ATSE

SUBMISSION TO THE

Standing Committee on Agriculture and Water Resources Inquiry into Water Use Efficiency in Australian Agriculture

MARCH 2017

AUSTRALIAN ACADEMY OF
TECHNOLOGY AND ENGINEERING

ATSE SUBMISSION TO THE INQUIRY INTO WATER USE EFFICIENCY IN AUSTRALIAN AGRICULTURE

The Australian Academy of Technological Sciences and Engineering (ATSE)[1] welcomes the opportunity to provide input to the Standing Committee on Agriculture and Water Resources' Inquiry into Water Use Efficiency in Australian Agriculture. ATSE is pleased to offer evidence and advice on the following issues related to the Inquiry's terms of reference:

- The role of technology, science and engineering in improving water use efficiency (WUE);
- The limitations of WUE; and
- The need for long-term water sustainability targets.

Australia is the driest inhabited continent on earth and agriculture is the largest consumer of water in Australia, accounted for 62 per cent of Australia's water use in 2013-14.[2] Efficient and effective use of water in agriculture is essential to help reduce the sector's water consumption and improve crop yields; however, it is not a panacea for the impacts of agriculture on water and associated eco-systems.

Water use efficiency must be considered in terms of impact on the sustainability of both surface water and groundwater (GW) ecosystems. Improvements in both irrigation WUE - the crop yield per volume of water applied to the farmer's field – and agricultural water productivity (WP) - the yield per volume of water transpired (i.e. consumed) by the crop - are highly desirable. However, they generally fail to account for the complexities of agricultural and water systems, and are only a partial response to the multiple tensions of the food-water nexus. A whole-of-system approach with a focus on long-term water sustainability targets is essential to improve the sustainability of Australia's agricultural and water ecosystems in the face of climate change and increasing competition for water.

Recommendations

ATSE recommends that the Committee recognises the need to:

1. Establish the actual impacts of irrigation water use efficiency programs on surface and groundwater systems, and the agricultural- and eco-systems that depend on them, at the regional-catchment and basin scale; and
2. Identify and implement long-term water sustainability targets to improve the stewardship of Australia's surface and groundwater systems and to inform the development of government funded irrigation efficiency programs.

ATSE's Position Statement, *Enabling Growth in Agriculture,* notes that efficient use of water resources, better water conservation technologies and infrastructure, and enhanced climate and long-term weather forecasting are essential to deliver better environmental outcomes and productivity in

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

2 Australian Bureau of Statistics (2016), *4610.0 - Water Account, Australia, 2014-15* [available at http://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/4610.0]

AUSTRALIAN ACADEMY OF TECHNOLOGY AND ENGINEERING both rain and irrigation based systems.[3] In addition ATSE's Position Statement, *National Water Management: New Reform Challenges*, highlights the need for strategic research that improves our understanding of water systems and informs their management.[4] Copies of both statements are attached for your reference.

Technology for Water Use Efficiency

There are a variety of available and upcoming technologies that offer potential improvements to WUE in irrigated systems. However it is good management of farming systems that is essential to enable the benefits of technology and to maximise WUE.[5]

Figure 1 (below) illustrates a simplified crop water balance diagram. WUE gains are derived from maximising crop transpiration (T); reducing the flows in weed transpiration, soil evaporation (E), runoff to surface waters (RO), and deep drainage to groundwater systems (D). At the same time, it is important to maintain an optimal leaching fraction (LF) to manage soil salinity levels. On-farm WUE can potentially reduce extractions from surface water and groundwater by up to 30-50 per cent when upgrading from flood or furrow systems to low-pressure sprinkler or drip systems. There are also potential improvements in agricultural WP. However, these are generally more modest (less than 10 per cent) as the relationship between transpiration and yield is close to linear.[6]

