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Energy Green Paper Taskforce
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To the Energy Taskforce

I have pleasure in submitting to you this response addressing all sections of the Green Paper including the important policy considerations we believe have been omitted. This paper has been developed through collaborative engagement of the Warren Centre's Energy Committee, policy researchers and experienced industry professionals. The White and Green Paper processes come at an important stage in Australia's energy development. I am pleased to contribute our views to the consultation process, and I look forward to learning of your findings.

Yours sincerely,

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Creating energy-based economic growth in the new and smarter Australia

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0 What is missing from the Green Paper?

While the Green Paper addresses the majority of the technical and business issues facing the Australian energy policy, the following critical issues are insufficiently addressed.

0.1 Long term GHG emissions reductions policy

While the Green Paper acknowledges Australia's international short-term commitments to reducing greenhouse gas (GHG) emissions by 5% below 2000 levels by 2020 and the likelihood of further commitments beyond 2020, the report offers little guidance on the energy sector's role in accomplishing this. The acceptance that electricity emissions are to remain stable to 2030 casts further doubt on a long term strategy for addressing the domestic use of fossil fuels. A failure to present a policy that recognises the need for emissions reductions from energy production risks Australia's ability to prepare properly for the short and long-term future.

0.2 Intense differences in public opinion

The Green Paper and the Warburton review arrive into a highly politicised environment with deep public suspicion and cynicism.¹ Questions of intergenerational equity and the divergence of opinion between younger professionals and senior industry leaders with deep experience in the conventional energy technologies are obvious within Australia's technical community. This is shown in the 2014 Lowy Institute Poll. Overall, 63% of Australian adults held the personal view that Australian government should take a leadership role on reducing carbon emissions.² However, in the demographic of 18-44 years 70% of adults held the personal view while in the 45 and older demographic, this was 56% of respondents.

The Warren Centre recognises the need for Australia and the world to use energy more efficiently and to transition to a low carbon future with a strong contribution to our energy needs from renewable energy. Idealism alone will not achieve this outcome. A pragmatic, economically efficient transition is required. Strong leadership and influence to guide public opinion are essential. To achieve this, the Government must provide energy users and energy industry participants with a comprehensive, coherent, consistent and workable set of guidelines and policies.

0.3 Market based solutions versus intervention solutions

There is a tension in the economic philosophies between an interventionist approach to future economic management and a 'market oriented' approach. With the abolition of the carbon pricing mechanism, the external costs of carbon dioxide emissions are not currently reflected in market decisions. The Warren Centre believes that policy interventions must be rational and based upon the efficiency of market economics. Australian credibility, influence and leadership on the international stage are essential. International market solutions are

¹ Frank Jotzo, Tim Jordan and Nathan Fabian, 'Policy Uncertainty about Australia's Carbon Price: Expert Survey Results and Implications for Investment' (2012) 4(45) *The Australian Economic Review* 395.

² Alex Oliver, "The Lowy Institute Poll 2014",
<http://www.lowyinstitute.org/lowyinstitutepollinteractive/2014-Lowy-Poll-web.pdf>.

needed, not just domestic. The closure of energy intensive manufacturing has contributed to problems observed in unforeseen electric demand reductions and the increased allocation of electricity infrastructure costs to consumers. Poor policy design and oversight in the past has led to the current situation where the funding for flawed capital investments in the electricity industry is forced upon consumers. Rational energy policy demands alignment among the Commonwealth and States as well as rationalisation of competition policy.

0.4 Policy uncertainty harms investment

It is unclear how stable any policy can be in the current environment of public opinion doubt. Long term policy instability causes investor finance uncertainty and undermines support for long term structural changes and technology progress needed. The recent statements of Jeffrey Immelt, CEO of General Electric, provide an example to highlight international investment uncertainty over Australian policy.³

0.5 STEM education

The Warren Centre believes that the current level of performance in Australia for STEM education (Science, Technology, Engineering and Mathematics) is a threat to the production of future engineers capable of leading the nation to develop its full potential in the domestic and global energy economies. Furthermore, the education system fails to deliver recent high school graduates to the minimum level of STEM proficiency required to achieve the status of “informed citizen”.⁴ Performance is slipping compared to international and regional neighbours. Participation in science subjects is at a 20 year low. Poor skills and understanding undermine the democratic process and engaged public policy debate needed to undertake tough decisions.

0.6 Innovation

The Warren Centre believes that although Australia has a strong international record in research and discovery, institutional factors undermine the national capacity to convert discovery to innovation and commercial impact. Policies should incentivise innovation, promote entrepreneurship and convert discoveries and research into national economic success.

