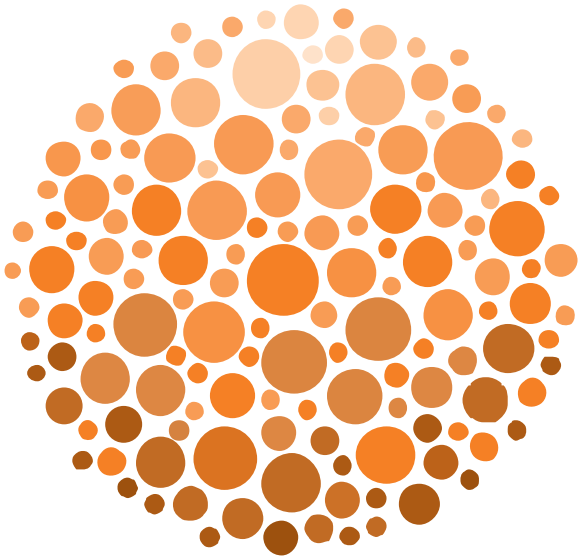

Doubling Australia's Energy Productivity by 2030

Delivering a 10% reduction in emissions and contributing $59.5bn to GDP

Dr Gordon Weiss
Associate
Energetics

energetics

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Energetics has 30 years experience in carbon and energy management working with large, complex, multi-site energy users spanning a wide range of economic sectors.

As advisers on the challenges of escalating energy costs and managing carbon emissions, Energetics is unique. Our services and products combine business insight with technical and project management excellence, and range from strategic advice to developing new business opportunities, skills development, managing risk and building investor confidence.

We employ around 75 multi-disciplinary professionals many of whom are thought leaders in resource management. Our clients achieve improved business metrics and decreased carbon and water footprints which reduce their exposure to energy and carbon price volatility.

Energetics has offices in Brisbane, Canberra, Melbourne, Perth and Sydney and we can mobilise project teams within metropolitan and regional Australia, and overseas when required.

We understand energy and carbon management from process fundamentals to business implications and have demonstrated experience with the ASX Top 200 and all levels of government.

Energetics is a proud to be a carbon neutral company. We are uniquely positioned to represent and advise government and the private sector on the full range of climate change issues. We support our clients from the assessment of their exposure to climate change risk, through to the development and implementation of management strategies that also identify and capitalise on opportunities.

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Doubling Australia's energy productivity by 2030: delivering a 10% reduction in emissions and contributing $59.5bn to GDP

Recently the Australian Alliance to Save Energy (A2SE) proposed that Australia strive to double its energy productivity (2XEP) by 2030. Energy productivity is ratio of the real GDP and the units of primary energy consumed. Over the period from 2010 to 2030 Australia's GDP will rise by around 70%[1]. A2SE demonstrated that doubling Australia's energy productivity would deliver a 2.8% increase in GDP to 2030, equivalent to a gain of $59.5bn GDP (2010$) in 2030.[2]

One aspect of understanding the broad benefits that such a focus would bring is the effect on national greenhouse gas emissions.

As the subject of this paper, Energetics has conducted an analysis and found that doubling energy productivity reduces Australia's emissions in 2030 by 10% relative to 2010.

This result suggests that an energy productivity target which provides economic benefits offers a potential route to a national emissions reduction target and associated policies that will have widespread and bipartisan support. An energy productivity drive would go some way to ending the 'Carbon Wars' that have been a part of the political scene in Australia for more than a decade, and that created significant uncertainty for Australian industry.

The opportunity to double energy productivity by 2030

Australia once derived a competitive advantage based on our abundant resources of cheap energy. As energy was then a low cost business input, energy productivity was relatively poor by global standards. Now we are in a position where low energy productivity and high energy costs act as a drag on the economy. For instance, Australia has moved from having some of the lowest residential electricity costs amongst OECD countries in 1990 to now having the most expensive residential electricity prices on a power purchase parity basis.[3] This next figure shows how Australia's energy productivity compares to the energy productivity of other nations.