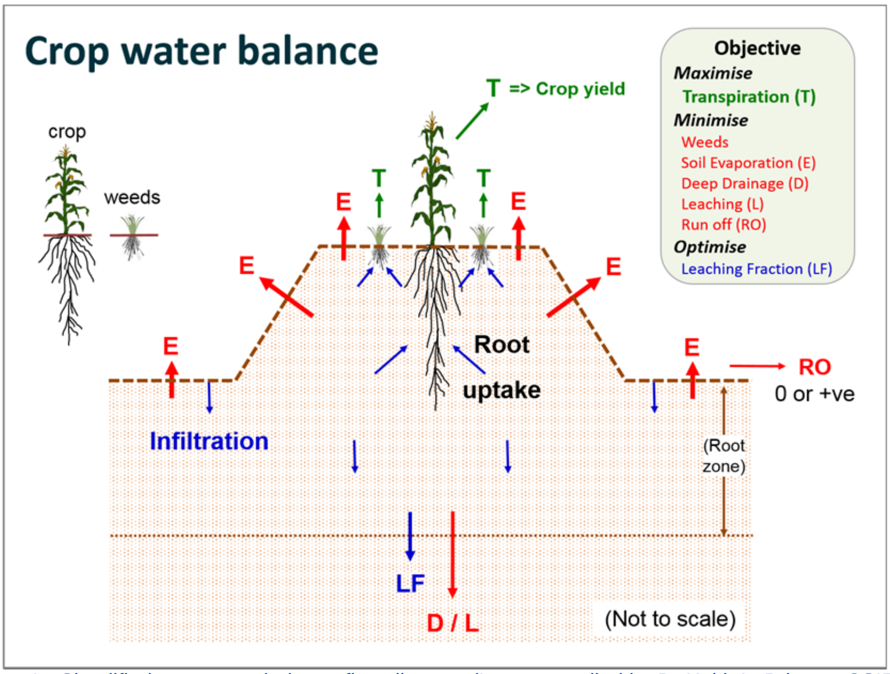

Figure 1 - Simplified crop water balance flow diagram (Image supplied by Dr Keith L. Bristow, CSIRO)

3 ATSE (2014), *Enabling Growth in Agriculture*, [available at https://www.atse.org.au/atse/content/publications/policy/enabling-growth-in-agriculture.aspx]

4 ATSE (2014). *National Water Management: New Reform Challenges* [available at https://www.atse.org.au/atse/content/publications/policy/national-water-management.aspx]

5 Perry, C., et al. (2009). Increasing productivity in irrigated agriculture: agronomic constraints and hydrological realities. Agricultural Water Management, 96(11), 1517-1524.

6 Perry, C., et al. (2009*). Increasing productivity in irrigated agriculture: agronomic constraints and hydrological realities.* Agricultural Water Management, 96(11), 1517-1524.

The inability to provide the required amount of water to a particular field at the appropriate time is a major constraint of most of our irrigated systems. Improving the ability of irrigation systems to deliver water as and when required by individual fields/farms within an irrigated area is necessary to support farmers to optimise their irrigation, rather than relying on fixed irrigation schedules. Networked sensors and control systems, smart software, and other technology developments can support the timely delivery of irrigation water to satisfy crop requirements, enabling optimal growth WUE. Wireless sensors can be used to monitor soil moisture, crop water retention, weather information, plant characteristics and other relevant information. Integrating these data with weather forecasts in cropping system models can assist farmers to determine current and future irrigation requirements, and networked control systems can allow for automated or remotely controlled irrigation based on crop requirements.

These advanced sensing and analysis technologies are already being applied in technology savvy irrigation industries (e.g. cotton, horticulture and viticulture). Developers are creating software systems and apps to help farmers to integrate and analyse the diverse data sources. It is crucial that these systems use reliable models and data. Regional internet connectivity is also an essential enabler for the application of these technologies. Greater application of integrated sensor and actuator networks to control irrigation at a farm and sub-basin level may allow conjunctive use of irrigation and conservation water to provide better environmental outcomes by more informed management of the surface, ground, and irrigation water systems. However, the infrastructure to monitor and control channel networks in an integrated way with rivers, groundwater, wetlands and other water ecosystems is not currently available.

