



# FOCUS

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## SUSTAINABLE WATER MANAGEMENT

### THE IMPACT OF GREEN GROWTH POLICIES

Contributors discuss the implications of a green growth approach to Australia's water issues – and particularly the Murray–Darling Basin in the third decade of the 21st century

## Resources / Sustainable water management impact of green growth policies

1 June 2012 / 1 / [Borvin Kracman](#)



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We cannot continue to grow as we have and erode our natural capital beyond its capacity to provide. Stewardship of the Earth's natural capital needs to achieve balance with the hierarchy of human economic and social needs.

We must also accept the variability of natural systems, the need to adapt and that adaptation is about knowledge, choices and informed intervention, not just about control.

Taking the Murray Darling Basin as an example, it is evident that we have the technology and tools to better manage consumptive use of water and the basin's capacity to deliver food and fibre whilst leaving sufficient water available for the reasonable health of its ecosystems.

In future, as water availability fluctuates, we will have to balance the adaptive load across communities.

As a nation we also need to reduce waste. Our systems are far from optimal. How can they be when every year we waste over 200 kilograms of food per capita between the paddock and our mouths? This wastes resources in multiple ways.

By 2020 a Green Growth approach can resolve the balance between water consumption and the needs of the basin's ecosystems, improve resource utilisation, contribute to food security and have a positive effect on basin and non basin communities.

Contributors /  
[Borvin Kracman](#)



I am a Principal of Arup, lead the Water business across the Australasia Region and have 34 years professional experience in Australia and internationally both in the private and public sectors. I believe in order to manage that most precious resource, water, we need to take a truly integrated approach. Sustainable water management requires a multi-disciplinary approach between government, engineers, planners, economists and wider society taking the long term view.

### Thoughts /

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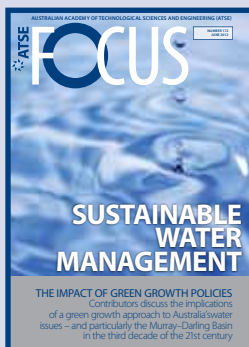
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Photo: iStockphoto



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## FOCUS

ATSE *Focus* is produced to stimulate discussion and public policy initiatives on key topics of interest to the Academy and the nation. Many articles are contributed by ATSE Fellows with expertise in these areas. Opinion articles will be considered for publication. Items between 800 and 1400 words are preferred. Please address comments, suggested topics and article for publication to [editor@atse.org.au](mailto:editor@atse.org.au).

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# Sustainable water management: securing Australia's future

The ATSE report lists 14 recommendations to improve water management and 63 opportunities to increase efficiency and productivity and reduce environmental impact.



By Brian Spies

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**W**hat is water worth? When is it safe to drink? How can water best be managed, and should this valuable commodity be rationed? What will be the impact of future climate change and population growth on our water resources? Do we really need desalination plants, and should farmers be allowed to grow rice and cotton in this dry country?

Why not harness our northern rivers and pump water south to where it is needed? What is the impact of over-extraction of surface water and groundwater on the environment and local communities?

These questions and more are addressed in the ATSE report *Sustainable Water Management: Securing Australia's Future in a Green Economy*, launched in Sydney in May.

The ATSE report explores a framework for sustainable water management in Australia, capable of adapting to current and future challenges through the principles of 'green growth'.

The 166-page ATSE report covers the broad spectrum of water management in Australia – urban and rural supply and demand, interdependencies between water and energy, the impact of climate change, population growth, evolving institutional and legislative arrangements and balancing economic, environmental and social outcomes.

Australia is leading the way in many aspects of water policy. The agreement by COAG in 1994 to open Australia's water markets, further developed in the 2004 National Water Initiative, represents a centrepiece of national water reform, enabling scarce resources to be most effectively and efficiently allocated among competing uses to where it is most highly valued.

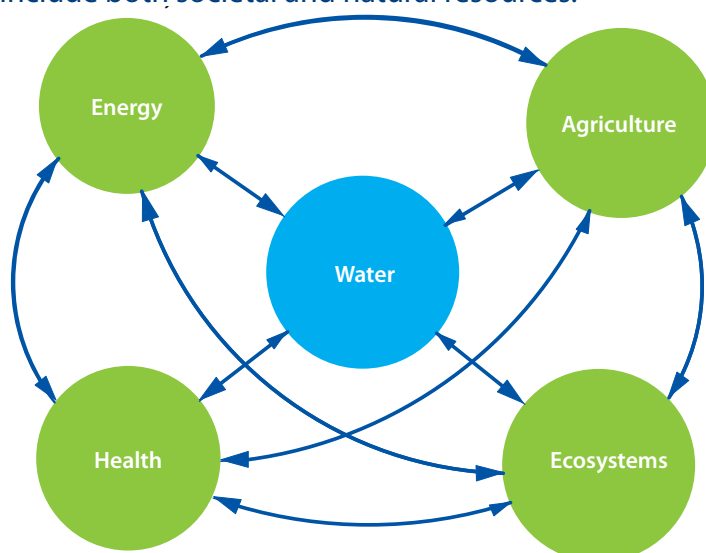
The ability to trade water has delivered real benefits to individual users, dependent industries and the environment. However, some states, supported by local governments, are resisting liberalisation of water markets due to concerns that industries may move elsewhere. There is political resistance in other reforms as well, including imposing barriers to urban-rural water trade (Victoria's

## Green Growth

Green growth describes the process of improving productivity and economic prosperity while optimising environmental and social outcomes. The concept encompasses sustainability, well-being, resilience and adaptability. Green growth principles provide a comprehensive framework for management of Australia's water resources and prioritising investment decisions.



Figure 1 High-level interdependencies between water and other key sectors of the Australian economy include both societal and natural resources.



north-south pipeline, Chapter 8 of the report) and not allowing highly purified recycled water to be fed into the water supply system (South-East Queensland's water grid, Chapter 5 of the report). These result in unused capital investment and adverse impacts on productivity and system resilience. Water costs from different sources vary widely (Table 1).

**Table 1 Typical cost of water supplied from various sources and inferred cost of water from infrastructure upgrades and water trading**

Water cost	\$/kL
Reservoirs	\$0.50 – \$1.30
Desalination	\$1.20 – \$2.20 (to \$7.00)
Recycling	\$0.80 – \$6.00
Rainwater tanks	\$1.40 – \$12.00
Bottled water	\$500 – \$3000
Water savings from AAA shower roses	\$0.77
Water savings from AAA dishwashers	\$33.40
Upgrades to irrigation infrastructure	\$0.40 – \$11.00
Traded rural water access entitlements	\$0.20 – \$2.10
Traded rural water allocations	\$0.05 – \$1.00
(Average purchase by Commonwealth for e-flows)	\$1.80

Statistics on the economic added value of goods produced per volume of water consumed highlight the large variation in the economic value of water – from \$700 per megalitre for dairy farming to \$18,000/ML for grapes and \$60,000/ML for electricity and gas supply (Chapter 2 of the report). But water also has value in supporting ecosystems, biodiversity and recreation.

How can environmental values be estimated and compared with financial returns from industrial and domestic use? Attempts have been made to express environmental values in monetary terms so that their value can be compared directly with economic uses of water. Some proponents argue that environmental and social values cannot be estimated in dollar terms and that they should receive equal weight in decision-making to ensure long-term sustainability.

Proposals to develop an improved management plan for the Murray–Darling Basin (Chapter 4 of the report) represents a prime example of the competing demands of agriculture, the environment and local communities when faced with reduced water availability, and the difficulties of establishing a long-term policy for water reform suited to climate uncertainties, economic conditions and the expectations of regional communities. The transition to a green growth economy will not be smooth.

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CONTENT MATTERS

The Millennium Drought, from 1997 to 2009 across much of Australia, resulted in concerns about security of supply and prompted urgent decisions by governments that were not always based on integrated scientific, technological and economic advice.

Large desalination plants were built in many capital cities, with capital costs of up to \$3.5 billion and a need to operate at high utilisation rates for decades. Decisions to construct were too often followed by heavy rains and overflowing dams. Modern, adaptive, integrated water-management systems with 'water grids', recycling and harvested stormwater (Chapter 8 of the report) offer a lower-cost and more resilient approach – with lower risk of stranded assets.

A case study of water supply planning for a modern urban city, Adelaide (Chapter 7 of the report), highlights the advantages of diversifying supply to non-traditional sources, as well as the essential role that water markets could play in lowering the cost of urban water, optimising energy demands and greenhouse gas emissions and deferring expensive infrastructure.

Water is needed to generate electricity. Electricity is needed to harvest, treat and transport water. The two are inextricably linked, yet energy and water policy have developed independently and often result in perverse outcomes and cross-subsidies with other sectors of the economy.

The increasing costs to produce both electricity and water will drive much-needed improvements in efficiency and the uptake of modern technologies. Market forces drive business improvements. However, the 'tragedy of the commons' often results in hidden costs being borne by others. Examples include saline discharges into streams corroding infrastructure in towns and cities further downstream, over-fertilisation and poor land management degrading soils, biodiversity and aquatic health, and greenhouse gas emissions increasing the likelihood of global climate change.

Better long-term investment decisions are made when these 'externalities' are incorporated into decision-making, such as is being done by water utilities that monetise the environmental and social cost of nitrogen discharges into waterways and greenhouse gas emissions from operations in their investment decisions (Chapter 2 of the report).

The ATSE report contains 14 major recommendations to improve water management in Australia, covering areas

such as investment decision-making, economic efficiency and productivity, coupling national economic and environmental accounts, potable recycling, social impact, the interconnections between water and other parts of the economy, investment in technology and support for R&D and commercialisation.

Technological and scientific innovation will underpin green growth in the water sector into the future. The report lists 63 scientific and technological opportunities that would increase efficiency and productivity and reduce environmental impact.

These technologies will drive multiple green growth and productivity objectives, including lower demand for energy and other resources, reduction in waste and pollutants, increase in economic efficiency, conservation of natural assets and improvements in social cohesion.

New industries will be created in the areas of energy- and water-efficient equipment and appliances, new decentralised stormwater and wastewater treatment technologies, more efficient agricultural practices, better weather forecasting, climate and hydrological modelling, improved recycling technologies and co- and tri-generation of energy, water and waste technologies.

Australia's long-term productivity and quality of life should be underpinned by improved understanding and management of water, and ensuring that economic goals are balanced by social prosperity and environmental outcomes. As a major food-exporting nation, Australia has an opportunity to use its water resources even more efficiently as a contribution to feeding the world. ◀

The 166-page ATSE report and 4-page summary can be downloaded from [www.atse.org.au/resource-centre/ATSE-Reports/Water/](http://www.atse.org.au/resource-centre/ATSE-Reports/Water/)

**DR BRIAN SPIES'** career spans senior roles in government and industry in Australia and the US in the resource and environmental sectors. In Australia they include Chief Research Scientist at CSIRO, Director of Physics at ANSTO and Principal Scientist at the Sydney Catchment Authority. Brian has a degree in geology and physics from the University of NSW and a PhD from Macquarie University. He has held numerous editorial and honorary positions, and is currently a senior visiting fellow at UNSW. Brian serves on the ATSE NSW Division committee, is Deputy chair of ATSE's Water Forum, and is lead author of ATSE's Sustainable water management report.

## Contributions are welcome

Opinion pieces on topics of national interest will be considered for publication in *ATSE Focus*. Items between 800 and 1400 words are preferred. They must list full name, title/role, organisation (if relevant), city of residence and email address for publication. Please address to [editor@atse.org.au](mailto:editor@atse.org.au)

# Water quality management; a safe and sustainable approach to an ever-changing environment.

Water quality and supply are of vital importance when considering the restoration of water flows within Australia's ever-changing environment. The dual implications of an ever-expanding population, combined with the threat of climate change, can cause problems in our water supplies, particularly in regards to microbial contaminants.

Professor Chris Saint's innovative research at the SA Water Centre for Water Management and Reuse at the University of South Australia (UniSA) is a key research contributor on the effects contaminants such as blue-green algae (cyanobacteria) blooms have on Australia's water supply.

Rapid and effective monitoring for blue-green algae in our water systems is of paramount importance as these organisms produce harmful toxins and compounds which can taint water with an unpleasant taste and odour. In a similar way to the forensic use of DNA for the identification of criminals, techniques have been developed that permit the rapid identification of these harmful organisms, so they can be managed and removed quickly.

With blue-green algae blooms becoming an increasing menace worldwide, Professor Saint's research undertaken at UniSA has been acknowledged globally for its contribution to their detection and control, particularly as the organisms thrive in Australia's nutrient-rich warm waters.

In partnership with UniSA, Professor Saint is continuing to build his reputation as a world leader in this field through his award-winning research and collaborative links with industry and government. His research within the SA Water Centre for Water Management and Reuse is leading the way in water conservation and reuse, and making a real difference to our health, safety and sustainable viability.

For more information about the SA Water Centre for Water Management and Reuse and research at UniSA visit [unisa.edu.au/research](http://unisa.edu.au/research)

*"We can expect to see blue-green algae become more prevalent throughout our waterways in years to come as we continue to create the warm nutrient rich environments they crave for their expansion."*



**University of  
South Australia**

# Water Forum seminar looks at green growth

The adoption of more sustainable water use is slow, incremental and opportunistic and requires the support of communities and governments.



By John Radcliffe

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In association with the launch of the ATSE report *Sustainable Water Management, Securing Australia's future in a green economy* in May, the Academy Water Forum convened two half-day seminars: *Sustainable Water Management* and *Beyond 2019: Environmental, Economic and Social Impacts of a Sustainable Water Management Strategy for the Murray–Darling Basin*.

The first seminar introduced the findings of a year-long ARC-funded ATSE study on Sustainable Water Management that considered the inter-relationships between key factors such as water and urban development, agricultural production, energy security, carbon management and ecosystems. The study report also examined the importance of a green growth strategy for water management in Australia.

The second seminar examined the environmental, economic and social impact of a green growth management strategy on the Murray–Darling Basin beyond 2019.

Launching the report, the Acting Chair of the National Water Commission, Professor **Stuart Bunn**, observed that the report was timely as there was a perception that “green tape was strangling investment”. The National Water Commission was encouraging more effective coordination of policies affecting water. Professor Bunn said that the National Water Commission considered the ATSE report an important input to developing a shared understanding of the key policy issues.

The Honourable **Craig Knowles**, Chair of the Murray–Darling Basin Authority presented a series of historical vignettes on water management in Australia. With a background in water policy as a former NSW Minister, he outlined the progressive changes that had emanated from the 1994 Water Reform Agenda and the 2004 Intergovernmental Agreement on the National Water Initiative.

He observed that adoption of more sustainable water use was slow, incremental and opportunistic and required the support of communities and governments.

He said the ultimate adoption of potable water recycling was a “no-brainer”, but it would still require a long journey.

Discussing the proposed Murray–Darling Basin ‘Plan’, and the consequent 12,000 responses to it, he noted that the worst outcome was “no plan”; the risks in adopting the plan were much less than having no plan; and that Australia had to make a start moving towards more sustainable and adaptive management of the River Murray. He said the “wisdom of the bush” should be heeded, but recognised the problems of living with short electoral cycles.

Mr Knowles’ presentation highlighted the extent of changes in water policy and management that had taken place in the past 20 years. Most Australians are not aware of their significance, yet they are attracting enormous international interest.

Professor **Jamie Pittock** from ANU introduced his presentation on the global perspective by saying the world was living beyond its means, with a 30 per cent decline in biodiversity and a 50 per cent decline in freshwater ecosystems – with the world consuming 1.5 times the Earth’s capacity to supply resources. He noted it was hard to convince the community of the problems since it was primarily responsive to the short-term issues of today.

Professor Pittock questioned how we manage uncertainty, the difficulty of defining the biophysical limits within which we must remain, highlighting the particular risks of inducing changes in climate, biodiversity and the nitrogen cycle. There was a risk of perverse outcomes, such as more carbon farming requiring greater water consumption. The principles of Ecologically Sustainable Develop-

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ment were adopted in the 1990s with a flurry of activity, he noted, but – as was also the case with the National Water Initiative – progress had been slower than anticipated.

In bringing the community along, care would have to be taken in the use of any “green economy” jargon. Political leadership would be crucial. He observed that the Academy’s report did Australia a “great service”.

Dr **Brian Spies** FTSE, as its principal author, introduced the Academy’s report, which defines “green growth” as a process for sustainable economic development that recognises the interrelationship and inter-dependence of elements of the economy, the environment and society as a whole.

A green growth strategy harnesses the economic opportunities provided by new technologies, while reducing the environmental impact from such changes. Green-growth principles can provide a comprehensive framework for managing Australia’s water resources and prioritising investment decisions.

Dr Spies described the report’s compass and its principal recommendations, noting that politicians had to ensure that a “good crisis was not wasted by missing opportunities for change”. An example where this had occurred was the failure to adopt drinking water from the South-East Queensland Western Corridor water recycling scheme through the decision that it would only be used for drinking when dam capacities fell below 40 per cent – a decision that left the community with an impression that purified recycled water was somehow inferior and only to be used in an emergency.

Yet the drought had encouraged water trading, he said, noting that significant economic benefits had been demonstrated from the ability to trade water.

Mr **Adam Lovell**, Director of the Water Services Association of Australia, which represents all the major water utilities, discussed what “green growth” meant to the water supply sector. Key issues included the notion of climate variability, the challenge of communicating it and people confusing climate with “today’s weather”. Other issues included population increase, service reliability, the future choice for having domestic gardens, asset management, the politics and inefficiencies of decision-making, the value proposition of new technologies and the movement towards a period of increased water efficiency.

He pointed out that most people did not appreciate that after two wet years in 2010-11 only one-third of the water deficit from the Millennium Drought had been recovered. The scope for increased energy generation directly by water utilities was noted. A major question was what local communities wanted and how involved they should be in decision making.

Professor **Graeme Dandy** FTSE, from the University

of Adelaide, the report’s second author, explored the relationship between water, energy and carbon in the natural and human environment. He emphasised to need to explore all water source options. Professor Dandy described the use of simulation modelling for securely supplying water to the city of Adelaide, encompassing water from the Mount Lofty Ranges catchments, the River Murray, sea-water desalination, stormwater and wastewater recycling for the period 2010 to 2050, taking account of CSIRO climate change modelling projections.

He noted that, on average, Adelaide used one per cent of the total amount of consumptive use water taken from the River Murray. He discussed the importance of energy efficiency and its impact on alternative water sources.

Professor **Richard Kingsford**, from the University of NSW, noted the high proportion of run-off (60 per cent) used for consumptive purposes in the Murray–Darling Basin. He discussed a number of the major Murray–Darling Basin wetlands and the potential problems of a warming climate, emphasising that decisions would need to be made with regard to wetland management requiring recovery of flows, adaptive management, the potential removal or mitigation of flood plain barriers and the possible need for triage to be undertaken with regard to the various ecosystems.

He posed the question of how developed flows would be related to natural flows and discussed the risks of salinisation and recent acidification, together with the impact of relatively minor environmental changes on the survival of native species with a narrow habitat range, such as fresh-water turtles.

He suggested there was considerable scope for new industries in the River Murray post 2019, such as eco-tourism.

Mr **George Warne**, a former senior government water policy manager and an experienced irrigator, is now responsible for the Northern Victoria Irrigation Renewal Project (NVIRP). He compared the existing irrigation systems with those used by the Pharaohs.

He outlined the \$2 billion NVIRP landscape change, modernisation and renewal program, which has been perceived as a real solution to irrigation issues, with potential to save 429 gigalitres of water losses from the Murray system by reconfiguring the shared channel infrastructure on which the Murray–Goulburn irrigation system depends.

He noted the backdrop of falling population – leading farmers leaving the district – the sale of water to other areas and rapid social change. Separation of land and water since 1990 was seen as a bigger influencing factor than the “Basin Plan” – some farm businesses had water entitlements valued at more than the land on which they use them.

The Honourable **Karlene Maywald**, former South Australian Minister for Water and for the River Murray,

discussed the awareness and impact of green growth on regional and rural communities.

Rural communities were concerned about many issues, apart from water issues, she said, and these drove “reform fatigue” and uncertainty about the future, she said.

