



Australian Academy of Technological Sciences and Engineering

Level 1, 1 Bowen Crescent, Melbourne Vic 3004

GPO Box 4055, Melbourne, Vic 3001, Australia

T+61 3 9864 0900 F+61 3 9864 0930 W www.atse.org.au

Australian Academy of Technological Sciences and Engineering Limited – Incorporated ACT ACN 008 520 394 ABN 58 008 520 394

Submission to the
Energy Green Paper

by

The Australian Academy of Technological Sciences and Engineering
(ATSE)

to

Department of Industry
Australian Government

November 2014

Contact details:

Australian Academy of Technological Sciences and Engineering

03 9864 0900

policyresearch@atse.org.au

Executive Summary

ATSE considers that the goals and proposals described by the Australian Government in the Energy Green Paper 2014 to be well focussed and sound. However the Green Paper is considered fundamentally weak on three critical issues:

- (i) **Near-term focus:** The majority of the document is focused on resolving near-term issues and falls short in positioning Australia's energy strategy to support the significant investment that will be required in the medium to longer term;
- (ii) **Resilience to geopolitical and economic risks associated with climate change:** The Green Paper represents a general acceptance that Australia and the rest of the world will continue to rely on fossil fuels for several decades. This may be so, but failure to recognise and plan for the real geopolitical and economic risks of Australia potentially finding itself to be out of step with international thinking around greenhouse gas (GHG) emissions and climate change leaves the country exposed to possible future international moves to limit and/or price carbon emissions; and
- (iii) **Institutional & fiscal barriers to implementation:** A range of reforms and suggestions are put forward which appear difficult to deliver upon under present policy settings due to institutional (e.g. lack of bipartisan support or policy misalignment between the Commonwealth and States) and/or fiscal constraints (funding cuts to research institutes, universities and State-owned utilities and reduced profitability in the energy and resources sector).

Specific additional topics that ATSE recommends the Australian Government consider in the Energy White Paper include:

Energy Security and Reliability:

The Green Paper does not adequately address the security and reliability around Australia's power systems or transport fuels. Notwithstanding the recent declining electricity demand trend and claims¹ of historical overinvestment in networks highlighted in the Green Paper, this sector will require significant capital investment in the coming decade.

ATSE recommends energy policy settings that create long-term certainty for investors. This is currently a critical issue for Australia with investment in the electricity sector at very low levels despite low interest rates. ATSE further recommends that policies be more supportive of innovation and investment in more efficient, less emission intensive technologies, including both renewables and nuclear energy, so that it is easier to write down and replace older, inefficient and emission intensive fossil fired plant and equipment.

In relation to security of gas supplies, three additional proposals should be considered:

- (i) Address the issues that are preventing resolution of current restrictions on coal seam gas (CSG) exploration and/or hydraulic fracturing in NSW and Victoria;

¹ It should be noted that the claimed "overinvestment" in networks arose as a result of the requirement for network companies to plan investment 5 years in advance, including for peak requirements. A shift from increasing demand to declining demand was not foreseen by the regulator, planner or the network companies.

- (ii) Pre-investment in gas pipeline infrastructure is likely to attract and accelerate investment in exploration and development of onshore, unconventional gas resources; and
- (iii) Improving community engagement must be preceded and underwritten by an increase in the wider community's trust in both industry and government.

Electricity Prices

ATSE agrees with the fundamental premise in the Green Paper that the present cost - price - value relationship is not effective and supports modifications to tariff structures along with a broadening of tariff choices to better align retail electricity prices with time-of-day cost and service value. Such tariff reforms should be accelerated, acknowledging the role of the States in this area.

Notwithstanding tariff structural reform and increased choice, there is evidence to suggest that the trend toward increasing distributed generation by so-called *prosumers* might continue and hence investment and policies to support smart metering and intelligent electricity networks incorporating storage is vital.

Australia must also position itself to be capable of meeting not just its near-term emissions reductions commitments but its longer term conditional emissions reductions targets. The Green Paper does not address Australia's readiness in this regard at all and hence leaves the electricity sector and economy highly exposed to future electricity price increases.

Building gas supply and improving market operation

ATSE generally agrees with the commentary and recommendations for addressing near-term east coast gas supply and prices, in particular, bringing on new east coast gas supply as quickly as possible and improving market transparency and competition. Australian governments, both Federal and State, must work together, drawing upon the best available scientific advice, to facilitate removal of the current restrictions on CSG exploration and/or hydraulic fracturing in NSW and Victoria.

