Seed Advisory

Electric Vehicles: Existing Regulatory Arrangements

Connection, Metering and Settlement Arrangements in Victoria

27 March 2012

Contents

Disclaimer – Reliances and Limitations

This analysis of regulatory arrangements for connection, metering and settlement of electric vehicles in Victoria Market Review, dated 17 February 2012 ("Report"):

- has been prepared by Seed Advisory Pty Ltd ("Seed") pursuant to an agreement with the Victorian Department of Primary Industries (DPI); and
- may only be used and relied on by DPI.

Seed and its subcontractors, servants, employees and officers otherwise expressly disclaim responsibility to any person other than DPI arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by Seed and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by Seed in connection with preparing this Report were completed on the following basis:

- they were limited to those specifically detailed in Section 2 and Appendix E of this Report;
- no detailed regulatory analysis or cost / benefit modelling has been undertaken; and
- Seed has relied on information provided by participants and publicly available information relating to the connection processes for Electric Vehicles (EVs) in developing this Report.

The opinions, conclusions and any recommendations in this Report are based on interpretations and assumptions made by Seed when undertaking the services and preparing the Report ("Assumptions").

Seed expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation, after which time, Seed expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

Glossary

Term	Meaning
AEMC	The Australian Energy Market Commission, which is established under section 5 of the *Australian Energy Market Commission Establishment Act 2004* (SA). Is responsible for maintaining the National Electricity Rules and responding to change requests presented to it.
AEMO	Australian Energy Market Operator – the operator of the National Electricity Market (NEM).
AER	The Australian Energy Regulator, which is the economic regulator of the Electricity and Gas, Distribution and Transmission businesses and will in future also be the regulator of the Retail businesses.
AS3000	Australian Standard 3000 – known as the wiring rules. This specifies the national minimum technical standards for wiring in electrical installations.
ASP	Accredited Service Provider – a Registered Electrical Contractor (REC) in NSW which is accredited by DNSPs to install electricity meters in NSW only.
B2B procedures	These are the procedures to be followed in using the Business to Business (B2B) e-hub in Market Settlement and Transfer Solution (MSATS) which allows electronic communication of service requests between Distributors and Retailers.
CATS	Consumer Administration and Transfer Solution – a subset of the AEMO MSATS IT system which is used for the administration of consumer information and facilitates consumers transferring between retailers.
CES	Certificate of Electrical Safety – a certificate which is issued by a REC or a Licensed Electrical Inspector (LEI) which certifies that an electrical installation which has been installed or modified is safe.
Child metering point (child meter)	A child metering point is a metering point which has a relationship to a parent metering point such that the difference between the energy measured at the parent metering point and the child metering point represents the energy consumption for one or more other connection points.
CPUC	California Public Utilities Commission – the economic regulator of public utilities in California including the regulation of electric utilities.
DB	Distribution Business (also called DNSP).
DNSP	Distribution Network Service Provider – a company which operates an electricity distribution network under license.
DUOS	Distribution Use of System – the service of operating a distribution network which is provided to a retailer serving a customer. DUOS charges refers to the charges from the DNSP to a retailer for a

Term	Meaning
	customer's use of the network
Embedded Network, also Private Network	An embedded network is a distribution network which has a connection point to another distribution network and does not also have a connection point to a transmission network.
ESC	Essential Services Commission (Victoria) – the ESC remains the economic regulator for energy retail businesses until the scheduled transition to the AER. The ESC was the economic regulator for distribution businesses in Victoria until 2007 when that responsibility transferred to the AER. The ESC retains some licensing obligations.
ESV	Energy Safe Victoria – the Energy Safety regulator for Victoria. Enforces electrical safety legislation and sets and enforces regulations.
EV	Electric Vehicle – in this context, not including hybrid vehicles
EV Charging Infrastructure	The charging infrastructure installed at a premise by some EVSP's to enable secure and safe charging of an EV. Depending on the EVSP business model the charging infrastructure could be as little as a 15 amp GPO, through to a dedicated piece of equipment that monitors and manages the charging of EVs.
EVSP	EV Service Provider – companies providing a range of services to EV owners, which may include manufacturers of cars, battery manufacturers, service providers that provide a monitoring and changing service, and service providers providing charging services, including batteries and power, as well as other possible offerings.
EWR	Electrical Work Request – a form used in the Victorian Electricity Industry which a customer or their agent is required to complete and lodge with their Retailer to have changes made to connection points or metering at those points on the electrical distribution network.
GPO	General Purpose Outlet – the proper term for power point used to plug in electrical appliances.
GSL	Guaranteed Service Levels – DNSP service levels prescribed by the AER. When the DNSP does not meet one of these service levels the DNSP is required to pay the customer a prescribed amount.
LEI	Licensed Electrical Inspector – a person holding an electrical installation inspection licence. A LEI is required to inspect all electrical work categorised by ESV as prescribed installation work and inspect a small proportion of non-prescribed installation work.
MSATS	Market Settlement and Transfer Solution. An IT system operated by AEMO which manages meter and customer data for the purpose of settling the wholesale electricity market and customer transfers between retailers.
NECF	National Energy Customer Framework. This is a legal framework for regulating retail (non-price) and distribution (non-economic) functions which is now incorporated in the National Electricity Law

Term	Meaning
	and the National Gas Law. It is to be implemented on 1 July 2012 through changes to the National Electricity Rules and National Gas Rules.
NEM	National Electricity Market – the wholesale electricity market operated across ACT, NSW, QLD, SA, VIC and TAS.
NER	National Electricity Rules – the set of rules under which the NEM operates.
NMI	National Metering Identifier – a unique numeric identifier for each metering installation used in the NEM to measure and settle customers' electricity purchases.
Off-market settlement	A contractual agreement between two or more commercial counterparties to give force to and agreed payment for the electricity used to charge an EV.
On-market settlement	The use of NEM systems and procedures to determine customers' consumption as the basis for wholesale settlement, transmission and distribution charges and customer billing.
OIC	Order in Council. Electricity legislation provides that the State Governor in Council has power to make orders on certain matters.
Parent - metering point (parent meter)	A parent metering point is a metering point through which the energy measured is supplied to more than one connection point.
REC	Registered Electrical Contractor – a person or business that provides electrical contracting services that has met the registration requirements of Energy Safe Victoria (ESV)
RP	Responsible Person – nominated company or individual for the purposes of on-market settlement of the consumption of an embedded network.
SIRs	Service and Installation Rules – a set of rules developed by the Victorian Electricity Distribution Businesses which set out what are considered to be reasonable requirements under the Victorian Electricity Distribution Code for electrical installations
Subtractive Metering	Where subtraction of consumption between a parent meter and the relevant child meters are required to facilitate settlement in the NEM.
V2G	Vehicle to Grid – the provision of electricity from an EV to the Grid.

1. Executive Summary

1.1. Introduction

The Victorian Department of Primary Industries (DPI) is seeking to better understand the current regulatory requirements relevant to the establishment of EV charging infrastructure and associated metering and market settlement processes. DPI wants to identify possibilities for regulatory improvement to reduce the complexity, time and costs associated with the current process. Specifically DPI requested a report that:

1. outlines the existing regulatory and practical requirements relevant to the establishment of charging infrastructure and metering for electric vehicles in Victoria, including market settlement arrangements; and
2. identifies any current regulatory and practical limitations on implementation of charging infrastructure, metering and settlements for electric vehicles in Victoria under each of the main business models utilised by charging infrastructure providers.

In undertaking this work on behalf of DPI we consider:

- the principal business models that have emerged to date for EV Service Providers;
- a range of alternative connection processes that would, in our view, provide similar functionality to the EV Service Provider but that potentially result in lower costs to the customer;
- the requirements of current national and Victoria specific regulations that may influence and drive the connection processes; and
- views of market participants on current practical and regulatory implications on connection processes.

1.2. Analysis Framework

Our analysis framework identifies an EV Service Provider's business model as a key driver for settlement requirements which in turn drive metering configurations and connection processes.

Table 1.1 on the following page looks at the metering configuration required by the principal business models and the simple, baseline comparison of a "plug and play" model used in this report, describes the connection processes (Cases) we have considered and provides a key to our further analysis in Section 3.3 of the steps in the connection process and the related regulatory requirements.

Table 1.1 Required Metering Configuration - Potential Configurations

The Customer pays for charging an EV…	Metering outcome required	Possible metering or measurement configurations to meet required outcome	Key for our analysis
Through a standard electricity contract with no EV specific contract terms	No new meter or National Metering Identified (NMI) is required.	• **'Plug and play'**: Plug in wall and wiring only, either or both of which may need to be new – no new meter or NMI.	• **Case A, B (i)**
Through a standard electricity contract with the possibility of an EV specific tariff or other terms	A measuring device is required, but no new NMI.	• **Installation of a Sub Meter**: Installation of a sub meter that is not a NMI. • **Meter in the EV**: Not a NMI, but effectively a sub meter.	• **Case C**
Through a separate, EV specific contract where the EV Service Provider has an independent relationship with the National Electricity Market (NEM)	A new meter and a new NMI.	• **Connection alteration (separation of supply)**: Installation of a new NMI in parallel with existing NMI. • **Connection alteration (Embedded network)**: Installation of a new NMI as child meter to the existing NMI. • **Meter in the EV, with a NMI**: Practical, technical and regulatory issues are presented by this option, which is included for completeness.	• **Case D** • **Case E**

(i) Case B is identical to Case A, looked at from the EV Service Provider's perspective. However, Case B differs from Case A because the customer requires a new 15 amp General Purpose Outlet (GPO) (most customers) or the customer's electrical system and metering configuration require significant modification to support the charging of an EV (probably a small number of customers).

Table 1.2 is a schematic of the requirements of the principal business models, the regulatory instruments that are bought into play by the requirements of the particular models and our consideration of these issues throughout this report.

Table 1.2 Report Schematic

	Business Model	Settlement Preferences	Metering Options	Connection Options
Comment	• The EV Service Providers' choice of business model will influence their settlement preferences which will in turn influence available metering options and therefore connection options.	• The need to settle the EV load separately from the premise's other load 'on-market' – through the National Electricity Market (NEM) using AEMO systems - will be limited by the metering configuration at the premise. • Off-market settlement – bilateral contractual arrangements outside the NEM - may be possible if on-market settlement is unavailable.	• The choice of metering configuration will impact the connection options available. • The current market design requires a separate NMI for the EV to facilitate separate 'on-market' settlement of the EV load. • Off-market settlement does not necessarily require a NMI for the EV or a meter, but if separate EV customer billing is required would require a suitably accredited meter.	• There are three categories of connection options matched to the metering requirements: — No meter (or NMI) is required – Cases A and B — A measuring devices is required, but not a NMI – Case C — A new NMI, and therefore a meter, is required – Cases D and E • Within each category there are alternative approaches to connect an EV with varying levels of complexity.
Key Regulatory Instruments	• The choice of EV Service Provider business model is not driven by regulatory instrument, except to the extent that electricity retail licenses or exemptions may be required by the EV Service Provider depending on the definition of the service being provided by the EV Service Provider. This key question is currently under consideration by the AEMC as part of its review of EVs.	• National Electricity Rules – the NER covers the approach to on-market settlement and the key requirements of metering. • AEMO Metrology Procedures – supports the NER in further detailing the use of metering data for settlement purposes. • AEMO Embedded Network Guideline – outlines the settlement for embedded networks.	• The Victorian Service and Installation Rules (SIRs) – outlines metering installation requirements and rules relating to the metering board and panel. • AEMO NMI Procedures – outlines the NMI allocation process and the relationship between meters and NMIs. • National Electricity Rules – outlines the rules for joint metering installations and the need for one responsible person per meter.	• Electricity Distribution Code –influences the process for connection and mandates the Distribution Network Service Provider's (DNSP) role in connection. • The Victorian SIRs – outlines key elements of the connection process and the role of the Registered Electrical Contractor (REC) in the process. • Victorian Distribution Licenses – include obligations to offer connection services.
Report Reference	• Section 3.1 outlines the principal EV Service Provider business models currently in the market and their key features.	• Section 5 discusses settlement in further detail.	• Section 3 discusses the metering and connection options for each case and Appendices B and C discuss the cases in further detail and the relevant regulations.	• Section 3 discusses the metering and connection options for each case and Appendices B and C discuss the cases in further detail and the relevant regulations.

1.3. Our findings

Connecting an Electric Vehicle – regulatory and practical requirements

Table 1.1 identified seven connection processes categorised by metering configuration. These can range from a relatively simple process, plug and play, which is similar to installing any new large appliance such as an air conditioner or pool pump to a more complex, time consuming and potentially costly process which involves the establishment of a new NMI.

Looking at the set of processes involved in the EV Service Providers' business models, connection, metering and settlement involve complex interactions with a range of parties. While some of these interactions are regulatory, some are determined by internal business rules not addressed in the regulatory framework.

The REC we spoke to compared the current connection experience to the installation industry's previous experience of installing the initial solar PV installations. This particularly appears to be the case in establishing an accepted process for the installation of a second meter with its own NMI. In the absence of an accepted process, delays – potentially significant – can emerge in the process of initiating the meter connection.

Even without the requirement for a separate meter, our analysis suggests that the larger part of the expense of an EV connection relates to the costs of installing the required equipment, including a 15 amp GPO and any required wiring downstream of the meter. The larger part of these costs – those relating to the GPO and the wiring downstream of the meter – is not regulated. The private costs could be reduced by co-ordination of installation standards, use of an improved standard form Electrical Work Request (EWR) for works notifications and better information provision to participants involved. Our estimate is that the reduction in costs might be in the order of 20 per cent of the REC's costs in the installation process, but we have not tested this estimate with industry participants.

The requirement to have a second meter with a NMI results in an increase in the complexity of the interactions and contributes to the expense. Again, however, the larger part of these costs is not regulated. The costs associated with the second meter with a NMI and a new meter board, where required, are regulated, but the requirement to involve the DNSP and a Licensed Electrical Inspector adds to the co-ordination task, may contribute to delays and increases the expense.

