Department of the Environment and Energy – Review of Climate Change Policies

Response to Discussion Paper

(May 2017)

Energy Networks Australia

Contents

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Recommendations

Energy Networks Australia recommends the Review address key measures to achieve Australia's current or future carbon abatement objectives without compromising energy security and affordability, including:

- The urgent and critical need to achieve enduring, stable and nationally integrated carbon policy frameworks based on consensus;
- The introduction by 2020 of an outcome based policy mechanism in the stationary energy sector, such as an Emission Intensity Scheme or alternative policy of similar merit to achieve the nationally agreed 26-28% emission reductions by 2030;
- Processes to review over time, Australia's abatement targets (in the form of nationally determined contributions), within the five-yearly cycle proposed following the COP21 Agreement in Paris;
- Achieve COAG agreement to appoint an independent agency to complete an independent assessment of national energy market implications, including power system security, when developing jurisdiction initiatives on carbon and renewables policy;
- Review the effectiveness of Federal Government and State based direct incentive programs that are focused on providing technology specific support for carbon abatement beyond 2020.

1. Introduction

Energy Networks Australia welcomes this opportunity to make a submission in response to the *Department of the Environment and Energy's Review of Climate Change Policies discussion paper*.

We represents Australia's energy grid supporting all Australian customers with over 900,000 km of electricity transmission and distribution lines and almost 90,000 km of gas distribution mains. Our members provide energy to almost every household and business in Australia.

The Review provides a critical opportunity to provide a much-needed blueprint for reducing Australia's greenhouse gas emissions, in light of Australia ratifying the Paris Agreement on 9 November 2016. Under the agreement, Australia will continue to set its own emission reduction targets in contribution to the international efforts to hold the increase in the global average temperature to well below 2 degrees above pre-industrial levels.

Our submission will draw on recent carbon and energy modelling work completed by Energy Networks Australia including

- comparative analysis of alternative carbon policy options by Jacobs,
- electricity system modelling in the *Electricity Networks Transformation Roadmap* (the Roadmap);
- an evaluation of deep decarbonisation pathways for the Australian gas sector, in *Gas Vision 2050*.

These publications are attached for your information and supporting consultancy reports and other resources are available from: www.energynetworks.com.au.

The Australian energy market has experienced historic shifts in the last five years including:

- Changing consumer behaviour including the rise of rooftop solar PV penetration to world leading levels;
- The decoupling of energy consumption from economic growth;
- Significant increases in renewable energy capacity impacting physical and financial markets as well as the operation of incumbent generation;
- Declining levels of synchronous generation particularly in the weakly connected system of South Australia;
- The exit of coal powered synchronous generation, some with short notice to the markets;
- Poorly integrated and uncertain policy settings, including in carbon and energy policy; inconsistent State and Federal measures; and partisan disputes over national carbon policy measures since 2007; and
- The internationalisation of eastern Australian gas markets at the same time as additional restrictions are introduced on gas exploration and development.

Energy Networks Australia regards the Review as a unique opportunity to reset consensus-based carbon policy and regulation in Australia, strengthening our institutional capacity to achieve better customer outcomes.

Recommendations

Energy Networks Australia recommends the Review address key measures to achieve Australia's current or future carbon abatement objectives without compromising energy security and affordability, including:

- The urgent and critical need to achieve enduring, stable and nationally integrated carbon policy frameworks based on consensus;
- The introduction by 2020 of an outcome based policy mechanism in the stationary energy sector, such as an Emission Intensity Scheme or alternative policy of similar merit to achieve the nationally agreed 26-28% emission reductions by 2030;
- Processes to review over time, Australia's abatement targets (in the form of nationally determined contributions), within the five-yearly cycle proposed following the COP21 Agreement in Paris;
- Achieve COAG agreement to appoint an independent agency to complete an independent assessment of national energy market implications, including power system security, when developing jurisdiction initiatives on carbon and renewables policy;
- Review the effectiveness of Federal Government and State based direct incentive programs that are focused on providing technology specific support for carbon abatement beyond 2020.

2. Energy Networks Australia climate change policy position

Energy Networks Australia advocates for the following key climate change policy settings:

1. ***Australia's response to climate change should be integrated with energy policy and measures should be built in to ensure implementation is 'followed through'.***

   Climate policy should not be set in isolation but be integrated with the other consultation processes underway across the Australian economy including the Independent Review into the Future Security of the National Electricity Market (Finkel Review), the Department of the Environment and Energy's stakeholder consultation on "Better fuel for cleaner air" and the independent inquiries on energy security and energy storage, and others.

   A number of related reviews and studies aimed at creating integrated national frameworks and consistency have previously been completed, but not acted upon. Recognising this, the Department should expand its current review and consider these other reviews and studies while developing an integrated carbon and energy policy framework and including a plan of action, with specified timeframes, actions and accountabilities.

   The greatest single risk to an efficient and secure transition to carbon neutrality is inconsistent jurisdictional policy frameworks in a national market and a lack of regulatory cohesion. Hence Energy Networks Australia advocates that the Department adopts an integrated approach to developing climate change and energy policy.

2. ***Technology neutrality and flexibility, rather than prescription will deliver better customer outcomes.***

   Adopting a technology neutral approach to carbon reductions provides the lowest impact to customers. The Jacobs analysis found that a technology neutral framework could achieve the 2030 abatement target at the lowest cost compared to other policy settings resulting in an average saving of $216 per annum over the 2020 to 2030 decade.

   While technology scanning will be important, the Review should seek to avoid identifying a 'silver bullet' or developing climate change policies favouring particular technologies. The Department should instead adopt a principle of technology neutrality and seek to establish a mix of market and regulatory frameworks which encourage innovation and competition, and remove barriers to the formation of commercial solutions. Measures supporting research and development, pilots and trials can play an important role in niche areas of technology development. However, the more significant investment risks to an efficient energy transition result from governance issues and poorly coordinated

policy and regulatory frameworks. For instance, the Review should avoid a recommendation to mandate direct support for particular generation options or other technologies like storage – instead focussing on the market service or outcome that is required, such as abatement targets or emissions intensity targets. Similarly, Governments should avoid prescriptive regulation of technology solutions which prevent new technologies like storage realising their full value across the supply chain.

The Department should also give consideration to potential abatement opportunities between sectors. For example, the current approach in the Emission Reduction Fund focusses on a sectoral baseline for the electricity sector. However, opportunities arise where emissions from the electricity sector could be reduced through switching from electrical to gas appliances within households or commercial buildings. Alternatively, the introduction of electric vehicles may reduce emissions from the transport sector but will require increase electricity generation and potential growth of emissions in that sector. Climate change policy settings should allow for reductions across the economy.

