ATSE

SUBMISSION TO THE

Infrastructure Australia Audit Report

AUGUST 2015

AUSTRALIAN ACADEMY OF TECHNOLOGICAL SCIENCES AND ENGINEERING (ATSE)

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Australian Infrastructure Audit

The Australian Academy of Technological Sciences and Engineering (ATSE)[1] welcomes the opportunity to provide feedback on the Australian Infrastructure Audit and input into the development of Infrastructure Australia's Australian Infrastructure Plan. The Audit is a valuable review of Australia's infrastructure needs and demands and is an essential step in planning and delivering the nation's future infrastructure.

Effective infrastructure planning is a critical issue for Australia, particularly as our population continues to grow. Infrastructure is vital for driving productivity, underpinning prosperity and our way of life. Its construction and use impact on all aspects of our society and environment.

ATSE agrees with several of the Audit's key findings and agrees that major reforms are needed to improve the way we plan, finance, construct, maintain and operate infrastructure to ensure it can underpin gains in Australia's productivity in the decades ahead, and contribute to economic growth.

ATSE is pleased to see that all of the recommendations outlined in the ATSE Infrastructure Position Statement 'Infrastructure to meet Australia's future needs' also feature as key findings within the Audit. These recommendations include: commit to robust long term infrastructure planning; ensure effective infrastructure development and delivery; implement best practice, whole-of-life infrastructure management; and, use existing infrastructure as effectively as possible. A copy of the Position Statement accompanies this submission.

However, the Audit raises some important issues which deserve further attention and these issues are discussed in this submission.

[1] 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

Direct Economic Contribution

The Audit states that it *"provides a top-down assessment of the value-add, or Direct Economic Contribution (DEC) of infrastructure".* In recent times the "value-added" or "value capture" concept has been an important issue in infrastructure considerations. A landmark report by the Committee for Melbourne published in 2012 explored the idea in some detail[2]. For example, the benefits of an infrastructure project may well be better reflected in the increases in property values that it causes, rather than in the net revenue it raises via usage charges. Boris Johnson, Mayor of London, has frequently argued that the benefits of London's Crossrail subway project will come from the indirect benefits to businesses and funding for Crossrail 2 should come from property taxes rather than fare collection. This form of "value capture" is common in the United States of America. Indeed, a common definition of "infrastructure" is that it covers essential services that could not be covered by usage charges and thus would not be provided by the private sector.

It was therefore disappointing to find that the IA Audit, although it uses the term "value-added", says that it is measured by DEC. Infrastructure Australia define DEC in Appendix 1, 1.1, as *"what we actually pay to use infrastructure, whether through direct user charges, or through other indirect forms of payment. In this sense, DEC also measures the direct cost associated with the use of infrastructure."* Where there are no direct usage charges, IA says that it uses taxpayer funds for the infrastructure that supports many of our transport services, e.g. the cost of providing and maintaining the roads we drive on. It is difficult to see any direct link between DEC and the value captured approaches used globally and by the Committee for Melbourne. It seems to incorrectly redefine DEC as a term to reflect infrastructure as an operating system rather than an enhancing system.

When using DEC as a measurement of the direct value derived from infrastructure, it is difficult to understand the inclusion criteria used in the some of the calculations. The following comments relate to Melbourne simply because this is the region where contributing reviewers have substantial personal knowledge. They may well apply more widely.

Specifically referring to Table A2.1 of Appendix 2, the DEC for the only road category for Greater Melbourne is 'National Highways' with a value of zero. Considering how heavily the Ring Road and the M1 are used, and the chaos that occurs when traffic is blocked, it is difficult to understand how there could be a DEC of zero. On the other hand, 'Urban Transport' has a DEC of $19 billion. An explanation could be that urban road travel is included under 'Urban Transport'. Clarification of the inclusion criteria would be useful.

The Audit notes that the dataset provides a broad range of data about corridors and that there are several ways to analyse the data. Table 44 ranks the 'Top 10 road corridors in Melbourne-Geelong 2011'. ATSE notes that to achieve consistent and comparable economic analysis of infrastructure that generalisations only provide a guide. A case-by-case analysis would be the best approach.

For example, looking at the 'Eastern Freeway corridor to Ringwood' as a road system, ATSE is concerned at the conclusions derive by the IA Audit. A more detailed analysis of this subsystem is provided to illustrate the issue. See Box 1.

[2] Committee for Melbourne (2012). *Moving Melbourne - A transport funding and financing discussion paper.*

Box 1. Eastern Freeway corridor to Ringwood – an ATSE analysis

The dataset and analysis used in the Audit, assisted by Veitch Lister Consulting, placed this corridor with a volume/capacity (V/C) ratio of 76 per cent between 7am and 9am. However, citizens that frequently use this road and those who undertake alternative studies on road usage know that demand is well in excess of supply, and entry queues are often over a kilometre long. Alternative research conducted over recent years on the Eastern Freeway and Alexander Parade between Chandler Highway and Nicholson Street confirms that traffic flow is not a measure of demand.

