17 August 2018

Michelle Croker

Assistant Secretary - Appliance and Building Energy Efficiency Branch

Department of the Environment and Energy

Via email: NEPPSecretariat@environment.gov.au

Energy Networks Australia response to Low Energy Homes modelling – Cost Benefit Analysis

Dear Ms Croker

Energy Networks Australia welcomes the opportunity to provide this submission in response to the Trajectory for Low Energy Homes: Cost Benefit Analysis report (Report) questions.

We represent Australia's energy grid that powers our economy with more than 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.

Our gas distribution businesses manage five million connections to Australian households and businesses. The gas supplied through these networks provides 44 per cent of the annual energy consumption in homes.

This submission highlights the current and future role of gas networks in supporting the decarbonisation of the stationary energy sector, balancing the energy trilemma of environmental impacts, cost and security, as well as our views on the results of the Report and recommendations for additional work. In Australia our current fossil fuel energy supplies are 70% of our emissions challenge, but gas and renewables can be part of the solution as we move from coal and oil to cleaner technologies.

Industry's preferred carbon and energy policies are built on the following principles:

- Australia contributing fairly to the global reductions of greenhouse gas emissions and pursuing targets with a technology neutral approach;
- Ensuring security across the energy system by considering renewables, electricity and gas as a single energy system;
- Avoiding unnecessary regulation or placing unwarranted restrictions on the development of industry; and
- Allowing markets to work effectively to reduce costs to consumers and increase economic benefits.

We note that the Department scoped and commenced the modelling work prior to engaging more broadly with industry. We think that the modelling design process would have benefited from earlier engagement with the gas sector to explore key technological developments that were not included in the modelling scope, including:

- renewable gases such as hydrogen and biogas,
- the role of gas infrastructure in managing daily and seasonal energy demand, and
- the opportunities presented from the integration of gas and electricity networks.

Earlier work completed for Energy Networks Australia[1] found that the national potential of biogas exceeds the gas consumed within the distribution networks. Other similar studies[2] are underway to evaluate the potential of hydrogen from renewable source. These studies, as well as many overseas studies, demonstrate the potential for decarbonised energy to be supplied through gas networks.

Energy Networks Australia's position is that the modelling results are biased to particular technologies given that the above technologies were not included in the scope. Could the Department outline its approach of how these potential benefits will be assessed and used to appropriately inform the consideration of NCC policy changes?

Energy Networks Australia's position, as relevant to the Report:

- Energy Networks Australia supports the integration of energy and climate policy in order to deliver Australia's emission reduction goals, while maintaining a secure, reliable supply of electricity.
- Energy Networks Australia supports research, development and demonstration of a diverse range of low emission technologies. Support of low emission technologies should be technology neutral.
- Commercially available technologies, such as heat pumps or rooftop PV panels should compete on their own merit in the market place without additional incentives or being mandated by building codes.
- Collaborative, nation-wide policies are preferred; disparate state policies (such as state based renewable energy targets) can undermine lowest cost outcomes for customers.
- Various initiatives such as the National Energy Productivity Plan (NEPP), the National Energy Guarantee (NEG), AEMO's Integrated System Plan, the AEMC's Reliability Frameworks Review, AEMO's and Energy Networks Australia's consultation paper on Open Energy Networks, consideration of renewable energy zones and others must be co-ordinated and aligned.
- Energy Networks Australia supports measures that increase competition. It is important that the NEPP facilitates rather than precludes options that could deliver more affordable energy, such as new network investment.

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[1] Deloitte Access Economics, Decarbonising Australia's gas distribution networks, November 2017, available from: https://www.energynetworks.com.au/gas-vision-2050
[2] CSIRO Hydrogen Roadmap to be launched on 23 August 2018.

- The NEPP should facilitate a wide range of options to reduce emissions and increase reliability. Distributed energy resources (DER) in distribution is key. Demand management should be designed with responsiveness and flexibility in order to provide a range of services, such as meeting the reliability requirement, or firming generation to satisfy dispatchability.
- Gas supplies 44 per cent of energy to households in Australia, mostly during winter. The gas industry is developing and demonstrating technologies to reduce emissions from the domestic use of gas. The NEPP should consider the role of low carbon gas in the form of biogas and hydrogen, in addition to options for electrifying some applications, without being prescriptive about technologies.
- While gas is already a far cleaner fuel than coal, the gas industry is investing in research and development for decarbonising the gas networks, continuing to provide customers with a fuel of choice.

The following pages provide further detail in response to the consultation questions in the Report.

We appreciate that this has been a long consultation process with many varied stakeholders and that this is a challenging project for the Department.