Water issues could not be considered in isolation. Although the River Murray communities survived relatively well through the drought, it was at the expense of their capital, both financial and human. There were also problems about leadership capacity in many communities, with the younger generation opting to pursue alternative education and career opportunities.

The way forward needed to encompass economic diversity, improved local education opportunities, growth opportunities for the younger generation, greater capacity to adapt to changing markets, and confidence in being able to adapt to change, Ms Maywald said.

These all formed components of the societal aspects of “green growth”.

Dr **Mike Raupach** FTSE (CSIRO) recently chaired the Prime Minister’s Science, Innovation and Engineering Council (PMSEIC) review *Challenges at energy-water-carbon intersections, discussed Where will green growth technologies take us in the future or where will we take green growth?*

He observed that, with even a rapidly rising population since the industrial revolution, global per-capita wealth and resource use since 1800 had doubled every 45 years. Only now were communities realising that they may be reaching limits to the capacity for growth.

With a global temperature increase of 2°C, (2.5°C to 3.0°C now seemed more probable), there was likely to be a 10 per cent reduction in rainfall in Australia and a 20 per cent reduction in rainfall run-off – and the run-off per person would reduce by a much larger percentage (a 4°C reduction could result in a 40 per cent reduction in run-off).

“Green growth” implied growing productivity, prosperity and living standards while improving environmental and social outcomes, but economic improvement should not come at the expense of the environment or social wellbeing, he said. Environmental sustainability and human wellbeing were entwined – both shared goals, within and between societies.

A range of principles had gradually been emerging to address these issues. These included the global principles such as Environmentally Sustainable Development, deriving from the 1992 Rio de Janeiro conference (to be reviewed in 2012), the United Nations Framework Convention on Climate Change and Kyoto Protocol, the Convention on Biological Diversity and the RAMSAR Convention. At the Australian national level, there was the Intergovernmental Agreement on the National Water



Report launch and seminar speakers included (from left) Professor Graeme Dandy, Dr Brian Spies, Dr John Radcliffe, Professor Robin Batterham, Professor Stuart Bunn and Dr Tom Connor.

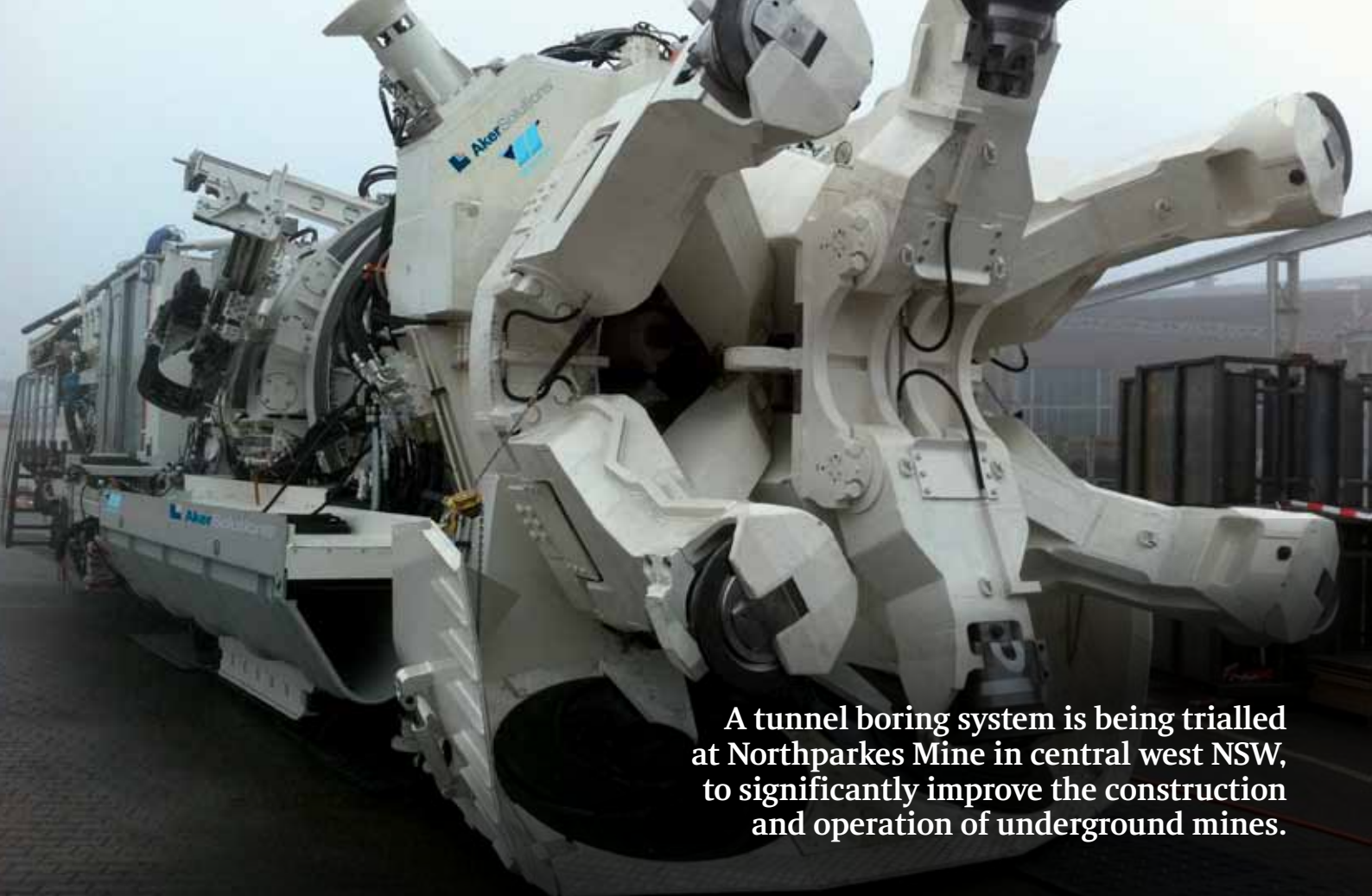
Initiative, the establishment of a price on carbon and associated programs to improve environmental resource efficiency. At the local level there was Landcare, Caring for Country and Climate Action.

But the community had yet to fully understand the ‘Earth System’ and appreciate the interactions between the different forms of capital – natural, physical, human, knowledge, social and financial. Furthermore it had yet to fully understand the dynamics of evolution, adaptation, transformation and resilience. These need to be understood but not necessarily be controlled.

Technologies were continually being sought to provide the needs for human wellbeing (water, energy, food, transport, communication, commerce and culture,) in sustainable ways, Dr Raupach said. To achieve these outcomes would require pricing for the use of natural assets, regulating the use of natural assets and community engagement, consultation, communication, and agreement.

Dr **John Radcliffe** AM FTSE summarised the main outcomes from the seminar. The presentations and a vigorous mid-seminar interactive discussion led by Dr **Tom Connor** AO FTSE reinforced the need to ensure that Australia, whether or not it adopted the expression “green growth”, to embrace a process for sustainable economic development that recognised the interrelationship and interdependence of elements of the economy, the environment and society as a whole, and was able to ensure that communities feel they were involved and empowered in decision-making processes. ◀

**DR JOHN RADCLIFFE** AM FTSE, a former Director-General of Agriculture (South Australia), former Deputy Chief Executive of CSIRO and former National Water Commissioner, is Chairman of the Academy’s Water Forum.



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# Green growth: taking a global perspective

A vast array of studies and policy development has not resulted in the socio-economic transformation needed for sustainability.



Dr Jamie Pittock

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**A**s world governments prepare to meet at Rio de Janeiro in June at the United Nations Conference on Sustainable Development their mission is to review the progress of a quarter of a century's work to harmonise people's needs with a healthy environment, and to agree on priorities for the coming decade.

The key questions are: Where have we got to? What needs to be done next? What does this new green economy jargon mean? Lastly, what is Australia's place and what role can the Academy best play in view of its work on water and the green economy?

On any objective measure, efforts to date to reorient our social and economic systems to live within Earth's biophysical limits have failed. The global Living Planet Index of known populations of flora and fauna shows that there has been a roughly 30 per cent decline in this biodiversity since 1970, and this is worse in the freshwater biome, which contains more species per unit area and is least well conserved.

The Global Footprint Network calculates that in each year humanity now consumes 1.5 times the output of the Earth's renewable resources, a situation that is clearly unsustainable.

Our knowledge of the Earth systems that we need to maintain has improved greatly. In 2009 Johan Rockstrom and colleagues identified nine "planetary boundaries" – biophysical limits – that we need to respect to provide a safe living space for humanity. In addition to the usual suspects such as biodiversity loss and greenhouse gas emissions, these boundaries include neglected sectors such as the nitrogen and phosphorus cycles.

These boundaries illustrate the interlinked nature of the sustainability challenge. The climate–energy–water nexus highlights the potential for conflicting responses – added pressures from climate change adaptation in the water sector usually consume more energy, whereas carbon sequestration and low-emission energy-generation technologies consume a lot of water.

Translating this knowledge into action for sustain-

ability in each sector is the challenge. In 1987 the World Commission on Environment and Development (Brundtland Commission) sought to codify an approach that links development and conservation of the environment in the form of the principles of "sustainable development" that "meets the needs of the present without compromising the ability of future generations to meet their own needs".

In Australia this was adopted as "ecologically sustainable development" and catalysed a vast array of studies and policy development – but these have not resulted in the socio-economic transformation needed for sustainability.

In 2000 our governments adopted the UN Millennium Development Goals to halve poverty by 2015. The goals specify quantified targets such as access to modern energy sources and to safe drinking water, as well as vague ones for "environmental sustainability", such as "a significant reduction in the rate of loss of biodiversity". When implemented poorly, actions to achieve these targets conflict.

Now the UN is proposing that the Rio Summit recommit to sustainable development in the form of "greening the economy". The UN Environment Program states (2010): "A green economy is one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities." They argue that it is an advance as "an economy or economic development model based on sustainable development and a knowledge of ecological economics".

Certainly, since the 1992 UN Conference on Environment and Development there have been advances that bring together our understanding of the environment and the economy. The increasing adoption of "ecosystem services" as a framework for systematically valuing the benefits people get from nature has the potential to better inform

A biome is a major regional group of distinctive plant and animal communities best adapted to a region's natural physical environment, latitude, elevation and terrain.



The Academy has important roles to play in instigating advances in these sectors in Australia, as illustrated by its report *Sustainable Water Management: Securing Australia's water management future*. In this report the Academy plays an important role in detailing the available national information across the water and related sectors, highlights a slate of practical technological solutions and outlines a number of the market-based and other institutional reforms needed to bring these to fruition. I congratulate the Academy on this work and urge you to promote its findings. I look forward to the upcoming energy and green economy components of this program.

– Dr Jamie Pittock

#### The iconic Menindee Lakes.

development decision-makers of trade-offs. Other recommended changes include taxing environmental 'bads' as well as reducing taxes on labour, and also those that block more flexible adaptation such as land taxes.

However there is still no consensus on what a green economy is. For instance, the OECD stated (2011): "Green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our wellbeing relies. Economic growth is decoupled from the depletion of natural capital."

There are examples of this beginning to emerge – for instance, the water market in the Murray–Darling Basin has enabled expansion of agricultural production with less water. In the draft agreement for the Rio+20 conference in June, the UN Secretariat states: "We view the green economy as a means to achieve sustainable development, which must remain our overarching goal. ... a green economy in the context of sustainable development and poverty eradication should protect and enhance the natural resource base, increase resource efficiency, promote sustainable consumption and production patterns, and move the world toward low-carbon development."

So why should we change our focus from the now well-accepted concept of sustainable development?

Clearly, sustainable development has failed to catalyse the transformation of our political, social and economic systems that are required. This is illustrated by the increasing use of narrower words that convey self-interest such as "security" and "nexus" in countries like Australia and the US to argue for better stewardship of natural resources.

A report on recent opinion polling in the Fairfax media on 30 April is another sign of the difficulties nations

such as Australia have in sustaining reform. Headlined "Australians' concern about the environment plummets", the report states that: "Concern for the environment has dwindled into a 'middling' issue ... a major study into Australian attitudes ... has found. ... People's concerns about industrial pollution, climate change, renewable energy and depletion of energy resources plummeted when compared to an identical study carried out in 2007 ... Overall, this reveals a startling decline in the Australian population's concerns about environmental sustainability."

Earlier this year the UN Secretary General's Global Sustainability Panel – which included Kevin Rudd – reached a similar conclusion: "Sustainable development has undoubtedly suffered from a failure of political will. ... there are few incentives to put it into practice when our policies, politics and institutions disproportionately reward the short term. ...the concept of sustainable development has not yet been incorporated into the mainstream national and international economic policy debate."

So does a change of jargon provide an opportunity to jump start reforms needed for sustainability? A green economy arguably is new and different through the application of the practical economic instruments suggested above. In my program's research on the climate, energy and water nexus we have concluded that we actually need a suit of mutually reinforcing measures to better optimise decisions to benefit society and the environment across sectors.

In our view these are:

- better knowledge to inform decisions;
- technological advances;
- market-based measures; and
- leadership and more integrated governance institutions.



PHOTO: ISTOCKPHOTO

Australia has an important role to play in promoting these sorts of solutions internationally – at the Rio+20 conference and beyond – as a nation with the need and resources to be a leader in charting a more sustainable future. In the *Australian Innovation System Report 2012*, the then Department of Innovation, Industry, Science and Research (DIISR) recognise this in stating that “Australia [is] exposed to ‘greater risks of climate change than any other developed country.’ ... one of the most emissions- and water-intensive economies in the world; ... other threats including food security, biodiversity and land

quality. ... Green growth has the potential to secure Australia’s future prosperity by managing these ‘wicked problems.’”

However The Department of Foreign Affairs and Trade (DFAT) is only faintly interested by comparison, saying only that (2012) “... our focus is on economic growth, social improvement and environmental protection. Australia is committed to the UN’s work on the green economy and sustainable consumption and production. Australia also supports ... a path of low-carbon growth.”

Over-exploitation of natural resources threatens humanity. Sadly the sustainable development concept has not delivered the transformation needed to date – perhaps the green economy concept can better link our socio-economic and environmental needs. In the context of water, the ATSE report shows that technical means exist that our challenge is to improve market and other institutions to foster their deployment. ◀

**DR JAMIE PITTOCK is based at the ANU’s Crawford School of Public Policy. He is Director of International Programs for the UNESCO Chair in Water Economics and Transboundary Water Governance. His current work includes developing research programs that link Australian and southern African expertise to improve management of river basins, green water and agriculture. He is also Program Leader for the Australia and United States – Climate, Energy and Water project of the US Studies Centre and ANU Water Initiative. Before joining ANU, Dr Pittock worked for WWF International as director of its global freshwater program on conservation of wetlands, water use in agriculture, and river basin management.**

## Trading ‘could help save groundwater’

A well-designed trading scheme could help protect one of Australia’s most precious resources for the future, its groundwater, as well as the many wetlands and lakes it supports.

New research by the National Centre for Groundwater Research and Training (NCGRT) suggests that water trading would benefit both urban and rural users, the nation’s water resources and also help protect the native environment, says NCGRT Director Professor Craig Simmons.

The research is based on a case study of Perth’s Gnangara groundwater system (GGS), by Mr James Skurray and Professor David Pannell, published in the *Journal of Hydrology*.

The research proposes a trading scheme that allows groundwater users to transfer their water rights to one another, as is currently being done with surface water in the Murray–

Darling and other parts of Australia, Professor Simmons says, which would give groundwater users the freedom to buy or sell their rights at an agreed price both to neighbours and to people further away.

To work well with groundwater, the researchers argue, trading schemes need to be based on ‘sustainable extraction limits’ – the amount of water that can be pumped out without exceeding the aquifer’s recharge rate.

“Groups in the community require different amounts of groundwater for their own uses, and so put a different value on their water,” says Professor David Pannell, a Chief Investigator at NCGRT. “For example, a sports oval is usually highly appreciated by the community, so the value of its water would be relatively high – on the other hand, a farmer who uses the water

to grow pasture for livestock might put a lower value on it.”

“Our scheme would allow the farmer to sell their water entitlement to the local government at a win-win price. The farmer gets more for the water than its agricultural value, and the local government can use it in a way that is highly valued by the community.

“Allowing water to change hands according to the needs of various users helps ensure it is used most productively. Trade can benefit both parties, without any increase the amount of water pumped.”

The National Centre for Groundwater Research and Training is an Australian Government initiative, supported by the Australian Research Council and the National Water Commission.



# Science in Action

The most commonly cited reason why students stop choosing science in upper secondary is that they do not see the relevance.

Despite the fruits of science being all around us.

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Find out more about STELR by visiting the web site ([www.stelr.org](http://www.stelr.org)) For pricing, contact STELR Project Manager Peter Pentland at +61-3-9864 0906 or [pentland@atse.org.au](mailto:pentland@atse.org.au)



STELR is a key initiative of the Australian Academy of Technological Sciences and Engineering (ATSE), [www.atse.org.au](http://www.atse.org.au)

# Technology underpins better water management

**W**ater holds the key to Australia's long-term productivity and quality of life, which will be underpinned by better understanding and managing it – based on technological innovation and scientific advances – according a major Academy report on water management which was launched in Sydney in May.

But the report notes that innovation is impeded by existing long-term investments in infrastructure and systems and technology lock-in, and governments should encourage investment and uptake of energy-efficient and flexible water supply options that increase efficiency and productivity and reduce environmental impact.

It says government support for innovation should be carefully targeted to accelerate the development and uptake of efficient technologies while minimising the risk of technology lock-in, reduced competition and crowding out of private investment.

The report – *Sustainable water management: Securing Australia's future in a green economy* – was released following a year-long study led by ATSE Fellows Dr Brian Spies FTSE, the former Research Director at the Sydney Catchment Authority, and Professor Graeme Dandy FTSE, Professor of Civil and Environmental Engineering at the University of Adelaide.

It is the first of three major studies being conducted by ATSE, with Australian Research Council funding, on the application of a 'green growth' approach to key resources issues in the Australian economy.

The report notes that investment decisions in water infrastructure should use the best science to balance social, economic and environmental factors and take account of the cost of externalities such as greenhouse-gas emissions, land degradation and water pollution.

As a major food-exporting nation, Australia has an opportunity to use its water resources even more efficiently as a contribution to feeding the world, the report says.

Technological innovation and scientific advances will play ever-increasing roles in improving our understanding of the water cycle, especially in areas such as hydrological modelling and forecasting, increased efficiency of water use, improved environmental outcomes and the ability to adapt rapidly to changes in climate and demand. Technology innovation could include:

- improvements in direct potable water recycling technology;

reduced energy use in water management; and

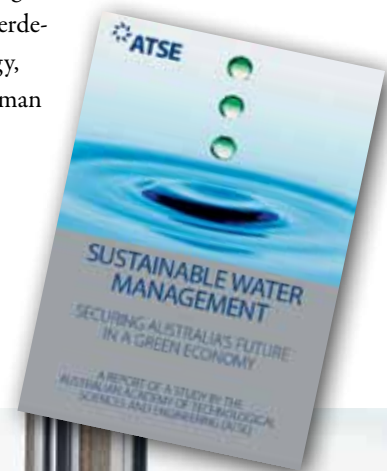
- reduced water use in power generation.

Australia's long-term productivity and quality of life will be underpinned by improved understanding and management of water.

Noting that water is interrelated with almost all sectors of the economy – including agriculture, mining, electricity production, manufacturing, recreation and tourism – the report recommends that water policy should be fully integrated across all relevant sectors within government, to recognise the multiple roles of water within the Australian economy and community.

The report was launched by Professor Stuart Bunn, the Acting Chair of the National Water Commission. The launch – which received wide media coverage, particularly in regional Australia – and the associated seminars were held at the NSW Trade and Investment Centre in Sydney.

The ATSE report outlines a great range of challenges and the interdependencies of water with energy, agriculture, ecosystems and human health. ◀



Professor Stuart Bunn launches the report.

# Why is Murray–Darling water reform so hard?

Jurisdictional boundaries, vested interests, political posturing and entrenched cultures are just some of the reasons why it is difficult to put the jigsaw together.



By Karlene Maywald

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**T**he road to water policy reform in the Murray–Darling Basin has been slow (some would say excruciatingly so) and difficult. Opinions have been polarised, communities disenfranchised and the road is littered with the fallout from various attempts to consult with and embrace the regional and rural communities most affected.

