

# Submission

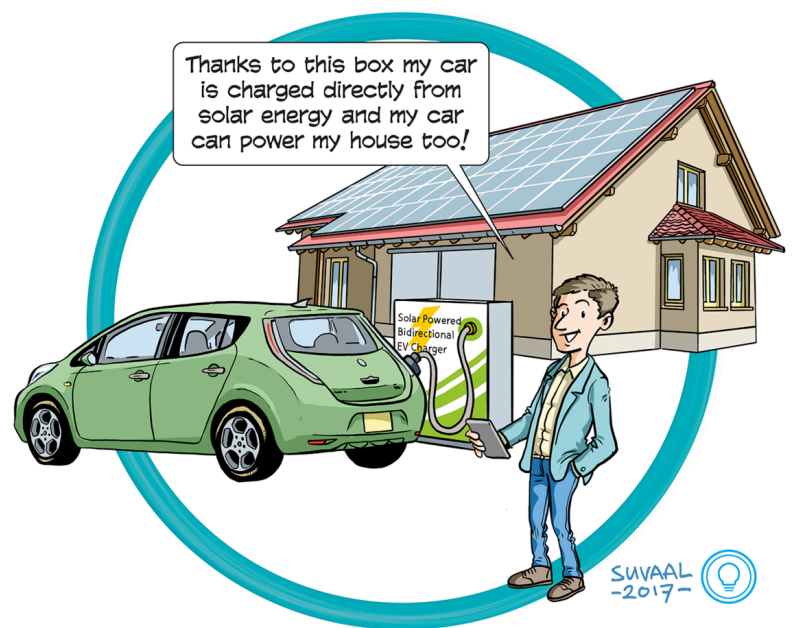
## Inquiry into the Transition to Electric Vehicles

by Renew Illawarra Network

**Neville Lockhart.**

**Greg Knight**

**Ty Christopher**



<https://electronics360.globalspec.com/article/8925/direct-vehicle-charging-with-solar-energy>

To: **CCEEW@aph.gov.au**

**Attention: Committee Secretary, Standing Committee on Climate Change, Environment, Energy and Water**

# Executive Summary

## BACKGROUND TO THIS SUBMISSION

At the November 2023 Energy and Climate Change Ministerial Council (ECMC) Meeting, ministers agreed to develop a National Consumer Energy Resources (CER) Roadmap – Powering Decarbonised Homes and Communities. Ministers also agreed to consider implementation of a national approach to technical regulatory settings for CER.

CER is relatively new terminology, probably originating from the Energy Consumers Association (ECA) decision to replace the common terminology Distributed Energy Resources (DER). That was summarised in: *Death to DER? Why we need to change the language we use for the energy transition* May 2022 The bECAuse Blog.

This change, while logical, remains a source of confusion. Therefore, Renew Illawarra set out to review DER/CER technologies and associated consumer and community energy, including history, statistics, future projections etc. We drew on facts and interpretations from multiple organisations and sources, then distilled the numerous individual aspects into a coherent whole. The resulting document *Consumer Energy Resources (CER) - What Are They and Where Are They Going?* Is available on request.

**EVs are a major and rapidly growing element of CER.** They have massive potential for interacting with other CER and with the grid to optimise the future electricity system. The Terms of Reference explicitly recognise this:

- the establishment of resources, **systems and infrastructure** required to support transition to EVs
- the opportunities for fuel savings, such as by **combining EVs with other consumer energy technologies** and savings for outer suburban and regional motorists
- **the impact on electricity consumption and demand**
- the opportunities for expanding EV battery manufacturing, recycling, disposal and safety, and other opportunities for Australia in the automotive value chain to support the ongoing maintenance of EVs
- **any other relevant matters.**

Our CER review provided the necessary background and starting point for this submission, which again draws together material from many sources. We particularly acknowledge contributions by Rewiring Australia (RA) and others published in *Renew Economy* and its sister journals.

We are independent of RA; however coming from the Distributed Energy Resources (DER) perspective we have similar positions as RA has reached from their Home Electrification perspective.

**We aim to show EVs can catalyse not only substantial transport emission reductions and cost savings, but also (with the right regulatory and operational settings) abundant, low cost, low emission electricity.**

## Main Premise:

The EV transition certainly offers a major opportunity to achieve substantial transport emission reductions. In addition:

**Consumer Energy Resources (CER) incorporating “Batteries on Wheels” also provides a major opportunity to facilitate abundant, low cost, low emission electricity, through:**

- eliminating constraints to domestic Solar Panel installation by:
  - storing “excess” electricity
  - enabling consumers to trade power without excessive grid charges.
- balancing electricity supply and demand
- time shifting - minimise duck curves and meet evening peaks
- avoiding excessive expansion of grid generation and storage capacity and reducing expensive transmission needs
- reducing overall energy consumption
- limiting oil demand and imports thereof
- accelerating and optimising overall CER
- overhauling regulatory and operational aspects of the electricity system.

## Key Points and *Actions*

1. Rooftop Solar, already a major component of the National Electricity Market (NEM), is expanding with > tenfold further potential. Panels last decades, power per square metre is increasing, system sizes are increasing and distribution networks can handle much more solar. So rooftop solar will dominate.
  - *Implement policies that accelerate solar and maximise solar installation size across households, rental properties, apartment complexes, commercial and industrial installations, public buildings, car parks etc*
  - *Implement National Energy Market rules and procedures that support (rather than curtail) rooftop solar expansion and distribution network hosting*
  - *Provide subsidies/loans that address social equity .*
2. Battery storage is essential; major growth potential for home batteries, community batteries, batteries on wheels
  - *Policies that accelerate rooftop solar should be designed to give preference to solar-battery systems .....*
  - *Incentivise battery installation in the following order*
    - I. *Community Batteries (CBs)*
    - II. *EVs*
    - III. *Home*