Long term support for research, development and demonstration (RD&D) and strategic incentives might also be considered in order to accelerate investment in exploration and development of certain onshore, unconventional gas resources.

Security, innovation and energy productivity

The Australian Government's goals for energy security, innovation and productivity are supported as far as they go, but disturbingly, they are silent on the requirement to position Australia to be capable of achieving significant decarbonisation and other emission reductions over the coming decades. This failure leaves Australia exposed and may have significant adverse implications for energy security and productivity as well as the nation's economic resilience.

ATSE strongly recommends that the goal of *securing reliable and affordable energy in a technology neutral way that could also help to lower emissions* must be recast as *securing reliable and affordable energy in a technology neutral way that will transition the energy sector to lower emissions*.

In the area of innovation, the lack of policy stability in Australia for at least the past decade and uncertainties around the carbon price outlook, the future costs of different

low emissions technologies and the level of energy demand have dampened private sector investment in research and development (R&D) and particularly in the demonstration of low emissions technologies. In recent years, financial stress and staffing cuts in the electricity and much of the resources sectors, and cuts to industry and government R&D budgets means innovation and collaboration between business and universities in the energy sector is declining. The Australian Government must play a critical role in reversing this trend.

Other specific recommendations for the Energy White Paper include:

- Include an objective to strengthen the resilience of the electricity system over the next decade by creating incentives for significant capital renewal and diversification (given risks around carbon intensity).
- Take a strong position on nuclear power and support amendments to the Australian Radiation and Nuclear Safety Act and the Environment Protection and Biodiversity Conservation (EPBC) Act that would allow construction and operation of nuclear power plants if the markets and communities accept them and plant owners/funders choose to use nuclear power.
- Undertake a rigorous risk assessment of Australia's energy security in respect of transport fuels, including consideration of the potential contribution of electric vehicles associated with low emission electricity supplies, and consider mitigation through a suite of initiatives as described in this submission.
- Improved education and training must go beyond the Industry Skills Fund. Initiatives should also seek to increase the RD&D talent base by developing home-grown talent, attracting international expertise and fostering international connections of researchers and industry.
- Increase strategic R&D plus demonstration investments in large scale solar power, large scale energy storage, intelligent networks, carbon storage resource characterisation, improving productivity of gas extraction and low emission liquid fuels technologies particularly for aviation, maritime and heavy logistics.
- Such strategic investments in R&D plus demonstration need to be supported by a robust and independent techno-economic evaluation process.

Contents

1. Context	6
2. Purpose	7
3. Critical Issues	7
4. Attracting energy resources investment	8
5. Electricity prices.....	9
6. Building gas supply and improving market operation	10
7. Security, innovation and energy productivity	11
7.1 Security	11
7.2 Innovation.....	13
7.3 Energy productivity	15
8. Conclusions	15

1. Context

Australia has for many years enjoyed comparative advantage through the wide availability of large, low cost energy sources, particularly for electricity generation. With national and international efforts and agreements to reduce emissions, natural gas increasingly linked to international prices and coal production costs rising, this advantage has disappeared. Retail electricity prices now are comparatively high compared to our competitor nations and retail gas prices are following.

Federal and State government policies have supported, and continue to support electricity supply from renewable resources. Fossil fuels are, though, are likely to dominate energy supply for many more years. This is an issue shared by many countries and presents a challenge to transition to a low emissions economy.

Developing and implementing policies that will deliver a transition to a low emissions energy future while maintaining adequate, reliable, secure and competitive energy supplies is Australia's – and the world's – key challenge.

Large investments are required if Australia is to transition to low emissions energy production. Investment decisions are driven by an investor's view of risks (including sovereign risk) and how each can be managed or mitigated to meet their required return on that investment. In particular, an investment environment that encourages the replacement of old assets with new, low emission technologies is essential.

Policy instability, such as a lack of bipartisan political agreement on the *vision* for Australia's energy sector, has meant investment uncertainty.

Australia must have a national energy policy that is balanced (between the sometimes conflicting objectives of security, affordability and emissions reduction), is coordinated (between innovation, industry, climate change and investment policies) and is stable to attract the large investments required to transition the economy to a lower emissions future.

Going forward, a robust and transparent approach is required for effective strategy formation, implementation, resourcing and oversight. The approach should involve key stakeholders in a more participatory engagement process and allow for regular review and revision given the rapidly changing economic, environmental and social landscape.