Likewise, to counter over simplification, measures of the cost of traffic congestion require a detailed analysis of the particular traffic sub-system. There is no evidence to support the reliability of the figures in the report. The deductions in the report are seen to be qualitative rather than quantitative and do not support a numerical ranking of projects. There are several additional similar examples published in the Audit.

The IA Audit is supported by a group of Veitch Lister reports and the December 2014 report relevant to Melbourne has also been reviewed. It is largely a traffic forecasting report and notes that the Eastern Freeway - Alexander Parade corridor was operating at close to capacity (V/C=1) in 2011. Section 7.4 of the Audit states *"V/C ratios are used to gauge the level of congestion in the road network".* As explained earlier, this is not the case – it only measures conditions on one link in the network and what happens to traffic in excess of capacity is not explored. Any costs based on this assumption would also be significantly under-estimated.

As the Veitch Lister report gives the V/C ratio on the route as 1, it is difficult to see how this same route can have a value of 0.76 in the IA Audit report, a value not supported by the associated Figures 62 and 63. This major discrepancy deserves further attention as it underlies the decision-making process. Perhaps this has resulted from an "averaging" process to accommodate that fact that the farthest upstream parts of the link are understandably not at capacity. If so, it is an unrealistic measure as it ignores the queues at entry points (such as Bulleen Road) and the queue stretching several kilometres from Chandler Highway to Wellington Street.

Consistent and accurate methods of analysis of infrastructure should be used across all State and Federal governments to identify infrastructure priorities. Current evidence is that this can only be done on a case-by-case basis. This would not only put greater weight behind the findings but could also enhance the level of trust between communities and governments if information is consistent and transparent for planning infrastructure investments of the future.

Decisions need to be based on better measures than these. In infrastructure, broad-brush analyses are a guide rather than a substitute for detailed analyses.

ATSE would recommend over generalisations within the IA Audit be reassessed.

Energy

In 2013, approximately 34 per cent of total domestic energy was sourced from coal, 39 per cent from petroleum products, 23 per cent from natural gas and 4 per cent from renewables. Recommending the incorporation of low-emission energy technologies in the development of energy infrastructure plans, construction methods and operational frameworks would be a welcome inclusion in the Infrastructure Australia Plan.

Developing and implementing policies that will deliver a transition to a low emissions energy future while maintaining adequate, reliable and competitive energy supply is Australia's — and the world's—key challenge. ATSE believes that policies, programs and regulatory mechanisms are essential to support the development of new technologies and their integration into existing supply chains to foster the transition to low-emission energy technologies[3]. Specifically, large investments are required if Australia is to transition to low emissions energy production. 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.

Overall, transport accounts for more than a third of all energy consumed in Australia and more than two thirds of this energy is derived from oil. Reliance on liquid fossil fuels for transport is a particular concern for Australia, which imports the majority of its transport energy in the form of crude oil or refined petroleum products.[4]

ATSE supports the Audit's finding that Australia's current arrangements for managing petroleum reserves and for ensuring energy security across the electricity, gas and liquid fuels sectors deserve wider public policy consideration.

Water

Economic regulation of the sector is fragmented and may not effectively protect the long-term interests of consumers. This comment made by Infrastructure Australia within the Audit is echoed by ATSE in our Position Statement 'National Water Management: New Reform Challenges'[5] that discusses the need to develop a national approach to streamlining water management-related regulatory systems.

Alongside policy reform, high-quality water in urban and regional areas is underpinned by quality, sustainable infrastructure. Investment in upgrades and maintenance of existing assets is critical to Australia as water is an enabling resource to improve national wealth and productivity, assisted by focussing on pricing and highest-value use. Infrastructure Australia is well placed to further raise awareness of the requirement of National Water Reform to ensure infrastructure is developed and is equipped to satisfy the needs of the growing population, growth sectors and can withstand the impact of a changing climate.

[3] ATSE Position Statement (2014). *A Sustainable Energy Future for Australia.*
[4] ATSE Action Statement (2014). *Low Emission Fuels for Transport.*
[5] ATSE Position Statement (2014). *National Water Management: New Reform Challenges.*

Telecommunications

Information Communications Technology (ICT) is an enabler for economic activity and digital infrastructure has the potential to increase efficiencies and productivity in a range of sectors not limited to health, energy, agriculture, transport, and can significantly improve the quality of urban life in cities. The roll out of the National Broadband Network is critical to achieving such benefits but it is more important that, moving forward, Australia is constantly innovating and upgrading its networks to ensure citizens, communities, cities and its infrastructure remain connected and capitalise on a multitude of benefits in the future. Supporting the development of and the implementation of emerging technologies into Australia digital infrastructure should be a priority area assisted by coordination between government, industry and researchers.

