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The Time is Now

Getting smarter with the grid

6 August 2024

An introduction from Energy Networks Australia

'The Time is Now' report shows that we can get smarter with how we use the local distribution grid and that, if we get the settings right, we can unlock and enable more benefits for customers.

Energy Networks Australia (ENA) has worked closely with L.E.K. to model what levers could be pulled on the distribution grid to support the decarbonisation of the electricity system and provide cleaner and cheaper energy solutions for all customers.

Australia is already working hard to deliver the large-scale renewable generation projects and transmission infrastructure that we need to transform the grid, and we must not lose focus on that. Nevertheless, this report shows that there are more levers we can and should pull now at a local level to help secure our renewable energy targets and reduce bills for customers.

L.E.K.'s 'whole of energy' system modelling shows that we have a window of opportunity now to empower distribution networks to take on more of the heavy lifting in the energy transition. By implementing the changes recommended in this report, customers could save around $160 per year, and we would collectively avoid $7 billion in overall system costs in 2030 alone. Importantly, this will also propel Australia towards securing its target of 82% renewable energy by 2030.

Increasing local grid generation and storage and plugging in more EV infrastructure directly to existing electricity assets like power poles, can lead to savings for all customers, enabling a smarter, more responsive local distribution grid. The report projects that the right policy and regulatory settings could unlock at least 5 GW of additional rooftop solar, 7 GW of additional front-of-meter generation by 2030 and 5 GW of additional distribution-connected battery storage, alongside enabling at least 4 million EV's on the road by 2030.

The time is now to change the way we think of the distribution grid, what we ask of it and the types of services it can provide customers. We must:

1. Allow distribution networks to establish and operate local energy hubs for all the community to benefit from.

2. Better utilise the extra capacity of batteries connected directly to the local grid and get more of them connected now, making sure all customers benefit.

3. Provide incentives for commercial operators to install more solar panels on existing rooftops and share it with the local community.

4. Classify kerbside EV chargers as a distribution service to put more chargers in more places and improve equitable access to charging while reducing range anxiety.

5. Sync resources to the grid in a coordinated and flexible way so that the benefits can be shared with the community.

The local grid customers need today, and beyond, is more than just its poles and wires. By implementing these recommendations, we can harness the full potential of our energy resources and deliver benefits to customers.

Dom van den Berg
CEO
Energy Networks Australia

"The distribution grid is under-utilised. It can do more of the heavy lifting. The time is now"

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An introduction from L.E.K. Consulting

The task to decarbonise our electricity sector is immense. Australia has set ambitious targets for emissions reduction in the electricity sector by 2030, including our national target of 82% renewables by 2030, and state-based targets with similar ambitions.

To achieve an orderly transition and continue to deliver for energy consumers, we need to be pulling every lever at our disposal.

To date, however, energy resources connected to electricity distribution networks (including Consumer Energy Resources, “CER”) have often been ascribed a static role in energy transition plans, but there is latent capacity in the distribution grid and the supporting industries to play a more significant role and deliver benefit to customers.

On behalf of ENA, L.E.K. has modelled an ‘All Levers Pulled’ scenario. This scenario combines multiple modelled changes to the way we use and operate the distribution grid that optimises what it can deliver for energy consumers. It is a more ambitious, optimised and dynamic role for the existing distribution grid and shows that we can do more at this level to achieving our targets and bringing down costs.

Our analysis has taken a whole of energy system perspective that includes not only electricity wholesale and network costs, but also the costs borne by consumers themselves when they invest in behind-the-meter CER resources like rooftop solar, batteries or electric vehicles. It also includes consumer fuel costs such as gas and petrol consumption. By taking this holistic approach we can properly quantify the benefits to customers and the energy system from CER investments, and we can also see how small, targeted investments in the distribution grid can yield large overall benefits for the energy system.

The modelling shows that the distribution grid can yield big overall returns including $7 billion of annual benefits to consumers in 2030 by enabling distribution-connected resources to play a more significant role in the energy transition. This would allow the energy system to still deliver the consumer cost benefits and emissions reductions that are built into the current energy transition plans in the event that the build of large-scale generation is prolonged.

This report also describes a series of pragmatic, near term actions that can be taken by the electricity industry, and by governments, policymakers, and regulators, to unlock this opportunity in the near term and set our energy system on the path to an optimised result by 2030.

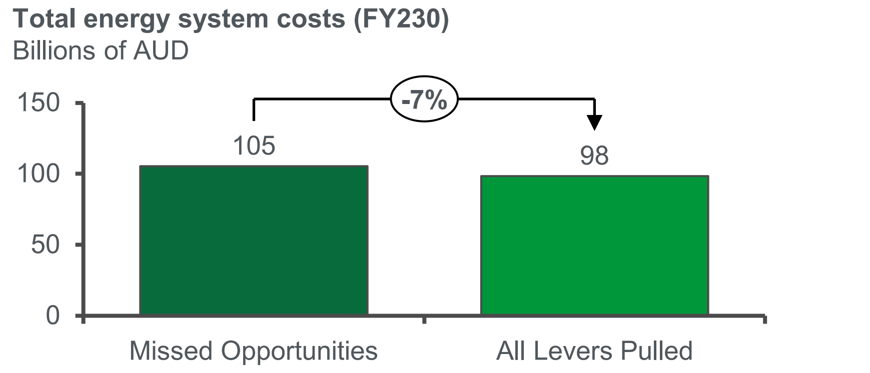
Jeff Forrest
Partner
L.E.K. Consulting

This report was prepared by L.E.K. Consulting Partners Jeff Forrest, Alastair Phillips, and Tim McGrath. L.E.K. would like to thank Franklin Liu and the team at Endgame Economics, Zubin Meher-Homji at Dynamic Analysis, Caroline Taylor, the ENA and its member organisations, and the L.E.K. team (Jessica Chow, Ross Dunbar, Joyce Fang, Emily Sheehan, and Jack Ma) for their assistance in preparing this report.

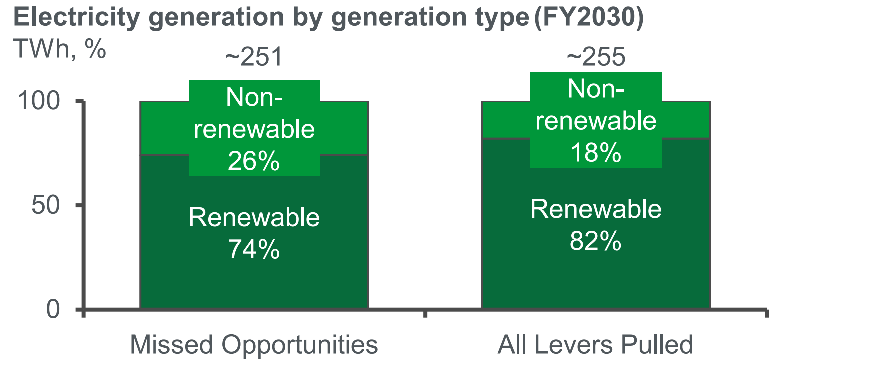
Executive Summary: Leveraging the distribution grid to assist the energy transition can deliver $7 billion in consumer benefits per year by 2030

- Australia has set ambitious targets for the decarbonisation of its electricity sector by 2030, both nationally and at state levels. There are immediate opportunities to deliver benefits to customers by pulling targeted levers in our distribution grid.
- L.E.K. has modelled an 'All Levers Pulled' scenario, which can deliver $7 billion of annual benefits to consumers by 2030 through distribution-connected resources playing a more significant role in the energy transition. This would allow the energy system to still deliver the consumer cost benefits and emissions reductions that are built into the current energy transition plans[1] in the event that the build of large-scale generation is prolonged.
- Our modelling includes a range of energy consumer archetypes: with and without rooftop solar, with and without a home battery, with and without an electric vehicle. All consumer types are better off under the All Levers Pulled scenario compared to the alternative 'Missed Opportunities' scenario (which shows the likely costs of a prolonged energy transition). Many customers will also see a 'step change' in energy cost reductions when they invest in rooftop solar or an electric vehicle.
- A typical energy consuming household (one that is grid connected, without rooftop solar, without an electric vehicle, and with a mix of electricity and gas as their home fuel sources) is $160 a year better off in 2030 under the All Levers Pulled scenario.
- This 7% reduction in energy system costs compared to the Missed Opportunities scenario can be delivered by 2030, while also securing the delivery of the national 82% renewables by 2030 policy target, and without compromising electricity system reliability.
- Delivering these benefits is achievable with the assets, workforce, and resources we have today, but it will require us to both **unlock the grid we have**, and **enable it to do what customers need**.

Reduces total energy system costs by $7 billion per year by 2030



Secures the delivery of 82% renewables by 2030



Note: 1 The All Levers Pulled scenario delivers 82% renewables by 2030 for the National Electricity Market, while providing the same consumer cost outcome as the 2024 ISP Step Change scenario
Source: Endgame Economics; Dynamic Analysis; L.E.K. research and analysis

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Executive Summary: Getting smarter with the grid by unlocking what we have and enabling what customers need

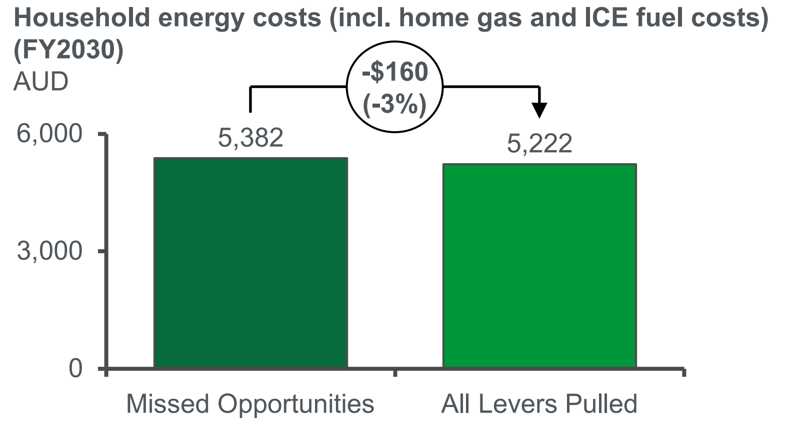
- Our All Levers Pulled scenario combines multiple changes that are beneficial for energy consumers in a way that complement each other, and includes:
  - 7 GW of additional ‘community generation’ by 2030**
  - 5 GW of additional Rooftop Solar by 2030**
  - 5 GW of additional distribution-connected battery storage by 2030**
  - 1 million more EVs on the road by 2030**
  - Coordination of consumer energy resources
- We can take action now to benefit all customers if we get smarter with how we use the distribution grid by:

  Unlocking the grid we have
  - Link ‘Local Energy Hubs’ to incentivise the connection of community generation to under-utilised parts of the network
  - Amplify the untapped opportunity of rooftop solar, providing incentives and a simpler connection path to unlock additional rooftop solar capacity

  Enabling the grid to do what customers need
  - Soak up surplus solar by facilitating the rapid roll out of front-of-meter batteries connected to distribution networks, helping to close the ‘storage gap’
  - Plug in more EV chargers on existing distribution assets (poles) to support an accelerated EV uptake and address customers’ range anxiety

  Underpinning all this is the need to ensure we sync consumer energy resources to the grid in a coordinated and flexible way so that the benefits can be shared.
- By taking these targeted actions, customers can save around $160 per year, and we can get Australia on track to hit our 82% goal by 2030.