2. Purpose

This submission is made by the Australian Academy of Technological Sciences and Engineering (ATSE)² in response to the Commonwealth's Energy Green Paper 2014.

Critical issues are identified and specific comments are made under the four identified *Australian Government Energy Policy Goals*, namely:

- Attracting Energy Resources Investment
- (Controlling) Electricity Prices
- Building gas supply and improving market operation
- (Enhancing) Security, innovation and energy productivity

3. Critical Issues

ATSE supports all of the government's energy policy goals as articulated in the Green Paper, however considers that the Australian energy policy will benefit by addressing the following three critical issues:

- (i) **Near-term focus:** The majority of the document is focused on resolving near-term issues and falls short in positioning Australia's energy strategy to support the significant investment that will be required in the medium to longer term. This submission identifies a number of examples;
- (ii) **Resilience to geopolitical and economic risks associated with climate change:** The Green Paper represents a general acceptance that Australia and the rest of the world will continue to rely on fossil fuels for several decades. This may be so, but failure to recognise and plan for the real geopolitical and economic risks of Australia potentially finding itself to be out of step with international thinking around greenhouse gas (GHG) emissions and climate change leaves the country exposed to possible future international moves to limit and/or price carbon emissions; and
- (iii) **Institutional & fiscal barriers to implementation:** A range of reforms and suggestions are put forward which appear difficult to deliver upon under present policy settings due to institutional (e.g. lack of bipartisan support or policy misalignment between the Commonwealth and States) and/or fiscal constraints (funding cuts to research institutes, universities and State-owned utilities and reduced profitability in the energy and resources sector).

Specific examples of these failings are highlighted throughout the submission under the four *Australian Government Energy Policy Goals* around which the Green Paper is structured.

² ATSE advocates for a future in which technological sciences, engineering and innovation contribute significantly to Australia's social, economic and environmental wellbeing. The Academy is empowered in its mission by some 800 Fellows drawn from industry, academia, research institutes and government, who represent the brightest and the best in technological sciences and engineering in Australia. The Academy provides robust, independent and trusted evidence-based advice on technological issues of national importance. ATSE fosters national and international collaboration and encourages technology transfer for economic, social and environmental benefit.

www.atse.org.au

4. Attracting energy resources investment

The Australian Government's energy policy goals around attracting investment to the energy sector appear to focus exclusively on resource development. Both the overarching goals and the initiatives outlined are silent on power generation, transmission and distribution infrastructure. Much of Australia's baseload (coal-fired) power generation fleet is ageing, inefficient and carbon and emission intensive. Further, with the increasing penetration of intermittent renewable (including distributed) generation, Australia faces growing issues around network stability and electricity storage will become increasingly important for our electricity system. Accordingly, notwithstanding the recent declining demand trend and claims³ of historical overinvestment in networks highlighted in the Green Paper, this sector will potentially require significant capital investment in the coming decade. Such investments tend to be large and long-lived and are typically preceded by long lead times for project development, permitting, financing and gaining community support.

ATSE recommends energy policy settings that create long term certainty for investors. This is currently a critical issue for Australia with investment in the electricity sector at very low levels despite low interest rates. ATSE further recommends that strategy be more supportive of innovation and investment in more efficient, less emission intensive technologies, so that it is easier to write-down and replace older, inefficient and emission intensive plant and equipment.

ATSE generally supports the Green Paper's proposals to: reduce environmental and other approval times; improve skills and workforce productivity; enhance the quality and accessibility of precompetitive geoscience and environmental data; improve community engagement; enhance supply chains and indigenous employment; and address infrastructure bottle necks and promote exports.

ATSE offers two additional suggestions for consideration by the Australian Government:

- (i) Pre-investment in gas pipeline infrastructure may help to attract and accelerate investment in exploration and development of certain onshore, unconventional gas resources; and
- (ii) Improving community engagement must be preceded and underwritten by an increase in the wider community's trust in both industry and government.

Finally there remain questions about the utility of some of the Commonwealth policies and interventions which are in conflict with the policies of certain States. For example, current restrictions on CSG exploration and/or hydraulic fracturing in NSW and Victoria have obviously stymied resource developments in those states with adverse implications for domestic energy security, domestic gas pricing and exports. The technology issues identified in the O'Kane report⁴, particularly regarding ground water, need to be addressed.