3. **Home Electrification offers huge energy and cost savings plus hundreds of billion \$ returns on investment**
  - *Prohibit gas in new developments*
  - *Eliminate barriers to disconnect existing gas*
  - *Facilitate subsidies/loans towards conversions to all-electric*
  - *Provide public education on Home Electrification*
4. **EVs are a key component of Home Electrification - total energy use more than halved, costs cut > fivefold. We need more EVs and cost effective charging options.**
  - *Implement Fuel Emission Standards asap*
  - *Increasing rooftop solar is the best way to provide capacity to charge the EV fleet which is otherwise a new demand on the existing grid.*
  - *Incentivise public and workplace charging stations to also have flexible time-of-use tariffs allowing ~zero cost over peak solar hours*
5. **EVs as “Batteries on Wheels” have massive potential, much higher than Snowy 2.0 capacity; the keys to unlocking this discharging capacity are Vehicle to Grid (V2G) and Vehicle to Home (V2H)**
  - *National EV policy to set V2G and V2H as a near term priority*
  - *V2G Vision in National EV Strategy*
  - *Fast track policies and standards to facilitate V2H and V2G connection*
6. **In the CER context**, the wide spread and massive numbers involved are seen as a problem, a risk, an annoyance - compared to the old simple, centralised system. So households are excluded and consumers/CER remain unrepresented - a clear anti-competitive and conflict of interest situation.  
Yet the future energy system needed – where electricity is clean, affordable and abundant – cannot be delivered if consumers and CER are not playing their part.
  - *Initiate serious reform, not “integration” of CER into the traditional system:*
  - *Consumers to be placed in governance roles on AEMO and other bodies*
  - *Redesign the power system to be centred much more on rooftop and community solar, home electrification and EVs V2G*
7. **CER generally and household electrification specifically, with EVs as a key feature, lead on to community energy, suburban microgrids and local power.** Localised electricity infrastructure, allows consumers - generators and users - to trade electricity with each other - not pay high fees to the traditional players for their non-relevant infrastructure.
  - *Treat CER on equal terms to large-scale generation and transmission in terms of policy, planning and regulation*
  - *Support Community Energy Zones (CEZs) that balance and complement the focus on REZ and associated long transmission lines, social licence issues etc.*
  - *Create “household-centred rules” for home electrification that catalyse progress towards Community “flagship” projects across suburbs*

**8. The established national electricity market (NEM) and regulatory system, comprising AEMO, AEMC, AER (and until recently ESB), *theoretically* have clear powers, functions and accountabilities that *supposedly* support the efficient operation of the market in *the long-term interests of consumers*.**

**In practice nothing could be further from the truth:**

Since the market “reforms”, privatisation, and “competition” in the 1990s, the price of electricity has skyrocketed. The NEM rules were developed for the old electricity and gas systems (before low cost solar) and the entities involved adhere to traditional ways, tinkering at the edges of market redesign. That has demonstrably failed and the ACCC has found price gouging. So the NEM is no longer fit for purpose and needs policy redesign by governments, not tweaking by regulators.

- ***Conduct a governance and competition review of the NEM with a view to rebuilding in order to deliver the energy transition at least cost to energy consumers.***
- ***Commission the ACCC to address AER’s anti-competitive rules, end vested interest control of market & operation, rebalance NEM towards the consumer/ demand side.***

**9. The Distribution Network Service Providers (DNSPs) remain key players.**

They have been prominent in trials of Community Batteries, EV charging, EV discharging (V2G and standards), community energy and microgrids. They have also successfully trialled conventional hot water heaters as a sink for excess solar energy by shifting “controlled load” times from overnight to the middle of the day. But under current market rules, the limited options available to the DNSPs generate expensive network augmentation over cheaper, faster non-network options such as demand flexibility.

- ***Change the rules and the regulatory environment, so that DNSPs are incentivised to procure demand flexibility.***
- ***Allow DNSPs to install generation capacity (ie Community and Network Batteries) and so optimise use of consumers solar power within the community***
- ***Ensure DNSPs facilitate easy connection to their network for third party power storage (ie Community Batteries, EV V2G, House Batteries).***

**10. As CER becomes more prevalent, a local network operator (as opposed to a local asset manager) who dispatches energy and manages power flows on the local level becomes more necessary.**

- ***Formalise the emerging role of Distribution System Operator (DSO) to be delivered by DNSPs, possibly ring-fenced outside their regulated business operations***
- ***Establish new entities such as Community Battery Operators, Local Power Operators, able to offer contract services to both DNSPs and retailers.***

## The Authors....

### Neville Lockhart

- (Retired) 27 years with CSIRO, mainly Energy Technology
- Research and technology management across coal, gas, renewables, energy efficiency and associated greenhouse issues



- Strategy and Business Development Manager
  - Energy Sector Outlook
  - Sector and Component Plans
  - Centre for Distributed Energy and Power, which included early EV efforts for Holden
  - Original CSIRO Flagship program Energy Transformed to address efficiency and emissions issues across the electricity generation, transport and energy end-use sectors
- Early adopter of passive energy efficiency (< 2000), solar panels (2003), e-bikes (2004), home batteries (2015), and EVs (2019)
- Ongoing updating on climate change and energy developments
- Volunteering and advocacy with Renew, Wollongong Community Power
- Local organiser of Renew's Sustainable House Day
- Local organiser of Tesla EV and Tiny House events at University of Wollongong and Shellharbour Council

### Greg Knight



- (Retired) Technology Planning Manager, BlueScope Steel:
  - Metallurgist
  - Quality Engineer
  - Manufacturing Process Standardisation
  - Change Management
  - Industrial Statistician
- Facilitation & Performance Systems
- Renew Illawarra convenor
- Leader of Renew Illawarra submissions to Wollongong Council Climate Change Mitigation Plans
- Initiatives to help residents reduce carbon footprints
- Leader of Renew Illawarra Network of scientists, engineers and technology managers
- Technology adviser Home Electrification Project 2515
- Project developer for Hi Neighbour community energy group



## Ty Christopher



- ~40 years experience in the electricity supply industry
- Was General Manager, Asset Management, Endeavour Energy
- Planning, building, maintaining large scale power assets

- Led NSW Demand Management Code of Practice
- Introduced new technology:
  - large-scale battery storage
  - embedded generation
  - digital asset management techniques
- Passionate about;
  - reducing customers' energy costs
  - decarbonisation
  - energy transformation
  - sustainable futures
- Currently
  - Professor/Director of the Energy Futures Network at the University of Wollongong
  - Director of the Australian Power Quality Research Centre (APQRC)
  - EcoJoule Energy Senior Adviser – Strategy and Business Development

**Collectively**, we are part of the network of technical, strategy and power industry expertise within the Wollongong LGA, which also hosts nationally-recognised residents Dr Saul Griffith (Rewiring Australia-RA) and Prof Tim Flannery (Climate Council).

