Submission to the 2017 Review of Australia's climate change policies

Energetics

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Final report	Dr Gordon Weiss	Dr Peter Holt Helen Wetherell	Tony Cooper	8.5.2017

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Executive summary

The 2017 Review of Climate Change Policies is a timely opportunity for the Government to ensure a policy framework that delivers a smooth transition for the nation from coal fired power to low carbon energy sources.

We need this focus not only because of the widespread concerns around energy supply security but, as Energetics' modelling shows, the bulk of the emissions reductions opportunities through to 2030 are to be found within Australia's energy sector.

The only way Australia will meet our 2030 target and have the ability to deepen emissions reductions in line with the 2 degree world and the 1.5 degree aspirational target, will be through driving down the demand for energy, a measure that delivers significant cost savings for business, or decarbonising energy generation.

A managed transition to a low carbon energy mix will also be in step with the multiple market forces that are growing the amount of solar and wind renewable energy sources across Australia. This is a trend with momentum, as vast amounts of R&D investment funds worldwide are channelled into low carbon technologies.

The key points in our submission are listed below.

- **Emissions reductions must come from the energy generation sector, with policy measures that either reduce energy demand or decarbonise generation**
  With the exception of Australia's energy generation sector, other parts of the Australian economy are not able to make a significant contribution to the abatement needed if Australia is to meet its current 2030 emissions reduction target. In particular, the LULUCF sector could struggle to significantly increase its contribution having already provided the bulk of emissions abatement in the Kyoto commitment periods and the majority of emissions to be purchased by the Emissions Reduction Fund.

- **Improvements to the nation's energy productivity need to be made, which will also deliver cost savings to business and ultimately consumers**
  Increasing energy productivity and thereby reducing the demand for energy, allows Australia to meet its climate target through a combination of measures. Noting too that across the range of possible energy productivity targets, the flow on effect is that the penetration of variable renewable energy will rise by at least 100%.
  Energetics' modelling also shows that more effort needs to be directed towards improving the productive use of energy for transport and stationary applications such as using solar thermal units to offset the consumption of gas for process heating.

- **Market forces are driving the increasing penetration of renewables**
  Business as usual will see Australia fall substantially short of its abatement target. Yet under this scenario, variable renewable energy generation[1] will double over the period to 2030 simply as a result of market forces and the continuation of current policy settings.
  The higher the energy productivity target, the less need for gas fired power generation to meet the national emissions target.
  If Australia's energy productivity is only increased by 40% then the decarbonisation of electricity supply necessary to meet the 2030 climate target will require additional gas-fired generation. The exact volume needed depends upon the amount of emissions reductions that can be delivered by other sectors. However, doubling energy productivity means that

[1] 'Variable renewable energy generation' refers to solar and wind, as opposed to hydro power.

Australia can meet its emissions reduction target without increasing the demand for gas-fired generation.

Of course in the context of the current energy security concerns, there is a trade-off between the decreasing need for gas fired generation if we improve levels of energy productivity, and an acknowledgement of the role of natural gas in ensuring constant, reliable electricity supply. We simply would not have the current energy security concerns if it wasn't for the east coast gas shortage.

As Energetics works with large energy users to manage energy markets risks in procurement, we further note a number of imperatives we see for a successful transition to a clean energy mix:

- More gas needs to be made available and at relatively low cost, noting that the high price of natural gas impacts the price of electricity
- Far greater levels of energy storage are needed, acknowledging both the rapid technological innovation in this area and the critical role of storage in smoothing out supply
- With the right demand response mechanisms, end users can play a critical role in managing and reducing demand peaks
- More transmission infrastructure, particularly interconnectors, between geographically dispersed renewable power generators are needed to ensure supply
- We await the outcomes of the Finkel Review with great interest.

- **A direct or indirect carbon price should not be off the table – there are many benefits**

  Australian businesses and peak bodies are, with few exceptions, comfortable with the pricing of emissions. As a market mechanism, business will adapt and innovate to decarbonise according to their carbon cost exposure. Also a carbon price will have bipartisan political support which will give large emitters the confidence to make the long term capital investment decisions needed for new, low carbon technologies, processes and practices.