So when the need for reform seems so obvious, why is it so difficult to just get on with it? It's just common sense isn't it? Why don't politicians show more leadership? Isn't that what they are elected to do? Can't they see what the science is telling them?

These are all questions that are asked (often) by people frustrated at "the process" that doesn't always seem to deliver a desired nor timely outcome.

The reasons behind the questions can be very different depending where an individual sits in the debate. For example, irrigators are aggrieved because they perceive a loss of security of water supply and the cost imposts of regulatory reform to be overly onerous – both of which may threaten their viability – whereas scientists and environmentalists see the environment as the big loser, as river system degradation continues while outcomes for reforms are negotiated.

Over the decades endeavors to change or reform water policy have been met with strong resistance for a multitude of reasons. Jurisdictional boundaries, vested interests, lack of knowledge, differing expert opinion, political posturing and entrenched cultures are just some of the reasons why it is difficult to put the jigsaw together.

Add to this news media focused on reporting matters of controversy rather than the boring facts of the debate and it is not difficult to understand why it is so tough.

## Challenges aplenty

So, what are the challenges facing rural and regional communities in adopting a 'green growth' future? It is critical for the drivers of change to understand that water is just one

of the challenges facing rural and regional communities.

Here are a few more ....

### INTERNATIONAL PRESSURES

- commodity prices;
- high Australian dollar;
- GFC;
- escalating input costs (e.g. fertiliser, fuel);
- transport/distance from market costs;
- biosecurity; and
- market access.

### REGULATORY/BUSINESS PRESSURES

- quality assurance;
- Carbon Tax;
- occupational health and safety;
- increasing competition;
- cost of new technologies;
- retail consolidation;
- telecommunications;
- labour shortages; and
- bank pressures.

### LOCAL PRESSURES

- declining population;
- centralisation of services;
- skills shortages;
- lack of community capacity;
- retail consolidation;
- ageing population; and
- personal pressures – financial, physical and mental.

It is also important to understand that rural and regional communities are suffering from severe reform fatigue. It is usually the same community leaders who attend all the meetings about all the different reform agendas on the go. This has a cumulative effect often resulting in information overload and consultation exhaustion.

## Two investment planks

There is also no shortage of 'experts' offering opinions publicly, which adds to the confusion and polarisation of the debate and a sense of not knowing who to trust.

The result is that rural and regional communities are operating in an environment of ongoing uncertainty, which inhibits sound business decision making and a reluctance to invest in the future until the goal posts are known.

To successfully introduce the concept of green growth to policy reform in this environment, governments will

need to expand their thinking in regard to supporting programs.

Currently there are two investment planks for the Federal Government to bridge the gap between the amount of water taken for consumption before and after reforms in the Murray–Darling Basin:

1. Buy back water entitlements from willing sellers; and
2. Investment to upgrade water infrastructure to save water.

### BUY-BACK

Many irrigators have already decided that it is all too hard and have sold their water to the Federal Government through the buy-back program and exited the irrigation industry.

This is the most cost-effective way to reduce consumption and increase available water for the environment, but it does create a policy dilemma. On one hand communities are concerned about the impacts on regional economies as a result of this random water exodus, and on the other hand it is the cheapest source for securing water for the environment.

### INFRASTRUCTURE

Investment in projects such as the NVIRP II (a \$1 billion project to continue the upgrade of northern Victorian irrigation water delivery systems) will produce significant ongoing water savings as well as long-term benefits to irrigators serviced by this infrastructure.

This is a good investment when the cost benefit analysis includes more than just cost of water saved, but it is much more costly per megalitre recovered than the buy-back program.

The policy dilemma in this program occurs when there is inconsistency in the application of ‘value for money’ on the return of water to the environment. There has been a wide range in the \$/ML saved in the successfully funded projects and irrigators have questioned the fairness of this process.

Not all irrigation communities are equal when it comes to efficiency of water use, which means it is difficult to apply a ‘one size fits all’ approach to infrastructure water recovery projects. Perhaps a more flexible approach to determining value would assist in unlocking the funds in this program.

### The third plank

To truly embrace green growth in the Murray–Darling Basin reforms, I believe there should be a third plank in the mix of investment programs to bridge the gap.

The ability for rural and regional communities to accept that a green growth future is possible will be directly linked to the support they get to adapt. It will require much more than just recovering water for the environment.

Building resilience to short-term climate variability and long-term climate change is critical to ensure long-term sustainability of rural and regional communities.

Programs that support those who choose to stay in the irrigation industry to adapt and grow in an environment of reducing water availability will help drive the ability of our irrigation communities to do more with the water that is left for consumption.

Initiatives to increase productivity could include:

- develop opportunities to maximise the use of existing irrigation delivery systems – address the inefficiencies cre-

► [MORE ON PAGE 22](#)



Karlene Maywald (left), then Member for Chaffey, and former SA Premier Mike Rann (second from right) meet with irrigators and environmentalists to discuss rehabilitation of the Yatco Lagoon in SA's Riverland.

# Irrigation renewal needs courage beyond 2019

Take into account that great love and great achievements involve great risk, the 14th Dalai Lama has said.



By George Warne

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**T**he statement by the Dalai Lama could well be a saying that the irrigation farmers of the Goulburn Murray Irrigation District (GMID) of northern Victoria are currently living by.

Progressive farmers with a love of the land are leading the way and showing great courage as the region undertakes a massive structural change at ground level.

Courage can, however, be tempered when there is a \$2 billion investment in one regional area to assist with the change aided by both the state and Commonwealth's water-saving policy budgets.

The Northern Victoria Irrigation Renewal Project (NVIRP) is tasked with the job of modernising the irrigation system in the GMID in two stages over a 10-year period. Not only is the task to modernise the system but in essence it is necessary to reduce the overall irrigation footprint to achieve the required water saving targets by 2018.

This coincides with the 2019 release of the final Murray-Darling Basin Authority's long-term average sustainable diversion limits program. The success of the two stages of the NVIRP program and the acceptance of a changed Murray-Darling Basin will herald the future of the highly productive food bowl region of Victoria, which is nestled

neatly between the Goulburn and Murray rivers.

NVIRP's structural changes for the modernised delivery service will see agricultural production increase by a commensurate amount. But, before all that happens, the 14,000 landowners who are spread over the 680,000 hectares in the region will be consulted in a one-on-one basis about their future business opportunities and philosophies for 'life on the land', with or without irrigation.

The program of connecting landowners to a modernised 'backbone' channel system involves considerable consultation as farm irrigation designers and NVIRP's Modernisation Coordinators work through the many issues as landowners are connected directly to the backbone or artery channels to access an improved water delivery service.

Properties are connected to the Goulburn-Murray Water (G-MW) channel supply system via supply point connections. Through NVIRP's Connections Program these landowners are being encouraged to upgrade their supply point connection or move supply points from 'secondary' or 'spur' channels to the backbone via a new connection, adopting the solution that best suits their farming operations.

As part of NVIRP's Stage 2 Connections Program, smaller geographic areas are clustered into separate Strategic Connections Projects (SCP). These SCP's have been planned to connect landowners located downstream of the main backbone channel system to the backbone.

Strategic Connections Projects involve a well-planned approach to working closely with landowners to explore connections options as well as schedule and deliver connections works. This stage of the project commenced in October 2010 and will continue to completion in 2018.

## Best and worst

The modernisation project encompasses the very best in humankind – landowners wanting to upgrade to increase their productivity and secure prosperity for their future.

Channel remediation with plastic lining in the Murray Valley area in northern Victoria.



Then there is the worst, which encompasses greed built around a false impression that the government of the day 'owes me something'.

Added to this, working through an SCP requires coordination between neighbours on a collective spur channel. While NVIRP encourages neighbours on these collective spurs to discuss their business futures together, some have an historical blanket 'no-speak' with the person on the next-door property.

NVIRP Modernisation Coordinators also deal in the human frailties of family deaths, divorce and patriarchal succession planning.

NVIRP has already completed 65 per cent of Stage 1 and has a planned reduction of the channel system by more than 750 kilometres (roughly the road distance from Melbourne to Sydney) by closing down unused internal channels and spurs while endeavouring to provide a better level of service delivery to G-MW customers.

This progress is also seeing considerable savings for the system operator, with the withdrawal of old and inefficient channels and outdated delivery structures. Additionally, more than 117km of channels have been repaired by using a mix of plastic and clay lining.

Water savings need to be measured accurately to guide investment decisions. By replacing and removing old service points, NVIRP can reduce measurement error and leakage around these old structures.

Already 2716 regulator gates or FlumeGates™ have been installed to regulate the flow – allowing the operator (G-MW) to manage and account for the flow so much better when it is measured in this way. A 24/7 customer contact to ensure around-the-clock services for irrigators is in operation and this has reduced requirements for advance water ordering notice and much improved response times for field maintenance issues.

In addition, automatic regular gates are being installed to control outfall losses and improve water level regulation, which in turn improves service levels to irrigators.

Plans are well underway for the 2012 irrigation shut-down period between May and August for NVIRP to install another 80 regulator gates over 60 sites throughout the GMID. In these winter months another 20km of channel remediation will be undertaken using a mix of clay lining and plastic.

Infrastructure change is a proven way for authorities and the irrigation community to achieve these modernisation milestones and gain proven water savings.

Water buy-back schemes need to be better aligned for state and Commonwealth programs to deliver greater efficiencies and better social and economic outcomes. However, significant efficiencies can be achieved by harmonising

existing programs including On-Farm Efficiency programs and the Commonwealth Water Share purchase program.

NVIRP is proof that these achievements can be gained when community engagement aligns with courage from the regulators. ◀

*On the advice of the Victorian Minister for Water, Northern Victoria Irrigation Renewal Project will merge with Goulburn-Murray Water on 1 July 2012.*

**MR GEORGE WARNE is the CEO of the Northern Victoria Irrigation Renewal Project. He has held the job since January and will assist with the transitional management as NVIRP is merged with the local rural water body – Goulburn-Murray Water by 1 July this year. He is recognised as a leader in the rural water sector and brings strong change management skills to assist with this merger. He has a record of delivering large and complex construction projects and infrastructure programs both in the commercial sector and in the irrigation and water storage infrastructure area. He was formerly General Manager of Murray Irrigation and more recently the CEO of NSW's rural bulk water delivery business State Water.**

**A FlumeGate being installed in a regulator structure as part of the NVIRP project.**



# Water must be central to urban planning

Water utilities will continue to build stronger relationships with communities and businesses to develop solutions that support resilient, healthy and liveable cities.



By Adam Lovell

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**T**he Water Services Association of Australia (WSAA) is mindful of the importance of urban water services to the community, particularly in the protection of public health.

Despite our extraordinary climate variability, the quality and supply of water and sewerage services in Australia is consistently of the highest standard.

The industry publishes its performance against approximately 130 indicators each year through the National Water Commission's *National Performance Report* – ensuring there is clear overview of the industry.

This transparency gives confidence to Australians that the urban water industry continues to meet community and stakeholders expectations in performance of three key areas:

- protection of public health;
- protection of waterways and ecosystems; and
- running financially sustainable businesses.

In its 2011 Report Card, *A sustainable future for the urban water industry*, WSAA identified the major challenges facing the urban water industry and gave key recommendations to support the industry's move to a sustainable future.

The existing infrastructure in our cities and towns has historically been based on social and transport needs rather than water supply requirements. Now, particularly given the welcome rain on the east coast of the country, is the time for the vital ingredient of life – water – to take a central role in urban planning. The potential for innovation in the way new developments plan water supply and usage has often been ignored, and we need to replace this complacency with a more collaborative approach with our customers and the broader community.

The two key drivers that influence demand for water in our cities and towns are population growth and climate variability. In the past 10 years, while Australia was in a very long dry period, the urban water industry responded by implementing significant capital projects. The objective was to develop a diverse portfolio of water supply sources and sophisticated water efficiency strategies. This approach

has been successful and means we are now well-positioned to accommodate higher population growth. Desalination plants are in place in all states, providing an insurance policy against our major capital cities running out of water.

In Perth the desalination plants are even more critical to base load supply and will form a major pillar of the climate independent supplies for the city by 2022.

The quiet achiever in diversifying water supplies has been the growth in recycled water. The urban water industry has developed a large portfolio of recycled water options and has gained substantial knowledge of the risk profile and systems and processes to support safe and fit-for-purpose recycling.

Why is this so important? As our urban water services become more complex and (in some situations) decentralised, the compact, sustainable water solutions for in-fill areas of cities will have less reliance on the potable water and sewerage 'grid'. Including storm water harvesting for our cities and towns is a growing focus area, with the new CRC for Water Sensitive Cities and the new Living Melbourne strategy.

More importantly, what do Australians see when they picture their cities and towns in the future? Many see green space as encouraging healthy lifestyles and reducing the urban heat-island effect. Many see the links between water and energy and the fact that much green energy could be tapped from sewage including carbon, heat and nutrients. Many see that cities and towns exert an 'Ecofootprint' that is growing and needs to be managed.

What will be the role for water utilities in delivering these visions and expectations? How can water utilities innovate, not just in a technical sense to deliver healthy, liveable communities? It cannot be doubted that water will deliver some of the critical liveable city and town objectives. However, with sectors including energy, transport, and waste all becoming more closely linked, now – more than ever – urban water service providers need to be at the table when the big infrastructure plans are developed.

Water utilities have always known that water saved through efficiencies is the cheapest water; not a drop wasted is the new paradigm. Water efficiency can delay capital expenditure in new water supplies and growth improving affordability. All utility bills can be lower because saving water can also save energy. There are environmental benefits from investment in water efficiency, lower greenhouse gas emissions associated with less pumping of water and less heating of water are benefits, while an increase in environmental flows is another.

With levels of leakage in some utilities running around 10 per cent this is an important area of investment to target in a fiscally constrained environment. Repairing leaks through investing in infrastructure upgrades and reducing pressure in mains to avoid bursts can go a long way to saving water in the long term. For example, by the end of 2010-11 Sydney Water had saved about 108,070 million litres of water a year through leak management, with the aim of achieving savings of 145,000 million litres by 2015.

## Building resilience

A new WSSA report (Occasional Paper 27 Climate Change Adaptation and the Australian Urban Water Industry) released in March 2012 supports this view and has made recommendations for urgent Federal and State Government action across the country.

The report found that although the Federal Government had invested well in programs that identified where water assets were vulnerable to climatic events and in research programs such as National Climate Change Adaptation Research Facility (NCCARF), they needed to go further.

WSAA believes the Commonwealth needs to progress initiatives with the States to adapt to climate change and extreme events. It can do this through a coordinated approach to planning, building and reinvesting in critical infrastructure, particularly for water and energy. It is conservatively estimated that around 30 per cent of the underlying infrastructure that Australia relies on for its water supply and sewerage may not be able to cope with severe climatic events in the future, particularly in low-lying areas. Crucial equipment, including pumps and other important assets, need to be moved. The estimated replacement cost of extreme event-exposed water assets is well in excess of \$100 billion.

Successive governments have continued to support policy positions that prohibit the inclusion of some non-rainfall water supply options – including the use of recycled water for drinking purposes. WSAA believes that governments need to remove the policy bans and allow the water utilities to have access to the full range of water supply options. By providing the full cost and benefits for each

option to the community and engaging our customers in a genuine two-way way dialogue, it is more likely that the best fit solution will be chosen for each particular circumstance. Healthy, liveable communities supported by water security are the prime desired outcome and potable reuse is just one of the options available.

Quite often you will hear the refrain ‘get politics out of water’. While this is true for day-to-day decision making and operations of water utilities, the political arena is where community sentiment is voiced. It is the role of water utilities – in fact the water sector as a whole – to better engage with customers and the community. Ultimately, a well-informed and engaged community and customer base will have its voice recognised in the political arena.

It was very pleasing to hear the NSW Minister for Finance and Services, Greg Pearce, say in NSW Parliament recently: “The ongoing long-term water planning for greater Sydney needs to consider all potential demand and supply options. This is industry best practice. ... Such a responsible approach must include options that do not depend on rainfall. This means desalination and water recycling.”

The Water Corporation in WA continues to lead the way in engaging its customers and community in water recycling through an innovative visitors’ centre and discussing openly and transparently all facts of this important water supply option. Now is the time for the east coast to engage with its communities in the same way. We must avoid hasty and potentially expensive decisions when the inevitable dry period is upon us again, possibly tougher than before.



Water manufacture is a key to supplies.

## Urban water

WSAA is working closely with state and national governments including the National Water Commission in the urban water space and is taking a lead role in developing a vision and principles that would fit within the next iteration of the urban water section of the National Water Initiative.

The White Paper to be released in August 2012 will lay down a vision and some initial steps for the industry for the next 20 years. The paper will assess the role of competition and regulation. For such a small country, population-wise, do we really need three sets of regulators for each state and territory? If nothing else, a move towards outcomes-focused regulation of urban water services must be on the agenda.

Some utilities face burdensome regulation, yet the Productivity Commission in 2011 found there had been no abuse of market power by water utilities. Somehow the pendulum needs to swing back to a form of regulation that encourages better customer-focused outcomes and leaves water service providers with freedom to meet those outcomes with an engaged customer base.

Will the recent long-term lease of the desalination plant in Sydney unleash competition in urban water services? Competition naturally drives innovation and innovation should drive more affordable bills for customers. But will those same forces support the objective of healthy, liveable cities and towns? These goals are not naturally convergent, so we expect some challenging thinking ahead.

Water utilities know that customers rely on them to:

- provide safe, clean drinking water;
- provide an efficient sewerage service;

- fix and maintain infrastructure; and
- supply water with acceptable look and taste.

This will continue to be the main focus of all water utilities. However, the additional initiatives have an important role to play in ensuring that Australians live in a sustainable urban environment in the future. It will be a combined and sustained effort across households, the commercial sector, the water utilities and related sectors that will be the key to resilience in the face of a long-term drying trend.

There are exciting opportunities for urban water services ahead. The ability to diversify into other services such as the production of green energy, the ability to provide a complete water service including plumbing, the advent of competition, a fresh look at regulation and the role of innovation, not just technical innovation, in providing affordable water services are just some of the options and pathways on the table. ◀

**MR ADAM LOVELL** has been Executive Director, Water Services Association of Australia, since 2011. He leads national water utility strategy and policy development in areas including climate change adaptation and mitigation, water efficiency, water quality and healthy, liveable communities. He serves on a number of Boards and Advisory Committees including the National Centre of Excellence for Desalination, the Water Reuse Research Foundation, the Global Water Research Coalition, CSIRO Water for Healthy Country and National Water Commission Stakeholder Engagement. He is also a member of the National Health and Medical Research Council Water Quality Advisory Committee. He was previously at Sydney Water for 11 years and Anglian Water in the UK.

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## Why is Murray–Darling water reform so hard?

ated through random water buy-back from willing sellers;

- adopt new innovative water-wise crop-production systems;
- modernise existing on-farm production systems;
- develop new, more efficient business models that may include incentives for the consolidation of land holdings to create efficiencies; and
- reconfigure or relocate irrigation areas that are less efficient or in high salinity impact areas.

The objectives of such a program should be to increase the underlying productivity of irrigation communities within the Basin. In essence, we need to help those that are left in the irrigation industry to do more with what is left as the water reform agenda is rolled out.

We will know success has been achieved in the implementation of a green growth approach in the third decade of the 21st century when rural and regional communities in the Murray–Darling Basin are producing more value – and are therefore more profitable – and the river

systems within which they are operating are considered sustainable.

We really have come a long way despite the hype. What Australia is currently endeavouring to do is world-leading in relation to water policy. The outcome will depend on a negotiated compromise. There is no perfect plan. ◀

**THE HONOURABLE KARLENE MAYWALD** was elected to the South Australian Parliament as the Member for Chaffey from October 1997 to March 2010. She served as a Cabinet Minister from July 2004 until March 2010. Her portfolio responsibilities included The River Murray, Water Security, Small Business, Regional Development, Consumer Affairs, Science and Information Economy, and Assisting the Minister for Industry and Trade. She is most noted for her significant contribution to progressing national reforms to the management of the Murray–Darling Basin and setting the direction for long term water security in SA. Ms Maywald heads Maywald Consultants Pty Ltd, providing water policy and government relations advisory services

# ATSE AND MOST RENEW LONG-TERM MoU

○ The Chinese Ministry of Science and Technology (MOST) and the Academy extended a 30-year arrangement to further science and technology cooperation when they signed a Memorandum of Understanding in Melbourne in May.

