Water everywhere but not a drop to drink

Water shortages are plaguing Australia's big cities. Climate change experts suggest a small reduction in future rainfall will cause a much larger reduction in runoff collected by dams. But not far away from the big cities is plenty of salt water. Why don't we just fix the 'water problem' and obtain most of our water from the ocean?

Seawater can be treated by reverse osmosis to remove the salt. This process also takes out other impurities and produces almost pure water. There are now several large desalination plants around the world, notably in Perth, Israel and Dubai, while a plant is being built at Tugun on the Gold Coast.

The Tugun plant will produce 125 megalitres per day, or 45,000 megalitres per year, half of which is for the Gold coast, while half of the water will be piped to Brisbane. The cost is expected to be $1.26 billion, with annual operating costs of $48 million.

The main concern about desalination is the energy cost and the 200,000 tonnes of carbon dioxide emissions associated with this energy.

Desalination of sea water requires a lot of energy due to the very high pressures required to force the water through the membranes. The pressure needed is related to the salt content. Dalby town has a desalination plant which requires pressures of 6 bar to treat underground water with a small amount of salt – around 3000 mg/litre. Seawater has 37,000 mg/litres of salt and the water pressure required is of the order of 60 bar.

Desalination plants are now built with energy recovery programs which uses the high pressure waste water stream to help pressurise the water going into the plant. However the net energy is still of the order of 4.9 kWh/kilolitre of water produced which will cost around $0.50.

The energy required for the Perth desalination plant is to be offset by energy from a wind farm on the coast to the north of Perth. This helps to offset the greenhouse gas emissions, but with green power around double the cost of normal power it will increase the price of water.

The energy cost of desalination is not so bad when we compare it with other alternatives. One estimate I have for pumping water 150 kilometres from the Traveston Dam to Brisbane is 4.7 kWh per kilolitre which is about the same energy as required for desalination of seawater. Pumping water from the Burdekin river to Brisbane is likely to require 6 to 8 times the energy of desalination. On this reason alone it sounds like a dead duck!

The cost of water produced from desalination has still to be determined, but is likely to be at least $2/kilolitre or twice the current price of water. The annual operating costs represent $1.06/kilolitre, while pumping from Tugun to Brisbane is likely to increase this by $0.50/kilolitre.

However, the huge cost hidden cost of all of the new water supplies is the capital cost and with much of it borrowed, taxpayers pay the interest cost one way or another. Whether it is the Tugun desalination plant or the Traveston dam. the interest on $1.2 billion amounts to around $80 million per year and $0.90 per kl for the water produced.

The main question about building more desalination plants whether there are likely to be cheaper alternatives.

In a previous article I presented data to show that Brisbane has more water available from storm water runoff than it uses each year. While the capital cost of collecting storm water may be high, a big advantage is that the energy costs and the operating costs would be much lower. Collecting the water within the city boundary would save the huge costs of pumping water from elsewhere.

If the price of water goes up, water customers may well find it cheaper to use water from rainwater tanks. If government incentives pay for two thirds of the cost of tanks, the urban household could to obtain their own water for $1/kilolitre. This is likely to be less than the cost of water once the new SE water grid is established. Importantly there is only a very small energy cost and greenhouse gas emissions related to this source of water.

The other main issue with desalination, apart from energy and cost is the disposal of the salty brine. The amount of salty water discharged is but a drop in the ocean, but high salt water can behave in peculiar ways. It is heavier than seawater and can remain intact in a plume, flowing along the ocean floor and affecting plant life such as seagrass and marine animals in its path. At Tugun this is being managed by dispersing the flow along many outlets in a pipeline extending 3 kilometres out to sea.

A water plan for the SE of Queensland needs to diversify its water supply and not just depend upon dams which may be less reliable in the future. Having a desalination plant as part of the supply network makes good sense, even though it is expensive water. It also means less water needs to be poached from rural towns and communities further and further away from Brisbane. However, there are likely to be better options to explore before building more desalination plants, including harvesting water from the 300,000 megalitres of storm water runoff from Brisbane's own catchment.