Increasing integration of renewables into the electricity grid

Address to the All Energy Conference, Melbourne 4 October 2016

John Bradley, Chief Executive Officer, ENA

I acknowledge the traditional owners of the land on which we meet – the Kulin Nations – and, in a spirit of reconciliation, pay my respects to their elders past and present.

I would like to thank the Conference organisers for this opportunity to be with you and acknowledge the **Chair, Kane Thornton** and the **Honourable Lily D'Ambrosio, Minister for Energy, Environment and Climate Change**.

I have been asked to address the issue of **Increasing Integration of renewables into the electricity grid**, an important issue in an important week for Australian energy and carbon policy as our State and Federal Energy Ministers gather for their ***second*** 'crisis' meeting within just 7 weeks. Perhaps this conference is exceptionally well-timed or perhaps this is a volatile time in the energy sector.

Australia needs to perfect **smarter, better and earlier** integration of renewables in the energy system as much as any place on the planet. Our renewable resources are immense and diverse. Our carbon abatement challenge is among the world's highest on a per capita basis and baseline readings of C02 recently exceeded 400 parts per million in the atmosphere. Our 900,000 kilometre, extenuated electricity grid covers a continent, with limited interconnection and low customer density in many areas. And of course, solar PV is already connected to – if not "integrated" with –the grid at the highest penetration rates in the world - even as we emerge as an international hotspot for battery storage.

Today, I will seek to answering a number of questions:

- **What lessons should COAG Energy Council's crisis meeting on Friday take from South Australia?**
- **How do we secure the achievement of current and future carbon targets at least cost to customers?**
- **How will the Grid transform itself to achieve greater Integration of Renewables?**
- **How can incentives help Australia unlock the full potential of its Distributed Energy Resources?**

Australia's energy system is undergoing the most radical transformation since the days of Edison and the original Tesla.

We initiated our Electricity Network Transformation Roadmap project with the CSIRO to equip electricity networks to support the dynamic services that customers value in a transformed market. It will be a **market driven** transformation - impelled by customers seeking greater ***choice and control*** over their energy use; embracing technology and expecting customised experiences without increasing the time they spend thinking about energy.

Whether its rooftop solar, battery storage, electric vehicles or microgrids, **customer choices** will shape the future of an integrated grid. In fact, the CSIRO's recent research for the Network Transformation Roadmap estimates customers or their agents will make 25% to 40% of all investment decisions in the energy supply system out to 2050 - up to $400 billion.

There is a lot of **uncertainty** about how consumer trends will emerge; how technology competition and convergence will play out; when the S-curve will see solar/batteries reach grid parity; or our tipping point for electric vehicle adoption. As the South Australian storms show, the electricity system has always dealt with risk but this market transformation will **fundamentally increase the breadth of uncertainty.** There is the real potential for impacts on system security and reliability, inefficient investment by customers or service providers; or for some customers to be disadvantaged or left behind. Energy transformation is an "Egg and Spoon" Race on behalf of consumers. We must execute a **rapid transformation** without compromising a **delicate balance**.

With a **planned** response focussed on customer outcomes rather than inputs, governments can remove unnecessary risks.

Neither utilities nor policy makers can **'command and control'** our way through that uncertainty. However, we are certainly responsible for the **incentives** that are provided to market actors – and I will make clear what is at stake for customers.

1. What lessons should COAG Energy Council's crisis meeting on Friday take from South Australia?

So far, last week's weather events in South Australia appear to have more to teach us about the poisonous nature of our political debate, than about the energy system.

This was a significant statewide 'system black' event which impacted 1.6 million people and caused distress or inconvenience to many. Based on what we know today, the primary cause was an extreme weather event, as evidenced by the damage to over 23 transmission towers.

The protection systems protected life and property and the restart from system black was undertaken promptly.

- Yes, as AEMO has indicated, there will need to be a careful assessment of the factors leading to the system black event.
- Yes, the interconnector did play a crucial role reenergising the system, as already anticipated by AEMO and Electranet studies.
- Without doubt, the resilience of South Australian power system security is certainly being stretched by the loss of synchronous generation, which is well documented in the work of AEMO and the rule change proposals of the South Australian Government itself.

