AEMC

REVIEW

Australian Energy Market Commission

APPROACH PAPER

Energy Market Arrangements for Electric and Natural Gas Vehicles

Commissioners

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Approach Paper

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About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005. The AEMC has two principal functions. We make and amend the national electricity and gas rules, and we conduct independent reviews of the energy markets for the MCE.

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1 Introduction

On 28 July 2011, the Australian Energy Market Commission received a Request for Advice from the Ministerial Council on Energy (MCE) with respect to the energy market arrangements for electric vehicles (EVs) and natural gas vehicles (NGVs). The MCE has asked us to investigate the costs and benefits such vehicles cause for the energy markets and to identify the arrangements necessary within the energy markets to facilitate the efficient uptake of these vehicles. We are required to provide our advice to the MCE by mid-2012.

This Approach Paper is designed to inform stakeholders of the Request for Advice and outline our time frames for providing this advice, including opportunities for stakeholder consultation. Importantly, this Approach paper sets out our analytical framework and provides an indication of the issues that will be addressed. We will undertake this Request for Advice in a consultative manner and this Approach Paper is the first step in this process. We request that submissions to this Approach Paper be made by 27 October 2011.

1.1 Context for the Request for Advice

In the context of more concerted attempts to address climate change and reduce greenhouse gas emissions, it is envisaged that EVs and NGVs will play a more prominent role in Australia's transport mix. In addition, the economic viability of these vehicles is improving due to technological advancements and because of the concomitant increase in the price of conventional fuel substitutes, namely petroleum and diesel. Indeed, from an international perspective, there is growing momentum for the development of low emissions vehicles.

With these forces at play, this is an opportune time to assess the impacts and to ensure that Australia's energy markets properly support the efficient uptake of EVs and NGVs. Given this, the Federal Government asked the MCE to instruct us to identify the energy market arrangements needed to facilitate the uptake of EVs and NGVs. Consequently, the MCE developed its Request for Advice.

Further, there are a range of related trials and programs currently underway across Australia. These trials and programs include the Victorian government's Electric Vehicle Trial; the Queensland government's development of an Electric Vehicle Roadmap; the South Australian government's Low Emission Vehicle Strategy; the Western Australia Electric Vehicle Trial; and the Australian government's Smart Grid, Smart City trial. We also note that the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is conducting research on electric cars through its Electric Driveway Project.[1] We will have regard to the lessons emerging from these trials and research in developing our advice to the MCE.

1 http://www.csiro.au/resources/Electric-Driveway-reports.html (accessed 13 September 2011)

Our work on the Power of Choice review is directly relevant to this Request for Advice.[2] The Power of Choice review aims to identify opportunities for consumers to make informed choices about the way they use electricity and to encourage efficient demand side participation in the National Electricity Market. Electric Vehicles are a source of extra demand to be managed and also could become a potential source of storage of electricity. The Power of Choice review will have common issues with this Request for Advice and so we intend to manage these two work streams together to provide consistent and comprehensive advice.

1.2 Request for Advice

The MCE's Request for Advice requires us to highlight the conditions that will enable Australia's energy markets to support the adoption of EVs and NGVs in the most economically efficient manner. We are required to provide observations on the potential costs and high level benefits of EV and NGV energy market infrastructure under the National Electricity Rules and the National Gas Rules.

We must provide our advice in a manner that promotes the achievement of the National Electricity Objective (NEO) and the National Gas Objective (NGO). Under section 32 of the National Electricity Law, we are required to have regard to the NEO. The NEO states:

Box 1.1: National Electricity Objective

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

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

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

Under section 72 of the National Gas Law, we are required to have regard to the NGO. Similar to the NEO, the NGO states:

Box 1.2: National Gas Objective

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

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

Our duty under the NEO and NGO requires us to provide our advice such that the costs and risks associated with the impact of these vehicles on the electricity and natural gas markets is allocated to the appropriate party; that the security, safety and reliability of the system is maintained; and that energy markets facilitate consumer choice with respect to these vehicles.