We published our early efforts in Renew 156 p29-38 July-Sept 2021:



---

*Sentences in Italics denote an article of the same name usually from web publishers*

- \* *Renew Economy,*
- \* *Switched On,*
- \* *One step off the grid, and*
- \* *The Driven*

*Articles can be found by searching for the title.*

*Greg Knight, Neville Lockhart and Ty Christopher describe how they made significant contributions to the Wollongong City Council's Climate Change Mitigation Plan—and how their ideas can help councils around the country.*

<b>Executive Summary</b>	<b>2</b>
<b>Key Points and Actions</b>	<b>3</b>
<b>The Authors....</b>	<b>6</b>
<b>Section 1 CONSUMER ENERGY RESOURCES (CER) Summary</b>	<b>9</b>
<b>1.1 COMPONENTS of CER</b>	<b>9</b>
(i) Rooftop Solar Panels	9
(ii) Home Batteries	9
(iii) Community Batteries (CBs)	9
(iv) Electric Vehicles (EVs)	10
(v) Home Electrification	10
<b>1.2 EVs as BATTERIES on WHEELS</b>	<b>10</b>
(i) Charging & Tariff Incentives	10
(ii) Discharging - General	11
(iii) Discharging - V2L, V2H, V2G	11
(iv) Standards for V2G	12
(v) Car manufacturers	13
<b>Section 2 ELECTRICITY SYSTEM Traditional-&gt;Consumers-&gt;Localised</b>	<b>14</b>
(i) Traditional Operation	14
(ii) Traditional Market Control & Regulation	14
(iii) Consumer Energy	15
(iv) Consumer Energy within Traditional Electricity System	15
<b>Section 3 MARKET and REGULATORY</b>	<b>17</b>
(i) Historical	17
(ii) Barriers - General	18
(iii) Solutions - General	18
(iv) Barriers - NEM Market Operators and Regulators	19
(v) Solutions - NEM Market Operators and Regulators	20
(vi) Barriers and Solutions - Distribution Networks (DNSPs)	20
<b>Section 4 CONCLUSIONS</b>	<b>22</b>



## Section 1 CONSUMER ENERGY RESOURCES (CER) Summary

### 1.1 COMPONENTS of CER

Full details are in *Community Energy Resources - What Are They and Where Are They Going? Available on request.*

#### (i) Rooftop Solar Panels

- \* Took off from ~ 2010-2012
- \* Now ~3.5 million = ~22GW capacity
- \* Still at least 10 x unused potential across residential (owned & rented), commercial, industrial, community land, rural etc
- \* Panels last decades
- \* Power per square metre increasing
- \* System sizes increasing
- \* Distribution networks can handle much more solar given the proper market rules
- \* Even under pessimistic scenarios, modelling by different experts all predict rooftop solar + battery storage will dominate the electricity market.

#### (ii) Home Batteries

- \* Only 1.6% of solar households have batteries
- \* Solar feed-in tariffs are low and decreasing
- \* Solar export limits and charges are starting
- \* Battery costs falling
- \* Therefore expansion of battery storage is certain, though “take-off” like solar panels requires subsidies
- \* Alternative/complementary options are Community Batteries and Batteries on Wheels (EVs)

#### (iii) Community Batteries (CBs)

- \* Early CB efforts in Australia were part of our article Towards Zero Emissions, published in Renew 156 p29-38 July-Sept 2021
- \* Subsequent federal government support for 400 CBs is being rolled out
- \* The current position and future potential are summarised by 2nd Conference on the Future of Neighbourhood Batteries (Nov 2023), organised by the Australian National University and the Energy Consumers Association.

#### (iv) Electric Vehicles (EVs)

- \* Australia at early adopters stage
- \* Full Battery models (BEVs) now ~8% of new car sales and rising fast
- \* World average is ~18% with China and Europe into majority stages
- \* Norway at 82% is the world leader
- \* International Energy Agency (IEA) forecasts EVs on road globally ~350 million by 2030 (from 16.5 million in 2021)
- \* Australian forecasts vary; a “middle of the road” ~50% is commonly quoted
- \* Imminent battery advances and cost reductions will increase rates of adoption
- \* Projections for Australia in 2030 range from 1 million to 3.8 million “needed to stay on track” for zero emissions by 2050.

#### (v) Home Electrification

- \* EVs have enhanced the push towards 100% electric homes
- \* Linked to going off gas and petrol/diesel
- \* Founded and led by Rewiring Australia
- \* The “average” Australian household uses 102kWh energy daily (2021) costing > \$5000/annum
- \* Conversion to all-electric uses 37kWh daily costing ~\$800/annum
- \* Implementation models show cumulative benefits >\$300 billion by 2035
- \* Massive decline in oil imports.

