Discussion Paper 1: Australia's Future Infrastructure Requirements

.

A Response by

The Australian Academy of Technological Sciences and Engineering

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DISCUSSION PAPER 1: AUSTRALIA'S FUTURE INFRASTRUCTURE REQUIREMENTS

SUMMARY

The Academy is pleased to comment on Discussion Paper 1: Australia's Future Infrastructure Requirements.

The Academy suggests three complementary Strategic Priorities:

- Address climate change as a real driver in shaping economical and social development;
- Identify and deal with the impacts of climate change on physical infrastructure;
- Emphasise mathematics, science and technology in the nation's schools and build the pool of technically qualified professionals in infrastructure areas.

The Academy notes herein and renews the eight key recommendations from its 2006 National Symposium, "New Technology for Infrastructure – the World of Tomorrow."[1]

The Australian Academy of Technological Sciences and Engineering[2] (ATSE) welcomes the opportunity to provide a submission on Discussion Paper 1: Australia's Future Infrastructure Requirements.

The Academy strongly supports the view taken by Infrastructure *Australia* that *"infrastructure does not matter for its own sake: it matters because infrastructure can play a fundamental role in determining whether Australia meets its economic, social and environmental goals".*

The Academy suggests that Infrastructure Australia consider adding the following complementary "Strategic Priorities" to those provided in the Paper:

- Address climate change as a real driver in shaping economic and social development;

[1] ATSE (2006), *New Technology for Infrastructure – The World of Tomorrow,* 2006 National Symposium (Sydney), Academy of Technological Sciences and Engineering, Melbourne

[2] ATSE, founded in 1976, is an independent, non-government organization, consisting of more than 750 eminent Australian Fellows that promotes the development and adoption of existing and new technologies that will improve and sustain our society and economy.

- Identify and deal with the impacts of climate change on physical infrastructure[3];
- Emphasise mathematics, science and technology in the nation's schools and build the pool of technically qualified professionals in infrastructure areas.

The Academy believes that Australia must develop its infrastructure to be a leading player in a world economy against a background of expanding trade, a sustainable environment, climate change, growing population and an improved standard of living. It must achieve this within the dual limitations of a small population and a large continent. Advantage can be taken from the increasingly sophisticated technology available for implementation, management and communication. However, the environment in which development takes place is not static. Increasing population, climate change and natural disasters are examples of challenges to planning future infrastructure in Australia.

As indicated in the Infrastructure Australia Discussion Papers, infrastructure is a broad term, covering at least: *"roads, rail, ports, airports, pipelines, grids, cables and communication networks."* The questions posed in the Section 3 of Discussion Paper 1 have different responses and priorities for the different sectors. The Academy considered in detail the issues of infrastructure at its National Symposium, "New Technology for Infrastructure – the World of Tomorrow[4]" that was held in Sydney in November 2006. The following is a summary of the findings across the broad spectrum of infrastructure and the recommendations flowing there from; these are very relevant in addressing the questions posed in Discussion Paper 1.

WATER

The Symposium identified that there had been a lack of planning and foresight in respect to water, but that technology was available and there was now a commitment to address the problem. The water we need for our societies, be it in agriculture or in cities, depends upon careful planning[5] and the willingness of governments, corporations and individuals to invest in the future. This is a worldwide problem and it is important to make sure that all options are considered. Water reuse is essential because water demands throughout the world currently exceed the ability of Earth's natural hydrologic cycles to replenish adequate fresh supplies, and this situation will only worsen as populations and urbanisation inevitably increases.

Without exception, the Academy recommends that the highest priority be allocated to co-ordinated programs on recycling, desalination, storage, water use and water management and education.

[3] ATSE (2008), *Assessment of Impacts of Climate Change on Australia's Physical Infrastructure,* Australian Academy of Technological Sciences and Engineering, Melbourne

[4] ATSE (2006), *New Technology for Infrastructure – The World of Tomorrow,* 2006 National Symposium (Sydney)*,* Academy of Technological Sciences and Engineering, Melbourne

[5] ATSE (2007), *Urban Water – Review of Water Supply Planning for Australia's Non-Metropolitan Urban Water Utilities*, Australian Academy of Technological Sciences and Engineering, Melbourne

Recommendation 1:
Water activities be given the highest priority and be expanded via strong programs, which are effectively co-ordinated across Australian governments, and which address recycling, desalination and education on water use, allocation and management.

GREENHOUSE GAS MANAGEMENT

The Symposium identified that other economies, particularly developing economies, have similar challenges to those faced by Australia in managing their long-term energy needs, while reducing greenhouse gas emission from generation of power with fossil fuels. Australia has been able to assist these economies in the past by supplying energy resources. It could continue to assist in helping to develop carbon capture and storage technologies and renewable technologies in those economies as well as for the national benefit.

This could provide export income and utilise the known ability of Australian financial institutions to finance such facilities with joint government and private investment. Economies such as Vietnam, with known coal and adjacent oil resources, could benefit from assistance in carbon capture from coal-fired power stations and subsequent use in improving oil recovery rates from existing fields.

