This online textbook provides free access to a comprehensive education and training package that brings together the knowledge of how countries, specifically Australia, can adapt to climate change. This resource has been developed through support from the Federal Government’s Department of Climate Change’s Climate Change Adaptation Professional Skills program.


Lecture 5.1: A Rationale for Demand Management To Adapt to Climate Change.
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Lecture 5.1: A Rationale for Demand Management to Adapt to Climate Change.

Educational Aim

Lecture 5.1 reviews the climate change science to see how it is going to affect water supply and demand. Lecture 5.1 shows that changes in water availability and demand for water from climate change will have a significant effect on the scale and timing of supply-demand gaps for water utilities. The global water industry has great expertise in increasing supply options to manage this supply/demand gap. But the global water industry is now experiencing a growing need to better understand and manage the demand for water as part of an integrated resource planning framework. Specifically, practitioners need new skills in understanding how to develop, implement and evaluate demand management programs. This lecture provides a rationale for water utilities and water planners to adopt a portfolio approach to demand management to underpin strategies for the water sector to adapt to climate change. Lecture 5.2, which follows, then provides detailed training on how to implement a successful portfolio approach to demand management.

Key Learning Points

1. Water utilities, and the governments which regulate them, are responsible for ensuring that the supply of water meets demand. Historically, the traditional method of ensuring that rising demand for water was met was through building more centralized infrastructure: dams and reservoirs, pipelines and water treatment plants. This approach has brought tremendous benefits to billions of people, but it has also had serious social, economical, and ecological costs.¹

2. Dams, inter basin transfers and water withdrawals for irrigation have fragmented 60 per cent of the world’s rivers. By the end of the 20th century, there were over 45,000 dams in over 150 countries. Negative impacts on natural habitat are significant. For instance, dams and water withdrawals have destroyed the free-flowing river ecosystems to the point that 20 % of all freshwater fish species are now threatened or endangered.² The landmark 2000 report from the World Commission on Dams³ (WCD) showed in detail that simply damming more rivers is a financially, socially and environmentally costly and environmentally unsustainable way to meet future water needs.

3. Now, with climate change reducing and altering rainfall patterns, this highly centralized approach, which relies on rain falling in relatively small dammed water catchments, cannot guarantee adequate future water supplies for rising populations. Other centralised water supply options like desalination, whilst available to some, or not an economically viable option for many landlocked countries. Desalination also tends to use more energy and emit more greenhouse gas emissions per litre of water produced than either water from dams or other water treatment and recycling options. These are major challenges facing water utilities in the 21st century which are going to change the way water utilities manage and supply water resources.

4. The IPCC 4th Assessment notes that climate change will lead to “changes in all components of freshwater system”. According to the IPCC,

   "Globally, the negative impacts of future climate change on freshwater systems are expected to outweigh the benefits (high confidence). By the 2050s, the area of land subject to increasing water stress due to climate change is projected to be more than double that with decreasing water stress. Areas in which runoff is projected to decline face a clear reduction in the value of the services provided by water resources. Increased annual runoff in some areas is projected to lead to increased total water supply. However, in many regions, this benefit is likely to be counterbalanced by the negative effects of increased precipitation variability and seasonal runoff shifts in water supply, water quality and flood risks." 4

5. This has important implications for the planning of water supply and demand management in the 21st century. Regions of Australia, California, the Middle East, Africa, and the Mediterranean are already dealing with scarce water resources in both urban and rural environments. Since climate change will reduce water supply and quality whilst increasing demand in many regions of the world, this will put pressure on water utility’s infrastructure to be able to meet rising demand.

