Centre for Energy and Environmental Markets

5 March 2011

Mr John Pierce
Chairman
Australian Energy Market Commission

EMO0022 – Energy Market Arrangements for Electric and Natural Gas Vehicles

Dear Chairman,

The Centre for Energy and Environmental Markets (CEEM) at the University of New South Wales undertakes interdisciplinary research in the design, analysis and performance of energy and environmental markets and their associated policy frameworks. CEEM brings together UNSW researchers from the Australian School of Business, the Faculty of Engineering, the Faculty of Arts and Social Sciences, the Institute of Environmental Studies, and the Faculty of Law, working alongside industry and international partners.

The Centre has particular interest in the integration of transformative technologies into Australia's electricity industry. Studies in the integration and economic value of Electric Vehicles complement and extend the Centre's work in wind and solar integration in this respect. Our submission addresses each of the questions posed in the Issues Paper with respect to Electric Vehicles with major themes in our response including:

- The key efficiency challenge for the Australian NEM is currently that of dynamic (innovation oriented) rather than allocative or productive efficiency. The industry faces growing energy security, social and environmental pressures and the ability of the NEM to facilitate innovative technologies and associated business models will be critical to its longer-term efficiency.
- EVs represent a highly promising but also potentially disruptive distributed electricity industry resource. The costs and benefits of EV deployment to the industry as a whole will greatly depend on market arrangements to facilitate appropriate investment in, and operation of not only the EVs, but other industry assets.
- Current NEM retail markets reflect the complex and in some ways competing objectives of the electricity industry in terms of accessibility and affordability versus economic efficiency. They do not provide economically efficient prices for virtually any customers; instead they are based on 'schedules of fees' or tariffs that reflect wider industry objectives and societal concerns. Furthermore, these markets also do not currently facilitate competition in the delivery of the energy services that customers actually seek but, instead, are based largely on competition between retailers to sell electricity.
- Energy Service Companies or ESCOs are the key missing institutional players in the current market arrangements. Their explicit focus is on energy services and the most

appropriate means by which they can be delivered to their clients. This involves not only the sale of electricity but, critically, appropriate investment and operation of end-use equipment to deliver these services.

- Business and technical innovation may well come from outside the existing institutional structure of the electricity industry. Arrangements which allow and enhance contestability, competition and the entrance of new players with different business models is critical to achieving the most efficient long term outcomes.
- EVs represent an exciting opportunity to facilitate new energy service providers focussed on delivery of mobility services rather than the sale of electricity. However, current market arrangements are not necessarily supportive of the technology and business model innovation required to deliver such services.
- Proposals to impose cost reflective network pricing on EV charging in the absence of wider retail market transformation that treats all electrical loads in an equitable manner risks the technology and participant neutrality that is a key tenant of the NEM design.
- There is, however, there is potential for electric vehicle charging to act as a catalyst for the development of regulatory and market arrangements applicable to demand response from a wider range of load groups and ultimately enhance the role of DSP in Australia's electricity industry.
- The regulatory burden on new entrants with energy service business models should be minimised to only those justified by a compelling public interest case. In this regard we feel particularly strongly toward the deeming all EV charging services to involve the 'sale of electricity'.

We thank-you for the opportunity to make a submission to the review and would welcome any opportunity to further contribute to the efforts of the Commission in this area.

Regards

Iain MacGill

Joint Director (Engineering) - Centre for Energy and Environmental Markets - CEEM

Associate Professor - School of Electrical Engineering and Telecommunications

University of NSW

Sydney 2052 Australia

Tel: +612 9385 4920

Fax: + 612 9385 5993

Mobile: +61 402 546 217

Email: i.macgill@unsw.edu.au

Question 1 Assessing the take up of EVs

Is the range of estimates provided by AECOM appropriate for assessing the potential impacts of EVs on the electricity market and developing our advice? Does the range of scenario estimates provide a credible view on the potential penetration of EVs?