There are many other existing and emerging technologies and farm management practices that can be applied to improve WUE and WP (e.g. CSIRO recently developed a sprayable biodegradable polymer membrane designed to suppress weeds, minimise evaporation and increase WP[7]). WUE is also very important in dryland agriculture as it sets the upper limit for yield potential. By altering farm management practices (e.g. less cultivation, direct drilling, and eliminating summer weeds) dryland farmers in Australia have made substantial increased in WUE. While water-limited yield potential for Australian wheat declined by 27% between 1990 and 2015 due to climate changes, “an unprecedented rate of technology-driven gains” helped to maintain actual yields.[8] Poor WUE which allows extensive leakage of water beyond the root zone can also cause environmental stress such as soil acidification and salinization.

Limitations of Water Use Efficiency

On-farm WUE improvements must be considered in terms of their impact on surface water and groundwater ecosystems. As outlined above, WUE principles and technologies have potential to improve crop yields and to reduce extraction from surface water and groundwater systems.

Water conservation technologies have been promoted as a practical means of improving the WUE and maintaining environmental flows in river systems[6]. However, there is increasing evidence that, somewhat paradoxically, WUE gains often contribute to intensification of water use by irrigators and a

7 CSIRO (2017), TranspiratiONal [available at https://www.csiro.au/sitecore/content/ON/Website/About/ON-alumni-teams/ON-Video-Item-7/TranspiratiONal]

8 Hochman, Z., Gobbett, D. L. and Horan, H. (2017), *Climate trends account for stalled wheat yields in Australia since 1990*. Glob Change Biol. doi:10.1111/gcb.13604

reduction in return flows to the streams and groundwater.[9 10 11] This occurs when one or more of the following outcomes transpire:

- increased crop yields coupled with increased consumptive water use (transpiration);
- improved efficiency, productivity, and profitability encourages farmers to increase the area cropped, or adopt multiple crop cycles per year or dual cropping systems.

In both cases, the net effect is an increase in annual evapotranspiration that, particularly in areas of increasing water scarcity, can reduce environmental flows.

An increase in beneficial water consumption in crop transpiration is usually associated with reductions in deep-drainage that recharges groundwater and in return flows to streams.[12] Unless WUE savings are reflected in an equivalent or greater reduction in extraction from the water resource, downstream flows will actually be reduced.[13] For example, modelling on the Lower Rio Grande in New Mexico has shown that providing higher capital subsidies for more water-use efficient irrigation technologies results in lower downstream river flows.[14]

Due to the complex interactions between agricultural and water systems it is essential that the Committee considers the broader impacts of WUE programs at system/basin-wide scales. WUE can help to reconcile trade-offs between tensions in the food-water nexus. However, it is unlikely to resolve the overuse of water and maintain, or more importantly, improve environmental flows. It is also not necessarily associated with maximum farmer net revenue or crop yields.[15] It is essential to establish the hydrological impacts of WUE on surface and groundwater systems, and to ensure that policy development is informed by sound hydrological research.[16]

Water Sustainability Targets

Given the substantial uncertainties imposed by climate change and the absolute certainty of increasing competition for water, Australia urgently needs to increase the sustainability of its irrigated and natural eco systems. Inefficient irrigation, while it can provide significant return flows to surface and groundwater, is typically detrimental to the quantity and quality of environmental flows. Excess irrigation water picks up salts, nutrients (especially nitrogen), and agrochemicals, which pollute water systems. The continual recycling of water through the root zone also damages the soil microbiology and soil health deteriorates, which undermines the ecological functioning and productivity of the whole system. However, a focus on WUE alone will not ensure the sustainability of Australia's agricultural and environmental ecosystems.

Setting long-term water sustainability targets for quality (e.g lowering nitrate concentrations to below the drinking water limit in an aquifer system) and quantity (e.g. maintaining or restoring appropriate water levels in a groundwater system; achieving the variable flows needed in a river ecosystem) to

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9 Giordano, M., et al. (2017), *Beyond "more crop per drop": Evolving thinking on agricultural water productivity*. Colombo, Sri Lanka: International Water Management Institute (IWMI); Washington, DC, USA: The World Bank. doi: 10.5337/2017.202.

10 Perry, C., et al. (2009*). Increasing productivity in irrigated agriculture: agronomic constraints and hydrological realities.* Agricultural Water Management, 96(11), 1517-1524.