[1] A2SE analysis

[2] "2XEP – Australia's Energy Productivity Opportunity, Framing Paper", Australian Alliance to Save Energy, 2014

[3] See Table 3 (League table – Residential electricity prices) in "2XEP – Australia's Energy Productivity Opportunity, Framing Paper", Australian Alliance to Save Energy, 2014

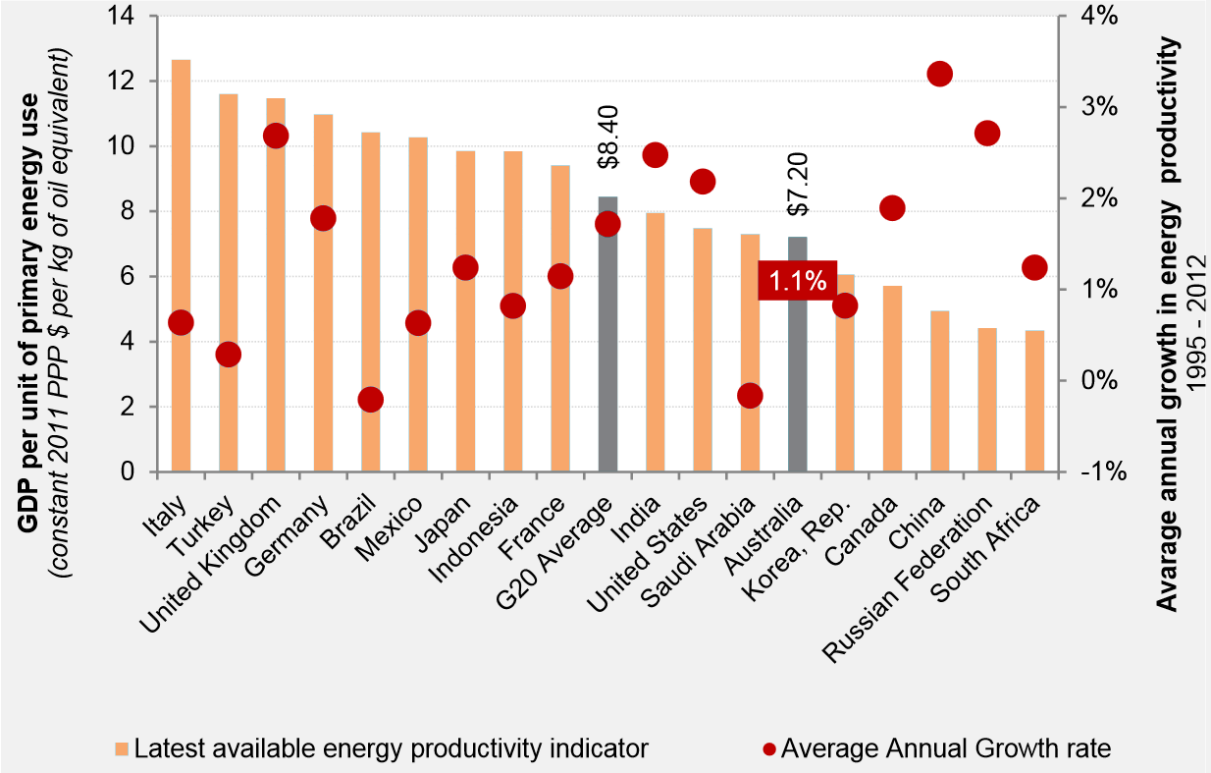

Figure 1: Energy productivity of selected G20 countries[4]

A2SE has argued that about 60% of the improvement needed, will be driven by economic output growth and structural changes in the economy, while the remaining 40% of the improvement will be required from enhancements in the productive use of energy in the economy i.e. energy efficiency. This is challenging but not impossible. For instance, similar rates of improvement in energy efficiency were seen in Australia's industrial sector between 2008 and 2010.

A doubling of energy productivity over that period will mean the total primary energy consumption will need to fall by 15% relative to 2010. This will result in a corresponding fall in national greenhouse gas emissions.

National emissions to 2030

The forecast of national emissions has been broken up into eight sources. This next chart shows the projected change in emissions according to the Department of the Environment in their 2014 forecast of national emissions **(the DoE forecast).** Overall, the Department is projecting a rise in Australia's emissions from 2010 to 2030 of 25%.

The Energetics forecast demonstrated that a number of assumptions in the DoE forecast could be challenged.

Accordingly, we made several adjustments to the Department's forecast. Our original forecast considered emissions only out to 2020, and applying those adjustments to the projections to 2030

[4] Source: A2SE

shows a reduction in projected 2030 emissions. Our results are also shown in Figure 2. The rise in emissions in the period from 2010 to 2030 falls slightly to 20%.

Neither the DoE Forecast nor the Energetics forecast has accounted for the impact of the Emissions Reduction Fund. If we assume that the ERF does just enough to see Australia meet its obligations under the Kyoto Protocol and that the emissions reduction driven by the ERF persists until 2030, then there is a further minor reduction in national emissions in 2030. The rise in emissions from 2010 to 2030 becomes 13%.