We welcome the post-event review to be undertaken and look forward to evidence-based conclusions it will draw. Until then, it would be better that those rushing to judgement or calling for heads to roll should take a breath.

We also welcome a further discussion by COAG Energy Council Ministers this week on further opportunities for the integration of carbon and energy policy. Given the need for a coherent, planned transition, Energy Ministers must be pulling *together*, rather than pulling *apart*, at this watershed moment for Australian carbon and energy policy.

Some of the actions required are already "in the pipeline":

- **The AEMC and AEMO reviews related to power system security will assess key questions about the future of the NEM, as synchronous, dispatchable generation declines and power electronics increase at all voltage levels.** Will the NEM require explicit capacity measures or flexibility markets as marginal costs approach zero? How will ancillary services such as fast frequency response best be secured?

  In the long-term, Australia will need dispatchable, low carbon energy sources to balance the power supply in real time. The good news is there an active technology competition underway. The solutions to intermittent generation could lie in concentrated solar thermal technology or battery storage. There are other options that remove the carbon footprint of conventional generation, like renewable biogas, carbon capture and storage, or storing energy in gas networks through Power to Gas technology.

- **We welcome the COAG Energy Council's commitment to review the regulatory investment test for interconnection to ensure is streamlined and fit for purpose.** Naturally, while timely development of interconnection is likely to be critical to supporting renewable integration, each proposal must be justified on its merits and its ability to provide value to customers.

With these matters in train, the key question Energy Ministers should focus on, on Friday, is:

2. How do we secure the achievement of current and future carbon targets at least cost to customers?

There is no doubt Australia faces a ***higher cost, less secure decarbonisation*** with a mish-mash of inconsistent Federal and State initiatives. We are 'running with scissors' in what is supposed to be a national energy market – but Energy Ministers gathering on Friday can reduce the risk.

Recent economic analysis by Jacobs for the ENA assessed the cost to Australian electricity customers and the economy of different carbon policy frameworks. It considered both Australia's current target of 26-28% percent below 2005 levels by 2030 and a higher target of 45%. The full report is available at the ena website. The three scenarios assessed were:

1. **Business-As-Usual** – where the suite of current government policies continues and major policy settings are adjusted to reach specific abatement targets.
2. **Technology-Neutral** – where the current suite of policies is adjusted to become technology neutral and elements of a 'baseline and credit' scheme are introduced.
3. **Carbon-Price-Mechanism** – where all policies are removed and replaced by a carbon price on all emissions

The results from the analysis demonstrate that the 2030 target could be met in **any** of the three scenarios, with the main difference being in the **cost** to achieve it:

The lowest residential electricity bills are achieved with Technology Neutral policy, with bills averaging $216 per year less over the 2020 to 2030 decade, compared to the Business as Usual setting.

Economic savings of $900 million could be achieved over the period under a Technology Neutral approach and up to $1.5 billion in savings could be achieved in the Carbon Price Mechanism scenario.

Importantly, Technology Neutral policy settings are not an attack on renewables. In all scenarios, the Renewable Energy Target of 33,000 GWh is met by 2020. Renewable generation output grows to reach at least 74,000 GWh by 2030. Nor is this a pitch for more gas-fired generation. While gas fired

generation output is increasing in the three scenarios, it is actually ***lower*** under the technology neutral scenario. Coal fired generation naturally falls significantly in all scenarios.

The key factor driving benefits was **outcome based policy which allows markets to work**. In these scenarios, each technology finds its efficient role and the power system is in a **stronger position** to support more renewable energy, while **avoiding reliability and security risks for customers**.

There is a pragmatic opportunity to allow carbon trading between electricity generators by building a 'Baseline and Credit' trading scheme on the existing Emissions Reduction Fund Safeguard Mechanism. Jacobs achieved the current targets with an 'average intensity' baseline reducing from 0.8 tonnes (CO2e) per MWh by approximately 3% per year from 2020.

The Jacobs analysis suggests policy 'fragmentation' could cost Australian customers hundreds of dollars per year without any benefit in reducing global warming. This is borne out by the recent report of the Climate Change Authority which conclude technology-specific carbon policy result in higher costs for the same abatement.

Higher abatement targets are also achievable. If Australia can secure tangible progress with consensus today, we can review and tighten our carbon targets and refine emissions trading options over time.