The MoU was signed by ATSE President Professor Robin Batterham AO FREng FAA FTSE and Mr Ma Linying, Deputy Director-General of China's Department of International Cooperation.

The MoU was signed at a dinner at University House, University of Melbourne, arranged to mark the visit to Australia of Chinese Vice Minister Madam Chen Xiaoya, who oversees the Department of Basic Research and the Communist Party of China (CPC) Committee of MOST.

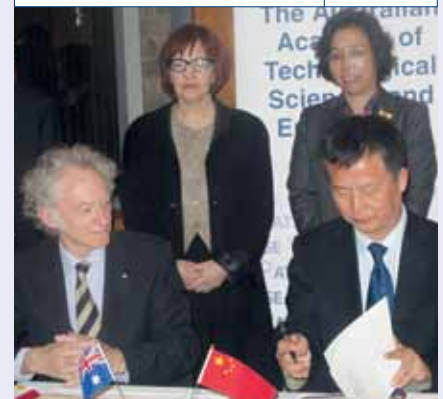
The signing renewed a 30-year relationship which commenced with the signing of the original MoU in April 1982 by the Academy's foundation President, Sir Ian McLennan KCMG KBE FAA FTSE. Subsequent MoUs were signed for ATSE by President Sir David Zeidler AC CBE FAA FTSE (1987), Mr Norton Jackson AM FTSE

(1992), Professor Greg Tegart AM FTSE (1997) and Dr Mike Sargent AM FTSE (2007).

Commenting on the MoU, Professor Batterham said that Australia and China had enjoyed decades of research collaboration in the S&T arena, underpinned by continuing exchanges of high level, mid-career and early-career scientists and students. He noted that China was now Australia's third highest research partner and the Australian research community and the Learned Academies had been at the forefront of this collaborative evolution.

"Over the past 30 years ATSE has demonstrated a unique capability in developing new and enhancing existing science and technology relationships with China through the Ministry of Science and Technology, through the Chinese Academy of Engineering, the Chinese Academy of Sciences, and via our Fellows' formal and informal networks," he said – adding that four per cent of ATSE Fellows spoke Mandarin.

"China is an important part of Australia's political and economic considerations. ATSE



**Signing the MoU – Professor Batterham and Mr Ma Linying, with Professor Mary O'Kane and Madam Chen Xiaoya looking on.**

looks forward to working with MOST to connect world-leading technological science and engineering contacts to enhance research outcomes of greater competitive edge and an investment in fast-tracking innovation."

Apart from Professor Batterham, ATSE was represented at the dinner by Professor Mary O'Kane FTSE, Vice President and NSW Chief Scientist and Engineer; Professor Michael Manton FTSE, Chair, ATSE International Strategy Group and ATSE Director; Professor Min Gu FAA FTSE, Australian Laureate Fellow and Director, Centre for Micro-Photonics, Swinburne University of Technology; and Professor Vaughan Beck FTSE, Executive Director – Technical.

## ATSE Industry Roundtable

The Academy recently held its second Industry Roundtable in Melbourne, hosted by Qantas Chairman Mr Leigh Clifford AO FTSE.

Other Fellows attending included President Professor Robin Batterham AO FREng FAA FTSE, Vice President Dr Susan Pond AM FTSE, CEO Dr Margaret Hartley FTSE, Dr Paul Donohue OAM FTSE, Professor Doug Hilton FAA FTSE, Dr Mark Toner FTSE and Dr John Skeritt FTSE – with industry representatives from Siemens, AiGroup, Rio Tinto and ANZ.

The Roundtable participants contributed frankly to a robust discussion of the challenges facing Australian industry and the ways that ATSE can work to construct a secure and resilient future. The first Roundtable was hosted by Telstra Chair Ms Catherine Livingstone FTSE in Sydney in September 2011 and those attending made strong commitments to work

together to influence the national agenda and become champions for transformation within their respective organisations.

In holding these conversations with highly influential individuals from industry, ATSE aims to identify and support concrete action on the interrelated matters of:

- the decline in innovation and productivity in Australia;
- the deepening skills shortage in technological sciences and engineering; and
- the multi-decade lack of progression of women in these fields to senior executive ranks and Board positions.

In November 2011, ATSE conducted a conference on Productivity, Innovation and Prosperity – the Great Australian Challenge, which highlighted the three key needs for action:

- demystify the term 'productivity' and re-craft a narrative that links innovation, productivity, and competitiveness to the achievement of sustainable economic futures for Australia;
- substantiate the role that science and technology have played and can play in innovation, productivity growth and competitiveness; and
- identify emerging opportunities and technology platforms that can drive productivity improvement in Australia.

In line with its agenda to accelerate productivity, ATSE agreed a target of electing one-half of its new Fellows from industry and one-third women among its annual election of new Fellows from 2012. ATSE also resolved to increase the representation of women on its Board and leadership bodies.

# AUSTRALIA AND KOREA MEET AGAIN ON GREEN GROWTH

○ A team of leading Australian researchers visited Korea in May for a bilateral workshop in Seoul on Impacts of Climate Change on Urban Living, which is part of the growing Green Growth linkages between the two countries.

Professor Ana Deletic FTSE and Professor Geoff Stevens FTSE were the Australian workshop convenors. Professor Deletic is Director, Centre for Water Sensitive Cities at Monash University and Professor Stevens is Associate Dean, Engagement at the University of Melbourne.

Participants discussed urban design and energy policy development and R&D issues, while developing collaborations to access new research, skills, capabilities and infrastructure to accelerate the generation of new ideas and technologies leading to innovation and commercialisation.

They also attended a roundtable meeting at the Yeosu Expo and made other site visits.

This was the third of a series of Korea–Australia Green Growth workshops, with the previous workshops in Seoul and Melbourne progressing low-carbon energy opportunities – highlighting Australia's excellent research base and Korea's key skills in the commercialisation of these technologies.

The meetings were organised by the National Academy of Engineering of Korea (NAEK) and ATSE and funded by the Australian Government through the Australia–Korea Foundation of the Department of Foreign Affairs and Trade; the Korea Australia Foundation, Australian Education International, GS Caltex and the Korean Institute of Energy Technology Evaluation and Planning (KETEP).

The Australian delegation included Professor Michael Manton FTSE, Board Member of Australia Korea Foundation, Chair of ATSE International Strategy Group and ATSE Board Member, from Monash University; Dr David Brockway FTSE, former Chief of the CSIRO Division of Energy Technology; and Dr Sukhvinder Badwal FTSE, Chief Research Scientist and Program Leader, CSIRO Energy Technology.



Dr Sukhvinder Badwal meets the Australian Ambassador to Korea, Mr Sam Gerovich.



Professor Myeong-ju Lee, from Myongji University, and Professor Ana Deletic.

## Green Growth Linkages

The 2011 Australia Korea Year of Friendship highlighted the strong economic, political and strategic partnership shared through common values, mutual interests and recognition of the importance of a low carbon, Green Growth agenda.

Korea is strongly focused on the implementation of a comprehensive strategic approach to green growth, involving industry participation, to achieve a sustainable climate and low carbon environment. Australia is keen to learn more of these

important initiatives and will progress opportunities through its \$10 million contribution to the Korea-led Global Green Growth Institute (GGGI), the Australian-led Global Carbon Capture and Storage Institute (GCCSI) and as fellow members of the G20.

ATSE has considerable expertise and interest in Green Growth strategies – especially in areas such as clean energy and water. ATSE is also involved in an Australian Research Council-funded project Green Growth in Australia: examining the linkages within – and potential of – sustainable resources management to

enable environmentally responsible economic growth. The first part of this project – focusing on water – was completed with the launch in Sydney in May of the ATSE Report *Sustainable Water Management: Australia's future in a green economy*, which received wide news media attention.

# INTERDISCIPLINARY RESEARCH UNDER THE SPOTLIGHT

○ The flaws in the nation's interdisciplinary research efforts came under the spotlight recently when a major report commissioned by the Australian Council of Learned Academies (ACOLA) – consisting of the four Learned Academies – was launched.

Report author Professor Gabrielle Bammer, Director of the ANU National Centre for Epidemiology and Population Health, said the real challenges of interdisciplinary research were not recognised and measures to address the problems were ineffectual.

Professor Bammer said that even though the value of bringing together insights from multiple disciplines and practitioners was accepted, the measures needed to really embed interdisciplinary research in the academic mainstream were not.

"There are two essential problems. First, interdisciplinary research is treated as if it is one entity, when in fact there are very different types of interdisciplinary studies. Second, the methods are never adequately documented,"

Professor Bammer said.

"The support needed is very different for a single researcher who is trying to work across two or three disciplines compared to a big diverse team which engages with stakeholders and end-users. Yet we keep looking for magic bullets that will work for all types of investigations.

"And then there are no standard agreed ways to report on different kinds of interdisciplinary research, which means it is hard to figure out exactly what was done and what methods were used. That impedes learning which can improve investigations in the future."

Professor Bammer said that her report, launched at the Melbourne Business School by Australia's Chief Scientist, Professor Ian Chubb, proposed three bold initiatives.

"One is to develop a classification to distinguish the major kinds of interdisciplinary research. This will allow us to gain a better understanding of what research is being



**At the report launch (from left) Professor Robin Batterham, Professor Robert Williamson and Sir Gustav Nossal.**

conducted," she said.

"Second is to develop an agreed framework for reporting on interdisciplinary research, which identifies the key elements for different kinds of studies. Third is to document the different methods and processes used and to make them available as toolkits of options.

The launch was followed by an interdisciplinary research workshop, with key speakers, including Professor Bammer, from CSIRO, ARC, NHMRC and CRCA. The report is available at [www.acola.org.au](http://www.acola.org.au).

## Emerging technologies can help older people

The mounting challenges of population growth and demographic ageing are strategic priorities for Australia, according to the Academy.

In a recent submission to the Federal Government's Strategic Review of Health and Medical Research (the McKeon Review) ATSE noted that the projected population of 36 million by 2050 would include 7.8 million people over 65 and 1.8 million over 85. This greatly increased cohort of elderly would lead to significantly increased healthcare costs due to higher levels of chronic illness, disability and degenerative diseases.

There was a suite of emerging innovative technologies that offered the prospect of enhanced security, safety, diagnosis, treatment and physical assistance to improve the quality of life for older people and to empower them to remain safely at home, ATSE said.

Over the period 2008 to 2010 The

Academy had conducted a major study resulting in the publication of its 2010 report *Smart Technology for Healthy Longevity* and organised two missions of Australian experts to meet with experts in Europe in October 2009 and in Taiwan in October 2010.

This had resulted in a substantial interest group of professionals in Australia focused on application of a range of technologies in aged care. In Europe and parts of Asia and North America, a new discipline of gerontechnology has been recognised to cover this area and journals and international conferences were now being devoted to this topic.

ATSE suggested there would be substantial advantages in the creation of an Australian network in gerontechnology to engage with international activities but, while the National Health and Medical Research Council (NHMRC) and the Australian Research

Council (ARC) had funded substantial networks in the past, there was now no mechanism for setting up new networks.

The Review is chaired by Australian of the Year and CSIRO Chair, Mr Simon McKeon, and its members include Professor Ian Frazer FRS FAA FTSE.

ATSE noted that about 10 per cent of its 850 Fellows were directly involved or had links to the health area.

It said elderly-friendly housing was critical for coping with the challenges of an ageing population. While a modest start on elderly-friendly housing had been made in Australia, there was a need for the establishment of Centres of Excellence in Elderly-friendly Housing within universities involving medical researchers, design engineers, social scientists and architects, with joint ARC/NHMRC funding support.

# RUN disadvantaged enrolments rising



Peter Lee

○ The Regional University Network (RUN) universities continue to provide increasing support for low socio-economic background students (SES), according to the acting Chair of RUN, Professor Peter Lee FTSE, Vice-Chancellor of Southern Cross University.

Quoting results released by the Minister for Tertiary Education, Skills, Science and Research, Senator Chris Evans, Professor Lee said that most of RUN's universities had shown a significant

increase in the percentage of students enrolled from disadvantaged backgrounds in 2009–12.

"The increase has come despite increasing competition from many metropolitan universities for low SES students," Professor Lee said. "Regional universities have higher concentrations of 'first generation to university' students and low SES students than metropolitan universities.

"RUN's universities teach 16 per cent of all the low SES students

enrolled at Australian universities. Many students choose not to travel, or cannot travel, to capital cities for university education.

"Regional universities play a key role in improving the economic, social, cultural and environmental wellbeing of communities. Fully utilising the potential of a region's resources including its people is an important part of this."

■ *The RUN group consists of Central Queensland University, Southern Cross University, University of Ballarat, University of New England, University of Southern Queensland and University of the Sunshine Coast.*

## MATHS TEACHERS GONE MISSING

○ About 30 per cent of 15-year-old Australian students are enrolled in schools where a lack of qualified mathematics teachers is hindering teaching, the Productivity Commission (PC) has found.

The PC has released a report on school workforce needs in which it highlights a persistent shortage of qualified maths and science teachers. A lack of qualified teachers affects about 24 per cent of secondary science students. These shortages are forcing many schools to use 'out of

## WOMEN IN TSE

### UniSA marks a decade supporting women

○ The University of South Australia is celebrating being named an Employer of Choice for Women by the Equal Opportunity for Women in the Workplace Agency (EOWA) for the 10th consecutive year.

Outgoing UniSA Vice-Chancellor Professor Peter Høj FTSE said the citation demonstrated that UniSA has made family-friendly policies and support for women's careers an integral part of the culture of the university.

"To secure this citation for the 10th year shows there is something more than just ticking boxes about our commitment to women in the workforce," he said. "Supporting women's choices and their needs so that we can enhance their career potential is core to the culture of our institution."

Winner of the gold award for Public Sector Employer of the Year at the 2005 Australian Council of Commerce and Industry and Business Council of Australia (ACCI/BCA)

National Work and Family Awards, winner of the National 'Diversity@work Award' for Work/Life Balance in 2006 and acknowledged as a breastfeeding friendly workplace, UniSA has also been a strong performer in the EOWA citations.

"Each year the bar is raised and each year we also aim higher too and we do that because investment in our people ensures we are in the best position to retain and attract top staff," Professor Høj said.

In addition to the Federal Government's Paid Parental Leave Scheme, UniSA provides 16 weeks at 100 per cent of the staff member's ordinary rate of pay plus an extra 12 weeks at 50 per cent of their ordinary rate of pay.

Under UniSA's phased-in return-to-work provisions, a staff member returning after maternity, adoption or child-rearing leave is able to work a reduced fraction (0.6 for a full-time staff member) and be paid their full-time

salary for a period of eight weeks while they transition back into paid work.

Staff with less than 12 months' service, prior to the expected date of birth or adoption are eligible for a week at 100 per cent of their ordinary rate of pay and a week at half their ordinary rate of pay for each month of service. UniSA also offers 15 days' partner leave. Other benefits include flexible work options for the care of a child where the child is under school age, or is under 18 and has a disability. In the event of the long-term illness of a child, partner or parent, staff can access their entire personal leave entitlement for caring.

Access to unpaid adoption leave has been extended to a child under 16 years of age and UniSA has also introduced pre-adoption leave of up to two days unpaid, to attend interviews and examinations required as part of the adoption process.

field' teachers in those subjects.

Professor Geoff Prince, director of the Australian Mathematical Sciences Institute, is not surprised by the findings. He and other experts have been warning for years about a mathematical crisis in the school system while pushing for initiatives to attract more qualified teachers.

Professor Prince said the PC report identified some important measures for addressing the shortage, including creating more flexible entry requirements for teacher training and offering retraining incentives for current teachers. He noted two-thirds of schools have problems staffing maths classes and the situation is expected to deteriorate as older, experienced teachers retire. He said the 30 per cent figure the PC identified would be higher in rural and regional areas.

A Staff in Australia's Schools survey indicated that at the start of 2010, 400 positions for maths teachers in secondary schools were unfilled.

## MOZZIE MASH A SCIENCE WEEK FEATURE

○ Mashing mosquitoes, maths that make you laugh and a science musical are among the entertaining events to receive funding to explore

serious science during National Science Week 2012.

Through the Inspiring Australia program the Australian Government has invested \$500,000 this year for 38 projects to deliver national, state and community-based festivals and events across Australia. From 11 to 19 August it will celebrate science, maths, engineering and technology.

National events include: the SCINEMA Festival of Science Film, to be held in more than 400 locations; WipeOut! the Energy Evolution musical; and The Fame Algorithm, a stand-up comedy touring six states that challenges perceptions about maths.

"Australians from Sydney to the Kimberley will be entertained and engaged by the variety of events and diversity of topics on offer during National Science Week 2012," said the Minister for Science and Research, Senator Chris Evans. "The lighter side of some events are intertwined with serious science.

"For example, the Mozzie Mash & Mud Pie tour through the Kimberley will ask participants to 'mash' and then test mosquitoes for arbo-viruses. The results will redraw the map of the dispersal of mosquitoes and their viruses across the Kimberley.

In National Science Week 2011, more than 1.4 million people participated in one of more than 1000 events held across Australia.

## Bridging the maths gender gap

○ A concerning gender gap exists in career aspirations among Australian youth across science, technology, engineering and mathematics (STEM) fields, a study has found.

The study, published in *Developmental Psychology*, was the first to compare participation and related occupational planning for STEM careers among senior high-school boys and girls from different country contexts.

Led by Associate Professor Helen Watt from Monash University's Faculty of Education, researchers cross-examined data from Australia, Canada and the US, finding significant gender differences only among Australian youth in mathematics-related career aspirations, with fewer girls aspiring to maths-related careers than boys. The gender gap was attributed to the greater and earlier degrees of choice Australian adolescents have to specialise in their school studies, than in the North American curriculum.

Associate Professor Watt referred to the 'leaky pipeline' – where students drop out of advanced mathematics along various points of their educational trajectory – as concerning.

"The leaky STEM pipeline has become a major area of concern in terms of economic growth in Western countries, particularly if Australia is to compete on the international platform," Associate Professor Watt said. "These findings increase our understanding of when and why girls 'leak' from the mathematics pipeline, in an effort to address the issue in schools."

The findings challenge current conceptions that girls and women opt away from high-prestige mathematical occupations. For girls who did aspire to mathematics-related careers, it was found their planned careers were of equal status to those planned by boys.

An important element of the study

was examining whether the 'leaky pipeline' would have a 'glass ceiling'. That is, whether girls aspiring to mathematical fields of career would not plan on high-prestige jobs.

"This was not the case and girls were found to plan equally as prestigious careers as boys," Associate Professor Watt said. "The gender gap in STEM-related career aspirations should be addressed by nurturing secondary students' interest and demonstrating how maths and science can be useful in the careers girls are most attracted to.

"The relatively early specialisation in secondary school course selections also needs careful thought, timely as the new national curriculum is under consideration."

**"The leaky STEM pipeline has become a major area of concern in terms of economic growth in Western countries."**

# Benchmarking can aid network efficiency

○ Benchmarking of electricity transmission and distribution operating costs could help to improve network efficiency, the Academy has told the Productivity Commission (PC).

Responding to the PC's Electricity Network Regulation Inquiry, the ATSE submission – with key input from Mr Simon Bartlett AM FTSE, Chief Operating Officer of Powerlink, in Queensland, said the key to benchmarking was to have it based on valid technical drivers.

It noted there were proposals by regulators to use benchmarking to compare the costs and efficiency of different network companies and the debate about whether benchmarking should be used solely to compare operation and maintenance cost (normal application) or whether it could also be applied to capital investment costs, which would be a more difficult application due to the differences and scarcity of new projects.

The Academy said there were some key technical aspects that warranted consideration in benchmarking transmission and distribution costs, such as:

- reliability and service standards used to plan network redundancy;
- customer density in the area being serviced;
- the profile of the customer load;
- the mix of large industrial loads and domestic loads; and
- the impact on the design of assets imposed by factors such as the nature of the terrain, climate and vulnerability to cyclones and bushfires.

The Academy suggested benchmarking should be broader than just the National Electricity Market, with consideration be given to including Western Australia and the Northern Territory.