3. *Incentives play an important part in the energy market transformation.*

The Roadmap suggests a 'co-optimised' energy system could reduce average network costs by 30% below 2016 levels by 2050 and contribute to total system savings of over $100 billion by 2050. However, this is reliant on:

- frameworks where customers or aggregators are given efficient incentives to provide flexible capacity services through Distributed Energy Resources 'in the right place, at the right time'
- networks effectively providing cost-reflective network tariffs which are important for efficiency and fairness
- regulatory arrangements, which are appropriately flexible to allow network innovation and the development of shared experience.

The efficiency created by a co-optimised system have the potential to offset the higher cost energy supply mix which is required to achieve energy sector abatement objectives.

4. *There are multiple pathways to deep decarbonisation.*

A number of parties including Energy Networks Australia and the Climate Change Authority acknowledge that deep decarbonisation of the electricity system is achievable without compromising security or affordability. However, it will require action in a number of areas including securing stable and enduring outcome-based, technology neutral carbon policy.

The Roadmap concluded a plausible projection for meeting wholesale energy requirements and achieving zero net emissions by 2050 in which there is a primary role for storage in balancing the output of intermittent variable renewable energy. While battery storage is forecast to provide the dominant new source of energy balancing, a diversity of potential solutions exist which could be employed as

alternative options while still achieving zero net emissions, depending on their changing economic potential. For instance, other options identified for energy balancing which may provide such solutions in a low or zero net emissions system include:

- renewables diversity (technological and geographical)
- pumped hydro storage
- co- and tri-generation
- power to gas hydrogen storage
- concentrated solar thermal generation or gas-fired generation supported by carbon capture and storage (CCS) technology
- firm (dispatchable) renewable capacity
- demand management.

Furthermore, the Gas Vision 2050 provides a conceptual framework for decarbonising gas used directly by households, businesses and industry.

However, it is neither *possible* nor *necessary* for the Department or Governments to predict the optimal technology mix which would secure deep decarbonisation between 2030 and 2050. As noted in the Roadmap and this submission, it is important that the technology pathways to deep decarbonisation emerge through competition in outcome-focussed, non-prescriptive market frameworks.

5. *Gas has a significant role to play in Australia's energy system*

Energy Networks Australia encourages the Government to adopt a holistic approach, which recognises the co-dependent relationship between electricity and gas systems in Australia. Gas contributes significantly to Australia's electricity generation sector. In 2014/15, it provided 18% of total generation. As a flexible generation technology, gas fired power stations can provide a critical balancing service, enabling higher penetration of variable renewable energy. This requires market participants to have sufficient commercial confidence to underwrite plant availability and gas contracting.

Further, gas also plays a recognised role in mitigating electricity peak demand events through the energy consumed directly. Gas is a low emission fuel and it is estimated that the direct use of gas in the home has between a quarter to a sixth of the emissions of the same energy sourced from the electricity grid. On a national basis, gas provides 44% of energy used in households for only 13% of the emissions from those households.

Gas can also positively contribute to the security and supply of electricity and energy more widely. Distributed natural gas is complementary to other energy sources and can assist with the energy trilemma:

- *Reliability:* gas networks are largely underground and as such are very reliable.

On average, customers experience only one hour off supply every forty years[1].

- *Security of supply*: diversifying the energy mix is key to energy security.
- *Affordability:* reduced distribution gas prices have been placing downward pressure on residential gas prices[2].

Energy Networks Australia recommends that the Department considers the longer term future of gas and gas infrastructure. There is increasing Australian and international recognition of opportunities to further reduce the relatively low carbon footprint of gas with innovation in, for instance, the use of biomethane and hydrogen applications.

It is likely that gas will continue to play an important role as Australia makes the transformation to a cleaner energy future. In the home, gas is currently a cleaner fuel than electricity from the grid. Fuel switching in power generation from coal to gas offers the most immediate and risk-free option to cut emissions from the electricity generation sector. Over the longer term, gas will have its own decarbonisation journey. New fuels, such as biogas and hydrogen, have the potential to become mainstream and complementary to energy solutions that will use existing energy infrastructure.

6. *Transmission interconnection, battery storage and secure gas supply are vital to creating a low emissions future.*

An increasing proportion of intermittent generation will be made possible by greater inter-regional transmission capacity. This capacity will allow for better management of intermittent generation profiles using geographic diversity, lower energy prices for consumers, and greater energy security and emissions reduction benefits from better utilisation of renewable energy resources. The transmission network will also increasingly provide ancillary services to stabilise the power system.

Such interconnection should be economically efficient with each project assessed on its merits against alternative solutions. However, the cost of these services is typically only a fraction of the overall cost of investment in generation and interconnection is recognised internationally as a key solution to manage the integration of variable renewable energy efficiently and securely.

Secure gas supplies will be needed to support carbon reductions. Australia has large reserves of natural gas but unnecessary restrictions are limiting industry gaining access to explore and develop these reserves. A national approach should be adopted allowing industry to explore and develop individual sites based on internationally scientific best practice rather than adopting regional bans and moratoriums, which are increasing pressure on national gas supply.

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[1] Australian Gas Networks (AGN) Victoria and Albury Final Plan. December 2016.
[2] For example, in South Australia, AGN's distribution tariff fell by 23 % on 1 July 2016.

7. ***Support to ongoing research and development, and demonstration of low emission technologies.***

   Research and development, and innovation allow new low emission technologies to be developed, tested and introduced to the market.

   The review should adopt a technology neutral approach to supporting new technologies and consider all technologies covering:

   - Renewable energy technologies,
   - Energy efficiency technologies,
   - Energy storage technologies,
   - Carbon capture and storage,
   - Biofuel/ biogas technologies,
   - Hydrogen technologies,
   - Electric vehicle technologies, and
   - Other technologies that may lead to effective reductions in emissions in other sectors, for example agriculture or industrial processes.

3. Response to questions

3.1 Australia's Paris Target

Australia has committed to considering a potential long-term emission reduction goal for Australia beyond 2030. What factors should be considered in this process?

The Paris agreement ratified by Australia seeks to reach global peak emissions as soon as possible and to achieve net-zero emissions in the second half of this century so as to limit global warming to 2 degrees with higher aspirations to limit global warming to 1.5 degrees. This allows for a range of global decarbonisation pathways.

It is important for the Australian Government, State Governments and stakeholders to share a common objective for the long-term carbon abatement outcome for the nation, and key sectors. This can then inform not only 'corridors' or trajectories used in emissions abatement planning by the Australian Government but also allow anticipatory planning or investment risk assessments by market participants who must make decisions in the short-term, where market or regulatory frameworks are yet to be determined.