  Achieving the support of the Opposition is particularly critical as Australia does not have the time for another round of climate policy reversals, noting too that the existing Safeguard Mechanism can easily evolve into a baseline and credit trading scheme.

Where can we achieve the emissions reductions needed to meet our 2030 target?

In developing this submission, Energetics has been guided by a number of key principles. The climate policy suite must:

- Acknowledge that the delivery of a reliable, secure and low cost energy supply is a paramount role of government
- Be capable of delivering abatement that meets the current international target, and be sufficiently adaptable to drive measures in keeping with expected deeper targets
- Apply to all sectors across the economy
- Be broadly aligned with the positions of both major political parties so that bipartisan agreement is feasible.

Energetics' submission to the 2017 review of climate change policies focuses on the role of the different sectors, while touching on other broad questions. We also draw on our modelling of the emissions abatement task to 2030. When the Commonwealth released its latest projection of Australia's greenhouse gas emissions late in 2016[2], the report confirmed earlier work by Energetics showing that Australia will exceed its 2020 cumulative emissions reduction target without the use of offsets carried over from the 2012 target[3].

The Commonwealth's projection also confirmed that Australia's emissions are now rising, and that meeting the cumulative 2020 target is the result of good work done from 2013 to 2016 rather than activities in the period to 2020. As a result, Australia's emissions in 2020 will be more than 5% above emissions in 2000.

This submission also builds on our earlier work which was put forward to the Minister of the Environment and Energy for consideration when setting the terms of reference for the 2017 review of climate change policies[4] (**ToR Submission**). Our recommendations remain relevant. These were:

- **The transformation of Australia's energy mix needs to be actively managed**
  Achieving the emissions reduction target of 28% relative to 2005 by 2030 will disrupt the electricity generation mix. Brown coal generated power will need to be substituted with either natural gas powered generation or additional renewable energy, or a combination of both. The two principal challenges associated with these substitution options are the current severe natural gas supply constraints in the south eastern states, and the inability of our transmission and distribution systems to reliably manage increasing intermittent supply from renewables.

- **Improving energy productivity is critical to deliver both emissions reductions and cost savings**

[2] '*Australia's emissions projections 2016*': Commonwealth of Australia, 2016.
[3] '***Tracking Australia's emissions to 2020: implications for reductions required by 2030***': Energetics, 2016.

[4] '***2017 Climate Change Policy Review - Terms of reference***', Energetics submission, 2016.

Energetics' submission discusses the impact of different energy productivity targets in view of the anticipated growth in GDP through to 2030 of 54%. Our modelling shows that Australia can achieve the 28% emissions reduction target with the current national target of a 40% improvement in energy productivity, however it will result in a major disruption to the generation mix given the growing demand for energy in an expanding economy.
As outlined the preceding point, the Review will need to consider the best pathway to achieve a managed, smooth transition to an energy mix with a high level of renewables penetration.

- **Carbon credits: the land sector has the opportunity to develop ACCUs for future sale into international carbon markets**
  The price of ACCUs may approach $65 towards the end of the next decade, reflecting both domestic and international supply and demand for carbon credits. With such a high cost associated with emissions reductions, abatement activity should be brought forward to minimise these costs over the back half of the next decade.
  Conversely there is a significant economic opportunity associated with the generation of carbon credits. By 2030 Australia could sequester in the land sector some 2 billion tonnes of carbon in excess of its domestic requirements. The actual figure will depend upon the international demand for offsets and their traded price. Creation of offsets from the land sector could see a transfer of funds from Australian urban areas to regional areas, and generation of carbon offsets for export.
  The 2017 Review should therefore address international linkages and pathways for abatement in the land sector to generate wealth for the regional areas of Australia.

- **Emissions reduction measures should be brought forward**
  There is a clear and compelling case for bringing forward abatement measures. Firstly, as emissions are currently rising in the economy, this trend needs to be reversed. Secondly, Energetics' modelling demonstrates the economic value of early action: one tonne of abatement implemented before 2020 displaces over three tonnes of emissions reductions needed over 2020 to 2030.

