Submission to the Senate Select Committee on Electric Vehicles

Energy Networks Australia

27 July 2018

Energy Networks Australia

Energy Networks and electric vehicles

Role of Energy Networks Australia

Energy Networks Australia is the peak national body representing gas distribution and electricity transmission and distribution businesses throughout Australia.

From an electricity perspective, we provide the low, medium and high voltage electricity lines that transmit and distribute electricity from energy transmission systems directly to the doorsteps of customers.

Energy Networks Australia recognises that battery electric vehicles have a strategic role in reducing greenhouse gas emissions from road transportation and are a key component of Australia's transition to a low carbon economy. However, it should be recognised that electricity network operators will be required to invest in their networks to ensure they can safely and reliably meet the increase in electricity demand required to support electric vehicle charging.

Energy Networks Australia also recognises that fuel cell electric vehicles also have a role to play in reducing greenhouse gas emissions from transport. While there is a large push for these vehicles, powered by hydrogen, the domestic take up of hydrogen/ fuel cell electric vehicles will depend on the rate at which the hydrogen industry in Australia can develop for both exports and domestic use.

Energy Networks Australia would welcome an opportunity to address the Senate Select Committee on Electric Vehicles to discuss the value that Australia's electricity networks can provide to governments in maximising benefits from increased electric vehicle uptake.

CSIRO – Energy Networks Australia electric vehicle impact modelling

Included in the Electricity Network Transformation Roadmap, published by Energy Networks Australia and CSIRO in 2017, was a projection for electric vehicle adoption and its likely influence on the electricity grid, building on existing studies (Attachment 1, here). This influence on the grid was found to be potentially positive or negative, dependent on the maturity of technical and regulatory frameworks for electricity networks operation.

Australia's distribution networks were not designed for any significant uptake of electric vehicles and the consequential demand for charging. This raises concerns about the potential impact of electric vehicle mass-charging events on energy security at a time when the system is susceptible to power outages during peak periods of energy demand. This will be especially problematic at periods where the grid is congested with individuals and businesses accessing power supply simultaneously. For example, given their current flat electricity structures, were most Australians to become electric vehicle owners in the near future, they would have no disincentive to plugging in their electric vehicles to charge when they get home at

Energy Networks Australia www.energynetworks.com.au
Unit 5, Level 12, 385 Bourke Street Melbourne VIC 3000
P: +61 3 9103 0400 E: info@energynetworks.com.au
Energy Networks Association T/A Energy Networks Australia
ABN: 75 106 735 406

5-6pm on an extremely hot summer day. Potential negative impacts of electric vehicles on electricity networks, if not managed correctly through suitable technical and regulatory frameworks, include:

- Exacerbation of electricity consumption peaks
- Exceedance of low voltage (suburban) network capacity, causing poor reliability or restrictions on EV charging.

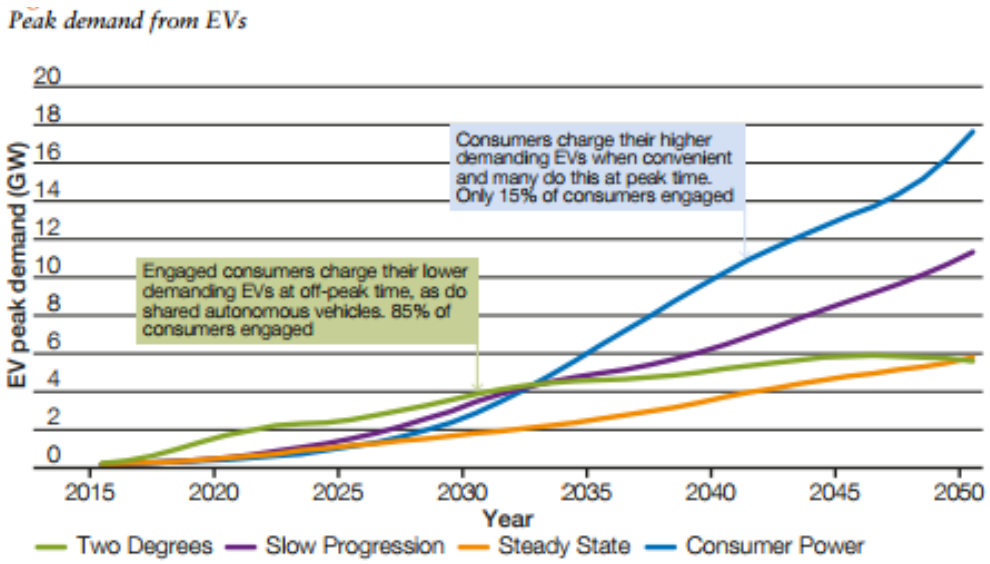
It is therefore important for distribution network operators to have visibility of where and how electric vehicle charging equipment is connected to the system, to better understand the increased demand, as well as ensure the network is fit for purpose. To create additional opportunities to manage this potential increased demand on the electricity networks, Energy Network Australia is also supportive of fuel-cell electric vehicles that use hydrogen as a fuel.