The numbering and sections below are aligned to the structure of the Green Paper.

1 Attracting energy resources investment

Energy resources extraction should be based upon a foundation of responsible and sufficient environmental review and community engagement. Appropriate environmental baseline data, community engagement, design standards, oversight and aligned economic rewards can enable unconventional gas development opportunities.

³ Anne Hyland, “GE boss wants ‘certainty’ on RET rule”, Australian Financial Review, October 23, 2014, http://www.afr.com/p/national/ge_boss_wants_certainty_on_ret_rule_8u651AikGfZ37w5IFilsHK

⁴ Australian Government Chief Scientist, “Science, Technology, Engineering and Mathematics: Australia’s Future”, September 2014, 11.

It is certain that Australian coal will fire existing domestic and global capital assets in the short to medium term. Australia should plan so that when coal fired plant retirements occur in the coming decade due to age and/or to meet global emissions reductions the country is positioned to take advantage of domestic and foreign opportunities in technologies such as large scale solar PV, solar thermal, carbon-capture-and-sequestration and nuclear replacement for retired coal fired assets. Ten years is not too soon for options to be defined. Strategies are needed today to secure Australia's global leadership for tomorrow.

Comments related to technology export are located in section 4.

2 Electricity prices

2.1 Electricity generation – new technologies

The Bureau of Resources and Energy Economics (BREE) acknowledges that, 'if Australia is to transition to a lower emissions economy, a long term structural adjustment to the Australian energy sector will be required.'⁵ This structural change clearly requires a shift away from current energy sources which must be evaluated against the impact on individuals and the economy in general. However, the Green Paper does not clearly articulate policies to achieve this change. Certain policy positions solidify fossil fuels for the foreseeable future.

2.1.1 Replacing coal fired assets

The transition of Australia's power generation from largely coal fired power generation to mixed energy has been brought about by the taxpayer subsidised MRET since 2007. The distribution network with centrally generated capacity has transitioned to its current structure with a sizeable distributed ad hoc generation capacity augmented by a large number of domestic PV installations. Ageing or obsolete coal fired generators are redundant as a result of falling demand. That decline is expected to persist until the economy has completed its present restructuring. Aged and obsolete plants should be retired permanently.

2.1.2 Solar PV and solar thermal

Australia's technical capabilities in solar photovoltaics and solar thermal energy generation distinguish Australia internationally. The University of New South Wales is frequently ranked first internationally in solar cell technology. The Australia National University concentrating solar power dish is the world's largest. The University of Sydney Centre for Sustainable Energy Development provides a systems-based approach to renewable and distributed energy systems and a focus on renewables enabling technologies such as batteries and energy storage engineering. The collective Australian intellectual capital should be supported to deliver the new solar energy technologies needed for the low carbon energy economy of the future.

The International Energy Agency^{6,7} forecasts a global \$44 trillion USD investment in new PV and solar thermal or conversion of legacy power stations to clean technology. This compares to a \$0.9 trillion USD/year market for fossil fuels.⁸ Domestic and overseas solar

⁵ Bureau of Resources and Energy Economics, *Australia's Energy Resource Assessment 2nd Edition*, 2014, 7.

⁶ IEA Technology Roadmap: Solar Photovoltaic Energy, 2014.

⁷ IEA Technology Roadmap: Solar Thermal, 2014.

⁸ Paul Rogers, 'Solar Power Viable Within A Decade', 30Sep2014, Forbes.

opportunities are large economic opportunities, not mere aspiration. Domestic R&D, innovation, commercialisation and continued progress up the commercial learning curve yield a unique Australian technical know how asset. This asset can yield overseas export trade in highly engineered, high value goods and services.

Levelised cost of electricity for renewables continues to decline. Environmental constraints unique to Australia contribute to innovation that lowers energy costs. For example, once-in-a-century drought conditions such as experienced in 2009, exposed the vulnerability of water supply to cool inland coal fired power stations. Diversity and innovation in Australia's wind and solar resources can moderate costs.

2.1.3 Small modular nuclear reactors

Since 2011, the Warren Centre has been investigating a project for independent base load power supply options for off grid and remote Australia. We make a separate specific proposal outlining study opportunities to explore technologies from overseas that could yield significant benefits to reduce electricity costs. While consideration of nuclear energy solutions has been 'off the agenda' in Australia, it is believed that all potential low carbon technology solutions need to be evaluated rationally when analysing potential energy supply mixes for the future.