Reduces energy costs for a typical* residential consumer by $160 in 2030



Note: * Based on a customer who is fully connected to the grid, does not have a solar system, battery or EV, and still uses a mix of electrical and gas assets in their home
** Compared to the 2024 ISP Step Change scenario

Source: Endgame Economics; Dynamic Analysis; L.E.K. research and analysis

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Recommendations: This report recommends we implement a suite of practical actions to unlock the potential of distributed resources

The $7 billion in annual benefits by 2030 that are demonstrated by the All Levers Pulled scenario can be unlocked by a set of targeted, pragmatic actions. Steps can be taken to enact these immediately (in the next 12 months) to set our energy system on the path to an optimised result by 2030.

Action Theme / Headline

Link Local Energy Hubs

- Align the treatment of connection costs between transmission and distribution to remove the disincentive for renewables to connect to local energy hubs
- Create a regulatory pathway that allows investments to create network capacity in local energy hubs

Amplify Untapped Solar

- Introduce an incentive scheme for larger scale C&I rooftop solar to facilitate investment above self-consumption and share it with the local community
- Expand existing programs to provide low-cost, CER financing options for renters and customers with poor access to capital

Soak up Surplus Solar

- Introduce an AER class waiver to allow distributors to share battery capacity with third parties, enabling customers to benefit from the full battery value stack
- Amend regulatory valuation methods to recognise the time-shifting ability of batteries to release customers' solar when it's most valuable

Plug in more EV Chargers

- Classify EV charging infrastructure as a 'distribution service' in our regulatory framework, so distributors' existing poles and skilled workforce can be leveraged to provide a base level of community charging

Sync with the Grid

- Implement consistent role definitions, backed by technical standards and consistent policies, to drive the formation of the partnerships, markets and incentives needed to ensure coordination of consumer energy resources

Enabling Initiatives

Greater Regulatory Flexibility

Enable greater flexibility within a 5-year determination period – could include flexibility for annual tariff changes, improved expenditure adjustment mechanisms, and a role for early, enabling, and efficient 'anticipatory' grid investment

Review inclusion of Distribution in the ISP

Work with AEMO to consider the range of options for contribution of distribution networks in the 2026 ISP, and to co-optimise between large scale and small scale in developing an optimal development pathway

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Our optimised ‘All Levers Pulled’ scenario deploys a series of complementary system changes to deliver benefits for energy consumers

The All Levers Pulled scenario

To calculate the net benefits for customers of a more optimised role for distribution-connected resources[1], we have developed an ‘All Levers Pulled’ scenario for the energy system in the National Electricity Market (NEM)[2]. We developed this scenario by first modelling a range of potential ‘system changes’ in isolation, and then selecting those that had the highest benefit for consumers. **Our All Levers Pulled scenario combines multiple changes that are beneficial for energy consumers in a way that complement each other and present an overall vision for an energy system with a more ambitious but optimised role for the distribution grid**. In this scenario the following changes are made across the NEM by 2030 (compared to the 2024 ISP Step Change scenario):

7 GW of additional ‘community generation’ by 2030, consisting of smaller scale renewable generation plants connected to the distribution grid, and designed to utilise available capacity at the sub-transmission level on these networks

5 GW of additional Rooftop Solar by 2030 installed on commercial & industrial facilities with available rooftop capacity, and on residential premises (with a focus on rental properties and low-income households)

5 GW of distribution-connected battery storage by 2030 installed by utilising existing land and connection points available on distribution networks, and made available to customers via distribution network and third-party partnerships

1M more EVs on the road by 2030, representing a scenario in which customers feel more confident buying an EV and the customer-driven tipping points for uptake of electrification of transport occurs faster than anticipated

Facilitate coordination of consumer energy resources, with a clear plan for how this can be achieved so that the consumer benefits of coordination can be secured

Notes: 1 We refer in this report to “distribution connected resources” to encompass both Consumer Energy Resources (CER) that are owned by consumers and connected behind the meter, as well as resources that are connected to the distribution network in front of the meter and which may include medium-sized batteries or generation plants. 2 Our system modelling is focused on the NEM, however the benefits we have identified apply equally to non-NEM electricity networks including the SWIS and NWIS in WA and the three regulated networks overseen by Power and Water Corp in the Northern Territory. The proposed system changes in the All Levers Pulled Scenario apply equally to these networks, as do a number of the proposed actions

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The All Levers Pulled scenario accelerates a transition that is already underway in Consumer Energy Resources

The All Levers Pulled scenario

	Today	2030 Trend*	*change*	2030 All Levers Pulled	Why increase?
Community Generation	4.4 GW	5.8 GW	*+7 GW*	**12.8 GW**	• There is network capacity available to host medium-scale generation today at low cost; added generation can be installed quickly and cheaply with low community disruption • All consumers are better off if this capacity is utilised, with total savings of $4 billion (or c.$200 per household) per year by 2030
Rooftop Solar	21 GW	36 GW	*+5 GW*	**41 GW**	• Consumers adopting rooftop solar save an average of $900 off their annual energy bills • Opening this benefit to more consumers (including renters, low-income households, and C&I customers) will improve energy equity • There is untapped capacity in the rooftop PV installation workforce
Distribution-connected Storage	<100 MW	1 GW	*+5 GW*	**6 GW**	• Batteries installed in the distribution grid are close to customers, can leverage existing land and workforces, and achieve 'coordination by design', resulting in maximum benefits • Batteries installed behind-the-meter require subsidies that are inequitable – the greatest benefits flow to the battery owner. Front-of-meter batteries benefit all energy consumers
Electric Vehicles	180,000	2,900,000	*+1.2 M*	**4,100,000**	• Customers switching to EVs see the largest benefits in terms of lower total energy costs, saving $2,000-3,000 in fuel costs per year • After exiting coal, one of the biggest opportunities for Australia to reduce emissions is in transport electrification
Coordination	Low	Low *(if no action taken)*	*Take action*	**High**	• Achieving coordination and ensuring consumer energy resources can respond to market conditions and signals can save consumers $0.5 billion per year by 2030, and avoid $37 billion of cumulative investments between 2030-2050

Note: * The 2030 Trend represents the Step Change scenario in the 2024 ISP

Source: AEMO; Endgame Economics; L.E.K. research and analysis

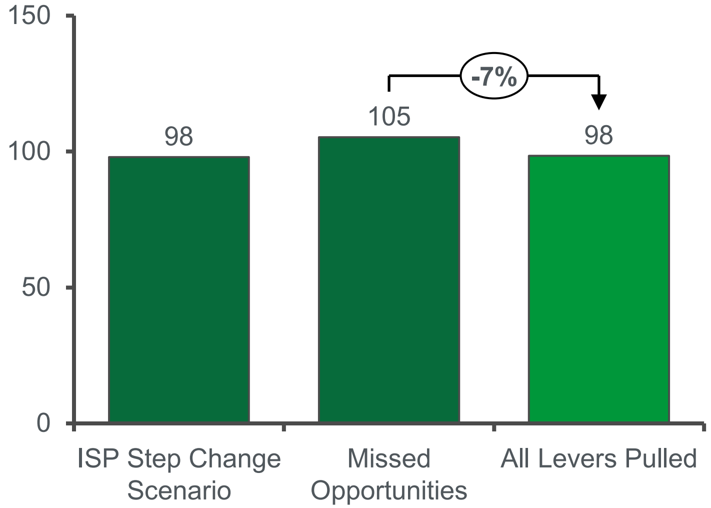
By 2030 this delivers a $160 p.a. reduction in total energy costs for a typical grid connected consumer, and secures delivery of the 82% renewable target relative to the Missed Opportunities scenario

The All Levers Pulled scenario

Aggregate outcomes of the All Levers Pulled scenario:

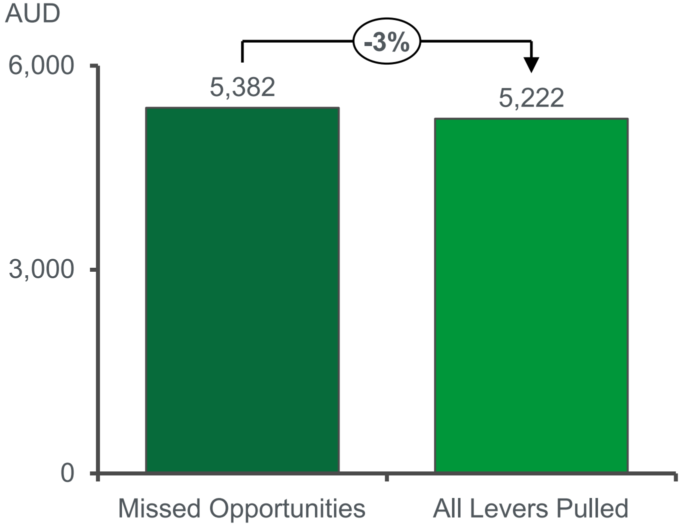
Reduces total energy system costs by $7 billion per year in 2030

Total energy system costs (FY2030)
Billions of AUD



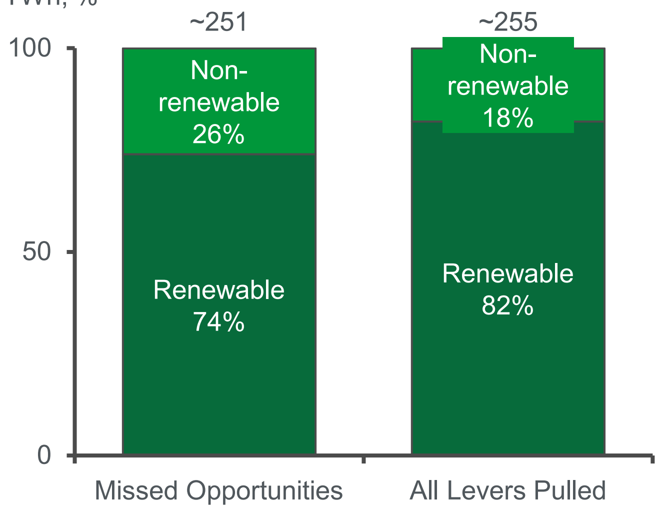
Reduces energy costs for a typical* residential consumer by $160 per year in 2030

Household energy costs (incl. home gas and ICE fuel costs) (FY2030)
AUD



Secures the delivery of 82% renewables by 2030

Electricity generation by generation type (FY2030)
TWh, %



As a comparison point for modelling purposes, we have prepared a 'Missed Opportunities' scenario. This scenario deploys large scale generation at rates consistent with the maximum levels achieved in Australia to date. This baseline represents an increasingly likely 'prolonged transition' for the broader energy system, and also demonstrates the customer benefits from seizing the opportunity for distribution networks to contribute to the desired outcomes of the energy system.