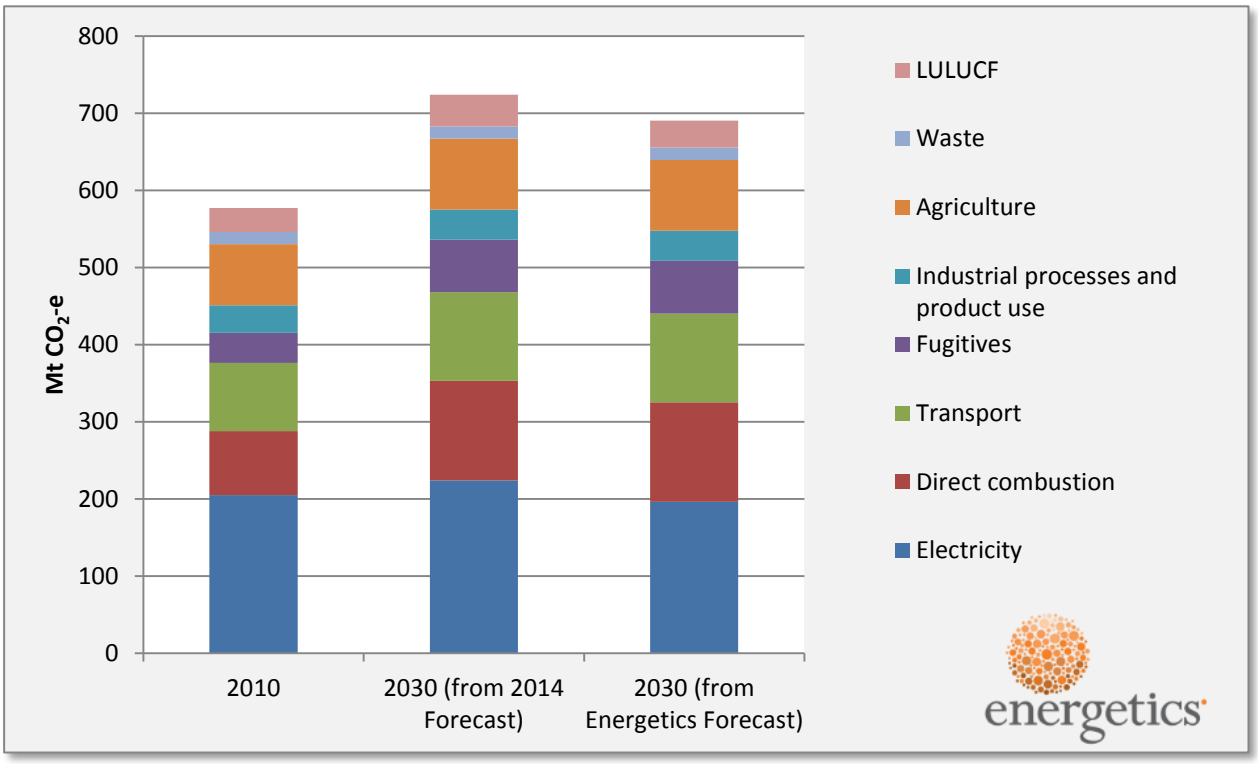

Figure 2: National greenhouse gas emissions in 2010 and 2030

These results are summarised in Table 1. The table shows how the various scenarios are projecting significant improvements in the emissions intensity on the Australian economy, and all scenarios project a rise in the absolute emissions. Many climate science professionals consider any rise in absolute emissions to be unacceptable. The '2 degrees or less' goal has become the default global goal[5] and all modelled scenarios that show how the global community can attain this goal require year by year reductions in emissions.

[5] "Targets and Progress Review Final Report", Climate Change Authority, February 2014

Scenario	Change from 2010 to 2030	
	Absolute	Relative to GDP
2014 Forecast	25%	-26%
Energetics Forecast	20%	-30%
Energetics Forecast with ERF	13%	-33%

Table 1: National greenhouse gas emissions in 2010 and 2030[6]

We will show how a doubling of energy productivity by 2030 will also lead to a reduction in Australia's emissions relative to national emissions in 2010.