As COAG Energy Council Ministers gather on Friday and as we consider the 2017 Review of Australia's carbon policy, we would urge Ministers to take 7 steps to smarter carbon policy:

1. Pursue an **enduring, stable and nationally integrated** carbon policy framework based on consensus.
2. Introduce a **'Baseline and Credit' Scheme** leveraging the current legislative architecture of the Emissions Reduction Fund Safeguard Mechanism.
3. Over time, **consider options to increase economic efficiency by moving to a Carbon Price mechanism**, with appropriate financial transfers and household support and without risking subsequent policy 'churn'.
4. If governments maintain direct incentive programs, transition Commonwealth and State programs to focus on **least cost abatement outcomes**, which are **scale neutral** and **technology neutral**.
5. **Continue to review Australia's abatement targets** (in the form of Intended Nationally Determined Contributions or INDCs), within the 5 yearly cycle proposed following the COP21 Agreement in Paris.
6. Incorporate an **explicit, independent assessment of national energy market implications** when developing jurisdiction initiatives on carbon and renewables policy.
7. Ongoing **support for research, development and demonstration** on a diverse range of low emission technologies.

3. How will the Grid transform itself to achieve greater Integration of Renewables?

This is an international focus. The 2015 IRENA Technology Brief indicated renewable energy could provide an average of 44% of global energy by 2030. While the IEA projections were lower at 30%, they reached 48% by 2050. The real question is not so much **where** our global energy mix is going, but **when** we will get there.

Transmission networks are highly focussed on how to support the development of large-scale renewable generation.

Many are well positioned to accommodate sizeable increases in new renewable generation without impacting on network stability. Some are progressing connection hubs to lower connection costs and address increasingly decentralised supply from renewable sources. For instance,

- Powerlink has adopted a 'clustering' model for shared assets designed to reduce connection infrastructure costs. It has mapped its network to identify potential areas where there is both existing network capacity combined with high solar radiation levels. In these Renewable Energy Zones (REZs), multiple proponents could connect to the existing network through 'shared assets' reducing their project costs.
- Transgrid has a similar approach to connection Hubs. It also sees its proposed NSW-SA interconnector as not only supporting market outcomes but facilitating the development of the renewable energy corridor in south-west NSW;

With over 40% of renewable generation on its system, Electranet has undertaken significant studies on high penetration renewable scenarios with AEMO. With Worley Parsons and AGL it recently evaluated the potential for medium to large scale (5-30MW) energy storage to support the integration of renewable energy.

Elsewhere diverse technical solutions are being used by Transmission networks to support grid stability, such as static compensators (STATcoms) providing reactive power to the grid with a highly dynamic response.

Many customers will never see the dramatic changes needed in the distribution network's planning, operation and design. Most would be surprised to know the 730,000 km distribution network was built to be relatively **passive,** for a **one-way electricity flow**, with **limited sensors** in the low voltage network. In most states, we can't measure when most of us use energy.

Yet the ***actively managed smart grid***, with intelligent devices, connectivity and controls, will be intrinsic to ensuring the more efficient more distributed and cleaner energy future that Australians will value.

The toolbox to support renewables integration are well known - including advanced analytics enabled by smart meters, distribution automation, renewable resource forecasting, smart inverters, distributed storage and micro-grids.

Battery storage has a critical contribution to make, not only in time-shifting and peak demand management but in flexibility services which enable more renewables to be hosted on the network. In a smarter grid, these distributed resources can be harnessed to support high voltage and medium voltage system requirements - perhaps at the "DSO/TSO" boundary.

We shouldn't lose sight of the extensive storage on our distribution networks today. Energex is making use of its widespread ripple control of hot water systems as a "solar sponge", resulting in the storage of PV energy and low cost integration.

This brings me to the final topic this morning –

4. How can incentives help Australia unlock the full potential of its Distributed Energy Resources?

ENA and CSIRO are today releasing the results of a key aspect of our Network Transformation Roadmap project, assessing how tariffs and incentives can achieve better outcomes for customers. Working with CSIRO, Energeia developed the largest scale, network cost-price forecast model undertaken in

Australia, evaluating tariffs and technology adoption. It evaluated outcomes for diverse customer types and analysed the network at a zone substation level.