6. There is now a rapidly growing body of literature which recommends a more sophisticated approach to meeting water needs focused on an integrated approach of water efficiency, demand management 5 and supply augmentation through decentralised approaches to water reuse and recycling such as rainwater and stormwater harvesting. This is referred to as the “soft path” to meeting society’s future water needs. As Dr Peter Gleick, explains:

   "The soft path for water strives to improve the productivity of water use rather than seek endless sources of new supply. It delivers water services and qualities matched to users’ needs, rather than just delivering quantities of water. It applies economic tools such as markets and pricing, but with the goal of encouraging efficient use, equitable distribution of the resource, and sustainable system operation over time. And it includes local communities in decisions about water management, allocation, and use." 6

7. This approach is increasingly being taken by water utilities and water planners, not just because it will help adapt to climate change, but because it is increasingly being seen as best

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practice. Detailed studies suggest that pursuing this “soft path” will cost much less globally than trying to continue the “hard path” of simply building more dams and desalination plants.

8. The most cited estimate of the cost of meeting future infrastructure needs for water is US$180 billion per year to 2025 for water supply, sanitation, and wastewater treatment. This figure is based on the assumption that future global demand for water and water-related services will reach the level of industrialized nations and that centralized and expensive water supply and treatment infrastructure will have to provide it. If we focus instead on meeting basic human needs for water with the soft path, the cost instead could be in the range of US$10 billion to US$25 billion per year for the next two decades—a far more achievable level of investment. The soft path is so much cheaper because of its emphasis on first cutting rising demand for water through a focus on water efficiency. The soft path is also so much cheaper because of the use of many small de-centralised water recycling systems to augment supply instead of large centralised and expensive dams. Decentralised water recycling systems are smaller than centralised systems and thus have both lower up-front costs (See Figures 5.1.3) and shorter construction time reducing the cost of tying up capital unproductively or needing to rely on loans from banks.

9. A number of municipal water suppliers have implemented a suite of aggressive water conservation programs and achieved remarkable results cost effectively. Jerusalem, Israel; Mexico City, Mexico; Los Angeles, California; Beijing, China; Singapore; Boston, Massachusetts; Waterloo, Canada; Bogor, Indonesia; and Melbourne, Australia have all achieved reductions in water demand varying from 10 to 30%. Sydney Water has achieved 1970 levels of per capita water usage in Sydney through its demand management programs. In 2009, Cooley et al reported that Seattle, USA since the 1990s has reduced per capita water usage by 35 per cent. These examples show the effectiveness of water efficiency and demand management approaches.

10. The world is in the midst of a major transition in water resource development, management, and planning. This transition is long overdue. The shift from traditional approaches to meeting society’s water needs through the construction of massive infrastructure in the form of dams, aqueducts, pipelines, and complex centralized treatment plants is giving way to a more sophisticated “soft path” approach. Taking a more sophisticated approach to demand management and alternative supply augmentation through water recycling will not only help the water supply sector adapt to climate change but also address a wide range of other challenges. These include, for instance, increasing population, economic activity, and other water needs, such as restoring environmental flows to rivers and wetlands; all of which are increasing the demand for limited water resources. Also, this shift will help water utilities address the fact that community attitudes have shifted dramatically against the damming of rivers over the last three decades. Hence Module C, builds on from Module B, and seeks to

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provide a step by step guide on how to find win-win approaches to simultaneously address these multiple challenges profitably for the water sector.

### Brief Background Reading

#### Understanding the Impacts of Climate Change on Water Supply and Demand

As explained in the Key Learning Points, climate change in most cases will reduce water availability and lead to increasing demands for water. Hence all major water utilities and governments now need to examine the impacts of climate change for the major components of freshwater systems – surface water, groundwater, water quality, hydrology, and water demand - as part of their planning. Hence we first consider here, in detail, how climate change will affect these major components and reference a wide range of literature to assist water planners developing climate change adaptation strategies.

