

Alternative water supply

The demand-side risks of large-scale desalination

There is a saying in Australia: "The easiest way to break a drought is to build a desalination plant..." They should know; they have been there, and have just done that. This article explores how a drought led to a vast investment in desalination capacity in several Australian cities, and what the various responses were in the different regions, when the drought was finally broken. It then reflects on the demand-side risk of the investments, and how different cities responded to it.

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“Nothing is more important to Western Australians than the security of our water supply. As we experience an increasingly dry climate, evidenced by dwindling inflow to our dams, we must re-think the way we source water.”

The worst drought in Australian history lasted from 1997 to 2009, and left a lasting scar on the national psyche. Their densely-populated coastal belt was hit the hardest, and the Murray-Darling basin, sustaining their primary agricultural zone, was devastated. In response to this crippling drought, Australia built six large desalination plants which, as a cluster, were the most expensive of their kind, to date, anywhere in the world. And then the rains came... Capital investment in a disruptive environment can be cruel.

The drought

It is important to know how the drought played out. Australia is not a stranger to droughts; since 1860, when records began, there has been a major drought somewhere on the Australian continent in 82 out of the 150-odd years, and droughts are now regarded as common and often-repeated events of Australian climate. The Millennium Drought, as the 1997 to 2009 episode is now known, was the most severe of all. Whereas the previous droughts affected only specific regions, this one affected large parts of the continent over several years, including Australia's five most populous cities, Sydney, Perth, Melbourne, Adelaide and Brisbane, as well as the major food-producing regions in the Murray-Darling basin.

The build programme

It was therefore no surprise that Australia launched a massive build programme of large-scale desalination plants,

which yielded six plants in the five most populous cities, coming on-line from 2006 through to 2012. Perth built two plants of 144 and 290 MI/d capacity, Adelaide a plant of 300 MI/d, Sydney a plant of 250 MI/d, and Melbourne a massive plant of 450 MI/d. The total EPC expenditure amounted to AUD12-billion.

It should be noted that the Australian projects, with the exception of the first Perth plant (Kwinana), set new industry records on a cost-per-design-capacity basis; these costs are certainly not the norm. The high cost was caused by a few contributing factors:

- All the projects except Kwinana required very expensive tunnelling during the construction of the marine works;
- This was Australia's first foray into the large-scale desalination market; bidders are known to add a risk premium in such circumstances;
- Australia's high labour cost;
- Very high environmental standards, which required expensive impact mitigation measures;
- The high cost of borrowing; the projects were financed during the global financial crisis.

The drought broken

Then came the rain, and in no small measures either. Frequent and heavy rain events during 2010 and 2011 brought about the wettest two-year period in the history of Australia. Large parts

of the continent had record-breaking rainfall throughout 2010 and 2011, and certainly the densely-populated coastal belt saw welcome relief. Notably though, the drought persisted around Perth in Western Australia.

Brisbane, situated on the Eastern edge of the continent, was struck by extreme flood events in January 2011 and again in 2013. Ironically, the newly-built Brisbane desalination plant had been handed over to the Queensland government just two months earlier, in October 2010.

Demand-side risk

This brings us to the demand-side risk of water infrastructure; the risk that the assumed demand projections made during planning may not endure through to the operational phase or, in fact, last for the duration of the facility's life span. Circumstances may change, which erode the need for a given size of facility. This has significant implications for loan redemption, and for the technology partner who is contracted to run the facility. However the contract may be structured, the risk that an investment may be standing idle, lodges somewhere.

Before we explore the validity of this risk, it is interesting to observe how the six Australian plants are utilised today. For apparent reasons we will explore later, the demand-side risk did not unfold in the same way for all of them.