Nevertheless, if managed well through installation of appropriate technical and regulatory frameworks, electricity networks can dramatically increase electric vehicle adoption. In turn, when connected to the grid and available to grid system operators, electric vehicles can have a positive impact on the electricity grid, as well as the economy, environment and society through:

- Acting as a battery that can be used to help manage electricity demand peaks and improve electricity reliability and affordability
- Pairing with solar PV systems to form "active" energy resources and gain access to payments associated with allowing use by grid system operators and other third parties for managing the aforementioned peaks and reliability
- Decarbonising electricity generation.

Preventing exacerbation of electricity usage peaks

In its 2018 Future Energy Scenarios report (Attachment 2, here), the UK's National Grid expects its grid to accommodate as many as 11 million electric vehicles by 2030 and 36 million by 2040. If these vehicles were all to charge at the same time, especially if this is during the existing primary electricity demand peak, as most people return home after work, it would put significant strain on the UK distribution network. Additional electricity demand, if not actively managed by grid system operators, could require additional network investment in increasing electrical infrastructure capacity to handle this increase.



International Energy Agency analysis in their Global EV Outlook 2017 (Attachment 3, here) shows the additional energy demand from electric vehicle loads is sizeable but largely manageable when compared to other forms of electricity consumption increases.

If not managed carefully the additional electricity demand caused by significant electric vehicle uptake will create challenges across the Australian energy system, particularly at peak times. Balancing demand and supply and power flows will become increasingly complex and need a coordinated approach across the whole industry, bringing together the transport sector, renewables, gas and electricity generation, transmission and distribution.

Electric vehicles to power homes and stabilise the grid

It should be noted that electric vehicles only represent one element of changes to the grid, in a context of wider changes as Australia increasingly relies on distributed energy resources (such as solar and storage) over traditional energy sources. These developments mean that utilisation of the grid is changing dramatically.

Energy Networks Australia is currently collaborating with the Australian Energy Market Operator (AEMO) on how to best integrate distributed energy resources, such as electric vehicles, into electricity networks. A consultation paper (Attachment 4, here) proposes options for improving the electricity system to ensure household solar and storage (including electric vehicles) work in harmony and deliver the most value for all customers, helping to bolster quality and reliability of supply and lower household energy bills.

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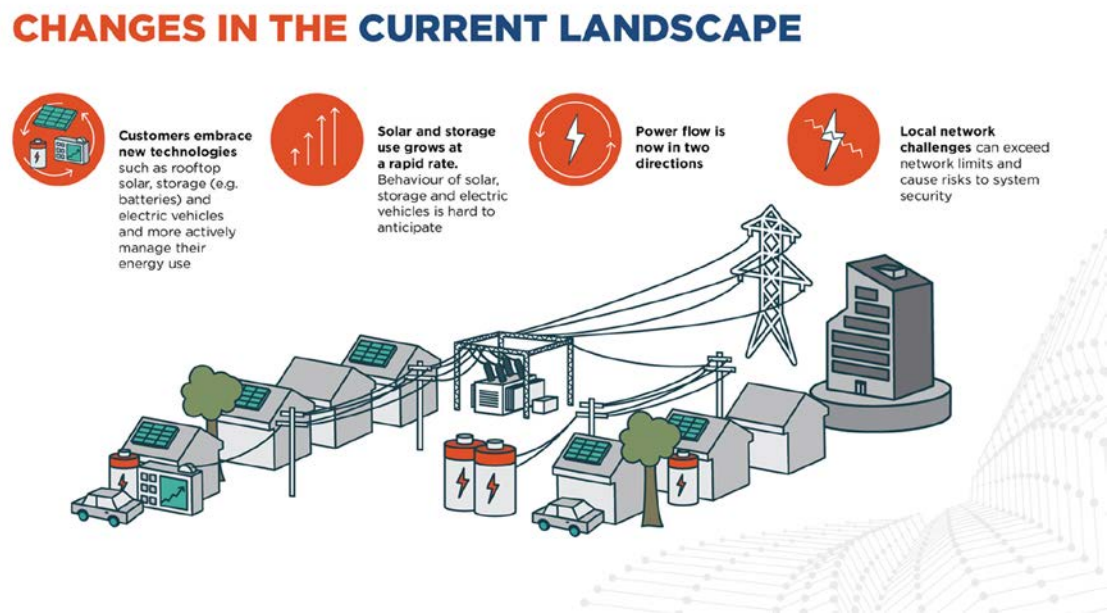

Customers increasingly see the grid as much as a means to export, as well as import, electricity. They are also becoming interested in understanding how they can share energy locally (for example, through a peer-to-peer trading program) or participate in wholesale or network services markets. Thus, the grid is increasingly becoming the gateway to a range of other markets and additional value streams for customers. At the same time, these developments are presenting new challenges for the safe and reliable management of distribution networks.