Decarbonising the energy sector will be critical to Australia's overall abatement objectives yet its investments are typically capital intensive and lumpy. A stable and enduring long term target for Australia for 2050 will influence investment decisions for new energy infrastructure. These investment decisions are being made in the next decade and efficient economic outcomes will need to consider long term targets.

The energy sector has opportunities to take early and create large decarbonisation opportunities compared to some other sectors, for example agriculture or industry. Decarbonisation of transport is also largely dependent on carbon free transport fuels and highly reliant on electricity generation through the emergence of electric vehicles.

The Roadmap shows that efficiency in other parts of the electricity supply chain can create "headroom" to offset the costs of more expensive low carbon emissions technologies. Pricing and incentive reform can lead to $16 billion savings to 2050 and 30% lower network costs.

What process could Australia use to implement its Paris commitment to review targets every five years?

No response provided.

What are the issues in the transition to a lower emission economy with respect to jobs, investment, trade competitiveness, households (including low income and vulnerable households) and regional Australia?

No response provided.

3.2 Electricity Generation

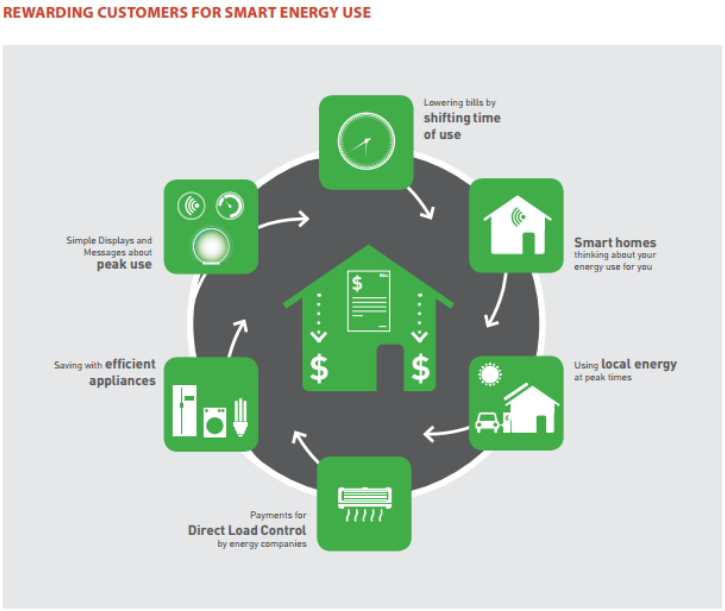
3.2.1 What are the opportunities and challenges of reducing emissions from the electricity sector? Are there any implications for policy?

Consumers are driving change

The 2017-27 decade is likely to see dynamic changes in the way Australians consume, produce and value electricity and related network services. CSIRO analysis for the Roadmap forecast that customers, rather than utilities, will make more than $200 billion of energy system expenditure decisions between now and 2050. Over 35 % of all electricity could be generated by customers by 2050.

For instance, the Roadmap identifies a number of benefits from a transformed energy system:

- Up to 10 million households and small customers will have onsite resources like solar, storage, smart homes and electric vehicles by 2050.
- The grid becomes a platform more like the internet, where customers can trade and share energy or receive offers of innovative services, with the confidence of a secure, affordable and low carbon service.
- Networks could buy grid support from millions of customers with solar, storage, smart homes or in demand response programs, with annual payments worth $1.1 billion within 10 years. (The orchestration of these distributed resources benefits all Australians as up to $16 billion in network infrastructure investment can be avoided by 2050, with network charges 30 per cent lower than today).



Source: Electricity Network Tariff Reform Handbook (May 2016)

An efficient and secure transition depends on a broad range of actions identified in the Roadmap, including a fairer system of prices and incentives.[3]

Given the significant carbon abatement achieved in the adoption of distributed energy resources, these trends can contribute significantly to Australia's abatement objectives with appropriate policy frameworks and incentives from market participants.

The transition to a low emissions economy is underway

Australia has committed to a 26 to 28% abatement target over 2005 levels by 2030. The agreement reached in Paris in December 2015 consists of two broad international targets; firstly, to reach peak emissions as soon as possible, and secondly, to reach carbon neutrality in the second half of this century. Australia is currently on track to reach its 2020 emissions target but will require additional or strengthened policy settings to reach the 2030 target and/or become carbon neutral in the second half of the century.

The modelling in the Roadmap shows that Australia can meet its 2030 abatement target. Three options to reach the 26 to 28% target were considered:

- **Business as usual** – where the suite of current government policies continues and major policy settings (i.e. reduction of absolute baselines) are adjusted to reach specific abatement targets.
- **Technology neutral** – where the current suite of policies is adjusted to become technology neutral and elements of a baseline and credit scheme are introduced.
- **Carbon price mechanism** – where all policies are removed and replaced by a carbon price on all emissions.

The modelling indicates that the 2030 emissions reduction target can be met through any of the options modelled. The modelling also shows that the electricity sector does more than its share with its reductions being reduced by 36% over the 2005 baseline levels. The main difference between options is in the cost to achieve the abatement.

Australia's electricity sector is positioned to support further carbon abatement targets beyond 2030 and, with appropriate action, achieve net zero carbon emissions by 2050. The Roadmap analysis provides a plausible projection of generation sources to meet wholesale energy requirements and zero net emissions by 2050. However, this modelling is not intended to be an optimised analysis of comparative technical solutions to achieve a wholesale portfolio scenario. While battery storage is forecast to provide the dominant new source of energy balancing, a range of diverse solutions could be employed as complimentary measures while still achieving zero net

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[3] Energy Networks Association (2017), *Electricity Network Transformation Roadmap – Final Report: Chapter 3 Customer Oriented Networks,* p 15

emissions, depending on changing economic potential.[4]

Figure 4: Historical and projected quantity of electricity sector abatement by location on the network (*Roadmap* Scenario)