2.2 Transmission and distribution

2.2.1 Introduction to network costs

Much of Australia's transmission and distribution (T&D) system operates at low load factors, but with reasonable diversity factors. Load factor is the ratio of the average demand divided by peak demand. Load factors for single industrial users can be as high as 80%, but collectively the household consumer load factor is typically only 30%. Individual homes are as low as 5% to 15%. The diversity factor, on the other hand, is the ratio of the peak demand of the collective load of a group of customers, divided by the summation of their individual peak demands. When diverse customer requirements are collected together, their many purely random variations average out such that the average demand per customer, of the collective, is only a fraction of the individual customer peak. Peak demands in households and commercial businesses are set by air conditioning loads during the hottest summer days. Even on these days there is diversity in customers' requirements. Large grids, because they serve diverse customer requirements require only a fraction of the capacity that stand alone systems (collectively) require. Micro-grids enjoy some of these benefits of diversity, but the smaller the grid the smaller the benefit. For stand-alone systems and (to a lesser extent) micro-grids, load management becomes critical as a means offsetting their loss of diversity.

The apparent advantage of stand-alone systems and micro-grids is avoidance of transmission and some degree of distribution costs, but because of the loss of diversity, distributed generation is not automatically cheaper than centralised generation. Moreover, in many cases the majority of the network saving is attributable to the avoidance of the geographic cross subsidies, inherent in the current network "postage stamp" tariffs. The avoided network savings are therefore of dubious value, on a macro scale.

The spatial distribution of demand customers and power generation assets yields a necessity for T&D. The majority of the distribution system investment is made because of where customers are located, rather than because of the size of their load. Greater customer dispersion requires greater investment. If customers defect from the grid, these spatially driven costs persist. Because of the loss of diversity, demand-driven costs reduce only marginally. Defections present tariff savings to individuals, but costs to the overall system do not reduce commensurately.

Recent increases in the installation of domestic air conditioning and small rooftop PV systems has exaggerated inequities among consumers' billing. Rooftop solar panels reduce the annual kWh sales of electricity, but do not reduce peak home demand for electricity.

Under current arrangements, transmission and distribution businesses are regulated monopolies. The T&D businesses are guaranteed a return on investment regardless of utilisation of the assets' sunk costs.

2.2.2 Stranded T&D assets

Under present tariffs, T&D costs are charged to consumers at "flat rate" (or average) kWh usage charges. However, the assets that are required to service peak demand are only utilised for a small fraction of time. Consequently the cost per kWh of meeting this peak demand is many, many times greater than the average rate per kWh charged. Air-conditioning units contribute heavily to peak demand, but do not add commensurately to kWh usage. Solutions such as PV reduce average sales of power, but peak demand remains the same. The regulated transmission and distribution monopolies are essentially facing "competition" from rooftop PV systems and micro-grid systems, but are effectively subsidizing that competition through non-cost-reflective pricing structures. Non-PV household customers are subsidising PV household customers. Air conditioning costs are likewise subsidised and are being paid for by non-air conditioning customers.

Battery and power storage solutions, which do have a genuine potential to improve the overall economics of T&D, could create unintended consequences. Sophisticated individual customers, incentivised by the current network pricing structures, could capture savings for themselves, yielding significantly redundant or underutilised sunk-cost assets. Redundancy could lead to asset optimisation (or write down) of the regulated asset base. Issues such as breach of the regulatory contract or sovereign risk arise if grid operators cannot recover past sunk costs.

Transmission and distribution reliability standards should meet true customer requirements balancing cost and capital considerations.

2.2.3 Tariff structure

The ideal tariff structure should include separate fees for initial connection hardware, peak usage and periodic kWh usage. This requires technology to measure instantaneous usage. Thus a two-part network tariff comprising a fixed charge per customer (differentiated by customer class) and a charge per kVA (differentiated by system level and customer class) is appropriated. Highly differentiated time of use tariffs are also appropriate.

The difficulty still arises of how to handle the sunk costs of legacy investments. Remote, spatially awkward customers now pay to build remotely at the time of construction, but substantial legacy investments were made by the T&D businesses in such assets. The most notable being rural electrification schemes. Moreover, many of these assets are now due for replacement. Dispersed, potentially stranded existing sunk assets must be reviewed. Such assets distort current network pricing signals.

The government might need to review legacy investments and consider how to return rational pricing to customers or implement real policies to increase industrial output and power demand to offset the asset amortisation costs.