Certainly the Review is an opportunity to reassess program timelines, deployment costs and impacts in order to drive emissions reduction measures before 2020. To this end, Energetics has already conducted an analysis of abatement that could be brought forward. This work can be found in Table 1 of our report for the Department of the Environment (**Energetics abatement report**)[5] which was released in May 2016. It is our intention to update this information as part of our submission to the 2017 Review.

The analysis that underpinned our ToR Submission contained a range of assumptions. In this submission we refine some of these assumptions to update our recommendations.

[5] "*Modelling and analysis of Australia's abatement opportunities: Meeting Australia's 2030 emissions reduction target*", Energetics, May 2016. Available from ***http://www.energetics.com.au/getattachment/insights/abatement-graph/Overview/20160506-Modelling-and-analysis-of-Australia-s-abatement-opportunities-Energetics-Report.pdf.aspx***

Abatement opportunities by sector

Figure 1 shows Australia's emissions in 2015 and the levels projected in 2030. The horizontal line shows where emissions must be if Australia is to meet its current Nationally Determined Commitment (NDC) under the Paris Agreement. By 2030, emissions related to energy (electricity, fuel combusted for stationary energy and fuel combusted for transport) will be responsible for just over two thirds of national emissions. The remainder of emissions come from sources spread across the whole economy.

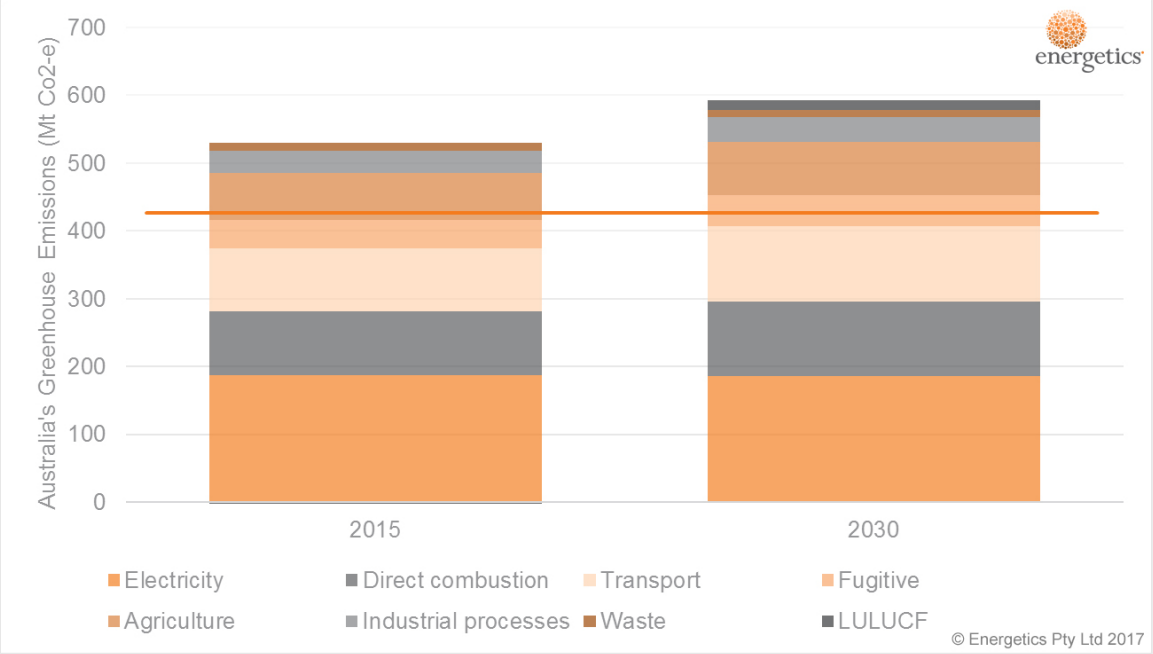

Figure 1: Australia's greenhouse gas emissions in 2015 and 2030

The scale of the emissions related to energy clearly shows that the bulk of the abatement should come from either reducing energy demand or decarbonising energy use.