Other Infrastructure Sectors

The Audit covers only transport, energy, water and telecommunications and omits the infrastructure needs of other key sectors of the economy. The infrastructure needs for waste management (collection, treatment, recycle/reuse, and disposal); emergency and disaster response capacity and capability; and education and research capacity and capability are not covered.

Concluding Remarks

Public and private sector provision of infrastructure that productively supports the economic, environmental and social needs of Australians and Australian businesses requires a comprehensive and connected Australian Infrastructure Plan rather than the narrow, albeit traditional, view of infrastructure taken by the Audit.

Further to the comments raised in this submission, ATSE would be pleased to offer its considerable expertise. If ATSE can be of any assistance, please contact Ms Sarah Parker, Senior Research and Policy Officer at sarah.parker@atse.org.au or 03 9864 0914.

Yours sincerely,

Dr Alan Finkel

AUSTRALIAN ACADEMY OF TECHNOLOGICAL SCIENCES AND ENGINEERING (ATSE)

INFRASTRUCTURE

INFRASTRUCTURE TO MEET AUSTRALIA'S FUTURE NEEDS

POSITION STATEMENT

NOVEMBER 2014

This Infrastructure Position Statement supports the ATSE 2013-2017 Strategy Plan which sets out the priorities and approaches the Academy will take to promote the application of technological sciences and engineering into innovation for the benefit of Australia.

INFRASTRUCTURE TO MEET AUSTRALIA'S FUTURE ECONOMIC, ENVIRONMENTAL AND SOCIAL NEEDS

Worldwide, countries are confronted with concerns about the planning, design, delivery, financing, operation and maintenance of public infrastructure. Growing populations are placing increased demands on physical infrastructure, information communications technologies, urban environments and other infrastructure needs that are required to maintain high living standards.

Infrastructure is crucial for Australia. It underpins productivity growth, supports a growing population, sustains industry growth, boosts competitiveness, enhances societal wellbeing and connects rural and urban environments. Improving investment in and the delivery of infrastructure makes the economy more attractive to foreign investors. But achieving sound infrastructure requires high quality planning, design, financing, delivery and management .

THE CHALLENGE: ENHANCE PROSPERITY IN A CHANGING ENVIRONMENT

Australia faces a number of challenges to providing effective and adequate infrastructure. The nation must come to grips with an existing backlog of infrastructure investment, and address the potential decay of existing infrastructure. Population growth and the impacts of climate change will further exacerbate these inadequacies, and the ability to mitigate, respond to and recover from natural disasters will be an ongoing fundamental requirement.

In addition, declining investment in mining infrastructure will change the mix of investment in public infrastructure, requiring a strategic plan to ensure sound infrastructure provision, job creation and economic growth into the future.

Effective infrastructure planning across all areas is critical and overcoming the challenges on the path towards best-practice infrastructure planning (Box 1) can ensure Australia gets the best return on public investment. Essential to planning is a clear articulation of the desired outcomes of investments, and openness to identify the most sustainable and resilient set of means to meet current and future societal needs, including supply and demand measures. These considerations should be a priority during the earliest stages of decision-structuring and decision-making processes.

THE VISION

- Australian infrastructure investments are based on world-class technology, evaluation and analysis to provide the best possible economic, social and environmental outcomes for all users and for future generations.
- Infrastructure planning processes are improved to provide outcomes that are more effective and efficient and that are delivered with greater certainty and transparency.

PRIORITY FOCUS AREAS

Addressing Australia's infrastructure challenges requires a shift in the current model for implementing change in Australia, to one that seeks net positive impacts in the face of growing challenges into the future. Meaningful public engagement will become the first critical step in decision making that considers national aspirations and the environmental, economic and social benefits and impacts of the following themes:

PLANNING

The principles of good infrastructure planning such as clear goals, a pipeline of projects and rolling long-term budgets are often enunciated but rarely applied in practice. Better processes for advanced planning are critical to ensure an ongoing pipeline of future projects that will deliver optimum value to the community and earn community trust and ongoing support. This will allow industry to develop effective delivery plans and better workforce management, particularly in engineering.

FINANCING

Alternative ways to fund infrastructure are required. This could be through user charging (based on at least marginal operating costs plus any external costs that can be attributed to the operation of the new infrastructure), greater private sector investment, processes for land value capture on infrastructure, and the sale of existing assets with re-investment into new projects. These financing alternatives should be based on cost-benefit analyses and consider and address infrastructure planning issues on the path towards best practice (Box 1).

MATERIAL EFFICIENCY, BUILDING DESIGN AND USE

Future housing needs to be affordable, suited to the growing population and resilient to change over the long term. This could be enhanced by making best use of, and the development of new technologies and structural materials.