AECOMs estimates represent a wide range of potential uptake outcomes and, as such, would seem to cover many of the various stakeholder views of potential deployment of this technology. Caution is always required for such deployment modelling as seen in recent years with other disruptive technologies including domestic PV systems and air-conditioning. Furthermore, while the success of EVs will depend in great part on factors external to the electricity industry including vehicle technology progress and international oil prices, NEM arrangements may play a key role in either facilitating or hindering deployment, hence the importance of this work by the AEMC.

Question 2 Cost of additional system peak demand

Are these estimates on the cost of additional peak demand provide the correct magnitude of the potential impacts of EVs? Are there any categories of costs not included in this discussion?

The cost of meeting additional peak demand within the NEM is a complex question that has also been raised with other major load technology deployments such as air-conditioning. Potential network expenditure requirements depend on the location, scale, timing and underlying uncertainty associated with demand growth. AECOM's method of estimating network investment requirements from taking approved CAPEX and dividing by the increase in system peak demand over the relevant regulatory determination period seems to be a reasonable first estimate of the cost of network augmentation in respect of additional peak demand, but more detailed work is clearly required.

While AECOM has included an estimate of capital costs in respect of the additional generation capacity required to cover this peak load, changes in overall industry costs will be a highly complex and uncertain outcome of other investment and operational impacts associated with this new peak demand, within the context of wider industry developments. A more sophisticated assessment of 'dynamic' electricity market outcomes than that undertaken by AECOM would be required to better assess these potential costs.

Both V2H and V2G have the ability to decrease demand peaks (for example, charge remaining in a battery can be used to reduce the residential evening peak before recharging overnight). These options should be incorporated into scenarios of EV's impact on the cost of peak demand.

Question 3 Costs imposed by EVs on electricity markets

Does this discussion capture all the potential costs impacts that EVs could impose on the electricity market?

We agree that the points discussed in the issues paper represent possible costs to the broader electricity market(s) in the case that charging is not managed. We also note that some of these 'costs' can also be benefits if charging is managed appropriately.

We also note that costs (as do benefits) on electricity markets accrue to different parties within those market(s), and that these costs and benefits differ depending on how well the charging/discharging correlates with peaks in demand, and potentially other market outcomes such as wholesale prices. CEEM is currently investigating the benefits and costs which accrue to different participants in the retail market, wholesale electricity market as well as the regulated monopoly sectors of the industry and would be happy to provide details on this work to the AEMC as it progresses.

Question 4 Benefits of EVs on the electricity market

Have we correctly identified the range of benefits of EVs on the electricity market? What are stakeholders view on the materially of these benefits and the appropriate arrangements of capturing such benefits?

We consider the Issues Paper to have identified the categories of potential benefits for electricity industry stakeholders. However, as with the response to the previous question, the benefits depend on the market in question and the particular participant within that market/regulated sector. As noted earlier, CEEM is investigating these benefits accruing to these different industry participants and would be happy to provide further details as the work progresses.

The benefits to the 'electricity market' from controlled EV charging are likely to be similar to those available from other potentially controllable loads. As such, market arrangements for EVs have close parallels with those arrangements for other loads. We look forward to seeing how the work of the AEMC's Power of Choice review with respect to enhancing the value of demand side participation in the electricity market is integrated with its EV work.

What makes EVs materially different to other controlled loads is the storage capacity of the battery and the potential to return power to the grid. With respect to V2G and V2H arrangements, the value to the owner of electricity exported from the battery will be greater when used to offset electricity purchased from the electricity system rather than exported to the electricity network. We note that IPART, in its recent decision on 'fair and reasonable' feed in tariff arrangements for small scale PV set a benchmark range of 8 – 10 c/kWh which is far below the value of retail electricity which is over 20 c/kWh. We see this as a strong incentive for the end user to move to V2H rather than V2G under current market arrangements.