#### Climate Change Will Affect Surface Water

Climate change is expected to change the quantity and timing of surface water run-off. While increased run-off can be expected throughout the tropics and higher latitudes, the dry tropical and mid-latitude regions will experience reduced run-off. Timings will also be impacted: summer flows will be reduced and winter flows increased, with earlier peak flows.\(^{11}\) This is reflected in the majority of models, which also point to reductions in precipitation and increases in evaporation impacting significantly on the security, quantity and quality of urban water supplies and key catchments across Australia. (Table 5.1.1)

<table>
<thead>
<tr>
<th>Year</th>
<th>Climate Change Impacts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td><strong>South-West Western Australia:</strong> Under the median future climate scenario, rainfall in the surface water basins declines by 8% and runoff by 25% compared with the historical climate. The reduction in future runoff may be between 7% (under a continuation of the recent climate) and 42% (under the dry extreme future climate).(^{12})</td>
</tr>
<tr>
<td>2030</td>
<td><strong>Tasmania:</strong> Averaged over Tasmania, changes in annual runoff under the future climate (relative to the historical climate) range from an increase of 2% under the wet extreme to a decrease of 8% under the dry extreme. Under the median future climate, runoff decreases by 3%.(^{13})</td>
</tr>
<tr>
<td>2030</td>
<td><strong>Victoria:</strong> runoff in 29 catchments declines by 0-45%.(^{14})</td>
</tr>
<tr>
<td>2030</td>
<td><strong>Northern Australia:</strong> Across the drainage divisions, rainfall in the future (around 2030) is expected to be similar to conditions of the 1990s, within a range of +10% to -20%.(^{15}) <strong>Kakadu National Park:</strong> 80% loss of freshwater wetlands in Kakadu for a 30 cm sea-level rise.(^{16})</td>
</tr>
</tbody>
</table>

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13 CSIRO (2009) Climate Change Projections and Impacts on Runoff for Tasmania CSIRO Tasmania Sustainable Yields Project. CSIRO.


<table>
<thead>
<tr>
<th>Year</th>
<th>Region</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>2030</td>
<td>Murray-Darling Basin</td>
<td>The impacts of climate change by 2030 are uncertain; however, CSIRO has found that due to climate change, the median decline in surface water runoff by 2030 for the entire MDB is most likely to be 11% – 9% in the north of the MDB and 13% in the south of the MDB. According to CSIRO, “The relative impact of climate change on surface water use would be much greater in dry years. Under the median 2030 climate, diversions in driest years would fall by more than 10% in most New South Wales regions, around 20% in the Murrumbidgee and Murray regions and from around 35 to over 50% in the Victorian regions. Under the dry extreme 2030 climate, diversions in driest years would fall by over 20% in the Condamine-Balonne, around 40 to 50% in New South Wales regions (except the Lachlan), over 70% in the Murray and 80 to 90% in the major Victorian regions.”</td>
</tr>
</tbody>
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Climate Change Will Affect Groundwater

Climate change is impacting both the depth of groundwater tables and renewable groundwater recharge rates. Around the world, knowledge of existing extraction and recharge rates and groundwater levels is poor and little research has been carried out on the impacts of climate change on groundwater or the interactions between surface water and groundwater resources.

However, knowledge of current recharge and levels in both developed and developing countries is poor; and there has been very little research on the future impact of climate change on groundwater, or groundwater–surface water interactions. Groundwater flow through shallow aquifers is an integral part of the hydrological cycle and therefore affected by climate variability and change through recharge processes and regional human impacts.

Groundwater extraction has been increasing and groundwater levels falling around the world due to over-pumping since mid last century. Any climate change related decreases in rainfall and subsequent groundwater recharge are therefore additional burdens to overstretched systems.

Increased rainfall events and variability may decrease groundwater recharge in humid areas as more frequent heavy rainfall events may over-saturate the infiltration capacity of the soil with water lost to surface systems. In semi-arid and arid regions increased variable rainfall events may increase groundwater recharge, as only heavy rainfall events are able to infiltrate the aquifers before evaporation. Alluvial aquifers are mostly recharged by flood inundation.