ENVIRONMENTAL

Natural disasters are inevitable, unpredictable and significantly impact communities, the environment, infrastructure and the economy. Disaster resilience, mitigation and recovery principles are critical to ensure the consequences of such disasters are minimal and service delivery is maintained.

Greater awareness of the linkages between infrastructure, the natural environment and climate trends are required with regard to planning, design and land-use. Effective use of environmental monitoring and data management is essential in long-term plans and national observational and data collection infrastructure is required.

MAINTAINING HIGH QUALITY OF LIFE FOR AUSTRALIANS

Our national aspirations should include infrastructure that is designed to promote social cohesion across demographics and makes best use of land.
Further investment in nationally significant infrastructure will improve national productivity, including:

- Transport infrastructure;
- Water/wastewater infrastructure
- Energy infrastructure;
- Information communications technologies; and
- Health and social infrastructure

Responding to challenges across infrastructure priority areas can be through the integration, consideration and investigation of the following issues:

BOX 1: OVERCOMING CHALLENGES ON THE PATH TOWARDS BEST-PRACTICE FOR AUSTRALIA'S INFRASTRUCTURE ASPIRATIONS

Objectives and intentions: What are the project-specific and societal objectives of current and planned infrastructure investments? What discernible and/or logical pattern do these objectives fit? How are goals for sustainability and resilience to future shifts and shocks embedded in objectives?

Needs and means: How were the societal service needs determined? How sustainable and resilient is the chosen set of means to meet the societal need both now and in the long term?

Performance: How have recent infrastructure projects performed relative to their objectives? What other benefits or detriments have emerged? How cost-effective have they proved to be in practice?

Evaluation: How have recent infrastructure projects contributed to economic, social, and environmental sustainability outcomes at local and societal levels? How well have the costs and benefits been distributed? How resilient have infrastructure investments proved to be in the face of significant shifts?

Benchmarking: How well does the design, financing, construction and operation of Australian infrastructure compare with world's best practice? How well priced, managed, and maintained is our public infrastructure?

THE WAY FORWARD

The identified priority focus areas are ones in which world-leading research, knowledge generation and innovative technology can be applied to address our societal needs and demands into the future. From these, ATSE has identified four key action areas and recommendations that must be addressed:

RECOMMENDATION 1: Commit to robust long term infrastructure planning

Societal shifts should be considered upfront when designing Australia's future public infrastructure and re-purposing current investments. Looking at what is actually required with a broader-than-historical understanding and set of means to meet those needs is essential.

There is a need to develop a clearer understanding of the Australian context in 15 to 30 years. This will identify major national infrastructure needs and assist to align infrastructure spending and maintenance with national macro socio-economic policy. This long-term planning boosts the confidence of engineering and other firms to invest in the most modern and productive equipment and technology that needs to be amortised over several projects.

Cooperation between political parties and at all levels of government is required, alongside introduction of a formal consultative mechanism at the earliest possible planning stage that attempts to resolve differences as quickly as possible.

Governments need to follow through on their commitments to the development of robust and integrated long-term strategic plans for our cities.

RECOMMENDATION 2: Ensure effective infrastructure development and delivery

Projects should be assessed not only on their potential patronage and their internal profitability, but also on the positive and negative impacts they may have on the whole system. Technical modelling (such as data analytics and optimisation techniques) can assist with planning through to execution and maintenance, but specific funding will need to be a priority in early budgets. This can ensure that new investments are planned to cope with future demands and that existing infrastructure is well maintained and optimally used.

ATSE recommends that current projects consider the various issues outlined in Box 1 when aspiring towards best-practice. Addressing these issues could help to restructure the cost-benefit analysis framework to consider a broader range of costs and benefits over a longer period of effect.

RECOMMENDATION 3: Implement best practice, whole-of-life infrastructure management

Current Federal, State and local government processes lead to domination of selected projects with short term financing. These projects have less than adequate provision for ongoing maintenance and whole-of-life costing is neglected. The outcome is often acceptance of lowest cost tendering irrespective of the longer term maintenance costs.

ATSE recommends that an appropriate asset management philosophy and whole-of-life budget, which is supported by a specific and quantitative maintenance regime, be adopted.

Examination of past projects, with respect to both alternative delivery mechanisms and practice in other countries, can help improve cost estimation frameworks.

RECOMMENDATION 4: Use existing infrastructure as effectively as possible

Rebalancing investment priorities and targeted, comparatively inexpensive investments are required, with greater attention to the maintenance of existing assets and demand management of existing networks. This is more likely to provide sustainable solutions to Australia's infrastructure challenges than focussing only on mega-projects.