Note: * Based on a customer who is connected to the grid, does not have a solar system, battery or EV, and still uses a mix of electrical and gas assets in their home; does not include gas distribution costs
Source: Endgame Economics; Dynamic Analysis; L.E.K. research and analysis

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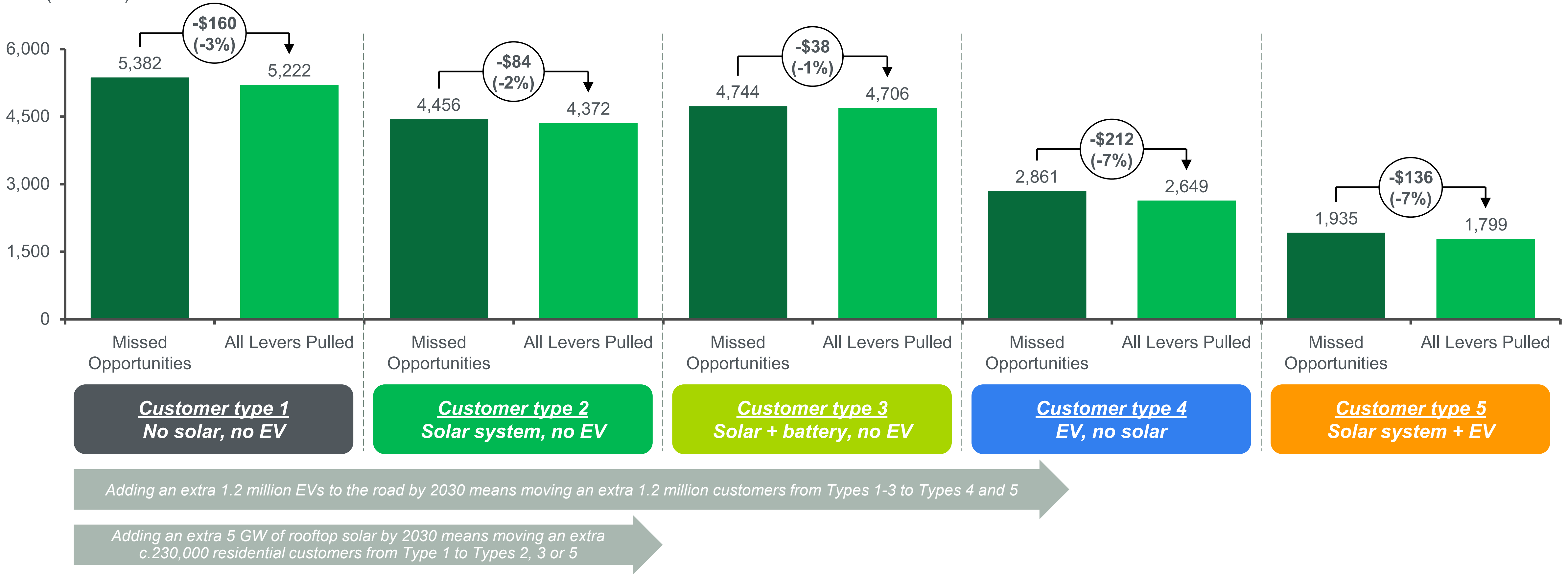
All customers are better off in FY2030 under the All Levers Pulled scenario when compared to the Missed Opportunities scenario

The All Levers Pulled scenario

Total customer energy costs [including vehicle fuel costs] by customer type* (FY2030)
AUD (2023 real)



Note: * Energy includes the cost of transport fuel, gas (excluding gas distribution costs) and electricity
Source: ABS; ACCC, CSIRO Gen Cost; Dynamic Analysis; Electric Vehicle Council; Endgame Economics; Energy.gov. Vic.gov, Redback Technologies, Solar Choice, L.E.K. analysis

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A suite of practical actions are needed to unlock the potential of distributed resources

Actions needed to unlock these opportunities

The $7 billion in annual consumer benefits by 2030 that are demonstrated by the All Levers Pulled scenario can be unlocked by a set of targeted, pragmatic actions. Steps can be taken to enact these actions immediately (in the next 12 months) to set our energy system on the path to an optimised result by 2030. We have grouped these actions into five themes, each representing a bundle of actions to unlock a specific set of outcomes. While each theme, or the individual actions within it, can be adopted alone, the full optimised benefits rely on all five themes working in concert with each other.

Action Theme / Headline

A Link Local Energy Hubs

- Align the treatment of connection costs between transmission and distribution to remove the disincentive for renewables to connect to local energy hubs
- Create a regulatory pathway that allows investments to create network capacity in local energy hubs

B Amplify Untapped Solar

- Introduce an incentive scheme for larger scale C&I rooftop solar to facilitate investment above self-consumption and sharing it with the local community
- Expand existing programs to provide low-cost, CER financing options for renters and customers with poor access to capital

C Soak up Surplus Solar

- Introduce an AER class waiver to allow distributors to share battery capacity with third parties, enabling customers to benefit from the full battery value stack
- Amend regulatory valuation methods to recognise the time-shifting ability of batteries to release customers' solar when it's most valuable

D Plug in more EV Chargers

- Classify EV charging infrastructure as a 'distribution service' in our regulatory framework, so distributors' existing poles and skilled workforce can be leveraged to provide a base level of community charging

E Sync with the Grid

- Implement consistent role definitions, backed by technical standards and consistent policies, to drive the formation of the partnerships, markets and incentives needed to ensure coordination of consumer energy resources

Enabling Initiatives

F Greater Regulatory Flexibility

Enable greater flexibility within a 5-year determination period – could include flexibility for annual tariff changes, improved expenditure adjustment mechanisms, and a role for early, enabling, and efficient 'anticipatory' grid investment

G Review inclusion of Distribution in the ISP

Work with AEMO to consider the range of options for contribution of distribution networks in the 2026 ISP, and to co-optimise between large scale and small scale in developing an optimal development pathway

Action Theme A: Link Local Energy Hubs

Actions needed to unlock these opportunities

A Local Energy Hub unlocks energy within the community to be used for the community. They are located within the existing footprint of a distribution network, allowing existing distribution assets to be leveraged. They are a cost-efficient way of deploying generation and storage, but enabling policies are needed

Barriers

The regulatory rules and planning frameworks that apply to Renewable Energy Zones (REZs) currently do not promote or support Local Energy Hubs (ie. "Distribution REZs"), although the concept of a Local REZ is being trialled in QLD

Specific Actions to overcome these Barriers

A.1 Work with state governments to define and declare formal Local Energy Hubs to unlock specific rules and economic regulation within those areas. Formal declaration of a Local Energy Hub may not be necessary in all cases, but in some instances, it will be helpful to unlock an investment mandate for the DNSP in that area. This may be enacted by policy, or by enabling legislation in jurisdictions that choose to do so.

A.2 Create a separate regulatory approval pathway for network investments within a Local Energy Hub, to allow the host network to make a program of local investments to create more network capacity for both generation and load.

Pathway to Change

- Policy changes (i.e. mandate from govt for a new or expanded role or new incentive) — on
- Legislative changes — on
- Rule changes — off
- Change in regulatory approach (i.e. AER guideline change) — on
- Technical standards change — off
- Data: access, and availability — off

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Action Theme B: Amplify Untapped Solar

Actions needed to unlock these opportunities

Rooftop solar represents an economically efficient means of deploying generation in the immediate proximity to customer demand, and existing industry installation capacity can support additional rollout across Australia. But there are barriers stopping customers from benefitting from empty roofs across the country

Barriers

There are economic barriers and split incentives between tenants and landlords that stop customers from benefitting from the full potential of rooftop solar that would be unlocked within a Local Energy Hub.

These barriers also add to energy inequality, as they limit access to rooftop solar to those who can afford to own property and have the capital available to spend on solar systems.

Specific Actions to overcome these Barriers

B.1 Introduce incentives for larger scale rooftop solar investments (suited to C&I customers) to overcome the current economic barriers to investment where there is a demonstrated need for more generation within a Local Energy Hub. Distribution networks can complement this by taking steps to better facilitate the ease and speed of larger rooftop solar connections by conducting advanced connection studies and simplifying connection processes for projects of this size. These incentives could be technology agnostic and available to any type of generation within a Local Energy Hub.

B.2 Work with the Commonwealth and State governments to expand existing programs to provide low-cost, government backed, CER financing options for renters and customers with poor access to capital. Work with state governments to harmonise these schemes across jurisdictions.

Pathway to Change

- Policy changes (i.e. mandate from govt for a new or expanded role or new incentive) — on
- Legislative changes — on
- Rule changes — off
- Change in regulatory approach (i.e. AER guideline change) — off
- Technical standards change — off
- Data: access, and availability — off

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Action Theme C: Soak Up Surplus Solar

Actions needed to unlock these opportunities

Distribution-connected batteries are the most cost effective and equitable means to deploy the small and medium scale battery storage needed for our future energy system, but face regulatory hurdles

Barriers

Current regulation prevents DNSPs from sharing battery capacity with third parties that participate in wholesale electricity markets, with all current pilots and programs only possible under limited waivers. A holistic and long-term solution is needed.

Current network investment regulations do not properly value the time-shifting ability of batteries to increase the value of a customer's solar output by absorbing it during the day and re-exporting it during the peak.

Specific Actions to overcome these Barriers

C.1 Implement changes to the regulatory guidelines to allow distributors to share battery capacity with third parties, maintaining the requirement that any market-facing activities (i.e. trading the battery on the market or selling battery capacity to customers) be done via partnerships with third parties such as retailers. DNSP battery ownership can coexist (as it does already) with other third parties that will invest in and own batteries across the country. The need for retail partnerships to handle the market-facing aspects of a battery will act as a natural brake against any over-investment in batteries by DNSPs above what the market will support. DNSP battery ownership is already subject to a benefits sharing test to ensure there is no 'double dipping' between regulated (socialised/shared) benefits and unregulated (market) benefits.

This can be achieved in the immediate term by the issuing of a class waiver by the AER, and in the longer term by a review of the AER's ring-fencing guideline.

C.2 Amend the existing network investment guidelines to properly value the time-shifting ability of batteries to soak up surplus solar. Current methodologies, such as the AER's Customer Export Curtailment Value (CECV), are based on traditional poles-and-wires investments that only unlock curtailed customer solar at peak solar export times (and are therefore given a low value). By updating the CECV to differentially value battery storage investments (that can re-export solar at peak times), the role of batteries in delivering customer and energy system benefits can be properly recognised.

Pathway to Change

- [x] Policy changes (i.e. mandate from govt for a new or expanded role or new incentive)
- [ ] Legislative changes
- [ ] Rule changes
- [x] Change in regulatory approach (i.e. AER guideline change)
- [ ] Technical standards change
- [ ] Data: access, and availability

Action Theme D: Plug in more EV Chargers

Actions needed to unlock these opportunities

Switching to an EV is one of the most beneficial steps a consumer can take to reduce their energy costs and carbon emissions. However, availability of Charging Infrastructure is one of the key barriers customers cite to EV uptake. DNSPs can also work to ensure the pathway of electrification is equitable for all customers

Barriers

Kerbside charging is essential to support EV uptake, but asset utilisation is too low to be economical for commercial providers in most locations. This means a market led approach may fail to deliver the infrastructure that communities need. DNSPs can play a role in delivering public kerbside charging, leveraging their existing assets and workforces, but EV charging is not recognised as a distribution service under current regulations.

Many households considering energy efficiency or electrification investments struggle with upfront costs.