On the topic of interconnection, the ATSE submission noted Australia had one of the world's most geographically dispersed electricity networks, with relatively weak interconnections between the five eastern states that form the NEM and no interconnection to WA or the NT.

While the existing interconnections between the NEM states could constrain the economic dispatch of generation, there was no recent evidence of material congestion causing substantially higher generation costs or threatening the reliability of electricity supply, ATSE said.

The NEM operated under a well-developed regulatory framework that aimed to ensure investment in new interconnectors only took place where there were demonstrable net economic benefits. The framework empowered a range of organisations, processes and publications to facilitate the identification, evaluation, consultation and development of interconnections in a transparent process.

Notwithstanding this framework, there had been virtually no new regulated interconnectors justified (or built) in the 14-year history of the NEM.

The regulatory framework for interconnectors appeared sound, ATSE said, but should it fail to deliver the new interconnectors required for Australia's remote renewable energy generation capability, government funding or other stimulus may be required.

Testing PCC technologies in international collaborations.



PHOTO: CSIRO

## CCS MOVES A STEP CLOSER

○ CSIRO has confirmed that post-combustion carbon dioxide capture (PCC) technology operates effectively under Australian conditions and is now technically available to the industry as the first stage in the carbon dioxide capture and storage (CCS) chain.

The importance of this is that while Australia continues to rely heavily on its low-cost and easy-to-mine coal reserves, technology can be introduced to the sector to reduce its contribution to carbon emissions into the atmosphere. Coal provides some 80 per cent of Australia's electricity, some 17 per cent of export income and approximately 40 per cent of greenhouse gas emissions.

The CSIRO findings follow a four-year \$21 million research program aimed at reducing greenhouse gas emissions from Australian coal-fired power stations.

The program, funded through the Asia-Pacific Partnership (APP) on Clean Development and Climate and supported by a grant from the Department of Resource, Energy and Tourism (DRET), enabled two PCC plants to be successfully established and operated at existing Australian power stations – at Delta Electricity's Munmorah power station in NSW and at Stanwell Corp's Tarong power station in Queensland.

The results showed that the PCC technology, which was able to capture more than 85 per cent of CO<sub>2</sub> from the power station flue gases along with other gases such as sulfur dioxide, could be fitted to both new and existing power stations, had flexible application according to changing consumer demand in the electricity market and could use renewable energy such as solar thermal as a power source.

An important part of the APP program was collaboration among research organisations, technology suppliers and end-users in Australia, Japan, the US, China and Korea to accelerate early adoption of the technology in member countries.

# First Qantas 'cooking oil' flight heralds study

Qantas is conducting a feasibility study into the potential for an Australian sustainable aviation fuel industry, which it announced recently ahead of its first domestic flight powered by sustainable aviation fuel.

Resources, Energy and Tourism Minister Martin Ferguson announced the Australian Government's support for the study on the occasion of Qantas's sustainable aviation fuel flight from Sydney to Adelaide, using a fuel derived from recycled cooking oil.

The fuel – a 50:50 blend of biofuel and conventional jet fuel, certified for use in commercial aviation and supplied by SkyNRG – has a 'life cycle' carbon footprint about 60 per cent smaller than conventional jet fuel.

Government funding for the study, which started in May, will be allocated under the Emerging Renewables Program, while Shell will provide technical support.

Qantas CEO Alan Joyce said the project would explore the conditions needed for the production of aviation biofuel from sustainable sources within Australia.

"Australia has the skills, resources and infrastructure to take a lead in this emerging sector, which CSIRO has estimated could generate up to 12,000 jobs over the next 20 years. But there are also significant challenges, which is why we need to establish a clear plan," Mr Joyce said. "Until sustainable aviation fuel is produced commercially at a price competitive with conventional jet fuel, we will not be able to realise its true benefits. This study aims to tell us how that can be achieved in Australia."

ATSE Vice President Dr Susan Pond AM FTSE, who is adjunct professor in the Dow Sustainability Program at the US Study Centre at the University of Sydney, was a guest on the Qantas flight. Dr Pond's special interest is development of an advanced transportation biofuels industry (see *Focus* 170, page 33).



Susan Pond and senior Qantas flight crew on the inaugural flight.

# SOLAR UPCONVERSION BREAKTHROUGH

Low-cost solar cells suitable for rooftop panels could reach a record-breaking 40 per cent efficiency following an early stage breakthrough by a University of Sydney researcher and his German partners, according to the Australian Solar Institute (ASI). With ASI support, Professor Tim Schmidt from the university's School of Chemistry, together with the Helmholtz Centre for Materials and Energy, has developed a "turbo for solar cells" – called photochemical 'upconversion' – which allows energy that is normally lost in solar cells to be turned into electricity.

Upconversion is a process that harvests the part of the solar spectrum currently unused by solar cells. Professor Schmidt said using the upconversion technique eliminated the need for the costly redevelopment of solar cells.

"We are able to boost efficiency just by forcing two energy-poor red photons in the cell to join and make one energy-rich yellow photon that can capture light, which is then turned into electricity," Professor Schmidt said. "We now have a benchmark for the performance of an upconverting solar cell. We need to improve this several times, but the pathway is now clear."

ASI supports the Australia-Germany Collaborative Solar Research and Development Program, which is open until 29 August. Application materials are available on the ASI website ([www.australiansolarinstitute.com.au](http://www.australiansolarinstitute.com.au)).

The ASI is a \$150 million commitment by the Australian Government to support the development of photovoltaic and concentrating solar power technologies in Australia.

# MELBOURNE UNI GETS CARBON MINI-PLANT

Cutting-edge carbon capture technology has been commissioned at the University of Melbourne, as part of research to cut carbon emissions from power stations. The UNO MK3 carbon capture mini-plant – a CO2CRC project – is part of significant industrial trials of a new carbon dioxide capture process with the potential to substantially reduce the costs of carbon capture and storage (CCS).

"The UNO mini-plant uses a solvent similar to baking soda to separate carbon dioxide from a gas stream, such as the flue gas from a power station," said Professor Dianne Wiley, Capture Program Manager of the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC). "It is much more environmentally friendly than current technology."

Researchers will be able to apply what they have learned to a much bigger system, with the results of the university trials to be applied to industrial pilot trials at IPR-GDF-SUEZ Australia's Hazelwood power station in the Latrobe Valley later this year.

"The major advantage of UNO is the potential reduction of capture costs by 15 to 20 per cent," said Professor Wiley. "At power station scale this could save literally millions of dollars a year and make CCS a far more commercial proposition."

# Liveris launches advanced manufacturing plan

Academy Fellow and one of the world's leading business figures, Dow Chemical's Dr Andrew Liveris FTSE, put manufacturing squarely on the table in Australia recently when he launched Dow's Advanced Manufacturing Plan for Australia.

As co-Chair of President Obama's Manufacturing Advisory



committee in the US, his words carry some weight when he says our resource-export-led growth trajectory is unsustainable and we need to focus on making things, not just selling them.

He called for more investment in innovation, the development of an Australian

venture capital industry of consequence and policies that will advance higher-technology industries – in advanced mining, clean energy, health sciences and agribusiness.

"Australia's way forward is along a technology path – and this is an area in which the Academy can continue to contribute strongly to building a better Australia," said ATSE's President Professor Robin Batterham AO FREng FAA FTSE.

"A key focus for Australia is the linked innovation/commercialisation/productivity issue which this Academy has been addressing strongly and

must continue to address. A major element of this is the development of an advanced manufacturing mindset and capability in this country."

Dr Liveris, President, Chairman and Chief Executive Officer of The Dow Chemical Company, a \$54 billion global chemical, advanced materials, agrosocieties and plastics conglomerate, launched his plan at a University of Technology, Sydney (UTS) lunch.

An advocate for the criticality of manufacturing, he is the author of *Make It in America*, a comprehensive set of practical policy solutions and business strategies for reviving manufacturing.

On the same visit to Australia, Dr Liveris and University of Queensland (UQ) Vice-Chancellor Professor Deborah Terry announced the establishment of the Dow Centre for Sustainable Engineering Innovation at UQ, funded through a Dow contribution worth US\$10 million over the next six years. The centre will pursue an imaginative program of research and collaboration aimed at harnessing solutions designed to confront the big sustainability challenges of the 21st century.

"Dow and UQ are natural partners," Dr Liveris said. "The university's strategic intent and core strengths in science and engineering align well with those of Dow. Dow's culture of discovery and innovation, a focus on advanced manufacturing and new markets, and a commitment to sustainability are closely matched by the new initiatives driven by global sustainability challenges that are defining UQ's strategic direction."

Dr Liveris is a Director of IBM, vice chairman of the US Business Council, vice chair of the Business Roundtable and a member of the President's Export Council. He serves as president and chairman of the Board of the International Council of Chemical Associations.

A UQ chemical engineering graduate, Dr Liveris is the inaugural chair of the UQ in America Foundation. He recently became an international member of the UTS Business School Advisory Board.

■ *The Dow Advanced Manufacturing Plan for Australia is at [www.dow.com/advancedmanufacturing/australia.htm](http://www.dow.com/advancedmanufacturing/australia.htm)*

## ANOTHER \$200 MILLION WLAN WINDFALL FOR CSIRO

CSIRO has successfully settled litigation in the US to license the wireless local area network (WLAN) technology, invented in Australia in the 1990s.

The WLAN technology was invented by a team of CSIRO scientists – Dr John O'Sullivan, Dr Terry Percival, Mr Diet Ostry, Mr Graham Daniels and Dr John Deane – and is now in more than three billion devices worldwide. The team won an ATSE Clunies Ross Award in 2010 for their work and Dr O'Sullivan was awarded the 2009 Prime Minister's Award for Science.

CSIRO first initiated litigation in 2005

and settled major cases in 2009 against 14 companies, recording proceeds of \$205 million for that year. Since that time, additional licences have been granted. CSIRO will receive more than \$220 million from this round of WLAN licensing.

"People all over the world are using WLAN technology, invented right here in Australia, to connect to the internet remotely from laptops, printers, game consoles and smart phones in their homes, workplaces and cafes," said the Minister for Science and Research, Senator Chris Evans, announcing the result. "It's hard

to imagine an Australian-invented technology that has had a greater impact on the way we live and work."

More than five billion products, including laptop computers, smart phones, games devices and consumer media products, will be sold incorporating CSIRO's invention by the time the patents expire in 2013.

CSIRO now has licence agreements with 23 companies, representing around 90 per cent of the industry, with total revenue earned from this technology now more than \$430 million.

# Cluster chases optoelectronic solutions

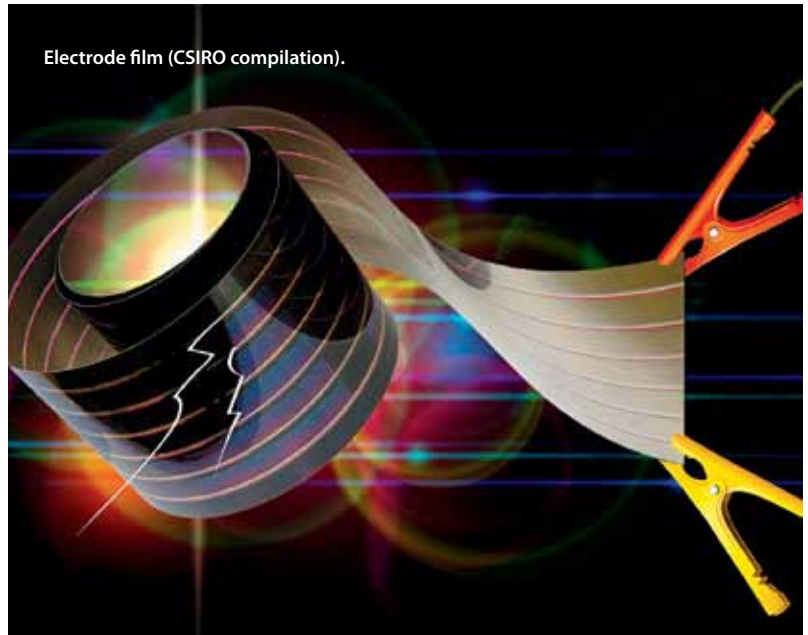
○ A group of leading Australian scientists will collaborate to develop lower-cost flexible optoelectronic solutions that could transform the Australian consumer electronics industry.

The Transparent Electrodes for Plastic Electronics Research Cluster, launched recently, brings together a team of experts from CSIRO and three Australian universities – the University of Queensland (UQ), the University of Technology, Sydney, and Flinders University.

With more than \$3 million in funding contributed to the research cluster by the CSIRO Flagship Collaboration Fund and a further \$3 million from the partnering universities, the project will run until June 2014. Its key goal will be to produce cheap, flexible optoelectronic devices such as displays and lighting based on organic light-emitting diodes (OLEDs), solar cells, plastic electronics and sensors for use in products ranging from plastic solar cells to flexible televisions.

Dr Calum Drummond FTSE, Group Executive of CSIRO Manufacturing, Materials and Minerals, and an ATSE director, said the research cluster provided a new and very unique combination of skills and technical capability in Australia.

"The cluster consists of leading Australian scientists with specialist skills in areas such as nanoscience, thin film deposition and characterisation, chemical physics and electrical engineering," Dr Drummond said.



"This is a novel partnership and one which is essential to the development of new commercial products such as plastic solar cells, solid-state lighting, flexible TV screens, computer displays and beyond."

Organic (plastic) optoelectronics is a fast-growing area with the potential to lead to a "multitude of commercialisation pathways", said Cluster Leader Professor Paul Burn, Director of the Centre for Organic Photonics and Electronics at UQ. "Australia should play a leading role in plastic optoelectronics to give us the best chance for being a net exporter of technologies, rather than an importer."

A major challenge will be to find a robust, processable, cost-effective electrode manufacturing material to replace indium tin dioxide, an expensive, inflexible and fragile material that has been widely used previously, but is projected to be in short supply in 20 years.

## WLAN TEAM FINALIST IN EUROPEAN INVENTOR AWARD

○ The CSIRO team that invented a faster system for wireless local area networking – which later became the foundation of Wi-Fi in its most popular form today – has been named as a finalist in the European Inventor Award 2012.

Inventors Dr John O'Sullivan, Dr Terry Percival, Mr Diet Ostry, Mr Graham Daniels and Mr John Deane have been nominated in the 'Non-European Countries' category of the annual awards for the patented WLAN technology,

The technology, which has given us the

freedom to work wirelessly in our homes and offices, is now estimated to be in more than three billion devices worldwide and expected to be in more than five billion devices worldwide by the time the CSIRO patent expires at the end of 2013.

This is only the second time in the history of the award that an Australian team has been named as a finalist. The EIA is presented in five categories: Industry, Research, SMEs, Non-European Countries and Lifetime Achievement.

Winners of the 2012 EIA will be



**(From left) Monash University Vice Chancellor Professor Ed Byrne, with John O'Sullivan, John Deane, Mr Graham Daniels and Diethelm Ostr, from the WLAN Team receiving their ATSE Clunies Ross Award at the Melbourne Town Hall.**

announced during an award ceremony in Copenhagen in June.

■ The WLAN team won an ATSE Clunies Ross Award in 2010



**Professor Chris Fell at the Australian Embassy reception with two of the delegates – Professor Ian Chen (Deakin University, left) and Professor David Officer (University of Wollongong, right).**

## Nano researchers meet US Defence

More than 30 leading Australian nanotechnology researchers visited Washington for a week-long review program with US Defence research agencies, organised between the Australian National Fabrication Facility (ANFF) and the US Air Force Office of Scientific Research (AFOSR).

The Australian delegation joined their US counterparts and heavyweights in the world of scientific research from the US Air Force, Navy and Army, NASA, National Institutes of Health, Defence Advanced Research Projects Agency and the National Science Foundation.

The delegation included representatives from 17 Australian universities. Participating ATSE Fellows were Emeritus Professor Chris Fell AM FTSE, Professor Mary O'Kane FTSE, Dr Cathy Foley PSM FTSE and Professor Laurie Faraone AM FAA FTSE.

"I am very pleased that we have continued to build upon this relationship through ANFF and that we are on our way to developing a strong framework that delivers Australian research expertise in collaboration with a research powerhouse such as the US Defence forces," said Professor Fell, Chair of the ANFF.

"This reflects the high calibre of our researchers and the value of the world-class infrastructure that ANFF has put in place to support nanotechnology research in Australia."

Australia's Ambassador to the US, Kim Beazley AC, welcomed the delegation with an embassy reception.

"For Australian scientists, international collaboration has always been vital," Mr Beazley said. "We have some unique capabilities and some of the smartest people in the world. But the truth is that no country – not even one the size of the US – can be self-sufficient in science in the 21st century."

During the program, Australian and US researchers shared ideas and expertise on a wide range of nanotechnology topics including high-temperature and lightweight materials, smart sensing, nanoelectronics and data management. The joint program will continue with a further exchange of personnel later in the year to focus on specific project areas.

## £1M QUEEN ELIZABETH ENGINEERING PRIZE

Applications are now open for the new £1 million The Queen Elizabeth Prize for Engineering and close 14 September – but self-nominations will not be accepted.

This global award for engineering, to be administered by the Royal Academy of Engineering, has been established to celebrate outstanding advances in engineering that have created significant benefit to humanity.

The Queen Elizabeth Prize for Engineering aims to attain the stature of the Nobel Prizes and joins a small group of international prizes which have similar aims – the Millennium Technology Prize, with a value of €800,000 to the winner, run by the Technology Academy, Finland, and the Charles Stark Draper Prize, with a value of \$500,000, run by the US National Academy of Engineering.

It will be awarded biennially, the first award being announced in December 2012 and presented in early 2013.

## HIGH SCHOOL ENGINEERING BY UWA

Students at Perth's Governor Stirling Senior High School will learn engineering in Years 8-12 and be encouraged to consider engineering as a future career under a new teaching program being developed with the University of Western Australia.

Students will be exposed to the world of engineering and learn how to find practical solutions to simple engineering tasks with the aim of showing how they can make a mark on the world through further study.

UWA's Faculty of Engineering, Computing and Mathematics – with organisations such as engineering firms Beacon and Sinclair Knight Merz – is working with the school to develop a ground-breaking curriculum and delivery style for a new fully integrated Year 8-12 Engineering Program.

The Dean of the Faculty, Winthrop Professor John Dell, said the new partnership with UWA would also offer a specialist high school engineering program with two streams of student intake: academic and vocational.

"The school is becoming a specialist centre in WA for engineering education," Professor Dell said. "Being a part of this is important because UWA is striving to promote engineering as a career pathway."

"We want to show that engineering is more than calculating an exact answer. It's about sustainability, social impact and environmental responsibility and about finding solutions to the very big problems facing the world – such as climate change, poverty, and the supply of clean water and health services."

Established in 1959, GSSH has a large number of educationally high-achieving students. The school is undergoing a \$63 million building redevelopment program with new facilities due to open next year in time for the first intake of Year 8-12 engineering program students. It is part of the WA Education Department's gifted and talented program.

# Port Botany expansion wins 2012 ACA Award

○ The expansion of facilities at Port Botany for the Sydney Ports Corporation by the Baulderstone–Jan De Nul Joint Venture, was chosen over six other Australia-wide finalists as the most outstanding example of construction excellence at the 2012 Australian Construction Achievement Award in Perth in May.

The \$515 million Port Botany project involved construction of 1.85 kilometres of new deep water shipping wharves, and dredging of more than 11 million cubic metres of material to create new shipping channels and provide fill for the land reclamation operation. The award recognised that the scale and nature of the works required the development of cutting edge solutions in reclamation compaction, seismic engineering and reinforced concrete marine structures. The outcome has set the benchmark for establishing new technical standards in design and construction for future infrastructure projects.