Connecting an Electric Vehicle - Implications of Business Model

The more complex the EV Service Provider's requirements, the more complexity introduced into the connection process and, at present, given the very small number of EV connections and the lack of familiarity with the models of the principal EV Service Providers, the more protracted the process is likely to be.

Our analysis identified two competing business models have emerged in Victoria which have different practical and regulatory limitations:

- **Charging infrastructure provider** – this business model involves the provision of dedicated charging infrastructure or access to charging infrastructure to facilitate recharging. The electricity to charge the battery is provided by a separate and unrelated party, through a standard connection to the electricity network and an electricity retail contract. ChargePoint is an example of such a service provider.

- **Bundled service provider** – this business model involves the provision of dedicated charging infrastructure or access to charging infrastructure *and* electricity to charge the battery separate from any other electricity consumed by the customer at the charging premise. Better Place is an example of such a service provider.

There is a possibility that EV charging will follow a 'plug and play' type model, where a customer plugs the car into an appropriately wired socket and re-charges their vehicle. In this business model, no specific charging infrastructure is provided at the customer's home and the car's energy requirements are part of the home's electricity load, as with any other appliance. At this stage proponents of this business model have not emerged, but we understand that it may be feasible.

Table 1.3 below highlights the relationship between business model, metering requirements and connection process.

Table 1.3 Connecting an Electric Vehicle – Implications of Business Model

Business Model	Metering outcome required	Possible metering or measurement configurations to meet required outcome	Key for our analysis
Plug and Play	No new meter or NMI is required.	• 'Plug and play'	• Cases A, B
Charging Infrastructure Provider	A measuring device is required, but no new NMI.	• Installation of a Sub Meter • Meter in the EV	• Case C
Bundled Service Provider	A new meter and a new NMI.	• Connection alteration (separation of supply). • Connection alteration (Embedded network). • Meter in the EV, with a NMI.	• Case D • Case E

As the penetration of EVs increases, issues raised in relation to the private costs of installing appropriate connections in existing premises, as well as issues relating to the consent to installations in multi-occupancy premises, are likely to become more significant than is currently the case. These issues fall outside the scope of energy market regulation, involving a range of considerations including planning, building standards, tenancy and liability issues.[1]

1.4. Possible future directions

In Section 6, we consider possible future directions with the potential – immediate and longer term – to improve the customer connection experience and reduce customers' costs. These possible directions include:

[1] Depending on the configuration of the premises, the size of the existing electrical load and the characteristics of the local distribution network, the costs incurred by the customer in Case B could be very high. There is no information on what proportion of residential connections might require significant electrical works to allow an EV connection, but in our interviews estimates of up to 15 per cent of all residential premises were given.

- Simplifying and standardising the EWR process for the connection of a second meter at a site;
- Developing standard processes for Customer – Distributor (DNSP) requests where there is no requirement for the host retailer's involvement;
- Considering the use of Accredited Service Providers for meter installations and other meter related works that currently require the presence of the DNSP in Victoria;
- Considering the preconditions for off-market settlement to provide the functionality required by EV Service Providers; and
- Considering the scope of other issues - planning, tenancy, liability and other – that could affect the penetration of EVs in multi-occupancy premises.

2. Introduction

2.1. Background

The Victorian Department of Primary Industries (DPI) is seeking to better understand the current regulatory requirements relevant to the establishment of EV charging infrastructure and associated metering and market settlement processes. DPI wants to identify possibilities for regulatory improvement to reduce the complexity, time and costs associated with the current process.

DPI's interest in better understanding the issues relates both to concerns raised by industry participants about current limitations on their preferred business model in Victoria due to current regulatory requirements and business practices, as well as the Australian Energy Market Commission's (AEMC) recently initiated *Review of Energy Market Arrangements for Electric and Natural Gas Vehicles*.

2.2. Scope

DPI has requested a report that: outlines the existing regulatory and practical requirements relevant to the establishment of charging infrastructure and metering for EVs in Victoria, including market settlement arrangements; and identifies any current regulatory and practical limitations on implementation of charging infrastructure, metering and settlements for EVs in Victoria under each of the main business models utilised by charging infrastructure providers.

A full extract of our Scope of Work is contained in Appendix E of this report.

Our report identifies the key regulatory and practical requirements, but does not extend to a detailed analysis of each regulatory instrument and identification of specific clauses where issues may arise. We identify the broad area and nature of the regulatory and/or practical requirements and suggest where further work may be warranted. The focus of our analysis is connection, metering and settlement arrangements. Other areas such as disconnections, maintenance/repairs and wiring implications at the home or premise are not covered in any detail.

2.3. Approach

Our approach to this project involves the following four key stages:

- **Establish analysis framework**: We established an analysis framework to understand the issues and process options. Our analysis framework considered the following elements:
  - Charging location – the key focus was on those issues specific to home charging of EVs. Home charging raises the most significant challenges to the existing regulatory framework because of the standard identification of an address and one connection at residential premises. We have, however identified at a high level where practical issues and regulatory requirements may arise in other charging locations, including business premises, public sites and multi-tenancies – both commercial and residential.
  - Customer lifecycle – we covered three key elements of the customer lifecycle – connection, metering and settlement.

  - Regulatory instrument and key responsible party or parties - we considered each regulatory instrument identified as well as some additional instruments.

- **Initial analysis of EV regulatory and practical issues:** we utilised the analysis framework to analyse the regulatory requirements and practical limitations.
- **Stakeholder consultation:** We undertook stakeholder consultations with key industry participants to test our initial analysis. The stakeholders are identified in Appendix A of this report. The purpose of these consultations was to:
  - confirm our understanding of the regulatory requirements with the responsible party and other stakeholders;
  - identify any missing regulatory requirements and/or practical limitations not already identified;
  - discuss the current findings and progress to date of the Victorian EV trial to understand any learnings that may be relevant to our analysis; and
  - amend and refine our analysis as required.
- **Refine our analysis and prepare the report:**
  - Refining and finalising our analysis in light of the discussions; and
  - Preparing a draft and final report.

3. Business models, connection options and the connection process

3.1. Principal business models for Electric Vehicle service providers

At this stage, two competing business models have emerged in Victoria[2] which may have different practical and regulatory limitations:

- **Charging infrastructure provider** – this business model involves the provision of dedicated charging infrastructure or access to charging infrastructure to facilitate recharging. The electricity to charge the battery is provided by a separate and unrelated party, through a standard connection to the electricity network and an electricity retail contract. ChargePoint is an example of such a service provider. This business model, due to the narrower service offering and the absence of a need for separate metering, does not require new metering arrangements, although, depending on the precise offer, it may require new settlement arrangements which could be private or off-market.
- **Bundled service provider** – this business model involves the provision of dedicated charging infrastructure or access to charging infrastructure *and* electricity to charge the battery separate from any other electricity consumed by the customer at the charging premise. Better Place is an example of such a service provider. This business model requires the electricity used in recharging the EV to be identified separately from other electricity consumption, so as to ensure the customer is not charged twice for the same usage. To achieve this, the model requires new metering and/or settlement arrangements.

There is a possibility that EV charging will follow a 'plug and play' type model, where a customer plugs the car into an appropriately wired socket and re-charges their vehicle.[3] In this business model, no specific charging infrastructure is provided at the customer's home and the car's energy requirements are part of the home's electricity load, as with any other appliance. At this stage proponents of this business model have not emerged, but we understand that it may be feasible.[4]

In the discussion that follows about business models and connection options, we move from the simple 'plug and play' model to the more complex models. This approach

[2] CO2 Smart Pty Ltd, which has been managing the Western Australian electric vehicle trials, has a business model that appears to combine ChargePoint's offer with the optional extra of providing savings through pooled electricity purchasing. See http://www.co2smart.com.au/co2-smart-services/

[3] Although EVs can be recharged from a standard 10 amp plug, we understand that for a range of reasons including safety, the recharge rate from a 10 amp plug will be inadequate for anything other than extremely low usage. In most circumstances, customers will require 15 amp connections.

[4] This model has also been the subject of considerable advocacy in submissions to the Australian Energy Market Commission's Review of Energy Market Arrangements for EVs and Natural Gas Vehicles. However, there are complexities, discussed in Section 4, relating to the existence of appropriate wiring, access in shared premises to a connection and a range of other complicating issues.

illustrates a key finding of our review: the more complex the business model proposed, the larger the number of potential practical and regulatory issues that may be raised in its implementation.

3.2. Possible connection options

In approaching this review, we try to consider both existing preferred business models in the form that they are currently understood, as well as possible alternative routes to the same end point with the potential for lower regulatory and administrative implications and, potentially, lower end user costs. In considering these alternative models, we start with the 'plug and play' model which has the lowest implications for the existing and regulatory arrangements and, considering the individual customer's costs only, the lowest costs.[5]

Figure 3.1 looks at the key elements we have considered for each of the models – settlement, metering and connection and maps them to the classification used throughout this report. As Figure 3.1 makes clear, the more complex the EV Service Provider's Business Model, the larger the number of parties involved in the processes of connection, metering and settlement and the more complex the coordination task.

We also considered and dismissed the 1 meter/2 elements/2 NMIs model, as it is generally believed that a single meter cannot, in the current regulatory framework support 2 NMIs. However, this model is a possible solution with off-market settlement and, we understand, the recent Australian Energy Markets Commission Metering Working Group saw some potential in this configuration to address the issues raised in connecting EVs.

3.3. The Connection Process: Differences resulting from the choice of connection option

Table 3.1 looks at the steps in the connection process, starting with the simplest possible case, Case A and move through to the most complex, looking at the additional steps required in moving to Case B and then Cases C, D and E. Appendix C provides the detail behind each of these processes, discussing the regulatory requirements for each step and the issues that are raised by the steps in the connection process. Appendix B includes a discussion of the regulatory instruments that we understand to be relevant and their application in the cases considered.[6]

[5] The 'plug and play' model alone may not provide the same level of societal benefit as the alternatives. Without the introduction of charging stations and public charging points, the driving range facilitated by existing battery technologies could significantly limit the uptake of EVs. Further, if a bundled service offering results in a significant shift of recharging behaviour from peak to off-peak energy consumption periods, there may be significant economy-wide savings in electricity generation and network infrastructure compared to the 'plug and play' status quo.

[6] In some instances, we believe that the regulatory instruments are, strictly read, inconsistent with the interpretation they are widely given in among industry participants. For example, in our view, which we believe is shared by AEMO, the widespread equation of "one customer (site), one NMI" has no basis in the relevant regulatory instrument.

Figure 3.1 Electric Vehicle Service Provider Models by key elements and parties involved

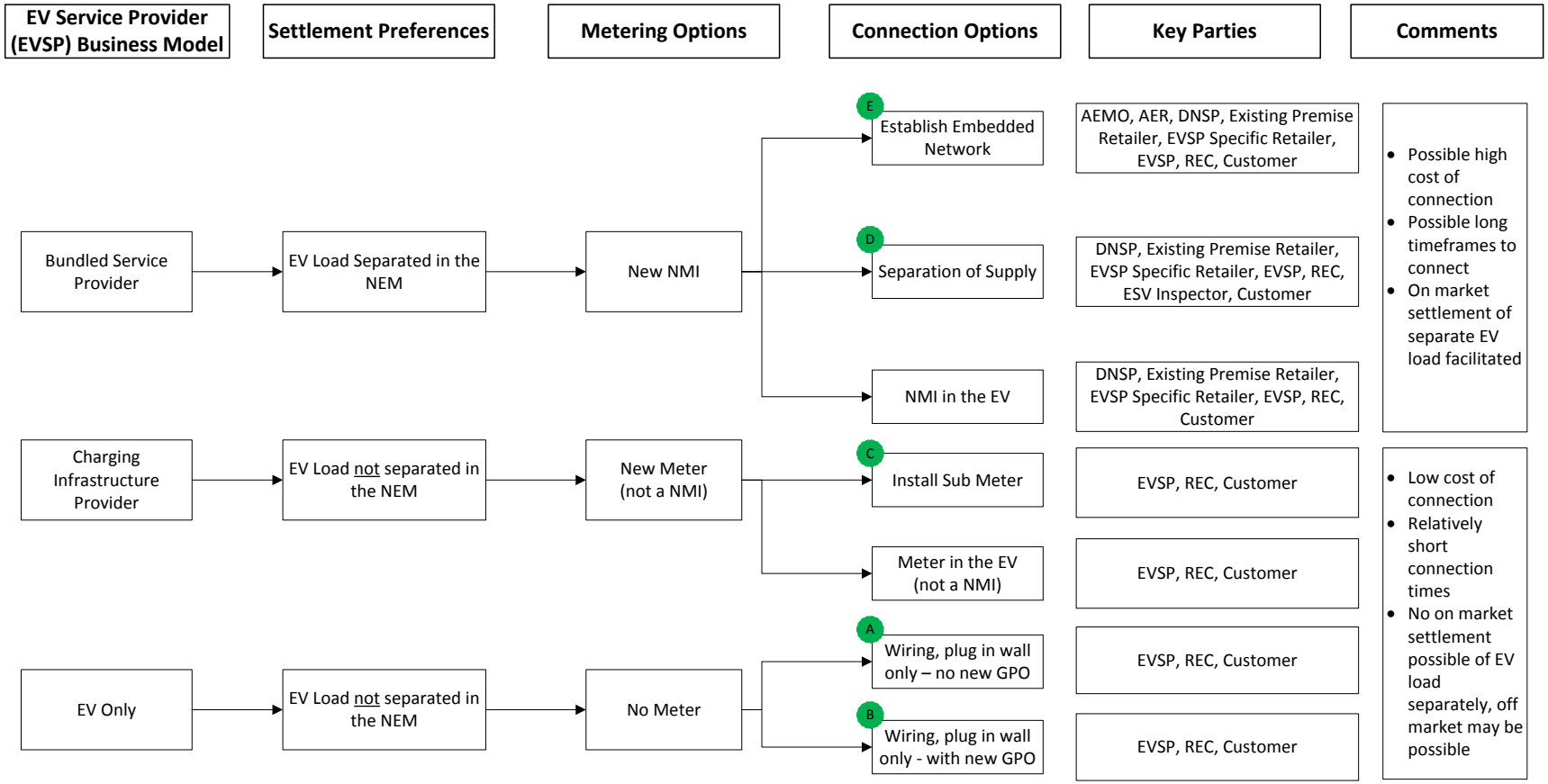

Table 3.1 Connecting an EV: the steps in the connection process by required configuration