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AUSTRALIAN ACADEMY OF TECHNOLOGICAL SCIENCES AND ENGINEERING (ATSE)

ENERGY
ACTION STATEMENT

LOW EMISSION FUELS FOR TRANSPORT

NOVEMBER 2014

This Action Statement supports the ATSE Energy Position Statement which sets out the challenges and priority focus areas, and a way forward, for the low emission energy systems required to sustain Australia's economic development and future prosperity.

AUSTRALIA MUST ACCELERATE PROGRESS TOWARDS SUSTAINABLE MOBILITY OF PEOPLE AND FREIGHT BY INTEGRATING LOW EMISSION FUELS INTO ITS TRANSPORT ENERGY MIX.

THE ENERGY CHALLENGE FOR TRANSPORT

Transport (including road, rail, aviation and shipping) is largely dependent on combustion engines powered by liquid fossil fuels in the form of gasoline, diesel and kerosene. The global transport sector consumes more than 60 per cent of the world's total oil production, or around 2,200 million tonnes of oil equivalent each year.

Oil use by the transport sector is forecast to rise due to increased demand for travel, goods and services by rapidly growing urbanising countries such as China and India. This is not a desirable or sustainable outcome, because it would lead to further increases in emissions (transport currently contributes approximately 20 per cent of global anthropogenic carbon dioxide emissions), deaths from airborne pollution (nitrogen and sulphur oxides and fine particulates) and utilisation of a finite resource.

Countries around the world are taking steps to reduce transport emissions while accommodating growth in the economy and population by maximising energy efficiency, electrification and development of low carbon fuels. Additional benefits include greater energy security and independence from reliance on a single fuel source.

REPOWERING TRANSPORT IN AUSTRALIA

Reliance on liquid fossil fuels for transport is a particular concern for Australia, which imports the majority of its transport energy in the form of crude oil or refined petroleum products.

The Australian economy depends on well-developed and extensive transport networks that move people, goods and resources domestically and offshore. Our geographically dispersed economy, with a mix of heavily populated urban areas and sparsely populated remote areas, creates different transport system requirements in different areas. Relative to global figures, the percentage of transport energy used by aviation in Australia is higher because of the necessity of long haul flights. Road dominates our transport energy use (75 per cent), followed by aviation (18 per cent), sea (4 per cent) and rail (3 per cent).

Overall, transport accounts for more than a third of all energy consumed in Australia. More than two thirds of this energy is derived from oil. Closure of several domestic refineries has reduced local refining capacity by at least 30 per cent during the last two years alone, and Australia is currently not meeting its treaty obligations to hold the equivalent of 90 days of net oil equivalent demand. This makes Australia vulnerable to disruption or misdistribution of supply because of our geographical isolation from overseas refineries. In addition, loss of capacity to refine crude oil, 20 per cent of which is processed into petrochemicals, is causing significant disruption to the Australian chemical industry.

Australia's high and rapidly growing dependence on imported vehicles and fuels means that overseas markets will largely dictate the technological paths we follow to repower our transport fleets and the rate at which we adopt them. Hybrid and electric vehicles, especially cars, buses and light duty trucks, hold considerable potential for our densely populated cities. However, the carbon footprint of the electricity supply systems for these vehicles will need to be progressively decreased. It will take some time before cost structures, distribution and supply points, standards and regulation of electric vehicles are put in place. The rate of uptake could be accelerated by reforms to Australia's electricity supply systems and markets in order to deliver reliable, competitive, low emissions electricity and manage load variability.

The use of compressed natural gas and liquefied natural gas for heavy vehicles such as trucks will expand in some settings where the cost of adjustments to infrastructure, and the likely rising cost of gas, can be mitigated. Aviation, shipping and rail have fewer options to switch from existing fuels or the associated expensive energy supply infrastructure. Even so, imperatives to reduce carbon dioxide, nitrogen and sulphur oxides and fine particulate emissions are very strong in these sectors because of global voluntary industry targets. Low carbon fuels, such as those derived from agricultural or other waste streams, that "drop-in" (i.e. require minimal adjustment to infrastructure and engines) to the conventional fossil fuel supply chains will be required.

The characteristics that differentiate Australia from many other developed countries will guide the repowering of transport here:

- A heavy reliance on imported (increasingly refined) petroleum products for transport fuels and chemicals, which is likely to increase.
- A highly urbanised but small population that is sparsely distributed and separated by long distances.
- Distances covered by national and international flights make secure sources of aviation fuel a priority.
- Electricity generation being primarily fossil fuel based, making meeting of internationally agreed emissions targets a challenge.
- Finite agricultural land and water, most of which is needed for production of food and fibre.
- A vibrant but under-resourced energy research, development and demonstration (RD&D) sector.

THE WAY FORWARD

ATSE's Position Statement on a Sustainable Energy Future for Australia has designated low emission fuels for transport as one of its four priority areas.