³ It should be noted that the claimed "overinvestment" in networks arose as a result of the requirement for network companies to plan investment 5 years in advance, including for peak requirements. A shift from increasing demand to declining demand was not foreseen by the regulator, planner or the network companies.

⁴ NSW Chief Scientist and Engineer, *Final Report of the independent Review of Coal Seam Gas Activities in NSW*, http://www.chiefscientist.nsw.gov.au/_data/assets/pdf_file/0005/56912/140930-CSG-Final-Report.pdf

5. Electricity prices

ATSE agrees with the fundamental premise in the Green Paper that the present cost - price - value relationship is not effective. ATSE therefore supports modifications to tariff structures along with a broadening of tariff choices to better align retail electricity prices with time-of-day cost and service value. Such tariff reforms should be accelerated, though this is clearly an action to be implemented by the States.

ATSE also supports the uptake of intelligent (i.e. 'smart') metering and again recommends the accelerated implementation of rule changes and the facilitation of such smart metering.

Notwithstanding tariff structural reform and increased choice, there is evidence to suggest that the trend toward increasing distributed generation by so-called *prosumers*⁵ might continue and hence investment and policies to support intelligent electricity networks is vital.⁶ This trend is driven in part by incentives and rising electricity prices but also in part by consumers' lack of trust in the industry participants as well as the regulator. Transparency, access to better and more relevant information on costs and service value, and stronger powers and independence for the regulator will help to build community trust.

The development of intelligent networks will play a key role in minimising the investment needed to provide efficient, affordable and low emission power for the Australian economy. The transition to intelligent networks will be a long term process and requires strategic development of technology, changes to market structures and significant investment to build confidence in their operation and then to deploy widely. Given the governance arrangements upon which the current markets are based, and the mixture of market-based and regulatory mechanisms upon which network arrangements are based, Australia faces long-term challenges to achieve effective transition to intelligent networks.

Misalignment between States in achieving reform is a significant issue and the Council of Australian Governments (COAG) has proven to be an imperfect model for delivering energy market reforms in a timely and consistent manner. This is an example of institutional barriers to achieving the Australian Government's energy policy goals.

While the rationalisation of emissions reduction schemes is accepted, energy policy must also assure Australia's long-term resilience in the face of the risk that there will be significant geopolitical developments in relation to abating GHG emissions and climate change. Failure to do so leaves Australia poorly positioned to respond to possible future international agreements to limit and/or price carbon emissions. This means that Australian governments must position Australia to be capable of meeting not just our near-term emissions reductions commitments but also the longer-term conditional emissions reductions targets. The Green Paper makes no reference to its published emissions reduction targets (as published by the Department of the Environment) and does not address Australia's readiness in this regard at all and hence leaves the electricity sector and the economy highly exposed. This is of concern to ATSE – the Energy White Paper must show policy linkages to support other key government policies. Whilst the Green Paper identifies some market reforms it is only for four

⁵ Prosumer is a portmanteau for professional-consumer. In the case of this submission, a customer with the ability to generate and store their own electricity.

⁶ See the attached ATSE Energy Action Statement "*Intelligent Electricity Networks for the Future*" – October 2014, www.atse.org.au/Documents/policy/atse-energy-action-statement-02.pdf

selected key energy areas. The Energy White Paper should adopt a risk management approach and start to implement comprehensive policies and intermediate targets that will enable Australia to meet deep emission reductions by 2050 should the need arise.

In the absence of an articulation of the relationship between GHG policy and energy policy, there is a fundamental contradiction in the Green Paper chapter regarding the role of renewables and fossil fuel generation in the electricity sector on the one hand, and reduction in GHG emissions on the other. To be technology and regulatory neutral requires that GHG objectives apply equally to all technologies.

Regulation should aim to level the playing field for all generators whilst providing a driver for reduction in GHG emissions. Logically this should be a carbon price through a cap and trade system since economic studies show this to be the most cost effective mechanism.

6. Building gas supply and improving market operation

ATSE generally agrees with the Energy Green Paper commentary and recommendations for addressing near-term east coast gas supply and prices, in particular, bringing on new east coast gas supply as quickly as possible and improving market transparency and competition. However, the Australian Government must act to facilitate the removal of the current restrictions on CSG exploration and/or hydraulic fracturing in NSW and Victoria.

