect the power supplied to customers.
	Simply Energy	Does not support parent-child metering arrangements; a thorough cost-benefit analysis of metering arrangements is needed. (p.2) Suggests EVs be incorporated into energy efficiency schemes (e.g. VEET and REES) or a regulatory obligation on retailers to engage with EV providers. (p.3)
	Simply Energy	Opposed to a retailer disconnecting as it would damage retailer's reputation, result in a breach of contract, liable to enforcement action under ACCC and state regulators and contravene disconnection payment obligations in Victoria. (p.4)
	TRUenergy	Disagrees as it cements embedded networks in the NER. Against subtractive metering arrangements as it compromises integrity of the data used for billing. The one-to-one relationship between NMI, customer, FRMP is the foundation industry is built on.
	TRUenergy	Concerned with costs to modify participant's systems that benefit a small proportion of customers. (p.1) Disagrees with alteration of metering arrangements. (p.3) The least cost option remains a separate metering installation and connection point. (p.4) Costs incurred by industry to modify systems, separate meter data and network billing far outweigh potential cost per EV owner and impact on all consumers. (p. 5)

Issue	Stakeholder	Comment
	Aurora Energy	Supports causer-pays but notes that costs of market-compliant IT systems to accommodate changed metering infrastructure difficult to attribute to EV customers. Unconvinced that the complexity and costs of two FRMPs will foster widespread utilisation. (p.2)
	Aurora Energy	Regarding embedded networks: agrees with recommendations and notes that permitting such arrangements, the application of NECF to these customers must be re-visited. (p.11)
	Aurora Energy	Regarding connection point/supply point: it is not clear how the proposed term 'supply point' differs from the term 'metering point' and how two terms interact. Also not clear how proposed change interacts with defined term 'metering installation'. (p.9) Suggests that to give effect to the Draft Advice, the definition of 'supply point' be changed and 'connection point' remain unaltered.(p. 12)
	Aurora Energy	Aurora provided cost figures for interval meters. Notes regulated tariff rates (approved by AER) of interval capable but with communications capability not enabled as being 6.961 cents per register (including meter hardware, installation cost, operational and maintenance expenditure and return on investment). Notes, majority (95%) of Aurora's distribution network on accumulation meters.
	Aurora Energy	Regarding parent/child metering: increased market related complexity without solving any meter provision issues. The cost of parent/child may be same or greater than traditional

Issue	Stakeholder	Comment
		metering.(p.10)
	Aurora Energy	Regarding multi-element meters: unconvinced that a single RP for a multi-element meter is an efficient solution because costs of proposed and alternative solutions have not been clearly articulated. No mechanism for market participants to choose who should be the Responsible Person. Suggests Responsible Person's services should be contestable to encourage efficient cost. (p.11)
	Ausgrid	Regarding connection point/supply point definition, Ausgrid cautions against changing connection point as this affects definitions in the National Energy Retail Rules. (p.5) AEMO's NMI Procedures already allows multiple meters at one NMI and multiple NMIs at the one connection point to the DNSP's network. Questions whether AEMC has considered changing existing market procedures to achieve same outcome. (p.5)
	Ausgrid	Regarding two FRMPs: argues that it is costly to redesign market systems, there is no consideration of the implications for a DNSP being assigned RP role (with no cost recovery mechanism), and it is unclear how DUOS charges for NMIs in embedded networks would be recovered. (p.9)
	Ausgrid	Regarding parent/child metering: do not agree with AEMC's approach to include embedded network connection points as it means that Chapter 7 (e.g. LNSP responsible person for Type 5/6 meters) applies to these connection points. This is problematic because no contractual relationship between DNSP and child

Issue	Stakeholder	Comment
		NMI, access issues and no direct cost recovery mechanism for DNSPs. Agree that embedded networks should be settled in the NEM, but should have specific embedded network rules (i.e. same rules as for existing Type 1- 4 meters). AEMC does not consider impacts on market participants' systems and processes to accommodate parent/child metering. (p.8)
	Ausgrid	Regarding multi-element metering arrangements, suggests that the AEMC's proposals would change the fundamental relationship and result in complete rebuild of participants' IT systems costing millions of dollars. Negligible difference between cost for a dual element Type 5 meter and two single element Type 5 meters. (p.8)
	Energex	Questions whether a new term (ie. 'supply point') is required and rather the NMI can be assigned to a metering point or metering installation as defined under the NER. (p.3)
	Energex	Responsible Person for the child meter - no mention in EV and power of choice documents. LNSP should not be obliged to provide an offer to the FRMP to be the RP. (p.3)
	Energex	Regarding parent/child metering, suggests that there is a need to protect parent MDP from penalties or performance reporting impacts due to a failure of the child MDP to provide data in sufficient time/quality. (p.3)
	Energex	Regarding parent/child metering, states that there is some inconsistency in AEMC's treatment of DUOS.

Issue	Stakeholder	Comment
		That is, parent/child suggests parent FRMP pays fixed DUOS whereas 2 FRMPs suggests fixed DUOS be shared. (p.3)
	Energex	Regarding multi-element meters, suggests that the AEMC needs to consider the implementation costs and timeframes for enabling two NMIs for a multi-element meter. (p.4)
	Ergon Energy	Supports separate metering but notes there may be technical difficulties from a meter installation/reading perspective requiring switchboard and service upgrades. (p.1)
	SP AusNet	Regarding definition of 'supply point', suggests that it is not necessary to introduce concept of supply point as the market approach already provides a mechanism for recognising multiple connection points and metering points in a property (i.e. in NMI procedure).(p.13) AEMC's proposals would entail significant change in participants and AEMO's systems at high financial impact across the NEM.
	SP AusNet	Regarding parent/child metering, considers that there is no reason for separate recognition of parent/child subtractive metering arrangements as this is recognised by AER and AEMO treatment of embedded networks. (p.17) DUOS charges would require agreement with DNSP as this would result in significant change to DNSP's billing systems (p.17). The allocation of NMIs to connection points on embedded networks is far from clear; AEMC's proposal for child NMI retailer to allocate a NMI becomes

Issue	Stakeholder	Comment
		complicated when NMIs are being created by multiple retailers in embedded networks. (p.18)
	SP AusNet	Regarding multi-element meters, these meters are not the most efficient solution. In Victoria, two element meters (with controlling contactor) are installed on customers currently with a controlled load type tariffs (e.g. hot water), but these tariffs are not available to new customers and no further two element meters will be purchased after rollout completes in 2013.
	SP AusNet	Regarding embedded networks, critical of the change to the definition of embedded network; the term 'circuits of a non-registered customer' is not specific enough to clearly indicate customers on an embedded network who are not customers of authorised retailers - a reference to authorised retailers and exempt onsellers would make this intent clearer. (p.22) Uncertainties with embedded network like in operational matters such as fault response, new connections, CATS/MSATS updates, recognition of life support customers, meter reading access, switching arrangements, bad debt disconnection etc. (p.23)
	SP AusNet	Regarding two FRMPs at a connection point, further work is required to arrive at the necessary market and metrology changes.(p.26)
	Alternative Technology Association	Regarding definition of supply point, suggests that 'metering point' be used instead of 'supply point'.
	Alternative Technology Association	Strongly supports parent/child metering and multi-element meters. Notes

Issue	Stakeholder	Comment
		National Minimum Functional Specification for twin element meters measures flows for each element and total flows.
	Alternative Technology Association	Where more than one FRMP exists at a connection point, embedded generators should not be required to pay any portion of DUOS charges that they would not normally be charged if there was only one FRMP. (p.9)
	Alternative Technology Association	Regarding two FRMPs and disconnection, agrees that it is necessary for a FRMP to disconnect total load where there is one point of disconnection. For this to occur, however, consumer must have provided explicit informed consent to each FRMP, the consumer must be given the option to have installed at a reasonable cost, a separate disconnection point for each or either FRMP, in the event of disconnection the initiating FRMP must inform the other FRMP. (p.10)
	Energy Retailers Association of Australia	Opposed to parent-child NMIs; suggests that smart metering technology could accommodate the metering requirements for charging of EVs.
	Energy Retailers Association of Australia	It is essential that each part of the load is able to be disconnected independent of the other FRMPs achieved through technical metering specifications. (p.3)
	Energy Supply Association of Australia	Troubled by proposal to allow one FRMP to disconnect the entire load. Notes electricity as an essential service. Best way to ensure consumer protection and avoid wrongful disconnection is for one FRMP (the one with primary responsibility for supply) has right to disconnect a single connection point. Supports a cost-benefit analysis of

Issue	Stakeholder	Comment
		AEMC's proposed arrangements. ESAA is concerned that AEMC's proposals provide rights to parties such as EV charging businesses without required them to have any responsibilities that existing energy supply businesses face. (p.2)
	better place	End distributor's monopoly of metering in Victoria. Unbundle metering charges from network tariffs in NSW and QLD. Allow accredited metering providers to act as the RP for a metering installation. Allow customers to select their metering provider directly (rather than only via a retailer or distributor). (p.4)
	better place	Regarding embedded networks, better place is opposed to an incumbent retailer or LNSP having the ability to block the creation of a new downstream connection point/supply point provided the customer has given its consent.(p.7)
	better place	Regarding disconnection where there are two or more FRMPs, agree that both FRMPs should have the power to disconnect the consumer's total load in accordance with consumer protections and subject to explicit informed customer consent. If they want separate disconnection equipment then this should be at the consumer's additional cost. (p.8)
	Metropolis metering	Supports removal of distributor controlled monopolies of metering services (e.g. DNSP is RP for small customer sites) but rather, supports competition and innovation. (p.3)
	Metropolis metering	Supports unbundling of