Distribution networks were originally designed for one-way flows and expenditure may be required to accommodate the increasingly bi-directional nature of energy flows. If not managed, reverse flows can cause voltage, protection and thermal network problems.

Energy network infrastructure the 'back bone' of fast charging

As an approach to positively influence electric vehicle uptake while better orchestrating charging times, energy network provision or enablement and management of DC fast-charging stations has significant merit.

The Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC) recently released a report by Energeia (Attachment 5, here) reviewing plug-in electric vehicle charging infrastructure and market modelling of plug-in electric vehicle sales and associated charging requirements.

This report identified that of the non-financial incentives, ease of access to public charging stations was ranked by potential electric vehicle owners as their top incentive for purchasing an electric vehicle. Fast-charging infrastructure, similar in function to current petrol stations, is likely to be an important source of electric vehicle enabling infrastructure as electric vehicle batteries increase in capacity and

charging times are far shorter at higher voltage connections than at home. Energeia states in the report that the large batteries inside some new electric vehicles could take greater than a full day to charge when connected to a regular 240V outlet. As shown in the figure below taken from the Energeia report, if supported by the right technical and regulatory frameworks, optimisation of the connection point of DC fast-charging stations into the grid, and ongoing management of the high voltage electrical charging infrastructure, is a logical role of existing electricity networks service providers.

Potential DC Fast Charging Developers – Strengths and Weaknesses

Category	Examples	Key Strengths								
		Software / Hardware	Infrastructure Development	Asset Management	Regulatory Backing	Access to Capital	Energy Risk Management	Existing Locations	Cost Sharing	Score
Major Petrol Station Operators	Shell, BP	×	✓	✓	×	✓	✓	✓	✓	6
Major Energy Retailers	Origin, AGL	×	✓	✓	×	✓	✓	×	✓	5
Regulated Electricity Networks	Ausgrid, TransGrid	×	✓	✓	✓	✓	×	×	✓	5
Automobile Associations	RACV, NRMA	×	✓	✓	×	✓	✓	×	✓	5
Major Overseas Operators	NewMotion	✓	✓	✓	×	×	✓	×	×	4
Major Infrastructure Developers	CMIC, Lendlease, etc.	×	✓	✓	×	✓	×	×	×	3
Unregulated Electricity Networks	Ausgrid, TransGrid	×	✓	✓	×	✓	×	×	×	3
Car OEMs	Tesla, etc.	×	×	×	×	✓	×	×	✓	2

Source: Energeia Analysis

Time of Use Tariffs important for orchestrating electric vehicle charging

Much like the fluctuations in price at petrol stations are influenced by supply and demand, electricity charging prices can be linked to electricity availability and network constraints. The true cost of producing and delivering electricity is influenced not just by how much you use, but by what time of day you use it. However, current electricity pricing (tariffs) structures generally do not reflect the peaks and troughs in electricity demand: charging your electric vehicle during peak electricity demand times after work currently costs the same as charging later at night or during the middle of the day.

Time of use tariffs (also referred to as cost-reflective tariffs), when combined with site-specific influences on charging demand (such as controllable charging devices),

could fluctuate and act similarly to petrol price changes in influencing charging demand and in turn flattening electricity demand peaks.

Recommendations

To allow for optimal electric vehicle uptake, orchestration of electric vehicle charging will be required. First and foremost, orchestration will be required so there is sufficient diversity of charging responses so that off-peak charging does not create a new peak period. While prices and incentives for off-peak charging are a key first step, managed charging of electric vehicles will eventually need to be achieved through some level of orchestration as vehicles begin to number in the millions. The alternative of fuel-cell electric vehicles should also be considered.

If optimised correctly, both battery and fuel-cell electric vehicles can become a positive for the electricity system as they could help flatten out demand, essentially meaning that with smarter technology we can ensure that vehicles are charging at the right times, i.e. when we actually have an excess of supply. This could also reduce the unit price of electricity, stabilise our grid and improve the reliability of our power supplies.

Attachments

1. Electricty Network Transformation Roadmap – Final Report
   https://www.energynetworks.com.au/sites/default/files/entr_final_report_web.pdf
2. Future Energy Scenarios Report 2018, National Grid
   http://fes.nationalgrid.com/media/1363/fes-interactive-version-final.pdf
3. Global EV Outlook 2017
   https://www.iea.org/publications/freepublications/publication/GlobalEVOutlook2017.pdf
4. Open Energy Networks – Consultation Paper
   https://www.energynetworks.com.au/sites/default/files/open_energy_networks_consultation_paper.pdf
5. Energeia (ARENA and CEFC report) – Australian Electric Vehicle Market Study
   https://arena.gov.au/assets/2018/06/australian-ev-market-study-report.pdf