Water–Energy–Carbon Linkages in the South East Queensland Water Cycle
Workshop Outcomes Report
Urban Water Security Research Alliance
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BACKGROUND

In order to ensure the success of water management options, there is a need to understand the complex and interrelated influences with energy and greenhouse gas (GHG) emissions. Energy implications of water strategies are important because the energy costs of water provision can be significant, are generally rising, and now represent a substantial business risk in Australian and some international water systems. Water-related energy in cities accounts for around 13% of Australia’s electricity use plus 18% of Australia’s natural gas use (Kenway et al. 2011). The connection is even stronger in California (Klein et al. 2005).

Similar to most developed nations, Australia recently committed to a long-term goal of reducing GHG emissions to 20% of 2000 levels by 2050 (Australian Government 2012). How the water sector contributes to this target, and how Australia builds the most water and energy-efficient economy, is yet to be determined.

The recent review of the National Water Initiative identified that water reform is occurring within a complex policy environment. It identified a need for increasing emphasis on the intersection and alignment of converging policy agendas including water, energy, carbon, sustainable development, land use planning and climate change.

In order to respond to these challenges, improved information is needed regarding the direct and indirect effects of water management on energy and related GHG flows and costs. The Urban Water Security Research Alliance (UWSRA) conducted substantial research in this domain between 2008 and 2013. This has included:

- Development of modelling and evaluation frameworks;
- Analysis of energy and GHG in current and future water systems;
- Centralised and decentralised system energy use, carbon analysis and life-cycle analysis;
- High quality end-use water data relevant to forecasting water-related energy;
- Detailed modelling of the influence of households on water-related energy;
- Quantifying energy influenced by urban water management indirectly;
- Quantifying GHG emissions from reservoirs and fugitive emissions from wastewater treatment;
- Identifying research priorities for managing water-related energy demands related to urban water.

In order to disseminate the work, and determine implications, UWSRA convened a workshop on 19 November 2012. Presentations were given from The University of Queensland, CSIRO, Qld Government, Griffith University, Seqwater, Queensland Urban Utilities, Stanwell Power, Energet, SEQ Water Grid Manager and GHD (See http://www.urbanwateralliance.org.au/publications/workshop-water-energy-carbon). Wide participation from industry, local and state government, consulting, and research encouraged robust discussion.

Facilitated discussion was used to identify implications and possible next steps. These are summarised below. While the discussion focussed on the SEQ water system, many recommendations are anticipated to be relevant across Australia and also wider afield.

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WHAT ARE THE MAIN IMPLICATIONS FOR WATER AND ENERGY MANAGEMENT?

The water-energy nexus covers a wide range of issues including economics, social science and environmental management. We are only scratching the surface of these issues. Some water-energy links have been quantified in a preliminary way, for example from water and wastewater infrastructure. However, the complete picture, or full impacts from catchment to discharge and including use and life cycle implications, is often missed. Stronger interrelationships are needed across the many pockets of research.

There are major gaps in understanding water-energy links in the industrial and commercial sectors as well as policy and governance aspects. Most current work addresses average conditions. The influence of particular systems/circumstances (such as peak load connections between water and energy) are typically missed.

Greater economic and/or financial analysis is necessary in order to build the business case for change. Such analysis should sharpen the drivers for combined management of water and energy. Options to “improve the system” must lead to savings (operational or capital) and/or payback in order to be viable. Least-cost studies to consistent boundaries are necessary. A clean development mechanism could support such analysis.

Lack of information creates difficulties for long-term planning. However, there is enough information to inform policy now. Good quality data, analysis, as well as stakeholder and community engagement is necessary to support stronger decisions. Clearer communication of research to policy makers is also necessary. Science to policy and science to practice require different mechanisms and dialogue. Knowledge and understanding needs to be translated into implications. Bridge building is necessary and mechanisms are not yet clear.

Water and energy research could position industry contributions to related discussions. There are a number of related strategic discussions to which the water and energy sectors could contribute. The Asian Century paper is an example. Food, tourism and economic activity all need water and energy. Water-energy-carbon systems thinking will be fundamental to delivery of challenges such as those raised in the Asian Century document.

WHAT ARE THE OPPORTUNITIES AND BARRIERS FOR INTEGRATED MANAGEMENT OF WATER AND ENERGY?

The long term Australian GHG target (80% reduction in carbon emissions by 2005), creates a strong impetus and opportunity for addressing links between water, energy and carbon. It was of interest that no participant at the workshop was undertaking research, strategy or policy development aimed at implementing this major, challenging and wide-sweeping new target.