The flexibility associated with EVs charging will in the longer-term likely best be harnessed through retail market arrangements that facilitate competition in the delivery of energy services

and support a far greater role for Energy Service Companies to work with such consumers and aggregate delivery of services to maximise overall industry benefits. EVs might potentially represent a very valuable energy service within such arrangements. In the shorter term, a key challenge is to facilitate innovative EV technologies and business models that will help us better understand and benefit from enhanced demand-side participation. This will require addressing current split incentives and cash flows between retailers and network service providers, and ensuring that possible EV service aggregators are able to benefit from the value that they can bring to the industry. The materiality of such benefits is directly related to the manner in which EVs are charged and the extent to which controlled charging is utilised. These benefits should be assessed against the possible business as usual costs associated with increased peak demand not only from un-managed EV charging but also from expected growth in peak demand more generally. In the context of planned network investment of $42 billion over the coming period to 2015[1] such benefits are clearly material.

As such, EVs represent an important opportunity to improve the dynamic efficiency (support for technology and business model innovation) that is essential to improving electricity industry outcomes in the longer term.

Question 5 Nature of service provided when an EV is charged

Does the EV charging service need to be prescribed as a sale of electricity? What are the implications for consumers and EV charging service business models if EV charging was not classified as a sale of electricity?

In a general sense, the development of an energy services industry (offering km travelled in electric vehicles or heating and cooling services) should be regarded as enhancing the efficiency and sophistication of energy use in a manner beneficial to the electricity industry and wider society. Energy consumers would be better served by market arrangements that focus on the energy services that they wish to receive rather than sales of electricity and gas. Energy Service Companies (ESCOs) are the most appropriate interface between customers and the NEM but current market arrangements have not supported them to play a greater role.

A deep competitive market for the provision of EV charging services is likely to involve some business models which involve the sale of kWh. Other business models will offer services in which kWh may be one input into the provision of other services.

In this regard, deeming all EV charging services, regardless of the commercial arrangements between the parties involved, to involve the 'sale of electricity' may impose a regulatory burden which would reduce competition and customer choice. The AEMC should carefully consider the potential impact of such an approach on the broader development of a sophisticated energy services sector beyond that potentially involved in delivering EV charging.

[1] Energy Networks Association 2011, Energy Prices Statement , Accessed Online (17 February 2012) http://www.ena.asn.au/udocs/2011/03/ENA-statement-on-energy-prices-March-20111.pdf

Question 6 Should EVs be treated differently as against other loads

Should the treatment of EVs in the electricity market regulatory arrangements be different in respect of any or all of their potential uses?

Ultimately, the arrangements with respect to EVs should translate to other loads amenable to demand response, aggregation, and delivery via an energy service business model. EVs in this regard could act as a catalyst for the development of possible business models and establishment of regulatory arrangements which can then be extended into other loads. Care should be taken to avoid arrangements that discourage load aggregation at an appropriate scale. For example, treating an EV load as entirely separate (in terms of charges applied to peaks in demand) to existing loads at a premise might discourage an EV owner or supporting ESCO from exploring options to manage other loads so as to compensate for increased demand due to EV charging.

In this respect, this review should ideally complement the Power of Choice Review in the context of a highly promising but potentially rather disruptive new energy service and associated demand for the electricity industry to provide.

Question 7 EV metering issues

- **Should EVs be treated as a standard appliance load or should they be separately metered from other load at the premises?**
- **Could sub-metering and roaming NMIs be an effective solution to the costs and time issues associated with a separate metering installation? Are these metering options mutually exclusive or can they coexist thus allowing EV suppliers and customers to choose the solutions that best meet their needs?**
- **Should metering costs for EVs be recovered any differently than for other existing metering equipment?**
- **Are the existing metering data confidentiality arrangements appropriate for EVs and, if not, what modifications should be considered?**

It is clear that metering arrangements are critical to:

- Customer choice through the contestability of loads within a premises;
- Visibility as to the impact of EV charging on network costs and augmentation requirements; and
- The ability to effectively harness the full flexibility benefits of EVs providing controlled load.