Other finalists were:

- Darra to Springfield Transport Corridor - Stage 1 - John Holland Group: an \$800 million integrated road and rail project for south-east Queensland which involved building a new passenger railway line, a railway station, a bus interchange, as well as an upgrade and duplication of the Centenary Highway from two to four lanes.
- Gateway Upgrade Project - Leighton Abigroup Joint Venture: construction of the second Gateway Bridge over the Brisbane River, refurbishment of the original bridge, construction of a new 7km six-lane motorway north of the bridges, and an upgrade of the 16km Gateway Motorway south of the bridges.
- Inner West Busway, Sydney – Baulderstone: a new city-bound bus lane on the 3.5km section of Victoria Road between the Gladesville Bridge and Anzac Bridge, Sydney, including a 470-metre long bridge across Iron Cove and lane management schemes through Drummoyne and Rozelle.
- National Fibre Program – Leighton Telecommunications: construction of 7800km of optic fibre through all mainland States and Territories to provide the backbone for the National Broadband Network.
- The Hilton Surfers Paradise – Brookfield Multiplex: development of a twin-tower icon building, including re-programming for simultaneous construction of the two towers and implementation of



The Port Botany project.

a Top Down methodology, the first time it was used in such a large scale environment.

- West Gate Bridge Strengthening – West Gate Bridge Strengthening Alliance: Strengthening the fully operational, 2.5km span of the West Gate Bridge in Melbourne, over the navigation channel of Australia's busiest port, to increase traffic capacity from four to five lanes in each direction during peak periods.



Signing the deal – (from left) Professor Paul Johnson, UWA's Energy and Minerals Institute Director Tim Shanahan, Education Minister Liz Constable and Rio's Sam Walsh.

## RIO AND UWA SIGN DEAL ON GRADUATES

○ Global miner Rio Tinto and the University of Western Australia have signed a multi-million-dollar partnership that will focus on creating a sustainable supply of graduates and expertise for the mining industry.

Rio announced that UWA was the first partner in its Global Education Partnerships Program, under which it will invest \$3 million with UWA as part of a long-term objective to foster skills for the future and build education capability. The program will establish a worldwide network of leading universities to generate and foster an appropriate expertise base for the resources industries.

The UWA partnership will be built around a series of education-related initiatives including a strong scholarship framework that will provide support and access to mining related education for more than 40 students. Supporting Rio Tinto and UWA's focus on building a supply of diverse talent, the scholarship framework also aims to encourage more female, international and Indigenous students into these study areas.

UWA Vice-Chancellor Professor Paul Johnson said the partnership would provide a diverse group of scholars with access to real-life work environments and work experience, and increase the University's attractiveness to potential students.

Rio Tinto Executive Director Mr Sam Walsh said the partnership would focus on building career and learning opportunities and establish a capacity of sustainable skills for the future benefit of the industry and the broader community.

In 2012 Rio Tinto introduced more than 300 graduates into its business, joining the 4000-plus graduate and postgraduate staff already employed in the increasingly high-tech operations.



NSW Chief Scientist Professor Mary O'Kane and UNSW Dean of Engineering Professor Graham Davies at the opening.

## Bionic vision gets \$2.5 million boost

○ The University of NSW has begun fabrication of implantable electronics ahead of planned patient tests of a functional bionic eye next year, researchers say.

A \$2.5 million facility opened by NSW Chief Scientist Professor Mary O'Kane FTSE is giving bionic vision researchers – including Professor Nigel Lovell FTSE – the on-campus capability to produce their own medical implants to the highest quality and safety standard.

“Our primary aim is to complete the first prototypes of the bionic eye so they can be tested in human recipients in 2013,” said Professor Gregg Suaning from the Graduate School of Biomedical Engineering at UNSW.

In the international race to develop a functional bionic eye the new facility will give researchers at UNSW an important leg-up.

“The new laboratory gives us the capacity to not only design and test, but to also fabricate novel and intricate bionic implants,” Professor Suaning said. “It will yield enormous potential and promise for future biomedical research and clinical outcomes.”

The upgraded facility will include a clean room and an array of state-of-the-art equipment for building complex microscopic components and testing the performance of microelectronics, said Professor Lovell, joint leader of UNSW's bionic vision research effort.

“The facility also allows the integration of implantable bionics with wearable sensors for telehealth monitoring, underpinning our future research in personal health systems for managing a wide range of chronic diseases,” Professor Lovell said.

Professor Suaning leads development of Bionic Vision Australia's wide-view device, the first of two prototypes aimed at restoring vision in people with degenerative retinal conditions. The key feature of the device is an implant with 98 electrodes, made of biocompatible materials, which will stimulate surviving nerve cells in the retina – a layer of tissue at the back of the eye that converts light into electrical impulses necessary for sight.

## NANOPATCH DEVELOPER WINS GLOBAL AWARD

○ Nanopatch™ vaccine technology developer Vaxxas Pty Ltd has won the prestigious 2012 Best Venture Capital Investment prize, announced at the Vaccine Industry Excellence (VIE) Awards at the World Vaccine Congress in Washington in April.

UniQuest Managing Director David Henderson said the award added to the stellar list of achievements for the emerging University of Queensland vaccine development start-up company.

“We congratulate the Vaxxas team on such a high-profile acknowledgement from the global vaccine industry,” Mr Henderson said.

Vaxxas was launched last August, following an AU\$15 million investment from a syndicate of Australian and international venture capital funds.

The Vaxxas investment, led by OneVentures with co-investors Healthcare Ventures, Medical Research Commercialisation Fund (MRCF) and Brandon Capital Partners, was one of Australia's largest first round start-up investments, the first investment for OneVentures, Brandon Capital and the MRCF in Queensland, and the first investment for Healthcare Ventures in Australia.

## INFRA-RED LIGHT CAN SAVE EYE DAMAGE

○ Treating eyes with gentle infra-red light can help prevent the damage caused by subsequent exposure to bright light, new research has found.

A breakthrough by researchers at The Vision Centre offers hope to people who suffer vision loss due to constant exposure to bright sunlight or artificial lights, such as construction workers, sportspeople, fishers, farmers, welders, actors and entertainers.

Dr Krisztina Valter and PhD researcher Rizalyn Albarracin at The Vision Centre and the Australian National University have shown that pre-treatment with near infra-red light (NIR) prevents a build-up of scar tissue in the retina causing subsequent harm to sight.

“There's a group of cells that look after our vision and work behind the scenes called Müller cells,” Ms Albarracin said. “They act to protect the retina by clearing toxins and inducing healing whenever there is injury to the vision cells. However, when the retina comes under extreme stress, as when it is exposed to intensely bright light and loses a large number of vision cells, the Müller cells can overreact by multiplying and forming scar tissue behind the retina.”

“We found that the treatment with mild NIR successfully inhibits the Müller cells from multiplying and forming scar tissue,” said team leader Dr Valter. “Our findings indicate that it may be possible to pre-treat someone who knows that they will be exposed to bright lights and so reduce the potential damage it can cause.”

# Global Research Alliance meets in Sydney

○ Australia was host recently to a meeting of the Global Research Alliance, where Chief Executives of nine of the world's leading applied research agencies discussed improved access by the developing world to science and innovation.

The members of the Global Research Alliance – which works collaboratively to create solutions to global challenges, such as water, energy, health, food security and digital access across Asia and Africa – are: Battelle (USA), CSIR (India), CSIR (South Africa), CSIRO (Australia), Danish Technological Institute (Denmark), Fraunhofer (Germany), SIRIM (Malaysia), TNO (the Netherlands) and VTT (Finland).

"It has become increasingly clear, to even the most scientifically and technologically advanced nations, that no nation can go it alone and no single country can lead in all fields," Australian Chief Scientist Professor Ian Chubb said.

"The Global Research Alliance is the conduit for us to share the breadth and depth of our collective science and technology resources and skills, and to translate this into affordable and sustainable solutions with positive and lasting impact for people in the developing world."

CSIRO Chief Executive Dr Megan Clark FTSE said it was critical to recognise the importance and benefits of collaboration.

"CSIRO recognises the importance of international collaboration and partnerships in meeting challenges and delivering impact on behalf of Australia," Dr Clark said.

"Internationally, alliances such as the Global Research Alliance mean that the resources and knowledge from across the world can be harnessed to address the challenges that we face as a global community, and enhancing the impacts CSIRO can deliver on behalf of the nation."

## ANSTO RADIOACTIVITY MEASUREMENT CENTRE

○ ANSTO's new \$8.7 million Environmental Radioactivity Measurement Centre at Lucas Heights, Sydney, is the only one of its kind in Australia and will mean Australian environmental scientists will be able to use top quality equipment to obtain world-leading, low radiation readings.

The centre uses ultra-sensitive equipment to provide data for climate change studies and to measure the natural radioactivity of items to ensure they meet strict import and export conditions.

The building's basement facility, enclosed by a 550-kilogram door made from pre-World War II steel and 30-centimetre-thick concrete ceiling, floor and walls to limit interference, houses five gamma spectrometers – tools which will detect traces of radiation in samples from around the world. The new centre features a range of specialised

radiochemistry and environmental monitoring laboratories that can unlock climate records held in sediment cores and tree ring samples.

Opening the new facility the Minister for Science and Research, Senator Chris Evans, said the facility and equipment would ensure ANSTO scientists could continue their work as world leaders in dating and sorting human-induced environmental change from natural change.

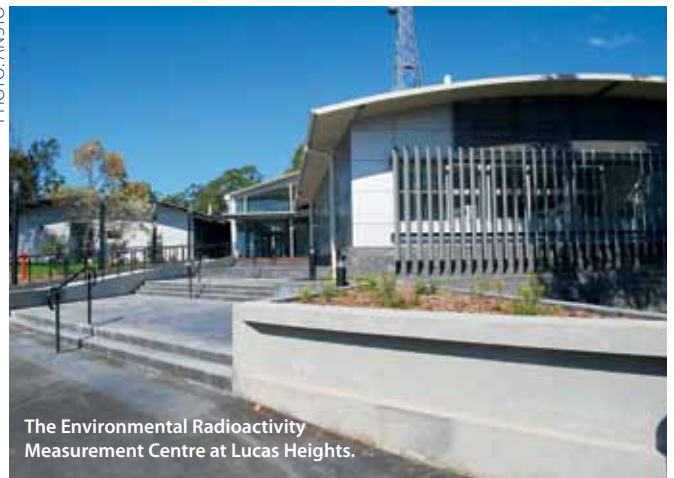
"The ITRAX-Corescanner, a key piece of equipment used to measure environmental samples and the only one of its kind in Australia, will be housed in the new facility and will allow thousands of measurements to be made within a few hours, instead of a few weeks.

"This research will help us predict future impacts on our environment so we can, in turn, develop more sustainable land and water practices to conserve our environment."

Senator Evans said designers and builders had spent months sourcing and analysing materials with the lowest possible levels of natural radiation for the construction of the centre – from cement in Gladstone, Queensland, and fine sand and gravel from Cowra in NSW.

Scientists at the centre have already carried out critical work to control algal blooms in drinking water reservoirs in Australia and in South-East Asia, accurately dated the introduction of toxic algae in South Australian, Tasmanian and New Zealand marine environments and collaborated with the Australian National University to study the frequency of bushfires on several islands in the Pacific.

PHOTO: ANSTO



The Environmental Radioactivity Measurement Centre at Lucas Heights.



Senator Evans being briefed at ANSTO with ANSTO CEO Dr Adi Paterson FTSE behind.



Breads and grains.

PHOTOS: CSIRO



David Topping

## Resistant starch a diet key – Topping

Consumption of resistant starch leads to positive changes in the bowel and could protect against genetic damage implicated in bowel cancer, according to Dr David Topping FTSE, from CSIRO's Food Futures Flagship.

Western diets are typically low in fibre and have been linked with a higher incidence of bowel cancer, he said. Even though Australians eat more dietary fibre than many other western countries, bowel cancer remains the second most commonly reported cancer in Australia, with 30 new cases diagnosed every day.

"We have been trying to find out why Australians aren't showing a reduction in bowel cancer rates and we think the answer is that we don't eat enough resistant starch, which is one of the major components of dietary fibre," Dr Topping said.

These findings, published in *The Journal of Nutrition*, reinforce the fact that dietary fibre is beneficial for human health, but go further to show that fibre rich in resistant starch is even better.

"It's not just the amount of fibre that we eat that's important, but the diversity of fibre in our diet," Dr Topping said. "We studied various sources of resistant starch, including corn and wheat, and the results suggest they could all protect against DNA damage in the colon, which is what can cause cancer."

Dr Trevor Lockett, colorectal cancer researcher with CSIRO's Preventative Health Flagship, said Australia has one of the highest incidence rates of bowel cancer in the world.

"Research suggests that improving our diets could go a long way to reducing our personal risk of developing this disease, which would also have

**Resistant starch is a component of dietary fibre that resists digestion in the small intestine and instead passes through to the bowel where it has positive effects on bowel health. Resistant starch is sometimes called the third type of dietary fibre (in addition to soluble and insoluble fibre) and is found in legumes, some wholegrain breads and cereals, firm bananas and cooked and cooled potatoes, pasta and rice.**

the follow-on benefit of reducing healthcare costs associated with bowel cancer," Dr Lockett said.

"These new studies suggest that increasing the amount of resistant starch in our diets may be one important step along the path to reducing the burden of bowel cancer. It takes about 15 years from the time of the first bowel cancer-initiating DNA damage to the development of full-blown bowel cancer, so the earlier we improve our diets the better."

The recommended intake of resistant starch is around 20 grams a day – equivalent to eating three cups of cooked lentils – which is almost four times greater than a typical western diet provides.

"Currently, it is difficult for Australians to get this much from a typical diet," Dr Topping said. "We have already had success in developing barley with high levels of resistant starch, and now our focus is on increasing the levels of resistant starch in commonly consumed grains like wheat. These grains could then be used in breads and cereals to make it easier for Australians to get enough resistant starch from their diet."

## INSECT SILK VENTURE

CSIRO and global life science industry supplier Lonza have announced a partnership to bring insect silk products to the global market.

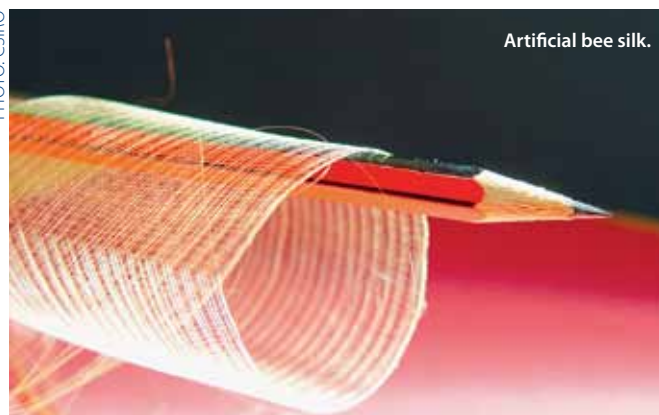
Insect silk is potentially a key component in a wide range of new products and applications under development by the fast-growing biotechnology manufacturing industry due to superior properties such as exceptional strength and toughness. Potential uses include composite fibres for the aviation and marine industries and medical applications including wound repair, drug delivery, and repairing and replacing human tissues such as membranes, ligaments, blood vessels and cartilage.

CSIRO is bringing scientific discovery, biomedical and materials science expertise to the partnership, according to CSIRO Business Development and Commercialisation General Manager, Cameron Begley.

Lonza brings its biotechnology and life-science product and service expertise to the partnership and is already providing process development for the recombinant bee silk protein, said Allison Haitz, Lonza's Head of Global Innovation.

CSIRO and Lonza are working closely to identify further commercial applications and partners for the new insect-silk-based products.

PHOTO: CSIRO



Artificial bee silk.

# CSIRO safflower world's best for oleic acid

CSIRO research has new varieties of the safflower plant containing the world's highest levels of valuable oleic acid in the pipeline for Australian grain growers.

It has produced safflower seed oil that contains more than 90 per cent of this valuable fatty acid, the highest level of purity of an individual fatty acid currently available in any plant oil.

The new safflower type will provide Australian grain growers with a unique opportunity to produce and supply renewable, sustainable plant oils that will replace petroleum-based feedstocks in the manufacture of industrial products.

CSIRO said future global demand for high purity oleic acid oil could require more than 100,000 hectares of this 'super-high' oleic safflower, which

is comparable to the size of the cotton industry in Australia.

Dr Allan Green, Deputy Chief of CSIRO Plant Industry, said this breakthrough safflower oil combines high purity for industrial chemical production with tremendous stability for direct use in industrial lubricants and fluids, creating a versatile, valuable industrial raw material.



PHOTO: CSIRO

Super-high oleic safflower.

"Plant oils contain a range of fatty acids including both monounsaturates and polyunsaturates," Dr Green said.

"For food use it's important to have a healthy balance of these. However, the polyunsaturates cause problems for industrial use because they are unstable and difficult to remove during oil processing."

Dr Green said the team used CSIRO gene-silencing technology to boost the level of desirable oleic acid in the seed by switching off its conversion to the undesirable polyunsaturates.

This new super-high oleic safflower was developed by the Crop Biofactories Initiative, a strategic research and product development partnership between CSIRO and the Grains Research and Development Corporation (GRDC).

Dr Jody Higgins, GRDC's Senior Manager Commercial Grain Technologies, said the breakthrough development could create a new crop industry in Australia, initially suitable for farmers in northern NSW and southern Queensland.

# TOP BRITISH SOIL SCIENTIST AT UWA

A leading UK scientist who helped map the bacterial ecosystems of British soil in a world-first study will join the University of Western Australia in October to lead an expert team in soil rehabilitation research. Professor Andrew Whiteley's work will be funded under the WA Government's Research Fellowships Program, which aims to attract world-class expertise to WA. His UWA research will include examining new ways to rehabilitate degraded mine site environments and increase agricultural production.

"WA represents a globally unique biodiversity hot spot but with strong economic requirements from the environment," Professor Whiteley said. "My research will work at this interface by developing new DNA-based environmental diagnostic technologies as well as developing innovative ways to engage WA residents through 'citizen science' projects."

# GREEN CAP CAN CUT SITE CONTAMINATION

'Phytocapping' – a technique for capping and cleansing old urban landfill sites and mine dumps – has been successfully trialled in South Australia. Phytocapping uses green plants to reduce rainwater flow into old dumps that could release pollution into nearby groundwater and streams or greenhouse gases into the atmosphere. The plants can later be harvested to produce clean energy.

The CRC for Contamination Assessment and Remediation of the Environment (CARE) and technology firm FibreCell Pty Ltd announced the successful demonstration of the technique using a combination of a clay cap and the plant giant reed to seal an old landfill at Salisbury, SA.

Leader of CRC CARE's Prevention Technologies Program Professor Nanthi Bolan explains: "Giant reed reduces the amount of water that enters the old landfill. This in turn reduces organic decomposition, which leads to greenhouse emissions from the landfill, and it prevents toxic chemicals and heavy metals from leaching out of the landfill."

Giant reed grows so fast it could be harvested for electricity or methanol production, or for biochar, he said.

"The growing characteristics of giant reed are well known and understood by FibreCell after seven years of extensive research and trials. This knowledge has enabled them to develop effective management protocols that optimise the beneficial uses of the plant without adversely impacting on the ecosystem."

In other research the 'green cap' of reeds has also proved useful in preventing dust containing toxic minerals from blowing from old mineral processing tailings across inhabited areas, Professor Bolan said.

Australia has an estimated 160,000 contaminated sites, many of them old urban refuse dumps and landfills. Keeping toxic chemicals contained within these sites so they do not affect surrounding communities or wetlands is a major challenge faced by all municipal authorities, CRC CARE Managing Director Professor Ravi Naidu said.



PHOTO: CSIRO

Deploying an Argo float in the Tasman Sea.

## Ocean salinity signals cycle shift

○ A clear change in salinity has been detected in the world's oceans, signalling shifts and an acceleration in the global rainfall and evaporation cycle, according to research by scientists from CSIRO and the Lawrence Livermore National Laboratory, California.

In a paper published in *Science*, they reported changing patterns of salinity in the global ocean during the past 50 years, marking a clear fingerprint of climate change.

**Development of the robotic drifting ocean profiling instrument called Argo has radically changed the amount of information available to scientists on ocean conditions. In a decade, this fleet has grown to more than 3500 Argo floats, which drift freely in the oceans providing oceanographers with measurements of salinity and temperature to depths of 2000 metres.**

Lead author, Dr Paul Durack, a graduate of the CSIRO-University of Tasmania Quantitative Marine Science program a post-doctoral fellow at Livermore, said that by looking at observed ocean salinity changes and the relationship between salinity, rainfall and evaporation in climate models, they determined the water cycle has strengthened by four per cent from 1950-2000.