Modelling the impact of 2XEP on national emissions

The non-energy related sectors (fugitives, industrial processes and product use, agriculture, waste and LULUCF[7]) contribute about 35% of emissions in 2010, and in 2030 as well, according to the DoE forecast. The remainder of emissions come from the energy related sectors of electricity generation, direct combustion and transport. Our approach to modelling the impact of 2XEP on the energy related emissions is outlined below.

Direct combustion and transport

In modelling the impact of 2XEP on emissions from these sources, we have assumed that the emissions factor in terms of tonnes of CO_2-e per GJ of energy expended for the two sources remains essentially constant and so the change in emissions from the sectors tracks the change in energy use. The latter was modelled as a fixed percentage reduction each year from 2017 until 2030 so that a doubling of energy productivity for the sources was achieved by 2030. We used a GDP rise of 170% from 2010 to 2030 as the basis of the calculation. There is some justification in thinking that the assumption of a constant emissions factor for the sources is conservative:

- Transport: The rise of electric vehicles[8] and the more widespread use of biofuels will reduce the emissions of transport.
- Direct combustion: This source may see the more widespread use of biomass for the firing to process heaters. Energetics also sees considerable interest in the use of solar thermal systems for hot water amongst industries that require low temperature heat for cleaning and sterilisation. Both biomass firing and solar thermal installations will reduce the emissions intensity of direct combustion.

[6] Source: DoE Forecast and Energetics Forecast

[7] Land use, land use change and forestry

[8] The impact of EVs will be even more dramatic as renewable sources such as solar panels are used to recharge the batteries

Electricity generation

We applied the same approach as for the other energy related sectors to calculate the volume of electricity that will be consumed in 2030: the ratio of GDP to electricity used in 2030 is double that of 2010. The GDP was assumed to have risen by 70% over that period. However in the case of electricity it is not appropriate to use a fixed emissions factor because the mix of renewable and non-renewable electricity will change. We outlined our approach to calculating the emissions intensity of electricity generation in the Energetics forecast of national emissions to 2020. A summary of our approach follows:

- Electricity consumed is split between renewable and non-renewable electricity.
- The volume of renewable electricity is driven by factors other than total demand:
    - **Hydroelectricity** in the period to 2030 is assumed to be the same as the average for the period 1990 to 2014. The availability of hydroelectricity is driven by the level of water in the dams and is unrelated to the price of electricity other than over the very short term.
    - **Solar PV** is assumed to grow at the rate used for high scenario in AEMO's latest forecast for the NEM. The Energetics forecast report explains how this is a safe assumption.
    - The expansion of **wind power** is driven by the RET. The volume of wind energy out to 2020 is assumed to grow at a rate consistent with the revised RET. Wind energy beyond 2020 is assumed to grow at 1% per year.[9]
- The volume on non-renewable electricity is the difference between the total volume of electricity that is required to meet national demand less the volume of renewable electricity.
- Emissions from renewable electricity are assumed to be zero. Emissions from non-renewable electricity are defined by the emissions factor for non-renewable electricity. The emissions factor is assumed to follow the recent trend in national electricity generation which sees it rise slowly by about 0.45% per year due to a gradual drop in electricity from natural gas because of rising gas prices. We also modelled a disruption due to the closure of one of the brown coal power stations as non-renewable energy is pushed out by renewable electricity.

  The substitution of electricity from a brown coal power station by electricity from other non-renewable sources was assumed to remove 6 Mt CO_2-e from national emissions.

The results of our modelling are summarised below.

[9] BREE used a figure of 2% for the rise of wind from 2015 to2050 in its 2014 report on Australia's Energy Projections to 2049-2050. This 2% figure included the impact of the RET.