11 Batchelor, C., et al. (2014), Do water-saving technologies improve environmental flows?Journal of Hydrology 518,140–149)

12 Grafton, Q. R., et al. (2013), *Global insights into water resources, climate change and governance*. Nature Clim. Change, 3(4), 315-321.

13 Batchelor, C., et al (2014), *Do water-saving technologies improve environmental flows?* Journal of Hydrology 518,140–149

14 Ward, F. A., & Pulido-Velazquez, M. (2008). *Water conservation in irrigation can increase water use*. Proceedings of the National Academy of Sciences, 105(47), 18215-18220. doi:10.1073/pnas.0805554105

15 Wichelns, D. (2015), *Water productivity and food security: considering more carefully the farm-level perspective*. Food Security, 7(2), 247-260.

16 As an example see: Khan, S. (2004). *Integrating Hydrology with Environment, Livelihood and Policy Issues: The Murrumbidgee Model.* Water Resources Development, Vol. 20, No. 3, 415–429, September 2004

achieve at least minimum stream flows) of both surface and groundwater is essential to inform agricultural WUE and irrigation capital investment programs, and the management of other water uses. The development of targets can be contentious, and will need to be informed by a strong understanding of the system's hydrology and thorough consultation with community and key stakeholders. Targets and the programs and policies that support them must be flexible and adaptively managed to allow for a dynamic system with changing needs.

Environmental Flows and Soil Health

Environmental flows are essential to the health of freshwater ecosystems, agricultural land, and human well-being. Environmental flow management must consider the quantity, quality, timing and durations of the flows in order to maintain healthy surface, groundwater and soil ecosystems. In many systems, good environmental flow management will require both high flows (flooding) and low flows (dry spells). Flooding is an essential part of effective environmental flow and the constraints to flooding on private land and infrastructure need consideration. Flooding of floodplains and wetlands is also a primary driver of recharge to groundwater aquifers. The economic value of recharging groundwater under flooding is rarely recognised. Low flows in surface water systems during droughts/dry periods are also important. These fluctuations provide an opportunity for groundwater to discharge from flood plains, removing salt from the system. Many rivers now have dams on them so you no longer get the fluctuations that helped remove salts from the system.

Irrigation usually demands increased river flow during summer and autumn to deliver water for crop demand at a time when naturally the river flow would be low. In short, irrigation extraction generally radically alters the flow regime of a river in addition to the direct impact of the dam storage. There are emerging agricultural practices (e.g. crop selection, on-farm storage of water) which can help to alleviate these changes to flow regimes.

Beyond a focus on WUE it is important to research and plan to mitigate the potential impacts of land use and irrigation on soil and river salinisation and acidification. The legacy of land-use changes and irrigation on the health of the Murray-Darling Basin highlights the environmental and economic costs of salinisation. Rising groundwater pressures becomes a major issue for surface water supplies with large tracts of agricultural land unusable and water undrinkable in some regions. Land and stream salinisation can be irreversible and remediation/mitigation imposes ongoing financial burdens on the agricultural sector. It is also necessary to consider the interactions of irrigation and environmental water flows with different soil chemistries. For example, the Lower Murray Reclaimed Irrigation Area in South Australia, which was a successfully farmed irrigation area, experienced widespread soil acidification during the Millenium drought. Reduced rainfall and limited irrigation water availability lead to oxidisation of acid sulphate soils to form acidic sulfuric clay soils (pH<4).[17] These examples further illustrate the importance of considering irrigation strategies and WUE as part of the wider ecosystem.

17 Fitzpatrick, R.W., Shand, P., Merry, R.H., 2009. *Acid sulfate soils*. In: Jennings, J. T. (Ed.), Natural History of the Riverland and Murraylands. Royal Society of South Australia, Adelaide, South Australia, pp. 65–111.