	Case A Minimum steps for all installations.	Case B Additional steps to A where supply capacity insufficient or no 15 amp outlet	Case C Additional steps to A where a new sub meter (not a NMI) on site is required.	Case D Additional steps to A where a new NMI on site is required.	Case E Additional steps to A and D where an embedded network is required.	Regulatory Source
1.	Customer enters agreement with EVSP					
2.	EVSP engages REC for wiring and installation of charging infrastructure.					Electricity Safety Act 1998; Electricity Safety (Installation) Regulations 2009; SIRs
3.	REC assesses the availability of 15 amp outlet and overall supply capacity.					SIRs
4.		If no 15 amp outlet then REC installs new 15 amp circuit.				AS3000 Wiring Rules; Electricity Safety (Installation) Regulations 2009; SIRs
5.		If insufficient supply capacity EWR will be sent to retailer and then DNSP for DNSP to address supply capacity issues.				Distribution Code; Electricity Safety (Installation) Regulations 2009; SIRs
6.		If required, DNSP schedules truck visit (requires 10 days' notice) to have higher capacity service connected				Distribution Code

	Case A Minimum steps for all installations.	Case B Additional steps to A where supply capacity insufficient or no 15 amp outlet	Case C Additional steps to A where a new sub meter (not a NMI) on site is required.	Case D Additional steps to A where a new NMI on site is required.	Case E Additional steps to A and D where an embedded network is required.	Regulatory Source
7.		REC will run new connection wiring from point of supply to meter board and issues a Certificate of Electrical Safety				AS3000 Wiring Rules; Electricity Safety (Installation) Regulations 2009; SIRs
8.			REC installs sub-meter.			Electricity Safety (Installation) Regulations 2009; SIRs
9.					Customer/EVSP submits application for exemption/ registration of embedded network.	Distribution Code; Embedded Network Guidelines; AER exemption Guidelines; National Electricity Rules/NECF
10.				Customer or EVSP enter into supply agreement with retailer for energy to charge EV.		National Electricity Rules/ NECF
11.				REC assesses meter board requirements to confirm if replacement or upgrade required.		Distribution Code; SIRs
12.				REC prepares wiring to meter board.		AS3000 Wiring Rules; SIRs; Energy Safety (installations) Regulations 2009
13.				REC books a Licensed		AS3000 Wiring Rules; SIRs;

Case A Minimum steps for all installations.	Case B Additional steps to A where supply capacity insufficient or no 15 amp outlet	Case C Additional steps to A where a new sub meter (not a NMI) on site is required.	Case D Additional steps to A where a new NMI on site is required.	Case E Additional steps to A and D where an embedded network is required.	Regulatory Source
			Electrical Inspector (LEI) to undertake inspection. Generally simultaneous with REC works.		Energy Safety (installations) Regulations 2009
14.			LEI inspects site and provides Certificate of Electrical Safety (CES). Generally simultaneous with REC works.		Energy Safety (installations) Regulations 2009.
15.			EVSP or REC submits EWR and CES to retailer re new meter installation who then submits it to DNSP.		SIRs
16.			DNSP schedules truck visit (10 days' notice required).		Distribution Code
17.			DNSP allocates NMI		National Electricity Rules; AEMO National Metering Identifier Procedure
18.			DNSP de-energises site, REC installs new meter board if required.		SIRs; Electricity Customer Metering Code
19.			DNSP installs new meter and re-energises site.		Electricity Customer Metering Code; Distribution Code
20. REC completes the installation of charging					AS3000 Wiring Rules; SIRs; Energy Safety

	Case A Minimum steps for all installations.	Case B Additional steps to A where supply capacity insufficient or no 15 amp outlet	Case C Additional steps to A where a new sub meter (not a NMI) on site is required.	Case D Additional steps to A where a new NMI on site is required.	Case E Additional steps to A and D where an embedded network is required.	Regulatory Source
	infrastructure and issues CES.					(installations) Regulations 2009
21.				DNSP communicates NMI to EV retailer.		National Electricity Rules
22.					Request for NMI transfer to EV retailer is submitted (if required).	National Electricity Rules

4. Charging Location: impact on connection

4.1. The Customer's Premises: Implications for the Connection Model

In considering the connection process, we start from a position where a customer's premises are suitable for any of the potential business models. However, regardless of the EV Service Provider's business model, the characteristics of the customer's premises have a potentially significant effect on EV connection. Table 4.1 looks at the relationship between the customer's premises and the ease of connection; although in practice the categories in the table are likely to collapse into four, if only because all EVs are likely to require a 15 amp GPO for effective recharging. A 15 amp GPO is not the standard in Australia; the standard GPO is 10 amps.

Considering the customer's premises as well as the EV Service Provider's business model introduces a further layer of complexity into the issues relating to connections. Current EV trials focus on 'low hanging fruit'– that is, those installations that can proceed without significant difficulty, cost or delay so as to maximise the number of installations in the course of the trial. However, as the penetration of EVs increases, issues relating to the customer's cost of connection, regardless of the business model adopted by the EV Service Provider, are likely to become more important in the uptake of EVs.

There is a long standing principle behind the allocation of costs in the electricity market which requires a customer to take responsibility for all costs downstream of the meter.[7] This principle necessarily means that, where a customer wants to introduce EV charging at premises where the costs of the installation are likely to be significant, these costs are borne by the customer. This may be a significant issue for the uptake of EVs for a range of customers, particularly those in multi-occupancy premises and possible policy responses are generally outside the scope of energy market regulation.

[7] In parallel, the customer is also required to take responsibility for the performance of its installation downstream of the meter. In general, a customers' installations poses no issues for the performance of the network to which the customer is connected. However, like solar PV installations, V2G installations are likely to be required to meet performance standards designed to prevent issues arising for the network from the two-way nature of the connection.

Table 4.1 Customers' Ease of Connection - Premise Characteristics by category

Category	Premise characteristics	Implications for connection costs and timing
Customer's EV can be connected at the home / business with no changes to the meter board and no new wiring (Cases A, C).	• Customer's connection at parking space is suitable for EV; *and/or* • Customer's expected load does not exceed design parameters for the customer's connection point.	• Connection costs low. • Connection time quick. • However, could be problematic in almost all premises where at least a 15 amp GPO and therefore some wiring changes are required.
Charging the customer's EV will require minor electrical works (no or minor single change to the meter board) – (Cases B, C).	• Either no or an unsuitable connection at the proposed connection point; *and/or* • Customer's expected total site load will exceed design parameters without some upgrade to the meter board; *or* • In preference to increasing the site load, the customer can install a load limiting device.	• Works could include any changes to the switch board, as well as a change to the meter board such as the installation of a thicker neutral cable from a neutral link on the meter board to an installed appliance. • Some connection costs, depending on the precise scope of works and materials required. Costs are subject to competition; not regulated. • Only REC is required to undertake the works. • As with all electrical works, random (1-in-10) inspections undertaken. • Timing subject to customer's agreement with REC.
Charging the customer's EV requires material electrical works, but does not require a new meter (more than one change to the meter board) – (Cases B, C).	• No existing accessible connection point *and/or* as a result of design of existing wiring, installation of connection point requires upgrading of elements of the electrical system or moving or replacing the meter; *or* • Customer's expected total site load will exceed design parameters without changes to wiring and meter board.	• Could include, for example, replacing a neutral link (upgrading it to increase capacity); replacing or moving a service fuse; replacing or moving a meter – all of which require de-energising a meter from the DNSP side of the meter (between the meter and the network). • Changes to the meter board or the meter require the presence of the relevant DNSP as well as the REC. Further, ESV inspections are undertaken for all meter changes. • Connection costs will depend on the precise scope of works and materials required. REC's costs and materials costs not including the meter are subject to competition; DNSP's costs, including the cost of a replacement meter are regulated by the AER. • Timing is subject to customer's agreement with REC, lodgement of the required EWR in the required formal and regulatory requirements on DNSP service appointments (within 10 days or as agreed). DNSP performance also subject to performance

Category	Premise characteristics	Implications for connection costs and timing
		penalties.
The customer's EV Service Provider requires an additional meter and a NMI and, therefore, material electrical works (Cases D, E).	• EV Service Provider requires a meter; *and*, • Consistent with current regulatory requirements, for separate billing direct to Financially Responsible Party for EV Service Provider required meter, a NMI is required. Number of possible forms, including second meter at the same connection point and Parent/Child metering configuration in an embedded network.	• While the customer's costs will include a new meter in this case, the costs may be less than the case above, where material electrical works are required. • However, the customer's costs will reflect the parties that are required, which include: the REC; the relevant DNSP and the ESV inspection; materials provided by the REC; the cost of the meter; and, depending on the configuration of the relationship between the original and new meter, under current tariff arrangements, may include two Distribution Use of System (DUOS) costs for the same premises (one for each connection). • Timing is subject to customer's agreement with REC, lodgement of the required EWR in the required formal and regulatory requirements on DNSP service appointments (within 10 days or as agreed). DNSP performance also subject to performance penalties.
Customer's EV cannot be connected	• No existing accessible connection point; and/or • As a result of design of existing wiring, installation of connection point requires significant work at a cost to the customer that makes the opportunity unattractive.	• This category includes both instances where: the cost would be acceptable to the customer, but access is unavailable, for example, as the result of the refusal of a body corporate to allow common property to be used in the installation of a meter; and • Where access is available, but the costs of the installation are sufficiently high to make the cost unattractive.

4.2. Implications of Charging Location: Other Locations

The connection processes covered in the previous sections focused primarily on the case of connecting the EV at the home and on the specific case where the home is not a multi-occupancy residence (that is, not a flat, apartment etc.), has off street car parking (e.g. garage or car port) and is owned by the EV owner.

For charging locations with different characteristics, the connections processes would vary. In some instances, the level of complexity can increase significantly due to issues such as:

- the ability to cost effectively access the premise's main metering equipment – if the main metering equipment is not conveniently located near the desired charging location, there may be significant costs to the customer to connect;
- the required permission to install the required wiring and infrastructure – this may be difficult in the case of flats or apartments where the equipment may need to be located on or to pass through common property. Alternatively, if the premise is rented or leased, the owner's permission may be required to install any permanent equipment.

Table 4.2 below outlines the key charging infrastructure locations and a summary of the high level impacts on installing the required 15 amp connection, assigning the GPO to the customer and, if required, installing a meter associated with the GPO at these locations.

Table 4.2 Overview of impacts of charge location on connection process complexity

Location	Sub-category	High level impacts on connection
Residential	Multi-occupancy	• Ability to obtain permission and the allocation of costs for changes to common property are important differences to the connection process for a single residence. • These differences are largely the result of regulations outside the energy market, in particular body corporate and tenancy regulations.
	Rented premises	• A tenant wanting to connect an EV will require the landlord's permission prior to installing any permanent EV charging infrastructure (or needs to rectify the premises on removal of the equipment). • Once permission is obtained, the connection process will be consistent with the processes outlined in Table 3.1. • The rights of the tenant and the requirement to obtain permission are outside energy market regulations.
	No off street parking	• An EV owner (or driver) in a residential premise with no off street parking will (almost certainly) be unable to have the relevant EV charging infrastructure installed. • The key reasons relate to the need to locate any charging infrastructure on public property (i.e. the street) and also the need to wire this equipment to the relevant premise to ensure the correct party pays for the electricity consumed. • The safety of any infrastructure and the increased potential for theft of electricity would also complicate any possible connection process.

Location	Sub-category	High level impacts on connection
Business	Single business, owner occupied	• The connection of charging infrastructure for a single business where the EV owner (or driver) is the business owner would be very similar to those outlined for single residential properties.
	Rental property	• A rented business property would most likely have similar additional complexities to a rented residential property – specifically in relation to obtaining permission prior to installing any permanent charging infrastructure. However, a business tenant may have a wider opportunity to make agreed changes to rented premises than a residential tenant.
	Multi-occupancy	• A multi-occupancy business premise (e.g. a commercial building) may have similar additional complexities to a multi-occupancy residential premise. • The costs to connect any charging infrastructure to the tenant's meter may be significantly higher due to the potentially longer distances between the charging location and the meter equipment room.
Commercial Charging Facility	Dedicated Premise	• A dedicated commercial premise used for the primary purpose of facilitating re-charging would most likely have a relatively simple connection process that would not be very dissimilar to connecting any new commercial premise. • Multiple meters or NMIs, if required, may be more readily catered for in any connection request, as many large commercial or industrial premises will already have multiple connections.
Commercial Charging Facility	Public Premise	• A dedicated commercial charging facility in a public premise, e.g. a street side charging facility or a charging facility in a public car park would require appropriate permissions to install the relevant equipment. • Once permissions are obtained the process for connection is likely to be simpler than those for a residential premise as multiple connection points or meters on commercial premises are more common.

5. Settlement implications

As previously discussed, the metering configuration and connection approach at a premise will be driven by the EV Service Provider's approach to settlement. This section describes the metering requirements for each key settlement transaction type in the National Electricity Market (NEM) and the broad approach to on-market settlement.

There are three sets of settlement transactions that take place in the NEM (on market):

- Settlement in the wholesale market between retailers and generators;
- Settlement between retailers and network operators for Distribution Use of System charging; and
- Settlement between retailers and customers for the electricity at retail rates.

Depending on the nature of the commercial arrangements entered into, "off-market" settlement could be required, where the transactions are settled by commercial parties outside the framework of the settlement processes operated by AEMO and may be more efficient, taking into account all of the relevant costs of the alternative. This section of the report therefore also discusses these cases where relevant to the EV connection and settlement options under consideration here.

5.1. Settlement in the wholesale market

Settlement in the wholesale market occurs based on a financially responsible person for each point of supply or demand in the system being identified. Each such supply or demand point where connection occurs is denoted by a unique NMI and there are established processes and procedures for obtaining data from NMIs for settlement.

