Water Optimisation through Intelligent Infrastructure:

Fresh water, an essential resource to maintain health, produce food and sustain the very quality of life, is a finite resource. A booming global population accompanied by climatic changes, have led to severe water shortages and made the need for improvements in water asset management a critical necessity.
**Introduction**

Consider this: Australians live on the driest inhabited continent in the world, rainfall is variable and droughts are common. Up to 70% of our fresh water demand is used in agriculture;\(^1\) and widespread use of cheap but wasteful flood irrigation exacerbates agricultural water intensity. The remaining meagre 30% is used in the manufacturing of goods, the distribution of produce and individual/household consumption.\(^2\) OECD estimates that more than 75% of Australia’s population will be facing severe water stress in terms of supply by the year 2030.\(^3\) Given the finite source of our fresh water, it is increasingly imperative to balance our use of this precious resource with our responsibilities toward the environment through improved water management techniques.

The critical issues facing the water industry are associated with our aging infrastructure and irrigation losses, which can be addressed by a sustainable approach to water infrastructure asset management. The key strategy would be to optimize our assets throughout their lifecycle, and derive the right information for smarter utility decision-making.

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**Sustainable Water Infrastructure**

Expensive, difficult to maintain and politically unpalatable, infrastructure is the water imperative that’s most easily ignored. Complex and aging water treatment, distribution, and wastewater treatment systems - some more than 100 years old, are critical for basic sanitation, health, and public safety. However, these systems are quickly reaching the end of their useful lives. Water infrastructure is three times more expensive to build and maintain than electricity infrastructure;\(^4\) but neglecting it may be even more costly. In some cities 15 to 20 percent of water is lost to leaks.\(^5\) Sprawling municipalities, old infrastructure, excessively high water pressure in some points and inaccurate system maps all contribute to the loss. The assets in a number of our capital cities are very old; not well mapped or recorded; and occasionally only discovered through routine maintenance in previously untouched areas.

Climate change, population growth, changes in demand management and recycling strategies will exacerbate the impact on Australia’s aging water and wastewater infrastructure whilst increasing the operational, maintenance and replacement costs of these systems. The challenge is not only based in the cities either; much of Australia’s existing rural water infrastructure is aging, inefficient and in a state of disrepair. In fact, the Bureau of Meteorology and CSIRO point to a significant decline in agricultural productivity in Australia’s “food bowl” regions over the next fifty to one hundred years due to dramatically reduced rainfall, improper water management and higher temperatures.\(^6\)

One of IBM’s key focus areas is on reducing water wastage through improved asset management and making better use of a finite resource. With an aging workforce that stores much of the vital asset information in their heads, the need to develop a comprehensive and efficient asset management infrastructure is evident. At the data level, the need to detect and locate leaks in pipelines, measure and assess pipe conditions, and map pipeline systems noninvasively is paramount. Techniques such as acoustics, digital robot inspection, ground penetrating radar, wireless sensor networks and benchmark-based flow modelling can all be deployed. In fact, recent innovative advancements make it possible to envisage a fully integrated distribution system with high accuracy smart metering, potentially with remote shut-off capability to control sudden leakages and reroute resource flows to and from critically affected areas.

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1. Source: Lux Research Energy & Environment Market Scan
2. Source: Lux Research Energy & Environment Market Scan
3. Source: Lux Research Energy & Environment Market Scan
5. Source: IBM Water Global Innovation Outlook Report

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**It takes...**

- **10 litres** of water to make one sheet of PAPER
- **70 litres** of water to make one APPLE
- **91 litres** of water to make 450 grams of PLASTIC
- **140 litres** of water to make one cup of COFFEE
- **4,800 litres** of water to make one kilogram of PORK
- **15,500 litres** of water to make one kilogram of BEEF
- **40 litres** of water to make one slice of BREAD
- **80 litres** of water per dollar of INDUSTRIAL PRODUCT
- **120 litres** of water to make one glass of WINE
- **1,300 litres** of water to make one kilogram of WHEAT
- **10,855 litres** of water to make one pair of JEANS
- **10,855 litres** of water to make one kilogram of LEATHER

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IBM can assist in the visibility and management of assets with our Maximo™ asset management solution. Maximo provides the core infrastructure for improved asset management, work management and service delivery. Potential estimates of the costs savings and return on investment of improved asset management practices include labour utilisation increases of 10-20% and planned maintenance increases of 50-80%.

Power And Water entered into a $14.5 million contract with IBM, which included a new asset management system aimed at delivering electricity, water and sewerage services more efficiently across the Northern Territory.

“The program helps us identify what assets we have, what pieces of equipment we have, where they are located, their make, model, when they were installed and then helps us to schedule maintenance tasks to prevent failures as well as to record problems in the network, so we can have them direct crews to the fault and get power back on as quickly as we can”, said Michael Knowles, Strategy and Corporate Affairs General Manager, Power and Water.

This client project illustrates how one organisation uses IBM products and/or services. Many factors have contributed to the results and benefits described. IBM does not guarantee comparable results elsewhere.