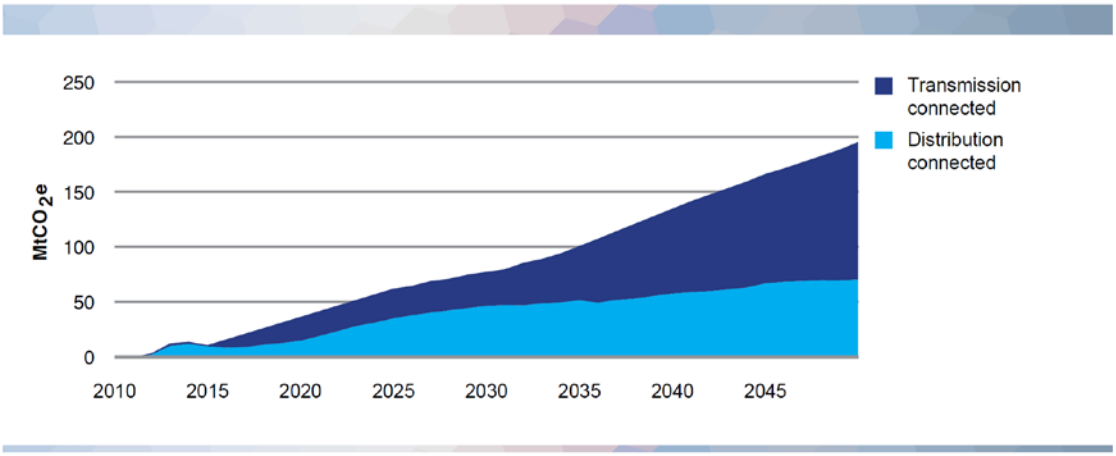
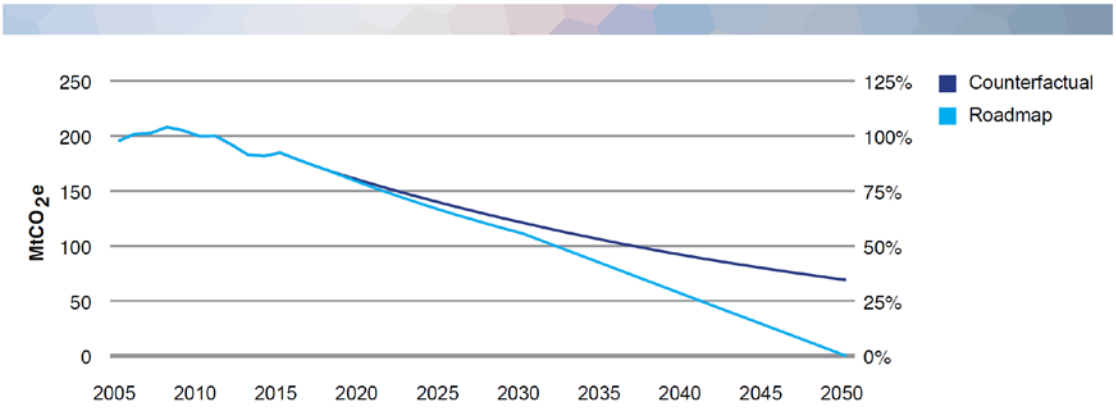


Figure 5: Assumed greenhouse gas pathways under *the Roadmap* and counterfactual scenarios (Left axis: emissions, right axis: percent abatement relative to 2005 emissions)



Source: Electricity Network Transformation Roadmap Final Report (April 2017)

Decline of traditional generation creates technical challenges

CSIRO energy system analysis concluded that Australia's electricity sector could exceed its share of current national carbon abatement targets, achieving 40% below 2005 levels by 2030. However, an integrated set of measures will be required including stable enduring carbon policy frameworks and incentives to enable 'orchestration' of millions of distributed energy resources.

Energy system modelling undertaken for the Roadmap identified plausible generation mixes required to meet wholesale energy requirements and zero net emissions by 2050. The analysis assumes a primary role for storage in balancing the output of

[4] Energy Networks Association (2017), *Electricity Network Transformation Roadmap – Final Report: Chapter 2 Program Evaluation & Benefits,* p 7

intermittent Variable Renewable Energy. However, the analysis also recognises that:

- While battery storage is forecast to provide the dominant new source of energy balancing, there are a diversity of potential solutions which could be employed as alternatives and/or complements while still achieving zero net emissions depending on their changing economic potential. For instance, some of the other options for energy balancing which may provide such solutions in a low or zero net emissions system include: renewables diversity (technological and geographical), 'pumped hydro' storage, 'Power to Gas' hydrogen storage, concentrated solar thermal generation or gas-fired generation supported by carbon capture and storage (CCS) technology, firm (dispatchable) renewable capacity and demand management.
- Power system security with this generation mix, with very low levels of native inertia will require careful analysis of system stability and security risks during the transition of the generation portfolio. A range of technical solutions exist to achieve inertia and frequency management outcomes, including the use of synchronous condensers, rotational stabilisers, large scale batteries, flywheel technology and emulated inertial responses from, for instance, super-capacitor technologies or wind turbines by using the kinetic energy to support the frequency by interchanging this energy with the grid.

Key elements of an emissions reduction policy

The Energy Networks Australia publication, *Enabling Australia's Cleaner Energy Transition*[5] outlines seven steps to improved national carbon policy. This was supported by detailed economic analysis completed by Jacobs[6] which examined a variety of policy options to achieve Australia's current abatement target (i.e. emission reductions of 26 to 28% below 2005 levels by 2030) or an extended target of 45%[7]. The analysis demonstrated that the current 2030 target could be met in any of the three scenarios, with the main difference being the economic efficiency and outcome for customer bills. Significantly, the technology neutral and carbon price scenarios – which did not have an expanded renewable energy target - saw significant increases in the level of renewable generation based on its economic merit in achieving carbon abatement. Nonetheless, the level of renewable generation in all scenarios reached approximately 30% of total generation by 2030 while meeting the current 2030 target.

These analyses indicate that the introduction of an additional renewable energy target does not increase the efficiency or effectiveness of the growth in renewables. There is material evidence that a technology specific renewable energy target or regulatory closures would perform more poorly (in terms of customer bill outcomes and economic costs) than technology neutral "indirect measures". The Climate Change Authority[8] also found that technology pull mechanisms, such as a renewable energy target and/or contracts for difference are a more costly approach to carbon abatement compared to market mechanisms such as a cap and trade or emissions intensity schemes.

Importantly, the key element is to pursue an enduring, stable and nationally integrated carbon policy framework. Building new energy infrastructure requires a long lead time and requires a long-term position on carbon and energy policy to provide investor confidence.

Energy Networks Australia supports the development of effective national policy initiatives that achieve the effective monitoring and abatement of greenhouse gas emissions to meet Australia's current and future international obligations.

This submission highlights in many areas the need for greater consistency between State and Federal policies related to carbon and energy policy, including a coherent and coordinated technology neutral approach to achieving national carbon abatement objectives. To achieve an efficient transition, climate policy frameworks should ideally be national and focused on outcomes (carbon abatement) rather than inputs (renewable energy generated). This permits Australia's abatement targets to be

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5 Energy Networks Australia (2016), *Enabling Australia's Cleaner Energy Transition*, available from www.energynetworks.com.au

6 Jacobs (2016), *Australia's Climate Policy Options – Modelling of Alternate Policy Scenarios*, available from www.energynetworks.com.au

7 The outcomes of the 45% target scenario are reported, indicating similar results – i.e. lowest residential bill under a technology neutral approach.

8 Climate Change Authority (2016), *Policy options for Australia's electricity sector – special review research report,* p.10

achieved at least cost and in a technology neutral manner.

