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1 March 2024

To: Department of Infrastructure, Transport, Regional Development, Communications and the Arts

RE: New Vehicle Efficiency Standard consultation

Thank you for the opportunity for the Institute for Energy Economics and Financial Analysis (IEEFA) to provide input on the New Vehicle Efficiency Standard (NVES) consultation paper. IEEFA is an energy finance think tank that examines issues related to energy markets, trends, and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy.

IEEFA wishes to draw the department's attention to the benefits that electric vehicles (EVs) can provide to the electricity grid, including via vehicle-to-grid, vehicle-to-load and vehicle-to-home (collectively V2X).

These benefits are likely to be considerable, and should be included in the cost-benefit analysis referenced in the NVES consultation paper.

EVs are not only lower-pollution, quieter, more efficient vehicles that provide several benefits for health. They are also batteries on wheels that can be used to provide a range of benefits to electricity markets and networks and resilience benefits as remote, transportable power supplies.

Based on several studies, IEEFA estimates the full potential revenue streams from V2X for a household with an EV could be between $1,000 and $3,700 per year.

Through V2X, EVs can also provide services across energy markets and networks that reduce costs for all consumers, not only EV owners. For example, enX estimates that if 10% of EV charging capacity is available for vehicle-to-grid (V2G) in 2050, $94 billion in storage costs could be avoided.

Unlocking this full stack of opportunities will require improvements to other technical standards, regulations and market access for distributed/consumer energy resources (DER/CER). These have been identified as a priority by governments and market bodies, and we recommend that the NVES should be accompanied by updated standards and regulations. As a minimum, the department should work closely with other government CER workstreams to ensure that the NVES is relevant and successful.

IEEFA's detailed recommendations are summarised on the following pages. Please do not hesitate to contact us if you have any further questions about this submission.

Regards,

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EVs offer valuable benefits to the electricity system that should be included in the NVES cost-benefit analysis

The cost-benefit analysis of policy options in the NVES consultation paper considers fuel savings, reduced vehicle maintenance, health benefits and emission reductions. This **excludes** a very significant category of benefits that electric vehicles (EVs) can provide via services to the electricity grid.

The Australian Energy Market Operator (AEMO)'s Draft 2024 Integrated System Plan (ISP) forecasts distributed storage to make up 79% of total storage by 2050.[1] EVs are likely to present the most significant source of future flexible electricity demand and storage, providing energy market and network services that are increasingly valuable as Australia's electricity systems transition to high shares of renewable energy.

Consider, for example a household with a higher-than-average daily commute of 50 kilometres.[2] Assuming an EV efficiency of 15 kilowatt-hours (kWh) per 100 kilometres, usable battery capacity of 50 kWh[3], and home charging capacity of 7 kilowatts (kW), it would take just over one hour for the household to charge their vehicle to full after a day's use. However, the available time window during which the vehicle could be charged in the home is likely to exceed 12 hours.

This implies a significant degree of flexibility in the timing of when that vehicle could be charged. If the EV charger were equipped with technology that enables it to respond to real-time data from the electricity grid, charging could be switched down or off at times when overall grid demand is high, and switched up or on when demand is low.

The potential is likely to be even more significant for EVs that are connected to chargers during the day, either in homes or workplaces, as charging times could be optimised in response to changes in grid solar output throughout the day.

When combined with time-of-use tariffs, such charging patterns would also lower the cost of vehicle ownership, as most charging would occur when the wholesale electricity price is low.

Business models are already emerging to enable EV owners to take advantage of low wholesale prices. For example, Amber Electric customers can already take direct advantage of low or negative wholesale prices during the day. [4]

In the UK, EVs are already competing with gas generation to provide grid-firming services. It is estimated that under current levels of EV uptake (2.8% of the total fleet), the theoretical firming capacity of the fleet is already greater than the capacity of gas-peaking plants.[5] EV owners are financially incentivised by the grid operator to provide these services.[6]

These benefits are also reflected in modelling by CSIRO for Energy Consumers Australia that found electrification would increase volumes of electricity sold more than it would increase peak

[1] AEMO. Draft 2024 ISP generation and storage outlook.
[2] The average Australian passenger vehicle travels 34.5 kilometres/day (ABS 2018).
[3] This is likely to be conservative; the new BYD seal for example will have a battery capacity of at least 60kWh, and capacities may grow in future.
[4] Amber Electric. Why Amber is a cheaper, greener EV charging option.
[5] IEA. Global EV Data Explorer. EV stock share – Cars – United Kingdom – 2022.
[6] Bloomberg. EV Chargers Take On Natural Gas for Power System Flexibility. 14 February 2024.