Here follows a summary of their operational status:

Desalination Project ¹	EPC Cost (AUD)	Capacity	Off-taker	Date On-Line	Current status (March 2015)
Perth 1 / Kwinana	\$387m	144 ML/d	Water Corporation	2/2007	Both on-line , and producing at 100% of capacity.
Perth 2 / Southern / Binningup	\$955m	290 ML/d		Phase 1: 9/2011 Phase 2: 9/2013	
Adelaide Desalination Project	\$1842m	300 ML/d	SA Water	Phase 1: 3/2012 Phase 2: 12/2012	On-line , and produced at 100% capacity through to December 2014. Now scaled back to 10% while optimal operation mode is being assessed.
Brisbane / Gold Coast / Tugun	\$1200m	133 ML/d	Seqwater	1/2009	On-line , but on 'hot standby' since December 2010.
Sydney / Kurnell	\$1900m	250 ML/d	Sydney Water	4/2010	Off-line, mothballed since December 2012.
Melbourne / Victorian / Wonthaggi	\$5700m	444 ML/d	Melbourne Water	12/2012	Off-line, mothballed since December 2012. The Government has placed a third consecutive zero water order for the supply period ending June 2015.

1. Depending on the literature referenced, the projects are called by various names, which could include the closest major city (e.g. Melbourne), the State (e.g. Victoria), or the suburb (e.g. Wonthaggi).

In Perth, Western Australia, the desalination plants are fully utilised, and they are supplying nearly half of Perth's water requirement. Rainfall has generally been below average since the Millennium Drought, and the dams within Water Corporation's service area are only 30% full. The general sentiment towards desalination is very positive, as it has been from the outset.

The view of the current leadership is that the two desalination plants were key investments in building water resilience. In the words of the Western Australian Water Minister, Bill Marmion: "Nothing is more important to Western Australians than the security of our water supply. As we experience an increasingly dry climate, evidenced by dwindling inflow to our dams, we must re-think the way we source water." In line with this thinking, Water Corporation has embarked on a ten-year plan to "drought-proof Perth by 2022 so that sufficient water supplies are maintained, whatever the weather."

In Adelaide, South Australia, the plant operated at full capacity from commissioning in December 2012 through to December 2014, during which time it produced one third of the city's water supply. However, due to good rainfall, the dams in the area are

now 58% full, and the desalination plant has been scaled back to 10% of capacity.

The current Water Minister, Leon Bignell says of the desalination plant: "It's there for when we don't have a rainy day. ... when it is in full production, and we are in the grips of a terrible drought, it will be seen as one of the best pieces of infrastructure ever built in South Australia." Despite this view, the regional political discourse on this matter seems to focus very much on the vast capital outlay for the plant, and the cost of desalinated water. An opposition water spokeswoman called the plant "an expensive experiment", and claims that the plant, which has the capacity to meet half of Adelaide's demand, "should have been built at half its size."

In Brisbane, Queensland, the Tugun desalination plant has been on hot standby since December 2010. This requires frequent start-ups for the plant, which it was not designed for, and it introduces additional asset risks. It does however save around AUD10-million per annum over running the plant at one third capacity, which would have cost around AUD24-million.

Dam levels in the South East Queensland region are now at 96% and plant will only be restarted when levels fall below 60%.

The current leadership view is that the plant capacity was designed "beyond its needed functional optimum", and the Queensland State Government has commenced with a study to explore alternatives for the future of the Tugun plant.

In Sydney, New South Wales, the Kurnell plant operated for a two-year proving period through to December 2012, when it was taken off-line and mothballed. The operating regime was adopted that it will be restarted whenever dams are at 70%, and again be mothballed at 80%. Dam levels are now nearly 100% full, and the prognosis is that a restart within the next two years is unlikely. In the interim, the plant's contracted operator (Veolia) has taken measures to protect the plant and its equipment during the extended shutdown.

During 2012, the State sold the Kurnell plant to a pension scheme for AUD2.3-billion under a 50-year lease-back agreement, which released net proceeds of AUD300-million back to the State for financing other infrastructure. This allowed the State to disinvest from an asset it no longer viewed as strategic, and so reduce much of the pressure on municipal water rates. It is interesting to note that capital recycling (selling public assets to provide capital for new



Perth also constructed desalination plans to assist the city against drought.

investment) has now become a regular practice in Australia.