If Australia was able to eliminate emissions from all non-energy related sources by 2030, the resultant fall would be just over 28% relative to 2005 levels - we will only just meet our current nationally determined commitment.

In this section, each of the emissions sources is explored in more detail, noting that much of the commentary is derived from the Energetics' Abatement Opportunities Report, 2016.

How much abatement can come from the energy sector?

Our analysis focuses on the balance between policy measures that drive improvements in energy productivity and those that decarbonise energy supply. It useful to consider the three contributors to energy related emissions together. The next table summarises the improvements in energy productivity (in all cases relative to total GDP) and changes in emissions intensity for electricity generation, stationary energy, and transport.

'EP' refers the annual increase in energy productivity for the indicated period to 2014. In the case of electricity, this is national GDP divided by TWh of electricity. For stationary energy and transport, it is national GDP divided by energy consumed by the sector. The intensity column reports the average increase in the emission intensity for the source. The intensity is the emissions divided by the fuel used, so decreasing the intensity assists in the decarbonisation of the fuel.

The overall figure for each item is the average of the other values for the item. For comparison, the overall improvement in national energy productivity – GDP per total primary energy - was 1.84%.

Table 1: Annual trends in energy productivity improvement

Rates of improvement to 2014	Electricity generation		Transport		Stationary energy	
	EP	Intensity	EP	Intensity	EP	Intensity
Previous year	3.1%	-2.8%	0.6%	-0.8%	1.2%	0.5%
Previous 5 years	2.6%	-3.1%	1.0%	-0.3%	0.3%	-0.1%
Previous 10 years	2.1%	-1.5%	1.0%	-0.3%	1.4%	0.3%
Previous 20 years	1.3%	-0.6%	1.3%	-0.2%	1.8%	0.1%
Overall	2.2%	1.2%	1.0%	-2.0%	0.2%	-0.4%

The table indicates that Australia has been far more successful at improving the productive use of electricity and in decarbonising electricity generation, than is the case for transport and stationary energy. The results may also suggest that:

- More effort could be directed to improving the productive use of energy for transport and for stationary applications
- There has been insufficient focus on decarbonising stationary energy applications such as using solar thermal units to offset consumption of gas for process heating.

In our analysis for the ToR Submission, we assumed that improvements in national energy productivity could be shared equally across the three sectors. However, Table 1 suggests that this is unlikely.

The volume of abatement from the energy sector depends upon the rate of improvement in energy productivity and how rapidly energy generation can be decarbonised.

How much can the land sector contribute?

Land use, land use change and forestry (LULUCF) is unique as it is the one emissions source that can also be a carbon sink[6]. The net emissions due to LULUCF are a balance between emissions principally from land clearing and abatement due to reafforestation and better forest management.

[6] In fact, emissions from LULUCF were -4 Mt CO2-e in 2015.

In 2014, these were roughly in balance, with 33 Mt CO_2-e of emissions resulting from land clearing being balanced by 32 Mt CO_2-e of abatement due to reafforestation and better land management.

Abatement from this sector has dominated the first five Emissions Reduction Fund (ERF) auctions with almost three quarters of contracted emissions reductions coming from measures associated with vegetation and early savannah burning. The question is whether there remains significant untapped abatement opportunities in the land sector at prices below \$15/t CO_2-e.

Figure 2 shows Australia's emissions since 1990. Emissions peaked around 2006 and have fallen since. However, a closer examination shows how emissions excluding those from LULUCF continued to rise until around 2011 before dropping. What we see is that Australia's challenge in meeting its obligations under the Kyoto Protocol would have been very much greater had not abatement been delivered via the land sector.