In providing our advice to the MCE, we intend to focus on Australia's energy markets for electricity and natural gas in accordance with our duties to promote the NEO and NGO. We will neither examine the broader economy-wide issues relating to EVs or NGVs technologies nor will we examine the rationale for rebates and incentive schemes to be applied to these technologies. Also, issues relating to technical and safety standards of low emissions vehicles are out of scope for this Request of Advice.

Our investigations will require us to examine the National Electricity Market (NEM) and the Western Australia (WA) electricity market regulatory arrangements as well as Australia's natural gas markets. Any overlapping issues in electricity and gas markets will be addressed as well.

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

- The potential usage patterns and penetration rates, including any peak demand impacts;
- Metering requirements, protocols and settlement issues;
- Network protection/balancing requirements;
- Connection and new network infrastructure implications; and
- Potential implications for tariff arrangements.

The MCE has asked for a high level investigation into the energy market arrangements for EVs and NGVs. This means that not all of the detailed issues relating to how low emissions vehicles interact with energy markets will be covered in our advice. We will focus on key issues in accordance with the Request for Advice.

1.3 Proposed analytical framework

Our analytical framework will explain how we will investigate the issues in the Request for Advice.

We consider that our primary objective is to advise the MCE on how energy market frameworks can support the uptake of EVs and NGVs in the most economically efficient manner.

In order to achieve this primary objective, we propose to apply the following analytical framework:

Table 1.1 Analytical Framework

Stage of Approach	Objective
Step 1	Identify and describe the technology (either EV or NGV).
Step 2	Assess the potential uptake of EVs and NGVs.
Step 3	Identify the costs and benefits of EVs and NGVs to the energy markets.
Step 4	Identify the appropriate electricity market or natural gas market regulatory arrangements necessary to facilitate the economically efficient uptake of EVs and NGVs.
Step 5	Identify the changes required to achieve the appropriate electricity market or natural gas market regulatory arrangements and propose recommendations.

1.4 Time frames

We are required to provide our Advice to the MCE by mid-2012. We will prepare our response to this Request for Advice in tandem with our Power of Choice review and therefore the draft and final Advice will coincide with the draft and final report for the Power of Choice review. Accordingly, we intend to undertake this Request for Advice to the following time frames:

Table 1.2 Time frames for this Request for Advice

Publication Milestone	Proposed Date of Publication
Directions Paper	December 2011
Draft Advice	May 2012
Final Advice	September 2012

1.5 Consultation and Submissions to this Approach Paper

All stakeholders will have the opportunity to provide submissions to us following the publication of the Approach Paper, Directions Paper and Draft Advice.

In addition, our Request for Advice specifically requires us to consult with:

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

For this Approach Paper, we would appreciate the receipt of submissions by 27 October 2011. Submissions should contain the project reference code **'EMO0022'** in the subject heading.

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

Australian Energy Market Commission

PO Box A2449

Sydney South NSW 1235.

1.6 Structure of the Approach Paper

This Approach Paper is structured as follows:

Chapter 2 - describes our analytical framework and an indication of key issues in relation to EVs; and

Chapter 3 - describes our analytical framework and an indication of key issues in relation to NGVs.

2 Electric Vehicles

This Chapter describes our proposed analytical framework in relation to EVs. It also canvasses some of the key issues and, by proposing a series of questions, seeks stakeholder feedback. This Chapter is structured to be consistent with the five step analytical framework described in section 1.3.

2.1 Understanding EV technology (Step 1)

The term 'electric vehicle' can be used describe any vehicle where the propulsion system contains one or more electric motors that contribute, partly or entirely, toward providing the motive force to drive the vehicle. For the purposes of this Request for Advice, we will focus solely upon those electric vehicles which have the capability to re-charge using electricity supplied through the distribution network. Therefore hybrid electric vehicles (HEVs) will not be part of our assessment as these vehicles do not require charging by electricity supplied via the distribution network.