Climate Change Will Increase the Risk of Greater Hydrologic Extremes

Climatic models suggest that global warming will lead to greater climate variability and an increase in the risk of hydrologic extremes such as drought or flooding. For Australia, this is partly because of the increased frequency of the phases of the El Nino under climate change scenarios. Every major mainland city has faced water stress already at times over the last

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decade in Australia. In many cases climate change will increase these pressures through increased temperature and possibly lower rainfall combined with more frequent El Nino events. El Nino has existed for the past 130,000 years, with studies validating El Nino events in the 20th century as the most intense over that period. The term refers to a general warming of the central and Asian Pacific, which manifests as major shifts in the strength and frequency of weather patterns. The consequences to surface water hydrology are severe. These include immediate and chronic impacts on agriculture and food production, ranging from major droughts (Australia and Brazil), decimation of crops, reduced water quality, increased potential for algal blooms, and destructive rains and flooding (as seen in Ecuador and northern Peru). The erratic nature of El Nino (2-10 years) makes it difficult for farmers to know which crops to plant, and when to plant them, or for reservoir managers to lower reservoir water levels to make storage room available for excess water. Reservoir or dam failure can have an immense impact on civilian populations, the economy, and the environment. Although it is not clear that climate change is a driver of El Nino, models project that climate change may exacerbate the severity and frequency of El Nino.

Unmitigated Climate Change Will Reduce Water Quality

In Australia, there is a 50% chance by 2020 of the average salinity of the lower Murray River exceeding the 800 EC threshold set for desirable drinking and irrigation water. There are no integrated assessments of the impacts of climate change on runoff quantity and quality, salt interception and revegetation policies, or water pricing and trading policies.

Eutrophication (input of excess nutrients leading to overgrowth of plant material and subsequent de-oxygenation of the water killing off other living organisms) is a major water quality problem. With climate change, toxic algal blooms are likely to increase in frequency and last longer, with the potential to kill fish and livestock also posing a threat to human health directly through potable water supplies and indirectly with recreational activities on affected waters. Simple strategies that are resource-neutral such as flushing flows can significantly disrupt the high nutrient, thermally stratified conditions that are conducive to algal blooms thereby reducing both their duration and frequency. Sea-level rise will impact on storm-water drainage and sewage disposal in coastal and low-lying areas and the quality of the receiving waters. Sea-level rise is already causing greater coastal erosion, inundation, loss of estuarine wetlands and saline

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23 The International Resource institute for Climate and Social Research is currently working on a research project at the Angat reservoir in the Philippines. The single reservoir provides 97% of Manila’s drinking water and 65% of the hydroelectric power for Luzon, as well as irrigation for over 30,000 hectares of land. During the 1997-98 El Nino rainfall was reduced so drastically that irrigation had to be stopped and the hydroelectric turbines had to be shut down. The Philippine government desperately scrambled to buy coal at elevated prices from Australia and Indonesia at the last minute in order to keep generating electric power. To make matters worse, in late September 1998, the El Nino gave way to La Nina conditions resulting in above normal rainfall and the reservoir level rose so rapidly that water had to be released to save the dam. Angat reservoir had tried to base its water strategy by averaging out historical records, which were unable to predict the unexpected variations likely to result from an unexpectedly strong El Nino. In contrast, if the reservoir management knew in advance that rainfall is going to be heavy, it can release water for irrigation early on.
intrusion into freshwater sources. This will require changes in coastal management programmes. Increases in storm activity and sea-level rise are already inhibiting the ability of mangroves to stabilise coastal erosion and damp down storm wave damage. Global warming will mean an increase in demand for farm irrigation, garden sprinklers, perhaps even swimming pools, and water for evaporative cooling systems in buildings. Rising temperatures and high rates of evapo-transpiration will mean greater water demand in agricultural cropping systems. Since irrigated agriculture accounts for 70 per cent of global water usage, this increase could well be significant. The IPCC found that, different climate models project different worldwide changes in net irrigation requirements, with estimated increases ranging from 1–3% by the 2020s and 2–7% by the 2070s.

The increase in household water demand (for example through an increase in garden watering and swimming pools) and industrial water demand, due to climate change, is likely to be rather small globally, e.g., less than 5% by the 2050s at selected locations. But it could be higher in Australia where a significant percentage of household water demand is for water for residential gardens. An indirect, but small, secondary effect would be increased electricity demand for the cooling of buildings, which would tend to increase water withdrawals for the cooling of thermal power plants. Sydney Water has found cooling tower demand from commercial buildings is quite significant and would increase under warmer weather scenarios.