Issue	Stakeholder	Comment
		metering charges.(p.2)
Controlled charging	Origin Energy	If aggregators are involved it is crucial they bear all costs and risks associated with aggregator functionality otherwise risk of free-riding. (p.5)
	TRUenergy	Considers that non-firm benefits have been overstated.
	Aurora Energy	Regarding controlled charging, it is unclear about what reference to 'non-firm' benefits are. (p.5) Suggests NECF is the appropriate framework for improving negotiations between parties. (p.6)
	Energex	Supports consumer's right to control charging, but considers that consumer must face appropriate network price signals and suitable contractual arrangements need to be in place to manage load. (p.2)
	Ergon energy	Should be managed within network security constraints to avoid another system peak being generated. (p.1)
	SP AusNet	Under the NECF, DNSP will generally not be able to recover shared augmentation costs from most EV customers so customers will not feel cost pressures aside from their direct connection upgrade costs so having decision rest with consumer is somewhat flawed. (p.10)
	SP AusNet	Any party that controls load must have regard to and be responsible for the potential distribution network impacts of their load block switching actions. (p.5) The regulatory framework dealing with network protection and compensation for impacts of load block switching needs to be applied to third party providers (as similar to

Issue	Stakeholder	Comment
		current market participants). (p.6)
	Alternative Technology Association	Valuing non-firm benefits and improving negotiation process should be preserved in the final recommendations for the Power of choice review.
	better place	LNSP should be provided with a clearer financial incentive for contracting with providers of demand-side services and subject to AER's regulatory oversight. (p.5)
Vehicle-to-grid	Australian Energy Market Operator	Requiring all interval meters to be able to measure bi-directional energy flows should 'future proof' these meters/provide maximum flexibility in functionality. But notes that V2G still has upcoming potential and may be premature to enshrine requirements in NER. (p.2)
	Origin Energy	Supports bi-directional flow and V2G applications.(p.5)
	Aurora Energy	Does not support amending clause 7.3.1(a)(7) based on the age of the technology. Does not support changing 7.3.1(a)(7) for bi-directional interval metering but may be appropriate to specify metering capability elsewhere in the rules. (p.7)
	Ausgrid	Does not consider any additional changes to the Rules are required.(p.4)
	Energex	V2G still at early stage so there should not be a requirement to have bi-directional metering installed. The customer's right to control discharge of an EV back to the grid must be subject to agreement with distribution authority, similar to other forms of generation. (p.2)

Issue	Stakeholder	Comment
	SP AusNet	V2G requires recognition of the obligations and requirements which comes with any generation on the distribution network (similar to PV installations). (p.10) These obligations are for safety purposes. Victorian AMI and SCER functionality specification includes bi-directional measurement capability as a standard. (p. 11)
	Alternative Technology Association	Interval meters should have bidirectional capability.
	better place	Unduly heavy-handed to install a bi-directional meter at this early stage of EV market. If a customer seeks this type of connection and meter, they should bear it at their cost from the LNSP and accredited Metering Provider. (p.5)
Identifying a large load	Australian Energy Regulator	AER considers it is unclear what value there is in mandating the identification of large loads on the network - a degree of flexibility will still be required for DNSPs as to how they reflect local level constraints and shared asset costs in implementing time varying tariffs. Suggests it would be administratively simpler to offer time varying tariffs for certain consumer categories. Also, refinement needed on how the AEMC sets threshold levels for time varying tariffs and interval metering. (p.4)
	Origin Energy	Supports load transparency and notes that this functionality will assist more with demand management. (p.6).
	TRUenergy	Load requiring 15 amps should be known by the DNSP.
	Aurora Energy	Suggests that the requirement to identify large

Issue	Stakeholder	Comment
		loads more properly belongs with the NECF (as it relates to network planning) than the wiring rules. The load threshold to be set by DNSPs should be dealt with in the NECF. The identification of large loads by DNSP is recognised in Chapter 5A of the NER and drafting of NECF package as a 'connection alteration'.
	Ausgrid	Does not support obligations in NEM arrangements because there is jurisdictional safety and network management regulation and a DNSP's connection policy that specifies notification requirements of an electrical installation. (p.4).
	Energex	While important to capture large load information, need to avoid onerous administrative and data management for DNSP and/or other parties. May be possible to include this information in the standing data for each NMI. From a DNSP perspective, important to aggregate data from individual premises to identify areas where there is an increasing concentration of large load. (p.1)
	SP AusNet	Electricity customers already have an obligation to inform their DNSP/retailer of any significant changes to their load (e.g. Victorian electricity distribution code). But notes clustering effect and notes it will be some time until network planning to cater for this is established. Considers a more specific obligation and reporting mechanism for high capacity EV charging stations should be established. (p.11)
	Alternative Technology Association	Supports load above a threshold being identified by the DNSP. Alternatively,

Issue	Stakeholder	Comment
		identify maximum customer demand in kVA or kW of the customer premises in the same way that demand charges are currently determined for some customers.
	better place	Suggests that current practice is inefficient. Rather than focusing on appliance loads above a specific size, regulators should focus on what cost-recovery mechanism could be introduced for those premises seeking increases to the size of their grid connection. (p.6)
Retail issues	Australian Energy Market Operator	The AER should review its exemptions framework in light of our proposals.(p.5)
	Australian Energy Regulator	Regarding the sale of electricity, the AER considers that EV charging does not constitute consumption 'for premises' as the energy sale is for an external, mobile purpose. Interpretation of the sale of electricity 'at premises' would create precedents beyond scope of Retail Law. Also, EV charging applies to transport sector as retail law may not be necessary nor appropriate for such services.(p.2)
	Australian Energy Regulator	Regarding the bundled service provider, the AER does not see merit in developing a specific guideline but has provided guidance in its exempt selling guideline as to what constitutes the sale of electricity. (p.2) AER considers a sale of energy takes place where there is a separate charge for energy consumed and where the charge is based on consumption. Where any value added services are provided and energy is one component of a broader charge, the AER's view is

Issue	Stakeholder	Comment
		that no sale of energy is taking place. (p.2)
	AGL	Any entity that interacts with a customer where the sale or supply of electricity is provided should be subject to same regulatory obligations as retailers. (p.4) Not placing an obligation on a supplier of electricity to hold a retail licence as they are providing a 'bundled product' would increase risk to retail customer and is inequitable for retailers. AER should be required to specify how it will determine whether a bundled service provider is involved in the sale of electricity. Retail exemptions: supports level playing field. (p.4)
	Origin Energy	Supports the AER determining the arrangements to apply to a bundled service provider. Any assessment of what is the sale of electricity should take into account the effects on authorised retailers and their existing obligations to consumers. (p.12)
	Origin Energy	Regarding retail exemptions, agrees that the AER should review its retail exemptions framework to clarify the status of EV charging at commercial EV charging stations. (p.13)
	Simply Energy	Supports AEMC view that EV charging is the sale of electricity and should be subject to an authorisation and to the NECF (p.2). Opposed to 'bundled' service provider being exempt from the need to obtain a licence to sell energy and undermines concept of electricity as an essential service and is an incentive to establish retailing business models that avoid the need for a licence. (p.2,4)

Issue	Stakeholder	Comment
	TRUenergy	Agrees that the AER should develop a methodology to determine what, where and when a product is impacting on the sale or supply of energy.
	TRUenergy	Recommends that a tiered licensing regime where all participants must comply with the requirements of the NECF but the costs and prudential requirements could be tiered based on the relative business models of niche retailers in the NEM. (p.2)
	TRUenergy	Disagrees that ROLR framework is adequate in all instances, in particular, where a service provider has not been required to hold a license or authorisation.
	Aurora Energy	Regarding sale of electricity and bundled service provider, agrees with the proposal for AER to develop a guideline for bundled service provider.
	SP AusNet	To ensure that the current electricity regulatory regime is maintained, the provision of electricity for EV charging should be the legal sale of electricity.
	SP AusNet	The AER exemption guideline does not provide a suitable model for the failure of parties operating an embedded network - it makes no practical suggestion as to how embedded network customers will retain supply if they have no service provider. (p.28)
	Alternative Technology Association	Supports the AEMC's view on treatment of sale of electricity for EV charging. Asks that the AEMC advise on the treatment of energy exported to the grid under future V2G arrangements.

Issue	Stakeholder	Comment
		Supports AER guidelines. Supports review of AER's retail exemptions framework.
	Energy Retailers Association of Australia	Supports AEMC's view that EV charging is the sale of electricity and that EV charging agencies should be subject to NECF - some form of retail licence or NECF authorisation required. Need clearer analysis of impact of EVs on essential electricity services. Does not consider it appropriate for the AER or ERA to determine what constitutes the sale of electricity; AEMC should provide more policy direction. (p.1-2)
	Energy Supply Association of Australia	Concerned that the AER or ERA in WA would have regulatory oversight over whether a bundled service provider is involved in sale of electricity. Need more policy direction. Also concerned that rights/responsibilities to an electricity supply contract may be compromised by the application of general consumer protection measures to EV charging services. (p.3)
	better place	Sale of electricity. Support a guideline from AER on bundled service providers. (p.8)
	better place	Exemptions framework. Support reviewing its retail exemptions framework for EV charging at commercial EV charging stations. (p.8)
Western Australia	Western Power	Supportive of desirability for retail pricing signals to manage the impact of EVs on peak demand. (p.1)
	Western Power	Review of Balancing and Load Following Ancillary Services, should be considered as part of IMO's Market Evolution Program. (p.1)

Issue	Stakeholder	Comment
	Energy Supply Association of Australia	The key issue for WA to facilitate efficient uptake of EVs is to move to cost-reflective pricing. (p.3)

Table A.2 Natural Gas Vehicles

Issue	Stakeholder	Comment
General	AGL	Considers that an impediment to the uptake of NGVs is the Taxation of Alternative Fuels Act 2011. AGL considers that the tax does not encourage transport companies or users to transfer to cleaner fuels.(p.2)
	APA Group	APA generally supports the recommendation for no changes at this time. APA are concerned about cost and affordability for consumers, equitable allocation of those extra costs to consumers, and consideration of more non-electric grid transport solutions (e.g. NGVs). (p. 3-4)
	Kenworth Trucks	Outlines impediments to uptake of LNG (e.g. lack of national refuelling network) and suggests governments should respond to address these issues/barriers. (p.1)

B Appendix B - Draft framework specification for metering arrangements

Objective

The purpose of these specifications is to explain in detail the regulatory requirements for metering, which were developed in the electric vehicle and Power of choice reviews.