Appropriate legislation, frameworks and mandatory monitoring of national CSG exploration and hydraulic fracturing, overseen by a trusted independent monitoring agency, will be an important step to facilitate the removal of the aforementioned restrictions in NSW and Victoria.

Improving community engagement is critical, but positive outcomes in terms of enabling policies and investment will need to be preceded and underwritten by an increase in the wider community's trust in both industry and government.

ATSE also acknowledges that high gas price signals and technology do improve the prospects for unlocking previously uneconomic resources. However, long term support for research, development and demonstration (RD&D) and strategic incentives to accelerate investment in exploration and development of onshore, unconventional gas resources.

The commentary and proposals for sustaining national gas supplies, improving gas price transparency and improving gas market function are considered sound, but again COAG appears to be an imperfect model for delivering energy market reforms in a timely and consistent manner.

7. Security, innovation and energy productivity

The Australian Government's goals for energy security, innovation and productivity are relevant but, disturbingly, are silent on the requirement to position ourselves to be capable of achieving significant decarbonisation and other emission reductions over the coming decades. Failure to recognise and mitigate against geopolitical risks around GHG emissions and climate change leaves Australia dangerously exposed to possible future international agreements to limit and/or price carbon emissions. That exposure will have significant adverse implications for energy security and productivity as well as the nation's economic resilience.

ATSE strongly recommends that the goal of *securing reliable and affordable energy in a technology neutral way that could also help to lower emissions* must be recast as *securing reliable and affordable energy in a technology neutral way that will transition the energy sector to lower emissions*.

In the area of innovation, the long time frames for RD&D make it critical that strategies to drive energy innovation are stable and predictable over the long term. Such stability has been absent in Australia for at least the past decade. Uncertainties around the carbon price outlook, future costs of different low emissions technologies and the level of energy demand have dampened private sector investment in RD&D of low emissions energy supply. In recent years, financial stress and staffing cuts in the electricity and much of the resources sectors mean that industry's capacity to invest and participate in innovation has declined. In addition there have been cuts to industry and government R&D budgets⁷ and there is evidence⁸ that collaboration between business and universities in the energy sector is declining.

7.1 Security

Electricity:

The general tenor of the Green Paper in relation to the decline in electricity demand fails to consider the implications of the network's exposure to risk due to its reliance on aging coal fired generation capacity and infrastructure. While demand growth may be unlikely until 2023-24, a resilient power sector needs to be prepared for significant capital renewal and diversification (given risks around carbon intensity and emissions reduction pressures) during the next ten years.

Given this scenario, ATSE recommends in line with its recent Energy Action Statement⁹ the Australian Government take a stronger position and support amendments to the Australian Radiation and Nuclear Safety Act and the EPBC Act to allow for construction and operation of nuclear power plants. Removing this barrier now would still likely mean a decade or more before any investment decision in a nuclear power plant, assuming that market regulators, project owners and funders select nuclear power as an option compared to alternatives and social-licence-to-operate can be gained for the particular deployment project.

⁷ Australian Government. (2012). *Mid-Year Economic and Fiscal Outlook 2012-2013*. Canberra, Australia: Australian Government.

⁸ DIISRTE. (2012). *Australian Innovation System Report 2012*. Canberra, Australia: Department of Industry, Innovation, Science, Research and Tertiary Education.

⁹ See the attached ATSE Energy Action Statement "Nuclear Energy is an Option" – August 2014, www.atse.org.au/Documents/policy/atse-energy-action-statement-01.pdf

In addition, increased use of electric vehicles could benefit the productivity of the electricity network and increase the amount of stored energy available to the network. Strategies to foster transition of transportation sector, especially passenger and light duty logistics vehicles, from petroleum fuels to alternative fuels and electric power, could have implications for electricity supply systems and lead to widespread adoption of passenger and light-duty logistics electric vehicles. This increasing penetration of electric vehicles will be an important driver of storage technology, and if widely adopted, would have important implications for the electricity system.

Gas supply:

Gas supply pressures, especially in eastern states, are noted and our comments have been offered in section 6.

Transport fuels:

The international outlook for the supply of crude oil and derived transport fuels is becoming increasingly uncertain both in the long-term and short-term. Global conventional crude oil production from established provinces has peaked and the long-term balance of supply is increasingly being made up from unconventional sources and/or remote locations both of which have high costs of production. The long-term trend will be for a consistent upward pressure on prices, notwithstanding short-term fluctuations. With geopolitical risks increasing, particularly in the oil-rich Middle East, the potential for short-term supply disruptions is as high or higher than it has ever been.