Specific Actions to overcome these Barriers

D.1 Work with state/federal governments to create a policy mandate for a DNSP-led rollout of kerbside public EVCI. Classify EV charging infrastructure as a 'distribution service' in our regulatory framework, so distributors' existing poles and skilled workforce can be leveraged to provide community charging. DNSPs can deliver kerbside charging infrastructure at lower cost, faster, with more competition and less disruption than other operators, leading to an improved customer and community experience.

D.2 Develop grid capacity availability maps for commercial EV charging installers, and define connection standards to simplify the connection and configuration of fast charging infrastructure.

DNSPs can also play a role in shaping the pathways for customer electrification and energy efficiency:

D.3 Work with state governments to introduce low-cost consumer financing options for the electrification of households or transport for customers with poor access to capital

D.4 Advocate for minimum energy efficiency measures for housing stock

Pathway to Change

- Policy changes (i.e. mandate from govt for a new or expanded role or new incentive) — on
- Legislative changes — off
- Rule changes — on
- Change in regulatory approach (i.e. AER guideline change) — on
- Technical standards change — off
- Data: access, and availability — off

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Action Theme E: Sync with the Grid

Actions needed to unlock these opportunities

Enabling CER coordination is critical to avoiding investment in network and generation assets and benefitting all consumers; however, role clarity, regulatory flexibility and consistent policies are needed to achieve this. More effort is also needed to engage customers and understand their preferences

Barriers

Successful coordination requires a partnership between networks, retailers and CER aggregators. Within this there needs to be a flow of technical information on grid status, as well as price signals, between parties.

There is a lack of technical standards and many devices currently on the market lack the capability to receive coordination signals.

Changes to customer tariffs and connection agreements are difficult to make within a five-year regulatory period, which limits the ability of DNSPs to provide economic signals to customers.

Specific Actions to overcome these Barriers

E.1 Reinforce and continue to refine the role for all **DNSPs as being responsible for defining the technical limits of the distribution system (within a Local Energy Hub and more generally) within which other players such as retailers can coordinate**.

E.2 Work with the Australian Energy Regulator (AER) to implement a single system of connection policies and agreements for customers that can better accommodate "flexible" devices and connections over time (as well as a "fixed" agreement for customers with a simple connection). This may take the form of national standardisation, or by agreeing a standard approach and set of clauses that can be adapted to state-based requirements.

E.3 Work with device manufacturers to **develop technical standards to improve the flow of data and control and price signals between devices behind the meter** and provide customers with the tools to better optimise their devices within their home or business.

E.4 Work with state governments to **implement standards for Consumer Energy Resources (specifically EVs, home batteries, solar inverters) requiring them to "flexible-ready"** and compliant with interoperability standards.

Pathway to Change

- Policy changes (i.e. mandate from govt for a new or expanded role or new incentive)
- Legislative changes
- Rule changes
- Change in regulatory approach (i.e. AER guideline change)
- Technical standards change
- Data: access, and availability

Enabling Initiatives

Actions needed to unlock these opportunities

	Initiative	Description	Pathway to Change
F	**Enable Greater Regulatory Flexibility -** Partner with regulators and policymakers to support greater flexibility within a 5-year determination period	The regulatory framework is encountering very different conditions from the more stable set of market and technological conditions that underpinned its design. The existing framework and approaches are now under challenge from greater levels of uncertainty around technology, required levels of future investment, and future cost conditions. This initiative could include flexibility for annual tariff changes, improved expenditure adjustment mechanisms, and a role for early, enabling, and efficient 'anticipatory' grid investment to allow networks to respond faster to customer needs.	Policy change (i.e. mandate from govt for a new or expanded role or new incentive) Legislative change **Rule change** **Change in regulatory approach (i.e. AER guideline change)** Technical standards change Data: access, and availability
G	**Review inclusion of Distribution in the ISP** – Work with AEMO to improve the manner in which the distribution grid and CER are included in the 2026 ISP	Work with AEMO to consider the range of options for contribution of distribution networks in the 2026 ISP, and to co-optimise between large scale and small scale in developing an optimal development pathway.	**Policy change (i.e. mandate from govt for a new or expanded role or new incentive)** Legislative change Rule change Change in regulatory approach (i.e. AER guideline change) Technical standards change **Data: access, and availability**

Contents

- What should we do: The All Levers Pulled scenario
- How do we get there: Actions needed to unlock these opportunities
- **Our methodology: Individual system changes we tested**
- Recommendations and Next Steps
- Appendix

We utilised three different models to understand how changes in the distribution network could impact customers

Individual system changes we tested

Wholesale modelling

Key inputs

- Costs of investment and operation of different generation types
- Committed investment plans for generation and transmission (incl. state government targets)
- Coal retirement plans

Key outputs

- Grid capacity
- Generation output
- Wholesale energy prices

Network modelling

Key inputs

- Outputs from system modelling (specifically peak load and native demand by region)

Key outputs

- Network capex and opex
- Network revenue
- Average price (c/kWh)

Customer assets, fuels and emissions modelling

Key inputs

- CER capacity additions
- Capex for CER asset types
- Gas and petrol prices
- Generation output by fuel type

Key outputs

- Total energy costs related to their total energy needs
- Emissions from the NEM

These models produced outputs for every year from 2024 - 2050, but we have focused on the near-term impacts (in 2030) and the steps to unlock them.

The results were compared against a baseline of the ISP Step Change scenario*, as well as a ‘Missed Opportunities’ scenario representing an increasingly likely ‘prolonged transition’ for the broader energy system.

Note: * Sourced from the 2024 Integrated System Plan, June 2024
Source: Endgame Economics; Dynamic Analysis; L.E.K. Analysis

Energy Networks Australia LEK™

To develop the All Levers Pulled scenario, we performed modelling of individual 'system changes' to identify the most impactful opportunities for distribution networks to benefit consumers

Individual system changes we tested

Long list of possible 'system changes' in the distribution networks^

- *add* rooftop solar & BTM storage
- *add* rooftop solar & FTM storage
- *add* community generation
- *faster* home/business electrification^
- *faster* transport electrification^
- *deliver* CER coordination**

Consumer benefits modelling of each change vs. the baseline*

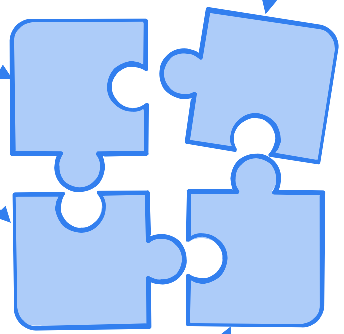
add rooftop solar & BTM storage	$$
add rooftop solar & FTM storage	$$$
add community generation	$$$
faster transport electrification^	$$
faster home/business electrification^	-$
deliver CER coordination**	$$

Grouped and prioritised set of system changes in distribution networks

1	*add* community generation	$$$
2	*add* Rooftop PV & FTM storage	$$$
3	*faster* transport electrification^	$$
4	*deliver* CER coordination**	$$
5	*add* Rooftop PV & BTM storage	$$
6	*faster* home/business electrification^	-$

'All Levers Pulled' combined scenario

A mix of system changes representing one option to close the 'gap' vs. the baseline



Barriers to each system change and ***Actions*** required to overcome them

Notes: ^ The starting point for our system changes was the 2024 ISP Step Change scenario, so changes that "add" are above the ISP, and "faster" is relative to the ISP trajectory.
* The baseline used for comparison was the 'Missed Opportunities' scenario.
** Less coordination was tested in our scenario modelling since the ISP Step Change scenario already assumes high levels of coordination without a clear pathway to achieve this. The 'less coordination' scenario was used to validate the need for coordination and the additional costs that would be incurred if coordination is not achieved.

Link Local Energy Hubs

1 *System Change Modelled: Additional Community Generation*

Individual system changes we tested

Medium scale projects connected to spare distribution capacity are a fast, cheap way to add generation capacity

The majority of the capacity on high voltage transmission networks has already been allocated. However, there is available capacity available in the sub-transmission levels of distribution networks. This capacity is highly suitable for medium scale generation projects (typically 30-50MW in size). Projects of this scale are expected to have lower installation costs and a higher capacity factor than rooftop solar on a per MW basis.

This means more generation capacity can be connected more quickly by DNSPs, delivering lower-cost energy to consumers as DNSPs can unlock sub-transmission hosting capacity at minimal cost. Much of the added capacity will require no network augmentation, which means the overall costs borne by consumers is minimised.

This opportunity should not be viewed as replacing large scale generation at the transmission level in favour of medium sized generation in the distribution level; it should instead be viewed as taking immediate action to get more generation connected by leveraging unused capacity, helping to de-risk the energy transition.

By facilitating more medium generation sites at the sub-transmission level, it gives large scale transmission REZs some ‘breathing room’ to be completed while Australia seeks to rapidly decarbonise.

What are the barriers to overcome?

There is currently no regulatory mechanism that supports a network to propose a program of enabling investments to unlock capacity within a Local Energy Hub.

There are inconsistencies in the costs charged to smaller generation projects connecting to a distribution network vs. larger projects connecting to a transmission network. This is due to regulatory differences in the rules regarding how much of the network capital cost to enable a connection (especially ‘deep network’ augmentations to unblock capacity constraints) are charged directly to the connecting generator. This imposes an undue burden on generation projects seeking to connect to sub-transmission networks and creates an economic disincentive for project developers to invest.

What did we model?

10.4 GW of additional front-of-meter generation (80% solar) connected to the distribution network, at an average project size of 30-50 MW*

Why did we model it?

Distribution networks have existing capacity which is currently not being leveraged to its full extent. We wanted to understand what the potential customer benefits would be if the spare network capacity in the distribution grid were leveraged to host more generation.

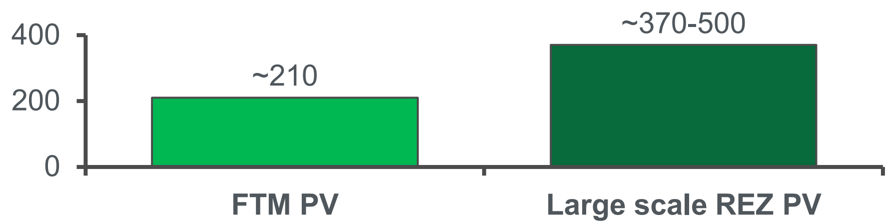
What did we find?

Medium scale generation was highly beneficial to customers due to the low cost of connecting, leading to a lower overall cost of electricity. Consumers saved c.$4b p.a.

What are the benefits?

Connection costs per MW for projects connecting to spare capacity in the distribution network can be 40-60% less than connection costs for new greenfield connections.

