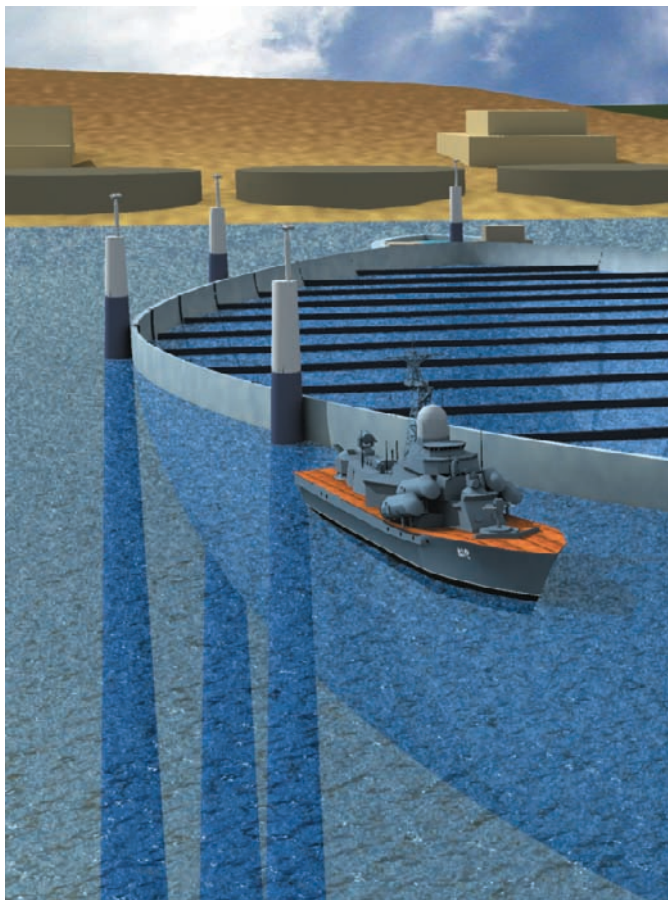
The Aquadam

A sea-change for water storage

Could a radical Australian idea for floating self-powered desalination reservoirs be a timely solution for water supplies, changing the way we handle water on land? It is an ingenious idea, and it just might work. **Wendy Pyper** reports.



Unique Planet is pushing ahead with its patented concept for a floating, self-powered desalination reservoir, which could provide continuous recycled water and excess power to cities. Stephen Outram/Unique Planet

Australian's are learning to live with water restrictions, reduced rainfall, disappearing aquifers and the ravages of drought. But what if we didn't need to? What if there was a way to supply our unquenchable demand for fresh water – to provide humans, animals, parks and gardens, industry and the environment with incessant water?

Enter the 'Aquadam Project' – a starkly innovative scheme to collect and store vast quantities of fresh water to supply entire cities. The brainchild of innovation architect, John Dobozy (see *Ecos* 118), the Aquadam will capture and store rainwater, stormwater and desalinated seawater in a flexible, floating dam sited some 2 to 5 km out to sea. A guaranteed supply of purified water will then be piped to neighbouring cities or towns, easing the growing burden on catchments and rivers.

'The Aquadam will be made from a hydro-dynamically shaped flexible reservoir, about 3 km in length and 1 km wide, which will float in the ocean and expand downwards as it fills,' Dobozy explains.

'The perimeter of the membrane will be attached to several flotation devices so that it remains buoyant, and two or more platforms – to support the infrastructure needed to operate the system – will be anchored to the seabed by several pylons.'

Each pylon will incorporate wind and wave turbines and solar panels to power the system, and Dobozy calculates that there will be enough surplus energy to supply surrounding homes and businesses. Critically, the structure of the Aquadam will be engineered to enable it to withstand tropical cyclones and high seas.

Dobozy and his son, John Jr., have been developing the Aquadam concept through his company Unique Planet Pty Ltd, for the past two years, in an effort to solve the problem of water scarcity and mitigate the environmental damage caused by river-based dams and over extraction. Already in consultation with experts in engineering, renewable energy technology, marine science, hydrology and desalination technology; and water associations, environmental organisations and council departments, among others; Dobozy aims to identify and implement the world's best practice in the construction of the first Aquadam on Queensland's Gold Coast.