Scope

Whilst these specifications were developed for during the electric vehicle and Power of choice reviews, and were initially prepared for small customers as defined by the NECF (residential and small business consumers), they are not limited to these consumers, and apply more broadly to all consumers.

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E. A consumer may buy electricity from more than one FRMP at one connection point

F. Multi-element meters

G. Move in arrangements

H. Metering in an embedded network

Definitions

Existing definitions in the rules have been italicised in these specifications. In addition, a number of proposed new terms for metering have also been italicised. Outlined below are the new terms and their definitions that have been included in these specifications.

Cascading settlements point

A settlements point in a chain of *settlements points* established at a *connection point* between a *financially responsible Market Participant and Non-Registered Customer* or *franchise customer*, where each *settlements point* has a direct relationship with another *settlements point* in that chain and only one *settlements point* in that chain has a direct relationship to the *connection point*.

Child connection point

The *connection point* at the interface of an *embedded network* and a *Non-Registered Customer* or a *franchise customer* or a child *embedded network*.

Connection Point [change to read]:

The agreed point of supply established between a *network*, which is connected to part of the *national grid*, and:

- another Registered Participant's *network*;
- a *network* exempt by the *AER* or by the *Rules* that would otherwise be required to be registered with *AEMO*; or
- the circuits of a *Non-Registered Customer* or *franchise customer*.

Downstream settlements point

The *settlements point* that is last in the cascading chain of *settlements points* that commence at a *connection point* and lie between that *connection point* and a consumer at a single consumer *connection point*.

DUOS means *distribution use of system.*

Embedded network

A *network* that is connected to the first *distribution network* in a cascading chain of *distribution networks*, which commences at a *transmission network connection point*. An *embedded network* may be registered with the *AEMO* or exempt from registering with the *AEMO*.

Embedded network connection point

A connection point on an *embedded network.*

Embedded network service provider

A person who engages in the activity of owning, controlling, or operating an *embedded network distribution system.*

FRMP means *financially responsible Market Participant.*

Independent settlements point

A unique *settlements point* that is established at a *connection point* between a *financially responsible Market Participant and Non-Registered Customer or franchise customer* and has no direct cascading relationship with any other *settlements point*.

LNSP means *local network service provider.*

Metering Coordinator

Under the proposed contestable metering model discussed in the Power of Choice review, the *Metering Coordinator* is the person who undertakes the current role of *responsible person*.

Micro generating unit

A *generating unit* that has a name plate rating of less than 1,000 kW and is capable of injecting electricity into the *national grid* at a *settlements point*.

Minimum functionality specification

The functionality of a *metering installation* as recorded in Section 2 of Part 1 of the Power of choice metering specification.

Multi-element settlements point

The *settlements point* that is assigned a *metering installation* formed from a *meter* that contains multiple *measurement elements*.

Parent connection point

The *connection point* at the interface of two *distribution networks* in a chain of *distribution networks*, and refers to the *distribution network* that is furthest away from the *transmission network*.

Point of disconnection

The recognised location where a circuit is switched so as to remove a *load* that was participating in the *national electricity market*. The location may be at or near a *connection point*, or at or near a *settlements point*.

Primary settlements point

The *settlements point* that supplies the consumer's primary load, as determined in the *metrology procedure*.

Settlements point

The agreed point of *supply* established at or near a *connection point* between a *financially responsible Market Participant and Non-Registered Customer or franchise customer*.

Single element settlements point

The *settlements point* that is assigned a *metering installation* formed from a *meter* that contains a single *measurement element*.

Upstream settlements point

The *settlements point* that is first in cascading order from a *connection point* and lies between that *connection point* and a consumer at a single consumer *connection point*.

These definitions are visualised in the following diagrams:

Figure B.1 Diagram 1 – premise of a single consumer

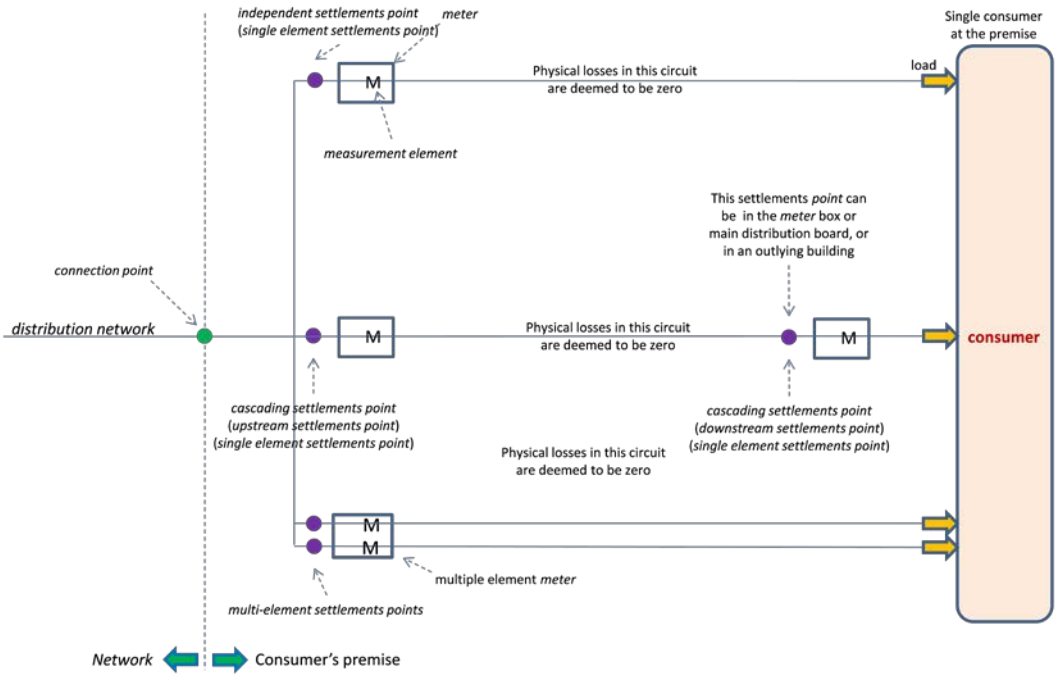


Figure B.2

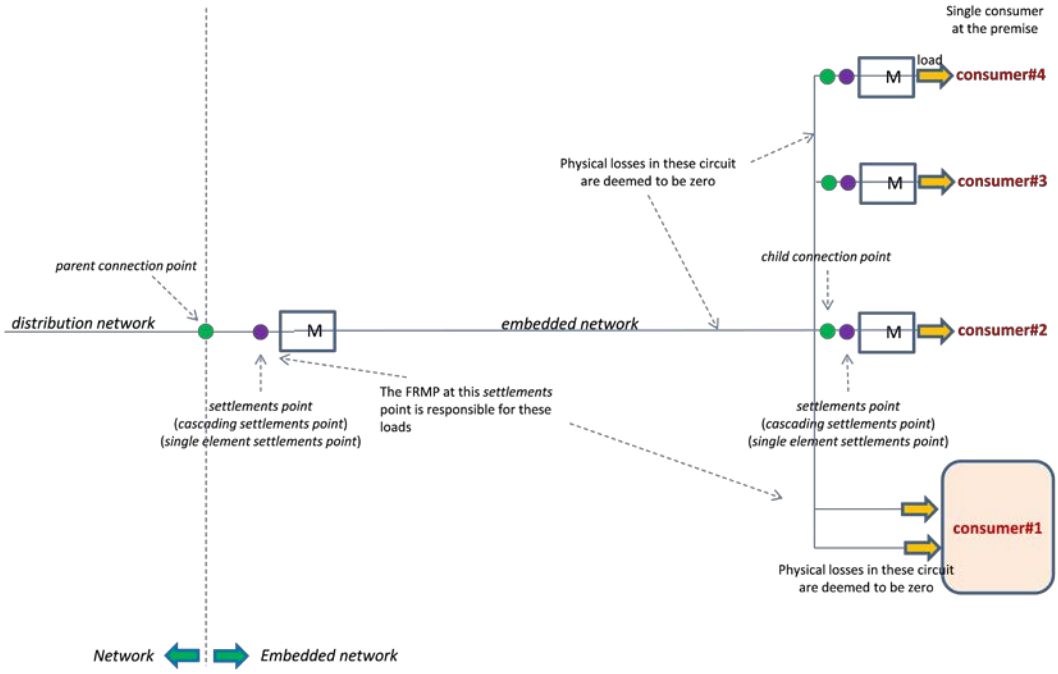
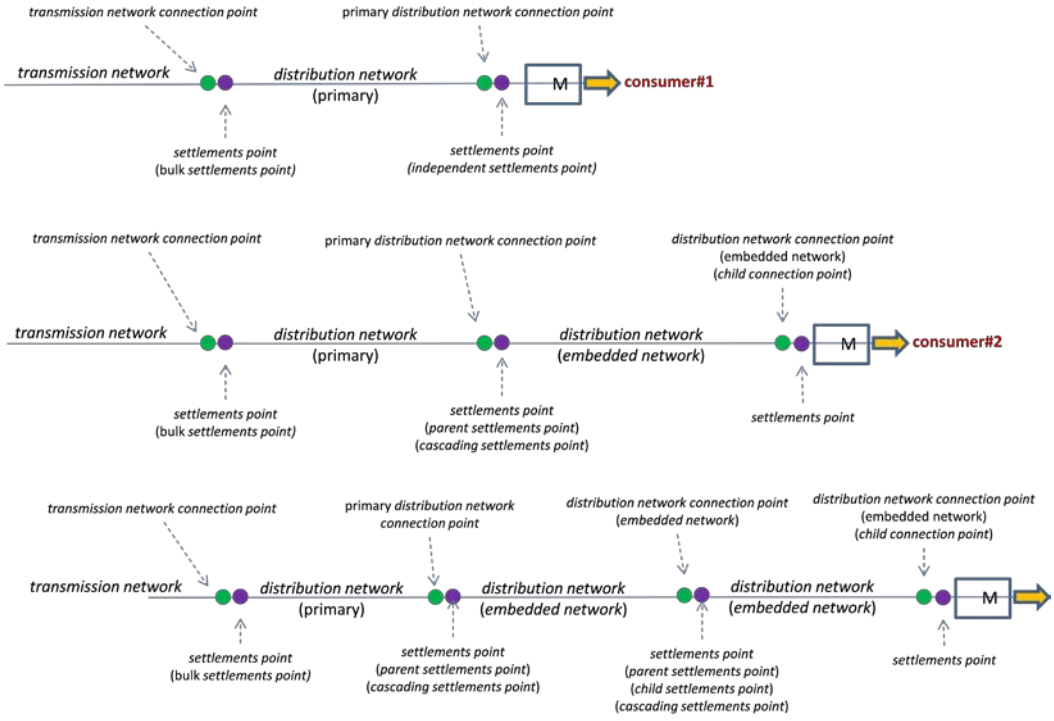