This was twice the response projected by current generation global climate models. With a projected temperature rise of 3°C by the end of the century, the researchers estimate a 24 per cent acceleration of the water cycle is possible.

"Salinity shifts in the ocean confirm climate and the global water cycle have changed. These changes suggest that arid regions have become drier and high rainfall regions have become wetter in response to observed global warming," Dr Durack said.

Scientists have struggled to determine coherent estimates of changes to the water cycle – the global process of evaporation, transpiration, condensation and precipitation – from land-based data because surface observations of rainfall and evaporation are sparse. However, according to the team, global oceans provide a much clearer picture.

"The ocean matters to climate – it stores 97 per cent of the world's water; receives 80 per cent of the all surface rainfall; and it has absorbed 90 per cent of the Earth's energy increase associated with past atmospheric warming," said co-author, Dr Richard Matear of CSIRO's Wealth from Oceans Flagship.

"Warming of the Earth's surface and lower atmosphere is expected to strengthen the water cycle largely driven by the ability of warmer air to hold and redistribute more moisture."

He said the intensification was an enhancement in the patterns of exchange between evaporation and rainfall – and with oceans accounting for 71 per cent of the global surface area the change is clearly represented in ocean surface salinity patterns.

# Veena joins Climate Commission

○ Professor Veena Sahajwalla FTSE, Associate Dean (Strategic Industry Relations) in the Faculty of Science and Director of the Centre for Sustainable Materials Research and Technology at the University of New South Wales, has been appointed to the Climate Commission.

Professor Sahajwalla has substantial research and development



**Veena Sahajwalla**

expertise in the fields of energy efficiency, sustainable materials and recycling. She invented a process of recycling plastics and rubber tyres in steelmaking. Professor Sahajwalla received the 2011 National Nokia Business Innovation Award at the Telstra Business Women's Awards and has been a judge on the ABC TV program *The New Inventors*.

Announcing the appointment, the Minister for Climate Change and Energy Efficiency, Greg Combet, said: "Professor Sahajwalla has conducted world-leading research in collaboration with major resources companies in Australia. Her understanding of Australian industries together with her expertise in science communication will be valuable additions to the Climate Commission."

Professor Sahajwalla replaces Dr Susannah Elliott, who has stepped down from her role as a Climate Commissioner due to an increase in her commitments with the Australian Science Media Centre.

## BIOGILL BUYS ANSTO WATER TECHNOLOGY

○ Ground-breaking water cleansing technology developed by ANSTO scientists has been successfully commercialised and sold to the private sector. Details of the sale remain commercial in confidence.

BioGill Environmental Pty Ltd, a manufacturing company based in Sydney, has bought the intellectual property for 'BioGill' technology, developed at the Australian Nuclear Science and Technology Organisation (ANSTO), which won ABC TV's *The New Inventors* contest in 2006.

The system has numerous industrial and environmental applications

including the treatment of greywater, sewage and wastewater from aquaculture, and food and beverage processing. The technology also has potential for cleaning water on ships, offshore platforms and remote islands where protecting sensitive environments is essential.

BioGill works by gravity feeding wastewater and greywater over above-ground nano-ceramic membranes, which provide oxygen-rich conditions for bacteria and fungi to multiply, resulting in accelerated treatment using less energy than conventional wastewater treatment systems.

The Minister for Science and Research, Senator Chris Evans, said the sale demonstrated the Australian Government fostered ingenuity then worked to get good inventions out into the commercial marketplace, where they belonged.

## ROBOT WILL MONITOR BRISBANE'S WATER

○ An autonomous robot will be sent into the depths of Brisbane's reservoirs to monitor the health of the city's drinking water.

The \$200,000 underwater robot, which Queensland University of Technology's Institute for Future Environments recently acquired, will enable researchers to take faster and more efficient water quality measurements, using multiple sensors to monitor elements including dissolved oxygen, chlorophyll, salinity, temperature and pH levels.

The robot, which is also capable of taking underwater images, went into action in April on a trial run in Moreton Bay and will later be deployed into water reservoirs.

Two computers are onboard the robot, one to operate the vehicle and its sensors and the other to act as an intelligent 'brain' that processes the gathered information and makes navigational decisions.

Dr Ryan Smith, from QUT's Science and Engineering Faculty, said the vehicle could be deployed for up to eight hours at a time and be programed to follow the same route to compare with previous data collected.



PHOTO: ERIKA FISH, QUT

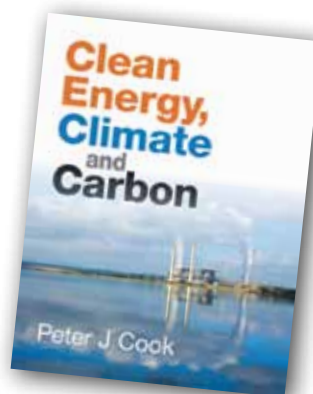
**The robot that will monitor Brisbane's water.**

# This Cook book is really worth reading



By Ian Rae

iandrae@bigpond.com



*Clean Energy, Climate and Carbon*, by Peter J Cook (CSIRO Publishing, 2012, paperback and epub, xiii + 215 pages, \$39.95)

**F**ellows will be familiar with the work of their confrere Peter Cook – he’s the bloke who buried 66,000 tonnes of CO<sub>2</sub> in a depleted gas field in south-west Victoria. So far it hasn’t come back up, and Peter is sure that it won’t.

He knows a lot about why it is important to reduce carbon emissions, and about the various proposals for doing this. Producing less CO<sub>2</sub> is just one of them, and Cook makes a good case that this is not a panacea but will be just part of the portfolio of emission reduction measures, foremost among which will be carbon capture and storage.

I was surprised to find that he is not a whole-hearted supporter of the carbon tax but the reasons emerge as one reads the book. Nonetheless, if the income is used wisely it could fund development of the technologies advocated by Peter Cook (Dr Peter J Cook CBE FTSE, former CEO of the CRC for Greenhouse Gas Technologies).

After introducing his subject, he devotes four chapters

to developing it: CO<sub>2</sub> and climate change; where and why are we producing so much CO<sub>2</sub>; technology options for decreasing CO<sub>2</sub> emissions; and the mitigation mix. Observing that we are looking at decades – not just years – to get solutions in place, he assesses the energy mix in the medium to long term, juxtaposing his views with the different projections of the Intergovernmental Panel on Climate Change and the International Energy Agency.

Renewables will be part of the mix, but probably a minor part because coal will be with us for a long time to come because it is so cheap, even when externalities are considered. Nonetheless, we’ll have to use it smarter and this will cost, but compared to the alternatives – and Cook draws attention to a finding of Australia’s Productivity Commission on “the staggeringly high cost of some existing renewable measures” – it’s not too bad. This part of the book ends with a striking ‘traffic light’ table in which the outlooks for eight technologies, from coal combustion

## ZIM PROBE HELPS MEASURE CLIMATE CHANGE

○ A new device – the Zim probe – could revolutionise botanists’ knowledge of water use and drought stress on native trees by sending continuous data from their leaves to researchers. The Zim probe is being used for the first time to find out how Australian trees cope with drought and climate change.

It is being pioneered in Australia by scientists of the University of Western Australia’s School of Plant Biology, led by Dr Martin Bader. They used a cherry picker to attach about 90 clamps to leaves from jarrah, tuart and banksia trees in Perth’s Kings Park.

Each probe consists of two round magnets smaller than a five-cent piece. The bottom magnet holds a sensor that records clamp pressure and sends data to the internet.

The magnetic force is weakened when the leaf holds a lot of water.

“It’s similar to measuring blood pressure in humans,” Dr Bader said. “Plants feel subtle changes in humidity, light, wind and water availability. This is the first big ecological project using the probe to enable us to record the effects of climate change.”

Dr Bader said 2010 was the driest year on record in south-west WA, followed by one of the state’s hottest summers.

“These extreme events have caused severe crown decline in jarrah and other important woody species of the jarrah forest,” Dr Bader said.

“Until Professor Ulrich Zimmermann in Germany invented the probe, the only way we could measure leaf water in relation to the

environment was destructive. We had to pick leaves and put them in a pressurised vessel to measure plant moisture stress. It was very time-consuming and gave us information only for one particular point in time.

“Transpiration measurements using a different device revealed that on a 40°C day, jarrah mostly closes its leaf pores (stomata) during the late morning to save water. This is bad for photosynthesis, which uses the sun’s energy to convert carbon dioxide into compounds including sugars.

The research, which will help the management of young trees on mine rehabilitation sites and allow predictions of tree responses to climate change, was featured on ABC TV’s *Catalyst* in April.

and nuclear energy to tidal and geothermal energy are rated green (positive), orange (neutral) and red (negative) against nine criteria, including emissions and estimated years to full deployment.

Cook then turns to his main theme, carbon capture and storage, devoting a chapter each to capture, transport, and storage, before addressing the obvious questions, 'How do we know it will be effective?' and 'How much will it cost?' and finishing with the technology and politics of clean energy.

In each of these chapters the existing and suggested alternatives are carefully appraised. Cook does not shy away from the tough issues, such as proposals to capture CO<sub>2</sub> from the atmosphere at large (impractical); wind power (no competitive advantage for its deployment here); renewable energy (comes at a cost that most people are not prepared to pay); nuclear energy (has significant advantages but in the post-Fukushima short term is politically unacceptable); geoengineering such as fertilising the ocean and deep ocean storage (both politically and environmentally unacceptable); the dichotomy of absorption by the ocean (disposes of CO<sub>2</sub> at the cost of ocean acidification); and the poor prospects for algal storage.

Whether the aim is 350, 450 or 550 ppm of CO<sub>2</sub> in the atmosphere, Cook says, we need to take balanced, practical action, and we must begin soon. Despite uncertainty, it would be foolish to defer action. Although he occasionally trots out truisms like "there is no quick fix" and "we are all in this together", Cook backs his assertions with a carefully

argued and brilliantly illustrated text.

In addressing the global challenge, he covers science, technology, environment, overseas and local experience, costs, and political and social issues. In reaching his conclusions he's in good company, to judge by Graeme Pearman's remarks in the April 2012 issue of *ATSE Focus* on biofuels and biosequestration ('sectoral myopia'). Then there is last year's CSIRO report *Unlocking Australia's Energy Potential*, and the Grattan Institute's recently published report on Australia's energy future, *No Easy Choices*, in which the obstacles to deployment of seven low-emission technologies for electricity generation are analysed.

Cook's writing is eloquent and, to a convert like me, persuasive. I hope that decision-makers will take note of his hard-headed advice about the way to produce deep cuts in our carbon emissions: "Without technology, a carbon tax or an ETS is a potentially very expensive and ultimately empty gesture. Without market discipline, unrealistically expensive and ultimately impractical clean energy solutions will be offered by researchers. It is therefore time for scientists, industrialists, economists and politicians to get together in a more meaningful way."

Was it not ever thus? ◀

**PROFESSOR IAN RAE FTSE, an Honorary Professorial Fellow at the University of Melbourne, is a former Technical Director of ATSE. He was President of the Royal Australian Chemical Institute (2006-08) and has served for more than a decade as a technical adviser to the United Nations Environment Program.**

## SEAGRASS A CARBON KEY

○ Researchers at the University of Western Australia have contributed to the first global analysis of carbon stored in seagrasses which shows they can hold as much carbon as the world's temperate and tropical forests.

The study, 'Seagrass Ecosystems as a Globally Significant Carbon Stock', published in the journal *Nature Geoscience*, provides further evidence of the important role the world's declining seagrass meadows have to play in mitigating climate change.

Results gathered from 3640 observations of 946 distinct seagrass meadows across the globe show that coastal seagrass beds store up to 83,000 tonnes of carbon per square kilometre, mostly in the soils below them. In comparison, a typical land forest stores about 30,000t/km<sup>2</sup>.

The research also estimates that, although seagrass meadows occupy less than 0.2 per cent of the world's oceans, they are responsible for more than 10 per cent of all 'blue carbon' stores buried annually in the ocean and rival carbon stores in the extensive peat deposits of mangroves.

UWA Professors Gary Kendrick and Carlos Duarte contributed to the study led by Dr James Fourqurean, a professor of biology at Florida International University.

"These results show that seagrass meadows are key sites for carbon storage and probably are far more important as carbon dioxide sinks than we realised," Professor Kendrick said.

Seagrasses are among the world's most

threatened ecosystems. About 29 per cent of all historic seagrass meadows have been destroyed, mainly due to dredging and degradation of water quality and a further 1.5 per cent of seagrass meadows are lost each year.

PHOTO: RACHEL SUSSMAN

A seagrass bed.



## Peter Høj to head UQ

Professor Peter Høj FTSE, Vice-Chancellor and President of the University of South Australia since 2007, has been appointed VC of The University of Queensland.



**Peter Høj**

He is a former Chief Executive Officer of the Australian Research Council and Managing Director of the Australian Wine Research Institute. His current roles include Deputy Chair and Lead Vice-Chancellor (Research) of Universities Australia, and board member of CSIRO.

The UQ Chancellor, Mr John Story, congratulated Professor Høj, saying he will continue to build UQ's momentum as a leader in learning and discoveries that have far-reaching impacts.

"Professor Høj has excellent credentials to lead a large and complex organisation that competes and collaborates in global learning and research, and which has extensive links with government, industry and non-government partners. He will expand a tradition of Vice-Chancellors who have elevated UQ's national and international stature, and have overseen tremendous contributions to the Queensland, Australian and international communities."

Professor Høj said he was honoured to be granted the opportunity to lead a research-intensive institution of UQ's stature.

"I look forward to working with UQ staff, students and alumni to further enhance the university's already

excellent global reputation for learning, research and outreach activities across a full spectrum of academic disciplines," he said.

Professor Høj has a Master of Science, PhD and Honorary Doctorate from the University of Copenhagen, Denmark. He has served on the Prime Minister's Science, Engineering and Innovation Council and his many awards include the Boehringer-Mannheim Medal from the Australian Society for Biochemistry and Molecular Biology.

He was recently appointed a Foreign Member (Natural Sciences Class) of The Royal Danish Academy of Sciences and Letters.

He expects to take up his new appointment at UQ by 1 November.

## David Lindsay in Hall of Fame

Professor David Lindsay AO FTSE was one of three agricultural trailblazers recognised for their decades of leadership by being inducted into the Western Australian Agricultural Hall of Fame.

A University of WA Emeritus Professor, David Lindsay spent more than 30 years bridging the gap between science and agriculture as a teacher and researcher at UWA, with a strong focus on sheep breeding.

Professor Lindsay said a highlight of his long career was bridging the communication gap between scientists and farmers.

"It was so refreshing and rewarding,

particularly as a scientist, to be working with people on whom you can try out ideas," he said. "In many cases I found that the team I was involved with actually got their first ideas from farmers just sitting around the kitchen table having morning tea or yarning over the yards.

"Agriculture needs science and science needs agriculture," he said. "They should not be considered two separate things."

Retired dairy farmer Lou Giglia and vegetable grower and exporter Nicolas Trandos were also inducted into the Royal Agricultural Society of WA's Hall of Fame.

## Mike Sargent joins Clean Energy Regulator

Dr Michael Sargent AM FTSE, Director at the Australian Energy Market Operator and former Deputy Chair of the ATSE Energy Forum, has been appointed to the Clean Energy Regulator (CER).

Along with former National Water Commission Chair, Ms Chloe Munro – who is the new CER Chair and Chief Executive Officer – Dr Sargent and Ms Jennie Granger will assist in setting the strategic direction of the CER and making key regulatory decisions.

The Clean Energy Regulator is part of the Government's Clean Energy Future Plan. It will be responsible for administering the carbon pricing mechanism, the National Greenhouse Energy Reporting Scheme, the Renewable Energy Target, the Australian National Registry of Emissions Units and the Carbon Farming Initiative.

Ms Granger has a wealth of public sector experience including working as a Second Commissioner at the Australian Taxation Office.



**Mike Sargent**



**Hall of Fame inductees (from left) David Lindsay, Lou Giglia and Nick Trandos.**

# Four Fellows join Academy of Science

Four ATSE Fellows are among the 21 eminent science leaders elected new Fellows of the AAS.

They are Dr John Church FAA FTSE, Professor Tanya Monro FAA FTSE, Winthrop Professor Stephen Powles FAA FTSE and Professor Michael Tobar FAA FTSE.

Dr Church, from CSIRO Marine and Atmospheric Research, was acclaimed for "investigating oceanic climate change indicators and providing pre-eminent expertise on the rate of sea level rise in the 20th century".

In a career spanning more than 30 years in Australian climate and ocean science, Dr Church's research interests have increasingly centred on sea-level rise and has helped generate a new benchmark in understanding the science and issues of sea-level rise.

Hobart-based Dr Church is a CSIRO Fellow and leads the Coasts and Sea-level Team in CSIRO Marine and Atmospheric Research. His latest book publication, released in August 2010, is *Understanding Sea-Level Rise and Variability* (Wiley-Blackwell). Dr Church is the lead editor, with the book identifying the major impacts of sea-level rise, assessments of past sea-level change and all the factors contributing to sea-level rise, as well as how extreme events might change.

Professor Monro, from the Institute for Photonics and Advanced Sensing, University of Adelaide, was honoured for "developing nanophotonics for nonlinear optics and sensing, resulting in novel solutions to diverse measurement problems".

Professor Monro is an ARC Federation Fellow, Director of the Institute for Photonics and Advanced Sensing (IPAS) and the Director of the Centre of Expertise in Photonics at the University of Adelaide. She is a member of the South Australian Premier's Science and Research Council and regularly serves on a range of committees for the Australian Research Council (ARC) and other key national bodies in the area of



Stephen Powles

science policy and evaluation.

Professor Monro won the 2012 Pawsey Medal, the 2011 Scopus Young Researcher of the Year, for Physical Sciences, and was named 2011 Australian of the Year (SA) and 2010 SA Scientist of the Year.

Professor Powles, of the School of Plant Biology, University of Western Australia, was noted for "foreseeing the problem of herbicide resistance and pioneering herbicide-resistance science internationally".

Professor Powles, Director of the Australian Herbicide Resistance Initiative, has edited two books and is an international authority on all aspects of herbicide resistance from a basic biochemical understanding of how plants evolve resistance, through to practical on-farm management. One of the world's most highly cited plant scientists, he is also interested in the generation of new knowledge through to application in cropping systems.

A Fellow since 1999, Professor Powles is a member of the Australian Society of Plant Biology, the Weed Science Society of America, the European Weed Research Society and the Australian Society of Antimicrobials, and has won a number of national and overseas awards.

Professor Powles was previously Chief Executive Officer, Australian Weed Management CRC, Adelaide. In May he will be a plenary speaker at a US National Academy of Sciences summit in Washington on herbicide-resistance problems, then travel to Argentina for a South American summit on herbicide resistance.

Professor Tobar, from the School of Physics, University of WA, was acclaimed for



John Church

"pioneering the development of devices for precision frequency generation and measurement, including in space".

He is an ARC Laureate Fellow and winner of the National Measurement Institute's 2009 Barry Inglis Medal for precision measurement and the 2006 Boas Medal presented by the Australian Institute of Physics. His research interests encompass the broad discipline of frequency and quantum metrology, precision measurements and precision tests of the fundamental of physics. He is also the focal point of Australian participation in space experiments involving precision clocks and oscillators.

A Fellow since 2008, Professor Tobar is a Fellow of the IEEE and has been cited by the Australian Learning and Teaching Council for inspiring research students to reach their full potential and transform to successful research scientists through participation in ground-breaking research.

## Drew Clark on ARENA Board

Mr Drew Clarke PSM FTSE, Secretary of the Department of Resources, Energy and Tourism, has been appointed to the Board of the Australian Renewable Energy Agency (ARENA).

Mr Greg Bourne (acting Chair) and Dr Brian Spalding have also been appointed to the Board. Mr Bourne is a former director of Carnegie Wave Energy and Dr Spalding is a current Australian Energy Market Commissioner with more than 30 years' experience in power system operations.



Anton Middelberg

## AIBN wins Gates Grand Challenge funding

The University of Queensland's Australian Institute for Bioengineering and Nanotechnology (AIBN) has won a grant as a Grand Challenges Explorations winner, an initiative funded by the Bill & Melinda Gates Foundation.