Water wise

The capture and cleaning of stormwater – which will comprise about 30% of the Aquadam supply – presents the first major challenge. Dobozy says this will be achieved by channelling runoff from existing stormwater pipes that flow into the ocean (some 30% of rain becomes stormwater), into a series of strategically placed storage wells on the beach. Councils already have debris traps in place, so the water would simply need to be purified.

'We'll use a jet stream distillation system which boils the water and removes 100% of the contaminants,' Dobozy says.

According to stormwater harvesting specialist, Richard Marks, of InterWater Pty Ltd, the challenge will be to find an economic means of capturing, holding

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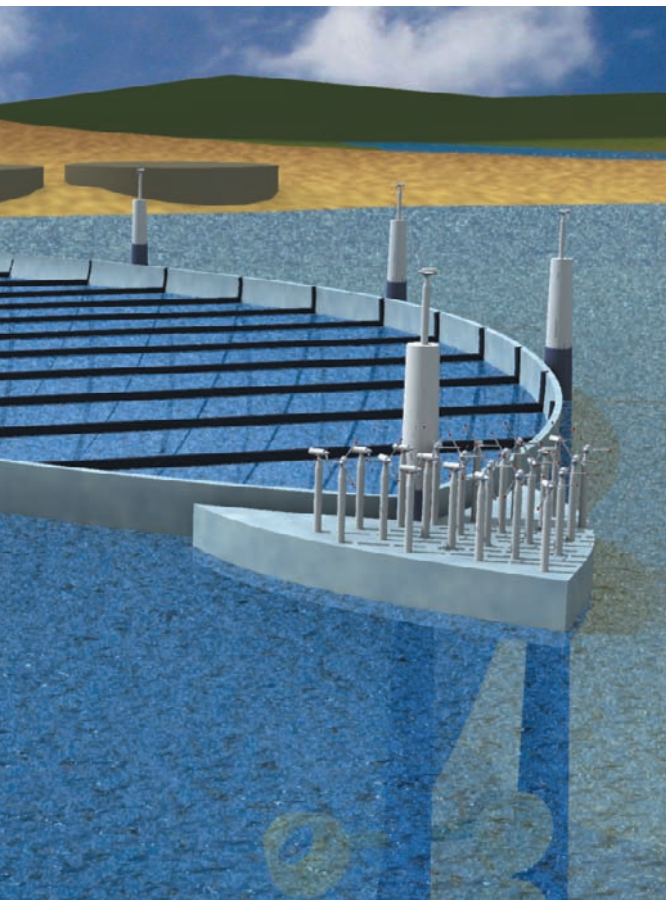


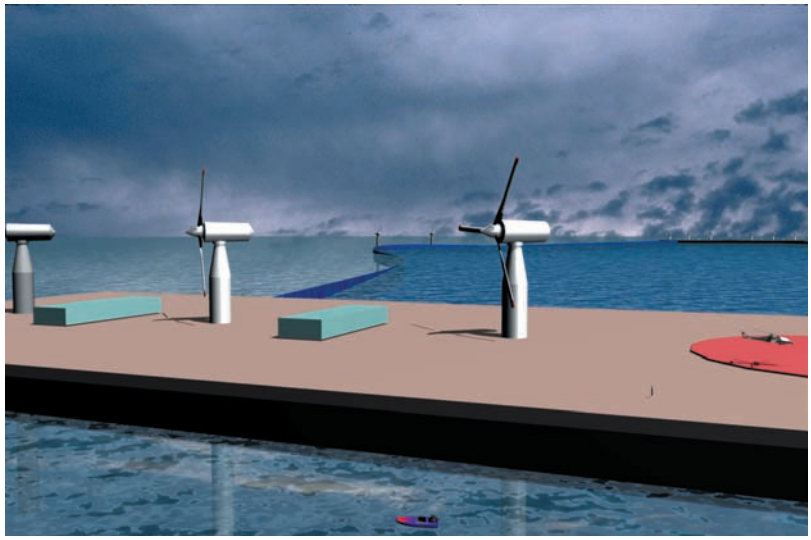
and cleansing the flow, for delivery to the Aquadam storage wells, at a manageable rate.