New institutional arrangements create opportunity. In SEQ, the new Ministry for Water and Energy and the new Department of Energy and Water Supply (DEWS) creates a single point of responsibility for water and energy issues as well as interrelationships. As DEWS is working on separate 30-year plans for water and energy in Queensland there would appear to be strong opportunity to address synergies across these plans, or even potentially to combine them. Industry input to the process would greatly strengthen the plans. Consideration needs to be given if our water and energy utilities are intended to solely supply water and energy. Alternatively, is the primary focus of utilities to ensure delivery of particular service levels (or environmental, economic and health outcomes). Additional recent water reform in SEQ has created a bulk water entity with responsibility for many of the major energy-intensive infrastructure components such as the Tugun Desalination scheme and the Western Corridor Recycled Water Scheme.
Establishing common targets and goals for water and energy/carbon in SEQ would be helpful for planning. Demands for water and energy over the next 30 years will also depend on how the SEQ urban environment is designed and managed. These connections should be more explicit and defined.

Existing research activities could be broadened. For example the CRC for Water Sensitive Cities and CRC for Low Carbon Living do not currently address the influences of synergies and feedbacks between water and energy. Expanding the scope of research or collaboration between CRCs could help address cross-over issues. Energy efficiency could add a lot to the concept of Water Sensitive Urban Design. Technological advancement (from household to city scale) is also an opportunity.

Energy literacy in Australia is low compared to water literacy. Energy literacy is currently a barrier to improved co-management of water-related energy. There is also a need to talk about the water-energy system, they are not separate.

Current regulations and governance arrangements can be barriers. For example some Acts inhibit water utilities working or undertaking research together. There is a need to find ways around these walls to improve the flow of information and collaboration.

WHAT ARE POSSIBLE NEXT STEPS?

There is a need for a shared vision and collaboration. Greater collaboration across the water and energy sectors is required and could vastly improve understanding of the issue and options for improved management. Champions are needed. Start-up resources would help. There is a need to move past the cycle of boom and bust, drought and flood. Part of the lack of shared vision relates to a lack of clearer conceptual frameworks for analysis and management of water-energy links. For example, where does an analysis start or stop with regard to inclusion of virtual and embedded flows of water and energy. The logic for collective action needs to be systematically established. Partnering for research can be one way of developing shared vision, however it can take time. Greater clarity and focus is needed across the mix of options including retrofitting, demand management and stricter standards for new development. Modelling analysis of scenarios could help establish a longer-term vision. The Queensland Healthy Waterways partnership was viewed as good example of wide collaboration for water quality management.

Pilot projects involving water and energy sector partners could be very helpful. As a component of building a vision, trials between water and energy utilities could help quantify the energy impacts of alternative water options, and water impacts of energy management options. A number of such trials have been undertaken by water and energy utilities in California supported by the regulator (the California Public Utilities Commission). Establishing successful trials would help implementation. There are a range of major land development sites in SEQ which could provide the ground around which trialling and associated analysis could be undertaken. Establishment of an industry-style forum could also be supportive. Formation of an enduring energy-water alliance could inform other debates.

Governance arrangements can create the “climate” for innovation. For example, in California, energy revenues have been decoupled from sales volumes, and strong financial incentives established for energy conservation. This has led to new patterns of investment including investment in water conservation as a pathway to energy conservation.

Data management strategies are needed. Currently, datasets around water and energy are fragmented. Bringing together the major datasets could be very helpful. This could possibly be achieved via reporting frameworks. Combined metering of water and energy (eg high resolution meters) could also be an opportunity.

There is an opportunity to draw on other international experience. There are a number of highly related activities occurring internationally. For example, California's strong carbon mitigation targets (80% mitigation) developed in 2006 led to the creation of a number of “Climate action teams” or “Cats”. The
Water-Energy “Climate Action Team” helped identify synergies between water and energy to find climate mitigation options. The Netherlands water-energy factory concepts were also identified as relevant.

The nature of the discussion and range of ideas generated suggests that further and more detailed discussions would be desirable.

**References**


**AVAILABLE TECHNICAL INFORMATION AND PUBLICATIONS**

A range of information is available from the Urban Water Security Research Alliance website (See [http://www.urbanwateralliance.org.au](http://www.urbanwateralliance.org.au)) This includes general factsheets, Science Forum proceedings, technical reports and recent journal article and conference paper listings.