Consequently, our response to the Request for Advice will focus on two main types of EVs - battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). The sole source of energy for BEVs is the electricity contained in the battery system and must be recharged when depleted. In addition to the battery system, PHEVs include a combustion engine to allow extended driving even with a fully depleted battery.

The batteries in a BEV are typically larger than those in PHEVs. Battery costs are in the range of $800 to $1000 per kWh of storage capability and are expected to fall significantly in the coming years.[3] The vehicle driving range for BEVs is around 100-150km for most passenger cars and for PHEVs it is slightly higher. However it is forecast that vehicle range will grow over time due to improvement in batteries and fuel efficiency.

There are two methods to charge EVs:

- AC charging – alternating current (AC) is supplied via a mains supply to a receptacle on-board the vehicle where the on -board charging system converts it to charge the battery; and

- DC charging – a high capacity AC electrical supply is converted to direct current (DC) off-board the vehicle by a charging station and delivered directly to the vehicle's battery. In these stations, the AC to DC conversion is undertaken in a dedicated unit and will allow much faster charging as higher electrical currents can be delivered safely.

3 Usher, J., Horgan, C., Dunstan, C., Paevere, P., (2011). Plugging in: A Technical and Institutional Assessment of Electric Vehicles and the Grid in Australia. Prepared for Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO), by the Institute for Sustainable Futures, UTS: Sydney at. p 62.

The nature and availability of the charging infrastructure will be crucial aspect to EV development. All commercially available EVs have the capability for AC charging and this is widely seen as the dominant form of vehicle charging. Most residential and public charging will occur at power levels ranging from less than 1 kW to as much as 19.2 kW and full charge times of 3 to 8 hours. DC charging (also known as 'fast charging' or 'quick charging') is used for higher rate, faster charging applications.

2.2 Potential uptake of EV technology (Step 2)

Assessing the potential demand for EVs is necessary to determine the materiality of the impact that EVs may have on the electricity system. However, there is a high degree of uncertainty concerning how quickly EVs can enter the market and grow in volume. Compared to other vehicles, EVs are generally more expensive and more technologically risky for vehicle manufacturers at present, which may reduce the likely rate of introduction of EVs.

The potential penetration of EVs in Australia's transport mix requires making assumptions and predictions on a range of variables such as (but not limited to):

- the global production of EVs and other vehicles;
- the *relative* prices of these vehicles, both in terms of the purchasing costs and also in the fuel and maintenance costs;
- efficiency improvements in current technologies;
- the *relative* price of batteries;
- transport policy;
- consumers' preferences and incomes; and
- the availability of electric charging infrastructure.

AECOM has completed reports for Victoria and NSW which attempt to forecast the uptake of EV technologies in those states.[4] Additionally, CSIRO has completed a report examining the penetration rates of EVs using Victoria as a case study.[5]

These studies forecast the uptake of EVs by firstly, developing a forecast for the total number of new vehicles sales in the estimation area, and then modelling how consumers would choose between the various vehicle types based upon estimates of the factors that drive the vehicle purchasing decisions of consumers. Developing a

4 AECOM (2009), Economic Viability of Electric Vehicles: Prepared for NSW Department of Environment and Climate Change; AECOM (2011), Forecast Uptake and Economic Evaluation of Electric Vehicles in Victoria: Prepared for Victorian Department of Transport.

5 Higgins, A. and Paevere, P. (2011). Diffusion Modelling of Electric Vehicle Uptake: Methodology and Case Study for Victoria. Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO)

strong understanding of these drivers will be important in providing our advice to the MCE.

These studies found that:

- Between 2010 -2020 growth in EVs share of vehicle sales will gradually increase and account for less than 10% of market share of new passenger vehicle sales;
- Growth in EVs should increase significantly after 2020 as the prices of EVs becomes competitive. EVs could account for between 15% to 40% of new vehicle sales;
- PHEVs will account for a larger share of the market than BEVs; although BEVs share is expected to increase significantly from 2020 due to projected performance improvements and falling battery prices; and
- The availability of charging infrastructure will be a key determinant in the penetration rate of EVs. The availability of public charging units and commercial stations as an alternative to household charging could add over 100,000 additional EV sales per year in Victoria and result in EVs accounting for a larger share of the market than HEVs.