## 1.2 EVs as BATTERIES on WHEELS

#### (i) Charging & Tariff Incentives

While decarbonising the passenger car fleet is critical for transport emissions, the charging demand on the electrical grid does need to be handled well, given that electricity use already peaks around 6 pm. A huge added load from masses of EV drivers coming home and plugging in their vehicles could be a major issue. This is certainly recognised and special EV tariffs have started in response:

- \* One EV Saver retail tariff allows free electricity between 12 noon and 2pm at weekends, while first drawing on excess solar
- \* Other retailers offer discounted EV charging rates between midnight and 6am
- \* OVO Energy EV Plan (Feb 2024) has both daytime (free 11am-2pm) and overnight (8c/kWh 12 midnight-6am) incentives
- \* Origin Energy is incentivising its EV customers *How to optimise home EV charging to soak up rooftop solar and overnight troughs*. That trial concluded that consumer demand for EV charging – and electric hot water heating – can be shifted by optimising tariffs.
- \* AusNet network is running a 3 year trial from July 2023 - Customers to be **paying** by network to charge EVs - **paying** 1 cent per kWh for every kWh charged between 10 am and 3pm, plus **payment** of \$1 for every kW the customer increases their rate of charging (from 3kW and 6kW) within these times, or decreases outside these times.
- \* Public fast DC chargers are also offering **special tariffs** eg *The 120kW EV fast charger that is free for the day time solar soak*, reports free charging between 9am and 4pm, compared to 90c/kWh 4pm to 10pm.

## (ii) Discharging - General

**There is much less appreciation of the discharging potential of EVs.** Thus, communications about charging and discharging focus on stationary batteries, both home and utility-scale, and on pumped hydro and some other options. Yet batteries on wheels can be a key player because the potential resource is huge and (given the appropriate charging infrastructure and incentives) largely flexible. Thus:

- \* The Smart Energy Council sees massive, untapped storage potential: in 10 years, Australia's electric car fleet is likely to have more battery capacity than Snowy 2.0 and it is parked about 95 per cent of the time.
- \* *Households need a fair go on the grid for solar, batteries and EVs:* Australia's 20 million vehicles will eventually be a battery 6 times larger than the Snowy Hydro project.
- \* ARENA (Australian Renewable Energy Agency) quantified this in three ways:
  - \* *EVs can deliver huge amount of low cost storage for wind and solar* - total storage requirements for the NEM (National Electricity Market) in 2050 = ~ 640GWh, while Australia's EV fleet would have 4x that capacity
  - \* *Opportunities and Challenges for Bi-directional Charging in Australia.* Australia's EV fleet could become the nation's biggest electricity storage opportunity in the next decade and could save consumers more than \$6000 on the cost of charging
  - \* *Australian EVs could earn \$12,000 in a single year with vehicle-to-grid tech:* a fleet of EVs used to supply Frequency Control Ancillary Services (FCAS) to the National Energy Market (NEM) could generate revenue of up to \$12,000 per vehicle in a single year.
- \* An equivalent international analysis - *EVs could provide entire global short-term grid storage needs by 2030* - a participation rate of just 12 to 43% would provide the entire short-term capacity needed globally. The authors, from Leiden University in the Netherlands and the National Renewable Energy Lab in the US, stressed their estimates were a conservative lower bound of future opportunities.

## (iii) Discharging - V2L, V2H, V2G

The marginal cost of accessing such EV capacity, based on an incremental cost of purchasing DC-AC Electric Vehicle Supply Equipment (EVSE), is low. But current EVSE is expensive and has limited functionality. However progress is being made towards the required Smart Chargers, dubbed Vehicle to X, at three levels:

- \* vehicle-to-load (V2L) where a car runs appliances in or out of the home
- \* vehicle-to-home. (V2H) in which cars power a house or building
- \* vehicle-to-grid. (V2G) in which cars export power back into the energy network

An increasing number of EVs now come with V2L, but V2G at present is only for dedicated and enthusiastic early adopters. They need a V2G-capable EV, an expensive bidirectional charger and permission to connect that charger to the grid.

The Nissan Leaf Gen 2 is the only commonly used full EV that can do it, while V2G is only approved for consumer use so far in South Australia's Power Network.

More than 170 V2G trials have been held worldwide, including two in Australia: one in Canberra using 51 Nissan Leaf vehicles, and another at Flinders University in Adelaide. The latter involves 10 public chargers that can use car batteries to power the campus: *Australia's biggest vehicle-to-grid charging station opened to back up wind and solar*. That trial is part of a government-private program to deliver around 140 Smart EV charging bays across a mixture of public and commercial fleet sites around the state.

A truly Smart charger can talk to the grid/have the grid talk to it in ways that negotiate the best time to charge and discharge and at what rate best suits the real-time power situation. This will avoid or minimise building additional power generation to meet peak demands, as well as soaking up the excess capacity at windy and/or sunny times.

The ACT's Evo Energy (which ran the V2G trial with Nissan Leafs) sees bi-directional charging as the ability to turn EVs into an asset rather than a liability.

Octopus Energy, partly owned by Australia's Origin Energy, launched the UK's first vehicle-to-grid tariff *Costs down, resilience up. First vehicle-to-grid tariff to save drivers \$1,640 per year*. It offers free charging for EVs if the customer allows Octopus to use their EV battery for exporting electricity back to the grid during peak demand hours: Octopus's smart tariff platform - Kraken - uses advanced data and machine learning to enable the new V2G tariff. That discharging tariff may be coming to Australia in time, since Origin is already trialling different EV charging tariffs, as mentioned above.

**To conclude, ARENA suggests that National EV policy should signal that we value V2G and V2H as a near term priority for industry development and we should set out a V2G vision in our National EV Strategy.**

#### **(iv) Standards for V2G**

Australian regulators have to agree a standard way to achieve back and forth communication between a car charger and the grid. Until then a smart charger wouldn't do anything than act in a smart-ish way. V2H requires a smart-ish unit as it does not require the grid to 'talk' to it, but it does need to sense the grid is there if it is do its work to switch-over to the car battery should the grid go off-line.

V2G on the other hand needs really high level smart-charger capability to talk and respond to grid commands. Some distribution networks (DNSPs) are pushing hard for standards that encourage smart charging infrastructure, and even for registers of EV chargers, citing Norway as a guide to how to encourage the purchase of smart chargers with discounts.