In relation to transport fuels¹⁰, ATSE considers it critical that the Government include an objective to facilitate the development of new fuel reserves to meet Australia's international oil security obligations and augment domestic security.

The Government should undertake a rigorous risk assessment of Australia's energy security in respect of transport fuels and consider mitigation through a suite of initiatives:

- (i) The ongoing assessment of the resilience of domestic reserves capacity. This should be through a scenario or "stress test" such as global system interruptions in Singapore and at the Straits of Hormuz.
- (ii) Consideration of increased strategic reserve/stocking requirements of refined products for commercial operators and how to encourage this. Any increase in stock levels would have to be implemented over a long time scale in order not to impact supply and prices.
- (iii) Acceleration of precompetitive exploration and release of acreage in new frontier offshore basins and development of onshore unconventional resources.
- (iv) Strategies to foster transition of the transportation sector, especially passenger and light duty logistics vehicles, from petroleum fuels to alternative fuels and electric power.
- (v) Implementation of more stringent vehicle fuel efficiency targets and standards.
- (vi) Acceleration of research, development and demonstration of alternative and lower emission liquid fuels technologies particularly for aviation, maritime and heavy logistics.

¹⁰ ATSE has developed a Future Fuels for Transport Action Statement which can be accessed on the ATSE website. Refer <http://www.atse.org.au/atse/about/policy/content/about/policy.aspx>

7.2 Innovation

Investing in the research, development and demonstration of new technology is critical to enable the transition to a low emissions economy. The Australian Government should consider strategic investments in RD&D of technology options where:

- Australia has a competitive resource, technology and/or capability position;
- An economic, commercially viable option can be demonstrated for immediate, mid-term or potential future deployment;
- Increased innovation investment drives transformational gains;
- Regulatory, social and market barriers to deployment are reduced using an evidence-based approach;
- Private sector investment in new energy technology is incentivised and leveraged; and
- Australia's investment is leveraged through international collaboration.

The long time frames for R&D and demonstration make it especially critical that the strategies to drive energy innovation are stable and predictable over the long term. Such stability has been absent in Australia for at least the past decade and can only come about if there is bipartisan support and the funding program is at arm's length from the government.

It must be recognised that Australia will mainly be an adapter / adopter of energy technologies. Applications development and deployment is likely to take place internationally where equipment manufacturers are domiciled or where very large market potential exists.

Improved education and training must be encouraged and supported in order to maintain a domestic competitive advantage and to equip Australia with the skills needed to adapt energy technology solutions from around the globe. This must go beyond the Industry Skills Fund. Initiatives should also seek to increase the RD&D talent base by developing home-grown talent, attracting international expertise and fostering international connections of researchers and industry.

Selecting target areas for strategic investments in R&D plus demonstration need to be supported by robust and independent techno-economic evaluation process. Possible target areas for investment are likely to include:

Renewable Electricity

Australia has excellent solar energy resources and solar technology capability and capacity. The Australian Government should support strategic R&D plus demonstration investment in collaboration with international efforts to facilitate the uptake of large- and small-scale solar power generation.

Large scale energy storage and intelligent networks

Increased penetration of intermittent renewable energy production will require renewable generators to become more active participants in maintaining the stability of the grid during power system contingencies. Supplementary controls are likely to be required. In the absence of affordable, fast acting reserve generation and insufficient energy storage, the system may become unstable and experience outages.

The Green Paper has identified large-scale energy storage as a potential *game changer* especially with the increasing uptake of intermittent renewable energy sources. ATSE considers energy storage more critical in Australia than in most other developed jurisdictions and recommends strategic R&D plus demonstration investment

in large-scale and in small-scale, highly distributed intelligent energy storage as well as electricity networks.

Over the next 10 years, pumped hydro is currently viewed as the most *cost effective* storage option; however there are a number of other technologies (such as advanced batteries and flywheels) that have undergone demonstration in the USA and are now considered to be *technically feasible*.

The widespread adoption of battery electric vehicles and plug in hybrid electric vehicles could be an important driver of efficient, low cost, ubiquitous but mobile energy storage devices and will demand substantial changes to the low voltage exchange network. That storage capability could have important implications for the electricity sector both as a demand management tool and by potentially enabling consumers with PV panels to store and use the electricity that they have generated.