Adapting to Climate Change in the Water Sector

Unmitigated climate change is predicted to alter rainfall patterns. Climate change already appears to be reducing and altering rainfall patterns in many parts of the world. Given that, it is no-longer viable for water utilities to rely on increasing the number of centralized dams, which rely on rain falling in relatively small dammed water catchments. There is now a rapidly growing body of literature which recommends a more sophisticated approach to meeting water needs focused on an integrated approach of water efficiency, demand management and supply augmentation through decentralised approaches to water reuse and recycling. It is well summed up by the 2008 IPCC Climate Change and Water report which stated

In the absence of reliable projections of future changes in hydrological variables, adaptation processes and methods which can be usefully implemented in the absence of accurate projections, such as improved water-use efficiency and water-demand management, offer no-regrets options to cope with climate change.

Such an approach will simultaneously address all the other major challenges currently being faced by water supply companies and water planners. These include:

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- Increasing population, economic activity, and other water needs, such as restoring environmental flows to rivers and wetlands, which are increasing the demand for limited water resources.36

- The trend for people to move to cities is placing greater demand on constrained geographical resources. This is creating increased competition for a scarce resource between agriculture, cities, and industry.

- In addition to this, new government policy objectives increasingly call for water to be provided at the lowest economic, environmental and social cost, often requiring stakeholder engagement.

- Water utilities are increasingly also required to meet demand reduction targets often set by government with little analysis of their cost or feasibility in a given region. Water utilities need to maintain profitability despite potential lost revenue through demand management and water efficiency programs and initiatives.

- Community attitudes have shifted dramatically towards the damming rivers over the last three decades. There has been a significant rise in ‘green’ attitudes and increase in demand from customers for sustainable solutions to water management. This includes re-use options.

The Demand Management Approach

We refer in this lecture to this relatively new “water efficiency/demand management” approach, as the “Soft Path,”37 and the old traditional centralised approach to water supply augmentation as the “Hard Path” out of respect for the original pioneering literature on demand management and resource efficient approaches to resource management dating back to the 1970s. Soft paths can be described as approaches to natural resources management that rely on firstly a focus on demand management and a prioritisation of ultra-efficient ways of meeting end-use water demands coupled with, secondly, a multitude of geographically distributed, relatively small-scale sources of supply.”38 In contrast, hard paths rely on large-scale, capital-intensive sources of supply and centralized management. Where soft path approaches are applied to existing centralised water infrastructure the “soft” path may also rely partly on centralized infrastructure, but complement it with extensive investment in water efficiency, demand management, and water recycling with decentralized facilities.39

Many water utilities are already embracing and implementing the “soft path approach” for water with remarkable results. For example, by 2005 Sydney Water Corporation (SWC) had invested over AUD$80 million in water efficiency/demand management programs and achieved an estimated saving of 35,000 ML per annum. This has enabled current water per capita levels in Sydney to be reduced now to what they were in 1970. Sydney Water estimates that they can achieve a further 145,000 ML per annum from further water efficiency and demand management. Water efficiency and demand management programs, such as water restrictions, plus water recycling are now being used by Sydney Water to manage supply and demand for water in the greater Sydney Region.

A Soft Path For Water to enable Adaptation to Climate Change

The environmentally sustainable “soft path” differs from the hard unsustainable traditional path for supplying water services in at least 8 fundamental ways. Each of these will be discussed in this lecture:

1. Focusing on achieving environmental sustainability. The soft path is motivated fundamentally by the recognition of the environmental unsustainability of the current approach and instead seeks, over time, to achieve a truly environmentally sustainable and lowest cost approach to providing water services. Hence soft path approaches often start by defining a vision of what a truly environmentally sustainable and water efficient future for water management could look like.
like, say for 2030 or 2050. A good way to plot a workable and attractive path between the current status quo and an ideal future is to backcast, by starting where we want to be, an equitable and water efficient future and then work backwards to the present. Too often planning is an extension of where we are, rather than identifying worthwhile goals and then setting out a path to achieve them. During this process transition technologies need to be identified with policies and programs developed to facilitate the changes towards the chosen future goals. Backcasting our preferred water futures can be an effective method of identifying and overcoming the challenges we face in achieving sustainable water use.