The CCS2 charge plug is fitted to virtually all new battery electric vehicles in Australia, and the group developing that CCS system is looking at how V2G will work. Trial units are being tested overseas.

The Electric Vehicle Council, Energy Networks, Car Manufacturers and Hardware Suppliers are working on a new AS/NZS4777 standard: *Inverter standards revised in big deal for solar and vehicle-to-grid technology*. This calls for public comment by March 2024. The expectation is that all states and territories will adopt the new version of the standard in their regulations, which will mean by 2025 V2G will no longer be limited to South Australia.

The International automotive standards organisation in January 2024 adopted key new V2G capabilities into its SAE J3068 - *EVs are one step closer to becoming roaming grid batteries in the US*

## **(v) Car manufacturers**

The third element of the framework for V2G is encouraging more car manufacturers to support smart charging and provide it in more cars. Many car makers offer a basic V2L facility via a power point in the car that can power tools and appliances. V2H is the next step. German automotive giant Volkswagen announced - *VW rolls out bi-directional V2H charging to turn its EVs into batteries on wheels* - that its all-electric ID family of cars will be one of the first to offer V2H through the CCS DC charging standard. It is already rolling out a trial at a Swedish farm that is being transformed into a sustainable housing development.

Two car brands offer V2G features in Australia – Nissan and Mitsubishi – though more manufacturers have announced support for the technology and plans to deliver it in future models. They include Polestar, Cupra, Audi, Volkswagen, Skoda and Kia, according to ARENA's report and, since that report's release, another three car makers have announced their support. This trend will continue and Australia should start seeing significant numbers of V2G-capable electric cars from a wider range of manufacturers in 2024.

Some manufacturers may limit V2H/V2G use to a set number of hours per year or have it count towards the battery pack's km warranty limit. Others may decide it's insignificant and let you V2H/V2G as much as you like. Bear in mind that the wear and tear on an EV battery back steadily discharging at ~7kW will be far less than releasing the same amount of energy at constantly varying higher and lower power levels on the road. Some manufacturers might not allow their vehicles to be used for V2H/V2G at all, but for the public choosing an EV with V2H/G may very well become the 'must-have' feature in future EV purchases.

V2H may become established first. V2H can certainly potentially substitute for home batteries as EVs have some 5 times the capacity of home batteries, only a small fraction of which is used in most commuting and average daily driving.

The major potential, however, is in V2G. Once EV owners and consumers generally are motivated to undertake energy intensive activities at times when excess solar energy is available and use/export their stored energy at peak demand times, then less battery storage and less grid infrastructure are required.

**In conclusion, as Evo Energy observes: with all these technologies evolving over the next few years, the proliferation of batteries, general storage and V2G, what does the grid need to look like to be able to manage that?**

The next sections cover the electricity system and the regulatory and operational changes required.

## Section 2 ELECTRICITY SYSTEM Traditional->Consumers->Localised

### (i) Traditional Operation

The electricity system system developed as a few large scale, relatively remote fossil-fuel generators connected to long distance transmission lines, then distribution poles and wires to substations and consumers. That model is evolving with Renewable Energy Zones (REZs). REZs still involve relatively small numbers of moderately large scale solar and wind farms, many still distant from the major markets. Thousands of km of new transmission lines are necessary, adding to social licence issues, aiding political opposition and polarising communities.

The original electricity system was largely government-owned and vertically integrated. Privatisation for revenue-raising and competition purposes has led to the present system comprising electricity generators, transmission networks (TNSPs), distribution networks (DNSPs) and electricity retailers.

### (ii) Traditional Market Control & Regulation

The national energy market began operating in 1998. The Energy National Cabinet Reform Committee (ENCRC) then created a new governance structure designed to deliver effective competition, to provide (in theory) clear accountabilities and to support investment certainty in the energy sector by separating decisions on government policy, energy regulation and energy system operation. This comprises AER and AEMC (both 2005) and AEMO (2009) with roles outlined below:

#### Market body roles



#### Australian Energy Market Commission

Rule maker, market developer and expert adviser to governments

*Protects consumers and achieves the right trade-off between cost, reliability and security.*



#### Australian Energy Regulator

Economic regulation and rules compliance

*Polices the system and monitors the market.*



#### Australian Energy Market Operator

Electricity and gas systems and market operator

*Works with industry to keep the lights on.*

Each market body is **theoretically** an independent decision-maker with clear powers, functions and accountabilities that **supposedly** support the efficient operation of the market in the long-term interests of consumers.