Connection Network Cost
$000s AUD / MW



Note: * 10.4GW was used for the System Changes modelling as each individual scenario needed to fully close the generation ‘gap’. The ‘All Levers Pulled’ scenario is co-optimised across generation types, and so a lower value is used for each contributing type of generation. Source: AusNet Services; AEMO; Endgame Economics; Dynamic Analysis; L.E.K. research and analysis

Case Study – Using ‘Digital Twins’ and data to unlock front-of-meter hosting capacity with ***Essential Energy***

Individual system changes we tested

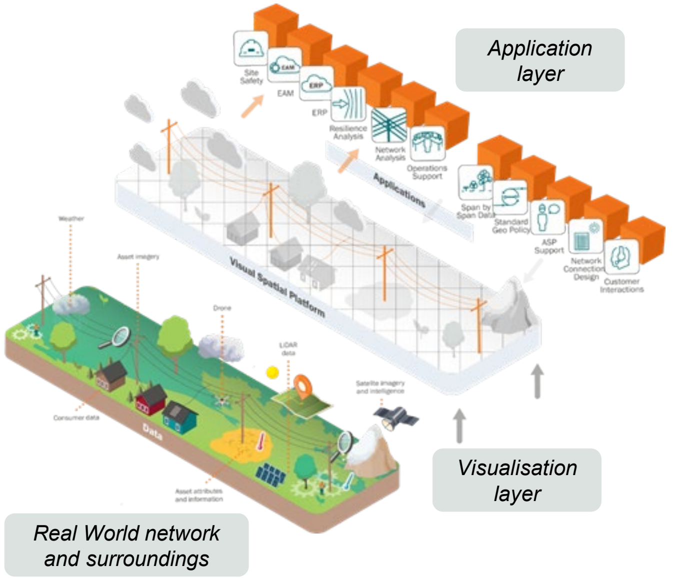
Unlocking front-of-meter hosting capacity with Essential Energy

Pilot objectives:

- To utilise ‘digital twin’ modelling to better understand the capacity of Essential Energy’s network and the latent capacity to connect more generation and load

Background and pilot overview:

- Essential Energy has 1.4 million spans of powerline across regional, rural and remote NSW and parts of southern QLD. Digital twin modelling builds an engineering-grade replica of the network, providing a level of insights that weren’t previously available.
- From emerging technologies and the smarts within the digital twin modelling platform Essential Energy has a much better understanding of capacity across the overhead network, with data showing capacity up to double in some areas to what was assumed before modelling was available.
- The untapped capacity will facilitate new connections faster and at a lower cost due to, in many cases, the need to upgrade the network being reduced or fully removed.
- Prior to using digital twin modelling to determine capacity, network planners were required to make assumptions about the rating of overhead powerlines or to carry out costly, time-consuming manual surveys of overhead lines in the field. Essential Energy’s application of digital twin modelling makes use of a digital survey of the network to create virtual objects that are a digital twin of the real-world overhead network. Smart analytics are applied to these virtual objects to determine the actual rating of the overhead network.



Pilot benefits:

- Through the digital twin modelling Essential Energy has identified 2.5GW of available network capacity to host additional front-of-meter generation

What can we learn?

- Similar digital twin hosting analyses have already been undertaken by other DNSPs. A national hosting capacity study is also being contemplated.
- These studies show that distribution networks can host significant volumes of additional generation with minimal costs in upgrading networks

Source: Essential Energy

Case Study – Connection Enablement Initiative with ***AusNet Services***

Individual system changes we tested

Connection Enablement Initiative with AusNet

***Program objectives**:*

- AusNet has launched a Connection Enablement Initiative to unlock grid-scale renewable capacity in the sub-transmission part of the distribution network

Background and overview:

- The Initiative was launched in 2023 and seeks to unlock efficient levels of additional capacity in the sub-transmission network by:
  1. *Maximising existing infrastructure* – better utilising existing assets through dynamic line ratings, network support agreements and tariffs that incentivise storage development.
  2. *Creating new capacity* – removing network constraints through new or uprated sub-transmission lines, new connection transformers and storage solutions.
- Three projects are underway as part of Tranche 1 of the program. Each project is a targeted network upgrade based on a net benefit of assessment of the value of investment. Benefits include (among others):
  - Market benefits, including lower cost of generation
  - Emissions reductions
  - Improved reliability.
- Other projects are currently under consideration, starting in the 2026-31 regulatory period, based on the same net benefits assessment methodology.

Program outcomes:

- Collectively the Tranche 1 projects will unlock approximately 650MW of added generation hosting capacity by 2027.
- The average cost of augmentations to enable 1MW of added capacity is $210k, making these projects a highly cost-effective means of adding hosting capacity.

What can we learn?

- Targeted augmentations of the distribution network can rapidly add capacity for additional generation capacity at low incremental cost compared to large greenfield REZ developments, unlocking benefits for customers faster

Source: AusNet Services

Amplify Untapped Solar & Soak up Surplus Solar

System Changes Modelled: Additional Rooftop Solar & FTM Storage

Individual system changes we tested

Adding more rooftop solar delivers benefits for all energy consumers (including those without solar)

Rooftop solar represents an economically efficient means of deploying generation in the immediate proximity to customer demand, and existing industry installation capacity can support additional rollout across Australia. The current industry can maintain c.3GW or more of capacity installations (which was achieved in FY2023), but current forecasts expect solar installations to fall over the short to medium term to 2.1GW in 2024-26.

There is untapped potential in rooftop capacity on homes, and on business properties. But this empty roof space cannot be efficiently accessed due to a misalignment of incentives:

- Commercial & Industrial properties represent a huge potential for un-used roof space[1] but lack incentives to invest above their requirements for self-consumption
- Low-income households have limited uptake of rooftop solar due to lack of access to capital to fund installations
- Rental properties remain largely untapped with limited uptake of rooftop solar today, primarily due to split incentives between landlords (who own the building capital assets) and tenants (who pay energy bills)

What are the barriers to overcome?

There is currently a lack of incentives for particular subsets of the population and economy which prevent them from investing in rooftop solar systems:

- Commercial and industrial property owners are not provided with any investment signals which would cause them to invest in solar above self-consumption needs
- Customers with limited access to capital are unable to invest in rooftop solar assets with high upfront cost, even if it reduces ongoing energy expenses, and landlords are often unwilling to invest, as they do not directly benefit from their investment.

What did we model?

An additional 15.8 GW of rooftop solar installed on rooftops (ie. behind the meter) vs. the base case trajectory in the 2024 ISP Step Change scenario), supported by 3.2GW of additional Front-of-Meter distribution-connected storage.

Why did we model it?

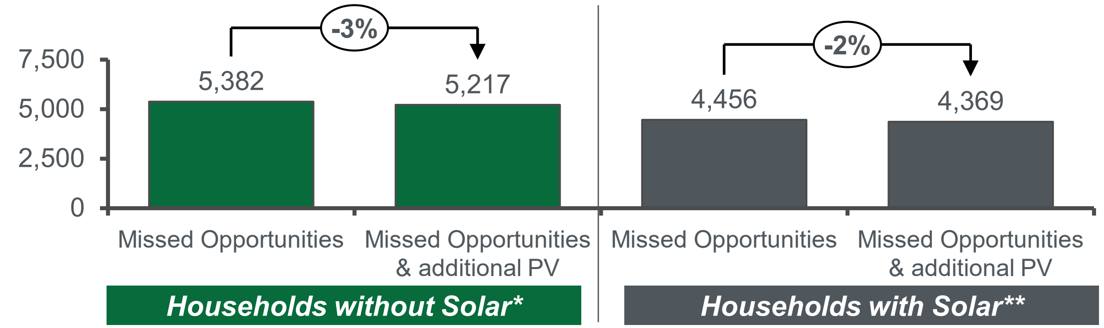
Rooftop solar is a widely understood and supported renewable energy source; we wanted to understand whether additional rooftop PV would be beneficial for customers, and whether those benefits of PV also reached those who do not own PV

What did we find?

Adding more rooftop solar into the system delivers consumer benefits. Customer energy costs are 2-3% lower, not only for those who have solar but also for those who don't

What are the benefits?

Total home energy costs (incl. home gas and vehicle fuel costs) (FY2030)
AUD



Notes: 1 For example, Endeavour Energy has estimated that 3.2 GW of additional rooftop solar could be connected within its network if 100% of C&I rooftop capacity was utilised
Note: * Based on a customer who is fully connected to the grid, does not have a solar system, battery or EV, and still uses a mix of electrical and gas assets in their home; does not include gas distribution costs;
** Based on a customer who is fully connected to the grid does not have a battery or EV, and still uses a mix of electrical and gas assets in their home but has a rooftop solar PV system; does not include gas distribution costs
Source: Clean Energy Council; AEMO; Endeavour Energy; Dynamic Analysis; Endgame Economics; L.E.K. research and analysis

Amplify Untapped Solar & Soak up Surplus Solar

2 *System Changes Modelled: Additional Rooftop Solar & FTM Storage*

Individual system changes we tested

Using front-of-meter batteries to support additional rooftop solar delivers benefits that are 20% higher than using BTM

As rooftop solar penetration continues to rise, it is necessary for this to be supported by localised energy storage. Localised battery storage has the potential to deliver significant benefits to customers, allowing the low-cost generation output of rooftop solar to be stored locally and then re-consumed during the peak. The most common form of localised battery storage today is behind-the-meter storage in private homes and businesses (refer to System Change #5); however, this is both currently uneconomical (requiring government rebates to encourage investment) and inequitable (the high cost means it is only taken up by those households with capital, which then collect the majority of the benefits).

Larger network batteries, installed in front of the meter, represent a scale-efficient way of installing storage deep in the distribution network. These batteries have a lower capital cost per kWh of storage than behind-the-meter batteries, and allow the benefits of localised generation and storage to be shared between all energy consumers.

DNSPs have the opportunity to deploy and own local distribution-connected batteries as a fleet. This comes with a number of benefits for consumers:

- Lower cost: Enables efficient procurement and installation at scale in a coordinated program, and leverages the land and field workforce DNSPs already have available
- Enables value stacking: Batteries are versatile assets. DNSP ownership (in partnership with retailers to access the market and customer benefits) allows the full value and customer benefits to be quickly unlocked.

What are the barriers to overcome?

Regulations restrict DNSPs from sharing battery capacity with third parties who trade in the wholesale market, with all current pilots and programs only possible under limited waivers. Regulatory valuation methods also under-value the time-shifting ability of batteries.

What did we model?

15.8 GW of additional rooftop PV supported by 3.2GW of additional distribution-connected storage, equivalent of a 5MW/10MWh battery installed in every second distribution zone substation (In practice, the mix of battery sizes and form factors would vary).

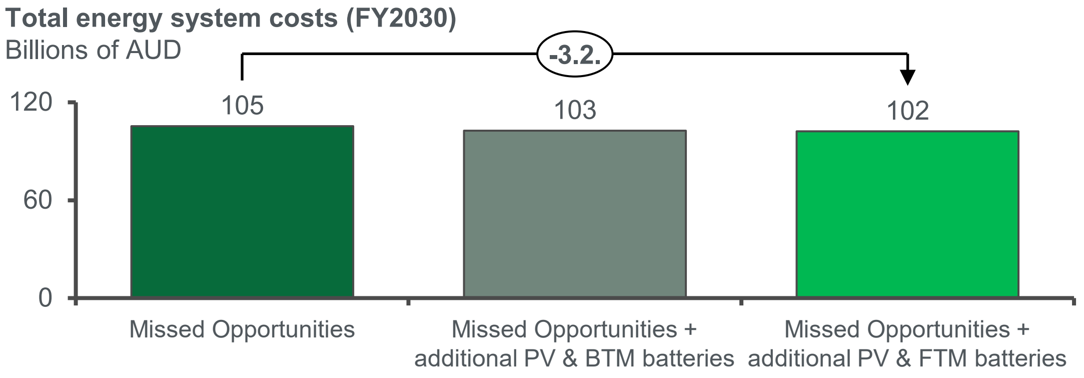
Why did we model it?

We wanted to understand the total system impact of front-of-meter batteries, and whether this would be more beneficial or equitable for customers in the NEM.