Recommendation 2:

- *There must be a massive increase in spending on greenhouse gas management within Australia;*
- *Australia must leverage its knowledge and accept a role in assisting developing economies in managing their greenhouse gas emissions by exporting innovative solutions.*

ENERGY SECURITY

Australia requires a reliable supply of electric power to match community and industry requirements for the future[6]. The only large-scale commercial technologies presently available to fulfil this requirement are generation from fossil resources or nuclear resources of which Australia has ample supplies. Both have significant drawbacks – release of greenhouse gas from fossil resources and waste management for nuclear resources. Significant, although lesser, contributions can also be made from solar, hot rocks, biomass and wind resources. Secure future energy depends upon sequestration of carbon dioxide and appropriate nuclear waste storage

Recommendation 3:
Governments determine and implement integrated energy policies which achieve an appropriate energy mix and serve the identified need for power in Australia into the long- term future.

INFRASTRUCTURE IMPLEMENTATION

The Symposium identified that the growth in Australia, on which we depend for our well being and lifestyle, would increasingly be limited by poor infrastructure, and while ample finance has been available from both government and private

[6] ATSE (2008), *Accelerating Technological Response to Climate Change*, Australian Academy of Technical Sciences and Engineering, Melbourne (To be published)

sources, the pace of investment was being impeded by complex planning and approval processes, shortage of engineers and other competent professionals with experience in the sector, and failure to recognise risks and allocate these realistically. All these factors are important and must be addressed, but failure to understand and allocate risks to the party best able to manage them was a major impediment in development and hampers innovation.

Recommendation 4:
The Academy supports a high-level study of risk allocation in the implementation of infrastructure, aimed at freeing up resources to concentrate on the efficient planning, delivery and operation of infrastructure.

URBAN DEVELOPMENT
The world's population is predicted to grow to around eight to 10 billion people in the next 50 years, and this population will be highly urbanised. This implies the equivalent of some three new conurbations worldwide, each of 10 million people every year for the next 50 years. The Australian situation will mirror these developments, at a scale commensurate with our forecast population. Within the framework of adaptive resilience and perceptive design necessary to address such challenges as climate change and significantly increased urban densities which will result in congestion and increasingly inadequate infrastructure, and the need for conservation of scarce resources, recycling and energy savings, we must consider what we can contribute through science and engineering[7].

Recommendation 5:
Our National Government must co-ordinate with State and Territory Governments and develop and fund long-term plans for all of Australia's larger urban centres. This need is urgent, and should be an immediate and high priority on the COAG agenda.

TRANSPORT INFRASTRUCTURE
Integrated transport systems within our cities are the key aspects of urban development. Much of our present transport infrastructure is ageing and fixed in outdated technologies. Physical changes are socially difficult to introduce and expensive. There seems to be a perception in the community that as cities grow and movements of goods and people increase, it is inevitable that transport and logistics "just get worse". Government policies do little to contradict this perception.

Recommendation 6:
Our National Government should co-ordinate and fund planning for integrated transport systems within our capital cities, as the major aspect of long-term urban development, and initiate the immediate implementation of these plans as a series of targeted infrastructure improvements in partnership with the private sector.

HEALTH CARE
Australia is facing a crisis in the next 10 years as the bulge of baby boomers enters the age of high health-care demand. The crisis will be exacerbated by the

[7] ATSE (2007), *30/50 - The Technological Implications of an Australian Population of 30 million by 2050*, Australian Academy of Technological Sciences and Engineering, Melbourne

rapidly ageing health care workforce and the extreme difficulty of replacing, let alone increasing, this workforce in the foreseeable future. This "Perfect Storm" scenario makes it extremely unlikely that the health system can self manage its way out of the combined crisis. This will place excessive demands for expenditure from the Australian governments on health care.

The Australian health care system must work smarter; maximising the benefits of ICT in avoiding duplication of tests and data collection and allowing health workers' time to be focused on productive effort.

Recommendation 7:
Australian State and Federal governments maximise the use of ICT solutions in the Health care work place by:

- *Implementing a fully integrated patient data record system accessible across hospital, nursing home and community health care providers to avoid duplication of tests and provide instant access to patient information;*
- *Implementing high bandwidth communication between hospitals and to clinics to allow true tele-presence access to high-quality specialist medical care from all locations without time wasting specialist travel;*
- *Immediately prototyping ICT solutions using available technology to assist patients to age in their homes with community care while minimising hospital admissions.*

ADAPTIVE RESILIENCE

Adaptive Resilience is the capacity to continue functioning through change, whether a sudden shock or a slow shift in external forces. Adaptive resilience results in lower life cycle costs for infrastructure.

The Symposium identified a potential process for minimising the long-term costs associated with large infrastructure caused by the increasing speed of technological change and the adverse effect this had on existing installations. Designing proposed infrastructure to be adaptive to the certain arrival of new technology and to changes in the external environment was seen to be essential for a more sustainable future. This process, Adaptive Resilience, was seen to be a key approach to sustainability in infrastructure. The concept is at an early stage and the Academy advocates that it should be developed into a key policy for infrastructure planners.

Recommendation 8:
Adaptive Resilience is advocated by the Academy as an overarching policy in respect to sustainability in the planning and development of all infrastructure. The concept should be promulgated to governments and the wider community, and guidelines should be developed for specific sectors.