Figure B.3



Principles that apply to consumer choice including use of dedicated loads

The Power of Choice and Electric Vehicle reviews found that *National Electricity Market ("NEM")* arrangements are generally capable of incorporating changes to accommodate demand side participation decisions by consumers, and efficient investment in and use of dedicated *loads*, an Electric Vehicle being one example. Based

on this finding, these specifications have been prepared in accordance with the following principles:

1. These rules apply to all consumers. Examples of their broader application include:

   (a) requirements on an *FRMP* before participating with a *load* in the market;

   (b) a medium sized consumer in an embedded network arrangement; and

   (c) the application of multiple *settlements points* at a *connection point* for a single consumer premise.

2. *NEM* rules that relate to *loads* (including dedicated *loads*) at a *settlements point* have been varied to facilitate efficient investment decisions for both consumers and providers for these *loads*.

3. The existing rules in Chapter 7 remain unless altered by the intent of these rules.

4. A consumer may buy electricity from one or more *FRMPs* at a *connection point*. Each *FRMP* must have a unique *settlements point*.

5. A *FRMP* who supplies electricity to a consumer must register the consumer's *load* against a *settlements point* and assign that *settlements point* to the related *connection point*.

6. More than one *settlements point* may be assigned to a *connection point*.

7. More than one *FRMP* may be associated with a *connection point* providing that each *FRMP* is also registered against a unique *settlements point* which is assigned to that *connection point*.

8. A *settlements point* must have a *metering installation* and a *metering installation* (other than a type *7 metering installation*) must have at least one *measurement element*.

9. Two or more *measurement elements* each designated a *settlements point* may be contained within a single *meter*.

10. A *metering installation* must meet the *minimum functionality specification* where a new *settlements point* is established, the *metering installation* is refurbished, or the *meter* is changed. This condition applies whether the appliance is a *load* or has the potential to, or does, inject electricity into that *settlements point.*

11. Some appliances have the potential to be a *micro generating unit* at a *settlements point* in which case the *metering installation* at that *settlements point* and other related *settlements points* (if any) must accommodate both the measurement and settlements of the electricity injected through the *settlements points*.

12. A dedicated *load* or *micro generating unit* may connect to a *distribution network connection point* at any location so long as there is a *settlements point* assigned to that *connection point*.

13. A consumer may separate the consumption of a dedicated appliance from its household consumption.

14. *Two settlements points* in a cascading chain will be given the formal title of *upstream* and *downstream* when the *settlements points* at a single *connection point* are registered against the one consumer. The proposed arrangements make it possible for subtractive metering arrangements to be applied equally to a parent-child meter configuration and at a single consumer's premise.

15. *Two settlements points* in a cascading chain will be given the formal title of *parent* and *child* when the *settlements points* are in an *embedded network*. The proposed arrangements make it possible for subtractive metering arrangements to be applied equally to a parent-child meter configuration and at a single consumer's premise.

16. A *distribution network* is a *network* that is connected to another *distribution network* but is not a *transmission network* or a primary *distribution network* (the *distribution network* that interfaces with the *transmission network*) is an *embedded network*, and may be exempted from some or all of the rules by the *AER*.

17. Disconnection of an *independent settlements* point is available to the *FRMP* who is registered against that *settlements point*.

18. Only the first *FRMP* engaged by a consumer to a *connection point* is permitted to register *settlements points* against that *connection point* where there is only one *point of disconnection* for all *settlements points* established at the *connection point*, except where subsequent *FRMPs* engaged by the consumer at the *connection point* agree to be subject to disconnection by the first *FRMP*. In the same way, only the first *FRMP* engaged by a consumer to a multi-element *meter* is permitted to register *settlements points* against multiple *measurement elements* within a single device where there is only one *point of disconnection* for all *measurement elements* established in the device, except where subsequent *FRMPs* engaged by the consumer at that device agree to be subject to disconnection by the first *FRMP*..

19. A *FRMP* is permitted to disconnect a *multi-element settlements point* if that *settlements point* is able to be disconnected separately to all other *multi-element settlements points* within the single device.

20. Disconnection of an *upstream settlements point* is available to the *FRMP* who is registered against that *settlements point*, with the *FRMP* who is registered against the *downstream settlements* point accepting the risk of disconnection, should it occur for any reason.

21. Disconnection of the *parent settlements point* in an *embedded network* is restricted to the *load* at that *settlements point* for which the *FRMP* at that *settlements point* is

responsible.[143] Note that at a single consumer's premise, a different principle has been adopted where disconnection of the *upstream settlements point* can result in the disconnection the whole consumer's *load*.[144]

22. An *embedded network* does not exist at a single *connection point* that is assigned to only one consumer.

23. Physical losses within a single consumer's premise[145]are deemed to be negligible (the *independent settlements point, multi-element settlements point or upstream settlements point*, as the case may be, will absorb these losses).

24. The physical losses in an *embedded network* are deemed to be zero unless the *embedded network* service provider obtains approval from the *AER* to apply actual losses or *distribution loss factors*, in accordance with clause 3.6.3 of the *Rules*.

25. Consumer protection is provided by reference to the NECF or to jurisdictional consumer protection regulation where NECF had not been adopted.

26. These rules will not impact on the intent of any existing metering related derogations specified in Chapter 9 of the *Rules*.

Contestable model proposed in the Power of Choice Review

The AEMC undertook the Power of choice - Stage 3 DSP Review in parallel with the Energy Market Arrangements for Electric and Natural Gas Vehicle Review. The Power of choice review proposed a contestable metering arrangement that would impact on the recommendations for the Electric Vehicles review. The relevant aspects of the contestable model are:

1. The term *responsible person* in the *Rules* to be replaced with the term *Metering Coordinator*.

2. A *minimum functionality specification* to be specified for all new, refurbished and replacement *metering installations*.

3. Conditions are provided for the provision of communication infrastructure to the *metering installation*.

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143 This principle was written to ensure that one consumer cannot cause the loss of supply to other consumers. For example, where a commercial building is an embedded network, a dispute between the owner of the building and the FRMP for the parent should not cause the disconnection of the various businesses within the building.

144 In the case of a single consumer's premise, disconnecting the *upstream settlements point* is allowed to disconnect the whole consumer's *load* as this would simplify the disconnection arrangements and only a single consumer is affected. The *FRMP* for the *downstream settlements point* needs to consider this risk when it establishes the *metering installation* for the downstream part of the consumer's *load*.

145 The term premise' is used as a general reference to a site, without a reference to the dimension of that site, the size of the consumption, or the number of consumers at that site.

Prior to the commencement of any of the recommendations from the Power of choice review, the *responsible person* will perform the role defined in this document as the *Metering Coordinator*, and the *minimum functionality specification* will be defined by the current requirements of rule 7.3.1(a) in Chapter 7.

A. Connection point, settlements point and metering point.

Objective

The purpose of these rules is to redefine the term *connection point* for use solely for *network* purpose, to define the term *settlements point* that uniquely relates a *FRMP* to a *connection point* and to explain their relationship to the *metering point*.

Introduction

In the existing *Rules*, the term *connection point* has been used for two purposes: (a) to identify where *network assets* interface between owners, and (b) to identify the agreed point of supply of electricity between *AEMO* and a *FRMP* or a *Market Customer*, and between a *FRMP* and a *Generator, Non-Registered Customer or franchise customer*.

To accommodate demand side participation of consumers, and investment in and use of dedicated *loads*, a separation of these two purposes is recommended. The separation requires the term *connection point* to be used for the former purpose and a new term (*settlements point*) to be established for the latter purpose. Note that a *settlements point* may be located physically co-incidental with a *connection point*, or physically different to a *connection point*.

The term metering point remains unchanged from its current definition, which is:

> "The point of physical connection of the device measuring the current in the power conductor"

Note that a *metering point* may be located physically co-incidental with a *settlements point* or placed in physically different location to the *settlements point* (for example where the *settlements point* was deemed to be at the start of a circuit and the *meter* was located at the end of the circuit. In this example, the *meter* would be generally programmed to accommodate the physical losses between the *settlements point* and the *metering point*.

The following arrangements are to apply to the terms *connection point* and *settlements point* in the proposed *Rules:*

Connection point

1. A *connection point* is to be restricted in its use and is to refer only to the interface between *network* assets, or between *network* and consumer assets, when they apply to *transmission systems* or *distribution systems*. Its reference to 'supply' is to be altered to 'connection'. Consequently, a change in the definition of *connection point* would be adopted in the *Rules*.