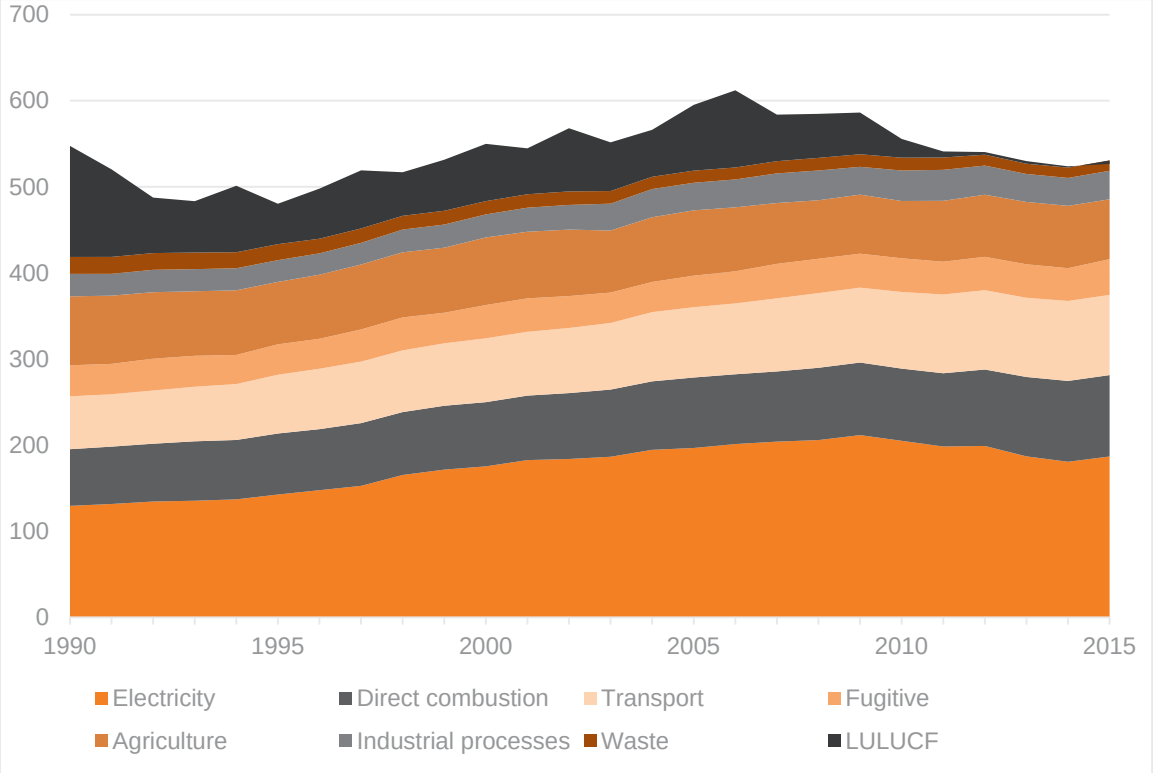

Figure 2: National greenhouse gas emissions[7]

Given that the land sector has already been very active in providing emissions abatement since 1990, it is reasonable to ask whether this rate of emissions reduction can be accelerated from now until 2030.

Figure 3 shows emissions due to LULUCF over the period from 1990 to 2015 and the most recent projections out to 2030 published by the Australian Government. The significant drop from 1990 to 2015 is clear. Much of the historical drop in these emissions was due to the cessation of extensive land clearing especially in Queensland. The Australian Government is forecasting a slight rebound in LULUCF emissions in the period from now until to 2030. This is due to a variety of factors including the relaxation of laws governing the clearance of vegetation in New South Wales and

[7] '*Australia's emissions projections 2016*', Commonwealth of Australia, 2016

land use changes returning to trend based on the projected farmers' terms of trade. The Government's projection also included the impact of measures supported by the ERF.

On the other hand, work by the CSIRO has pointed to the large potential for abatement in the land sector[8]. Reflecting this, the Energetics' Abatement Opportunities Report (2016) assumed that 94 Mt CO_2-e of additional net abatement is available from the land sector in 2030. However, given the fact that much of Australia's response to climate change to date has been realised through the sector, the figure of 94 Mt CO_2-e could be hard to achieve.

In this analysis, we use the more conservative figure of 47 Mt CO_2-e of additional net abatement in 2030.