In the case where the EV has its own (fixed) NMI where it is charged, these procedures would operate without any issue arising, whether the NMI is a standard standalone NMI or a child NMI under a parent-child NMI arrangement. For example, within an embedded network (private network) with parent-child (subtractive) metering arrangement, the EV driver's home garage could be equipped with a charging point with its own NMI, with all electricity consumed through that charging point assigned to and settled through that NMI. However, when that same EV is charged elsewhere, the electricity would no longer be associated with that NMI and other arrangements will apply.

In the case where the EV is simply part of the supply at the premise under a single NMI along with other demand, the EV's consumption will not be separately identified. Rather its load will be accounted for as part of the load at the premise and wholesale settlement will occur based on the usage at premise, based on the single NMI. This case would be analogous to how the electricity usage of any other large load - such as air conditioning - at a site might be settled. No data specific to that appliance - whether an EV or air conditioner or some other appliance - is taken into wholesale settlement or available from wholesale settlement for use by others. In this case, if parties went to settle the electricity for the EV separately, they would need bilateral off-market arrangements to do so.

Where the NMI is mobile (meter in the EV), this represents a special case of the EV having its own NMI. This would be a new feature in the NEM, since currently all NMIs are fixed in place, with fixed geographical locations and hence attached to a single distribution network with given transmission and distribution loss factors. The functionality to account for a

mobile NMI is not currently available in the NEM and the case has not been considered in any detail in this report.[8]

5.2. Settlement between retailers and network operators for Distribution Use of System charging

Where data is available in wholesale settlement, there are processes and procedures in place to provide the data to the relevant retailer and network operator for use in settlement between the retailer and the DNSP and between the retailer and the customer.

This means that no new processes or procedures would be required in the case where the EV is charged at its own NMI, as appropriate data would still be available from wholesale settlement.

The case where the NMI is in the EV could provide some new complications for determining tariffs for Distribution Use of System, as for example the EV might be charged in different areas on the same day – requiring different charges to be levied – not connected anywhere on some days – requiring adjustment to the profile used in settlement. Further, a fair system applying fixed supply charges to the new, mobile NMI might be challenging.

In the case of a NMI which is a child meter, under existing rules DUOS will be charged solely to the retailer that serves the parent meter. If any accounting of the DUOS charge is to be borne by the retailer to the child EV metering point, then off-market DUOS settlement between the retailers at the parent and child meters would be required.

Where the EV does not have its own NMI, no data specific to the EV is available from wholesale settlement for use by other and there is no specific settlement between retailers and network operators for Distribution Use of System charging in respect of the EV. If any part of the DUOS charge levied on the retailer of the NMI under which the EV is charged is to be borne separately, the settlement would need to be off-market with that retailer and based on data other than that which is available in wholesale settlement.

5.3. Settlement between retailers and customers for the electricity at retail rates

Customers purchase electricity through appointing a retailer at the NMI where they are supplied. If the EV has its own NMI, the appointed retailer can settle with the customer under existing processes and procedures. The customer of the electricity retailer is not necessarily the EV driver. It could, for example, be an EV service provider who has some other billing arrangement with the EV driver.

If the EV does not have its own NMI, then the costs of EV charging will appear as part of a larger bill for electricity supply to the NMI where the EV is charged. Electricity bills do not generally distinguish between electricity used for different appliances. If the costs of EV

[8] Issues include: the association of the mobile NMI with a distribution network and loss factors on a dynamic basis, depending on where the EV is being charged; the need to ensure there is no double charging if the mobile NMI were connected downstream of another NMI; issues relating to interstate travel, where a Victorian based EV could travel to South Australia or NSW and might connect to networks there.

charging are to be separated out, then separate bilateral arrangements will be required, based on a separate stream of data that is applicable only to the EV charging and not to other electricity use under the NMI.

5.4. Summary of settlement arrangements

The settlement issues discussed above are summarised in Table 5.1 below.

Table 5.1 Settlement Issues: Summary

Business Model, Case and Metering	Settlement Options	Comments / Issues
'Plug and Play'		
Cases A, B: No new meter or NMI for the EV	No separate on-market settlement for the EV will be in place	If separate settlement is wanted for the EV charging, then new bilateral (off-market) arrangements based on estimates of the EV consumption will be required.
Charging Infrastructure Provider		
Case C: Sub-meter installed	No separate on-market settlement for the EV will be in place	If separate settlement is wanted for the EV charging, then new bilateral (off-market) arrangements will be required.
Case C: Meter in the EV, not a NMI	No separate on-market settlement for the EV will be in place	If separate settlement is wanted for the EV charging, then new bilateral (off-market) arrangements will be required. For the EV to have its own NMI associated with it when it is charged elsewhere, the NMI must be mobile.
Bundled Service Provider		
Case D: New (fixed) NMI for the EV charging (separation of supply)	Settlement based on existing procedures and processes	No new issues arise.
Case E: New (fixed) NMI for EV charging (embedded network)	Settlement based on existing procedures and processes	No new issues arise. Note that if the EV NMI is a child NMI then full DUOS settlement will be applied only to the parent NMI. An off-market arrangement may be required to settle DUOS between the parent and child NMI.
Meter in the EV with a NMI	Settlement based on modifications to existing procedures and processes	New challenges arise because of mobility, including dynamic assignment of location, network and loss factors and existing DUOS tariff structures would need to be revisited.

6. Possible future directions

6.1. Implications of our findings

The existing processes for establishing charging infrastructure in Victoria, including those that involve a new meter and a National Meter Identifier (NMI) can range from a relatively simple process similar to installing any new large appliance such as an air conditioner or pool pump to a more complex, time consuming and potentially costly process. The simple connection processes relate to connections that do not require a new meter or new NMI. The more complex connection processes involve the establishment of a new NMI.

Not all delays experienced when connecting an EV are as a result of regulatory or other requirements. The REC we spoke to compared the current experience to the installation industry's previous experience of installing the initial solar PV installations. With some coordination, elements of the delay could be reduced or eliminated, to the benefit of consumers. This particularly appears to be the case in establishing an accepted process for the installation of a second meter with its own NMI. In the absence of an accepted process, delays – potentially significant – can emerge in the process of initiating the meter connection.

Looking at the set of processes involved in the EV Service Providers' business models, connection, metering and settlement involve complex interactions with a range of parties. While some of these interactions are regulatory, some of which are determined by internal business rules not addressed in the regulatory framework. Addressing these internal business rules may be difficult – it is unclear that the Victorian Government has the relevant direct authority, but the parties may consent to participating in a forum to agree to defined processes that would reduce these interactions and the associated costs.

Even without the requirement for a separate meter, our analysis suggests that the larger part of the expense of an EV connection relates to the costs of installing the required equipment, including a 15 amp GPO and any required wiring downstream of the meter. The larger part of these costs – those relating to the GPO and the wiring downstream of the meter – is not regulated. The private costs could be reduced by co-ordination of installation standards, use of an improved standard form EWR for works notifications and better information provision to participants involved. Our estimate based on information provided to us by one stakeholder is that the reduction in costs might be in the order of 20 per cent of the REC's costs in the installation process, but we have not tested this estimate with other industry participants.

The requirement to have a second meter results in an increase in the complexity of the interactions and contributes to the expense. Again, however, the larger part of these costs is not regulated. The costs associated with the second meter and a new meter board, where required, are regulated, but the requirement to involve the DNSP and a Licensed Electrical Inspector adds to the co-ordination task, may contribute to delays and increases the expense. The requirement for a second standalone meter is a function of the particular business model adopted by one of the industry participants and its settlement preferences. The extent to which wholesale market and industry practices should be conformed to that participant's business model is a matter for policy consideration.

As the penetration of EVs increases, issues raised in relation to the size of private costs of installing appropriate connections in existing premises, as well as issues relating to the consent to installations in multi-occupancy premises, are likely to become more significant than is currently the case. These issues fall outside the scope of energy market regulation, involving a range of considerations including planning, building standards, tenancy and liability issues.

At this stage in the development of EV Service Provider business models, a likely preferred model has not emerged. Alternatives exist to achieve the preferred outcomes of the existing models – as the number of potential processes identified in this report illustrates – and identifying the appropriate policy response is very difficult in the current circumstances. As the discussion below relating to the current arrangements in California illustrates, there is no obvious, easy solution to the issues raised by EVs.

6.2. The approach used in California

6.2.1. Sub-metering options

The California Public Utilities Commission is still grappling with the same issues that are discussed in this report and has not yet reached any conclusions on appropriate metering arrangements for EVs or on settlement in the case where an EV is charged at a premise served by another retailer or DNSP. The Commission issued a decision in July 2011 on various aspects of EV deployment[9] and hosted a workshop on EV sub-metering in San Francisco on October 27, 2011.[10]

The decision sets out a process to develop an EV metering protocol to accommodate increased EV metering options, such as sub-metering. It considers three metering options:

- **Single metering** - Single metering arrangements which measure and bill EV load as part of the total customer load using the pre-existing meter.
- **Separate metering** - Separate metering arrangements requiring an additional meter dedicated to measuring EV load. This arrangement measures EV load as if the load were a separate service account and enables the EV load to be billed separately from other non-EV load served on the premises.
- **Sub-metering** – Sub-metering arrangements in which a sub-meter measures EV charging apart from the primary meter. This is similar to separate metering in that it uses a dedicated meter for the EV load.

The Commission decided to leave all these options open, preserving customer choice in metering arrangements at this early stage of EV market development and stated that "despite the benefits of single metering in terms of keeping initial equipment costs low, we

[9] See Phase 2 Decision Establishing Policies to Overcome Barriers to Electric Vehicle Deployment and Complying with Public Utilities Code Section 740.2, CPUC, Decision 11-07-029 July 14, 2011. http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/139969.htm. Aspects of the decision that are not relevant in this report relate to rate design, service equipment, cost recovery, education and outreach, demand response and load management technology.

[10] The presentations made by various stakeholders can be found at http://www.cpuc.ca.gov/PUC/hottopics/1Energy/111027_evsub.htm

will not direct the utilities to encourage single metering options as the preferred approach in the near-term."[11]

In regard to sub-metering, the Commission noted that "the sub-meter is typically located on the customer's side of the primary meter, making it possible to bill EV load and the remaining household load on different rate schedules. At the present time, sub-metering is not an available option. In order to facilitate timely development of cost-effective sub-metering equipment, we direct the utilities to collaborate with other stakeholders to craft a sub-metering protocol."[12] The sub-metering protocol is to allow for the meter to be in the EV.

The roadmap report subsequently submitted by the utilities pursuant to the decision identified 17 use cases for sub-metering. The Commission set a deadline for completing a sub-metering protocol by July 31, 2012. However, its staff recommended that this deadline be changed, based on the substantial number of outstanding issues identified in the roadmap report.[13]

Of 17 identified sub-metering use cases (and one base case), Use Case 10 is the Standard Mobile Sub-meter Use Case.

The assessment of this Use Case has led the Investor Owned Utilities to categorise this use case as implementable in the *long-term*, for the following reasons:

- It is conceivable that there may be a mobile meter standard in the near term and automakers may be able to place such a mobile sub-meter in a car as long as it meets protocol requirements.
- In addition to meeting technical performance requirements, mobile sub-meters would need to develop a method for associating to master meters.
- Until performance and association issues are resolved, utilities have found that mobile sub-metering is not technically feasible.
- Leveraging mobile sub-meters for the purpose of roaming (inter-utility charging and bill reconciliation) is not feasible until a ubiquitous clearing house for revenue-grade billing data aggregation is developed and available and other issues resolved.
- The cost-effectiveness and timing for technical implementation are still indeterminate, compared to the current capability of the IOUs' AMI, separate metering and other non-subtractive billing options.

6.2.2. Settlement options

Section 5.1.4 of the Commission's July 2011 decision is also relevant to this report. It briefly considers: "whether special arrangements were necessary for a residential customer to pay for electricity when charging an EV in another utility's service territory. For example, should the utilities establish a single billing procedure to link all EV electric usage, regardless of the service territory within which the EV charging occurs, to a customer's home utility. In the Staff's Rates Issue Paper, this issue was referred to as inter-utility

[11] CPUC, section 6.3
[12] CPUC, section 6.1
[13] See:
http://docs.cpuc.ca.gov/cyberdocs/WebQuickstart.asp?DOC_ID=E53144
http://docs.cpuc.ca.gov/cyberdocs/WebQuickstart.asp?DOC_ID=E54461

billing". It concludes: "We find that it is premature for the Commission to direct the utilities to implement inter-utility billing. We leave open the possibility that further development of this concept may be useful in the future."

The relevance to Victoria of the EV entering another utility's service territory is not just that the DNSP is different but also and primarily that the retail energy provider is different. In California, in the absence of retail competition the service territory defines the retailer that bills for energy.

6.3. Possible directions

The following are some possible directions that could result in efficiency improvements in the addition of meters for measurement of EV charging energy use.

6.3.1. Simplifying the EWR procedure

For the EV Service Provider model where a second meter is required to be installed on the customer's meter board, an EWR is required to be lodged with the customer's retailer. It is then forwarded to the DNSP. There is no benefit in providing the EWR to the Retailer because all work is done by the DNSP. Further, the lodgement with the Retailer can be the source of delay and rework, as the request relates to an unfamiliar procedure. In addition, it is unclear that it is a requirement of the Victorian regulatory framework that the Retailer processes all requests initially. The regulatory framework appears to recognise Customer – DNSP requests. Finally, the traditional relationship – Customer to Retailer to DNSP - is not required in the NECF; the NECF includes recognition of a triangular relationship with the customer such that the DNSP can deal with the customer directly.[14]

In the short term, agreeing the form of a simplified procedure with the Retailers and DNSPs and training RECs in the appropriate form for the procedure could remove a source of delay and cost in the current connection process. However, the issues involved in agreeing on an appropriate form should not be under-estimated: our interviews with the DNSPs suggest there is no agreement about the preferred form of a second meter installation and some disagreement that it is even consistent with the wider NEM regulatory framework.