In Melbourne, Victoria, the Wonthaggi plant will remain mothballed for a third year running, and probably remain so for the foreseeable future, since the dams in the region are currently 75% full. The current labour government sees the plant as an “important insurance policy” – it was, after all, a labour government who committed to the plant back in 2007.

But incredibly, the AUD5.7-billion plant has produced no water since the performance tests and commissioning were completed. Even prior to completion, the project became a significant liability to the Labour government who launched it; a political hot potato, synonymous with waste, mismanagement and spin.

In December 2010 a Liberal-National coalition came to power in Victoria, and early in 2013 the new Water Minister, Peter Walsh announced that it was “a personal ambition to never order water from the Wonthaggi Plant”. The desalination plant had become politically “toxic”, to the extent that the *Sydney Morning Herald* speculated that the coalition government “is so determined to use the plant as a political weapon against Labour, it is deliberately planning to keep it mothballed for as long as possible, stressing the idea that the whole thing has been a giant waste of taxpayers’ money.”

Numerous project challenges and setbacks were encountered during construction: Cyclonic weather, labour unrest and low productivity of the workforce caused construction delays of nine months. This resulted in legal claims and counter-claims between Aquasure, the consortium that built, owns and operates the plant, and the State of Victoria, during 2012 and 2013.

By October 2013, claims amounting to AUD1.3-billion, mainly from Aquasure against the State, were finally resolved, which paved the way for Aquasure to refinance AUD3.7-billion of project debt at less than half of its original cost.

“Agreeing to early refinancing now and resolving claims will allow AquaSure to obtain a better risk profile for the desalination plant project, and in turn, this means significantly lower financing charges,” said Walsh at the time. “The amount of savings to be realised by water customers is expected to be significant.”

In December 2014, the Labour party returned to power in Victoria. The desalination plant is still a sensitive matter, but now less of a political embarrassment.

Reflection

The events described in this article, the drought, the desalination build programme, and the two wettest years that followed, created a pretext for suggesting how water may be valued in the different parts of Australia. In Western Australia, and to some degree also in South Australia, the value of water security, and its fragility in the light of climate change, seems pervasive and deeply ingrained into the consciousness of nearly all who live there. Of course, the same is true of those who live in other parts of the country, but it seems to a lesser degree, and less pervasive. The relative ease with which the desalination investments became politicised in Victoria, and the decision in New South Wales to sell the desalination plant, suggest that the price of water may be perceived as more important than climate-independent water security.

Neil Palmer, the CEO of the National Centre of Excellence in Desalination Australia (NCEDA), observes: “Internationally, other countries are looking at Western Australia’s use of desalination as a stand-out example of best practice, and using its plants as environmentally sustainable benchmarks as their energy requirements are offset by purchasing renewable energy. Yet sadly on the east coast the focus around desalination is short term, on current pricing rather than the long-term benefits - avoiding the fact that without desalination, east coast cities will face water deficits in years to come.”

Which brings one to the demand-side risk of the desalination investment; drawing on the Australian examples, it is clear that an expectation of substantial and sustained demand on a desalination plant will often be unrealistic, unless the region is naturally water scarce, and the yield of the plant is destined purely for base-load supply. In areas where the dam inflows have been slowly decreasing over a number of decades, suggesting a long-term decline in rainfall and increased evaporation, desalination can certainly be a solution, but with the caveat that the demand-side risk be assessed over an extended period.

Finally, as the *Sydney Morning Herald* observed in 2013: “... Australia experiences a drought on average every 18 years, although the time between severe droughts can vary from four to 38 years. Victoria’s desalination plant has been built to last 100 years. In the absence of new dams, it is almost inevitable Victoria’s desalination plant will be needed at some point, particularly with Melbourne’s population swelling by around 80 000 people a year. At this point, instead of seeing it as a white elephant, it might be viewed as a necessary insurance policy – albeit a fairly expensive one.”