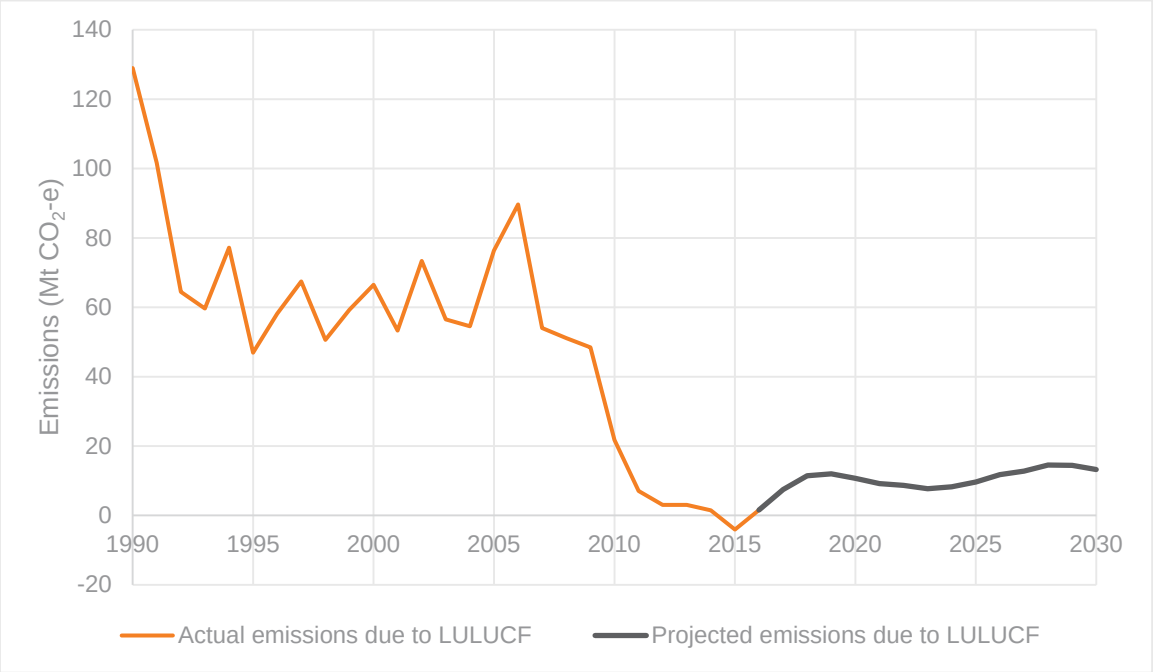

Figure 3: Australia's emissions due to LULUCF[9]

How much abatement can the waste sector contribute?

Emissions from waste such as landfill gas, were in the order of 12 Mt CO_2-e in 2015 and are therefore relatively small. The Energetics' Abatement Opportunities Report (2016) assumed that 6 Mt CO_2-e of additional net abatement is available from the waste management sector in 2030. We note that the abatement of landfill emissions is covered by the ERF and was also addressed by the carbon tax, thus restricting further abatement in the sector.

How much abatement can the industrial sector contribute?

Emissions from industrial processes (such as cement manufacturing, metal extraction and the use of products that are substitutes for Ozone Depleting Substances) were 33 Mt CO_2-e in 2015. The main contributors are metal extraction and the use of substitutes for ozone depleting substances. The Energetics Abatement Opportunities Report assumed that an additional 10 Mt CO_2-e of

[8] '*Greenhouse gas mitigation from livestock sector revealed'*, CSIRO, March 2016.
[9] Source: ib id

abatement is possible. The majority comes from restrictions on substitutes for ozone depleting substances. Many of the other sources in the sector are linked to the basic stoichiometry of the industrial transformations for which there are limited options for change.

How much abatement can the agricultural sector contribute?

This sector is currently the largest of the non-energy related sources, contributing some 70 Mt CO_2-e in 2015, with around 75% coming from enteric fermentation in livestock. There are limited options for reducing emissions from this sector and we used a figure of 5 Mt CO_2-e of abatement in the Energetics' Abatement Opportunities Report.

How much abatement can come from management of fugitive emissions?

Fugitive emissions contributed 41 Mt CO_2-e to Australia's emissions in 2015. Two thirds of these emissions come from coal mining and the rest from oil and gas extraction. The management of fugitive emissions is expected to contribute 12 Mt CO_2-e of abatement relative to business as usual in 2030.