To ensure the integration of low emission transport fuels into Australia's transport energy mix, ATSE recommends the following policies and actions:

RECOMMENDATION 1:
Energy productivity, electrification and low carbon fuel technologies in the transport system

Government and industry sectors (including electricity, oil, gas, chemicals, forestry, agriculture and waste) need to work together to develop national targets for reduction of emissions from our transport systems, increased transport energy productivity and accelerated utilisation of low emission fuels.

RECOMMENDATION 2:
Security and diversity of transport fuel supplies

The Australian Government should review the security, diversity and independence of Australia's transport fuel supplies. The Government should facilitate the development of new fuel reserves, ensure diversity of Australia's fuel supplies (including alternative fuels and electricity), meet Australia's international oil security obligations and augment domestic transport fuel security at an acceptable cost.

RECOMMENDATION 3:
Production of low emission fuels for aviation as a strategic priority

Industry, in conjunction with the Australian Government, should designate production of low emission fuels for civil and defence aviation as a strategic priority for Australia.

RECOMMENDATION 4:
Regulations, incentives and market signals to improve vehicle efficiency and pollution standards

Australian Governments should create durable strategies, market signals, regulations and incentives for stringent vehicle efficiency and pollution standards. They should also greatly expand mass transit programs. Vehicle emission standards should be reviewed to ensure that Australia complies with international best practice.

RECOMMENDATION 5:
Innovation to support future fuel research, development and demonstration (RD&D)

The Australian Government, in conjunction with industry, universities and research centres, should encourage innovation by supporting RD&D of new transport energy technologies, new methods of manufacturing renewable fuels (such as biofuels produced without competing for land and water resources), decarbonised electricity sources and first-of-a-kind demonstration plants.

ALIGNMENT WITH ATSE's ENERGY POSITION STATEMENT

ATSE's Energy Position Statement, A Sustainable Energy Future for Australia, sets out four key priorities to transition to low emission energy systems that are affordable, secure and reliable. The following are particularly relevant to progressing future fuels for Australia.

THEME 3: Supply systems and market measures that deliver reliable supply of competitively priced, low emissions fuels for transport.

Reform Australia's transport fuel supply and use policies—including excise and subsidies—to ensure progressive and efficient transition without supply constraints to low emission liquid fuels (particularly for aviation, maritime and heavy logistics) and electricity (particularly for passenger and light-duty logistics vehicles), including fostering local production of transport energy supplies that significantly reduce Australia's growing dependence on imported liquid fuels.

THEME 4: Strategic investments in innovation of low emissions energy technologies.

Australia should support and fund research, development, demonstration and deployment (RDD&D) for low emission fuel technologies. There are various ways to support RDD&D including:

- Direct R&D grant funding;
- R&D tax concessions;
- Accelerated depreciation of investments in exploration, plant and infrastructure; and
- Support for demonstration projects (either in Australia or in collaboration with overseas partners).

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ENERGY

A SUSTAINABLE ENERGY FUTURE FOR AUSTRALIA

POSITION STATEMENT

MAY 2014

This Energy Position Statement supports the ATSE 2012-2017 Strategy Plan which sets out the priorities and approaches the Academy will take to promote the application of technological sciences and engineering into innovation for the benefit of Australia.

TO SUPPORT ITS SUSTAINABLE DEVELOPMENT AND FUTURE PROSPERITY, AUSTRALIA MUST MOVE TO LOW EMISSION ENERGY SYSTEMS THAT ARE AFFORDABLE, SECURE AND RELIABLE.

OUR PLACE IN THE WORLD

Energy is essential to Australia's economy. Its availability, affordability and efficient use are key drivers of business productivity and social well-being. Importantly, Australia is a net energy-exporting nation, with considerable national wealth derived from our exports of energy resources, including coal, uranium and liquefied natural gas.

The coal and petroleum industries contributed around $54 billion to industry gross value added in 2010–11, representing 4 per cent of the Australian total. The electricity and gas supply industries contributed another $24 billion, and all these industries also provide significant employment and infrastructure.[1]

Australia is heavily reliant on fossil fuels for its domestic energy needs. In 2013, approximately 34 per cent of total domestic energy was sourced from coal, 39 per cent from petroleum products, 23 per cent from natural gas and 4 per cent from renewables. Energy consumption is dominated by transport (38 per cent) followed by manufacturing and construction (25 per cent), mining and agriculture (16 per cent), residential (11 per cent) and commercial and other (10 per cent).

Australia is an inventor and adapter/adopter of energy technologies, but rarely a commercial energy equipment manufacturer and supplier due to geographic location, market size and cost.

AUSTRALIA'S ENERGY CHALLENGE

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 moving towards international parity price and coal recovery cost following at a lesser pace to price levels that are not affordable within the present Australian context, this advantage is quickly disappearing.

Federal and State government programs have supported, and continue to support, electricity supply from renewable resources. Fossil fuels are, though, forecast to dominate energy supply for many more years. This is a problem shared with other countries as many struggle to reach agreed emission reduction targets.