Australia has one of the most developed *isolated* power systems undergoing transformation globally. Opportunities may exist to provide leadership and know-how to other less developed economies with similar power systems.

Low emissions fossil fuels

The Green Paper suggests fossil fuels may remain a significant contributor to Australia's electricity generation mix for decades to come. Ensuring the option for the potential deployment of carbon capture and storage (CCS) becomes critical in such a scenario. To assure this CCS option, significant investment is required to explore and appraise carbon storage resource potential. Given the timelines required to undertake detailed storage site assessment, it is likely that this work will need to commence several years in advance of feasibility assessment of carbon capture plants. This early lead time, and the uncertainty surrounding the future commerciality of CCS, means it is unlikely that private sector investment in storage exploration and appraisal will be mobilised in the near to medium term.

The Australian Government along with state Governments should consider prioritising the characterisation of prospective large-scale geostorage sites.

Gas supplies

Australian exploration and development costs are high compared to international competitors. New gas sources, particularly unconventional onshore sources, are inherently higher cost to produce than traditional sources and require significant up-front funds at risk, as well as long lead times.

In order to further stimulate the growth in gas sources the Australian Government should support targeted RD&D which aims to reduce costs, improve productivity, better understand social impact and improve community engagement practice.

Australia's record in delivering the first large scale development of unconventional gas for LNG production presents opportunities to provide leadership and know-how in other jurisdictions

Transport fuels

Strategic R&D plus demonstration in low emission liquid fuels technologies particularly for aviation, maritime and heavy logistics should be considered. In particular:

- Long term R&D plus demonstration is needed to improve the cost structure and scalability of second generation 'drop-in' biofuels (e.g. from lignocellulosic plants and algae).

- Long term R&D plus demonstration is needed to develop novel gas- and coal-to-liquids technology with a substantially lower carbon intensity than the current proven technologies.
- Long term R&D plus demonstration is also required to unlock oil-shale resources ordinarily exploited through mining/retorting operations, in particular (i) beneficiation of associated heavy metals, (ii) reduced energy use and (iii) reduced carbon intensity.

7.3 Energy productivity

ATSE supports the proposals under consideration to improve energy productivity via a National Productivity Plan and recommends a toughening of regulations and standards to deliver major improvements in building appliances and industrial energy efficiency along with vehicle fuel efficiency.

Improving energy consumption information particularly for the commercial and residential sector is also critical.

At the macro level, the energy economy is increasingly subject to rapid change – technological, social, and economic. ATSE supports any initiatives to improve ‘outlook’ capacity by coordinating energy sector reporting and increasing the frequency of assessments.

8. Conclusions

ATSE considers that the goals and proposals described by the Australian Government in the EWP Green Paper 2014 to be well focussed and sound. However the Green Paper is considered fundamentally weak on three critical issues:

- (i) **Near-term focus:** The majority of the document is focused on resolving near-term issues and falls short in positioning Australia’s energy strategy to support the significant investment that will be required in the medium to longer term;
- (ii) **Resilience to geopolitical and economic risks associated with climate change:** The Green Paper represents a general acceptance that Australia and the rest of the world will continue to rely on fossil fuels for several decades. This may be so, but failure to recognise and plan for the real geopolitical and economic risks of Australia potentially finding itself to be out of step with international thinking around GHG emissions and climate change leaves the country exposed to possible future international moves to limit and/or price carbon emissions; and
- (iii) **Institutional & fiscal barriers to implementation:** A range of reforms and suggestions are put forward which appear difficult to deliver upon under present policy settings due to institutional (e.g. lack of bipartisan support or policy misalignment between the Commonwealth and States) and/or fiscal constraints (funding cuts to research institutes, universities and State-owned utilities and reduced profitability in the energy and resources sector).

ATSE recommends energy policy settings that create certainty for investors. This is currently a critical issue for Australia with investment in the electricity sector at very low levels despite low interest rates.

ATSE strongly recommends that the goal of *securing reliable and affordable energy in a technology neutral way that could also help to lower emissions* must be recast as *securing reliable and affordable energy in a technology neutral way that will transition the energy sector to lower emissions*.

ATSE further recommends that policies be more supportive of innovation and investment in more efficient, less emission intensive technologies, so that it is easier to write down and replace older, inefficient and emission intensive plant and equipment.

Specific additional matters that ATSE recommends the Australian Government consider in the Energy White Paper are provided within the body of this submission.