2. **Focusing on ensuring water for human needs.** The soft path redirects water utilities, government agencies, private companies, and individuals to work to meet the water-related needs of people and businesses, rather than merely to supply water. People do not want to “use” water, rather they want the services water provides. Taking a services approach opens up new options and opportunities to meet society’s needs whilst using water in a much more environmentally sustainable manner. This means that water utilities are now becoming ‘water service providers’ rather than commodity suppliers.

3. **Focusing on meeting the supply-demand gaps in water resources as much as possible from the demand side.** The goal is to apply least-cost approaches to reduce water use at every stage from water withdrawal to wastewater disposal and (ideally) recovery. As Module B showed water efficiency opportunities of between 30-80 per cent exist across most sectors of the economy. In Module B, Lectures 2.4 – 4.3 highlighted significant potential for water efficiency improvement in the industrial, commercial and institutional sectors. Effective communication of these efficiency gains, as part of aggressive demand management programs, has seen some municipal water utilities reduce water demand by as much as 30 per cent.41

4. **Matching the Quality of Water Needed with the Quality of Water Used:** The soft path leads to water systems that supply water of various qualities, with higher quality water reserved for those uses that require higher quality. For example, storm runoff, greywater, and reclaimed wastewater are explicitly recognized as water supplies suitable for landscape irrigation and other non-potable uses. This is almost never the case in traditional water planning: all future water demand in urban areas is implicitly assumed to require potable water. The soft path recognizes that single-pipe distribution networks and once-through consumptive-use appliances are no longer the only cost-effective and practical technologies. The soft path recognises that the potential to augment traditional water supply with reuse and recycling of water is significant as shown for instance by Sydney Water in Figure 5.1.1 Most of the water used for agriculture and around half of the water being used for industrial and domestic purposes (half of household use is for toilet flushing and gardens in OECD countries) does not need to be water of drinking quality. Thus the soft path seeks to match the quality of the resource supplied to the quality required by the end use. Drinking water gets most of the attention, but it is one of the smallest users in our water budget. Increasingly, wastewater, stormwater and rainwater are being seen as recyclable resources rather than as disposal problems.

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5. **Matching the scale of the infrastructure to the scale of the need**: The soft path recognizes that investments firstly in water efficiency and demand management when combined with numerous decentralized approaches augmenting supply – such as rainwater and stormwater harvesting and use of large water tanks – are more cost-effective than simply ignoring demand management options and investing in large, centralized options such as more dams and desalination plants. Hence, in a “soft path”, we continue to rely on carefully planned and managed centralized infrastructure but this is complemented by a strong focus on firstly water efficiency and demand management and secondly on small-scale decentralized water augmentation options. In Module B we showed the significant potential for water efficiency improvements to be made in most sectors. Thus, by using water more efficiently and utilising the full array of water recycling options, it is possible to delay, or even eliminate, the need to construct more dams and other major centralised water infrastructure such as desalination plants. Figure 5.1.2 clearly shows the significant decline in new dam construction globally from the 1950s/60s to the 1980s/90s.