Please do not hesitate to contact Dr Dennis Van Puyvelde – Head of Gas on 02 6272 1548 or dvanpuyvelde@energynetworks.com.au if you would like further information.

Yours sincerely,

Andrew Dillon
Chief Executive Officer

Response to questions

1. Do you think the scenarios should be adjusted:

a. Brought forward or delayed?

b. Include other changes?

Clarification of Building Performance

Page 5 of the Report outlines the scenarios and refers to the "b*uilding performance identified in Table 1*". Unfortunately Table 1 is not provided in the Report so it is unclear what these scenarios actually model. Earlier in the report, the following energy and emission requirements are noted:

- *Class 1 – 35% reduction in energy usage and 13% reduction in carbon emissions.*
- *Class 2 – 29% reduction in energy usage and 16% reduction in carbon emissions (sole occupancy units only).*

The Department should clarify whether these are the proposed building performance metrics that were modelled and whether these will be recommended as a trajectory to support amending the National Construction Code (2022). It is also unclear whether these requirements will apply to all climatic areas of Australia.

As mentioned, Energy Networks Australia supports Australia contributing fairly to the global reductions of greenhouse gas emissions and pursuing targets with a technology neutral approach.

Scenario outcomes

The main outcome of scenarios summarised in the Report indicates that either the electrified or the option with gas provide similar cost outcomes but that the gas results provide better emission outcomes.

It is understood that the Department is undertaking additional analysis to better understand the impacts of gas and electricity price outlooks, cost reductions, renewable energy generation in the home and the additionally of rooftop solar PV.

Given the uncertainty in price outlooks, technology improvements and gas markets, there appears to be no compelling argument for the NCC to limit appliances choices for new Class 1 or Class 2 buildings. Indeed, this may be counterproductive to national emission targets when specifying electrical appliances will increase CO_2 emissions compared to continuing to use gas appliances.

Furthermore, appliance efficiency improvements are specified in other regulatory Measures such as MEPS and GEMS and appliances can be changed over once homes are constructed.

Energy Networks Australia supports that the focus of Trajectory should be outcome based aimed at improving the energy efficiency of the building itself, without limiting consumer choice on appliances and lifestyle choices.

Energy savings

Additional energy savings are modelled with the increasing savings over time. The results indicate that additional energy savings are made when 100% solar PV offset is used. For example, the only difference between scenarios 1, 2 and 3 are additional offsets with rooftop solar PV. The reported energy savings in 2050 are larger than those from improving the energy efficiency (savings between BAU and Scenario 1).