Given the inherent uncertainties in forecasting potential EV penetration rates, we propose to devise a set of scenarios catering for various levels of EV penetration. That is, there could be three scenarios that would form the basis for analysis: a high level of uptake; a medium level of uptake; and a low level of uptake. Our modelling will build on the existing work and we intend to consult on these scenarios in our Directions Paper which is due to be published this December. We will then evaluate the impact that each scenario of EV penetration will have on electricity market infrastructure, including peak demand impacts.

Question 1

What are the key drivers and likely uptake of EVs in the NEM? Are there any differences in these drivers between NEM and WA?

2.3 Impact of EVs on electricity markets (Step 3)

Once a sense of the materiality of the uptake of EVs in Australia's transport mix is ascertained (in Step 2), this can provide a clearer indication of the likely impacts that EVs may place on electricity markets.

In determining the impacts that the uptake of EVs will have on electricity markets, it is necessary to consider two variables: electricity demand/capacity (measured in kW or MW) and electricity consumption (measured in kWh or MWh). In terms of electricity

demand or capacity, it is estimated that recharging an EV battery will require 3-4kW.[6] This increase in demand or load would have impacts on generation and network augmentation. Such a significant increase in load could also cause problems for the electrical system within the household.

The timing of EV charging can create either positive or negative impacts on electric generation and networks. The arrival of an EV back home is typically correlated with peak load, so it is often assumed that vehicle charging could create a large load coincident with the peak. A significant amount of EV charging coincident with the system peak would create a need for additional generation. On the other hand, charging performed consistently during off-peak hours could reduce the need for additional generation.

In terms of electricity consumption, it is estimated that the average consumption of electricity by an EV is around 3.5 MWh per annum.[7] This would represent a 50% increase in electricity consumption for a typical household with an EV. Some scenario modelling conducted across the NEM has found that there would be a 2 to 5 per cent increase in electricity consumption by 2030.[8] According to this modelling, this would result in average wholesale prices across the NEM increasing by less than $1.00/MWh or by less than 0.7%.

Discussions on the impacts of EV often focus on policies to alter the load shape generated by EV charging, whether by use of electricity pricing incentives, actively managed or 'smart' charging, or on-board programming of charging times. The use of pricing structures to alter demand, especially peak demand is being considered under the Power of Choice Review and this will be an input to this Request for Advice.

EVs will also lead to new challenges and regulatory issues arising from the interaction between retailers, distribution networks and energy service providers (such as EV charging infrastructure providers). Issues relating to the ownership and usage of infrastructure and the boundary of regulatory and competitive activities would also need to be addressed.

For distribution businesses, there may be challenges relating to the management of their networks in response to a significant uptake of EVs. For example, there is a risk of transformer overload where transformers in a particular locality are not designed to service additional EV load. This situation could be geographically specific to areas where there is a large scale uptake of EVs. In addition, there may be issues relating to the implementation of residential, commercial and public charging infrastructure. There may also be a need for responsibilities to be imposed that relate to consumer education in relation to EV technologies.