6.3.2. Developing a Procedure for Customer-DNSP Requests

Our interviews with the DNSPs suggest that, while some of the DNSPs recognise that the introduction of the NECF in July 2012 has the potential to change the Customer – DNSP relationship, no material work has been done in thinking about alternative procedures. Agreeing the form of a revised procedure with the DNSPs and training RECs in the appropriate form for the revised procedure could remove a source of delay and cost in the current connection process.

[14] This issue is complicated by the AMI derogation in Victoria. After the AMI derogation expires in Victoria at the end of 2013, it is not certain whether the DNSPs will retain exclusivity of metering provision for small customers. Should such metering be competitively provided, then the EWR would need to go to the Retailer first as the Retailer would appoint the Metering Provider and the Metering Data Provider.

6.3.3. Using Accredited Service Providers for Metering

Where the DNSP is required to come to the customer premises to de-energise the premise, install a new meter and re-energise the premise, this can be costly, taking into account the time costs of the REC, as well as the regulated costs of the DNSP's attendance.

In NSW the ASP model operates, allowing Registered Electrical Contractors to become ASP and perform metering installation activities. This could streamline the process and reduce the costs for the installation of metering. In this model a REC qualified as an ASP would:

- Perform whatever electrical work is required at the customer's premise. In the case of EV Service Provider models generally, this would include running a new 15 amp circuit to the EV charge point;
- Obtain a suitable meter from the local Distribution business, that is pick up a meter at a DNSP's depot;
- De-energise the customer supply by removing the service fuse;
- Install the new meter;
- Re-energise supply by insertion of the service fuse; and
- Provide a Certificate of Electrical Safety to the DNSP and the customer. Subsequently, some or all such installations would be audited by an ESV inspector.

This ASP model could be work in Victoria and has the potential to reduce costs to customers and to improve service response times.

6.3.4. Off-market Settlement

Part of the complexity of the connection arrangements for the business models put forward by the EV Service Providers is a function of the requirement for on-market settlement in the NEM. Alternatively, private arrangements for off-market settlement, based on contracts between the required parties – which would not typically include the DNSPs – could provide similar functionality. We understand that, similar to the current experience in California, there are some parties interested in facilitating this functionality in the NEM and it may be worth assessing the necessary preconditions for off-market settlement to function.

6.3.5. Issues outside the energy market

Because we anticipate that issues raised in relation to the size of private costs of installing appropriate connections in existing premises and the consent to installations in multi-occupancy premises, are likely to become more significant than is currently the case, we believe that the range of considerations including planning, tenancy and liability issues raised by these issues should be considered.

A. Stakeholders Interviewed

During this project we interviewed industry participants from the following organisations.

Organisation	Industry Role
AGL Energy	Energy Retailer
Australian Energy Market Operator	Market Operator of the NEM
Better Place	Electric Vehicle Service Provider
Charge Point	Electric Vehicle Service Provider
CitiPower / Powercor	Distribution Business
Department of Primary Industries (VIC)	State Government Department
Department of Transport (VIC)	State Government Department
Jemena	Distribution Business (Service Provider)
SP AusNet	Distribution Business
Origin Energy	Energy Retailer
Twin Electrics	Registered Electrical Contractor
United Energy	Distribution Business

B. An Overview of the Regulatory Instruments Reviewed

The following is a listing of the codes and regulations that were reviewed in the process of analysing possible issues affecting the electrical connection of EVs for battery recharging and the settlement of EV energy use.

Victorian Service and Installation Rules (SIRs)

The Victorian SIRs were reviewed. The SIRs available on website www.victoriansir.org.au are dated 2005 and are out of date in many respects[15]. We understand that an updated version of the SIRs is being prepared, but has been under review for more than 2 years. The most relevant parts of the SIRs in regard to EVs are:

- Section 5 – Supply Application, Connection and Disconnection; and
- Section 8 – LV Metering.

Section 2.4 of the Victorian SIRs states "The objective of these rules is to provide Victorian electricity customers with industry agreed DNSP *reasonable technical requirements* (Rules) that meet all the legislative and code requirements for the supply and metering related aspects of any connection to the Victorian electricity supply networks."

The term "reasonable technical requirements" is used in section 2.6.1 (d) of the Electricity Distribution Code in relation to the conditions under which a DNSP will connect supply.

It would appear that the SIRs have no regulatory standing as they are issued by the electricity DNSPs but under no legislative or regulatory instrument. The DNSPs manage the SIRs and have sole responsibility for change control.

Some of the requirements of Section 5 will impact on EV Service Provider models for metering of EV consumption. In particular:

- Section 5.3, Item 5 – "Customer's agent to ascertain the electrical installation and supply and metering requirements, completes electrical installation and provides Customer's Retailer with EWR Form … and the certificate of Electrical Safety".
- Section 5.3, Item 7 – "Retailer's meter provider installs meters and requests DNSP to connect the electrical installation."

These clauses require the EWR to be submitted to the Retailer and not the DNSP because, under the NER, the Retailer can appoint a Meter Provider other than the DNSP to install metering. However, there is a derogation in Victoria from this rule giving exclusivity to DNSPs for all metering up to 160MWh pa until December 2013.

Some of the requirements of Section 8 may impact on EV Service Provider models for metering of EV consumption. In particular:

- Section 8.3.1 – Requirement for separate metering for each individual customer's electrical installation. An EV Service Provider model proposing to use a two element meter where one element was used for the billing of the EV Service Provider for EV energy use would be affected by this requirement, if the EV is to be treated as a separate customer.

[15] For example, they refer to the requirements of the Office of the Chief Electrical Inspector which has since become Energy Safe Victoria (ESV). They also refer to AGL and TxU as DNSPs.

- Section 8.3.2 – The DNSP must agree to the reuse of a metering panel for the addition of extra equipment (including metering) where sufficient wiring space is available.
- Section 8.11.2 – Tables 8.2 and 8.3 list the maximum number of occupancy meters per panel. This will affect the EV Service Provider model where a second meter is added to the customer's meter board for measuring EV charging energy.
- Section 8.11.4.2 – Requirement for each individual occupancy meter to be capable of being individually isolated by a supply disconnection device, normally a service fuse. This affects the EV Service Provider model where a second meter is added to the customer's meter board for measuring EV charging energy. It means that two service fuses will be required on the metering panel to allow for independent isolation of supply to either meter.

Electricity Safety (Installations) Regulations 2009

- Electricity Safety (Installations) Act 2009 Division 4 requires the provision of a Certificate of Electrical Safety (CES) for any electrical work done on a customer's electrical installation. Where the work does not affect the meter board or the electrical service connection from the DNSP this is covered by a non-prescribed CES. For non-prescribed electrical work the REC procures a non-prescribed CES form from Energy Safe Victoria (ESV) and completes this detailing the work done and providing copies to the customer and ESV. ESV uses Electrical Inspection companies to inspect the work done for a small random sample of non-prescribed CESs.
- Where electrical work done on a customer's electrical installation involves work on consumer mains, earthing systems, main switchboards (including metering) etc., this is categorised as Prescribed Electrical Installation work. All prescribed electrical installation work requires a Prescribed CES. The REC procures a prescribed CES form from ESV provided by ESV and completes this, detailing the work done and providing copies to the customer and ESV. For prescribed work ESV uses Electrical Inspection companies to inspect all work done. The DNSPs require this inspection to be done before they will allow electrical installation to be energised.
- For the EV Service Provider model where another meter is added to the customer's meter board to measure EV charging energy use, the installation of the second meter is a prescribed activity and will require an electrical inspection.
- The Regulations (clause 238) allow that, if there is only one item on the meter board that is changed, then this change would not require a prescribed CES. This reads as follows:

  '(3) For the purposes of section 45 of the Act, prescribed electrical installation work does not include—
  a. the repair or maintenance of a single component part of an electrical installation; or
  b. the replacement of a single component part of an electrical installation by an equivalent component part at the same location.

  (4) A single component referred to in subregulation (3) includes any terminating device required to connect that single part of an electrical installation to the electricity supply.'

- This exemption means that for EV Service Provider models apart from those that require an additional meter, there will be no need for a prescribed CES.

Electricity Distribution Code

The Distribution Code includes connection requirements relevant to EVs:

- Section 2.2 – New connection must be completed by the DNSP within 10 business days after the request is received;
- Section 2.3.1 – Requests for energisation must be made through a retailer. In the case where a second meter is being installed at an address, then it may be that this requires the retailer associated with the first meter to make the energisation request, which could be undesirable, considering competitive neutrality issues.
- Section 2.6.1(b) – a Certificate of Electrical Safety must be provided to the DNSP for the customer's electrical installation as a condition of connection.

Electricity Customer Metering Code

The Customer Metering Code regulates the non-technical provisions and customer obligations relating to metering in respect of first and second tier customers. The National Electricity Rules ("NER") contain the technical and market settlement provisions for first and second tier customers and is supported by the Metrology Procedure. This code applies to customers taking supply from a DNSP or in an embedded network (now called a private network). The code deals with:

- Meter Installation and Provision
  - Access to metering equipment;
  - Ownership of metering equipment (i.e.: the customer does not own meters);
  - Safety, check metering, information for customers;
  - changing tariffs;
  - meter seals;
  - meter testing requests;
  - obligation of DNSP or retailer to provide meters; and
  - embedded networks.
- Meter Data Services – General Requirements
  - Access to data;
  - Confidentiality of data; and
  - Collection of metering data.

There are no specific requirements that impact permanent EV charging connections such as a charge point in a customer's garage. However if a "customer" can recharge their vehicle at various locations on a transient basis then the code may need to be revised to cover requirements such as:

- The customer's responsibility for the safety of the metering;
- The customer's ability to provide and install check metering;
- Customers' ability to access cumulative meter readings, which may limit where the meter can be located;
- Inappropriate references to a customer's premises.

Victorian Distribution Licences

The following are some of the Distributors' licence obligations in relation to their potential impact on EV Service Provider models:

- Section 6 of the license requires that "if a retailer of a customer requests the Licensee to offer to provide connection services … the licensee must make such an offer within 20 business days in accordance with clause 11 and subject to the Electricity Distribution Code". Section 11 states that this period begins when the DNSP "receives all information which the Licensee reasonably requires to make the offer."
  Connection Services are defined as "the service of establishing connection between the … distribution system and another electrical system (including, without limitation, an electrical installation).
  - For the EV Service Provider model requiring a separate meter, the second meter is a connection. There is a new electrical installation and a new customer at the premise. Hence, the requirement for providing connection services within 20 business days should be applicable to this EV Service Provider model. Either the retailer or the customer can request connection services, allowing an EV Service Provider to lodge the connection request with the DNSP directly.
- A connection offer must be fair and reasonable and either consistent with the applicable Price Determination or the requirements relating to exempt services (now called Alternative Control Services) in that Price Determination.
- Section 14 requires the DNSP to issue unique NMIs for each metering installation in its distribution area (even in those cases where the National Electricity Code does not require it to do so).
  - This is relevant to the EV Service Provider model where there is a new meter is required. The DNSPs have contended that there cannot be more than one NMI at an address, yet the licence requires them to provide NMIs for each metering installation without limiting this to one metering installation at a premise. The definition of a metering installation is stated to be that as defined in the National Electricity Code (now the NER) and that definition does not limit the number of metering installations at a premise or address.
- Section 4, dealing with the Default use of system agreement, requires that customers (and retailers) cannot be discriminated against in the application of the terms and conditions of the default use of system agreement and must be treated fair and reasonably.
  - Assuming that the installation of a second or sub-meter is subject to the default use of system agreement, then changes to any business processes covered by the use of system agreement would presumably need to be extended to all classes of customers.
  - However, a Retailer, a person who has applied for a Retail License or an exempt retailer can enter into a use of system agreement, the terms and conditions of which can differ from the default use of system agreement. Other than a requirement that the use of system agreement be in writing, there are no other requirements in the License relating to this form of use of system agreement. However, by virtue of a clause that obliges the DNSP to offer all parties with use of

system agreements the option of moving to the default agreement in the event of changes to the default, the Retailer has the option of reverting to the default agreement in the event that its terms and conditions change to a superior offering.

- Obligation to offer connection services – the license requires that in response to either a Retailer's or a customer's request, a DNSP is obliged to make an offer to provide connection services within 20 business days. As Connection Services are defined as "the service of establishing connection between the … distribution system and another electrical system (including, without limitation, an electrical installation), then, a request for a second or sub-meter is a request for connection services, given the scope of the definition of electrical installation.
  - Alternatively, a second or sub-meter may be caught by Section 8, Obligation to offer undergrounding and similar services, given that this category includes modification to the assets to "improve the amenity or appearance of the environment". Failing this – that is, if a second meter's not a request for connection services and not caught under this category – then it may not be a subject for the license at all.
  - Concerns relating to the costs of installation of a second or sub-meter presumably require reconciliation to the relevant charging schedule for the responsible DNSP. The route for contesting the charges is via the ESC (presumably, the AER) on the basis that the charges are not fair and reasonable.
- The license requires a unique NMI must be issued for all metering installations, in line with National Electricity Code requirements for all metering installations in its area, even if not required to do so under Metering Code for installation in question. The NMI must be issued prior to connection. In a somewhat circular process, metering installations are defined by reference to the National Electricity Code.
- The license provides for the ESC to require the DNSPs to participate in the development, issue and review of any standards and procedures specified by the Commission. Standards and procedures are defined as
  - Customer-related standards;
  - Overall performance standards;
  - Complaint handling … etc.;
  - Security deposit, disconnection and credit ... etc.;
  - Rules for compensating customers for failure to comply with standards; and
  - Procedures relating to prepayments, debit cards, etc.

  To the extent that the ESC has the power to give rise to B2B standards and procedures relating to metering, presumably it would have to come under the first category, about which no further information is given.

Use of System (UoS) agreements

Each DNSP's licence requires it to offer retailers a default use of system agreement. However, the DNSP and retailer are free to negotiate a use of system agreement with terms and conditions that are different from the default use of system agreement approved by the ESC. Each of the DNSP's UoS default agreements is virtually identical.