AUSTRALIAN ACADEMY OF TECHNOLOGICAL SCIENCES AND ENGINEERING (ATSE)

ATSE

AGRICULTURE

ENABLING GROWTH IN AGRICULTURE POSITION STATEMENT

APRIL 2014

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

ATSE CALLS FOR THE INTEGRATED PURSUIT OF INCREASED PRODUCTIVITY AND THE ENHANCEMENT OF ECOSYSTEMS TO SECURE THE FUTURE GROWTH AND PROFITABILITY OF AUSTRALIA'S AGRICULTURAL AND FOOD SECTORS.

THE FUTURE OF AUSTRALIAN AGRICULTURE

The world is facing a confluence of pressures which, on current indications, will increasingly threaten global food security and agricultural production for the foreseeable future, arising mainly from the effects of population growth, changing dietary preferences, climate change, and increasing competition for natural resources. Concerted action by industry and governments is required across agricultural and food value chains to increase the use of technology, science and engineering in off-setting and reducing these pressures.

Australia's agrifood industries face new opportunities in production, processing, and marketing to meet growing international demand for safe, high-quality food and fibre products, especially from an increasingly affluent middle class in Asia. To be in a position to create enduring advantage from growth opportunities in these competitive markets, the output, quality, value, and sustainability of Australian agriculture must improve. The availability of water, infrastructure, transport systems, and global market access are also critical to agriculture's success.

There is increasing pressure on the availability of natural resources for agricultural production, due to drought, changing land and water use patterns, competition from other industries, increased input costs (e.g. energy and nutrients), and environmental degradation. In order to maintain and accelerate growth in agricultural production where possible, Australia's natural resources must be utilised more efficiently and protected against future depletion.

By embracing all the tools for innovation in production, processing and marketing that are available, Australian agricultural and food industries can meet these challenges and take advantage of new opportunities. This will require partnerships and collaboration between industry, governments and financial systems to invest in future international competitiveness.

THE VISION

ATSE sees vigorous and globally competitive Australian agriculture and food industries thriving through investment in technology, science and engineering innovation. These industries will seize the considerable market opportunities arising now and in the coming decades, in the face of significant competition and environmental challenges. Greater engagement across agrifood value chains will be crucial, as will the ability of industries to respond rapidly and flexibly to changing market needs.

Through ecologically responsible intensification, innovative agrifood businesses will reap the rewards from the increasing wealth in Asia while building resilience for future challenges.

VALUE

The production, processing, and export of safe and high-quality food and other agricultural products is a crucial part of Australia's economy, particularly in rural and regional areas, and a major contributor to the country's wealth and high standards of living. Affordable and nutritious food is also fundamental for people's health and well-being.

In 2011-12 the food value chain in Australia had a combined worth of $270 billion[1]. This included $43 billion in farm and fish production, $91 billion in food and beverage processing, and $136 billion in retail food sales. Australia also exported $30 billion and imported $11 billion worth of food and beverages. In the same period, the entire food industry, from farm production and manufacturing to retail food service, employed 1.6 million people, around 15 per cent of Australia's total employment.

1 DAFF 2012, *Australian Food Statistics 2011-12*, Department of Agriculture, Fisheries and Forestry, Commonwealth of Australia, Canberra.

ATSE

Australia has significant comparative advantages in agriculture and food production over regional trading partners, making these sectors an essential strategic economic investment. A focus on improving profitability from the farm-gate across the whole value chain will see excellent returns on this investment. A strong and innovative agriculture and food sector is also an integral part of Australia's contribution to the global community.

PRIORITY FOCUS AREAS

Technology, science and engineering-driven innovation have key roles to play in achieving this vision. Priority areas include:

- **Biotechnology**, integrated with modern genetics, breeding, and other techniques, offers opportunities to improve agricultural productivity, natural resource management, and consumer demand, while offering new opportunities for bio-industries across the agricultural value chain. Appropriate regulation is essential for public acceptance and safe deployment.
- **Information technology services** can revolutionise agricultural production systems. Increased deployment and penetration of ICT and high-speed internet access will enable greater use of real time data analysis and agri-informatics, and improve the competitiveness of industries and services.
- **Water** is fundamental to agricultural production. Efficient use of water resources, better water conservation technologies and infrastructure, and enhanced climate and long-term weather forecasting can deliver better environmental outcomes and productivity in both rain and irrigation based systems.
- **Environmental impacts and natural resource management** are critical to the future of agriculture. Mitigation of environmental damage through reducing emissions-intensity, soil degradation, and nutrient pollution, among others, is essential for both commercial and sustainability imperatives. Maximising the availability of scarce resources in a more sustainable way through improved regional and local natural resource management capabilities will secure ongoing agricultural production while maintaining ecosystem health.
- **Biosecurity** is essential to protect natural ecosystems, farm productivity, and access to sensitive export markets. Stronger partnerships with industry would enhance Australia's biosecurity capabilities and capacity in prevention, response and recovery.
- **Enhanced product specifications and certification** requiring high standards of environmental management, safety, and quality can offer a premium market position to Australian agrifood exports. Advanced food processing techniques can also produce high-performing, highly-specified functional foods and ingredients.
- **Waste reduction** across entire value chains is increasingly essential. The recovery and recycling of non-renewable and scarce resources, such as nutrients and water, maximising value chain efficiency and transforming waste streams into output will enhance the productivity, sustainability and profitability of agricultural and food production.

THE WAY FORWARD

ATSE will analyse these priority focus areas through the following reference matrix to clarify actions to strengthen innovation in agriculture and food industries in Australia.

PUBLIC POLICY

- The interaction of industries, individual businesses, research institutions, and government departments in the agriculture and food policy space will determine the level of success or failure in securing Australia's agricultural future. This includes interaction around regulatory environments, public funding mechanisms, international relations and trade, and the finance and investment sectors, among others.

INNOVATION

- Ongoing, broad-based innovation provides the foundation to adapt to and mitigate threats while increasing productivity, profitability, and sustainability into the future. A strong scientific, research, and engineering capability in agriculture, food, and related areas will enable innovation through knowledge, practices, and technologies. Developing and maintaining this capability requires a strategic, long-term approach, increased business investment, and a focus on international and national collaborative research partnerships.

EDUCATION

- Enhancing Australia's human capital in agriculture, food production and natural resource management will be essential to achieve this vision. A greater appreciation of the opportunities in and importance of food and agriculture across the whole of society, alongside the revitalisation of agriculture and food science related education, will ensure the continued strength and growth of this key economic sector.

Australian Academy of Technological Sciences and Engineering (ATSE)
Enhancing Australia's prosperity through technological innovation

ATSE Office
Level 1 / 1 Bowen Crescent
Melbourne VIC 3004

Mail address
GPO Box 4055
Melbourne VIC 3001

Phone
+613/(03) 9864 0900

Fax
+613/(03) 9864 0930

Email
info@atse.org.au

Websites
www.atse.org.au
www.stelr.org.au
www.crawfordfund.org

ATSE

Australian Academy of Technological Sciences and Engineering Limited
ACN 008 520 934 ABN 58 008 520 394
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WATER REFORM

NATIONAL WATER MANAGEMENT: NEW REFORM CHALLENGES

POSITION STATEMENT OCTOBER 2014

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

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

NATIONAL WATER REFORM

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

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

WATER CHALLENGES – THE NEXT DECADE

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

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

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

THE VISION

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

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

VALUE

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

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

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

PRIORITY REFORM AREAS

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

NATIONAL REFORM PROCESS:

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

WATER SCIENCE:

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

ECONOMIC ISSUES:

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

PLANNING AND REGULATORY ISSUES:

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

THE WAY FORWARD

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

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

All levels of government need to work together to:

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

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

Australian Academy of Technological Sciences and Engineering (ATSE)

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ATSE Office
Level 1 / 1 Bowen Crescent
Melbourne VIC 3004

Mail address
GPO Box 4055
Melbourne VIC 3001

Phone
+613/(03) 9864 0900

Fax
+613/(03) 9864 0930

Email
info@atse.org.au

Websites
www.atse.org.au
www.stelr.org.au
www.crawfordfund.org

ATSE

Australian Academy of Technological Sciences and Engineering Limited
ACN 008 520 934 ABN 58 008 520 394
Incorporated in the Australian Capital Territory Limited by Guarantee