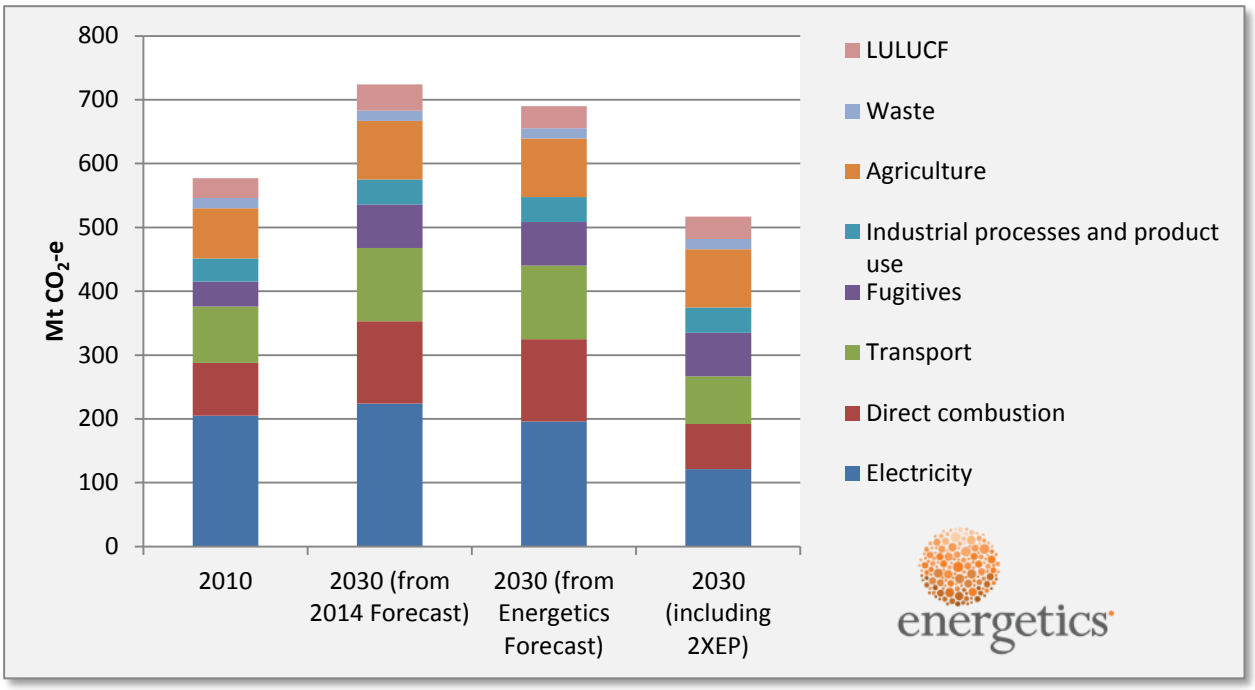

Figure 3: National greenhouse gas emissions in 2010 and 2030 including 2XEP[10]

Doubling energy productivity reduces Australia's emissions in 2030 by 10% relative to 2010.

The emissions per unit of GDP are reduced by 47%. The contribution of energy related emissions to the national total is just over 51%.

Indicative trends in national emissions under the various scenarios are shown in the next figure.