2. The term *connection point* is to be changed to read:

"The agreed point of connection established between a *network*, which is connected to part of the *national grid*, and:

(a) another *Registered Participant's network*;

(b) a *network* exempt by the *AER* or by the *Rules* that would otherwise be required to be registered with *AEMO*; or

(c) the circuits of a *Non-Registered Customer or franchise customer*."

Settlements point

3. A new term is required to uniquely identify the point in a *network* or consumer's circuits where responsibility is assigned for the transfer of electricity from one party to another party. This point may be at the same physical location as a *connection point*, or it may be at a different physical location to the *connection point*. In each case, the agreed point of supply would be referenced to the *connection point* in the *metering register*.

4. For any one *connection point*, there may be one or more *settlements points* assigned to the *connection point*. The *settlements points* may transfer electricity that is mutually independent, or they may transfer electricity, some of which cascades though a chain of *settlements points*. To accommodate these situations, a new term is required.

5. The term *settlements point* is to be defined as:

"The agreed point of *supply* established at a *connection point* between a *financially responsible Market Participant* and a *Generator, Non-Registered Customer or franchise customer* at a *distribution network connection point*, or between *AEMO* and a *financially responsible Market Participant* at a *transmission connection point*. The *settlements point* must be assigned to that *connection point* as well as the adjacent *settlements point* (that is closest to the *connection point*) where there is a *cascading* chain of *settlements points*.

General

6. The reference to cascading only applies to *settlements points* without limitation to the *network* in which they apply. For example, they can apply in a consumer's distribution board or '*meter* box', between the meter box and an outlying building at the same premise or in an *embedded network*.

7. *Connection points* are described in terms of the entity connected at that point.

    (a) For example:

        (i) the *connection point* between a *transmission network* and a *distribution network* is termed the *transmission network connection point*;

(ii) the *connection point* between a *distribution network* and a consumer is termed the *distribution network connection point*;

(iii) the *connection point* between a *distribution network* and an *embedded network* is termed the *distribution network connection point*; and

(iv) the *connection point* between an *embedded network* and a *consumer* is to be termed the *embedded network connection point*.

8. *The* current use of the term *connection point* in Chapter 7 and other rules, such as rule 3.15, will be changed to *settlements point*. However, Chapter 7 will contain references to *connection point* after these changes have been made.

9. In the remainder of the *Rules*, the term *connection point* would continue to refer to the connection between the network asset owners and the assets of the *Network User*. Examples include:

(a) the interface between one *transmission network* and another *transmission network*;

(b) the interface between a *transmission network* and a *distribution network*;

(c) the interface between a primary *distribution network* and another primary *distribution network*;

(d) the interface between a *distribution network* and an *embedded network*;

(e) the interface between a *distribution network* and a *franchise customer*; and

(f) the interface between an *embedded network* and a *franchise customer*.

10. For the removal of doubt:

(a) A consumer that establishes a second *settlements point* at its premise, and hence an additional *metering installation*, need not establish a second *connection point* if there are no other consumers at that *connection point*, and the second *connection point* is at the same physical location as the first.

(b) If there is more than one consumer at a *connection point*, the circuits to these consumers form an *embedded network*, with that *connection point* being classified as the *parent connection point*. In this situation, *child connection points* are required to be established for each consumer.

11. The *metering installation* at a *cascading settlements point* must provide a unique data stream which will be sent by the *Metering Data Provider* engaged for that *metering installation*, to *AEMO* for purpose of *settlements*.

(a) For the removal of doubt, the *metering installation* at an *independent settlements point* must provide a unique data stream (or streams) which will

be sent, after processing by the *Metering Data Provider* engaged for that *metering installation*, to *AEMO* for purpose of *settlements*.

B. Requirements for loads to participate in the NEM.

Objective

The purpose of these rules is to enable *FRMPs* and consumers to understand the conditions for participating in the NEM for *loads* of all magnitudes.

Conditions for a load to be drawn from the NEM

1. Before participating in the *market* in respect of a *load*, a *Market Participant* (who will become the *FRMP* for that *load*) must ensure that:

   (a) the *load* is registered against a *settlements point*;

   (b) the *settlements point* is assigned to a *connection point*; and

   (c) a *Metering Coordinator* has been registered against the *settlements point* for the purpose of providing a *metering installation* at that *settlements point*;

2. The *Metering Coordinator* must ensure that the *metering installation* at a *settlements point*:

   (a) has at least one *measurement element*, unless it is a type 7 *metering installation*; and

   (b) meets the *minimum functionality specification* requirements for *metering installations* if a *meter* is deployed in the *metering installation*;

   (c) has been allocated a *NMI*; and

   (d) has been registered with *AEMO* against that *settlements point*.

3. For the removal of doubt, paragraph 1 covers all magnitudes of *loads*. The *connection point* can be on a *transmission network*, a primary *distribution network* (the *distribution network* that interfaces with the *transmission network*) or an *embedded network*.

4. At any one *connection point*, a *FRMP* who has been registered against two or more *settlements points* must ensure that the *load* at one *settlements point* is separately identifiable in the consumer's bill from a load at another *settlements point.*

C. Requirements for micro generating units to participate in the NEM

Objective

The purpose of these rules is to ensure that an appliance that has the potential to act as a *micro generating unit* meets certain *NEM settlements* requirements.

Background to the term 'micro generating unit'

Chapter 2 of the *Rules* makes reference to the capacity level of 30 MW to govern some of the conditions that must apply to *generating units*. Elsewhere, in *AEMO* procedures, a capacity level of 5 MW is identified as a lower level of capacity that *AEMO* is interested in when considering the classification of *generator units*. Early experience with the NEM indicated that *non-market generating units* (whose output is purchased entirely by a *Local Retailer*) required special conditions to be applied in regard to metering. These conditions were introduced in rule 7.3.1(i). The rule identifies the 1 MW (1,000 kW) capacity level as a divider between certain conditions that must be applied to these *generating units*.

Solar *generating units* are a recent addition to the small *generating units* in the NEM. Most domestic solar units are around 1 to 2 kW capacity (say 5 kW). The outcome of the EV Review has pointed to the future possibility of an electric vehicle being used as a *generating unit*. An assessment of the maximum capacity of an EV *generating unit* suggests a capacity of around 7 to 12 kW (say 15 kW). Whilst this technology has capacities well below the 1,000kW level, the metering requirements would not differ across these levels.

Consequently, it is proposed to adopt the 1,000 kW level as the level to which these new rules should apply. To assist in developing rule provisions for this level of capacity, the term *micro generating unit* has been adopted.

Mechanism to facilitate the settlements of electricity that is injected towards a network

1. Before participating in the *market* as a *market micro generating unit* or a *non-market micro generating unit*, a *Market Participant* (who will become the *FRMP* for that *generating unit*) must ensure that:

    (a) the *micro generating unit* is registered against a *settlements point*;

    (b) the *settlements point* is assigned to a *connection point*;

    (c) a *Metering Coordinator* has been registered against the *settlements point* for the purpose of providing a *metering installation* at that *settlements point*;

2. The *Metering Coordinator* must ensure that the *metering installation*:

    (a) For a *market micro generating unit* meets the *minimum functionality specification* requirements for *metering installations*;

    (b) For a *non-market micro generating unit* meets the provisions of rule for 7.3.1(i) of Chapter 7;

    (c) has been allocated a *NMI*;

    (d) has been registered with *AEMO* against that *settlements point*.

3. Note that the provisions in rule 7.3.1(i) of Chapter 7 will generally remain unaltered for *non-market micro generating units*. The following exemption will be added to this rule to remove any conflict between it and the application of the *minimum functionality specification:*

   (a) In instances when sub-paragraph (1) of paragraph 7.3.1(i) applies, remote collection of *metering data* will not be required when the *metering installation* does not measure the flow of electricity in *trading intervals*, or sub-multiples of a *trading interval*.

   (b) Sub-paragraph (5) of paragraph 7.3.1(i) refers to new accumulation metering equipment. This will be changed to remove the ability to use accumulation metering equipment in a new installation – the *minimum functionality specification* will apply to the metering equipment in this situation.

4. For the removal of doubt:

   (a) where sub-paragraph (2) of paragraph 7.3.1(i) applies, the *metering installation* must be in accordance with the *minimum functionality specification*;

   (b) sub-paragraph (6) of paragraph 7.3.1(i) applies to *micro generating units*;

   (c) sub-paragraph (7) of paragraph 7.3.1(i) only applies where the *metering installation* is required to meet the *minimum functionality specification*.

5. A *distribution network service provider* must not allocate *DUOS* (to a *FRMP* who is assigned to a *connection point* via its registration against a *micro generating unit* at a *settlements point*) that is in excess of the amount that would have been allocated if there was only one *FRMP* at that *connection point*.

D. Separating loads and generation within a premise of a single consumer.

Objective

The purpose of these rules is to permit a single consumer to separate the metering of one *load* or *micro generating unit* from the metering of another *load*.

Introduction

The proposed arrangements make it possible for subtractive metering arrangements that are used in a parent-child meter configuration to be used at a single consumer's premise.

The *connection point* at a premise defines the connection of that premise to a *network*. The number of consumers within that premise will determine the relationship of that *connection point* to other *connection points* within that premise.

These rules address a premise with a single consumer.

Within this premise, there may be one or more *settlements points* assigned to the *connection point*. The *settlements points* may transfer electricity to the consumer that is mutually independent, in which case independent measurement of the *load* will be required at *independent settlements points*. Or they may transfer electricity through a cascading chain of *settlements points* that are interconnected, in which case the measurement of *load* at each of the *cascading settlements points* will be required. A mixture of both types of measurement locations may occur at any one premise.

One or more *settlements points* may be established for the purpose of injecting electricity back into the *national grid*, whilst others transfer electricity from the *national grid* to the consumer.

Relationship of connection point to a single consumer

1. A premise with a single consumer must only have one *connection point*. For the removal of doubt, this rule refers to one physical location. A premise with a single large consumer who takes supply at more than one physical location may have one *connection point* at each of those physical locations.