AIBN Professor Anton Middelberg FTSE will pursue an innovative global health and development research project titled 'A transformational vaccine platform for the grand challenge of rotavirus'.

Grand Challenges Explorations funds individuals worldwide to explore ideas that can break the mould in how we solve persistent global health and development challenges.

Professor Middelberg's project is one of more than 100 Grand Challenges Explorations grants announced in May by the Bill & Melinda Gates Foundation.

To receive funding, Professor Middelberg and other Grand Challenges Explorations winners demonstrated in a two-page online application a bold idea in one of five critical global health and development topic areas, which included agricultural development, immunisation and nutrition.

Professor Middelberg's research project aims to deliver a new vaccine against rotavirus using virus-like particles (VLPs) – synthetics that mimic the virus. VLPs have a long history of safe use for other diseases, but are manufactured in cells using complex and costly approaches. Professor Middelberg aims to make a rotavirus VLP in a reactor instead of cells. In this way, he hopes to develop a new manufacturing technology for VLPs that can be used throughout the developing world.

"This approach may revolutionise

vaccine development in the same way that Henry Ford revolutionised the car industry," he said. "Vaccine components are designed and quality-controlled – and only then assembled into a complex product.

"This approach ensures that components which compromise product safety are removed from the assembly line, making manufacture cheaper and more robust."

UQ's Queensland Alliance for Agriculture and Food Innovation (QAAFI) also was named a Grand Challenges Explorations winner, under which Dr Neena Mitter and colleagues from AIBN will pursue an innovative global health and development research project, titled 'BioClay – crop protection against biotic stresses from field to market'.

Dr Mitter and her colleagues propose to design and develop 'BioClay' technology to deliver biological agents targeting plant pathogens. If successful, the 'BioClay' technology offers smallholder farmers a safe, low-cost and environmentally sustainable solution for managing field and postharvest diseases.

*Grand Challenges Explorations is a US\$100 million initiative funded by the Bill & Melinda Gates Foundation. Launched in 2008, more than 600 people in 45 countries have received Grand Challenges Explorations grants. The grant program is open to anyone from any discipline and any organisation. The initiative uses an agile, accelerated grant-making process with short two-page online applications and no preliminary data required. Initial grants of US\$100,000 are awarded twice a year. Successful projects have the opportunity to receive a follow-on grant of up to US\$1 million.*

## David Sparrow led the nation's barley breeding

Dr David Sparrow, a Fellow since 1984, was acknowledged as the doyen of Australian barley breeders. He died in Adelaide in March, aged 84.

Dr Sparrow, who retired in 1992 from the Waite Agricultural Research Institute in Adelaide as a Reader in Plant Breeding, was born in England and graduated in agricultural botany from Reading University before coming to Australia.

Following graduation he spent eight years working in the UK at the National Institute of Agricultural Botany and the National Agricultural Council's Plant Breeding Institute before joining the Waite Institute, part of the University of Adelaide, in 1960.

Over the next 32 years, working at Waite, he became renowned as a barley breeder, winning the 1979 Urrbrae Medal and the 1990 Farrer Medal. He was a member of the Institute of Brewing, the Australian Institute of Agricultural Science and the Crop Science Society.

His citation for Fellowship in 1984 noted that in the 23 years since he established the barley program at Waite it had become the largest and most active Mediterranean climate breeding program for barley and resulted in the release of several new barley varieties.

"Dr Sparrow is the doyen of Australian barley breeders. His variety Clipper has had a major influence on barley production over the past decade, increasing barley yields by at least 15 per cent – and the quality of the grain was responsible for re-opening the German market.

"Dr Sparrow's breeding, quality and scholarly studies are an outstanding contribution to the agricultural and brewing industries."



David Sparrow

# John Skerritt to head TGA

Dr John Skerritt FTSE has been appointed National Manager of the Therapeutic Goods Administration (TGA), which is responsible for regulating therapeutic goods including medicines, medical devices, blood and blood products.

Dr Skerritt, who has a PhD in Pharmacology and is an adjunct Professor at the University of Queensland, is currently the Deputy Secretary of the Victorian Department of Primary Industries.

Announcing the appointment, the Secretary of the Commonwealth Department of Health and Ageing (DoHA), Professor Jane Halton, said Dr Skerritt would bring to the TGA extensive experience in medical, agricultural and environmental policy, regulation, research, research management, technology application and commercialisation.

"Dr Skerritt currently leads more than 1200 staff (including 700 regulatory staff in two major science-based regulatory divisions) and has more than 17 years' experience managing laboratory programs and operations in diagnostics, cell culture, biomedical instrumentation, chemistry and biochemistry," Professor Halton said.

"He also has recent experience in the regulatory reform of veterinary drugs and agrochemicals, which includes chairing a national committee of Commonwealth and State Regulators."

Dr Skerritt is the former Deputy CEO of the Australian Centre for International Agricultural Research (a Commonwealth statutory authority) and a two-term Ministerial appointee on the Gene Technology Technical Advisory Committee of the Office of the Gene Technology Regulator.



**John Skerritt**

He has experience on Boards of international and national organisations and more than 25 years' experience in negotiating and leading major technical and commercial collaborations with OECD and Asia-Pacific countries. He took up the position at the TGA at the end of May.

Dr Skerritt has also been selected by The Rotary Foundation Trustees to receive Rotary's 2011-12 Global Alumni Service to Humanity Award. This award is given each year to a Rotary Foundation alumnus whose achievements have enriched his or her profession and whose service to humanity exemplifies the spirit of Rotary. This is the highest honor the Foundation gives to its alumni. Dr Skerritt accepted the award at the Rotary International Convention in Bangkok in May.

## Mary O'Kane on NICTA Board

ATSE Vice President and NSW Chief Scientist and Engineer, Professor Mary O'Kane FTSE, has joined the Board of NICTA (National ICT Australia Ltd), Australia's Information and Communications Technology Research Centre of Excellence.

Professor O'Kane is a distinguished scientist and educator, with a long history of supporting innovation, science, energy and information technology transfer.

She chairs several key boards and committees. From 1996 to 2001, she was Vice-Chancellor of The University of Adelaide.

"It is with great pleasure that I accept a place on the NICTA Board," Professor O'Kane said. "NICTA is integral to Australia's future economic growth. Its cutting-edge research and development is significantly improving productivity across a number of industry sectors, including transport and logistics, environment and security, health and the digital economy. I look forward to contributing to the organisation's continued success."

She is joined on the NICTA Board by



**Mary O'Kane**

former Victorian Minister Theo Theophanous, who had a long career in public life as a Victorian Member of Parliament for 22 years and as a Minister for seven years. He held various portfolios, including Industry and Trade, Information and Communications Technology (ICT) and Energy and Resources.

## Erol Harvey wins technology award

Dr Erol Harvey FTSE, Founder and CEO of MiniFAB (AUST) Pty Ltd, has been named the Victorian Manufacturing Hall of Fame's 2012 Enabling Technology Entrepreneur of the Year.

The award recognises Dr Harvey's contribution, leadership and achievements in embracing enabling technologies in manufacturing. Victorian Minister for Manufacturing, Exports and Trade Richard Dalla-Riva announced the 2012 Victorian Manufacturing Hall of Fame winners at an awards ceremony in May.

Dr Harvey has been involved in the commercial and scientific development of micro- and nanotechnology for more than 20 years. In addition to founding MiniFAB in 2002 with Michael Wilkinson, he has held a variety of roles in industry and academia, and founded the Australian CRC for Microtechnology. He serves on a number of professional committees, including the Australian Government's Future Manufacturing Industry Innovation Council.

His award comes one year after MiniFAB received the Victorian Manufacturing Hall of Fame's 2011 Enabling Technology Company of the Year award for successfully building an international track record as a specialist in the design, integration and manufacture of polymer micro engineered systems.



**Erol Harvey**

# Nancy Millis turns 90 – and celebrates

The University of Melbourne community recently celebrated Nancy Millis's 90th birthday and her significant contribution to agricultural science. Annie Rahilly reports in this article, reprinted from the university's *VOICE* publication.

Most days Emeritus Professor Nancy Millis AC MBE FAA FTSE arrives at her office at the University of Melbourne at approximately 9.30am. She drives from her home in Brighton to the university for a full day's work. Professor Millis recently celebrated her 90th birthday. It is a stage in life when she can say and do whatever she likes!

Her office at the Department of Microbiology and Immunology is testament to a life of learning, teaching and research. On top of a pile of journals and papers is a much-thumbed copy of the *Concise Oxford English Dictionary*. By her own admission, Professor Millis is not a strong speller and her cherished volume offers instant comfort.

While not opposed to technology that assists with communications (such as a computer), Professor Millis maintains that nothing replaces the value of people talking to one another. "I want to see the whites of peoples' eyes," she says.

Professor Millis has had a long and distinguished career in industrial microbiology, particularly the science of fermentation, used to make beer and cider. She has been recognised and honoured by nations and peers alike for her work in developing courses, maximising links between universities and industries, and for a lifetime devoted to science and innovation.

At the moment, Professor Millis is busy examining several issues. She has a long-standing

interest in water quality and quantity. She is keeping an eye on the water industry that oversees the water we drink and its uses in agriculture.

Her other current passion is Parks Victoria where she is keen to witness the science that Park Managers can bring to bear on how our parks are managed. She applauds the fact that 15 per cent of the surface area of Victoria is national park and argues that governments should be allocating appropriate resources to enable effective management. Her passions are topics that are of international as well as local importance.

Professor Millis is quick to pay homage to the teachers (all men in her day) at the

University of Melbourne who inspired her in the first instance and made her a critically inquisitive person. The university fostered an entry into the world of research and to this day, she maintains that "research is about the sharing of knowledge".

This commitment to research was established early in her career when she travelled to Japan in the 1960s and collaborated with an American bioengineer and a Japanese chemical engineer to create the first course and textbook in biotechnology.

"I went to Japan to work on continuous culture and quickly established that much could be achieved by the combination of our various talents and interests," she says.

As she reflects on her 90 years of innovative research and intrepid travels to some of the most inaccessible locations (including working in Papua New Guinea in the 1940s), Professor Millis remains enthusiastic about the wonders of this age. Medical care and good health are examples of the marvels of scientific advances that she welcomes.

Walking around the university, she is glad to see many young women on campus. She

celebrates the achievements of women in academic life generally but in particular women entering science. "I am here to spread the word. Science advances only as long as new hypotheses are put forward."

At the distinguished age of 90, after an impressive academic career as a scientist and trailblazer, Emeritus Professor Millis insists that her story and journey is not unusual. It is now up to the next generation of women academics to continue on the path she has prepared.

• Professor Millis joined the Academy in 1977 and served on the ATSE Council (1979–82) and ATSE Crawford Fund Management Board (1994–2001). She is a former Chancellor of La Trobe University.

Nancy Millis celebrates with staff.



# Norton Jackson a strong Academy supporter

The recent death in Adelaide of Academy stalwart Mr Norton Jackson AM FTSE brought to a conclusion a remarkable career in the resources industry spanning some 70 years and much of the world.



Norton Jackson

Mr Jackson, a Fellow since 1981, died in Adelaide on 2 May, aged 93. He was a renowned supporter of the Academy. He served twice on the ATSE Council (1983–87 and 1992–96) and was the inaugural South Australian Division Chair from 1984–87 and again in 1992–94. He was a strong backer of the Academy's international program.

He was widely travelled in his career and later as a member of the China/Australia Joint Science and Technology Commission from 1991 to 1998, during which he frequently visited South-East Asia, China and Latin America.

Mr Jackson was a graduate of the School of Mines and Industries and the University of Adelaide (1936–42), with Diplomas in Applied Science and Mining and a Bachelor of Engineering in Metallurgy. He was the Klug Medallist in his final year of undergraduate engineering studies. He was awarded a Master of Engineering by the University of Melbourne in 1964.

Following his tertiary studies, Mr Jackson enlisted in the Australian Citizen Military Forces in 1942 and was commissioned Lieutenant in April 1943. He was then seconded to the Second Australian Imperial Force. He served in Australia, New Guinea and New Britain from 1943 until February 1946.

He joined the Emperor Mining Co in

Fiji and worked as a Research Chemist and in Production Control from 1946 until 1948, when he was appointed Chief Metallurgist at the SA Department of Mines until 1957, when he joined the American Cyanamid Company. He rose from Field Engineer to the position of Regional Director, Hong Kong, then, based in the US, heading Cynamid's Eastern Region and Europe Africa operations. From 1976–77 he was Managing Director of Cynamid BV, based in Holland and was responsible for the manufacturing and sales activities of the company's industrial products in Europe and Africa.

In 1978 he was appointed Managing Director of the Australian Mineral Development Laboratories. He held this position until mid-1983, before accepting positions as Director of Aberfoyle Ltd, Poseidon Ltd and Adelaide Wallaroo Fertilizers Ltd.

Mr Jackson was a Chairman of Norminco Ltd and Director of SX Holdings, Centrex Resources and Australasia Gold Ltd, as well as Muswellbrook Coal and Energy and Bathurst Coal and Power. He was a Member of the Major Development Panel of the Department of Transport and Urban Planning for the SA Government. He served as a Member of the Australian Mineral Foundation Council and Executive Committee from 1978–99.

He was an active supporter of the University of SA, serving on its Council (1995–98) and a member of its Development Board for several years. He was awarded an honorary doctorate by the university for his "distinguished contribution to the knowledge and understanding of a branch of learning which gives the candidate authoritative standing and general recognition by scholars in the field".

An alumnus of one of its founding institutions, the SA School of Mines and

**"On my return to Australia in 1970, Norton was one of the first people I met. He made a wonderful impression and subsequent interactions always reinforced that early impression. One of Australia's marvellous heroes is no more and we mourn his passing."**

– Professor Batterham

Industries, he recently established the Norton Jackson Material Science and Engineering Medal for graduates of the Ian Wark Research Institute at UniSA. The inaugural winner in 2011 was Dr Karyn Jarvis. Several Academy Fellows, apart from Mr Jackson, have been contributors to the Norton Jackson Medal fund, including Professor Robin Batterham AO FREng FAA FTSE, Dr Ian Chessell, Mr Robert Champion De Crespigny AC FTSE, Dr David Klingberg AO FTSE, Professor John Zillman AO FAA FTSE, Dr Ian Gould AM FTSE and Dr Ian Duncan FTSE.

Professor Batterham, President of the Academy, noted "the great esteem we hold him in and our gratitude for so much support and insightful contributions over so many years".

"On my return to Australia in 1970, Norton was one of the first people I met. He made a wonderful impression and subsequent interactions always reinforced that early impression. One of Australia's marvellous heroes is no more and we mourn his passing," Professor Batterham said.

Mr Jackson was a Fellow of AusIMM, RACI, AICD and the American Institute of Mining, Metallurgical and Petroleum Engineering.

**An alumnus of one of its founding institutions, the SA School of Mines and Industries, he recently established the Norton Jackson Material Science and Engineering Medal for graduates of the Ian Wark Research Institute at UniSA.**

# Bruce Grey on Clean Tech Investment Committee



Bruce Grey

Mr Bruce Grey FTSE has been appointed to an independent expert committee to help Innovation Australia deliver the \$1 billion Clean Technology Investment programs.

The seven-member committee of leading technology figures will assess applications by businesses for funding under the two Clean Technology Investment programs: the \$800 million Clean Technology Investment Program and the \$200 million Clean Technology Food and Foundries Investment Program. Both programs encourage manufacturers to invest in energy-efficient capital equipment and low-pollution technologies.

Mr Grey was Managing Director of the Bishop Technology Group Ltd prior to becoming Managing Director of the Advanced Manufacturing CRC. He has extensive experience in general management of engineering and manufacturing companies. He has been an Executive Director of two Australian public companies, and for 10 years, until 2009, was Chairman of a German joint venture between Bishop and Mercedes-Benz Lenkungen GmbH. He has more than 20 years' experience in managing industry R&D and more than 30 years' experience in international commercialisation of Australian innovation.

He has been directly responsible for creating new manufacturing facilities in Germany, Thailand and South Korea and indirectly the US, all based on Australian innovation. Over this period he also negotiated licence agreements in Japan, China, South Korea and the US yielding in excess of \$100 million in royalties and licence fees. In 2001 he negotiated with Daimler AG to purchase a minority stake of 30 per cent in Bishop.

Mr Grey was Group General Manager of Clyde Industries Ltd from 1985–95. In 2001 Mr Grey became a member of the Industry Advisory Network at the University of Technology, Sydney, serving as Chairman for two-and-a-half years.

In 2005 he was also appointed Chairman of the Federal Government's Advanced Manufacturing Action Agenda. He is currently Chairman of the IP and Commercialisation Committee for the Murdoch Children's Research Institute. He is also Chairman of the Victorian Government's Small Technology Industry Uptake Program, Expert Advisory Panel.

Other appointees include:

- Dr Bruce Godfrey, Principal and Director of the Wyld Group, who is on the Committee of ATSE's Energy Forum and the Steering Committee for Stage 2 of the ARC-LASP Green Growth Project (focus on energy); and
- Mr Nixon Apple, Industry and Economic Adviser with the Australian Manufacturing Workers' Union, who was a panellist at the Academy's seminar Productivity, Innovation and Prosperity – the Great Australian Challenge in Melbourne last November.

## Alan Cook renowned as a petrologist

Dr Alan Cook FTSE, the Foundation Professor of Geology at the University of Wollongong (UoW), who died in Wollongong last November at 76, was internationally renowned for his work on the geology of fossil fuels

A Fellow since 1989, Dr Cook held the

post at UoW from 1973 until his retirement in 1990 and was subsequently a consultant organic petrologist/geologist.

Born in Newcastle-on-Tyne and educated at Cambridge, following graduation he served as a prospecting officer, National Coal Board (1957–59), experimental officer, CSIRO Coal Research Section (1959–62) and district geologist, Joint Coal Board (1962–64).

From 1964 to 1973 he was on the academic staff of the University of NSW (later UoW) before being appointed to the Geology Chair in 1973. He lectured at various universities – Syracuse, Carolina, Pennsylvania State, Kansas, Chiang Mai, Melbourne and Queensland, as well as addressing international oil companies, the Chinese Ministry of Petroleum and the Indonesian Petroleum Association.

His citation when elected to the Academy noted he had contributed greatly to an understanding of the key factors in the generation of petroleum from organic matter, especially the nature and timing of maturation.

"He is the leading Australian authority on the petrology of fossil fuels as a group and one of the most respected organic petrologists in the world, being particularly highly regarded by international oil exploration companies.

"His characterisation of coal and development of improved optical techniques have been outstanding, both in support of his petroleum work and in the assessment of coals for industrial use."

Dr Cook was a member of a number of editorial boards for



Alan Cook

international journals, Editor of *Australian Black Coal*, author of 100 journal articles and some 400 reports for commercial organisations and a member of a number of Australian and international professional bodies.

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# UQ RESEARCHERS MAKING AN IMPACT ON GREENHOUSE GAS EMISSIONS

## Advanced Water Management Centre helps address issues for the water industry

Climate change caused by greenhouse gas (GHG) emissions is one of the major challenges facing mankind today. Substantial reductions in GHG emissions are inevitable and essentially a shared responsibility by all sectors, including the Australian Water Industry.

The GHG research team at UQ's Advanced Water Management Centre (AWMC) have been addressing issues of GHG emissions for the water industry since 2007.

This program focuses on two major fugitive greenhouse gases and covers fundamental studies, process modelling and mitigation strategy development. The team covers wastewater treatment plants, waterways (estuaries and bays), water storages systems, and was the first in the world to report GHG emissions from wastewater collection systems (sewers).

The team has developed substantially over the past few years, now with over 10 research staff and students and a total funding of over \$2M. The team also has strong linkages with industry, with collaborations with eight water utilities both in Australia and overseas.

The Advanced Water Management Centre is an internationally recognised centre for excellence in innovative water technology and management and the GHG program is one of seven AWMC research programs achieving sustainable outcomes for the water industry.

The Federal Government's 2010 Excellence in Research for Australia (ERA) survey confirmed The University of Queensland as one of the nation's top two universities, measured on a combination of research quality and breadth. ERA reported that research at UQ is above world standard in more broad fields than at any other Australian university; this reflects UQ's leading global role in many areas of discovery. UQ's outstanding critical mass offers researchers significant interdisciplinary capability.

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