What did we find?

Using front-of-meter batteries to support additional rooftop solar delivers benefits that are 20% higher than the same scenario with behind-the-meter batteries.

What are the benefits?



Source: Endgame Economics; Dynamic Analysis; L.E.K. research and analysis

Case Study – Unlocking Commercial & Industrial Rooftops with ***Endeavour Energy***

Individual system changes we tested

Unlocking Commercial & Industrial Rooftops with Endeavour Energy

Background

- Despite 27% of residential customers having solar PV today, only 16% of commercial customers have adopted it. Further, the systems for commercial and industrial (C&I) customers have been restricted to localised consumption with a median system size of only 15kW.
- C&I customer feedback is that low feed-in-tariffs (even compared to residential customers), split incentives between landlord and lessee, and complex network and connection processes are barriers to overcome.

Pilot overview:

- Endeavour Energy has conducted studies to estimate the hosting potential of C&I rooftops within its geographic footprint.
- Endeavour estimates that 1.4GW of additional rooftop PV could be connected, assuming just 30% of available rooftop capacity is used. This analysis represents what can be connected subject to current network constraints but without significant investment in storage and/or network upgrades.
- To progress the pilot Endeavour Energy has identified substations that have both a high number of residential customers, a high amount of unused C&I rooftop space, lower socio-economic communities (who would benefit most from low-cost localised energy) and minimal network constraints.
- Endeavour is currently working with policymakers to develop incentive schemes that would unlock C&I rooftop PV investment, as well as working directly with C&I site owners to identify prospective sites.

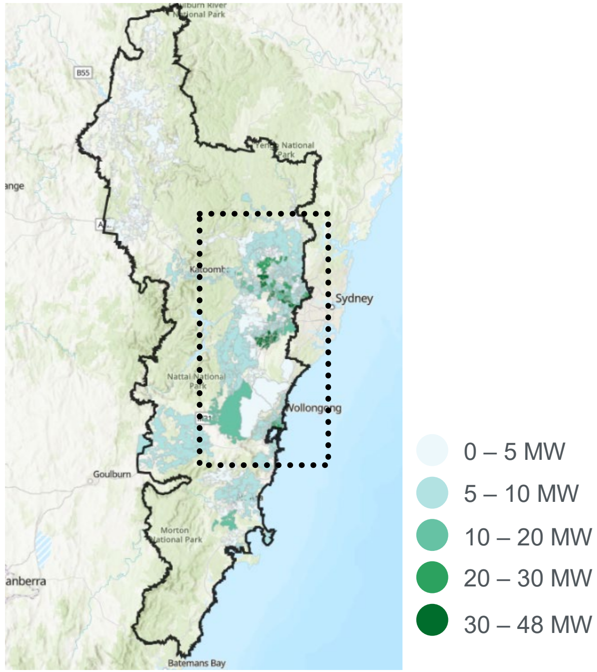
<u>What can we learn?</u>

- The potential capacity for additional rooftop solar is immense, with C&I representing the biggest opportunity.
- Targeted programs can focus on unlock this capacity in the specific areas of the grid where it's most valuable

1.4 GW*

C&I ROOFTOP SOLAR

Largest opportunities in urban fringes, Western Sydney Industrial Lands, Port Kembla



Source: Endeavour Energy Note: * 1.4 GW has been set as an achievable stretch target for solar C&I uptake, representing c.40% of the 3.2 GW of estimated total C&I rooftop capacity

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Case Study – Enabling Rooftop Solar through Local Batteries with ***Energy Queensland***

Individual system changes we tested

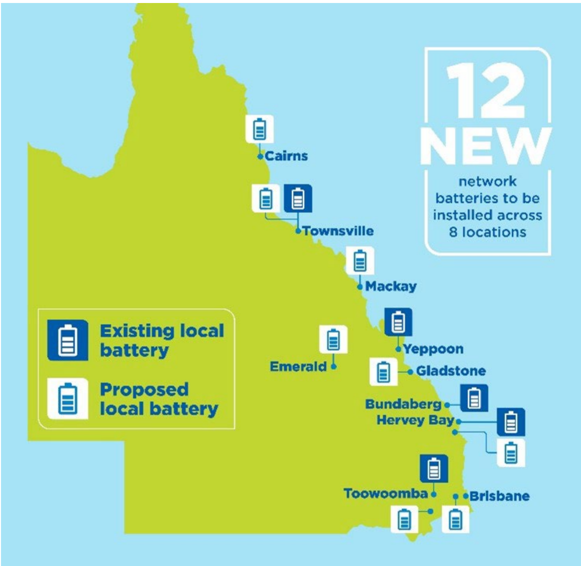
Local Network Batteries with Energy Queensland

Pilot objectives:

- To trial the installation of larger distribution batteries in centralised network locations and partnership models with retailers

Background and pilot overview:

- Energy Queensland's Local Network Battery Plan is seeing utility-scale and smaller, community batteries connected to the electricity distribution network across Queensland to support the continuing uptake of renewable energy.
- Queenslanders are putting solar on homes and businesses at world record rates with more than 40% of houses across Queensland now with rooftop solar energy. The Local Network Battery Plan is designed to ensure Queensland's electricity networks can support potentially double today's solar energy by 2030, from well over a million rooftops.
- Network batteries will allow more solar energy to be sent back into the grid, while the suns shining, storing it for use locally when demand for electricity is at its highest.
- They will become an essential tool for managing the renewable energy flowing into the electricity network and to addressing the capacity and security of supply challenges created by major reverse and negative flows, as well as changing demands at the system level.



Pilot benefits:

- The success of stage one of the plan – the installation of the large batteries in Townsville, Toowoomba, Yeppoon, Bundaberg and Hervey Bay – led to stage two getting underway to support the continuing uptake of renewable energy. This is now seeing a further 12 batteries installed across the state.
- Each energy storage system is a large 4MW/8MWh battery. They are allowing more solar energy to be sent back into the grid, while the sun's shining, storing it for use locally when electricity demand is high.

What can we learn?

- Energy Queensland has successfully partnered with multiple retailers to provide the battery services to local residents
- This means the batteries provide direct benefits to local residents (who can access to battery as a form of 'virtual' energy storage) in addition to the indirect benefits of a more stable electricity network

Source: Energy Queensland

Energy Networks Australia LEK

Case Study – using Distribution-Connected Batteries to unlock solar capacity with ***Horizon Power***

Individual system changes we tested

Distribution Batteries with Horizon Power

Pilot objectives:

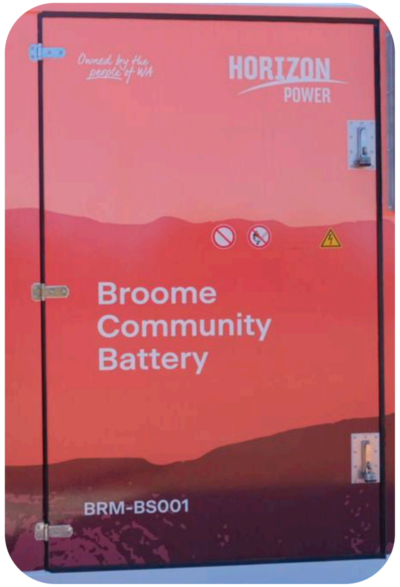
- Install centralised distribution-connected batteries to allow more customer rooftop solar to be installed

Background and pilot overview:

- Horizon Power commissioned centralised distribution-connected batteries in Broome in 2023, completing a program of installing centralised battery storage across nine remote towns to deliver on its commitment to improve customer access to solar energy.
- Current hosting capacity constraints limit how much rooftop solar Broome's electricity network can accommodate without disrupting supply. This means some residents and businesses have been unable to connect rooftop solar systems.
- Horizon Power has been working with the Broome community to develop a solution that meets the town's growing appetite to install rooftop solar and help customers reduce their energy costs and carbon emissions.
- The energy storage solution means excess energy generated by rooftop solar can be absorbed by the batteries, which simultaneously smooth the flow of energy back into the network. This will ensure reliability of power supply and allow for a greater uptake of rooftop solar.

Pilot benefits:

- Together, the Broome batteries free up more than 1,400kW of hosting capacity for Broome residents and businesses
- Currently, customers with systems over 30kW capacity are required to install a smoothing battery. This ensures fluctuations in energy generated by their system does not impact network stability and reliability of power supply.
- These batteries add significant cost to solar installations and require additional hardware to be installed at the customer's premises. For a fixed daily fee, Broome customers are now be able to access Horizon Power's distribution battery to provide solar smoothing instead.



What can we learn?

- Centralised network batteries installed in the distribution network can unlock additional solar capacity for consumers by soaking up solar and managing the impact of solar generation on the network

Source: Horizon Power

Plug in more EV Chargers

3 *System Change Modelled: Faster Transport Electrification*

Greater access to public charging will allow consumers to switch to EVs with confidence

Individual system changes we tested

Consumer switching from Internal Combustion Engine (ICE) to Electric Vehicles (EVs) is a significant opportunity for consumers to reduce carbon emissions and lower energy costs. Consumers who switch to an EV can expect to save $2,000-3,000 per year in fuel costs. EV uptake has been slow to date, with only c.7% of new vehicles sold in 2023 being EVs, but uptake is expected to accelerate. A 2024 survey by Sydney University indicated that 36% of Australians are considering buying an EV in the next 5 years.

Willingness to uptake EVs is strongly linked to expectations for the availability of public charging infrastructure. 34% of Australians cite concerns about travel distances (i.e. EV range) and ability to charge when needed as a barrier to EV purchase. EV Charging Infrastructure (EVCI) rollout is lagging Australia's uptake of EVs, with c.32 EVs for every public charge point in Australia (vs. a global average of 10 EVs per public charge point). Amongst current EV owners, a recent survey indicated 49% would consider switching back to an ICE, with the highest pain point being a lack of public EVCI.

DNSPs can deliver public charging infrastructure (via kerbside chargers) at lower cost, faster, with more competition and less disruption than other operators, leading to an improved customer and community experience. This would involve DNSPs rolling out EVCI on existing distribution assets (i.e. poles), while offering an 'open access' model for charge point operators to allow a competitive market for charging services. DNSPs would also maintain the EVCI to ensure uptime and availability, addressing a key EV owner pain point (international studies have shown that at any point in time over 25% of public commercial chargers are inoperable or require maintenance).

What are the barriers to overcome?

Installation and ownership of EVCI is not considered a distribution service under our current regulatory framework, which restricts DNSPs from playing a role in rolling out and maintaining kerbside public chargers as part of their regulated asset base.

What did we model?

1.2 million additional EVs by 2030, representing an acceleration of the 'tipping point' for EV adoption to occur between 2025-30. This is supported by DNSP rollout of c.51,000 public kerbside EVCI, which would maintain the current 32:1 ratio of EVs to charge points (assuming DNSP 40% coverage).

Why did we model it?