Frameworks for abatement should:

- facilitate national abatement outcomes in an economically efficient manner across all relevant sectors of the economy, and
- seek to minimise economic distortions and, in the case of the stationary energy sector, emissions abatement policy must consider, and be appropriately integrated with, energy policy objectives and market frameworks.

The role for natural gas in reducing greenhouse gas emissions in the electricity sector

Gas contributes significantly to Australia's electricity generation sector. In 2014/15, gas provided 18% of total generation. Gas is a low emission fuel with significant capacity to support Australia achieve its carbon abatement targets.

It is estimated that the direct use of gas in the home has between (a quarter to a sixth of the emissions of the same energy sourced from the electricity grid)[9]. On a national basis, mains supplied gas provided 44% of energy used in households, but represented only 13% of the emissions from those households. Forty nine per cent of households are connected to mains gas with a further 20 % connected via bottled gas. Overall, more than two-thirds of Australian households are connected to gas.

Gas used in efficient new gas-fired power generation has approximately half the emissions of the current electricity grid[10]. Modelling completed by Jacobs[11] indicates the energy mix to achieve the 2030 abatement target will change from being coal dominated to becoming more diverse in 2030, with coal, renewables and gas contributing more equally to the fuel mix.

However, unnecessary restrictions on gas explorations and development by state and territory governments including Victoria and Northern Territory are placing upward pressure on gas prices. A national approach to gas exploration and production, based on scientific advice, such as that provided by the Academy of Technological Science and Engineering[12], could provide incentives for industry to recommence exploration activities, placing downward pressure on long-term gas supply and prices.

Pricing & Market Reforms create 'headroom' for Carbon Abatement

The Roadmap demonstrates that efficiency in other parts of the electricity supply chain can create "headroom" to offset the costs of more expensive low carbon

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9 Energy Networks Association (2015), *Australia's Bright Gas Future – competitive, clean and reliable*, accessed from: www.energynetworks.com.au
10 Department of the Environment (2014), *National Greenhouse Accounts Factors.*
11 Jacobs (2016), *Australia's climate policy options – modelling of alternate policy scenarios*, report completed for Energy Networks Australia, accessed from www.energynetworks.com.au
12 Academy of Technological Sciences and Engineering (2015), *Unconventional gas is here: It presents challenges and opportunities*, available from: http://www.atse.org.au/atse/content/publications/focus/issue/193-unconventional-gas-is-here.aspx

emissions technologies.

For instance, network pricing and incentive reforms alone have the potential to achieve $16 billion in network expenditure savings to 2050 and to reduce network charges to customers by 30% by 2050 in real terms. Current small customer network tariffs currently provide no reason for consumers to use less electricity during peak times to manage their bills. Instead, network charges are currently structured in a way that rewards customers for using less energy throughout the day, even where it does not reduce the underlying costs of providing the network service.

Through the COAG Energy Council, Australian Governments have previously indicated strong support for tariff reform, as reflected in the Communique of December 2014.[13]

> *The Council supports tariff reform as an essential next step in this process as a means of providing better price signals to consumers and notes that new Distribution Network Pricing Arrangements will enable distribution businesses to set prices that reflect the efficient costs of providing network services to each consumer.*

By rewarding efficient use of distributed resources, it is possible to achieve a low emissions electricity sector, without compromising reliability and with better optimisation of distributed energy resources and network expenditures.

Energy Networks Australia identifies the need for pricing and incentives reform in two 'waves'.

First Wave Tariff Reform ensures universal tariffs are fairer and more efficient by reflecting the key cost driver of additional network services, the capacity required. With demand-based tariffs, for instance, customers are rewarded for helping to reduce future pressure on network costs.

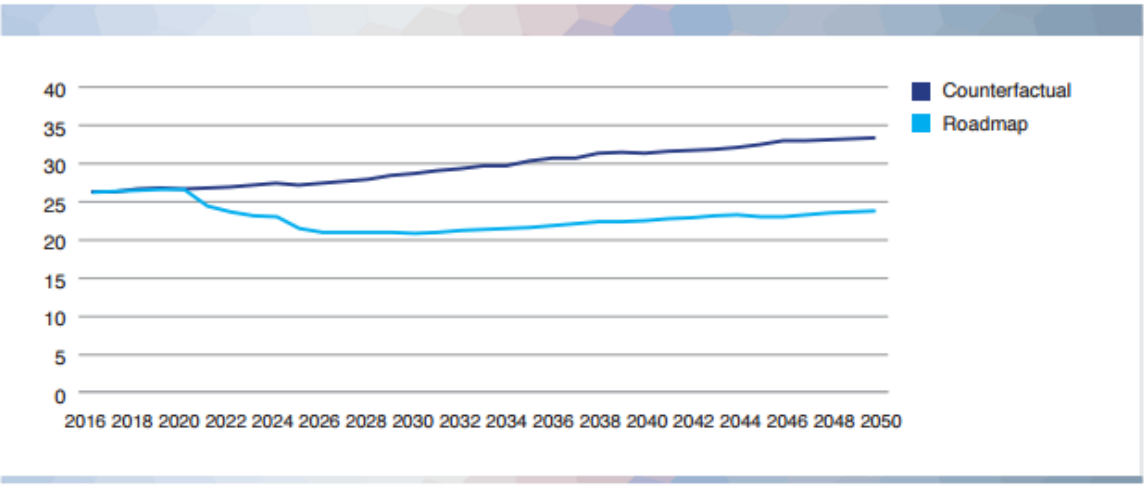
Second Wave Incentives allow customers (or their agents) to choose to 'opt in' to rewards for network support in the *right place* at the *right time.* These incentives are location specific and dynamic in time and could include:

- Incentive ***Payments for 'orchestration' of distributed energy resources (DER)*** (eg. battery discharge; smart inverters; load control; HEMs platforms);
- ***Advanced Network Tariffs for Behavioural Response*** (eg. Critical Peak Price; Peak Time Rebates; Nodal Pricing); or
- ***Transactive Energy*** (eg. real time pricing in future in distributed markets).

[13] COAG Energy Council, Communique, December 2014

The potential benefits of the pricing and incentive reforms recommended in the Roadmap to network peak demand management are identified in the Figure below.

Figure 18: Non-coincident substation peak demand



Source: Electricity Network Transformation Roadmap Final Report (April 2017)

It is important to note changes to tariff structures are revenue neutral for network businesses in the short term because they operate under 'revenue cap' regulation. In the long-term, *less* network revenue is actually required.