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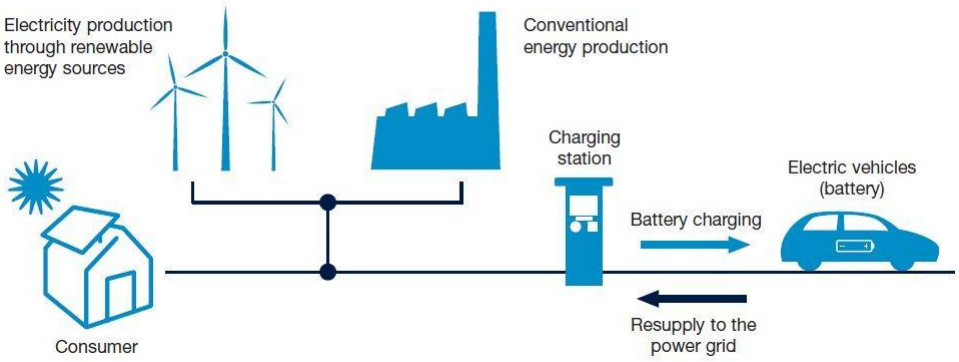
6 Better Place (2011), Submission to the Australian Energy Market Commission Power of Choice Review, at p. 9.

7 Estimate provided by Better Place.

8 McLennan Magasanik Associates (2009), Electricity Markets and the Uptake of Electric Vehicles: Report to Victorian Department of Primary Industries.

In addition, a salient technological feature of an EV is its potential to use its electric battery as a form of storage device whereby electricity can be fed back to the electricity grid; that is, vehicle to grid (V2G) capabilities. However, the technology necessary to support this application is currently at a nascent stage. The idea behind V2G is that utilities would be able to use the distributed storage provided by EV batteries as back-up capacity to help meet unusual demand spikes. For example, power could be drawn down from car batteries and sold back to the grid to power a home for the afternoon during high temperatures and then recharged at night as the temperature cools. With dynamic pricing, the EV owner could make a profit because the price offered at peak times for selling power to the grid could far exceed the cost of charging the battery at off-peak times. Alternatively, if EV batteries continue to increase in storage capacity, excess power generated from utility scale wind power plants during the night could be stored in EVs and then used to provide power to the grid during the day. Figure 2.1 illustrates this relationship.

Figure 2.1



This vehicle to grid capability has potential value in terms of distributed generation and storage but can create network control issues. This could require two way inverters to be developed and installed on a wide scale to bring vehicle to grid technology to fruition. There may be a need to place incentives on Distribution Network Service Providers (DNSPs) and implement smart grid technologies (which are being addressed in the Power of Choice Review).

The impacts that EVs may have on electricity markets can be classified as the respective costs and benefits that EVs may place on electricity markets. In considering these impacts, it is analytically useful to segment the electricity market broadly into its generation, network and retail segments and considering the respective costs and benefits by market segment.

At a high level, it is conceivable that the widespread uptake of EVs may potentially benefit the electricity market in the following ways:

- In terms of generation, it may be a complement to renewable energy (such as intermittent wind generation) through its functioning as a potential storage device;

- In terms of networks, EVs can be part of the deployment of smart grid technologies and also provide ancillary services; and
- In terms of retail, EVs may be able to be aggregated as a form of demand side participation that responds to times of peak system stress.

We welcome views on other benefits that EVs may bring to Australia's electricity markets.

We are also required to consider the costs that the widespread uptake of EVs may have on the electricity market. If we assume a scenario with a high uptake of EVs, then the costs may include:

- In terms of generation, it may increase wholesale prices due to exacerbating the effects of peak demand and requiring additional generation investment;
- In terms of networks, investment costs may arise in adapting to this technology (eg. Metering arrangements or network protection equipment) and possible impacts on reliability at a local level; and
- In terms of retail, there may be costs associated with management of EV customers and a potential increase in retail prices.

We welcome views and evidence on the suite of costs that EVs may place on Australia's electricity market.

Question 2

What are the costs and benefits that EVs may introduce into Australia's electricity markets? Please provide evidence if available.

2.4 Appropriate electricity market regulatory arrangements for EVs (Step 4)

Following the development of our understanding of the likely uptake of EVs and their impacts (in terms of costs and benefits) on the electricity markets, it is next necessary to determine the appropriate electricity market regulatory arrangements that would facilitate the economically efficient uptake of EVs. By electricity market regulatory arrangements, with respect to the NEM, we refer to the National Electricity Rules and with respect to Western Australia, we refer to the WA electricity market regulatory arrangements.