![Fig. 5.1.2. Construction of large reservoirs worldwide in the 20th century. Average numbers of reservoirs with volume greater than 0.1 km³ built by decade.](source: Avakyan et al, 1998)

The annual cost of continuing down the ‘hard path’ until 2025 globally has been estimated at US$180 billion per annum. This is the cost of the global provision of water and related services at the current level of industrialized nations; it assumes the provision of such services via centralized supply and treatment infrastructure. However, this figure can be reduced to an annual cost of US$10 – 25 billion, if the emphasis is on employing the soft path for the provision of basic human water needs. As Dr Peter Gleick explains,

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The more expensive estimates assume a cost of around US$500 per person—typical of the costs of centralized water systems in developed countries. However, field experience shows that safe and reliable water supply and sanitation services can be provided in urban areas for US$35 to US$50 per person and in rural areas for less than that when local communities build appropriate-scale technology. The soft path is so much cheaper because of its emphasis on first addressing rising demand for water through a focus on water efficiency and demand management. The soft path is also cheaper because of the use of many small de-centralised rainwater/stormwater harvesting and water recycling systems to augment supply instead of building additional large centralised and expensive dams and desalination plants. Decentralised water recycling systems are smaller than centralised systems and thus have both lower up-front costs and shorter construction time reducing the costs from tying up capital unproductively or needing to rely on large loans from banks.

![Centralized wastewater treatment and Decentralized approach](image)

**Figure 5.1.3** Comparison of Centralised and Decentralized Approaches to Wastewater Service. STP indicates a centralised sewage treatment plant. *(Source: RMI, 2004)*

Urban water systems were designed largely to meet the health concerns of over 100 years ago with the water treatment technologies available at that time. This was an important step forward, at that time, as ensuring clean water sanitation has had a profoundly positive effect on health. But now, in the 21st century, innovations in water recycling and water treatment are making it possible to re-design urban water systems anew in a more decentralised manner. For instance, as Professor Mike Young stated:

‘One of the really interesting ones is how we use sewage water. Recent work by CSIRO’s urban water program is showing that the most profitable sewage treatment plants now are really ones that treat effluent, between 5000 and about 8000 or 10,000 houses, so rather than having sewage treatment plants right at the end of the city and taking all the sewage the whole way down, you would take the sewage from say, 5000 houses, treat it, and then actually pass it down in a dual system through the rest of the city.’ This work by CSIRO demonstrates the cost effectiveness now of the decentralised approach.

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47 ABC 4 Corners Reporter Ticky Fullerton interviews Professor Mike Young, CSIRO economist and member of the Wentworth Group on 15 June 2003 near Tailem Bend, SA.
6. **Focusing on meeting society’s water needs with a minimum carbon footprint:** The soft path also recognises that in a carbon constrained world, water utilities need to consider the energy requirements and greenhouse gas emissions of each water supply augmentation option. Desalination, for instance, is highly energy intensive, compared to the implementation of a comprehensive demand management and water efficiency program to manage the water supply and demand gap. For instance, water utility led demand management programs that encourage households to use more water efficient showerheads also will lead to significant energy savings as hot water systems can use as much as 30 per cent of all energy used by households. Water utilities also can save energy and reduce greenhouse gas emissions within existing operations. Sydney Water has:

> Identified 104 opportunities to save on electricity demand, with a varying range of payback periods. A total of 48 are either underway or are in the process of being implemented. These include eight cogeneration and hydroelectric plants that will be operational by mid-2009, adding to three such existing facilities that are already running. Cogeneration captures biogas from the wastewater treatment processes to create heat and electricity, while hydroelectricity energy is generated from water and wastewater flows within the pipe network. Other methods of savings include real-time pump scheduling of water supply systems, running pumps closer to their best efficiency point, optimising control and use of equipment within treatment plants, optimising aeration systems “and a number of smaller projects that will add up benefits to the organisation.”

7. **Ensuring Public Participation in decisions over Water:** The soft path requires water utility personnel to interact closely with water users and stakeholders. Users need help determining how much water of various qualities they need, and neighbours may need to work together to capture low-cost opportunities such as greywater treatment plants that capture and resupply water to a number of homes on a street. In this way not only costs but also total available water source is shared. Communal rainwater tanks are another example of the opportunities available through public participation. Communal tanks overcome some of the traditional issues with household tanks. Plenty of examples of these in new developments.