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

Policies, programs and regulatory mechanisms are essential to support the development of new technologies and their integration into existing supply chains to foster the transition to low-emission energy technologies. Market forces and enabling regulatory regimes must drive Australia's energy transition.

1 BREE 2013, *Energy in Australia*, Bureau of Resources and Energy Economics, May 2013

PRIORITY FOCUS AREAS

GROWTH AND INVESTMENT

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 replacement of old assets with new, efficient, low emission technologies is essential.

Policy instability, such as an absence of a bipartisan political agreement has meant continuing uncertainty. Consequently Australian companies have been reluctant to invest in energy generation. Further, overseas companies who have many other options available to them are able to seek more accommodating investment climates elsewhere. The problem is compounded by the fact that one of the few areas where all political parties are in agreement at present is that nuclear energy, an option for low emission generation, is excluded from consideration as an option for Australia.

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.

ENERGY INNOVATION

Investing in the development of new technology is challenging but the transition to a low emissions economy will not be possible without competitive and technologically reliable energy supply and use solutions. This requires research and technical innovation. However in the absence of stable policy settings and a strong signal on the future basis for pricing of carbon, the energy industry locally and globally has little or no incentive to invest in low emissions energy technology development and deployment.

Past experience and the inability of Australian firms to fully capture the benefits of research makes it unlikely that the private sector alone will provide sufficient investment in the research, development and demonstration (RD&D) of low emissions technologies.

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 adopt and adapt energy technology solutions from around the globe. This should include developing home grown RD&D talent, attracting international expertise to Australia and fostering international connections of researchers and industry to encourage inward streams of investment, information and skills.

Commonwealth, State and Territory Governments must intervene to provide strategic support for RD&D of new energy technologies, which must have close links with innovation policy. The long time frames for RD&D make it especially critical that policies to drive energy innovation are stable and predictable over the long term.

THE WAY FORWARD

ATSE believes that for Australia to ensure that its energy system is secure, low emission and cost effective, there are four key themes that need to be considered in an integrated approach to effective Government policy.

- **Theme 1: Improved and new regulatory, market and information measures to double Australia's energy productivity by 2030.**

Expand the scope of and progressively toughen regulations and standards to deliver major improvements in building, appliance and industrial energy efficiency; vehicle fuel efficiency; and consumption information for energy consumers (particularly residential and commercial).

- **Theme 2: Supply systems and market measures that deliver reliable, competitive, low emissions electricity.**

Reform Australia's electricity markets to support investment in low-emissions electricity supply capacity that is appropriate to the levels (utility-to-residential-scale generation; transmission; distribution) in Australia's electricity supply systems and to meeting the reliability, economic, environmental and social needs of consumers, suppliers and governments.

- **Theme 3: Supply systems and market measures that deliver reliable supply of competitively priced, low emissions fuels for transport.**

Reform Australia's transport fuel supply and use policies—including excise and subsidies—to ensure progressive and efficient transition without supply constraints to low emission liquid fuels (particularly for aviation, maritime and heavy logistics) and electricity (particularly for passenger and light-duty logistics vehicles), including fostering local production of transport energy supplies that significantly reduce Australia's growing dependence on imported liquid fuels.

- **Theme 4: Strategic investments in innovation of low emissions energy technologies.**

Support and fund research, development, demonstration and deployment (RDD&D) for a portfolio of technology options where:

- Australia has a competitive 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 and evidenced-based approach;
- Private sector investment in new energy technology is incentivised and leveraged; and
- Domestic investment is leveraged through international collaboration.

A series of Action Statements on particular energy supply and use technologies will be prepared as specific examples of and for these Themes.

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WATER REFORM

NATIONAL WATER MANAGEMENT: NEW REFORM CHALLENGES

POSITION STATEMENT OCTOBER 2014

This Natural Resource Management – Water Position Statement supports the ATSE 2013-2017 Strategy Plan which sets out the priorities and approaches the Academy will take to promote the application of technological sciences and engineering into innovation for the benefit of Australia.

ATSE CALLS ON THE GOVERNMENTS OF AUSTRALIA TO DEVELOP AND COMMIT TO A NEW DECADAL STRATEGY FOR NATIONAL WATER MANAGEMENT.

NATIONAL WATER REFORM

Australia has a strong recent history of successful water reform, through policy development, implementation and institutional governance. The 1994 Council of Australian Governments Water Reform Framework, and the subsequent 2004 National Water Initiative (NWI), have driven valuable reforms from a national perspective for the past two decades.

The NWI has delivered on a shared commitment to improve Australia's water management, through better security of supply, efficiency, and productivity as well as substantial environmental benefits. It has been recognised around the world as a leading edge reform program.