We will consider the appropriate arrangements for:

- Metering protocols and settlement systems;
- EV charging infrastructure;
- Pricing/Tariff arrangements, for example, time of use pricing;

- Investment in the distribution network necessary to support EVs;
- Interaction between EV technologies and smart grid technologies; and
- Potential scope for integrating EVs with renewable generation.

We welcome views and evidence on the appropriate electricity market regulatory arrangements necessary to support the efficient uptake of EVs.

Question 3

What are the appropriate electricity market regulatory arrangements necessary to facilitate the efficient uptake of EVs?

2.5 Identification of changes required to the current electricity market regulatory arrangements (Step 5)

The final step in our analysis is to identify the required changes to the current electricity market regulatory arrangements that is necessary to facilitate the efficient uptake of EVs. This step of our analysis focuses on the National Electricity Rules and the WA electricity market regulatory arrangements. These proposed changes would constitute a suite of reform options to facilitate the economically efficient uptake of EVs.

We note that Western Australia has a different market design to the NEM and there may be separate issues that need to be addressed. The identification of reform options will be determined in light of the National Electricity Objective (where relevant) such that reforms are made in the long term interests of consumers.

We welcome views on the required changes to the current electricity market regulatory arrangements or reform options to facilitate the economically efficient uptake of EVs. Further, we welcome views on any electricity market regulatory arrangements that affect EVs, which may also apply to NGVs.

Question 4

What are the required changes to the current electricity market regulatory arrangements and suggestions for reform to facilitate the efficient uptake of EVs?

Question 5

Are there any electricity market regulatory arrangements that affect EVs which may also apply to NGVs?

3 Natural Gas Vehicles

This Chapter describes our proposed analytical framework in relation to NGVs. It also canvasses some of the key issues and, by proposing a series of questions, seeks stakeholder feedback. This Chapter is structured to be consistent with the five step analytical framework proposed in section 1.3.

3.1 Understand NGV technology (Step 1)

For the purposes of this Request for Advice, we define a 'natural gas vehicle' as either a vehicle that uses compressed natural gas (CNG) or liquefied natural gas (LNG). CNG refers to natural gas that has been compressed to around 20 to 25 mega Pascals. In the case of LNG vehicles, the LNG that is used is natural gas that has been converted to liquid form by condensing it, at atmospheric pressure, to minus 162 degrees Celsius. Compared to EVs, which tends to be used as passenger vehicles, NGVs have the potential to service the demand for industrial and commercial freight vehicles that account for a large proportion of Australia's energy demand for road transport.

There are differences in the way that CNG vehicles and LNG vehicles interact with the gas markets. At a high level, vehicles that use CNG are able to acquire natural gas through the gas distribution networks (reticulated gas networks). This means that vehicles using CNG can recharge their vehicle using refuelling units in their household or at commercial refuelling stations. For example, Sydney buses run on CNG and refuel at commercial refuelling stations at their base. Vehicles that rely on CNG typically include fleets of buses and other vehicles that operate on a 'return to base' cycle within a limited range.

In contrast, LNG production facilities acquire gas in bulk via the gas transmission networks. However, smaller scale LNG production facilities may rely on distribution networks for their supply of natural gas. Vehicles that rely on LNG are typically heavy duty vehicles (such as trucks and locomotive trains for industrial applications) where LNG is often a substitute for diesel.

Vehicles that operate on liquefied petroleum gas (LPG) are out of scope in relation to this Request for Advice.

3.2 Potential uptake of NGV technology (Step 2)

In order to appreciate the possible impacts of NGVs on the natural gas markets, it is necessary to undertake an analysis of the projected uptake or penetration rate of NGVs. The projected uptake or penetration rates are necessarily sensitive to the underlying assumptions made such as the price of substitutes such as diesel, or the availability and price of relevant technology and infrastructure.