How much abatement can come from management of emissions from transport?

Transport is the first of the energy related sources, and contributed 93 Mt CO_2-e to Australia's emissions in 2015. Energetics' analysis in our Terms of Review submission estimated that transport emissions will change in proportion to Australia's energy productivity and did not consider any change in the carbon intensity of energy used for transport. So for instance, transport emissions were calculated to be 82.6 Mt CO_2-e, if Australia's energy productivity is doubled by 2030.

Meeting the emissions reduction target through abatement from the energy sector

Two thirds of Australia's emissions come from the combustion of fuel, and must therefore deliver the bulk of the abatement needed to meet the 2030 target.

In our ToR Submission we discussed the balance between reducing energy consumption and decarbonising energy supply in meeting Australia's abatement targets. Noting too that improving the way energy is used and thereby reducing energy wastage delivers significant cost reductions for business.

We showed how achieving the current target for improving energy productivity by 2030 of 40% relative to 2015 as adopted in the National Energy Productivity Plan (NEPP)[10] will mean the burden of achieving the emissions reduction target falls to decarbonisation of energy supplies. Our initial analysis in the ToR Submission showed that even just a 40% improvement in energy productivity results in a significant disruption to the electricity sector if Australia is to meet the 26 to 28% reduction target.

We also assumed that the change in energy productivity for electricity generation, stationary energy and transport were similar and reflected the overall improvement in energy productivity. However, analysis of national energy consumption figures suggests that the major improvements in energy productivity result from reductions in the use of electricity (refer to Table 1 above).

In this section of our submission, we examine the impact that rates of improvement in energy productivity and decarbonisation of energy have on national emissions, and in so doing present future scenarios for the energy sector that are needed if Australia is to meet the national emissions target.

Our analysis uses the latest emissions projections of the Australian Government to provide the business-as-usual (BAU) forecasts for emissions from non-energy related sources, our assumptions of the potential abatement in the non-energy related sectors discussed above (and totalling 80 Mt CO2-e) and the overall values reported in Table 1 to establish the BAU forecasts for emissions from energy related sectors.

We have also assumed that the closure of Hazelwood power station and the planned closure of Liddell power station does not reduce electricity from coal fired generators as the remaining generators currently have unused capacity. In practice, there is some contraction of coal fired generation as the baseload power stations cannot act as substitutes for gas-peaking plants. BAU also assumes no increase in the RET beyond 33 TWh.

We have also assumed that:

- Any shortfalls in generation capacity are met by new gas fired generators

[10] ***National Energy Productivity Plan*** (NEPP), Department of Environment and Energy.

- Solar PV will continue to grow outside of the RET due to the favourable economics that support its continued take up for both the residential and commercial sectors. We have assumed that solar PV will contribute 24.4 TWh in 2030 up from 6.2 TWh in 2015 (an annual growth of 10%).

The scenarios described below see several of the BAU figures adjusted.

Business as usual

Business as usual - no forced closure of power stations, no expansion of the RET and no additional abatement from the non-energy related sectors – sees national emissions fall by 6% relative to 2005 by 2030. This falls well short of our emissions reduction target.

Meeting the target by actions outside of the energy sector will require an additional 136 Mt CO2-e of abatement primarily from the land use sector. This will require a fivefold increase in the current rate of reafforestation.

Even with no increase in the RET, the expansion of wind generation to meet the current RET, the expansion of solar PV and the planned closure of two power stations means that the variable renewable generation fraction rises from 10% in 2015 to 20% in 2030. Gas rather than coal fired generation will be displaced by this rise in renewable energy which diminishes its impact in terms of emissions reduction.

Key observation: Even the business as usual trajectory of Australia's generation fleet will result in a doubling of amount of solar and wind across the energy mix.

The BAU scenario sees a 40% reduction in the quantity of electricity from gas-fired generators.