These agreements deal mainly with contractual matters between a Retailer and a DNSP and cover:

1. Compliance with Electricity Law
2. Customer relationship
3. Services
4. Connection
5. Disconnection and interruption of customer
6. Fees, billing and payment
7. Information exchange
8. Communication regarding customers and system data
9. Force Majeure
10. Enforcement of DNSP's rights against customers
11. Term and termination
12. Representations and Warranties
13. Notices
14. Confidentiality
15. Law and jurisdiction
16. General

The first category of definition of services in Item 3, "Services", is *"The Distributor will provide to the Retailer in relation to each Customer the Distribution Services in accordance with Good Electricity Industry Practice".* This allows DNSPs considerable latitude to insist on doing things their way and to represent this as good industry practice. With EVs projected to become a major new application of electricity this definition of service could limit innovation.

Item 5, "Connection", requires:

> Section 5(a) - *If the Retailer receives a request for Connection from a Customer, the Retailer must submit to the Distributor a Connection Request in respect of the Customer without delay and in accordance with any electricity industry standards, but no later than the next Business Day following receipt of the Customer's request for Connection.*

In the EV Service Provider model which requires new metering to be installed on the customer's meter board, this is particularly applicable. The new metering constitutes a new connection, yet EV Service Providers advise that the delays in getting connection requests from Retailers to DNSPs are much longer than 1 business day.

National Electricity Rules

In relation to an EV Service Provider having a second meter installed at a customer's premise, section 7.2.4 of the NER is particularly relevant as it deals with "joint metering installations". This section requires that where there is more than one market participant using a metering installation, then one of the market participants needs to be the responsible person (RP): there cannot be two responsible persons for the metering installation. In the EV Service Provider model being considered this would mean that either the EV Service Provider's retailer or the end customer's retailer would be RP for the metering installation and presumably, that this would need to be the subject of agreement

between the retailers responsible for the sale of electricity associated with each meter, where the retailers differ.

AEMO metrology procedure

Where a Market Participant or Local Network Service Provider requests in writing for the responsible person to provide and install a metering installation, the responsible person must use reasonable endeavours to provide and install the metering installation within 20 business days of receipt of the written request. (Clause 2.8.4)

In the EV Service Provider model which utilises an embedded network (private network) and where the EV energy use is measured by a child meter, the child meter is required to be an interval meter and the parent meter must be an interval meter. (Refer Clause 2.5)

AEMO National Meter Identifier Procedure

This AEMO procedure sets out the structure for National Metering Identifiers (NMIs) to be used in National Electricity Market (NEM) and details metering data streams for each category of installation.

In this procedure there are examples given of supply and metering installations with varying numbers of meters and varying numbers of NMIs. It is noted that in sections 13.7, 13.8, 13.9, 13.10 and 13.11 there are examples of multiple NMIs at one customer address. This is significant as some DNSPs have advised that their systems are designed to reject connection applications that would result in more one NMI per physical address. This DNSP business requirement affects the EV Service Provider model that requires an additional meter and NMI to be added to a customer premise. The impediment to installing two NMIs at a single address appears to be one relating to DNSP business processes rather than a regulatory requirement.

Orders in Council for VIC AMI program

The VIC AMI Orders in Council were reviewed. Nothing came to our attention that would impact on the connection of EVs for charging or for the settlement of EV energy use.

AER Electricity NSP registration exemption guideline

This covers the requirements for private networks, previously called embedded networks or exempt networks. An EV Service Provider seeking to have sub-metering for measurement of the electrical energy used in charging an EV would need to meet the requirements of this guideline. This guideline states that:

> *"Anyone, no matter how small the network, who supplies electricity to another person over a private network of any kind, is providing an electricity distribution service. An exemption may be required for any network by which electricity is supplied to another party, be that party a legal person, corporation, government department or statutory body of any kind." (Part A, section 1, 3rd paragraph)*

If an EV Service Provider were to use this model, the meter customer becomes the private network operator and is required to meet the requirements of this guideline.

Implicit in this guideline is an assumption that there will be relatively few exempt private networks; the guideline does not contemplate the circumstance of perhaps hundreds of

thousands of such networks being used for EV charging. The processes in the guideline would need to be changed if large numbers of EVs were connected to these networks.

AEMO embedded network guidelines

This guideline outlines how settlement operates for embedded networks of various configurations. The meter used to measure all energy entering the whole electrical installation is a market meter and is termed the parent meter. Meters within the embedded network are termed child meters. For subtractive metering to occur, the child meter must have its own NMI and both the parent meter and the child meter that is a market meter must be interval meters or smart meters.

For an EV Service Provider model using embedded networks and requiring subtractive metering, the child meter needs to be a market meter with a NMI and interval capability. With the Smart Meter rollout in Victoria by the end of 2013 all parent meters will be smart meters. A child meter that is an interval meter but not a smart meter will require the DNSP to manually read this meter, which given the absence of other manually read meters is likely to be quite expensive. The other option of having the child meter as a smart meter is viable but it will increase the cost of that meter.

An EV Service Provider model that uses off-market settlement would not require child meters to be market meters.

C. EV Connection: Possible Models and Steps in the Connection Process

C. 1 Case A, B: "Plug and Play": plug in the wall without a new meter

	Description	Regulatory Source	Comment
1	EV Service Provider enters into agreement with customer to provide relevant service.		
2	EV Service Provider or Customer engages a REC to install a charge point for the EV. If there is a 15 amp General Purpose Outlet (GPO) often called a power point - adjacent to the desired location of the charge point skip to Step 7	Regulatory – Electricity Safety Act 1998; Electricity Safety (Installation) Regulations 2009; SIRs	• Only a REC can undertake this work. • We understand that at a minimum a 15 amp GPO will be required for most EVs because most require level II charging which will require a REC to install a 15 amp GPO if one is not already available at the premise.
3	If there is not a 15 amp GPO available, then REC will need to install an additional circuit. Before doing this the REC is required to assess the site for adequacy of supply capacity to meet the additional load of the EV. If supply capacity is adequate skip to Step 6	AS3000 Wiring Rules, Electricity Safety (Installation) Regulations 2009; SIRs	• Particularly in older areas supply capacity can be quite limited
4	If there is insufficient supply capacity then the REC will issue an EWR to the customer's retailer to seek an increase in the supply capacity of the service connection.	Distribution code, Electricity Safety (Installation) Regulations 2009, SIRs	• Theoretically an EWR can be lodged with the DNSP directly. However, the current practice is to go via the Retailer.
5	The Retailer will process the EWR, forward to the DNSP who will arrange with the REC to have the supply capacity increased if there are no supply constraints on the DNSP's network. The DNSP will undertake the required works and charge the site owner.	Distribution Code, Electricity Safety (Installation) Regulations 2009; AEMO B2B procedures, SIRs, AER price determination of charges for upgrading supply	• The DNSP will only undertake this additional work if included in an EWR. • The cost for this work will be as approved by the AER.

6	The REC will install an addition circuit breaker on the site owner's switchboard, run a new cable to charge point location and fit a 15 amp general purpose power outlet (GPO)	AS 3000 wiring rules,	• In some cases there may be additional costs – for example where there is not sufficient space on the switchboard for an additional circuit breaker. • The cost of running a new cable from the switchboard to the charge point will vary significantly from site to site dependent on the distance the cable is to be run and the nature of the construction of the building.
7	The REC will install the charge point and issue a Certificate of Electrical Safety; one copy to the site owner and one to ESV. ESV inspectors may inspect the installation at a later time.	Electricity Safety (Installation) Regulations 2009; SIRs	• ESV undertakes a random audit of all non-prescribed CES work.

A Measuring Device is required, no new NMI

C. 2. Case C: Installation of a sub meter (no new NMI)

	Description	Regulatory Source	Comments
1	EV Service Provider enters into agreement with customer / site owner to install charging infrastructure.		
2	EV Service Provider engages a REC to install a charge point for the EV and sub meter. If there is a 15 amp general purpose outlet (GPO) often called a power point - adjacent to the desired location of the charge point skip to Step 7	Electricity Safety Act 1998; Electricity Safety (Installation) Regulations 2009; SIRs National Measurements Institute metrology specifications	• Only a REC can undertake this work. • We understand that at a minimum a 15 amp GPO will be required for most EVs because most require level II charging which will require a REC to install a 15 amp GPO if one is not already available at the premise. • The sub meter needs to meet legal metrology requirements but not market requirements
3	If there is not a 15 amp GPO available, then REC will need to install an additional circuit. Before doing this the REC is required to assess the site for adequacy of supply capacity to meet the additional load of the EV. If supply capacity is adequate skip to Step 6	AS3000 Wiring Rules, Electricity Safety (Installation) Regulations 2009; SIRs	• Particularly in older areas supply capacity can be quite limited
4	If there is insufficient supply capacity then the REC will issue an EWR to the customer's retailer to seek an increase in the supply capacity of the service connection.	Distribution code, Electricity Safety (Installation) Regulations 2009, SIRs	• Theoretically an EWR can be lodged with the DNSP directly; however the current practice is to go via the Retailer.
5	The Retailer will process the EWR, forward to the DNSP who will arrange with the REC to have the supply capacity increased if there are no supply constraints on the DNSP's	Distribution Code, Electricity Safety (Installation) Regulations 2009; AEMO B2B procedures, SIRs, AER price	• The DNSP will only undertake this additional work if included in an EWR. • The cost for this work will be as approved

	Description	Regulatory Source	Comments
	network. The DNSP will undertake the required works and charge the site owner.	determination of charges for upgrading supply	by the AER.
6	The REC will install an addition circuit breaker on the site owner's switchboard, run a new cable to charge point location and fit a 15 amp general purpose power outlet (GPO)	AS 3000 wiring rules,	• In some cases there may be additional costs – for example where there is not sufficient space on the switchboard for an additional circuit breaker. • The cost of running a new cable from the switchboard to the charge point will vary significantly from site to site dependent on the distance the cable is to be run and the nature of the construction of the building.
7	The REC will install a sub-meter and the charge point and issue a Certificate of Electrical Safety- one copy to the site owner and one to ESV. ESV inspectors may inspect the installation at a later time.	Electricity Safety (Installation) Regulations 2009; SIRs	• ESV undertakes a random audit of all non-prescribed CES work.
8	Customer enters into a supply agreement with its chosen retailer for the entire site.	National Electricity Rules / NECF	• In the absence of an off-market settlement arrangement, the retailer for the EV load is the same retailer as the main premise.

C. 3. Meter in an EV (no new NMI)

	Description	Regulatory Source	Comments
1	EV Service Provider enters into agreement with EV customer to provide relevant service		• What type of metering and quality of information would be required to enable off-market settlement between relevant parties based on the meter in the EV? • How will the mobility of the car and the meter impact any off-market settlement arrangement?
2	EV Service Provider or Customer engages a REC to install a charge point for the EV. If there is a 15 amp general purpose outlet (GPO) often called a power point - adjacent to the desired location of the charge point skip to step 7	Electricity Safety Act 1998; Electricity Safety (Installation) Regulations 2009; SIRs	• Only a REC can undertake this work. • We understand that at a minimum a 15 amp GPO will be required for most EVs because most require level II charging which will require a REC to install a 15 amp GPO if one is not already available at the premise.
3	If there is not a 15 amp GPO available, then REC will need to install an additional circuit. Before doing this the REC is required to assess the site for adequacy of supply capacity to meet the additional load of the EV. If supply capacity is adequate skip to step 6	AS3000 Wiring Rules, Electricity Safety (Installation) Regulations 2009; SIRs	• Particularly in older areas supply capacity can be quite limited
4	If there is insufficient supply capacity then the REC will issue an EWR to the customer's retailer to seek an increase in the supply capacity of the service	Distribution code, Electricity Safety (Installation) Regulations 2009, SIRs	• Theoretically an EWR can be lodged with the DNSP directly; however the current practice is to go via the Retailer.

	Description	Regulatory Source	Comments
	connection.		
5	The Retailer will process the EWR, forward to the DNSP who will arrange with the REC to have the supply capacity increased if there are no supply constraints on the DNSP's network. The DNSP will undertake the required works and charge the site owner.	Distribution Code, Electricity Safety (Installation) Regulations 2009; AEMO B2B procedures, SIRs, AER price determination of charges for upgrading supply	• The DNSP will only undertake this additional work if included in an EWR. • The cost for this work will be as approved by the AER.
6	The REC will install an additional circuit breaker on the site owner's switchboard, run a new cable to charge point location and fit a 15 amp general purpose power outlet (GPO)	AS 3000 wiring rules,	• In some cases there may be additional costs – for example where there is not sufficient space on the switchboard for an additional circuit breaker. • The cost of running a new cable from the switchboard to the charge point will vary significantly from site to site dependent on the distance the cable is to be run and the nature of the construction of the building.
7	The REC will install the charge point and issue a Certificate of Electrical Safety- one copy to the site owner and one to ESV. ESV inspectors may inspect the installation at a later time.	Electricity Safety (Installation) Regulations 2009; SIRs	• ESV undertakes a random audit of all non-prescribed CES work.

Note: The meter in the EV need not be a meter to measure electricity consumption – it is a measurement device that can be used to assess the amount of electricity used to charge the battery – examples include the odometer, the level of charge in the battery or an electricity measurement device.

A new meter and a new NMI are required

The DNSPs consider this process to be a connection alteration. However, it is arguably a new connection. A service is being created for a new customer (the EV Service Provider) and there is a separate meter and separate electrical wiring. Nevertheless, the process steps below reflect a connection alteration.