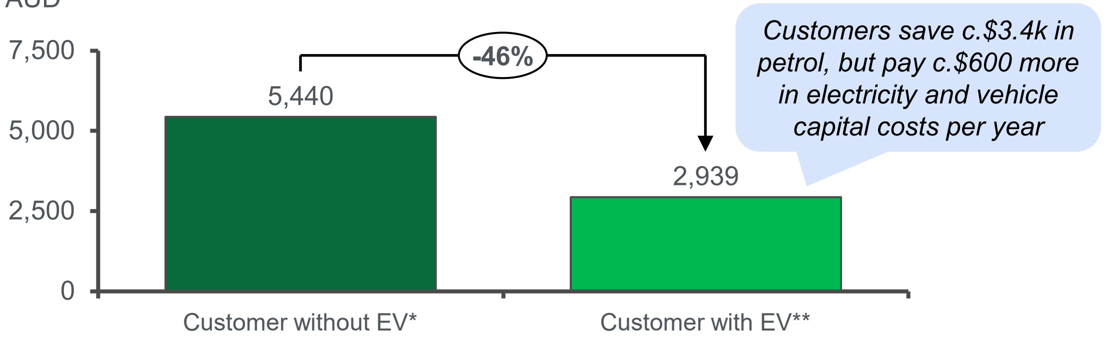
To understand the impact on the total customer energy costs if they were to switch to an EV and to understand whether benefits outweigh the incremental costs associated with EVs (incl. incremental capex required to purchase an EV over an ICE)

What did we find?

Facilitating an extra 1.2 million consumers switch to EVs delivers total annual benefits of $2.2 billion per year, with individuals who switch saving c.$2,500 each per year.

What are the benefits?

Total home energy costs (incl. gas and petrol)under accelerated EV Scenario (FY2030)
AUD



Note: * Based on a customer who is fully connected to the grid, does not have a solar system, battery or EV, and still uses gas assets in their home; does not include gas distribution costs;
** Based on a customer who is fully connected to the grid, does not have a solar system or battery, and still uses gas assets in their home; does not include gas distribution costs

Source: RACV; ACT Government; Consumer Policy Research Centre; International Energy Agency; University of Sydney; Endgame Economics; Dynamic Analysis; L.E.K. research and analysis

Energy Networks Australia LEK

Case Study – EV Charging Infrastructure-as-a-Service with ***Ausgrid***

Individual system changes we tested

EV Charging Infrastructure-as-a-Service with Ausgrid

Pilot objectives:

- To demonstrate the feasibility of pole-mounted EV charging infrastructure to provide public kerbside charging access.

Background and pilot overview:

- Ausgrid has pioneered the installation of public EV chargers on its existing power pole infrastructure. These chargers, installed on suburban streets, deliver 22kW charging levels, enough to provide 35-110 km of range per hour of charging.
- Ausgrid has piloted sixty two pole-mounted chargers with two partners (EVX and Intellihub) across greater Sydney and the Hunter Region. A site in Newcastle was the first power pole-mounted public charger in Australia.
- Pole mounted chargers are faster and cheaper to deploy than other kerbside charging units, while reducing urban clutter and causing less disruption to the surrounding communities. The program's learnings will help inform the broader trial, with the aim of deploying more units across the network in the coming months.
- PLUS ES, which provides EVCI installation services to Ausgrid, has been awarded a grant under the NSW Government's EV Charging Program to install 149 pole-mounted chargers across Ausgrid's geographic footprint by December 2024.

Pilot benefits:

- The pilot through partners have allowed Ausgrid to learn that if DNSP's were allowed to roll out kerbside charging it could be done at lower cost with larger scale.
- The pilots have also delivered insights into when and how customers use the public kerbside chargers.

<u>What can we learn?</u>

- There are cost and speed advantages to a DNSP led rollout of pole-mounted chargers, as well as less community disruption due to the use of existing infrastructure
- Customers have welcomed the installation of power pole-mounted chargers

Source: Ausgrid; NSW Government

Case Study – Vehicle-to-Grid with ***Horizon Power***

Individual system changes we tested

Vehicle-to-Grid with Horizon Power

Pilot objectives:

- To explore the potential for EV orchestration and vehicle-to-grid capabilities within a real-world customer environment

Background and pilot overview:

- Four trial partner organisations in Exmouth, WA will each be the custodian of Vehicle-to-Grid (V2G) compatible Nissan Leaf EVs. Each organisation took custodianship of a V2G compatible Nissan Leaf EV in March and are encouraged to use the EV as they would existing fleet vehicles over the 12-month trial
- The four EV Orchestration Trial partners have two options to charge their Leaf.
  - At a V2G smart charger
  - Through a normal power socket to Type 2 plug (AC).
- In addition to normal EV charging that utilises electricity from the network to charge the EV battery, V2G is a smart charging technology that allows for the discharge of energy stored within the EV battery into the connected premises, be it a home or business, and beyond the premises into the energy network. An EV battery may prioritise charging / discharging based on different network signals such as high or variable levels of local renewable energy production and periods of peak energy demand.
- The trial will provide a real-world assessment of the user and organisational experience of having an EV permanently placed in the vehicle fleet, to inform future fleet transition planning.

Pilot benefits:

- The EV Orchestration Trial participant research program is designed to gain insights into the trial experience from the perspective of drivers, their organisations and the wider community
- Horizon Power will conduct interviews with participants and administer periodic surveys and other social testing programs to achieve this goal.

What can we learn?

- This pilot launched in 2024, and results are still being gathered
- Horizon Power aims to understand customer acceptance and knowledge of V2G systems, as well as customer and community expectations for V2G future use. This will enable Horizon Power to incorporate a human-centred perspective into the trial output.

Source: Horizon Power

Energy Networks Australia LEK

Sync with the Grid

4 *System Change Modelled: Deliver CER Coordination*

Individual system changes we tested

Effective coordination of CER saves consumers $0.5 billion per year by 2030, and $4.0 billion per year by 2050

Achieving coordination is central to the ISP and other future plans within our energy system. Without this level of coordination, additional CER is expected to contribute to supply / demand challenges that will require substantial capital investment in physical assets to augment the network – if coordination is not achieved in line with plans, our modelling suggests that $37bn more will need to be invested in network assets between 2030 and 2050. As a result, consumers will wind up paying substantially more in electricity system costs (ultimately meaning higher bills) than a more coordinated system.

Assumptions regarding the coordination of CER (including loads, batteries, and generation resources) are central to the ISP. For example, the 2024 ISP assumes that by 2030, 57% of the battery storage assets installed behind-the-meter in customer homes and businesses are centrally coordinated. Despite being central to the contributions made by CER in ISP, there is no established pathway to achieve this level of coordination.

DNSPs need to define the pathway to unlock the level of coordination assumed in the ISP; otherwise, network costs will significantly increase. Enabling this capability for a coordinated network will require DNSPs, retailers and CER aggregators to each play a role to create an efficient ecosystem where:

- DNSPs can provide ‘grid awareness’ to market participants, including real time supply/demand balance, power quality, and information on localised constraints
- CER aggregators enrol and dispatch CERs when and where required
- Retailers act as market-markers and provide incentives for consumer participation

What are the barriers to overcome?

There is currently a lack of technical standards that allow the interoperability and data sharing and that would underpin this ecosystem. DNSPs also face challenges in varying customer tariffs and connection policies and agreements to provide economic incentives.

What did we model?

To determine the value of coordination to consumers (and the cost if we don’t achieve it), we have reduced the coordination assumptions for storage and EVs to the ‘ISP Progressive Change’. Note that these assumptions are still more coordinated than today

Why did we model it?

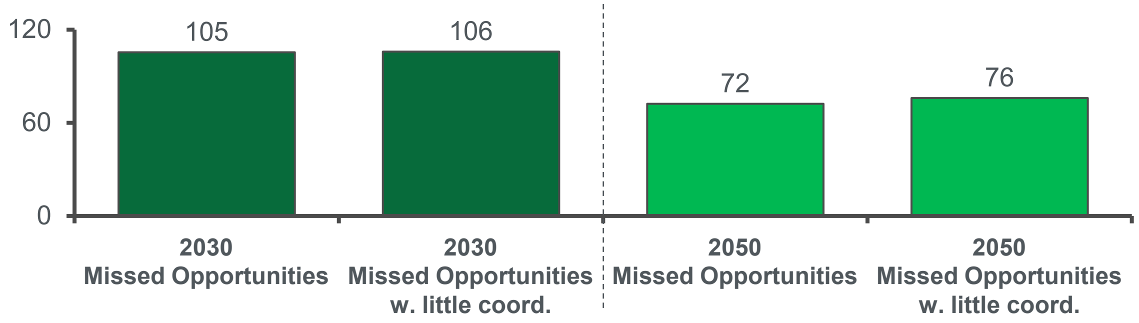
We wanted to understand the costs that will be borne by customers if network augmentation, additional generation and storage are the means of delivering a system that meets customer needs rather than higher levels of coordination

What did we find?

Without coordination consumers pay more for their electricity. These additional costs are $0.5b p.a. in 2030, but increase to $4.0b p.a. by 2050

What are the benefits?

Total energy system costs (FY2030, FY2050)
Billions of AUD



Source: Endgame Economics; Dynamic Analysis; L.E.K. research and analysis

Energy Networks Australia LEK

Case Study – Delivering Flexibility Services with ***Western Power***

Individual system changes we tested

Delivering Flexibility Services with Western Power

Pilot objectives:

- To enable businesses to determine the best way to productively manage their energy in order to suit their needs while supporting the network.
- To partner with business customers to control energy flow by smoothing the network load (i.e. energy demand). This flexibility will enable Western Power to manage the integration of renewables on the network

Background and pilot overview:

- Through flexibility services, WA businesses can productively manage their distributed energy resources in a way that provides network support, in return for financial compensation by Western Power.
- Businesses involved in the pilot were requested to change their energy use and generation at specific times on nominated days.
- On days when there is low energy demand from the grid, participants were requested to 'shift' their energy use to help balance network flow. Examples of energy shifting could include shutting off solar panels for a short period of time, or moving energy-intensive activities to times when there is high solar generation, such as between 10am and 2pm.
- Stage one of the Pilot ran between September 2020 and April 2021. During this time, 250 businesses and sites modified their energy use and generation between 10am-2pm on specific weekends.

STEP 1 – DER owners sign up to 'flexibility services'- a voluntary increase energy usage or solar PV management in times of reduced electricity demand

STEP 2 – During certain times, electricity demand reduces to the point that the grid can become unstable

STEP 3 – DER owners increase their grid energy demand or manage their solar PV production to compensate

STEP 4 – Increased demand and solar PV generation helps balance supply and demand and stabilises the grid

STEP 5 – DER owners are paid for the provision of flexibility services

Pilot benefits:

- Over the course of the Pilot, an average 20MW of energy flexibility to support the grid was achieved. This is a significant amount given it was the first time that partners had participated in a program like this.
- The Pilot results provided Western Power with significant insight into the type of technologies that may support the efficient delivery of flexibility services for WA businesses and the grid in the long-term.

<u>What can we learn?</u>

- Flexibility Services can contribute significantly to managing demand profiles and delivering grid stability
- This can help commercial & industrial customers realise the value of their distributed energy resources (DER) while supporting the network.