WATER CHALLENGES – THE NEXT DECADE

Now, more than ever, a strategic national approach is imperative to improving the management of our most precious resource. Water will always be scarce in Australia, and the challenges of managing it efficiently will only increase in the future. There remains significant unfinished business in water reform – much of it complex. Successfully addressing these challenges will be central to unlocking our water resources as an enabler of improved productivity, liveability, and wellbeing – particularly in our urban environments – while protecting and enhancing ecosystems and the environment.

Leadership and commitment will be essential to improve the quality and extent of water planning in Australia, independently of natural cycles of drought and flood. Development of innovative policy and identifying and addressing emerging challenges will result in greater community confidence that our water is being managed efficiently, effectively, and wisely, and that our supplies are secure.

A new, forward-looking strategic reform agenda, building on the lessons learnt through past national water reform, and with a strong appreciation of the critical role of science, technology, and engineering, will enrich all Australians through access to high-quality, secure, and affordable water resources.

THE VISION

ATSE envisages a future of continuing water reform and improvement in the way we manage our water resources. This vision will require leadership, cooperation, and commitment from all levels of Australian government in pursuit of a consensus on the core principles of sustainable and cost-effective water management.

Through commitment to technology, developing our knowledge base and our experience in delivering sustainable water management strategies Australia will continue to be a world leader in water reform activities and contribute significantly to global wellbeing.

VALUE

Water management decisions should be driven as much as possible by market forces, while being guided by good science within a framework that secures environmental sustainability and equitable access to water that is fit for purpose.

The past two decades have delivered significant economic, social, and environmental benefits. For example, securing entitlements for water holders has resulted in a marketplace where the value of these assets can be realised. The next decade will be just as crucial.

Significant returns can be expected from continued investment in the reform of Australia's water management systems. The required investments will in many cases be large and complex. Leadership in water reform accompanied by independent oversight and accountability mechanisms will ensure that maximum benefits are delivered from these investments.

PRIORITY REFORM AREAS

A range of important areas require attention in Australia's future national water reform agenda. These include:

NATIONAL REFORM PROCESS:

- Re-establish national pathways to build consensus across governments for continuing water reform.
- Continue consolidation of recent reforms.
- Plan for the impact of a changing climate on water availability across Australia.
- Develop a greater understanding and appreciation of water-related cultural and economic interests of indigenous Australians.

WATER SCIENCE:

- Develop a set of strategic, national priorities in water science and research to inform water reform processes.
- Areas that would benefit from focussed research to guide water management reform include:
  - Groundwater systems and their physical processes, particularly for the ongoing development of northern Australia.
  - The interaction of groundwater systems with resource extraction activities.
  - Ecological and hydrological science, specifically relating to ecological responses to changes in water regimes, to guide decision making processes for the Commonwealth Environmental Water Holder.
  - Carrying capacity and the effects of cumulative impacts on the natural resource base for both surface water and ground water.
  - Urban water issues, particularly improving our understanding of social aspects of water reform.

ECONOMIC ISSUES:

- Focus on the economic drivers of water as an enabling resource to improve national wealth and productivity, including pricing and highest-value use.
- Develop a transparent, national framework for unencumbered trade of water resources within and between states and territories to enable free trade of water between environmental managers, irrigators, urban and rural users, subject to externality impact assessments.
- Leverage national water reform as a competitive advantage for Australian firms competing in world markets, including the export of Australian water management skills, experience and technologies.

PLANNING AND REGULATORY ISSUES:

- Emphasise urban water reform issues. Priority areas for urban water reform include:
  - The role of decentralised systems and more effective third-party access regimes, capital recycling and private capital in infrastructure development and renewal.
  - Increasing competition in the delivery of water-related services.
  - The importance of water to liveability and relationships between urban planning and water policy, including community and stakeholder involvement in the development of local water plans.
- Pursue improved independence in pricing determination for water utilities.
- Develop a national approach to streamlining water management-related regulatory systems.
- Integrate sectoral planning processes across the Water-Energy-Environment-Food nexus in urban and regional contexts, including for the development of new major infrastructure such as dams.

THE WAY FORWARD

A plan for the next decade of water reform must be prepared now.

ATSE calls on the governments of Australia to develop and commit to a new decadal strategy for national water management.

All levels of government need to work together to:

- Implement new arrangements for collaboration among all governments to develop and set the agendas for national water reform, which should include:
  - urban water
  - national principles for water management in the mining and gas sectors
  - national principles for water management in northern Australia
  - national principles and guidelines for the development of new irrigation infrastructure, including dams
  - a national strategy and priorities for water science and research
  - national principles for the best use of environmental water
- Implement new arrangements for the ongoing leadership, assessment and evaluation of reform progress.

Continued pursuit of the next generation of national water reform should be a whole-of-government issue for States, Territories and the Commonwealth. Above all, effective auditing and feedback into the reform process is critical to its ongoing success.

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