C. 4. Case D: Connection alteration [separation of supply] resulting in two NMIs

	Description	Regulatory Source	Comments
1	EV Service Provider enters into agreement with customer / site owner to install charging infrastructure.		
2	EV Service Provider engages a REC to investigate wiring requirements and installation of charging infrastructure.	Electricity Safety Act 1998; Electricity Safety (Installation) Regulations 2009; SIRs	• On the assumption that the customer has requested the EV Service Provider to act on their behalf. • Only an REC can undertake this work at the premise.
3	REC assesses electrical installation: 1. whether the supply has sufficient capacity to meet the additional load of EV charging 2. whether the meter board has sufficient space for the additional meter and two service fuses (two because supply has to be separated).	Distribution Code, SIRs (which details meter board space requirements)	
4	EV Service Provider enters into a supply agreement with a Retailer for supply to EV charging installation.	National Electricity Rules / NECF	• The retailer for the EV is required to be the retailer on the EWR for the energisation of the new NMI • The retailer for the premise has to be informed of the temporary de-energisation of their NMI and re-energisation of their NMI that occurs during this process. • The co-ordination of both retailers can cause additional time and complexity.

	Description	Regulatory Source	Comments
			• Concerns by stakeholders have been raised that if the address on the EWR for the new NMI is the same address as the existing NMI at the site this will cause problems in the DNSPs' and retailers' systems. • We understand this is a business process or system issue as opposed to a regulatory requirement driving the need to have a new address for each NMI on the site. • We understand from stakeholders that privacy legislation also adds complexity to the EWR as the REC is unable to send private customer information to the DNSP and / or retailer without the customers consent.
5	REC performs the electrical installation. If the meter board does not require replacing, the REC will install wiring ready for the new meter (plus new service fuses), install new switchboard and circuit breaker and run new cabling to location of charge point and install charge point. If meter board does need replacing the REC will prepare the new meter board with wiring ready for the new meters and switchboards, plus run new cable to location of charge point and install charge point. REC books a Licensed Electrical Inspector to undertake the inspection.	AS3000 Wiring Rules, SIRs, Energy Safety (installations) Regulations 2009	
6	Licensed Electrical Inspector and REC meet at the site. Licensed Electrical Inspector (LEI) inspects installation before signing off on Certificate of Electrical Safety (CES)	Energy Safety (installations) Regulations 2009.	• All installations of this type must be inspected by a Licensed Electrical Inspector.

	Description	Regulatory Source	Comments
	and providing copies to REC/site owner / DNSP and ESV.		
7	EV Service Provider / REC submits an EWR and CES to the EV retailer including if relevant the requirement to replace the meter board and increase the supply capacity.	SIRs	
8	The EV retailer submits EWR to DNSP	SIRs	• We understand that retailers can take up to 5 business days to process the EWR. • Stakeholders have also expressed concerns about the level of complexity in the EWR process going via the retailer and the lack of familiarity by the retailer of potentially technical metering requirements causing delays. • The introduction of NECF will assist in simplifying this process as the customer (or REC as agent for the customer) can contact a DNSP directly and send the EWR to them directly.
9	DNSP allocates NMI	National Electricity Rules, AEMO National Metering Identifier Procedure	• The allocation of the NMI is a simple process which will take up to 5 business days.
10	DNSP schedules truck visit (on or before 10 working days) to the site and communicates this date to the EV retailer who then communicates the date to the REC. If meter board is to be replaced then this will require the REC to be on site. If REC is required to be on-site then an agreed date and time is negotiated between the REC and DNSP.	Distribution Code	• There is a GSL on a 2 hour window for appointment and 15 minute arrival time for the site visit by the DNSP.
11	DNSP truck visit occurs and DNSPs service technician de-	SIRs	• Only the DNSP can de-energise and remove

	Description	Regulatory Source	Comments
	energises the site using the service fuse or pit connection as appropriate. If the meter board at the site is deemed by the DNSP's service technician to be non-compliant for the addition of a second meter (despite the REC considering it OK in step 3) the REC will be informed of the requirement to upgrade the meter board first, before the DNSP can install the new meter and fuse. Go to step 13		the first meter to enable the REC to undertake the required work to upgrade the meter board.
12	If the meter board was known to need replacement from step 3, the REC fits the new meter board and the service technician connects the service cable and installs all new metering. If the meter board was known not to need replacement from step 3, the DNSP's Service Technician installs second meter If the service connection required an upgrade as identified in step 3, the service cable is replaced by the DNSP's service technician (if an overhead supply) or if an underground supply the Technician connects the new service cable run by REC to the pit and the meter board to give the required capacity. The DNSP service technician then re-energises the site. Skip to step 16	SIRs, Electricity Customer Metering Code	• Only the DNSP can install the meter. • We understand that the specific derogation in the National Electricity Rules prohibiting RECs from installing meters will cease at the end of 2013. • If it is not replaced, this will potentially allow type 4 meters to be installed by a meter provider (other than the DNSP). This may assist in addressing this issue.
13	If REC can complete replacement of meter board in one hour then truck remains to complete meter installation. The DNSP service technician then connects the service cable and installs all new metering. If the service connection required an upgrade as identified in step 3,	AER price determination (defines one hour service call prices).	• Stakeholders have said that if the process takes longer than one hour, then usually the truck stays if the time is not materially longer. Otherwise, the truck usually comes back later in the day for the second visit

	Description	Regulatory Source	Comments
	the service cable is replaced by the DNSP's service technician. The site is then re-energised. Skip to step 16 If REC cannot complete upgrade in one hour then a second truck visit will need to be scheduled. Go to step 14		based on discussions with the REC.
14	While the site is de-energised, the REC replaces the meter board. The DNSP truck returns when requested by the REC to install all new meters and to reconnect the service cable, then re-energise the site.	Distribution Code	• The energisation of the site for the new NMI can only occur if requested by the EV retailer and would be on the EWR. The REC and / or customer cannot request this. • If not on the original EWR a new request placed to energise the site. With the AMI roll out this should be easy with no truck visit required to energise.
16	DNSP communicates NMI to the EV retailer. DNSP charges EV Service Provider via the EV Service Provider Retailer	NER, AER price determination	

C. 5. Case E: Connection alteration (embedded network) with the parent NMI being the original NMI and the EV having the child NMI.

	Description	Regulatory Source	Comments
1	EV Service Provider enters into agreement with customer / site owner to install charging infrastructure.		
2	EV Service Provider engages a REC to investigate wiring requirements and installation of charging infrastructure.	Electricity Safety Act 1998; Electricity Safety (Installation) Regulations 2009; SIRs	• On the assumption that the customer has requested the EV Service Provider to act on their behalf. • Only an REC can undertake this work at the premise.
3	REC assesses electrical installation: 1. whether the supply has sufficient capacity to meet the additional load of EV charging 2. whether the meter board has sufficient space for the additional meter.	Distribution Code, SIRs (which details meter board space requirements)	
4	REC performs the electrical installation. If the meter board does not require replacing, the REC will install wiring ready for the new meter, install new circuit breaker and run new cabling to location of charge point and install charge point. If meter board does need replacing the REC will prepare the new meter board with wiring ready for the new meters and switchboards, plus run new cable to location of charge point and install charge point. REC books a Licensed Electrical Inspector to undertake the inspection.	AS3000 Wiring Rules, SIRs, Energy Safety (installations) Regulations 2009	
5	Licensed Electrical Inspector and REC meet at the site. Licensed Electrical Inspector (LEI) inspects installation before signing off on Certificate of Electrical Safety (CES)	Energy Safety (installations) Regulations 2009.	• All installations of this type must be inspected by a Licensed Electrical Inspector.

	Description	Regulatory Source	Comments
	and providing copies to REC/site owner / DNSP and ESV.		
6	Customer (or EV Service Provider on their behalf) makes application for exemption/registration for the embedded network and for the customer to be the Embedded Network Operator.	Distribution Code, Embedded Network Guidelines, AER exemption guidelines, National Electricity Rules / NECF	• The customer or EV Service Provider will be the embedded network operator. • A registration needs to be sent to AEMO and an application for exemption / registration needs to be sent to the AER.
7	Customer or EV Service Provider enters into a supply agreement with its chosen retailer for the energy to charge the EV.	National Electricity Rules / NECF	• The retailer for the EV (child NMI) does not have to be the same retailer as the main premise (parent NMI).
8	EV Service Provider / REC submits an EWR and CES to the parent meter retailer including if relevant the requirement to replace the meter board and increase the supply capacity.	SIRs	
9	The parent meter retailer submits EWR to DNSP	SIRs	• The retailer for the EV is required to be the retailer on the EWR for the energisation of the new NMI. • The retailer for the parent meter has to submit an EWR to the DNSP as the main connection point to the distribution network. • We understand that if the retailer for the parent NMI does not consent to their EWR that the process can stop at this stage. • The co-ordination of both retailers can cause additional time and complexity. • We understand that retailers can take up to 5 business days to process the EWR. • Stakeholders have also expressed concerns about the level of complexity in the EWR process going via the retailer and the lack of

	Description	Regulatory Source	Comments
			familiarity by the retailer of potentially technical metering requirements causing delays. • The introduction of NECF will assist in simplifying this process as the customer (or REC as agent for the customer) can contact a DNSP directly and send the EWR to them directly.
10	DNSP allocates NMI	National Electricity Rules, AEMO National Metering Identifier Procedure	• The allocation of the NMI is a simple process which will take up to 5 business days.
11	DNSP schedules truck visit (on or before 10 working days) to the site and communicates this date to the EV retailer who then communicates the date to the REC. If meter board is to be replaced then this will require the REC to be on site. If REC is required to be on-site then an agreed date and time is negotiated between the REC and DNSP.	Distribution Code	• There is a GSL on a 2 hour window for appointment and 15 minute arrival time for the site visit by the DNSP.
12	DNSP truck visit occurs. If the meter board at the site is deemed by the DNSP's service technician to be non-compliant for the addition of a second meter (despite the REC having considered it OK at step 3) the REC will be informed of the requirement to upgrade the meter board first, before the DNSP can install the new meter and fuse. Go to step 14	SIRs	• Only the DNSP can replace meters
13	If the meter board was known to need replacement from step 3, the DNSP's service technician de-energises the site. The REC fits the new meter board and the service technician connects the service cable and installs all new	SIRs, Electricity Customer Metering Code	• Only the DNSP can install the meter. • We understand that the specific derogation in the National Electricity Rules prohibiting RECs from installing meters will cease at the

	Description	Regulatory Source	Comments
	metering. If the meter board was known not to need replacement from step 3, the DNSP's Service Technician turns off the main switch and installs second meter If the service connection required an upgrade as identified in step 3, the service cable is replaced by the DNSP's service technician (if an overhead supply) or if an underground supply the Technician connects the new service cable run by REC to the pit and the meter board. The DNSP service technician then re-energises the site. Skip to step 16		end of 2013. • If it is not replaced, this will potentially allow type 4 meters to be installed by a meter provider (other than the DNSP). This may assist in addressing this issue.
14	If REC can complete replacement of meter board in one hour then truck remains to complete meter installation. The DNSP service technician then connects the service cable and installs all new metering. If the service connection required an upgrade as identified in step 3, the service cable is replaced by the DNSP's service technician. The site is then re-energised. Skip to step 16 If REC cannot complete upgrade in one hour then a second truck visit will need to be scheduled. Go to step 15	AER price determination (defines one hour service call prices).	• Stakeholders have said that if the process takes longer than one hour, then usually the truck stays if the time is not materially longer. Otherwise, the truck usually comes back later in the day for the second visit based on discussions with the REC.
15	While the site is de-energised, the REC replaces the meter board. The DNSP truck returns when requested by the REC to install all new meters and to reconnect the service cable, then re-energise the site.	Distribution Code	• The energisation of the site for the new NMI can only occur if requested by the EV retailer and would be on the EWR. The REC and / or customer cannot request this. • If not on the original EWR a new request placed to energise the site. With the AMI roll out this should be easy with no truck visit required to energise.

	Description	Regulatory Source	Comments
16	DNSP communicates NMI to the EV retailer. DNSP charges EV Service Provider via the EV Service Provider Retailer	NER, AER price determination	
17	Site owner requests transfer of new NMI (if required) to appropriate retailer if the EV retailer is to be different from the main premise retailer.	National Electricity Rules	• The parent NMI retailer will need to assume subtractive metering and billing capabilities for network charges as the DNSP will only bill network charges to the parent NMI.

Meter in an EV which is a new NMI

We appreciate that this process is somewhat theoretical, given the current technical, regulatory and system limitations preventing a NMI from being in a moveable location as well as an embedded network. This process has therefore been developed on our understanding of how it may work if possible as opposed to an accurate representation of how it does work in practice.

C. 6. Meter in an EV which is a new NMI

	Description	Regulatory Source	Comments
1	EV Service Provider enters into agreement with EV customer to provide relevant service		• Not really a required step. • What type of metering and quality of information would be required to enable off-market settlement between relevant parties based on the meter in the EV? • How will the mobility of the car and the meter impact any off-market settlement arrangement?
2	EV Service Provider or Customer engages a REC to install a charge point for the EV. If there is a 15 amp general purpose outlet (GPO) often called a power point - adjacent to the desired location of the charge point skip to step 7	Electricity Safety Act 1998; Electricity Safety (Installation) Regulations 2009; SIRs	• Only a REC can undertake this work. • We understand that at a minimum a 15 amp GPO will be required for most EVs because most require level II charging which will require a REC to install a 15 amp GPO if one is not already available at the premise.
3	If there is not a 15 amp GPO available, then REC will need to install an additional circuit. Before doing this the REC is required to assess the site for	AS3000 Wiring Rules, Electricity Safety (Installation) Regulations 2009; SIRs	• Particularly in older areas supply capacity can be quite limited

	Description	Regulatory Source	Comments
	adequacy of supply capacity to meet the additional load of the EV. If supply capacity is adequate skip to step 6		
4	If there is insufficient supply capacity then the REC will issue an EWR to the customer's retailer to seek an increase in the supply capacity of the service connection.	Distribution code, Electricity Safety (Installation) Regulations 2009, SIRs	• Theoretically an EWR can be lodged with the DNSP directly; however the current practice is to go via the Retailer.
5	The Retailer will process the EWR, forward to the DNSP who will arrange with the REC to have the supply capacity increased if there are no supply constraints on the DNSP's network. The DNSP will undertake the required works and charge the site owner.	Distribution Code, Electricity Safety (Installation) Regulations 2009; AEMO B2B procedures, SIRs, AER price determination of charges for upgrading supply	• The DNSP will only undertake this additional work if included in an EWR. • The cost for this work will be as approved by the AER.
6	The REC will install an additional circuit breaker on the site owner's switchboard, run a new cable to charge point location and fit a 15 amp general purpose power outlet (GPO)	AS 3000 wiring rules,	• In some cases there may be additional costs – for example where there is not sufficient space on the switchboard for an additional circuit breaker. • The cost of running a new cable from the switchboard to the charge point will vary significantly from site to site dependent on the distance the cable is to be run and the nature of the construction of the building.
7	The REC will install the charge point and issue a Certificate of Electrical Safety- one copy to the	Electricity Safety (Installation) Regulations 2009; SIRs	• ESV undertakes a random audit of all non-prescribed CES work.