In its report for CSIRO and Energy Networks Australia, Energeia makes it clear that second wave measures depend on implementing 'First Wave' measures like demand-based tariffs for all customers. Nuanced incentives in specific grid locations at specific times will not be effective if the universal tariffs remain heavily volumetric with increasing cross-subsidies to DER customers. With the Roadmap measures, around $2.5 billion per annum in payments (or equivalent rebates etc.) to customers could be achieved by 2050 as a more efficient substitution for network augmentation and replacement investment[14].

These reforms to incentives do not need to be complicated for customers. DER will leverage automated platforms, energy management systems and machine learning, so that customers can choose to 'set and forget'. Similarly, customers who prefer simple bills under predictable plans will increasingly be offered retail products where the retailer uses its portfolio of resources to optimise and smooth costs.

[14] Energy Networks Association (2017), *Electricity Network Transformation Roadmap – Final Report: Chapter 7 Pricing and Incentives*, p 39

3.2 How can energy and climate policy be better integrated, including the impact of state-based policies on achieving an effective national approach?

There is a need to achieve better integration of policy frameworks in the following areas:

- Renewable and carbon policy measures which are developed without robust assessments of implications for national electricity markets, power system security or electricity network operations; and
- Carbon and renewable policy measures which are overlapping or inconsistent between State and Federal Governments;

Energy Networks Australia has recently recommended two key institutional reforms:

1. The Commonwealth Government should secure COAG agreement to appoint an independent agency to complete an independent assessment of national energy market implications, including power system security, when developing jurisdiction initiatives on carbon and renewables policy[15]; and
2. An independent institution (an Energy Security Council)[16] should develop and maintain:
    - a *National Energy Security Plan* with a 5 year outlook evaluating near term risks to energy security including relevant geographic considerations; the sufficiency of existing market and regulatory mechanisms to ensure energy system security; and prioritising intervention which will occur by a defined time if identified security risks persist in the market; and
    - a *National Energy Transition Plan* with a long term 30 year outlook to identify both the *required* trajectory or 'corridor' to achieve Australia's long-term carbon abatement objectives, energy security and affordability; and the *current* trajectory or 'corridor' noting the implications of State and Federal policy and regulatory frameworks and market circumstances.

Without a well-planned approach to navigate this transformation, Australia's energy system will be unable to efficiently and securely integrate the diverse technologies, large scale renewable energy sources and customer owned distributed energy resources. This will potentially result in the costly duplication of energy investments.

Australia is not unique in considering these matters. However, Australia arguably has a less cohesive and planned transition program being led by its diverse Federal and State Governments and national institutions, compared to other key jurisdictions.

» In a report for the **United Kingdom** Department of Business, Energy and Industrial Strategy, the Carbon Trust and the Imperial College of London examined the need for flexibility in the UK Power System to adapt to different

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[15] Energy Networks Association (2017), E*lectricity Network Transformation Roadmap – Final Report: Chapter 5 Carbon and Renewable Policy Options,* p.25

[16] For further information please see Energy Networks Australia's *Further Submission to the NEM Security Review Panel submission to the NEM Security Review,* available at www.energynetworks.com.au

future generation scenarios. The report recognised the "possibility of regret" when making decisions for uncertain futures, with power system investment requiring both long lead times before operational, and even longer lifetimes once installed. It concluded that decisions now to support a more flexible energy system provides option value and avoids the impact of maximum regret scenarios in the future[17]. The report arrived at similar conclusions to the Australian Roadmap about the potential value to customers of integrating flexible resources. It found that

> *Combining flexible solutions in a whole system approach could save the UK £17-40bn cumulative to 2050 through building less low carbon generation capacity, reducing peaking plant and fuel spending, and deferring investment in network reinforcement while still meeting carbon targets.18*

- **China** illustrates that a failure to anticipate system integration requirements can have significant implications for resource efficiency and utilisation. The Peterson Institute for International Economics (January 2017) noted that installed wind capacity in China is 75 per cent larger than that of the **USA.** However, output from wind energy is 14 per cent less, partly due to the necessary curtailment of wind output and the lack of flexibility in the power system to adapt to intermittence from wind generation[19].
- The **New York** Independent System Operator (NYISO) recently released its Distributed Energy Resources Roadmap. The NYISO Roadmap sets out a sequenced plan to develop the market design, pilot programs, metering policy and granular pricing over 3 to 5 years. This capability will permit Distributed Energy Resources to participate in NYISO's Energy, Ancillary Services, and Capacity markets, distinguishing between dispatchable or non-dispatchable resources. It notes that currently, there are limited options for these technologies to participate in the NYISO's markets and the system changes will allow Distributed Energy Resources to take advantage of real-time scheduling[20]:

While in many ways the characteristics of the NEM are different Australia has a comparatively less cohesive and planned transition program compared to other key jurisdictions. This is despite it integrating variable renewable energy at higher rates than anywhere else in the world, in terms of rooftop solar PV at microgeneration scale; and large scale renewables in South Australia. A more systematic, well-planned and cohesive approach is required given Australia is experiencing a more rapid transition.

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17 Carbon Trust and Imperial College of London: An analysis of electricity system flexibility for Great Britain, November 2016
18 Department of Business, Energy and Industrial Strategy & Ofgem (2016) *A Smart Flexible Energy System: A Call for Evidence*
19 Peterson Institute for International Economics: Against the Wind: China's struggle to integrate wind energy into its national grid, January 2017
20 NYISO Distributed Energy Resources Roadmap for New York's Wholesale Energy Markets, January 2017

3.2.3 Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, and regional Australia that should be considered for households, SMEs and the built environment?

Price structures can be made more equitable when:

- customers are transitioned to more cost reflective tariff arrangements which:
  - increase incentives/price signals for customers to reduce or substitute grid use at times most likely to reduce future network costs
  - reduce incentives/price signals for customers to reduce or substitute grid use at times unlikely to reduce future network costs
- customers with distributed energy resources are able to receive incentives for providing network support services at the time and location needed to improve the system's efficiency for everyone
- there is flexibility for new and differentiated services to be offered to customers – including transmission networks potentially introducing differentiated pricing in a more dynamic environment, to better incentivise connections in areas with underutilised network capacity.

However, the Roadmap is quite clear that the current policy settings will not achieve equitable outcomes without timely action by government and industry. To deliver affordability, customers need to transition earlier to cost reflective tariffs, with appropriate support measures and safeguards, such as the option to move back to legacy tariff arrangements if they choose. This in turn requires positive action to increase the penetration of digital (smart) meters, and removal of barriers so that customers can be transitioned to cost reflective tariffs by 2020.

Meeting the needs of vulnerable and hardship consumers

Given Australia's energy markets are experiencing significant changes in technology, customer preference and new information and services, it is important to review the effectiveness of the support provided to vulnerable customers - those that are at risk of experiencing financial stress due to a moderate increase in their energy bills.