2. A premise with one *connection point* may have more than one *settlements point*.

Independent measurement of loads

3. *Settlements points* may be established so that each has an independent relationship with the *connection point* (*independent settlements point*). That is, these *settlements points* would transfer electricity in a radial manner away from the *connection point* in the case of a *load* or towards the *connection point* in the case of a *micro-generating unit*.

4. A *Non-Registered Customer* or a *franchise customer* may elect to have one of its *loads* or *micro generating units* registered against one *independent settlements* point and another of its *loads* or *micro generating units* registered against another *independent settlements point*, with no limitation to the number of *settlements points* established in this manner. For the removal of doubt, a *load* and a *micro generating unit* may be connected to the *national grid* through the same *independent settlements point*.

5. A *FRMP* must register the *load* or *micro generating unit* of a *Non-Registered Customer* or a *franchise customer* against one or more *independent settlements points* if so requested by that customer.

6. Each *independent settlements point* must have its own *metering installation* and *NMI* and be separately registered with *AEMO* for *settlements* purpose.

Cascading measurement of loads

7. *Settlements points* may be established in a cascading chain (*cascading settlements point*) between the *connection point* and the consumer with only the first *settlements point* having a direct relationship with the *connection point*. That is, these *settlements points* would transfer electricity in an interconnected manner

away from the *connection point* in the case of a *load* or towards the *connection point* in the case of a *micro generating unit*.

8. A *Non-Registered Customer* or a *franchise customer* may elect to have all of its *loads* registered against the first *cascading settlements point* and one or more of its *loads* or *micro generating units* registered against the *cascading settlements point* that is electrically further away from the *connection point*, with no limitation to the number of *cascading settlements points* established in this manner.

9. A *FRMP* must register the *load* or *micro generating unit* of a *Non-Registered Customer* or a *franchise customer* against a *cascading settlements point* if so requested by that customer.

10. Each cascading *settlements point* must have its own *metering installation* and *NMI* and be separately registered with *AEMO* for *settlements* purpose.

Accounting for electrical losses:

11. If the *cascading settlements points* are assigned to the *connection point* of a premise with a single consumer, no adjustment of the relevant *metering installations* is required to accommodate *electrical energy losses* between the *settlements points*.

12. For the removal of doubt, if the *upstream settlements* point is located at the *meter box* in one building and the *downstream settlements point* is located in an outlying building, the physical loss in the circuit between these locations is deemed to be zero and will be measured by the *upstream settlements point metering installation*. The *FRMP* at the *upstream settlements point* will bear the increase in measurement due to the physical loss and pass this on to the consumer in accordance with commercial arrangements.

E. A consumer may buy electricity from more than one FRMP at one connection point.

Objective

The purpose of these rules is to establish the necessary arrangements that enable a consumer to buy electricity from more than one *FRMP* at a *connection point* and to change those *FRMPs* if so desired. This would increase consumer choice by enabling a range of electricity related services to be offered to the consumer.

Relationship of settlements points and FRMPs to a single consumer

1. Each *settlements point* in a premise with one *connection point* must be assigned to a *FRMP*, but the consumer has discretion, except where rule 2 below applies, as to whether each *settlements point* has a unique *FRMP* or a common *FRMP* or a combination of unique and common *FRMPs*.

2. The number of *FRMPs* at a *connection point*, irrespective of the number of *settlements points* assigned to that *connection point*, will depend on the number of *points of disconnection* available to those *settlements points*.

Consumer may buy electricity from more than one party

3. A *Non-Registered Customer* or a *franchise customer* may buy electricity from more than one *FRMP* at a *connection point* providing each *FRMP* is registered against a unique *settlements point*.

4. There is no restriction on the number or relationship of the *settlements points*. The *settlements points* may have an independent relationship to the *connection point* or have a cascading relationship to the *connection point*.

5. The financial arrangement between each *FRMP* and the *Non-Registered Customer* or a *franchise customer* at each *settlements point* is a retail market arrangement and not a wholesale market arrangement.

6. The wholesale market financial arrangements for each *FRMP* at *cascading settlements points* must follow the *AEMO settlements* by difference process

7. The *metering data* at any one *settlements point* is *confidential information* and must not be available to a *FRMP* who is not registered at that *settlements point*. For the removal of doubt, the *metering data* from an *upstream settlements point* must not be made available to a *FRMP* at a *downstream settlements point* but the *metering data* from a *downstream settlements point* must be made available to a FRMP at an *upstream settlements point* for the sole purpose of determining the *load* for which that *FRMP* is responsible.

Consumer may sell electricity to one party and buy electricity from another party

8. A *Non-Registered Customer* or a *franchise customer* may sell electricity to a *FRMP* at a *connection point* and buy electricity from another *FRMP* at the same *connection point* providing each participant is registered against a unique *settlements point*.

9. The *FRMP* at an *upstream settlements point* is not separately liable to any party for any electricity injected into the *national grid* as a result of a *micro generating unit* that is registered by a *FRMP* at a *downstream settlements point*. However, the *FRMP* at the *upstream settlements point* is liable for the difference in measurement between the *upstream settlements point* and downstream settlements point when all *measurement elements* of the related *metering installations* are taken into account in the *settlements process*.

Conditions that apply when one FRMP seeks to disconnect

10. A *point of disconnection* may be contained in the *meter* or outside that *meter*.

    (a) For the removal of doubt a *meter* that meets the *minimum functionality specification* will contain a *point of disconnection* in that device.

11. If there is only one *point of disconnection* for two or more *settlements points* at a *connection point* then as a general rule only one *FRMP* will be permitted to disconnect those *settlements points*. The exception will be when two or more *FRMPs* agree (either amongst themselves or as requested by the consumer) that

one *FRMP* will have all rights to the disconnection of all affected *settlements points*, in which case:

(a) The *FRMP* who has the right to disconnect must be registered in *MSATS* with that right;

(b) The *FRMPs* who do not have that right accept the risk of disconnection, should it occur for any reason;

(c) The *FRMP* who exercises its right and disconnects all *loads* at the affected *settlements points* is not liable to other *FRMPs* for any loss of *load*.

(Note: this rule covers the conditions prior to upgrading all *metering installations* at a *connection point* to the *minimum functionality specification*, or where some *metering installations* have been upgraded and other not upgraded).

12. If an *independent settlements point* has a unique *point of disconnection* the *FRMP* associated with that *settlements point* is permitted to disconnect that *settlements point* but not any other *settlements point*.

13. Consistent with the previous conditions, the following rules apply:

(a) The *FRMP* that is registered against an *independent settlements point* may disconnect a *Non-Registered Customer* or a *franchise customer* who is a buyer of electricity at that *settlements point* subject to the *FRMP* meeting its obligations under the National Energy Customer Framework (NECF) or under jurisdictional consumer protection regulation where NECF had not been adopted.

(b) The *FRMP* that is registered against a *downstream settlements point* that is furthest away electrically from the *connection point* may disconnect a *Non-Registered Customer* or a *franchise customer* who is a buyer of electricity at that *settlements point* subject to the *FRMP* meeting its obligations under the NECF or under jurisdictional consumer protection regulation where NECF had not been adopted.

(c) The *FRMP* that is registered against an *upstream settlements point* may disconnect (and reconnect) the total *load* of the *Non-Registered Customer* or a *franchise customer* who is a buyer of electricity at that *settlements point* without regard to any supply arrangements established between the customer and another *FRMP* at a *downstream settlements point*. In this situation:

(i) If the *FRMP* decides to disconnect a *Non-Registered Customer* or a *franchise customer*, it must be in accordance with the arrangements specified in the NECF or in jurisdictional consumer protection regulation where NECF had not been adopted.

(ii) The *FRMP* who initiated the disconnection or re-connection (which will be regarded as planned in the case of disconnection) must inform the *LNSP* who is registered against the *connection point*, the *FRMPs* who are registered against *downstream settlements points* and the *Metering Data Providers* who are registered against the *cascading settlements points* of the change in supply conditions at the *upstream connection point* with reasonable notice prior to the disconnection and as soon as practical after the re-connection. For the removal of doubt, the parties may be informed of the event via the *MSATS* facility or any other industry agreed facility.

(d) A *FRMP* who registers a *load* or *micro generating unit* against a *downstream settlements point* must accept the risk that the *FRMP* at the *upstream settlements point* may disconnect and reconnect the *upstream settlements point* for commercial reasons without agreement from the *FRMP* at the *downstream settlements point*. For the removal of doubt, there is nothing preventing that *FRMP* from establishing an *independent settlements point* if the risk in establishing a *downstream settlements point* is not acceptable.

The situation when a consumer changes one of its FRMPs

14. Two unique situations exist when a consumer changes one of its *FRMPs* at a *connection point*:

    (a) The *FRMPs* may be associated with *multi-element settlements points*; or

    (b) The *FRMPs* may be associated with *single element settlements points*.

15. If the consumer engages more than one *FRMP* at a *connection point* it may change one or more of those *FRMPs* as separate and independent acts in accordance with the following arrangements.

16. If the *FRMP* to be changed by a consumer is registered to a *single element settlements point*, that *FRMP* may be changed without impacting on any other *FRMP* at that *connection point*. In this situation:

    (a) The new *FRMP* will assume the financial responsibility for the relevant *settlements point*, including any *DUOS* charges allocated to that *settlements point*.

    (b) The new *FRMP* will accept the registered *Metering Coordinator* and the commercial arrangements established between the *Metering Coordinator*, the old *FRMP* and the consumer.

17. If the *FRMP* to be changed by a consumer is registered to a *multi-element settlements point*, that *FRMP* may be changed in accordance with the following arrangements:

(a) The new *FRMP* will assume the financial responsibility for the relevant *settlements point*, including any *DUOS* charges allocated to that *settlements point*.