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demand, with the largest contributor being EVs. This resulted in lower energy system costs for all consumers.[7]

The benefits are also reflected in a report compiled by NERA Economic Consulting for the Australian Renewable Energy Agency (ARENA), which found a net present value (NPV) of $3 billion in energy system cost savings and $5 billion in consumer cost savings by 2040 under a high EV uptake scenario.[8]

The benefits of V2X are material, and should be included in the NVES cost-benefit analysis

Most of the benefits discussed in the previous section can be provided by EVs with unidirectional (one-way) charging capabilities. However, there is a significant additional category of benefits that can be enabled via two-way (bidirectional) charging.

Of the top five manufacturers of EVs sold in Australia today, all either already include bidirectional charging capabilities in their cars, or have immediate plans to include this as standard in upcoming models.[9]

Bidirectional EV chargers are new to the consumer market, and currently attract a premium. One of the few bidirectional chargers on the market currently costs around $10,000, compared with $1,000-$1,500 for a unidirectional charger.[10] However, prices are expected to fall as adoption rates grow. One US manufacturer is targeting a price point of US$1,500 (AU$2,300) for its upcoming bidirectional charger.[11]

Bidirectional charging enables EVs to provide three significant new types of services:

- **Vehicle-to-home (V2H)**, where energy from the EV battery is used for household energy consumption.
- **Vehicle-to-grid (V2G)**, where energy from the EV battery is exported to the wider energy grid.
- **Vehicle-to-load (V2L)**, where energy from the EV battery is used to power a specific load such as an electric appliance, or to charge another EV.

Collectively these are described as V2X.

In the case of V2H and V2G, the EV functions as a mobile battery storage system for homes or businesses. Use of the EV battery can be optimised by, for example, charging EV batteries when solar output (especially directly from rooftop solar) is high, and discharging the battery at times when renewable generation is low.

A meta-analysis by RACE for 2030 found that the median annual revenue for EVs providing V2X services could be $879/kW-year. The maximum was $1,817/kW-year (see Figure 1).[12]

[7] CSIRO. Consumer impacts of the energy transition: modelling report. July 2023. Page v.
[8] ARENA. Load Flexibility Study Technical Summary. April 2022. Page 8.
[9] Top 5 manufacturers are Tesla, BYD, MG, Volvo and Polestar. Tesla intends to include bidirectional charging as standard by 2025. BYD already supports bidirectional charging. The MG 4 already supports bidirectional charging. Volvo will include bidirectional charging as of its EX90 model, and Polestar (owned by Volvo) includes bidirectional charging capabilities in its Polestar 3.
[10] SolarQuotes. EV Bi-Directional Chargers Will Enable Home Batteries on Wheels. 16 February 2022.
[11] TechCrunch. Are bidirectional EV chargers ready for the home market? 28 April 2022.
[12] RACE for 2030. My V2X EV: Informing strategic electric vehicle integration. April 2023. Page 12.

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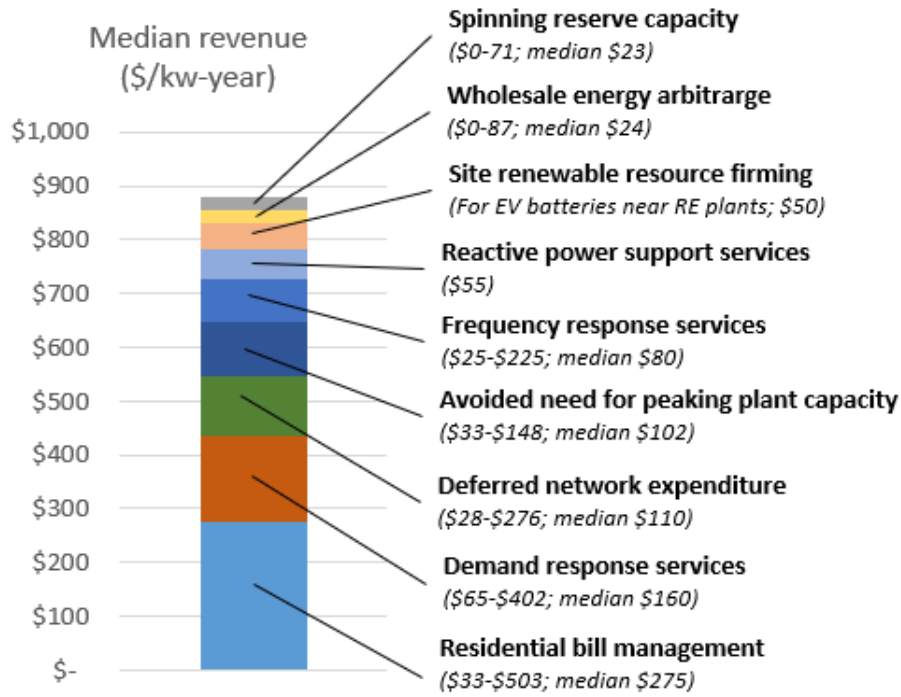
Figure 1: Median potential revenue from various V2X revenue streams