Maximo covers the full life cycle of your assets including procurement management, contract management, work management, materials management, service management and mobility management. With Maximo, water authorities can change their organisation’s culture and approach to asset management, leading to more efficient and better managed assets, supported by a team of skilled resources who are actively maximising the term of each asset’s lifecycle.

Of particular relevance to the water industry are the following Maximo features:

- Linear Assets – comprehensive coverage and support for assets that have linear properties, such as pipes, valves, pumps, pipeline inspection gauges
- Maximo Spatial – the ability to spatially view problem areas and planned work
- Maximo Maps – interfaces Maximo data with GIS to identify areas with serious infrastructure problems
- Maximo Mobile – a work management solution that enables maintenance and operations technicians to manage work orders from mobile devices for remote pipe lines
- Maximo Service Management – automatically creates a work order based on customer call via automated voice recognition.

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Conceptual Interfaces

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Standards-based, Service Oriented Architecture
As the best of breed market leader, Maximo delivers the ability to measure and manage the availability and use of all strategic assets. Planned maintenance of an accurate asset register allows proactive management of all production assets, reducing cost inefficiencies and optimising operations.

Building and repairing water infrastructure is disruptive, inconvenient and time-consuming. However, we now have the opportunity to improve our existing networks and most importantly, do it better and smarter, by adding intelligence and instrumentation into the asset management system.

**Irrigation with Intelligence**

Historically, the world’s greatest centres of commerce have had two things in common: access to an abundance of freshwater supplies and proximity to water-based trade routes. Despite this simple truth, the economics of water can be complex and confounding. Whether building a business around it or attempting to invest directly in it, water often defies common business sense. That is not to say there is no commercial opportunity in water, however it is difficult to identify. Business models and technologies built around cleaner, more efficient and more sustainable water are blossoming. And the most successful of these solutions help save both water and money.

A full smart grid solution for water must include irrigation. Australia’s incredibly successful local and global agricultural market would not exist without irrigation. By continuing to make water systems smarter, particularly for agricultural use, water industry stakeholders can make money and save water. Smart irrigation will play a vital role in drought stricken areas where farmers have to maximise water supplies. Many have pointed out that the future of farming will include the integration of crop models, geographic information system (GIS) data, local soil maps, historic weather information, and precision agriculture that takes site-specific data entered into a smart controller to manage irrigation scheduling. Industry solutions in the early stages of commercialisation range from weather monitoring interfaced with irrigation systems either through web-based sites or installation of on-site weather stations, to models based on extensive evapo-transpiration data interfaced with more than 40,000 National Oceanic and Atmospheric Administration weather stations.8

To support advanced site-specific solutions, ensuring that enough water is supplied to the plants is critical to ensure a good-yielding crop. Smarter water management systems would directly translate into better usage of rural water tables, thus leading to better irrigation and less wastage of ground water in farming techniques. Furthermore, it would provide better accountability, enabling future generations of systems to target specific optimisation goals in a systematic manner.

A “Smarter Irrigation Project”, led by the University of Melbourne in conjunction with NICTA and IBM assembled a unique combination of cross-disciplinary expertise and intellectual property to develop and deploy fully-automated measures and control irrigation systems at a number of commercial farms in Victoria. The project demonstrated the potential of automated measures and controlled irrigation to more precisely control water application in agriculture and deliver substantial environmental and economic benefits. In addition, a number of significant technical outcomes were demonstrated including the development of novel wireless-based sensing networks, technology to integrate data from a wide variety of sensors, and novel closed-loop control technologies.

Many factors have contributed to the results and benefits described. IBM does not guarantee comparable results elsewhere.

A key barrier to the better management of our water resources is a fundamental lack of accurate, reliable, and timely data. As a global technology and innovation organisation, IBM believes that an integrated intelligent irrigation system that provides access to the right information is vital to your ability to make smart business decisions. Our experience in large-scale, complex systems integration, predictive data analytics, and information management provides capabilities to better understand and manage the vast volumes of data that will result from an interconnected water system.

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8 Source: Lux Research Energy & Environment Market Scan
A New Look At Smarter Water

Despite the fact that we often treat water as a ubiquitous undervalued commodity, there are numerous exciting and innovative opportunities to address our water challenges. Currently emerging technologies tend to focus on desalination, rainwater catchment and treatment, and industrial reuse, all of which are designed to increase supply, an undeniably important part of the equation. Far more promising, both socially and economically, is the less-developed market for technology that decreases water demand.

At IBM, we believe that we can help to make our economy sustainable and manage our most precious resource, by creating an integrated and intelligent water system. A smart network that monitors its own health, remotely senses damage, assesses water availability and predicts demand. We know that to achieve this vision will require a collaborative approach from a broad ecosystem of partners and stakeholders.

We can conclusively state that the only way to ensure the supply of fresh water to meet growing consumption needs is to manage it better. We cannot increase what we get from a finite source, but we can certainly collectively get smarter with what we do with it. Water well managed, is water saved!