A 40% increase in energy productivity

Increasing national energy productivity in-line with the NEPP means that the overall electricity demand is roughly constant in the period to 2030, and the anticipated increases in renewable electricity from wind and solar will squeeze out some fossil fuel-fired generators in the absence of any other policy measures. The variable renewable component of electricity increases to 22%. However, this is not enough to meet the emissions reduction target, with emissions falling by only 11%.

Even **replacing all coal-fired generation with gas fired generation** only sees 2030 emissions fall by 21% relative to 2005. This scenario also requires a 260% increase in gas-fired generation. Adding additional abatement from the non-energy related sectors (42 Mt CO2-e) allows the nation to meet its emissions reduction target. So too does raising the rate of decarbonisation of stationary energy (other than by electrification[11]) so that it matches the rate of decarbonisation of electricity generation. A more than tripling of the RET will also Australia to meet its emissions reduction target. The required 75 TWh of additional variable renewable generation will see the fraction of variable renewable generation in the electricity networks rise to 51% but does reduce the quantity of new gas fired generation required.

[11] Decarbonisation of either stationary energy or transport through electrification will increase the demand for electricity.

Combinations of the measures discussed above will also deliver the required abatement. For instance, a combination of closing half of the coal-fired generators, doubling the RET, reducing the emissions intensity of stationary energy by 1% per year and doubling the rate of reafforestation will also see Australia meet its target. This combination will still see gas fired generation increase by 30% and the penetration of variable renewable generation rise to 35%.

Key observation: A 40% increase in energy productivity will require Australia to implement a combination of additional measures across several sectors if the emissions reduction target is to be met. In most cases, the volume of gas fired generation will increase as will the penetration of variable renewable generation.

Doubling energy productivity

A doubling of energy productivity leads to a reduction in the demand for electricity and in the absence of no other policy measures will see Australia just fall short of the 26 to 28% emissions reduction target. The reduction in electricity demand coupled with the need for some gas peaking capacity will also see around 50% of coal-fired generation forced from the market. This scenario also sees the penetration of variable renewable generation rise to 29%.

Adding an additional 33TWh of renewable generation will see the reduction in emissions increase to 33% and the variable renewable generation penetration increase to 46%.

Deeper cuts to emissions which will be required by the 2 degree scenario will require more rapid improvements in the productivity of energy used for stationary applications and transport, and more rapid decarbonisation of transport and stationary energy.

Key observation: Doubling energy productivity will make meeting the 26 to 28% reduction target less disruptive than a 40% increase in energy productivity. However, we will still see the penetration of variable renewable generation rise. On the other hand, a doubling of energy productivity, it will not require an increase in gas-fired generation.

Why does a carbon price need to be off the table?

Energetics has long stated that above all else, Australian business needs policy certainty. With this in mind, the benefits of a carbon price are clear and compelling:

- Australian businesses and peak bodies such as the Business Council of Australia and the National Farmers Federation are, at the very least, comfortable with the pricing of emissions
- It is a market mechanism and the market will accordingly adapt and drive decarbonisation according to cost exposure
- There is a strong global trend against coal-fired generation
- A carbon price will have bipartisan political support which will give large emitters the confidence to make the long term capital investment decisions needed for new, low carbon technologies, processes and practices. Achieving the support of the Opposition is particularly critical as Australia does not have the time for another round of climate policy reversals.

The Safeguard Mechanism can meet most of the requirements listed above.

Currently covering an estimated 50% of Australia's reported emissions and facilities that emit more than 100 000 tCO_2-e of Scope 1 emissions per annum, the threshold could be dropped and coverage widened. Should it be an intensity based scheme, which is favoured by business, this would also ensure that better performers which have already worked to lower their carbon intensity are recognised and rewarded. Businesses focussed on reducing their emissions can create offsets from which they can derive a financial benefit.

Also, building on the framework of the Safeguard Mechanism would allow the Australian Government to establish a carbon pricing scheme that would not lead to the same calls for financial compensation that a cap and trade scheme would. We note too that at the recent CMI conference in Melbourne, Opposition Minister Mark Butler indicated that the Safeguard Mechanism with changes to coverage and the lowering of baselines could work for an ALP administration should they win office in the future.

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