(b) The new *FRMP* will accept the registered *Metering Coordinator* and the commercial arrangements established between the *Metering Coordinator*, the old *FRMP* and the consumer.

(c) If the old *FRMP* at the *settlements point* was the *Metering Coordinator* for the associated *metering installation*, the old *FRMP* must continue providing *Metering Coordinator* services to the second *FRMP* and the new *FRMP* (or consumer as the case may be) under the existing arrangement, or under a new arrangement as determined by the consumer. If the consumer decides to change the *Metering Coordinator*, then it would be required to pay any exit fees under the contract with the old *FRMP*.

(d) If the old *FRMP* at the *settlements point* was not the *Metering Coordinator* for the associated *metering installation*, then the new *FRMP* must accept the existing *Metering Coordinator* and the established commercial arrangements, including the payment of its share of the costs of the *Metering Coordinator* unless otherwise requested by the consumer. The new *FRMP* may recover the costs of the *Metering Coordinator* from the consumer.

Allocation of DUOS charges to FRMPs

18. At a *connection point DUOS* charges would be allocated by a *Distribution Network Service Provider* to *FRMPs* in accordance with the following arrangements:

(a) The fixed component of *DUOS* must be allocated to the *FRMP* who is registered at the *primary settlements point*[146];

(b) Any energy component would be paid by the *FRMP* who is registered at an *independent settlements point* in proportion to the measured *load* at that *settlements point*;

(c) Any energy component would be paid by the *FRMP* who is registered at a *cascading settlements point* in proportion to the *load* attributed to that *FRMP* by *AEMO* in the *settlements* process at that *settlements point*;

(d) Any peak demand component would be shared by *FRMPs* at their *settlements points* in proportion to the coincident contribution that their measured *load* at that *settlements point* made to the peak, where the *load* may be reduced by any generation at that *settlements point* or at a *downstream settlements point*.

146 Note that this arrangement is to ensure that competition between FRMPs (at multiple settlements points registered against a single connection point) is based on variable prices.

19. A *FRMP* may recover its portion of the *DUOS* charges through the *FRMP* invoice received by the consumer.

20 *AEMO* must amend the *metrology procedure* within 12 months of the commencement of the rule to include the principles that allow the *primary settlements point* to be identified by FRMPs without ambiguity. When amending the *metrology procedure* under this rule AEMO must consider the following principles:

- the *primary settlements point* is only to be defined at a premise with a single *connection point* and a single consumer;
- if a *connection point* has only one *settlements point*, that *settlements point* will be the *primary settlements point*. For the removal of doubt, a subsequent *settlements point* that was established for a dedicated *load* would not be classified as a *primary settlements point*;
- the *primary settlements point* supplies the majority of the consumer's appliances, rather than a dedicated *settlements point* for an individual *load*. Typical consumer appliances include:
    - in the case of a household: lights, general purpose power point appliances, stove, fridge, washing machine, and similar basic appliances; and
    - in the case of a business: lights, office machines, general purpose power point appliances, and similar basic appliances; and
- a *downstream settlements* point cannot be the *primary settlements point*.

Situations where a consumer or FRMP wants to upgrade its metering installation

It is noted that situations where a consumer or *FRMP* wants to upgrade its *metering installation* it is covered in Section A Part 1 of the Power of choice metering specification.

F. Multi-element meters.

Objective

The purpose of these rules is to specify the arrangements when a multi-element *meter* contains two or more *metering installations* that are registered to one or more *FRMPs*.

Number of FRMPs at a multi-element meter

1. The number of *FRMPs* permitted at a multi-element *meter* will depend on the number of *points of disconnection* available to all the *measurement elements* in that *meter*.

2. If there is only one *point of disconnection* at a multi-element *meter* then as a general rule only one *FRMP* will be permitted to register *settlements points* against those *measurement elements*. The exception will be when two or more *FRMPs* agree (either amongst themselves or as requested by the consumer) that one *FRMP* will have all rights to the disconnection of the multiple *measurement elements*, in which case:

   (a) The *FRMP* who has the right to disconnect must be registered in *MSATS* with that right;

   (b) The *FRMPs* who do not have that right accept the risk of disconnection, should it occur for any reason; and

   (c) The *FRMP* who exercises its right and disconnects all *loads* at that *meter* is not liable to the other *FRMPs* for any loss of *load*.

3. If a *measurement element* in a multi-element *meter* has a unique *point of disconnection* a *FRMP* will be permitted to register a *settlements point* on that circuit and assign a *metering installation* that contains the *measurement element* to the *settlements point*.

4. For the removal of doubt, a *point of disconnection* of a *measurement element* may be contained in the multi-element *meter* or outside that *meter*.

Multi-element and single element settlements points

5. A single element *meter* refers to the *meter* used in a *metering installation* that is registered against a *single element settlements point*.

6. A multi-element *meter* refers to the *meter* used in a *metering installation* that has two or more *measurement elements*, where those *measurement elements* are collectively or individually registered against one or more *multi-element settlements points*, and where:

   (a) each *measurement element* in the *meter* is registered to the one *FRMP*; or

   (b) one *multi-element settlements point* is assigned to one *FRMP* and another *multi-element settlements point* is assigned to a different *FRMP*.

7. An individual *measurement element* may be defined as a *metering installation* for the purposes of the *Rules*. In this situation, an individual *measurement element* must:

   (a) be registered to a *settlements point* that has been assigned a *FRMP* by the consumer;

   (b) be assigned a unique *NMI* by the *Metering Coordinator*; and

(c) provide a unique data stream which will be sent by the *Metering Data Provider* who has been engaged for that *metering installation* to *AEMO* for purpose of *settlements.*

Metering Coordinator arrangements

8. Where a multi-element *meter* is installed and the *measurement elements* are assigned to one or more *settlements points*, the same *Metering Coordinator* must be registered against each *measurement element*. In this situation:

   (a) Each *measurement element* must be assigned to one or more *metering installations*.

   (b) Each *metering installation* that is established must be registered against a unique *settlements point*.

   (c) Each *measurement element* that is assigned a unique *metering installation* must be allocated a unique *NMI*.

   (d) The *Metering Coordinator* must share all the common costs of its service equally with the *FRMP(s)* at those *settlements point(s)*.

   (e) The *Metering Coordinator* may provide customised services to each *FRMP*, if more than one. The customised portion of the service cost is to be allocated to the requesting *FRMP* in addition to its share of the common cost.

   (f) The *Metering Coordinator* is responsible for managing access to each *metering installation*.

9. For the removal of doubt, where two *metering installations* are established in a two element *meter*, one *measurement element* will be a component of one *metering installation*, and the second *measurement element* will be a component of a different *metering installation*.

10. The choice of a *Metering Coordinator* for a multi-element *meter* is to be made in accordance with the following arrangements:

    (a) If only one *FRMP* utilises the multi-element *meter*, the *Metering Coordinator* must be chosen in accordance with Part 1 Section A of the Power of choice Metering Specification.

    (b) If two or more *FRMPs* utilise the multi-element *meter*, the *Metering Coordinator* must be chosen by the *FRMP*, who is registered at the *primary settlements point*, in accordance with Section F.13 below, unless the consumer chooses, or requests one of the *FRMPs* to choose, the *Metering Coordinator* in which case the *Metering Coordinator* must be chosen by that consumer or FRMP in accordance with Part 1 Section A of the Power of choice Metering Specification.

11. The *Metering Coordinator* who is responsible for a multi-element *meter* must ensure that the datastream for each *metering installation* is partitioned to the point where it is available to the *FRMP* that is entitled to that datastream but is not accessible to the *FRMPs* who may be registered against other multi-element *metering installations* of the multi-element *meter*.

Allocation of DUOS charges to multiple FRMPs

12. At a *multi-element settlements point* the determined *DUOS* variable charge would be allocated to a *FRMP* who was registered against that *settlements point*. For the removal of doubt:

    (a) The energy component would be paid by that *FRMP* in accordance with the measured *load* at that *settlements point*;

    (b) The determined peak demand component amount would be paid by that *FRMP* in proportion to its contribution to the coincident peak demand at the *connection point*.

13. For the removal of doubt, a *multi-element settlements point* may be classified as a *primary settlements point* by the *metrology procedure*, in which case the *FRMP* at that *settlements point* would be liable for the total *DUOS* fixed cost should the multi-element *meter* be the only *meter* at the *connection point*.

14. A *FRMP* may recover its portion of the *DUOS* charge through the *FRMP* invoice received by the consumer, where the *FRMP* must separately itemise the *DUOS* charge on that invoice.

Disconnection of a consumer at a multi-element metering installation

15. The *FRMP* that is registered against a *multi-element settlements point* may disconnect a *Non-Registered Customer* or a *franchise customer* who is a seller or buyer of electricity at that *settlements point:*

    (a) in accordance with the rules of disconnection in Section E; and

    (b) subject to the *FRMP* meeting its obligations under the National Energy Customer Framework (NECF) or under jurisdictional consumer protection regulation where NECF had not been adopted.

16. For the removal of doubt, disconnection at a multi-element *meter* that has only one point of disconnection can only be initiated by the *FRMP* who has been allocated that right.

G. Move in arrangements.

Objective

The purpose of these rules is to specify the arrangements when a consumer moves into a premise which has an existing *connection point*, one or more *settlements points*, *FRMP(s)*, *Metering Coordinator(s)* and *metering installation(s)*.

Situations where a consumer moves premise

1. If the consumer moves into an existing premise after another consumer has moved-out, the existing *settlements points, FRMPs and Metering Coordinators* remain unaltered for that premise until the move-in consumer chooses to engage new parties and those parties have been registered against the *settlements points*.

2. If an existing *Metering Coordinator* had a metering services agreement with a *FRMP* for the move-out consumer, that metering services agreement must continue to be applied to the move-in consumer.