Energy Networks Australia recently commissioned independent analysis by HoustonKemp, *Supporting Vulnerable Energy Customers*, which has identified potential options for government support and energy industry action.[21] Six key areas of opportunity were identified:

1. Harmonising the value of government assistance across jurisdictions.

[21] Energy Networks Australia (2015), *Supporting vulnerable energy customers*, available from: http://www.energynetworks.com.au/sites/default/files/ena_information_paper_-_supporting_vulnerable_energy_customers_may_2015.pdf

2. Effective targeting of government assistance based on need.
3. Maintaining the relative value of energy concessions over time.
4. Providing assistance to finance household or community investments in technology or energy efficiency improvements.
5. Transitioning vulnerable customers to more cost reflective electricity network pricing, including the option of 'social tariffs'.
6. Improving customers' access to information and decision tools.

Vulnerable and hardship customers require effective customer safety net arrangements which are resilient to changing energy technologies and choices by other customers. This can be met through:

- concession schemes which support those who need it most;
- robust customer protection frameworks; and
- clear rules for market entry and participation[22].

The introduction of cost-reflective electricity prices will need to be carefully managed to manage impacts for vulnerable customers. In 2014, the AEMC estimated that 70-80% of all customers will have lower network charges as a result of cost-reflective network pricing, over the medium term[23].

There is evidence that cost reflective pricing reforms are often beneficial to vulnerable customer cohorts which may be paying more than their share under existing tariff structures. For instance, a significant study identifying impacts of cost reflective tariffs on vulnerable customers was undertaken by AGL utilising its Victorian residential customer smart meter data combined with demographic data to identify the impact of demand based tariffs on Hardship and Concession and Pensioner Households. The study concluded that vulnerable customers are in fact more likely than other customers to benefit from cost reflective pricing once demand response is accounted for.

Detailed analysis is required of customer segments during the reform process, as noted in Energy Networks Australia's Electricity Network Tariff Reform Handbook.

[22] Energy Networks Association (2017), *Electricity Network Transformation Roadmap – Final Report: Roadmap Chapter 4 Customer Safety Net*, key findings 1 and 2. See also Power Transformed, Consumer Action Law Centre, July 2016

[23] AEMC: New rules for cost-reflective distribution network prices, News Release November 2014

3.3 Household, small to medium-sized enterprises and the built environment.

What are the opportunities and challenges of reducing emissions for households, SME's and the built environment? Are there any implications for policy?

Households, SME's and the build environment produce indirect emissions through the use of electricity but also direct emissions from the use of fuels within these environments. For example, gas, diesel or wood can be used to provide space heating in homes while co and tri-generation could be used in commercial buildings to provide a range of energy services including on-site electricity, space heating, hot water and/or cooling.

Some policy settings have produced programs that have provided carbon abatement at high costs. While some of these policies had dual purposes with the primary purpose being market development, it is arguable that these policies are currently no longer warranted and hence provided an unnecessary and economically inefficient subsidy. Two particular examples are the Small-scale Renewable Energy Scheme (SRES) and state based premium feed in tariffs. Analysis by Jacobs indicates the abatement cost of these programs is higher than alternative market approaches to securing that abatement. The SRES is winding down with the support being provided being reduced in the period from now to 2030 and state governments have switched to minimum feed in tariffs, more reflective of the cost of electricity generation that is being displaced.

It is estimated that the direct use of gas in the home has between (a quarter to a sixth of the emissions of the same energy sourced from the electricity grid)[24]. On a national basis, mains supplied gas provided 44% of energy used in households, but represented only 13% of the emissions from those households. Forty nine per cent of households are connected to mains gas with a further 20% connected via bottled gas. Overall, more than two-thirds of Australian households are connected to gas.

Co-generation and tri-generation also offers opportunities to reduce emissions in the built environment. This allows electricity to be generated from gas and at the same time producing either heating and/or cooling. These technologies allow a much greater proportion of energy within the fuels to be converted to usable energy and can operate between 60 to 80% efficiency compared to around 40 or 50% for high efficiency gas turbines used in power generation. The American Gas Association[25] shows that the combination of producing heat and electricity can be carried out at 75% efficiency compared to 51% efficiency when they are carried out separately.

Member businesses of Energy Networks Australia are investing in future technologies for decarbonising gaseous fuels used by residential, commercial and industrial

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[24] Energy Networks Association (2015), *Australia's Bright Gas Future – competitive, clean and reliable*, available from: www.energynetworks.com.au

[25] American Gas Association (2017), *2017 Playbook – Natural Gas: Moving our nation forward*, available from www.playbook.aga.org

customers. For example:

- **Energy Networks Australia - Gas R&D Fund** - The Energy Networks Australia Gas Committee members contribute to this fund. One of the projects supported by this fund aims to identify the commercial, technical and regulatory issues for ***injecting hydrogen into networks*** at levels of up to 15%. The scheduled completion date for this project is June 2017.
- **Australian Gas Networks (AGN) Hydrogen Project** - AGN has partnered with AquaHydrex, a business that has developed an advanced electrolysis technique for producing ***hydrogen from water***. The concept is based on the use of surplus electricity from renewables (i.e. wind and solar) to produce hydrogen for injection into natural gas networks. AGN currently purchases natural gas to offset system losses, and the displacement of all of this gas with hydrogen would be the ultimate goal. Funding is currently sought to build a demonstration pilot plant for commissioning in 2018.
- **Jemena trials of new technologies -** Jemena is actively exploring the potential for trialling hydrogen, biogas and other low carbon gas technologies in New South Wales with the objective of driving increased GHG emissions reduction and providing large-scale energy storage services to improve electricity grid stability.
- **ActewAGL Networks Sustainability Projects** - ActewAGL is investigating sustainability projects. One of these projects aims to convert organic waste streams to ***biogas*** in an anaerobic digestor and to inject that the produced gas into the ACT's gas distribution network. A business case for a pilot scheme is being developed. The second project aims to establish a pilot plant for research and development into producing hydrogen from excess renewable energy, linked to one of the ACT's wind farms.

Energy Networks Australia supports policy settings that are technology neutral for reducing emissions in the built environment. This will allow individual consumers to adopt the energy solution that best meets their individual requirements balancing cost, environmental footprint and security.

Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, and regional Australia that should be considered for households, SMEs and the built environment?

No response provided.

3.4 Resources, manufacturing and waste

What are the opportunities and challenges of reducing emissions from the resources, manufacturing and waste? Are there any implications for policy?

No response provided.

Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, households and regional Australia that should be considered when reducing emissions in the industrial sector?

No response provided.

3.5 Transport

What are the opportunities and challenges of reducing emissions in the transport sector?