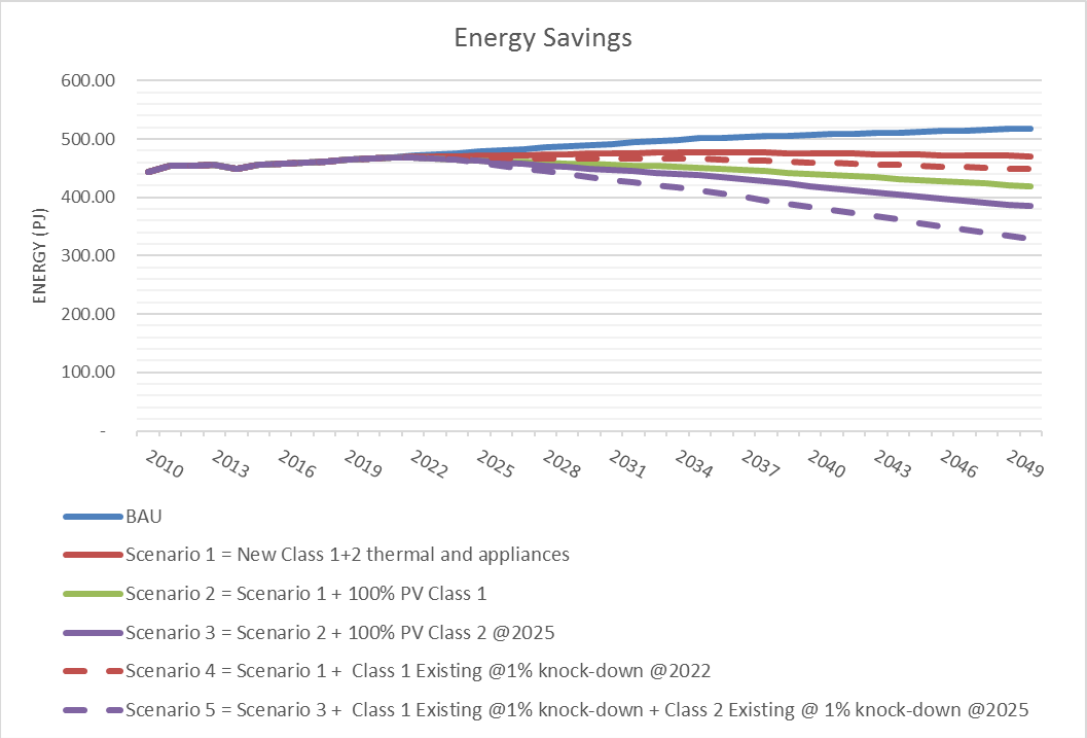

Figure 1: Modelled Energy Savings (Source: Cost Benefit Analysis Report, Figure 1).

Offsetting energy usage does not imply increased energy efficiency of the home. Indeed, it could be argued that a home which installed excess rooftop solar PV could be considered to have massive energy savings but that relates to the energy generated by the home compared to that consumed. It does not relate to the energy efficiency of the home.

Furthermore, a hybrid home that uses gas, can similarly offset emissions from displacing coal fired electricity when installing solar rooftop PV, although that will not make any change to the actual energy efficiency of the home.

Energy Networks Australia recommends that energy offsets are excluded as part of the energy savings of Class 1 and Class 2 buildings, and that they are excluded

from the Cost Benefit Analysis. Energy savings should be limited to the actual energy consumed during operating the home.

2. Are there implementation issues that need to be considered with the scenarios?

a. Are there lead-times that would not work within these timelines?

b. Are there issues with including renewable energy requirements in the Code?

As mentioned in previous submissions, Australia's gas industry has developed a high level plan to decarbonise the sector – referred to as Gas Vision 2050[3]. The aim of this plan is to ensure that gas used in homes and businesses decarbonises as the economy decarbonises in line with the Paris Accord. This will rely on deploying a combination of three transformational technologies:

- Substituting hydrogen for natural gas in networks;
- Adopting the use of biogas in networks;
- Adopting carbon capture and storage for reducing emissions from gas production or its use in industrial operations or power generation.

These technologies have been demonstrated in numerous locations around the world. Gas distribution businesses are working towards the following timelines, in line with the 2050 emission objectives:

- Within the next 5 years – support research and development to reduce the cost of transformational technologies and to demonstrate the application of these technologies to Australian gas networks.
- Between the early mid 2020's to mid-2030's – start reducing the carbon intensity of fuel distributed by blending with hydrogen and/or biogas.
- From early to mid-2030's onwards – large scale decarbonisation by fuel substitution with hydrogen and/or biogas.

Furthermore, as gas networks decarbonise, it will result in emission reductions from existing homes connected to gas. As all networks are converted, all homes connected to this network would be able to reduce emissions, whereas the proposals for the NCC only applies to new homes. Hence, decarbonising gas networks would have a higher reach than specifications for new homes through the NCC.

These developments will ensure consumers can continue to benefit from a choice of fuels to provide energy services to homes.

[3] Available from: https://www.energynetworks.com.au/gas-vision-2050

3. Do you have any additional data that should be used in the modelling?

a. Is there better data for cost reductions over time, e.g. windows?

The cost reduction curves for the different technologies are presented in the Appendix of the Cost-Benefit Analysis report. These assumptions appear to create a number of biases that lead to additional benefit for specific technologies.

Hot water

It is unclear why the learning rates for hot water systems have a different form for solar heat compared to other technologies. One is a power function while the other are exponential decays. These learning curves have been recreated in the diagram below by comparing the relative cost reduction from 2018 prices out to 2050.

