

Australian Government

IMPACT STATEMENT Challenges at Energy-Water-Carbon Intersections

PMSEIC

A report to the Prime Minister's Science, Engineering and Innovation Council – 2010

This report identifies the transformational knowledge, systems and technology needed to put Australia on a sustainable and resilient path in its use of carbon, energy and water by 2050.

Energy, water and carbon underpin the functioning of natural ecosystems and human society. In coming decades they will influence these in new ways, as the world and Australia face the twenty-first century challenge of sharing a finite planet with limited resources. The challenge is great, but so too is the opportunity for an effective and productive response.

Central to the challenge is the need to mitigate climate change risk, by reducing carbon emissions, while continuing to supply energy and water to a growing population.

Energy, water and carbon are deeply connected in nature and so also in society.

- Energy (sunlight), water and carbon (dioxide) are the key elements required for photosynthesis which is necessary for production of our food and a healthy ecosystem. Climate strongly influences these connections.
- Increases in atmospheric carbon dioxide, primarily through human use of fossil energy sources, are key drivers of current and future climate change, which affects the water availability for human and ecosystem use.
- For Australia to make a proportionate contribution to keeping global temperature rise to 2°C or less, our emission levels must decrease by 45% by 2030 and 85% by 2050.



By treating carbon and water as finite, interconnected resources, budgeting principles can be used to explore options and predict outcomes for the nation. For example, rainfall per person in SE Australia is predicted in 2050 to be about 60% of that available today, if population maintains its current trend and global warming is restricted to a maximum 2°C. To achieve this outcome and avoid further warming and steeper rainfall reductions, carbon per person must decline.

Goal: Consistent principles for valuing energy, water and carbon, and transformation of the stationary and transport energy sectors, to limit the impacts of climate change and evolve to a sustainable Australia.



Tackling the challenges at intersections of energy, water and carbon can lead to a more resilient Australia.

- Australia's growth rates for energy use and carbon emissions (in both absolute and per capita terms) are currently much higher than in other developed nations. In the 17-year period to 2007, Australia's total greenhouse gas emissions had risen by more than 8%. This trend must be reversed to achieve a sustainable Australia and for the nation to meet its international responsibilities.
- Energy, water and carbon jointly underpin 5 major landscape functions (1) food, fibre and wood production,
 (2) water production and use, (3) bio-energy production and bio-sequestration, (4) conservation of environmental assets, and (5) economic and social well-being.
- Establishing joint development goals for these landscape functions through integrative land-use practices that optimise carbon (greenhouse gas), water and energy budgets, can resolve energy-water-carbon tensions and provide more options in an uncertain future.



Smart network technology can facilitate the integration of lowemission, renewable energy sources into the electricity grid.

Goal: A flexible and scientifically informed resource management strategy that supports a socio-ecological system capable of recovering from shocks and disturbances, whilst adapting through learning and transforming when necessary.

The challenge is pervasive and solutions will require a holistic "Systems Approach" that is cross-disciplinary, cross-sectoral and transcends silos.

- Australia has one of the world's most urbanised populations. As urban environments are points of confluence for vulnerabilities in energy, water and carbon systems, up to 90% of the nation's population are therefore exposed.
- The necessary reduction in greenhouse gas emissions will require focussed and innovative R&D to bring online low-carbon energy sources, more effective grid networks, more power storage options, and better water productivity. By 2050 Australia's energy portfolio could include up to eight low-carbon sources.
- Transformation of Australia's energy and water sectors, through the use of "smart networks" to monitor and manage electricity and water supplies, can facilitate the necessary systems approach to management, whilst assisting in decarbonising the energy sector through the integration of distributed renewable energy sources.

Goal: A science R&D sector at the forefront of systems thinking and analysis to underpin resilience in Australia's socio-ecological system, fed by continuous data from extensive monitoring and communication infrastructure.



For More Information Contact: Office of the Chief Scientist Level 2, 15 Moore Street, Canberra ACT 2601

GPO Box 9839, Canberra ACT 2601

P +61 2 6276 1727 F +61 2 6213 6558 E chief.scientist@chiefscientist.gov.au W www.chiefscientist.gov.au