### (iii) Consumer Energy

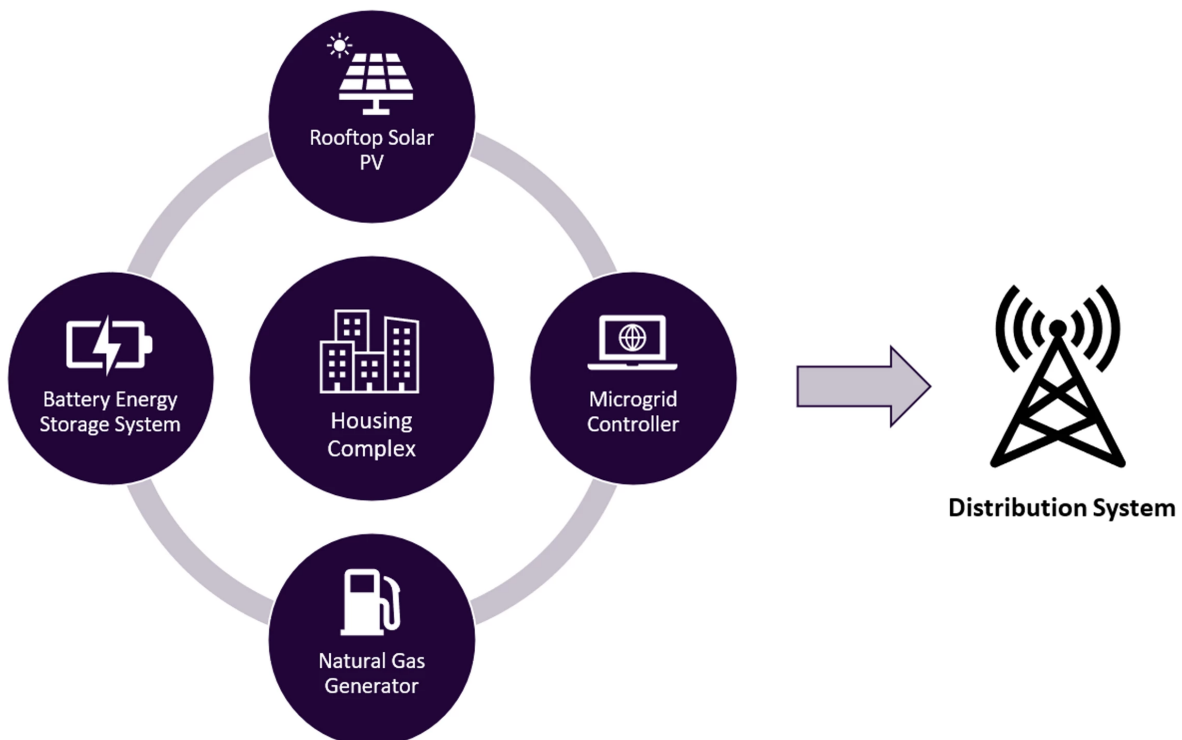
Consumer Energy and collective Community Energy expanded in tandem with the growth of rooftop solar, then evolved to include batteries as storage of solar became necessary. The recent Home Electrification thrust was catalysed by EVs because of the major energy, emissions and cost savings that these offered.

The Terms of Reference for this inquiry use the descriptor Consumer Energy Technologies. The technical descriptor Distributed Energy Resources (DER) has been more common. Notably, the Energy Consumers Association (ECA) ended its use of DER and replaced it with the broader term Consumer Energy Resources (CER). The background to that is in: *Death to DER? Why we need to change the language we use for the energy transition.* May 2022 The bECAuse Blog.

Recently, CER became “official” terminology: at the November 2023 Energy and Climate Change Ministerial Council (ECMC) Meeting, ministers agreed to develop a *National Consumer Energy Resources (CER) Roadmap – Powering Decarbonised Homes and Communities*. Ministers also agreed to consider implementation of a national approach to technical regulatory settings for CER.

### (iv) Consumer Energy within Traditional Electricity System

With the rapid growth of rooftop solar, interfacing with the existing electricity system has become increasingly problematic. However, parts of that system, notably the DNSPs, have at least adapted to community energy projects - microgrids - for remote communities or those at the end of distribution lines or where such lines are exposed to bushfires.



Microgrids also feature across universities, shopping complexes, data centres and other commercial entities. Potentially large Home Electrification projects, covering suburbs like 2515 in

NSW and 3068 in Victoria, involve substantial links to the local distribution network. *Australian Renewable-Energy Microgrids: a Humble Past, a Turbulent Present, a Propitious Future* confirms that microgrids are emerging as autonomous energy networks - an attractive mechanism for the delivery of electricity to end users.

**To conclude, Consumer Energy Resources (CER) - rooftop solar, home batteries, home electrification, EVs, consumer and community energy, microgrids and local power - should and will become an even larger part of the future electricity system.**

The next section covers the long-standing market operation and regulatory issues that have impeded CER progress and stymied the potential. And changes required to reverse this.

## Section 3 MARKET and REGULATORY

### (i) Historical

To repeat, each market body is **theoretically** an independent decision-maker with clear powers, functions and accountabilities that **supposedly** support the efficient operation of the market in the long-term interests of consumers. The Australian National Electricity Market (NEM) rules define the roles and responsibilities of the market bodies, what commodities are traded, how and by whom. Since the market reforms, privatisation, and “competition” in the 1990s, the price of electricity has skyrocketed. Interestingly, the Energy Security Board (ESB) was created in 2017 to implement the recommendations from the Independent Review into the Future Security of the National Electricity Market (Finkel Review). ESB comprised a Chair, Deputy Chair and senior leaders of AEMC, AER, AEMO. Yet, in May 2023 Ministers disbanded the ESB for reasons well illustrated by *“Not fit for purpose.” After coal-keeper and solar-stopper, energy ministers axe ESB.*

Ministers replaced ESB with an Energy Advisory Panel (EAP) consisting of the heads of the AEMC, AER, AEMO and an ACCC commissioner. That ACCC (Australian Competition and Consumer Commission) recently found price gouging, including by the three large entities (Origin, AGL, Energy Australia) that are both generators and retailers and have considerable market power.

Belatedly, the “dying act” of the ESB was an 84 page report Consumer Energy Resources and the Transformation of the NEM. It says (or rather finally admits) that with consumer appetite for rooftop solar increasing, uptake of electric vehicles exceeding forecasts, and home electrification gaining traction, policy governing consumer energy resources, or CER, is “at a critical juncture.” Then: “it is timely for CER integration to progress from a demonstration and incubation phase to a reform design, delivery and implementation phase”. To this end ESB sets out Critical priorities to support transformation: a call to action and recommends a CER taskforce mandated with clear terms of reference to drive outcomes over a 12 month period.

The energy ministers (ECMC) meeting in November 2023, no doubt considered the draft ESB final report. And decided accordingly to place more emphasis on CER.