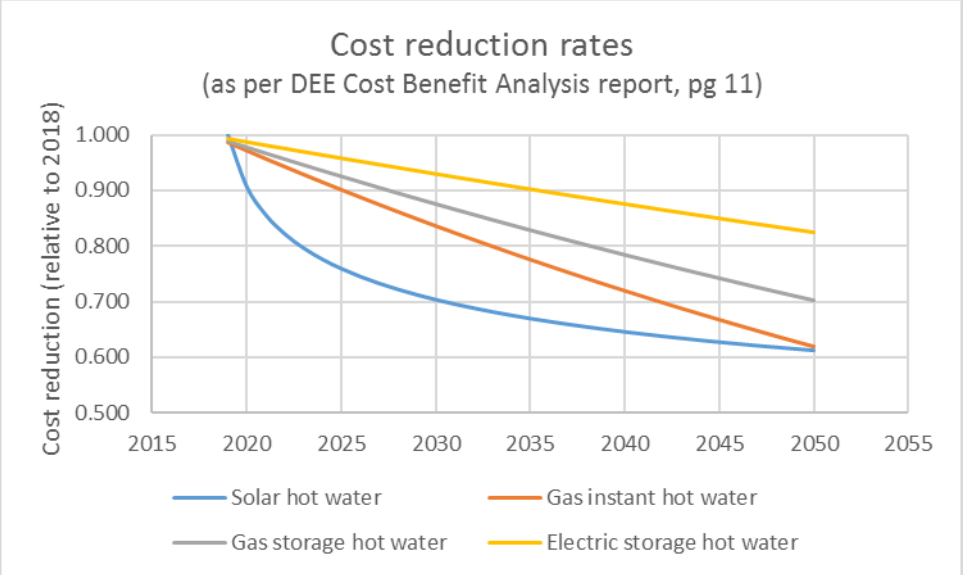

Figure 2: Cost reduction rates for hot water (Source: Energy Networks Analysis of Cost Benefit Analysis Report)

As can be seen, the assumptions in the report indicate that the cost of solar hot water reduces much faster than instant hot water gas although both reach the same level of cost reduction by 2050. The cost reductions of storage hot water systems are slower.

These assumptions would lead to a much higher NPV for the solar hot water as its costs reduce more in the next decade and that has a greater impact on NPV compared to the cost reductions in the 2040 to 2050 timeframe.

Furthermore, cost reductions are generally measured against installed capacity and not by year. As shown in the figure of the Global CCS Institute below, all technologies reduce costs in a similar manner. Hence it is unclear why the

Department has adopted a different type of learning curve for solar hot water compared to the other hot water technologies, nor indeed, why it is modelling this against year, rather than total cumulative instalments.

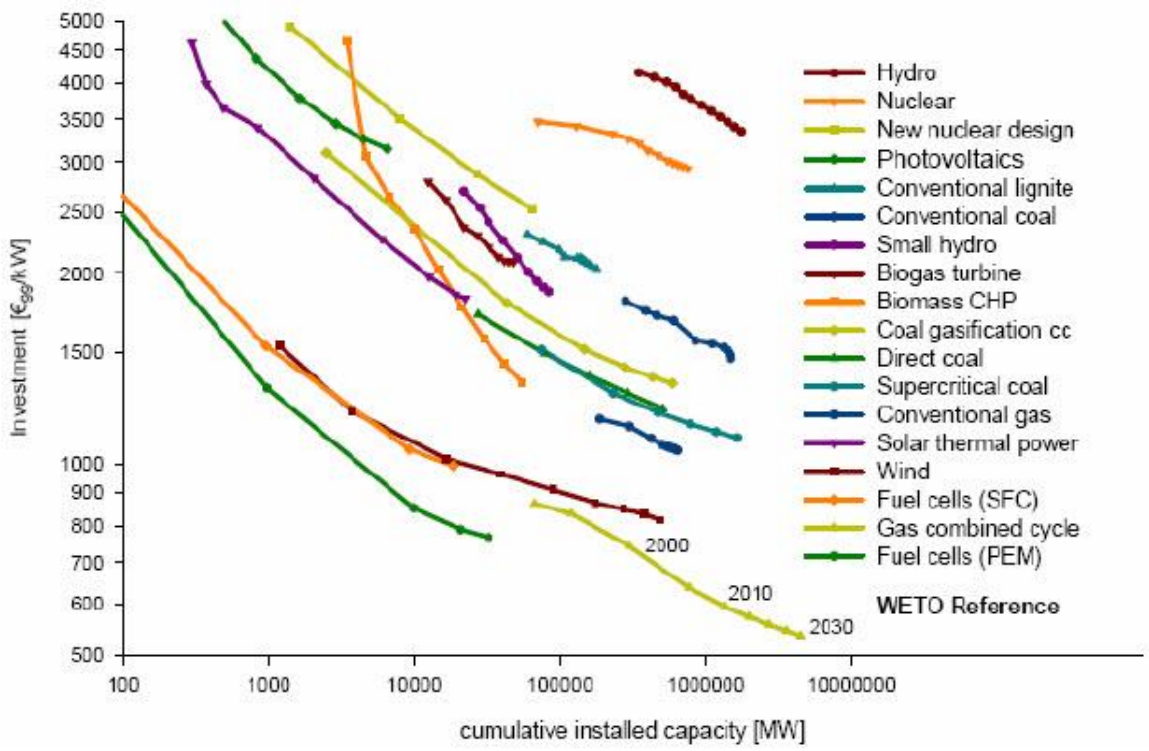

Figure 3: Capitol cost reduction of power generation technologies (Source: Global CCS Institute - https://hub.globalccsinstitute.com/publications/co2-mitigation-potential-and-cost-analysis-ccs-power-sector-guangdong-province-china/32-technical-setting-model)

Energy Networks Australia recommends that this apparent bias favouring solar hot water is addressed in the cost benefit analysis.