2.2.4 Advanced metering and smart data management

Advanced metering technologies are needed to implement time of use and peak demand tariff alternatives. Metering also allows consumers to understand and manage power usage.

Domestic Australian advanced metering technology innovation, development and large scale commercialisation offers a technology export opportunity through high value added products and services.

2.2.5 Micro-grids, grid defection, batteries

An appropriate regulatory mindset is needed for emerging technologies in self-sustaining micro-grids, community micro-grids, building and estate micro-grids. There is significant possibility to enable renewable power alternatives, but there may risk to the grid from inappropriate integration of new technologies. Appropriate regulatory regimes and vision are needed enable bold thinking and to support market innovation. Domestic experimentation could yield export technologies. Badly managed development and experimentation could remove natural diversity among customers' load profiles creating new load management costs. Individual customers or micro-clusters might optimise their own local load management against the management objectives of the overall system. Customer controlled local load management might act counter to overall grid load management objectives. Such an outcome could intensify variations at the macro level yielding network sub-optimisation. Instability would lead to expensive capital increases at the network level or risky instability in operation during summer peaks.

There are opportunities for experimental new technology development, but there are also risks to network stability and overall network costs.

2.3 Change regulations to increase competition

The present regulated pricing system creates the outcome that capital investment, even when excessive, is remunerated by the consumer. Thus in a period of falling demand, the consumer, not the producer, is bearing the investment risk. This policy undermines the concept of a competitive market and should be corrected. The national energy policy should become consumer driven, not producer driven. The electricity industry comprises relatively few participants, from both the private and the public sector. Australia has moved from having some of the world's lowest electricity prices to the highest prices and lost one of its global sources of competitive advantage. This situation should be reversed to improve the investment climate.

Previous government approaches to markets were designed to foster competition between the few participants by regulation. Competition policy should facilitate emerging inter-fuel competition. Restoration of competition requires first bringing into balance electricity supply and demand. At present there is no case for investment in electricity generation in Australia. The incentive to invest must be restored.

A freely operating market is the best process for coping with technological and demand changes. Regulation has failed to maintain competitive electricity prices or adapt to technological change. Removal of government imposts will ensure that Australia once again has globally competitive electricity prices. Surely this is the core of a national energy policy.

3 Building gas supply and improving market operation

The Warren Centre is pleased to receive recent studies by the NSW Government and NSW Chief Scientist reviewing the safety and environmental issues of coal seam gas development. Responsible science and respected studies are the best method to demonstrate the power of technical development and to reassure communities.

The Warren Centre acknowledges the Government's desire to bring on new gas supplies as quickly as possible. TWC acknowledges this opportunity to secure early mover advantage internationally and to supply Asian markets with LNG. Queensland is well ahead in supplying unconventional gas LNG contracts.

After East Coast Australian gas supply is 'connected' to Asia via LNG export, East Coast consumers will be paying global commodity prices for gas. It is doubtful that increasing domestic supply will significantly reduce the global price for LNG until the new export facilities reach capacity constraints. Global factors, not domestic factors, will affect the global price. Speed and urgency of bringing online new projects will affect timing to the Asian market and significant sales opportunities, but possibly not substantially decrease prices in the domestic market. In the absence of Government policy intervention, in the short to medium term, it is difficult to see how LNG exports will not substantially increase the cost of gas to domestic households and industries. The urgency of supply of unconventional gas should be balanced against sensible development timelines that address issues sensitive to communities.

The Warren Centre first contributed to the coal seam gas development discussion twenty years ago in a 1994 report on "Coal Bed Methane Extraction". Unconventional gas production technologies have already proven significant economic potential in the US and in Australia. If adaptation of unconventional gas technologies from the USA and QLD/SA/WA are required for development in local VIC/NSW geological conditions, the Warren Centre is willing to undertake or support studies. If adaptation or dissemination of water purification technology is needed for the local VIC/NSW environment, the Warren Centre also stands ready to support development. Development in VIC/NSW should include best-in-class well design standards, local spill containment, safe operating practices, environmental baseline data and appropriate fugitive methane considerations. Some technology may need to be developed. Reasonable, environmentally practicable development is possible, but demands public buy-in. The social licence to operate requires "right" regulation, not just de-regulation. Avoidable community disruption to projects might continue if there is misinformation, lack of transparency or feelings of economic gains not shared among stakeholders. Institutions with scientific gravitas should be consulted to give independent evidence based advice and to communicate and educate communities. The limiting factor may not be de-regulation speed or market speed, but community buy-in speed.