Individual metering is important from a competition perspective. Individual metering may be in the context of a dedicated metered connection point with its own NMI or sub metering with subtractive metering arrangements, also with dedicated NMI. Individual metering is required to allow non-

incumbent retailers/service provider's access to the EV charging load thus facilitating consumer choice.

We note that a number of stakeholders have advocated the idea of the 'integrated home solution' which does not require individual EV metering points. Such an arrangement however, maintains the present 'monopoly' of the incumbent retailer over load within a premise shutting out competition from other service providers. While arrangements should not in any way prohibit the use of an 'integrated home solution', arrangements which do not allow for dedicated metering appears contrary to the goals of the review to enhance customer choice. We consider that the benefits possible from individual EV metering arrangements which allow for contestability are likely to significantly outweigh any additional metering costs.

Sub-metering is a desirable arrangement not only with respect to EV charging but also other loads which may provide demand response. It is likely to be the cheapest and most practical approach from an implementation perspective. In order for sub-metering to be effective in this regard regulatory arrangements will be needed which:

- Appropriately define roles and responsibilities with respect to metering within embedded networks;
- Streamline the arrangements with respect to the establishment of subtractive metering in MSATS and allow the request of such arrangements to be by service providers other than incumbent electricity retailers;
- Ensure that arrangements with respect to retail contestability of loads within embedded networks allow competition;
- Ensure that the small customer connection arrangements proposed in Chapter 5A are clear with respect to the establishment of connections for EV charging.

Our understanding is that contestability within embedded networks is currently a jurisdictional matter with some jurisdictions allowing consumer choice in respect of sub-metered load and others not[2]. The harmonisation of arrangements in this regard (to the extent possible given the AEMCs rule making powers) would be beneficial and assist the development of energy services and demand response across a range of loads not limited to EV charging.

Roaming NMI is an exciting concept, the practicalities of which (in particular involving interaction with the settlement system) are substantially unknown at this point. We look forward to results from Ausgrid's Smart Cities Smart Grid trial.

[2] AEMO Embedded network guideline v1.0, http://www.aemo.com.au/electricityops/0640-0012.pdf, (accessed online 5 March 2012)

Question 8 Options for EV charging

- To what extent are changes required to the regulatory arrangements to allow different battery charge management scenarios to increase efficiency?
- How should the arrangements ensure that the party in control of charging faces the all system costs? Who should be providing the information for decision making for smart meter charging?

The rights to control EV charging should generally be vested in the hands of the EV user in the first instance given that they are the users of the energy services that it provides. The challenge is that current market arrangements do not appropriately signal the potential wider industry costs and benefits of different charging arrangements. This applies, of course, to virtually all electrical loads. There would be considerable potential value in EV users assigning the right to control charging, or discharging in the case of V2G, to a third party in exchange for acceptable structure and quantum of payment. Such aggregation would enable EVs to provide greater industry value through shifts in demand patterns sufficient to defer network expenditure, the offering of ancillary services and coordinated responses to changing wholesale market conditions.

These third parties may be incumbent retailers or DNSPs (who may purchase rights for the purpose of maintaining system security and reliability) or new Energy Service Companies with innovative business models. A key concern is that market arrangements facilitate appropriate competition in the origination of charge control rights rather than automatically assigning them to particular industry participants.

At the moment, economically regulated monopoly DNSPs own the metering infrastructure, are responsible for the greatest component of overall industry expenditure of any sector (the distribution networks), and in some cases see themselves as the natural parties to control EV charging. The difficulty is that DNSPs are monopolies and their current business and regulatory arrangements don't necessarily support appropriate competition in the controllable load space. Furthermore, charge control has wider potential market benefits including the wholesale spot market and ancillary services markets (and associated derivative markets). We see some of the keys to the development of a competitive market as:

- Arrangements which allow 'open access' to data and metering infrastructure;
- Arrangements which allow and enhance contestability of load metered by child meters under subtractive metering arrangements;
- Arrangements which enumerate the rights of third party aggregators in acting on behalf of the EV user;
- Changes to current market rules where they work against participation of aggregated load (and potentially V2G) in central dispatch.