Air conditioning

The Report provides data for the reduction of reverse cycle air conditioning costs for 4 to 6 kW systems. The observed trend from 2003 to 2014 has been extrapolated to 2050 as an indication of potential cost reductions for this technology. This assumption is based on exponential decay in the cost of this appliance continuing whereas history (and Figure 3 above) demonstrate that cost reductions are related to the cumulatively installation of appliances.

The size of the air conditioners modelled appears quite small and are not representative of ducted heating systems. Instead, they appear to be single room air conditioning units. It is unclear from the Report how the costs reduce for larger ducted systems.

Furthermore, the modelling in the Report does not appear to consider potential cost reductions for gas heating appliances. As more gas heaters are installed, the cost would reduce similarly to the cost reductions of air conditioning. Excluding

this potential cost saving, while including a cost saving for air conditioning units will lead to a biased NPV outcome favouring air conditioning.

Energy Networks Australia recommends that this bias is addressed in the cost benefit analysis. .

Solar PV

The Report notes that savings from solar PV have not included the level of solar PV that is installed in the business as usual case, and that the Cost Benefit Analysis attributes all the energy offsets from solar PV to the Scenarios tested. This would create an additional bias.

Offsetting coal fired electricity through rooftop Solar PV can be done through any home, whether it is an all-electric home or a hybrid home with gas. However, this does not fundamentally affect the energy efficiency of the home and leads to biased outcomes on energy consumption.

Energy Networks Australia recommends that rooftop solar PV is excluded from the Cost Benefit Analysis.

Appliance mix

Overall, the cost assumptions provided in the report lead to a favourable outcomes for appliance mixes consisting of solar hot water, air conditioning and solar PV panels. Specifying these technologies in the NCC is counter to being technology neutral. More importantly, the results in the Cost Benefit Analysis are reflective of these biased assumptions and the real cost benefit of picking these technologies could in fact produce worse outcomes for customers in terms of costs and emissions from energy.

Energy Networks Australia recommends that household appliance specifications, including hot water heating, space heating and rooftop solar PV, are not included in the NCC as part of improving energy efficiency of residential homes.

4. Do you have any other comments or suggestions?

The modelling to date does not appear to have modelled the impact of time of use of appliances and generation through rooftop solar PV. The Stage 3 modelling report from AECOM provides a chart of different occupancy profiles, as well as a composite profile. It is noted that a higher proportion of homes are occupied at night compared to during the day. This indirectly leads to additional energy being consumed by homes at night compared to during daytime. Furthermore, space heating and hot water would be consumed more during non-daylight hours, when solar PV is not generating.

Rooftop Solar PV offsets should not affect whether a new home should be using gas or electricity for hot water and space heating.

The argument being presented that electrified homes by using reverse cycle air conditioning and heat pumps for hot water, where the electricity is offset by rooftop solar PV is misleading. Space heating requirements mostly occur during non-daylight hours when rooftop solar PV is not generating. Hence, the electrified home is largely dependent on the grid, and at that point in time, the emissions associated with using those electrical appliances are physically linked to the electricity produced at that time, which is mostly coal fired. A hybrid home using gas for space heating would be able to provide that energy during no-daylight hours with lower emissions, even after accounting for different efficiencies of air conditioning.

The growing use of batteries also provides additional opportunities to use rooftop solar PV. AEMO and Energy Networks Australia have recently produced a discussion paper[4] to better understand the impact of large scale deployment of distributed energy resources such as rooftop solar PV, batteries, electric vehicles and the like. One of the options being considered in this work is the integration of the gas and electricity networks through technologies such as hydrogen. This has the potential benefit of being able to provide large scale storage (even at seasonal scale) of renewable energy that could subsequently be used in homes to provide heating services.

Energy Networks Australia recommends that the trajectory being developed through the NEPP consultation process takes account of the numerous initiatives such as the National Energy Guarantee (NEG), AEMO's Integrated System Plan, the AEMC's Reliability Frameworks Review, AEMO's and Energy Networks Australia's consultation paper on open energy networks, consideration of renewable energy zones and does not make specific recommendations that could undermine these other initiatives.

[4] OpEN Energy Networks, available from www.energynetworks.com.au