4 Security, innovation and energy productivity

4.1 Security and supply of transport fuels

4.1.1 Fuel supply disruption

With the ongoing decline of production of indigenous crude oil and the closure of half of Australia's oil refining capacity, Australia has become vulnerable to disruption of supply from overseas. Tensions can occur suddenly in the Middle East, North or East Asia and along the major trading routes, as evidenced during the last year. Indeed, at present there is a 'glut' of crude oil, despite having little spare production capacity and shut-ins due to war and unrest, for oil prices have fallen dramatically and are likely to affect the economics of all new LNG capacity and the more expensive oil production capacity. This is the best time to address oil security.

4.1.2 IEA compliance options

Australia still does not comply with the terms of membership of the IEA. It has zero strategic storage. The ADF also maintains no strategic storage. In the event of a major disruption, Australia would grind to a halt within days or weeks. It is time for Australia to comply with the requirements of the IEA. This would be the low cost insurance policy. The higher cost alternative is to build a major natural gas fuelled GTL plant for production of petrol, jet fuel and diesel.

4.1.3 Supply distribution

Australia's weak policy link is the lack of Australian flag crude oil and product tankers. In the event of a supply disruption, a massive shortage of tankers would arise. Australia can take relatively small capacity tankers which must be double hulled for local environmental reasons. Only two refineries are connected by pipeline to the ever diminishing supply of indigenous crude oil, Geelong and Altona, the other two refineries being in Kwinana and Brisbane. Domestic crude oil, condensate and products cannot be distributed optimally in an emergency. The ADF has one tanker for use by the navy. The ADF should acquire two more tankers as another aspect of a national transport fuels insurance policy-- one tanker for diesel and one for petrol/jet fuel. This would be the same approach which the government had adopted for air transport with the purchase of a relatively large fleet of C-17s.

4.2 Convert R&D to domestic innovation and commercialisation

Australia is the invention leader in certain fields of solar technology. The challenges of integrating solar energy to modern power grids and storing energy gives Australian innovators the opportunity to develop significant new products and service skills. These new technologies can enhance domestic environmental performance.

4.3 Export high value-added goods and services

Technologies that are invented in Australia can become value-added export goods and services leading to new industrial development. As noted above in 2.1.1, this is a \$4 trillion

global market opportunity. Human capital, education and research resources are national investments and intelligence assets. These assets can be deployed domestically and exported to the rapidly rising economies in the Asia-Pacific region. Australia has the technical resources to supply manufactured good and high technology services in the region more cheaply and more effectively than competitors at much greater distance in Europe and North America. Better market access, better local and regional knowledge, better cultural fluency, and better within-time-zone technical support and service are comparative advantages of Australia's geographic position. Australia should capitalise on longer term strategic advantages in the low-carbon energy economy.

4.4 Specific technology opportunities

Renewable energy technologies represent high capital investments with lower marginal operating costs. Australia's access to globally fluid investment capital at a risk-adjusted interest rate demands stable energy policy. Long term strategies are needed. Solar PV and solar thermal are areas of demonstrated technical expertise.

Technology opportunities

- Solar PV and solar thermal
- Grid stability
- Demand management technologies, including electric vehicle charging
- Electricity consumption and costs management
- Energy demand forecasting
- Smart meters
- Storage including batteries
- Integrated IT and data solutions

Implementation of technologies domestically builds the opportunity to export products.

4.5 Market reform and tariff advisory consultation as an export industry

New expertise developed in Australia can be exported to international regional neighbours as consulting services and university education.

4.6 Energy efficiency

Energy efficiency and behavioural change are critical to long term demand management. The Warren Centre's Low Energy High Rise project undertook a comprehensive study of energy efficiency in the office sector from 2007-2010. Commencing with a technology and asset age focus, the project discovered significant energy savings related to management and operational behaviours, most of which required no expenditure. Energy savings potential of about 30% for the commercial property sector equated to a 1.2% reduction in Australia's overall greenhouse gas emissions. Many of the study's recommendations have become standard for the commercial property sector. On a policy level, energy efficiency disclosure drive consumer sophistication.

5 Conclusion

Australia has abundant domestic energy resources. Australia's future domestic energy supply will come from a rich and diverse range of sources. It is vitally important to set stable policies that encourage investment for the future. Constant, frequent, rapid policy changes damage investments in Australian engineering capability.

As coal ramps down internationally, Australia should be ramping up in global trade based on Australian intelligence. Australia must align to global trends, regional trends and long term thinking.