Question 9 Retail pricing and EVs

In an area where the sale of electricity is subject to retail price regulation and given the appropriate metering capability, should the sale of electricity for recharging be treated any differently to other loads? If so, why?

Our understanding is that (in NSW) individually metered EV charging, or EV charging in the context of a household load, would be eligible for a regulated retail tariff under current arrangements so long as annual energy consumption at that premise remains below 160 MWh. This may extend to access to a flat (non-TOU) tariff structure in certain circumstances.

Access to non-TOU regulated retail tariffs is clearly undesirable from the point of view of minimising network impacts; however decisions with respect to retail price regulation remain jurisdictional matters. It is anticipated however, that the current retail price determination in NSW will be the last with price controls being lifted in 2013, although we also note that the NSW Government has not made a final announcement to this effect. Given the slow rate of EV uptake expected in early years, retail price regulation in NSW should not be of major concern to the AEMC in considering long term arrangements with respect to electric vehicle charging.

It should be noted that retail price regulation (in NSW) only represents an obligation by standard retailers to provide customers consuming less than 160 MWh per annum the option of a regulated retail electricity tariff. This requirement in no way precludes any retailer (standard or otherwise) the ability to offer whatever tariff structure they wish to whatever customer, small or otherwise, under a negotiated electricity supply arrangement. As such, the presence of regulated retail tariffs does not necessarily represent the barrier to alternative retail arrangements as suggested by some stakeholders.

Question 10 Structure of retail pricing for EVs

How are rules regarding the availability of TOU pricing likely to affect efficient uptake of EVs? Should there be a requirement to offer TOU tariffs for EVs? Should other forms of pricing apply to EVs to discourage charging at peak times, such as critical peak tariffs or other dynamic tariff structures? Should EVs be treated any differently from any other load in this regard?

In theory, EV users should see economically efficient prices for energy and network services. Such pricing would vary by time and location and be subject to considerable uncertainty just as the NEM wholesale market exhibits. However, such spot pricing alone is insufficient to drive appropriate investment and future planning. This would, in theory, require an infinite number of futures markets that determine the impact of current decisions on future prices over all relevant timeframes. Furthermore, location and time specific ancillary services prices are required, again with their own associated futures prices as well. Clearly we will only ever achieve a partial implementation of such arrangements. As such, simplistic calls for real-time pricing for all customers without appropriate arrangements to manage risk and help customers act in an aggregate manner are not particularly thoughtful or helpful. More generally, the same

opportunities and challenges exist for all other loads as well. Implementation of special arrangements only for particular technologies such as EVs puts the objective of technology and participant neutrality within the NEM at risk.

There are excellent opportunities to reform current NEM retail markets given advanced metering infrastructure, emerging distributed technologies and innovative business models. However, such reform requires a careful, transparent and fair restructuring process that doesn't unfairly discriminate against particular technologies. EVs do, however, represent a potential opportunity to explore the opportunities and challenges of such a transition albeit in a way that facilitates rather than hinders innovative technologies and business models.

The language used in the Issues Paper refers to 'utilities controlling load'. One of the key points we would like to make is that the innovation to enhance competition, consumer choice and efficient market outcomes might well come from outside the current electricity industry. The entry of new third party load aggregators/energy service providers into the controlled load space might play a key role in driving such innovation if market arrangements are supportive of the technological and business model innovation they seek to bring. History makes it clear that a key driver of market innovation is new entry by such players.

Question 11 Network pricing and EVs

Are new or bespoke network tariffs warranted for EV charging? If so, what form should these network tariffs take? How can these network tariffs be better integrated with overall retail tariffs?

If there are to be separate tariffs for EV tariffs, should there be regulations for identifying the EV household and for monitoring consumption? If so, how?

Current network tariffs are the outcome of a long and complex process of electricity industry development and restructuring, and reflect significant conflicts and hence trade-offs between electricity industry objectives. In particular, electricity's key role as an essential public good that all of society should be able to access has evident potential conflicts with strict allocative efficiency concerns which see a role for cost reflective pricing. At this time network pricing (better termed schedules of fees) is far from cost reflective for almost all customers, and particularly the residential and commercial sectors.