The key issues evaluated included:

- What benefit can be achieved in **'First Wave' tariff reform** where Australia moves from current volume-focused network tariffs to demand tariffs which reflect the key driver of future network costs?
- What **options to transition customers** to demand-based tariffs enabled by smart meters, will be most effective while enabling choice?
- What value could be created if customers **sell DER services to networks** at the right place at the right time to avoid network investment?
- If some customers have the ability to self-supply with onsite resources, can the grid offer them new products like a **Stand Alone Power System (SAPS)** tariff to create "win-win" value for them and other network customers?

The major key findings on the immediate need for first wave reforms were as follows: [SLIDE}

- A transition to demand based tariffs could save customers over 10% per year on average network bills by 2026 and achieve economic benefits of $1.8 billion.
  - Demand based tariffs reward customers who help to reduce peak demand pressure on networks. However, current tariffs will increase the risk of unnecessary investment in network infrastructure and DER, leading to higher average electricity bills and unfair cross-subsidies paid for by some customers.
- Waiting for customers to "Opt In" to new network tariffs fails to achieve timely take up of fair and efficient tariffs, with 70% of customers remaining on legacy tariffs in 2026.
- By contrast, customers can be assigned to demand tariffs, with a choice to "Opt Out" while achieving effective reform – less than 10% choose to return to legacy tariffs.
- Smart meters are essential to enabling demand-based tariffs and will require close monitoring by policy makers to ensure market-led deployments are effective by 2021. Over time New & Replacement policies and DER installation could see about 8 million extra smart meters by 2027 and 16 million by 2050.
- However, without actively assigning customers to demand-tariffs, 60% of forecast smart meters will remain unused for cost-reflective tariffs in 2050, resulting in $2.4 billion in under-utilised investment.

With demand-based tariffs in place, Energeia also evaluated the potential for **'second wave' incentives** – to unlock the value of distributed resources. Customers (or agents) could choose to 'opt in' to rewards for grid support in the right place at the right time. That might be incentives for the 'orchestration' of DER. That could include direct load control of hot water and air conditioning we already see in Queensland and New South Wales. It could be a subsidised battery which can be called on by the network a few times per year, which is happening in a South Australian trial. The customer might have a relationship directly with the network or an aggregator – the essential requirement is that the service is secured to allow the avoided network investment. In the future, a very sophisticated, 'transactive energy market' might see dynamic trading between networks and the DER, while still keeping life simple for the owner.

Many of those models deliver grid benefits but **don't** rely on being 'passed through' as a component of the retail electricity tariff. This may provide the kind of certainty needed to support a firm planning decisions not to undertake traditional network investment. Energeia projected up to **a third of customers** would participate with the right incentives either directly or through an intermediary.

By 2026, 42% of customers have DER including 20 GW of solar and 30 GWh of battery storage. With orchestration, this can make a significant difference to localised network peak demand that drives network expenditure. In fact, by 2050 Energeia forecasts that peak demand could be ***below*** 2016 levels.

» If Networks buy grid services from DER Customers in the right place at the right time, this 'orchestration' could replace the need for **$16.2 billion in network investment**, avoid **cross subsidies**, and **lower average network bills by around 30%** compared to today.

Many customer advocates and policy makers have recognised the risk that current tariffs could embed cross-subsidies between customers, particularly as distributed resources become more widespread. One of the important conclusions of Energeia's analysis is that better incentives will protect 'passive' customers, including the vulnerable or those unable to participate in new markets.

» Not only are average bills lower with orchestration of DER - the gap between active and passive customers is far lower, reducing cross-subsidies and inequity between customers. **This could save $600 per year for a medium family without distributed resources.**

Conclusion

Thank you for the opportunity to be with you today – and to address just some of the opportunities greater integration of renewables into the grid. There are consistent themes in our analysis of carbon policy, network transformation and incentives to unlock distributed resources.

The network sector is committed to approaching the future with customer outcomes in mind – rather than being wedded to 'business as usual' or particular technologies. Our favoured scenario in the Energeia analysis is the one which sees the lowest level of network investment. It is the option that involve stronger partnerships with customers, aggregators and alternative technologies.

I wish you well in the rest of the Conference.