The Australian transport sector is responsible for over 17% (93Mt CO_2 in 2015) of Australia's greenhouse gas emissions. This covers emissions from road transport (including passenger vehicles, trucking), rail transport, domestic shipping and aviation. Without emissions reduction strategies, emissions are projected to grow to 111 Mt CO_2 in 2030 due to population and economic growth that increases transport activity.

There are multiple ways to reduce emissions from the transport sector, especially in the road transport sector as noted below.

1) Electric vehicles

The NTR showed that 40% of light vehicle road transport could be electric vehicles by 2050. This would results in an additional 43 TWh of electricity being generated by 2050. For effective carbon reductions, this electricity would need to be generated from a low carbon source of electricity, such as described in Section 3.2.

2) Fuel cells (hydrogen)

Vehicles powered by fuels cells that use hydrogen only emit water vapour. The hydrogen can be sourced from electrolysis using excess renewable energy or through the common industrial approach of reforming natural gas.

3) Gas and biogas vehicles

Switching to gas vehicles also offers lower emissions compared to traditional petrol and/or diesel powered vehicles, as well as reductions in nitrous oxides and particulates that are responsible for smog within cities. If the gas used is sourced from biogenetic material, it is considered carbon neutral and produces lower emissions compared to traditional fossil fuelled vehicles. Further reductions can be possible by applying carbon capture and storage to the biogas production process resulting in net negative emissions from the use of biogas.

Energy Networks Australia supports a technology neutral approach to emission reductions from transport. This includes setting an appropriate emission standard for light vehicles.

Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, households and regional Australia associated with policies to reduce emissions in the transport sector?

No response provided.

3.6 Land and agriculture

What are the opportunities and challenges of reducing emissions from the land and agriculture sectors? Are there any implications for policy?

Biogas is a term that covers gaseous fuels such as biomethane or biopropane recovered from renewable sources including wastewater, landfill, agricultural or forestry waste. This means there are net-zero emissions from its use. Feedstock sources for biogas are widely available and diverse, so biogas could be produced at many different locations close to users and simply injected into the existing network. ARENA is funding a study[26] to identify and assess the bioenergy sources across Australia. This project will provide reliable nationwide information on biomass feedstocks, which will support the development of bioenergy and biogas projects across Australia.

Production of biomethane, which is the same as natural gas, is a well-established process using currently available commercial technologies. It can be mixed with natural gas in transmission and distribution networks with no modifications of user appliances or industrial processes required. Production of biopropane, which is the same as propane in LPG, is becoming established overseas. It can be used as a transportable gaseous fuel in areas where the gas network does not extend. Biogas can be stored in the distribution or transmission networks, or within cylinders, effectively providing renewable energy on demand. Biomethane converted to CNG or LNG or biopropane can also be used as transport fuel.

The potential for biogas is significant. In Canada[27], it is estimated that up to 1,300 billion cubic feet of biogas could be produced annually, representing approximately 50% of domestic gas consumption. In the UK[28], it is estimated that between 30 and 50% of natural gas demand could be met from the production of biogas. The Clean Energy Council[29] estimates that Australia's bioenergy has the potential to power 10.2 million homes by 2050, although that is mostly focused on using biomass for power generation instead of the production of biogas. Regardless, the potential for biogas is significant.

Converting waste to biogas also benefits our environment through improved waste management and reduced waste.

Producing biogas from biomass uses a commercially available reactor that reduces the biomass to biogas. This gas is then processed prior to being injected into the distribution network. This practice is common in Europe, especially in Norway,

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26 ARENA (2016), *The Australian biomass for bioenergy assessment project*, https://arena.gov.au/project/the-australian-biomass-for-bioenergy-assessment-project/
27 Canadian Gas Association (2014), *Renewable natural gas technology roadmap for Canada*, December 2014.
28 National Grid (2016), *The future of gas – supply of renewable gas*, available from http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Gas/
29 Clean Energy Council (2012), *Bioenergy fact sheet*, available from: https://www.cleanenergycouncil.org.au/cec.html

Germany and the United Kingdom. Within Australia, the largest biogas reactor is located near Goulburn, New South Wales, and processes 20 percent of Sydney's household waste. This reactor[30] is located at an old mine site. The biogas produced is converted to green electricity, but also provides heat for an aquaculture farm. Another project[31] in Western Australia, uses a specialised process to convert biomass into biogas. This project procured and modified technology from European vendors. Once again, the current setup is focused on generating green electricity but the project could just as easily be configured to produce gas that can be injected into the gas network as renewable gas.

There are no technical obstacles to biogas production. It has been proven on a commercial basis for producing renewable electricity and the produced gas could easily be injected into the distribution network as renewable gas.

What can be done to realise further benefits from emissions reduction activities beyond carbon abatement?

No response provided.

Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, households and regional Australia associated with policies to reduce emissions in the land and agriculture sectors?

No response provided.

[30] http://www.veolia.com/anz/our-services/services/municipal-residential/recovering-resources-waste/woodlawn-bioreactor
[31] Jandakot project – biogas, available from: https://arena.gov.au/files/2015/11/Jandakot-Bioenergy-Plant.pdf

3.7 Research, development, innovation and technology

What is the role of research, development, innovation and technology in reducing Australia's emissions? Are there any implication for policy?

The transition to a decarbonised economy will rely on new technologies and the deployment of those technologies.

A diversity of potential technologies and different mixes of these technologies exist which could be employed as alternative options while still achieving zero net emissions. Some of these technologies include:

- renewables diversity (technological and geographical)
- pumped hydro storage
- power to gas hydrogen storage
- co- and tri-generation
- concentrated solar thermal generation or gas-fired generation supported by carbon capture and storage (CCS) technology
- firm (dispatchable) renewable capacity
- biogas production and use
- demand management.

It is neither *possible* nor *necessary* for the Department or Governments to predict the optimal technology mix which would secure deep decarbonisation between 2030 and 2050. As noted in the Roadmap and this submission, it is important that the technology pathways to deep decarbonisation emerge through competition in outcome-focussed, non-prescriptive market frameworks.

Supporting this technology development will require ongoing research, development and innovation. Government research support should include the full range of technologies and consider all technologies rather than picking technology winners. R&D programs should be open to all technologies including:

- Renewable energy technologies,
- Energy efficiency technologies,
- Energy storage technologies,
- Carbon capture and storage,
- Biofuel/ biogas technologies,
- Hydrogen technologies,
- Electric vehicle technologies, and
- Other technologies that may lead to effective reductions in emissions in other sectors, for example agriculture or industrial processes.

Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, households and regional Australia that should be considered in relation to research, development, innovation and technology?

No response provided.

3.8 International units

What is the potential role of credible international units in meeting Australia's emissions targets? Are there any implications for policy?

No response provided.

How can the quality of international units be ensured?

No response provided.

Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, households and regional Australia that should be considered in relation to international units?

No response provided.