We agree that capacity-based rather than volumetric-based network pricing would send clearer signals to end users regarding the impact of their decisions to invest in and operate particular loads, on the network. However, such pricing should not be targeted at EV's alone and if such pricing is to be introduced, it should be imposed on all end load which contributes to network demand and hence expenditure. Furthermore, NEM arrangements must then facilitate end-users, and ESCOs seeking to support them, in being able to respond to such arrangements, and hence drive changed network expenditure. There appears to have been little willingness with policy circles to embrace universal cost-reflective pricing or facilitation of genuine demand-side engagement including ESCOs to date.

Question 12 Forecasting the take up of EVs for the network operator and NSP

Are measures required to facilitate more effective forecasting of EV take up for network operator and NSPs?

Accurate uptake and impact monitoring may be considered a common good justifying specific regulation and arrangements, and public funding of the costs that such regulation involves. The lack of appropriate and timely data to assist monitoring deployment of other disruptive distributed technologies such as air-conditioning has proved problematic in the past. Beyond ensuring that arrangements for determining actual deployment are in place, there may be value in publicly funded forecasting work to assist all electricity industry stakeholders to better plan for future developments.

Issues with respect to a regulatory compliance requirement to track the EV purchases and premises in which EVs are being charged include:

- On whom would this requirement be placed?
- How would compliance under this requirement be managed?
- How would privacy be protected while still ensuring that useful information is available publically?

We note that the consequences of poor underlying information and uptake monitoring were evident in the experience of the NSW Solar Bonus Scheme[3]. Any arrangements should ensure that such experiences are not repeated in respect of EVs.

Question 13 Network Issues: Connection services

What issues arise in regard to connection services for EVs? Are there further connection issues if additional capabilities such as Vehicle to Grid arise? How should these issues be addressed?

Should EV charging in residential premises qualify as a 'basic connection service'? We note that a basic connection service is defined in the draft chapter 5A as a customer who is either:

- typical of a substantial class of customers who have sought, or are likely to seek, the service; or
- the customer is, or proposes to become, a micro embedded generator; and

the provision of the service involves minimal or no extension to, or augmentation of, the distribution network.

Draft Clause 5A.B.1 goes on to define two classes of basic connection services:

[3] Audit Office of NSW 2011, Solar Bonus Scheme – Special Report (accessed online 5 March 2012) http://www.audit.nsw.gov.au/News/Solar-Bonus-Scheme

- basic connection services for customers who are not micro-embedded generators; and
- basic connection services for customers who are micro-embedded generators.

From the definitions above it would appear that:

- Low capacity EV charging, whether conducted as part of an existing household load or under separate metering arrangements, would qualify as a basic connection service on the basis of being typical of a substantial class of customers who are likely to seek the service, and on an individual basis involve minimal or no extension to, or augmentation of, the distribution network.
- Higher level charging without appropriate charge control arrangements may not qualify as a basic connection service as the provision of the connection, on an individual basis, could require augmentation of the network. Should suitable charge control arrangements be in place, however, actual costs of augmentation should be minimal or non-existent.

Given the challenges for DNSPs to appropriately determine appropriate network augmentation requirements, the AEMC should ensure that there is regulatory oversight and that charge control arrangements are taken into account by DNSPs in calculating any augmentation costs. Assigning responsibilities to the AER in this area is likely to facilitate the efficient uptake by preventing un-reasonable connection charging.

The AEMC may also wish to clarify the language used in the definition of micro-embedded generators to include export under V2G arrangements from electric vehicles. The current proposed definition in draft chapter 5A refers to energy systems 'contemplated' by AS4777 as being micro-embedded generators. A clearer definition is likely to avoid confusion in this area.

Question 14 Network Issues: Network reinforcement and augmentation

What new issues arise regarding requirements for network reinforcement and augmentation to support EV charging and recovery of the costs incurred, and how should they be addressed?