Subsequent reactions varied: *Ministers put consumer energy on agenda. Is this a turning point or Groundhog Day?* Observations included:

- \* while many of the ideas raised at the ministers meeting were not new, the weight given to CER (including EVs) was an important first
- \* the first time energy ministers have directly addressed the DER/CER space and recognised the importance of the multi-billion dollar private investment in what is now the largest electricity generation capacity in the country
- \* CER has been given only cursory attention with the AEMO still seeing it as a problem to be managed and not an integral part with which it must be engaged

That ministerial-level recognition of EVs and CER flows on to the present inquiry and its terms of reference. The above comments about these getting “cursory attention” and being “a problem” are mirrored by the Energy Consumers Association (ECA). Their 2022 statement, linked to the change from DER to CER, was that the electricity system has been seeing CER as a messy, cacophonous chorus of voices, a problem, a risk and even an annoyance — compared to the simple, centralised system of yesteryear.

But if these resources are seen as a problem for the system, they are also its best chance of a solution. The future energy system we need – one in which electricity is clean, affordable and abundant — cannot be delivered if consumers and their resources are not playing their part.

**ECA concluded the changes required involved Re-Imagination, not just Integration. This is implicit in the sub-sections that follow.**

## (ii) Barriers - General

- \* The NEM rules, that define the roles and responsibilities of the market bodies, were intended for the old electricity and gas systems
- \* These bodies and regulators adhere to traditional ways, at best evolving slowly one rule at a time towards a new system
- \* Consumers, their consumer energy resources and interests remain unrepresented
- \* Yet Australian households already generate much of their own electricity needs
- \* And excess rooftop solar is effectively resold to neighbours at the rate for the whole generation/transmission/distribution/retail system, indeed often with a “Greenpower” premium on top; thus solar exports that attract ~5c/kWh are sold at ~40c/kWh
- \* Plus Australia’s EV’s are rapidly growing towards massive unused battery capacity
- \* So households and vehicles are major national energy infrastructure that would increase reliability and resilience and lower costs
- \* Yet dumb rules remain eg solar export limiting and even switch-off; another allows gas companies to charge customers for disconnecting from their gas network.

## (iii) Solutions - General

- \* Electrification is the fastest, cheapest way to lower energy bills and eliminate fossil fuels
- \* Install the largest rooftop installations as widely as possible including public, commercial, industrial buildings, car parks etc
- \* Allow consumers with solar panels, batteries and electric vehicles (CER) to trade electricity with each other - that will level the playing field between them and the NEM-defined energy companies
- \* More locally produced energy will also reduce the need for expensive, large scale regional transmission infrastructure.
- \* CER can act like a “Swiss Army Knife” for the grid, what economists call the value stack of available revenue sources (from Kuiper, Institute for Energy Economics and Financial Analysis)

## DER: The Swiss Army knife of the electricity system

DER can deliver multiple energy services with large economic benefits



**\$11bn<sup>1</sup>** in avoided networks costs

**\$8bn<sup>2</sup>** in reduced generation and storage costs

**\$10bn<sup>2</sup>** in reduced generator super profits

**Net present value to 2040**

1 Baringa Partners. Potential network benefits from more efficient DER integration. 18 June 2021.  
2 NERA Economic Consulting. Valuing Load Flexibility in the NEM. 1 February 2022.

- \* In essence, the grid should be democratic and fair, households should be incentivised to further progress CER, microgrids etc; and not pay high fees to the traditional players for their non-relevant infrastructure.
- \* The ACCC should be tasked with addressing the anti-competitive NEM market rules by AER and (see below) conflict-of-interest actions by the regulatory and operational entities.

#### **(iv) Barriers - NEM Market Operators and Regulators**

- \* The privatisation, competition, and reforms summarised above in sub-section (i), clearly did not work
- \* Market regulators continue to tinker at the edges of a market redesign
- \* Theoretically, generation, transmission, distribution and retailing are ring fenced by regulation, but the largest retailers (Origin, AGL, and Energy Australia) are also generators and have considerable market power; as mentioned above, the ACCC confirmed price gouging
- \* Furthermore, most generation, transmission, distribution and retail companies usually have overseas shareholders, sometimes majority or even wholly owned; they are responsible to shareholders, not to customers.
- \* AEMO's regulated business model means they need to raise income from market transactions; operators and regulators are 40% funded by the companies that dominate the market. Households are excluded, which is anti-competitive and a fundamental conflict of interest situation.
- \* After leaving the ESB, Dr Gabrielle Kuiper published detailed critiques such as:
  - \* *We have wasted years trying to set standards for Distributed Energy* and
  - \* *Solar switch off - how AEMO took control of rooftop solar and why it did not need to*

These chronicle the long history of AEMO's approach to the rise of rooftop solar detailing the lack of transparency and accountability where "AEMO is acting as judge and jury and having state bodies act as executioner through blunt solar cut-offs"

- \* Recent AEMO outputs:
  - # Integrating Energy Storage Systems project (2023) - a monster 591-page rule change that was not well received
  - # Draft 2024 Integrated System Plan by AEMO does capture significant changes in CER, but still treats them as an input to the model rather than an investment choice. And it provides no discussion about how Australian homes and businesses might reorganise their collective demands on the system to make the best use of variable sun and wind.
- \* AEMC's latest (Feb 2024) draft rule change considers new arrangements to allow customers to have their CER separately metered and managed from their "passive" loads, like lights and fridges. It is supposedly about making it easier for CER "to be identified and managed separately", thus helping to deliver reliability and security as well as emissions reduction and reduced costs for all consumers.
- \* To the contrary, *Power to the people? Critics say new rule that affects EVs and home batteries misses mark* points out the limitations:
  - # The vital change that could unlock the potential of CER is missing
  - # the door will only be open to one retailer per household, and be closed to competition for some time to come
  - # CER provide the real opportunity to open up competition - but the regulator has said no to increased competition [for households] at this point.

- \* Another critique describes that AEMC draft rule change as: *Policy patch on a leaking ship*. Rewiring Australia, points out that as far back as 2018, the AEMC received the Wholesale Demand Response Mechanism (WDRM) rule change request to deliver the **original design objective for the NEM**, which was that demand and supply would be equivalent. **Still nothing has happened!**
- \* Yet, the demand response rule was recently endorsed by ACCC chair Rod Sims precisely because it allowed competition to sell into the market in a simple mechanism that was easy to understand.