8. **Using the Power of Smart Economics:** The soft path recognizes the complexity of water economics. “Decoupling regulation” to enable water utilities to profit from selling less is a huge issue for water, as it is for energy. Currently in the urban water sector, most urban water utilities are simply required in their statutory requirements and by regulation to ensure supply of water and maximise the financial return from providing it. In other words water utilities, under current regulations, are required to maximise financial return and their main way of achieving this is by selling more water. Currently in statutes and regulations in most countries there is no incentive for most water utilities to help their customers use water more efficiently as this would perversely hurt their bottom line. Dover gives an example of how this works in Australia, where regulations for urban water utilities currently work against efforts to achieve water efficiency and demand management.

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While public health and basic service provision were still important, economic efficiency of operations (has become) an underlying imperative, given direction by the corporatisation of water agencies within statutory frameworks that gave greater primacy to financial return... (So) In their defence, many of the things that are increasingly being demanded of corporatised water utilities are simply not rational for them to do within the statutory mandate that governments, representing society, have given them. This includes such things as mandating efficiency, undertaking long-term environmental monitoring, collecting water data that informs other than straight commercial accounting needs and investing in different forms of supply and treatment infrastructure.50

Thus statutory requirements of water utilities currently work against any CEO of a water utility in Australia contemplating implementing water efficiency programs for its customers. That said, even under current regulation and statutory requirements, water utilities have still found that water efficiency and demand management programs over time are more profitable than having to build expensive dams or more desalination plants to meet rising demand for water from their customers. Given that, imagine what could be achieved, if governments, regulatory frameworks and statutes governing the water supply sector actually rewarded water utilities for their water efficiency and demand management programs. This can be done. It is possible through smart regulation to decouple water utilities profits from sales so that they are rewarded for helping their customers use water more efficiently. This approach has worked well in the energy sector for energy utilities in California. In California energy intensity is 55 per cent less than the US national average partly due to these regulations which decouple utility profits from sales and instead encourage utilities to run efficiency programs for customers.

Water utilities, generators and suppliers benefit from changes to regulations which reward them, rather than punishing them financially, when they encourage water efficiency. There are significant commercial benefits from this approach because it maintains and improves their bottom line whilst delaying the need to build new dams or sewage treatment plants. It also helps utilities build customer goodwill and loyalty. Rewarding utilities for selling less water also shifts the focus of water utilities from asking “how can we increase sales?” to “how can we further reduce demand.” Such regulation has been shown to be very successful at flattening demand and thus making investment in further large dams and large supply augmentation not necessary and financially risky. Hence, governments have a key role to play in enabling the soft path to happen as efficiently as possible through regulating to reward water utilities for doing the right thing and helping their customers save water.

Conclusion:

To conclude, this soft path requires expertise in multiple fields such as engineering and new technologies, the latest advances in water efficiency (see Module B), environmental, health and social sciences, economics, stakeholder engagement, and policy. Water utilities and the water professional associations increasingly recognise that they need their staff to diversify their skills to proactively address these challenges and opportunities facing water supply utilities in the 21st century. Module C, complements Module B in bringing together the latest best thinking, writing

50ibid.
and frameworks to help improve the skills of staff of all water utilities, engineering firms and relevant government departments to help to realise the opportunities of the “soft path.”

To start to implement the soft path to water supply and demand management water utilities need to adopt a new water planning and management framework. Over the last three decades, various approaches have been under development internationally to help water utilities manage these complex issues. Integrated water resource planning has emerged as the most useful framework for decision making in this area. In Lecture 5.2 we provide an overview of how to implement an integrated water resource planning framework.

Further Reading

Soft Paths for Water


accessed 3 March 2010


Introduction to the Key Elements of a Soft Path Approach

Vision for A Sustainable Water Future Through A Soft Path Approach


Backcasting


Identifying Water Efficiency Opportunities


Decentralised Approaches to WasteWater Treatment and Recycling


Integrated Water Resource Planning


Other Useful Links

Additional papers on “soft path for water” available at [http://www.poliswaterproject.org/softpath](http://www.poliswaterproject.org/softpath) accessed 3 March 2010