3. If an existing *Metering Coordinator* had a metering services agreement with the move-out consumer, the move-in consumer must inherit that agreement. In this situation:

    (a) and irrespective of an agreement between the *Metering Coordinator* and the move-out consumer, the billing for that agreement must be made by the *Metering Coordinator* to the relevant existing *FRMP* (and any new *FRMPs*) unless and until the move-in consumer provides the *Metering Coordinator* with a request for direct billing. In this situation:

        (i) the existing *FRMP* (and any new *FRMPs*) must accept the *Metering Coordinator* billing arrangements as specified in the agreement established for the move-out consumer until alternative billing arrangements are requested by the move-in consumer;

        (ii) the *Metering Coordinator* must provide the existing *FRMP* (and any new *FRMPs*) with a copy of the agreement established for the move-out consumer on request.

    (b) The *Metering Coordinator* must inform the move-in consumer of this arrangement, and provide the consumer with a copy of the metering services agreement established for the move-out consumer;

    (c) The consumer may choose to terminate the metering services agreement with the *Metering Coordinator* and enter into another agreement with that *Metering Coordinator* or another *Metering Coordinator*;

    (d) The *FRMP* who receives the bill from the *Metering Coordinator* on behalf of the move-in consumer may recover in a transparent manner the full amount of the bill from the move-in consumer. If the *FRMP* adds a handling fee to the *Metering Coordinator's* cost, the *FRMP* must separately

itemise the *Metering Coordinator's* cost and the handling fee on the *FRMP* invoice received by the move-in consumer;

(e) The move-in consumer must pay the *FRMP* who acts on behalf of the *Metering Coordinator* the metering services amount demanded by that *FRMP*.

H. Metering in an embedded network

Embedded network metering arrangements

1. An *embedded network* is a *network* that is connected to the first *distribution network* in a cascading chain of *distribution networks*, which commences at a *transmission network connection point*.[147] An *embedded network* may be registered with the *AEMO* or exempt from registering with the *AEMO*.

2. The *connection points* and *settlements points* in an *embedded network* are to be applied in Chapter 7 and other rules, such as rule 3.15, as they do in any other *distribution network*.

3. The terms parent and child are only applied to *embedded networks*.

4. A premise has an *embedded network* if there is a *parent connection point* and at least one *child connection point* each with a different consumer. A premise does not have an *embedded network* if only one consumer receives electricity from all *settlements points* that are assigned to a single *connection point*.

   (a) For the removal of doubt, the parent *settlements* point would be assigned to a *parent connection point* and the child *settlements point* would be assigned to a *child connection point*.

   (b) For the removal of doubt, an *embedded network* can't exist within a *connection point* that is assigned a single consumer, irrespective of the number of *settlements points* assigned to that *connection point*.

5. If the *FRMP* for the *child connection point* is different to the *FRMP* for the *parent connection point*, then the electricity must be billed through the *NEM settlements* process.

   (a) For the removal of doubt, an *MDP* associated with an *embedded network connection point* must send *metering data* to *AEMO* for *settlements* purpose, and not to another *MDP*, unless there is a commercial contract with a party that requires delivery of *metering data* to that other *MDP*.

6. If the *FRMP* for the *child connection point* is the same as the *FRMP* for the *parent connection point*, then the *FRMP* must not have its electricity for the *child connection point* billed through the *NEM settlements process*.

[147] This definition is a repeat of the definition provided above and is included for convenience.

7. For the removal of doubt:

   (a) the primary *distribution network service provider* (the *DNSP* of the *distribution network* that interfaces with the *transmission network*) has no *network* regulatory obligations in an *embedded network*; and

   (b) a primary *distribution network service provider* may be engaged on a commercial basis by an *embedded network service provider*.

Parent/child metering arrangements

8. The market arrangements (*metering installation* requirements, etc) that apply to a *settlements point* generally also apply to a *settlements point* in an *embedded network*. For the removal of doubt, *settlements points* associated with an *embedded network* must:

   (a) be assigned to either a *parent connection point* or a *child connection point*;

   (b) be registered with a *FRMP*; and

   (c) be registered with a *Metering Coordinator, metering installation* and a *NMI*.

9. If the parent *metering installation* contains an interval *meter* all child *metering installations* that are associated with *FRMPs* who are not also the *FRMP* associated with the parent *metering installation* must have interval *meters*.

   (a) For the removal of doubt, a new or replacement interval *meter* must meet the *minimum functionality specification*.

10. If the parent *metering installation* contains an *accumulation meter* and at least one child *metering installation* is associated with a *FRMP* who is not also the *FRMP* associated with the parent *metering installation*, the parent *metering installation* must be upgraded to include an *interval meter* in place of the *accumulation meter*. In this situation:

    (a) The *Metering Coordinator* for the parent *metering installation* must advise the counter party to its metering services contract of the obligation to change the *meter* in the parent *metering installation*, and proceed to make that change in accordance with the terms of the contract and the provisions of the *Rules*.

    (b) For the removal of doubt, the new parent *meter* must meet the *minimum functionality specification*.

11. A *FRMP* or a consumer (in accordance with the rules in Part 1 Section A of the Power of choice metering specification) may choose a *Metering Coordinator* for a *metering installation* that is assigned to a parent *settlements* point or a child *settlements point*.

(a) The *Metering Coordinator* registered against a *metering installation* at a parent *settlements point* must obtain a *NMI* for that *metering installation* from the primary *distribution network service provider* (the *distribution network* that interfaces with the *transmission network*) and register that *NMI* with *AEMO*.

(b) The *Metering Coordinator* registered against a *metering installation* at a child *settlements point* must obtain a *NMI* for that *metering installation* from the registered *embedded network* service provider, or *AEMO* if the *embedded network service provider* is operating a *network* that is exempt by the *AER*.

12. Losses within the *embedded network* are to be accommodated in the following ways:

(a) *Distribution Loss Factor*s are to be set to 1.0 per unit as a default, unless otherwise approved by *AER* (under rule 3.6.3) on application of an *embedded network service provider*;

(b) Physical losses between *child settlements points* and *parent settlements points* are assumed to be negligible and set to zero. In this situation:

(i) If the losses are considered to be material by an *embedded network service provider* that provider may request the *AER* to approve *Distribution Loss Factors* for the *embedded network* in accordance with the methodology applied by the *embedded network service provider* under rule 3.6.3 and must provide AER with sufficient information in support of that request;

(ii) If *AER* determines *Distribution Loss Factors* for the *embedded network*, those loss factors must be published by *AEMO* in accordance with the *Rules* and applied in the *NEM settlements* process.

(c) Physical losses are to be determined between *metering points* and their associated *settlements points* in accordance with the arrangements provided in Chapter 7 of the *Rules*.

13. The total *distribution use of system (DUOS)* charge for the primary *distribution network* (the *distribution network* that interfaces with the *transmission network*) is to be assigned to the *FRMP* registered to the parent *settlements point*.

14. The *embedded network* use of system (ENUOS) charge, if any, is to be allocated in the following way:

(a) The fixed portion of the ENUOS, if any, is to be shared equally between the *FRMPs* registered to the *child settlements points*;

(b) The variable portion of the ENUOS is to be based on the *active energy* measurement at the relevant *child settlements point* and billed to the *FRMP* at that *settlements point*.

Disconnection of a consumer in an embedded network

15. The *FRMP* that is registered against the *settlements point* assigned to a *parent connection point* may disconnect the *load* of the *Non-Registered Customer* or a *franchise customer* who is a seller or buyer of electricity at that *settlements point* but must not disconnect any *load* that is transmitted to a *settlements point* assigned to a *child connection point*. In this situation:

    (a) If the *FRMP* needs to disconnect a *Non-Registered Customer* or a *franchise customer* at the *settlements point* assigned to a *parent connection point*, then it can only disconnect the consumer's load through that *settlements point* for which it is responsible.

    (b) If the *FRMP* decides to disconnect a *Non-Registered Customer* or a *franchise customer*, it must be in accordance with the arrangements specified in the NECF or in jurisdictional consumer protection regulation where NECF had not been adopted.

16. The *FRMP* that is registered against a *settlements point* assigned to a *child connection point* may disconnect the *load* of the *Non-Registered Customer* or a *franchise customer* who is a seller or buyer of electricity at that *settlements point* subject to:

    (a) the *FRMP* meeting its obligations under the NECF or under jurisdictional consumer protection regulation where NECF had not been adopted; and

    (b) there being only one *FRMP* at the *settlements point*.

17. If two or more *FRMPs* are registered against *settlements points* at a *child connection point*, the arrangements for multiple *FRMPs* at a *connection point* with a single consumer apply.

Operational matters associated with an embedded network

18. The *AER* must consider operational matters such as fault response, recognition of life support consumers, access to *metering installations* for any reason, MSATS and Consumer Administration and Transfer Solution (CATS) obligations, and disconnection arrangements for bad debt when determining whether a *network* is to be granted *embedded network* exemption status.

    (a) For the removal of doubt, the AER must consider these operational matters when determining its guidelines for establishing exemptions for *embedded network* status

Disputes in an embedded network

19. A dispute between one *Registered Participant* or a *Metering Coordinator* and the owner of an exempt *network* must be referred to both the *AER* and *AEMO* for assessment and comment.

(a) The disputing parties must independently notify the *AER* and *AEMO* of the dispute and provide a written explanation of its background if the dispute has an age greater than 6 months;

(b) The *AER* and *AEMO* must each provide written comment on their assessment of the dispute and a possible resolution to each party within *20 business days* of receiving the notice from the disputing parties;

(c) The disputing parties may consider the *AER* and *AEMO* comments in seeking to resolve the dispute.

20. For the removal of doubt, a dispute between one *Registered Participant* and:

(a) another *Registered Participant* associated with an *embedded network* is a dispute under rule 8.2 of the *Rules* and is to be resolved in accordance with that rule;

(b) the *Metering Coordinator* associated with an *embedded network* is a dispute under rule 8.2 of the *Rules* and is to be resolved in accordance with that rule.