Source: Western Power

Case Study – Advancing demand flexibility through ***SA Power Networks*** and retailer partnerships

Individual system changes we tested

Demand Flexibility Trial with SA Power Networks

Pilot objectives:

- To demonstrate the customer, industry and network benefits of demand flexibility and smart homes, and accelerate their deployment at scale
- Trial flexible demand side technology in homes, and offering customer-focused 'flexible' energy service offerings to access the benefits of smart homes

Background and pilot overview:

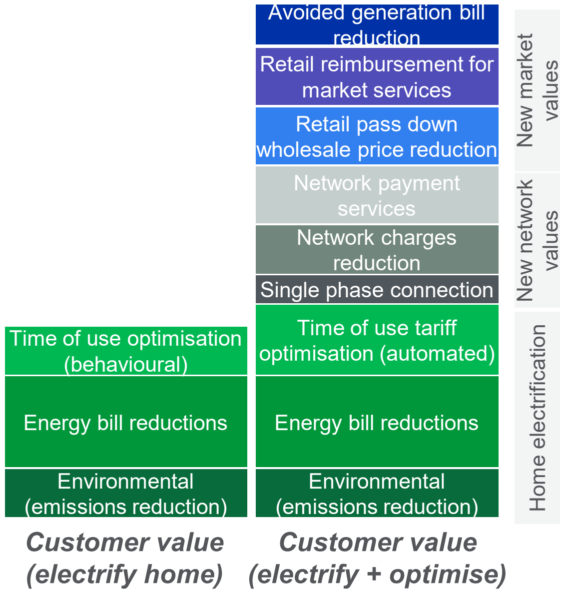
SAPN announced its Demand Flexibility Trial in May 2024. It will:

- Recruit 500 homes and install Home Energy Management Systems (HEMS) and electric appliances with subsidy support
- Develop and trial demand flexibility technologies across market active PV, batteries, hot water, heaters and EV chargers
- Codesign and test new energy offers that reward customers for their demand flexibility
- Run an 18-month research program exploring technical, policy and behavioural barriers

Demand flexibility will unlock new customer, electricity market, and network values, but these may bring added complexity and cost. SAPN is searching for the 'sweet-spot' between complexity, cost, value and customer acceptance.

It is expected the trial will:

- Show customer willingness to adopt demand flexibility technologies and services
- Demonstrate the value of demand flexibility for industry, network and customers
- Inform the design of national interoperability standards and supporting policies and regulation
- Deliver knowledge sharing to stimulate industry and accelerate scale up



Pilot benefits:

- The pilot will allow for simple retail offers which combine the benefits of network, market, and in-home optimisation
- This is enabled by smart 'plug-and-play' CER, appliances and home energy management technology
- Customers can choose their level of sophistication and engagement, are rewarded for increased flexibility, and have the freedom to switch between retailers and different product lines
- Flexibility benefits will be maximised without impact to customer amenity
- Accelerate the commercial viability of the demand flexibility industry to enable deployment at scale

What can we learn?

This pilot launched in 2024 and results are still being gathered. It will:

- Provide insight into how to orchestrate the home behind the meter, as further complexity in the CER space evolves
- Help us understand how DNSPs can provide flexibility beyond the front-of-meter assets which are easy to reach
- Help understand how networks and retailers can work together to develop offers that leverage the full value stack of CER flexibility, and the customer perception of these offers
- Inform network planning and strategies to manage residential electrification

Source: SA Power Networks

System Change Modelled: Additional Rooftop Solar & BTM Batteries

5 *Note: that this was not included in the 'All Levers Pulled' Scenario*

Individual system changes we tested

Supporting Rooftop Solar with BTM Batteries delivers lower benefits than an equivalent capacity of FTM batteries

As rooftop solar penetration continues to rise, it is necessary for this to be supported by localised energy storage. Localised battery storage has the potential to deliver significant benefits to customers, allowing the low-cost generation output of rooftop solar to be stored locally and then re-consumed during the peak.

The most common form of localised battery storage today is behind-the-meter (BTM) storage in private homes and businesses; however this is currently uneconomical for consumers with battery payback periods typically exceeding 10 years. A number of state governments are currently offering rebates to encourage customer investment in BTM batteries.

The high cost, and need for subsidy, is also inequitable: BTM batteries remain an asset that is only taken up by those households with capital, which then benefit from the subsidy and collect the majority of the benefits from the operation of the battery.

A further challenge for BTM batteries is coordination – in order for battery storage to deliver the most benefits to the overall electricity system it must be coordinated to import at times of solar excess, and export at times of peak demand to reduce the overall strain on the system. However, BTM batteries require incentives to be offered to entice customers to enrol their batteries in coordination programs and reward them for handing over control of the battery.

Due to the lower net benefits to consumers of soaking up excess solar with BTM batteries we have not included additional BTM battery capacity above the baseline in our 'All Levers Pulled' scenario.

What did we model?

An additional 15.8 GW of rooftop solar installed on rooftops (ie. behind the meter) vs. the base case trajectory in the 2024 ISP Step Change scenario). In this scenario, c.3.2GW of additional **BTM storage** has been included to complement the additional rooftop PV

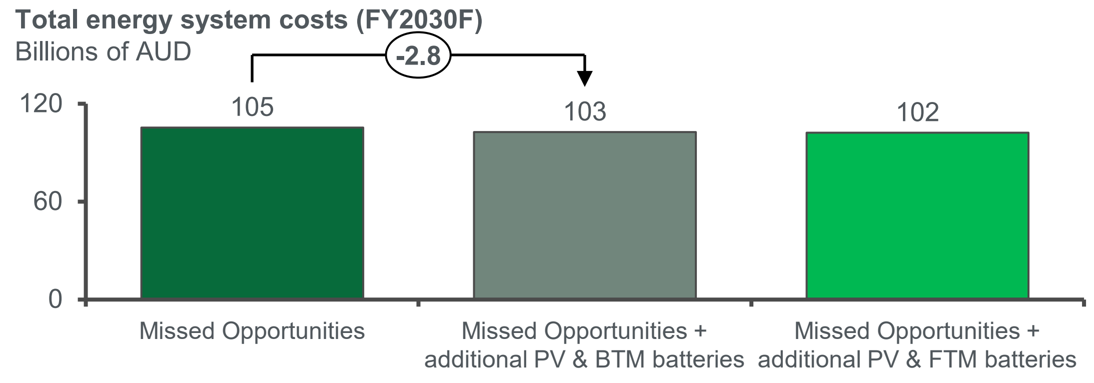
Why did we model it?

We wanted to understand the total system impact of supporting solar with behind-the-meter batteries, and whether this would be more beneficial or equitable for customers in the NEM.

What did we find?

Adding more rooftop solar to the system supported by BTM batteries delivers benefits, but the aggregate benefits are lower than using a similar capacity of FTM batteries.

What are the benefits?



Source: NSW Government; Victorina Government; Dynamic Analysis; Endgame Economics; L.E.K. research and analysis

System Change Modelled: Faster Home/Business Electrification

6 *Note: that this was not included in the 'All Levers Pulled' Scenario*

Individual system changes we tested

Accelerating replacement of consumer and business gas assets before end of life does not deliver net benefits

Electrification of homes and businesses may occur at a faster rate if consumers choose to accelerate their fuel switching (or if they are incentivised to do so, or forced to do so by government policies). The 2024 ISP Step Change scenario already assumes high levels of electrification; it already implies that all new home builds and replacements from FY2025 and onwards utilise electrified assets in the base case (c.200k houses electrified in 2030).

Adding faster electrification assumptions would accelerate these high levels of electrification and reflects a scenario in which households and businesses replace gas assets with electrified assets before the end of the asset's useful life, making the replacements more expensive. Under this scenario customers are replacing gas assets early, resulting in uneconomical outcomes where the capex spent on electrification is higher than the fuel cost savings a consumer receives from not spending on gas.

What did we model?

- Homes (residential) are electrified 5 years faster when compared to the 2024 ISP
- Businesses (C&I) electrify following the ISP's 'Green Exports' scenario

Why did we model it?

To understand the costs and benefits if the pace of electrification is faster than the ISP Step Change (central) scenario.

What did we find?

Accelerated electrification is not beneficial to consumers if it brings forward asset replacement to before the end of the asset's useful life. The excess cost of replacement is not outweighed by the fuel cost savings from reduced gas usage. As a result consumers wind up paying more under this scenario.

What are the benefits?

Total energy system costs (FY2030)
Billions of AUD

Source: AEMO Draft 2024 ISP; AEMO GSOO 2024; ABS; ACIL Allen; AER; AEMC; Australian National Greenhouse Accounts Factors; BITRE; Climate Council; CSIRO GenCost; Dynamic Analysis; Endgame Economics; L.E.K. research and analysis

Energy Networks Australia LEK™

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- How do we get there: Actions needed to unlock these opportunities
- Our methodology: Individual system changes we tested
- **Recommendations and Next Steps**
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Summary of Recommendations and Next Steps

Our All Levers Pulled scenario represents a possible future in which distribution networks and distribution-connected resources are leveraged to play a more significant role in the energy transition.

In this scenario, consumers will:

- **Avoid $7 billion per year in total energy system costs** versus the cost burden of a more prolonged transition
- **Share more equitably in the benefits provided by consumer energy resources (CER)**, irrespective of their means or type of property they live in
- **Secure the achievement of the 82% renewable energy target** (and associated decarbonisation of our energy system) that is enshrined in policy

This report has proposed **14 specific, pragmatic actions and 2 enabling initiatives** to achieve this. We recommend that these are all implemented in full.

The overall effect of implementing these actions on our energy system will be:

Linking more community generation with unused capacity in the grid via introduction of 'Local Energy Hubs. These will become hubs for hosting of a large volume of lower cost generation and storage, including an additional 7GW of community generation, delivering benefits to consumers and local communities.

Amplifying the opportunity of untapped solar, allowing an additional 5GW of rooftop solar generation to be added. This will be targeted at commercial & industrial premises, and households with tenants or lower access to capital, helping to reduce the current inequity of access to rooftop solar generation.

Soak up surplus solar by facilitating the rapid roll out of 5GW of front-of-meter batteries connected to distribution networks. This will help to close the 'storage gap' in the energy system, provide firming for the influx of new renewables, and reduce inequity by ensuring all consumers get the benefits of local storage.

Plug in more EV chargers at scale to accelerate EV update, support customers and overcome range anxiety. This will remove one of the primary barriers to EV uptake, allowing more consumers to get the economic benefit of switching to EVs (and accelerating the decarbonisation of the transport sector).

Sync with the grid by connecting and operating assets in a coordinated way to maximise the customer benefits. Greater coordination of consumer energy resources will ensure we avoid $37 billion of investments in the energy system that would otherwise be needed if coordination remains low.

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Glossary

Abbreviation	Definition
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BTM	Behind The Meter
CER	Consumer Energy Resources
CECV	Customer Export Curtailment Value
C&I	Commercial & Industrial
DERMS	Distributed Energy Resource Management Systems
DNSP	Distribution Network Service Provider
EV	Electric Vehicle
EVCI	Electric Vehicle Charging Infrastructure
FTM	Front of The Meter

Abbreviation	Definition
GW	Gigawatts
HEMS	Home Energy Management System
ICE	Internal Combustion Engine
ISP	Integrated System Plan
kW	Kilowatts
kWh	Kilowatt-hours
MW	Megawatts
NEM	National Electricity Market
REZ	Renewable Energy Zone

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- Founded 1983
- 21 Offices
- 203 Partners
- 2,200 Staff

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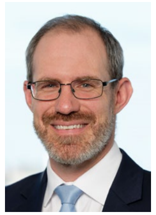

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