How should the connection services for EV households be classified? It is necessary to differentiate between EV and non-EV households?

Does the take up of EVs require a departure from the current method of recovering the costs of grid augmentation from small customers, with the costs spread across all customers, towards a "causer pays" approach?

The actual costs to the network associated with EV charging will be a function of how that EV is charged and that will critically depend on the market arrangements in place and their ability to facilitate charging regimes that reduce adverse network impacts. In particular, EVs under controlled charging agreements may not result in additional augmentation costs for the network. It will likely be difficult for DNSPs to calculate from the actual cost impacts of EV charging given all the other drivers of network demand.

There are potential economic efficiency advantages in appropriate cost allocation to stakeholders with regards to network expenditure. However, to date there have been only very limited efforts in this regard for small customers. Arrangements to impose this only for EVs would represent a significant departure from existing arrangements and clearly discriminate against their deployment by comparison with other load technologies. For example, large ducted air-conditioning almost certainly would be a greater driver of network costs than standard EV charging due to higher electricity demand and its very high correlation with peak demands. Furthermore, the very low load factors seen with some residential air-conditioning (only occasional use on very hot summer days) might well involve a significantly higher cross-subsidy than that likely for EVs given current network tariffs based on consumption. Moves towards more economically efficient network pricing need to be implemented in a fair and transparent manner, rather than just imposed on new technologies.

As previously mentioned our view is that charging below a threshold capacity should be regarded as a basic connection service (with definitions clarified with respect to V2G/V2H) and any required network augmentation costs borne across all customers. Higher capacity charging 'fast charging' may be treated under another form of connection agreement in which involves the payment of 'reasonable' network augmentation costs.

The AEMC should consider how the EV user will be treated equitably in this regard and DNSPs prevented from levying unwarranted connection charges. Powers should be given to the AER to provide oversight into the allocation of network costs specifically with respect to new connections for EV charging.

Question 15 Retail issues: Retailer and NSP exemptions and embedded networks

Should the provision of commercial charging (both in public spaces and in dedicated charging stations) be classified as on-selling? Do retailer and NSP exemptions and embedded networks provide an appropriate framework to apply to EV charging? What would be the preferable arrangements?

The dividing line between what could be considered commercial and non-commercial may not be clear cut and as a result create confusion and inhibit the development of public charging infrastructure. Energy service agreements may involve the provision of charging at residential and 'commercial' charging stations under the one agreement with the result being that the same energy service provided in two different locations are treated differently by regulation.

Deeming all EV charging services to involve the 'sale of electricity' would not seem to reflect the nature of the agreement between the end user and the service provider in respect of EV charging provided as part of an energy service agreement. It would certainly impose a regulatory burden on potential service providers and hence potentially inhibit the development of a deep and competitive energy service sector. This would appear counter to the objectives of the review and require a compelling public interest case to justify.

Question 16 Retail issues: Settlement

What new issues for wholesale settlement arise with EVs, and to what extent do they depend on the metrology arrangements in place? How can these issues be addressed?

Ultimately it is beneficial to all parties for EV charging to be individually metered via a dedicated connection point or via a child meter and subtractive metering arrangements each with distinct NMI.

Our understanding is that the settlement system in its existing form can manage subtractive metering arrangements[4]. Given the declining cost of physical metering equipment, and ease of installation, subtractive parent/child metering is clearly the preferred arrangement.

Arrangements with respect to contestability of load metered by child meters are critical to resolve. Without the resolution of such arrangements in certain jurisdictions, separate metering will be required to introduce competition at an individual load level with the higher costs that entails.

Question 17 Retail issues: Licensing arrangements

What licensing issues arise with EVs, if licences are required? Do new issues arise because of the nature of EV loads or from new business models for EV charging? Are the existing licensing arrangements still appropriate?

We note that current jurisdictional electricity retail licencing arrangements are in the process of transitioning to a harmonised national framework under the NECF. As part of this harmonisation, jurisdictional electricity retail licences will become obsolete in time[5].