Source: RACE for 2030 2023

These revenue streams are a mix of consumer savings and system-wide benefits. For example, median revenue for residential bill management alone was $275/kW-year. This represents households optimising their bills by charging their EV battery when prices are low or when they have surplus rooftop solar needs, and discharging for use in the home or the grid when wholesale prices are high.

Other revenue streams are related to overall reductions in costs across the energy system, such as deferred expenditure on new network or generation capacity assets. These cost reductions are shared across all users of the energy system – not only EV owners – and are important to consider in the NVES cost-benefit analysis

A report by enX found, for example, that if only 10% of the EV fleet's charging capacity is available for V2G by 2050, this could provide 37% of total storage in the NEM, offsetting $94 billion in storage capex for other batteries.[13]

The actual revenue a single household could receive from V2X services would depend on a wide range of factors, including: battery charging capacity; availability during peak times or days; and the degree to which regulatory reform enables households to be compensated for providing distribution network services.

[13] enX. V2X.au Summary Report – Opportunities and Challenges for Bidirectional Charging in Australia. 30 June 2023. Page 3.

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However, considering even a portion of the value stack shown in Figure 1 for a standard home EV setup[14], and other external estimates of revenue streams for various customer types[15], IEEFA expects revenue within a reasonable potential range of $1,000-$3,700/year.

Recommendation: The NVES cost-benefit analysis should be extended to consider the benefits that EVs can provide to households and the grid, including via V2X.

The NVES will be most successful if accompanied by new and updated standards and regulations and market access for EVs

The technology to unlock the potential of grid flexibility services and broader V2X revenue streams from EVs is available today. However, current standards and regulations in Australia unintentionally prohibit access to many of these revenue streams.

Nonetheless, distributed or consumer energy resources (DER or CER) are a rapidly-evolving space in Australia, and have emerged as a key priority for Australian governments and market bodies. The Energy Security Board (ESB) has noted "CER policy is at a critical juncture" in Australia, and "[…] it is timely for CER integration to progress from a demonstration and incubation phase to a reform design, delivery and implementation phase".[16]

In 2023, energy ministers agreed to develop a National Consumer Energy Resources Roadmap..[17] This presents a logical forum to investigate the reforms necessary to maximise the potential of EV grid services.

For the NVES to operate as a successful and relevant policy, it is essential that it be aligned to current and likely future developments in CER.

Previous IEEFA analysis has highlighted the significant potential of services that EVs can provide to the grid, including via V2X, and identified several key recommendations that could unlock this.[18] These included but were not limited to:

- Development of an EV-grid integration plan.
- Establishment of a body to set CER technical standards, including demand response requirements for EV chargers.[19]
- Removal of static limits on household energy exports in favour of dynamic operating envelopes.
- Commissioning a thorough, independent review of distribution network revenue regulation to ensure the regulation supports the integration of DER including EVs.

Recommendation: The NVES should be accompanied by actions on technical standards, regulatory reforms and market access to support the provision of EV grid services, including V2X.

As a minimum, the NVES should be designed in a way that supports the deployment of DER/CER in Australia, which has been identified as a priority by government.

[14] Based on Figure 1, a 3.6kW charging capacity (well below the standard capacity of most EV models) could be enough to see revenue of $1,000/year from residential bill management alone.
[15] For example, a 2022 study by Jones et al modelled a maximum revenue of $3,744 for a vehicle charged at a workplace under dynamic prices and accessing frequency control ancillary services (FCAS) revenue.
[16] ESB. Consumer Energy Resources and the Transformation of the NEM. February 2024.
[17] Energy and Climate Change Ministerial Council. Meeting Communique: 24 November 2023. Page 2.
[18] IEEFA. Growing the sharing energy economy. 13 October 2023.
[19] See also: IEEFA. Mandating AS4755 Ignores Households and Widely Supported International Solutions. August 2021.