## (v) Solutions - NEM Market Operators and Regulators

**The numerous Barriers listed require serious reform: —> a clean sheet redesign centred around household electrification, rooftop and community solar and EVs is required.**

- \* Vested interests in control of market rules and operation should be halted altogether, at least counterbalanced by households and businesses and their distributed assets (CER) having representation on the Board of AEMO.
- \* AEMO's own Project Edge highlighted that over \$5 billion could be saved if we coordinate the solar, batteries, electric vehicles and energy uses like hot water that are distributed throughout our system.
- \* So AEMO needs to step up its CER game and show consumers and industry that it has smart tools with benefits for consumers like dynamic operating envelopes (DOEs) and the overall flexible demand response capability of CER

## (vi) Barriers and Solutions - Distribution Networks (DNSPs)

- \* The highest of the six priorities in the “dying act” ESB report was to define what role distribution network service providers (DNSPs) will play in a high CER environment, noting that the capabilities and accountability of DNSPs are critical to integrating CER, but currently hampered by “fundamental limitations” in existing regulatory and investment frameworks.
- \* This is disingenuous given that the ESB, made up of the regulatory bodies and their centralist principles, were a major reason for the limitations on DNSPs.
- \* The associated ESB priority about identifying “the capabilities and the interfaces” (of DNSPs) with AEMO and other industry participants seems particularly presumptuous, as the three components of the former ESB (AEMO, AEMC, AER) continue to exist unchanged
- \* DNSPs have actually been the more flexible and adaptable of all these NEM entities, prominent in trials of
  - # Community Batteries
  - # EV charging
  - # EV discharging (V2G and standards)
  - # community energy and microgrids.
- \* DNSPs have also successfully trialled conventional hot water heaters as a sink for excess solar energy by shifting “controlled load” times from overnight to the middle of the day. The barrier to nationwide implementation of this simple and effective approach apparently lies with the retailers, not the DNSPs.
- \* Projects Edge, Edith and Symphony were actually funded by ARENA to encourage the network businesses to learn how to coordinate household equipment in preference to limiting rooftop solar or requiring expensive network upgrades. If anything is happening it is too slow.



- \* Thus the ESB Report priority Requiring distributors to integrate solar is a belated “no-brainer”. But under the current rules, the intervention options available to the DNSPs remain limited. Perversely, this delivers expensive network augmentation options over cheaper, faster non-network options such as demand flexibility. Even if regulators did review such perverse incentives it can be up to five years before the regulatory reset.
- \* Therefore change the rules and the regulatory environment, and DNSPs could be incentivised to procure demand flexibility instead.
- \* Clearly, the ESB’s final recommendations **still fall well short of governance and competition reset that is required**. The electricity market was set up before low-cost solar was available and is no longer fit for purpose. It needs policy redesign by governments, not tweaking by regulators to ensure the NEM is re-balanced towards the demand side.
- \* The DNSPs are the key to this, with economic reform, a new vision and the efficient carrots and sticks.
- \* For example Essential Energy, which covers 95% of the land area of NSW, said in *Cheaper and quicker: Distributed networks put case to host wind and solar*: the switch to wind and solar and away from coal is being unnecessarily slowed down because local networks are being bypassed by the focus renewable energy zones and existing or new transmission lines.

One of us, with decades of DNSP experience at Endeavour Energy, adds specific points:

- \* Concerns that local electricity networks are at or approaching some sort of ‘saturation point’, past which large volumes of capital investment in network assets will be required to facilitate further home electrification are as inaccurate as claims that little to no new network investment will be needed
- \* Opportunities exist to allow monopoly service providers to access new revenue streams which will offset capital and operating cost increases resulting from home electrification
- \* One underlying motivator for network companies is the desire to ‘lock in’ their relationship with customers and fill the emerging role of Distribution System Operator (DSO). As CER becomes more prevalent, a local network operator (as opposed to a local asset manager) who dispatches energy and manages power flows on the local level becomes more necessary.
- \* This function has not been needed in the past when energy flows were basically one-way, it is needed now.
- \* The DSO function could be delivered by DNSPs within their existing supply areas
- \* The DSO function may be best ‘ring fenced’ outside of regulated business operations and placed into a more market-oriented business structure.
- \* Adopting an approach similar to OFGEM in the UK, who have granted permission for DNSP monopoly businesses, within appropriate guidelines, to operate dynamic voltage control services within energy markets, thereby reducing the overall cost burden on traditional monopoly network service charges to end use consumers.
- \* The establishment of entirely new entities such as community battery operators, able to offer contract services to both DNSP’s and retailers, would assist in addressing energy inequities within the NEM.

## Section 4 CONCLUSIONS

The still ongoing history of the NEM - rules, regulators and operators - suggests a rapid review of NEM governance arrangements is needed to support smarter CER integration and to ensure Australia reaches 82% renewables by 2030.

The November 2023 Energy and Climate Change Ministerial Council (ECMC) Meeting, as well as developing a National CER Roadmap ministers agreed to “give consideration to implementing a national approach to technical regulatory settings for consumer energy resources in 2024;” and to progress reforms in a way that boosts energy affordability for all, and that boosts EV uptake. The ministers also agreed upon the appointment of an expert taskforce to deliver priorities under the Roadmap.

**The present inquiry should analyse these, bearing in mind the above history and barriers. What is needed should include:**

- \* **A governance and competition review of the NEM and its ability to deliver the energy transition at least cost to energy users, including placing consumers in governance roles in all regulatory bodies.**
- \* **“Household-centred rules” of the market to improve take-up of CER, of overall zero-emission all-electric households, then of**
- \* **Community “flagship” projects that prototype this future in real Australian shires and suburbs.**

**Thereby balance the investment and focus in Renewable Energy Zones (REZs) towards ‘Community Energy Zones’ (CEZs) with EV batteries as a major component.**

---