If all EV charging services are deemed to be the sale of electricity that EV charging service providers will require an electricity retail licence and be subject to the associated compliance costs. This will be the case even if the nature of the agreement between that service provider and the end EV user does not involve the sale of kWh.

Our view is that the current content (and proposed content) of electricity retail licenses are not well aligned to the sale of energy services which is what end consumers are really in the market for, and this should therefore be a key focus of NEM reform processes including that for facilitating EV deployment. .

[4] AEMO Embedded network guideline v1.0, http://www.aemo.com.au/electricityops/0640-0012.pdf, (accessed online 5 March 2012)

[5] NSW Government, Trade and Investment 2011, NSW Implementation National Energy Customer Framework, http://www.trade.nsw.gov.au/__data/assets/pdf_file/0010/407719/NSW-implementation-of-NECF.pdf (accessed online 5 March 2012)

Question 18 Vehicle to Grid/Home issues

What additional issues arise from EV discharging and to what extent are those issues different from those that arise from any other on-site small scale generation? Are there any unique issues or requirements if the electricity is only provided to the home and not exported to the grid? Who should control discharging schedules? How can the right incentives be provided to facilitate the use of EV discharging to support DSP?

With respect to V2G and V2H arrangements, the value to the owner of and EV battery of electricity exported from the battery will be greater when used to offset electricity purchased from the electricity system rather than exported to the electricity network under current retail tariff arrangements. For example, IPART's recent decision on 'fair and reasonable' feed in tariff arrangements for small scale PV set a benchmark range of 8 – 10 c/kWh which is far below the current flat retail electricity tariff which is over 20 c/kWh. [6]Clearly this as a strong incentive for the end user to move to V2H rather than V2G.

From a power quality perspective, V2H should not present any particular issues as it is in effect just load reduction - as occurs for on-site use of electricity from photovoltaics (PV). V2G is a different matter, however. Like PV, at high penetrations, it may result in voltage rise and reverse power flow, as well as network power quality issues such as power fluctuation, and impacts on power factor and harmonics - if appropriate load control is not in place. However, EV and distributed generation such as PV can also assist with maintaining power quality and reducing demand peaks (neither of which necessarily require V2G). EV electricity has the advantage that, being from a battery source and therefore dispatchable, it is more likely to be provided as and when most valuable (if appropriate market arrangements are in place) - although significant progress is being made with linking PV to batteries, even at the residential level, and so this distinction is likely to diminish over time, especially where a single household has both EV and PV.

It is possible for EV to provide ancillary services, although it is currently unclear how this would occur given current arrangements for their provision in the NEM. For example, it is possible for inverters to be configured to automatically provide services such as frequency response and reactive power support, but this would not require the EV owner to bid this service into the market as currently occurs for ancillary services. If EVs are required to bid into a market to provide ancillary services, this is likely to require some form of aggregation. Inverters (from EV as well as PV) can be configured to provide reactive power support using power from the grid, and so would not require power from the battery (or the PV panels). This means the provision of reactive power support is independent of driving behaviour and charge levels, and in fact does not even require the vehicle to be present. Note that at this stage, the configuration of inverters as discussed here is generally not allowed by Australian Standards (ref).

It is also worth noting that the total value of ancillary services provided to the NEM is relatively small on a per MWh basis - about 50c/MWh, or 0.05c/kWh - so there is little financial incentive for

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small scale participation.*does this include NCAS as well as FCAS*. However, in the longer-term there may be excellent opportunities for a range of distributed resources including EVs to provide some key ancillary services at the point where they are actually required – the customer connection.

V2H and V2G can also have different financial implications depending on how the meters are configured. For example, with parent/child metering, it may not be clear what is responsible for export to the grid - reduction in household load or additional output from the EV battery. If the current values applied to PV exports are also applied to EV exports, it is unlikely that either the household or the owner of the EV battery would want to export anyway, as there would be greater value with either on-site use or reduced battery use.