To determine the potential uptake of NGVs, we propose to adopt three scenarios that would form the basis for analysis: a high level of uptake; a medium level of uptake; and a low level of uptake. We intend to consult on these scenarios in our Directions

Paper, which is due to be published this December. We are aiming to gain a better understanding of the drivers that influence the supply and demand of NGVs.

Question 6

What are your views as to the projected uptake of NGVs? Please provide views and evidence if available.

3.3 Impacts of NGVs on natural gas markets (Step 3)

With an understanding of the projected uptake of NGVs as obtained from the previous step of analysis, we seek to identify the impacts that NGVs would have on the natural gas markets. These impacts can be referred to as the respective costs and benefits on the natural gas markets brought about by the uptake of NGVs. The natural gas markets refer to those that apply across Australia, including Western Australia.

Some of the impacts that NGVs could have on gas markets include:

- Whether there is sufficient gas supply to meet extra demand placed on the uptake of NGVs;
- Impacts on network gas balancing arrangements to support the uptake of NGVs;
- Demand for connection and new network infrastructure; and
- Impacts on metering and billing requirements at CNG refuelling stations and residential premises.

The Commission welcomes views on the costs and benefits that NGVs would have on natural gas markets.

In addition, the Commission welcomes views on any impacts that NGVs may have on electricity markets. For example, an increase in demand for natural gas due to the penetration of NGVs may create material issues for the electricity generation market, either in terms of affecting the supply or price of natural gas and this may have secondary effects on electricity supply or prices.

Question 7

What are the costs and benefits that NGVs would introduce into Australia's natural gas markets? What are the impacts that NGVs may have on Australia's electricity markets? Please provide evidence if available.

3.4 Appropriate natural gas market regulatory arrangements for NGVs (Step 4)

Once the projected uptake of NGVs and its likely impacts on natural gas markets is understood, the next step is to determine the appropriate natural gas market

regulatory arrangements, which would facilitate the economically efficient uptake of NGVs. By appropriate natural gas market regulatory arrangements, we refer to the National Gas Rules.

In order to facilitate the economically efficient uptake of NGVs, the appropriate natural gas market regulatory arrangements may address the:

- Regulatory arrangements for commercial and residential refuelling infrastructure for CNG vehicles/fleets;
- Network access arrangements for LNG vehicles;
- Metering and billing arrangements for NGVs; and
- Tariff arrangements for NGVs.

We recognise that this is not an exhaustive list of issues and would welcome stakeholder feedback on the appropriate natural gas market regulatory arrangements for the efficient uptake of NGVs.

Question 8

What are the appropriate natural gas market regulatory arrangements that would facilitate the economically efficient uptake of NGVs? Please specify for CNG vehicles and LNG vehicles, respectively.

3.5 Identification of changes required to current natural gas market regulatory arrangements (Step 5)

Similar to the analysis for EVs, this stage of analysis requires us to identify the changes required to the current natural gas market regulatory arrangements necessary to facilitate the efficient uptake of NGVs. These changes will constitute a suite of reform options. Where applicable, the reform options that will be recommended would promote the achievement of the NGO, which would be in the long term interests of consumers.

We are also interested in obtaining views as to any natural gas market regulatory arrangements affecting NGVs, which may also apply to EVs.

Question 9

What are the required changes to the current natural gas market regulatory arrangements and suggestions for reform to facilitate the efficient uptake of NGVs? Please specify for CNG vehicles and LNG vehicles separately.

Question 10

Are there any natural gas market regulatory arrangements that may also apply to EVs?

Abbreviations

AC	alternating current
BEV	battery electric vehicle
CNG	compressed natural gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DC	direct current
DNSP	Distribution Network Service Providers
EV	electric vehicle
HEV	hybrid electric vehicle
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MCE	Ministerial Council on Energy
NEM	National Electricity Market
NEO	National Electricity Objective
NGO	National Gas Objective
NGV	natural gas vehicle
PHEV	plug-in hybrid electric vehicle
V2G	vehicle to grid
WA	Western Australia