Description	Regulatory Source	Comments
site owner and one to ESV. ESV inspectors may inspect the installation at a later time.		

D. Key Questions – Thinking about the issues from a customer's perspective

In this appendix, we consider the issues raised with DPI by stakeholders and reflect our findings in possible responses to those issues. In moving past the immediate answer to the question raised, we consider, in a preliminary way, what measures could be taken to address elements of the issues raises. The measures we identify feed into the Section 6 where we discuss possible future directions.

Table D.1 Key Questions in the Connection Process - Answers and Issues

Key Questions	Answer	Issues
What explains the customer's costs to install?	• The bulk of the customer's costs are unregulated/not subject to energy market regulation. — Registered Electrical Contractor's prices are subject to competition. Without any detail on the costs in the examples provided by DPI we cannot be certain but we would anticipate the labour costs of the REC explain the larger part of the costs. However, where the REC is charging on a time and materials basis, then delays to the connection process, including, for example, in the approval of the EWR, are likely to increase the costs to the customer. — Only services provided by the DNSP are regulated and these services are provided in line with published regulated prices. — The equipment, *including* the meter board, but *excluding* the meter, is privately procured and the price is set in the market. This is true of all equipment other than that provided as part of a DNSP regulated service. The requirement for an upgrade to a meter board where a second meter is to be installed is a function of the SIRs and is the result of the requirement for a second meter. Our interviews did not suggest that most premises would require an upgraded meter board in the absence of a requirement for a second meter. — Meters provided by the DNSP are provided at the published regulated price.	• The requirements for wiring to/from the meter board and the configuration of the meter board are set by the DNSPs in the SIRs. — The extent to which savings are possible as a result of revisions to the SIRs/national harmonisation is unknown, but, without a wider changes to installation practices, may not be large.
What explains the delay in the commencement of the customer's installation?	• The customer's meter installation should occur within 10 days of the receipt of a valid EWR, or by agreement with the REC, in line with the requirements of the Distribution Code. • Our interviews suggest that the principle source of delay is the lodgement of a *valid EWR.* — The DNSPs' systems apply a business rule that restricts to one the number	• While the DNSPs appear to view the "one site, one connection" rule as a requirement of AEMO's, AEMO's view and our own is that there is no basis in the market rules for this restriction. — However, we appreciate that, as a quality control on the businesses' records, the

Key Questions	Answer	Issues
	of connections that can be installed at a given address. As a result, an EWR for a second meter at the same address will be rejected/not be processed, on the basis that a meter already exists at the address. — The REC can implement a work-around by nominating a (fictional) second address at the same site, for example, 1A The Avenue. In this case, the EWR needs to distinguish between the billing address (1 The Avenue) and the connection (1A The Avenue) to ensure that billing is received by the customer at the site for the second meter. • In some cases, the REC has found other issues that have prevented the processing of the EWR. For example, the existing customer's name was not held by the business systems for the existing connection – the customer was known in the systems as "The Customer"- and an application for a second meter in the customer's name was rejected for inconsistency with the existing customer record.	business rule is a useful control. — Further, given the DNSPs' views on the status of this requirement, then, short of the power to force a change, voluntary compliance is likely to be difficult to achieve. • There is an existing process for, for example, the conversion of a single site meter into a multiple occupancy site that could be used as the basis for an EWR in cases where a second meter with a NMI is required. — There may be some resistance to this from the DNSPs, but it could be a useful short term measure as an agreed upon process is put in place. — Guidance to installers would be useful if this process is to widely used, to ensure consistency in the approach among other things, to nominating the second (fictitious) address. • There appears to be a business process "black hole" in the processing of EWRs, where an EWR that fails a retailer's or DNSP's requirements may not be promptly returned to the REC with an indication as to the reason for failure. — Better forms and better guidance for RECs installing second meters would assist. • There may also be a role for automating the B2B lodgement and processing of EWRs, which would improve turn-around times and could improve the quality of EWRs submitted.
What about "the DNSP's truck arrives, departs, reschedules, etc..." part of the process?	• Our limited interviews didn't suggest this was a frequent issue, although the REC we interviewed suggested that it would be preferable where a DNSP has cancelled its attendance, for early notification to be given. — The EWR, if correctly lodged, should have identified that a meter board change was required.	• A customer has some limited redress for the failure of the DNSP to meet the mandated performance level for customer appointments, although the level of the penalty is now quite small relative to the cost of the works.

Key Questions	Answer	Issues
	— The REC would typically have undertaken the bulk of the work associated with the meter board change prior to the arrival of the truck, up to and including unscrewing but not detaching the existing meter board. — The REC we interviewed indicated that, in their experience, if there was a (marginal) overrun in the time required, then the truck would stay (with a commensurate increase in the cost) for the additional time required. — Failures by the DNSP to attend, although not frequent, occurred in the context of, for example, crews being busy repairing the damage from overnight storms. • Our interviews did not support that the truck would be required (and unprepared to undertake) works relating to the connection to the house or other overhead works. — We are aware of estimates of the number of inner city properties that might require rewiring, meter board upgrades, larger connections, etc. However, one distribution businesses' experience in the trials, while very limited in the number of trial installations, is not the source of these estimates. This distribution business has no process for identifying supply upgrades relating to the installation of an EV. — In any event, the EWR lodged would typically include requirements, if necessary, for the upgrade of the connection. • Finally, the DNSPs' view is that, if a truck crew were to become aware of the requirement for overhead works, then it was generally the case that the crew would be equipped to undertake most required works in the course of the visit and, failing this, would install a temporary fix if possible.	• In the event of the failure of the DNSP to adequately prepare for the services required in a correctly lodged EWR, then I imagine the customer (and the REC) would be in a position to dispute the DNSP's charges. • Are the EWR's correct when lodged by the REC? — We can't tell, although the DNSPs did not raise this as an issue when we spoke to them. — Better forms and better guidance for RECs installing second meters would assist. • Perhaps the installation issues should be being considered in the same light as, for example, pay television installations, with specialist installers as a sub-class of RECs used by EV Service Providers to manage connections in the early days of EV uptake.
Is the ESV inspection requirement the problem?	• Again, neither the REC we interviewed nor the DNSPs regarded this as an issue. • Accredited inspectors are private contractors and are booked to be on site at the time the meter changeover occurs.	• Are ESV inspections required for all meter related changes? — Unlike electrical works generally, where around 1 in 10 jobs are inspected, all changes to the meter are required to be inspected. (We have not found a direct source for this: see the discussion in Appendix B.) — Is this a safety issue related to the general public's safety from faulty metering installations or is it a damage limitation exercise for the DNSP, which is otherwise

Key Questions	Answer	Issues
		responsible for the safe operation of the network and, by insisting on an inspection, limits its exposure? If the latter, what is the case for the customer bearing the cost? • There may be a redundancy in the process in future as EVs are considered for V2G. At least one of the DNSPs strongly holds the view that the DNSP will require its own crew to undertake an anti-islanding test, notwithstanding the two previous anti-islanding tests that are undertaken by the REC and the ESV Inspector respectively. • However, there is no suggestion that this is currently an issue, as the EV installations that are going ahead are not currently considering V2G.
What about the involvement of all these retailers (the main premise and the EV retailer) in the process?	• Not all processes relating to the meter, including the establishment of a second meter, include a role for the retailer and, from our review of the relevant instruments, it's not entirely obvious that this one does. However, in the examples seen by DPI, the involvement of the premise retailer and the EV retailer is a direct consequence of a business model separating the EV Service Provider electricity supply from the home supply, using a NMI and on-market settlement. — Business models *not* involving the physical separation of the EV's electricity supply from that of the existing connection point may only need to notify the host retailer of the temporary disruption to supply from changes to the wiring and meter board, where required. — Where the physical separation of the electricity supply between the connection points is not required, it may be possible to achieve the required economic outcome, but it requires prior agreement with the host retailer about off-market settlement and the arrangements, such as the level of required data quality, to support off-market settlement. • Furthermore, the NECF's introduction on 1 July opens the door to an alternative process, where the customer interacts directly with the DNSP for a range of services. • However, discussions with the DNSPs did not suggest that their thinking on how the changed processes under NECF could be implemented was	• A requirement to notify the host retailer of a range of changes to a customer's connection was regarded as a key protection to unauthorised churning (and to the customer departing with an unpaid, difficult to recover account). Whether this should be altered for the case where the customer is separating out an element of his/her supply is a matter for policy. • Having said that, the B2B processes for these notifications could potentially be improved, with efficiency gains to the parties in the installation process.

Key Questions	Answer	Issues
	particularly advanced.	
Can the host retailer insist on a second account (with it) being opened before processing an EWR relating to the installation of a second meter?	• No. If this were to be the case, it could be regarded as third line forcing.	• The installation of a second meter with a NMI requires the Local Network Service Provider to initiate a process under the *MSATS Procedures: CATS Procedure Principles and Obligations*. The retailer has no role in this process. • However, the *CATS Procedures* also contain a procedure for customer switching that the retailer initiates. — Our suspicion is that the retailer's representative was trying to make an unfamiliar transaction fit a model the representative was familiar with. • Better guidance to the industry to support the processing of unfamiliar applications could reduce the likelihood of this recurring.
Why does it take so long for a NMI to be allocated?	• The *MSATS Procedures: CATS Procedure Principles and Obligations* indicates that an LNSP is expected to lodge a Create NMI Change Request for each Connection Point supplied within its area within two business days of the mandatory data required by the MSATS change request becoming available (2.4.(a)). The data required to activate a new NMI is required to be supplied by the LNSP within 5 days (2.4 (l) of the CATS procedures). • This would suggest 7 days are required if the processes are contiguous. However, see the comment on the right about general practices in this area, which suggest that the 2 processes are not necessarily contiguous.	• Processes in this area may differ from DNSP to DNSP. One of the DNSPs informed us that, for example, for new subdivisions, NMIs are allocated at the time the DNSP is notified of the sub-division by the relevant planning authority, significantly in advance of the establishment of an individual meter. In these circumstances, the maximum time required for registration post energisation would be reduced to 5 days.

E. Scope of Work

Electric vehicles – metering and settlement arrangements in Victoria: analysis of existing regulatory arrangements in Victoria

Introduction

It is expected that the number of EVs in Australia will steadily increase from 2012 as a number of electric vehicles become available to the Australian market. The Victorian Government, through the Department of Transport, is currently leading an Electric Vehicle Trial (to mid-2014) to better understand the process, time lines and barriers for transitioning to electric vehicle technologies. As part of the Victorian Trial, electric vehicle charging infrastructure and associated metering is being installed in participating homes and workplaces.

The Victorian Department of Primary Industries (DPI) has been informed that the process of establishing the charging infrastructure in Victoria, including a new meter and National Meter Identifier (NMI), currently costs between $1000 and $8000 per site and takes 2 to 4 months. This process includes formal and informal interactions between the electric vehicle customer, registered electrician, retailer, distributor, charging infrastructure provider and Energy Safe Victoria.

DPI would like to better understand the current regulatory requirements relevant to the establishment of electric vehicle charging infrastructure and associated metering and market settlement processes, in order to identify possibilities for regulatory improvement to reduce the complexity, time and costs associated with the current process.

The Australian Energy Market Commission (AEMC) has recently initiated a Review of Energy Market Arrangements for Electric and Natural Gas Vehicles. The AEMC Review will identify the energy market regulatory arrangements which will facilitate the economically efficient uptake of electric and natural gas vehicles, including (amongst other things) appropriate arrangements for metering protocols and settlement systems for electric vehicles. The AEMC is to provide a final report with recommendations to the Standing Council on Energy and Resources (SCER) by mid-2012.

Scope of work

The consultant is requested to produce a report for the Department of Primary Industries (DPI) which:

3. outlines the existing regulatory and practical requirements relevant to the establishment of charging infrastructure and metering for electric vehicles in Victoria, including market settlement arrangements; and
4. identifies any current regulatory and practical limitations on implementation of charging infrastructure, metering and settlements for electric vehicles in Victoria under each of the main business models utilised by charging infrastructure providers.

DPI understands that regulatory requirements relevant to establishment of electric vehicle charging infrastructure, metering and settlements are contained in the following regulatory instruments:

- Victorian distribution licences, issued by the Victoria Essential Services Commission (ESC) under the *Electricity Industry Act 2000*
- The ESC *Electricity Distribution Code*

- The ESC *Electricity Customer Metering Code*
- The Victorian *Service and Installation Rules* (SIRs)
- The Orders in Council for Victorian Advanced Metering Infrastructure (AMI) Program
- The *National Electricity Rules*
- The *AEMO Metrology Procedure*
- The *AEMO Embedded Network Guideline*

In considering any regulatory and practical limitations under point 2 above, the report should consider the necessity and viability of implementing alternative metering arrangements for electric vehicles (such as sub-metering). This should include consideration of recent arrangements initiated by the California Public Utilities Commission (CPUC) to support sub-metering for electric vehicles in California[16].

The consultant is encouraged to engage with any relevant person or organisation deemed relevant to assist in examining these issues.

Supporting documentation

DPI will provide a copy of a letter an electric vehicle service provider detailing current limitations on their preferred business model in Victoria due to current regulatory requirements and business practices, as background to this work.

Output

The consultant is asked to provide a draft report for DPI review and a final report which incorporates DPI comments to the draft report.

[16] http://docs.cpuc.ca.gov/published/Final_decision/139969.htm