[10] Source: DoE Forecast and Energetics Forecast

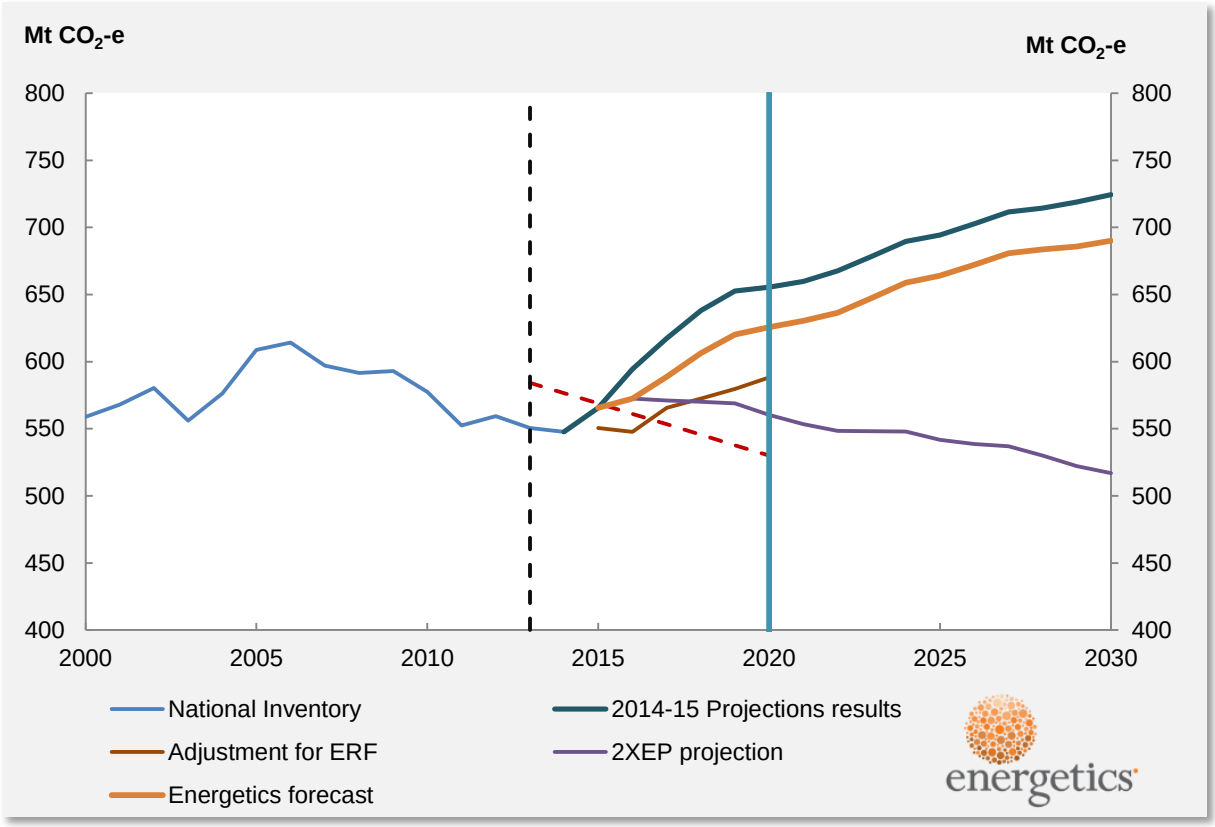

Figure 4: Australia's greenhouse gas emissions

The Climate Change Authority, in its first draft report of the Special Review: Australia's future emissions reduction targets[11], calls for a 60% reduction in emissions by 2030 relative to 2000.

In this paper we have shown how a doubling of energy productivity alone (relative to the assumptions in the DoE Forecast) will see a 10% reduction in emissions by 2030. For instance, the estimate of the impact of 2XEP assumed no significant increase in utility scale renewable energy (i.e. wind) post 2020. If however, an annual growth in wind generation of 10% is assumed, then emissions fall by 17% relative to 2010. This 10% annual rise in wind generation will see the renewable component of Australia's electricity rise to 56%.

The role of 2XEP in meeting the 2 degree challenge

In its recent assessment of projected national greenhouse gas emissions[12], Energetics showed how the Department of the Environment's revision of the national greenhouse emissions forecast published in April 2014 significantly overstated national emissions. Outlined in our paper, "New modelling shows Australia's emissions continue on a downward trend", we conclude that Australia's cumulative abatement task to 2020 is likely to be less than 91 Mt CO_2-e.

[11] See http://www.climatechangeauthority.gov.au/special-review/first-draft-report

[12] Weiss, G: "New modelling shows Australia's emissions continue on a downward trend", Energetics, 2015.

Energetics believes that our revised figure is conservative as a number of factors, not considered in the analysis, will place downward pressure on national emissions. These factors include:

- the recent or anticipated strengthening of the energy efficiency schemes in the ACT and Victoria
- the possibility that the new government in Queensland will introduce measures to reduce the state's energy use or greenhouse emissions
- the emerging focus on lifting Australia's energy productivity.

This third factor focussed on energy productivity has been the subject of this paper.

Turning to the challenge of limiting global warming to 2 degrees, a 10% reduction in national emissions by 2030 resulting from a national energy productivity improvement effort, together with a more aggressive expansion of the Renewable Energy Target that leads to an annual 10% increase in wind power coupled with 2XEP will result in a further reduction of 7%. However, this still falls short of the reductions in emissions required to keep the rise in global temperatures to below 2 degrees.

Actions to reduce Australia's energy consumption are not enough, and further action will be required across all sectors of the economy if Australia is to make its contribution to the global fight against climate change.

Contact details

Brisbane

Level 12, 410 Queen St, Brisbane Qld 4000
Ph: +61 7 3230 8800
Fax: +61 2 9929 3922

Canberra

Unit 2, 6 Napier Cl, Deakin ACT 2600
Ph: +61 2 6101 2300
Fax: +61 2 9929 3922

Melbourne

Level 6, 34 Queen St, Melbourne VIC 3000
PO Box 652, CSW Melbourne VIC 8007
Ph: +61 3 9691 5500
Fax: +61 2 9929 3922

Perth

Level 3, 182 St Georges Tce, Perth WA 6000
Ph: +61 8 9429 6400
Fax: +61 2 9929 3922

Sydney

Level 7, 132 Arthur St, North Sydney NSW 2060
PO Box 294 North Sydney NSW 2059
Ph: +61 2 9929 3911
Fax: +61 2 9929 3922

web www.energetics.com.au
abn 67 001 204 039
acn 001 204 039
afsl 329935

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