'Urban storm events deliver large volumes of water in several hours and typically what is collected in one day may take 10 days to cleanse in natural systems, such as wetlands, and deliver at a practicable rate to the Aquadam,' Marks says.

Marks uses a hydrological model called WaterCress, developed by David Cresswell and Richard Clark in South Australia, to optimise the capture, holding and cleansing components of stormwater harvesting systems for different catchments and required water quality. This model could help Dobozy identify the optimal stormwater capture and storage system for a site.

The advantage of the Aquadam over current stormwater 'recovery and use' systems is that it doesn't rely on aquifers (such as Adelaide's aquifer storage and recovery system), or land-based storage and treatment areas.

'Most capital cities in Australia don't have the hydrogeological features that allow aquifers to be used for stormwater storage, and finding a piece of land large enough to build a storage and treatment area is increasingly difficult and expensive. The Aquadam is an answer to this problem,' Marks says.



Powering the project

Desalinisation will contribute the bulk (around 60%) of the fresh water to the Aquadam. Powering a desalination plant with oil and diesel is expensive, but Dobozy's solution is to replace fossil fuels with green energy.

'We'll be using desalination technology that is more efficient and less costly than anything currently in use, and we'll operate the system with wind, solar, tidal and wave power,' Dobozy says.

Infrastructure for the desalination plant and power station will be located on two floating platforms at either end of the dam, anchored by pylons to the seabed. Wind turbines and solar panels would be situated on top of each pylon, and wave and tidal turbines below.

'We've estimated that we could generate over 160% of the power required for the entire system, and the excess energy could be fed back into the energy grid to supply electricity for as many as 3000 residential homes,' Dobozy says.

'There is even potential to use the excess energy to produce hydrogen from seawater.'

Mr Peter Parker of the Inventco Group of Companies and a consultant on tidal and wave turbines for the Aquadam, says further consideration may need to be given to comparing the cost of desalination on site, versus on land.

'But given that land is at a premium, using renewable energy generated *in situ* to desalinate seawater could prove more viable,' he says.

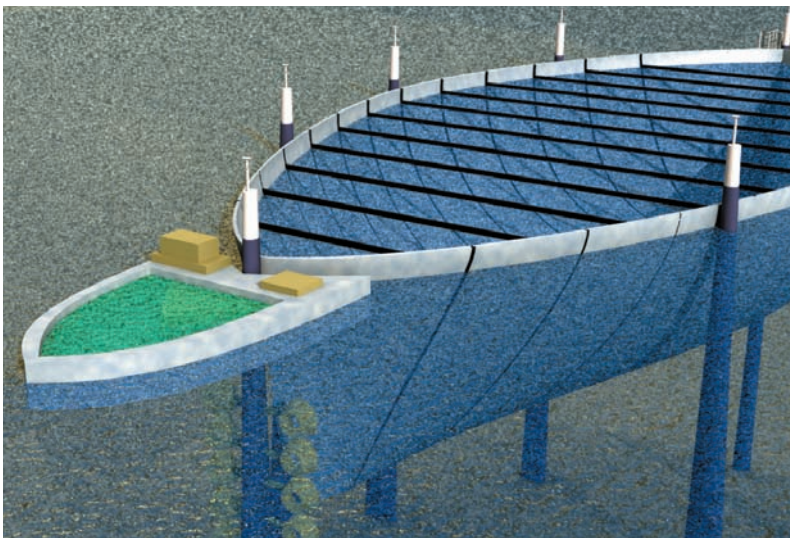
Dobozy says that using the most efficient renewable energy technology available will reduce costs. Parker has been involved in developing a tidal power system that is uniquely configured so that it extracts greater energy than a regular turbine. This and similar advances in solar and wind technology will be discussed at a series of workshops Dobozy has planned for early 2005.

Security and supply

It is estimated that Australia's 250 major dams collect only 7% of our rainfall, while the rest rushes out to sea. The Aquadam, however, will collect fresh water from multiple sources, which Dobozy says will guarantee a continuous supply.

By the time customers receive water from the Aquadam it will have been treated (by distillation) two or three times. To protect the water supply from

The Aquadam's parallel desalination process will be powered by renewable energy generated onboard. While other desalination techniques produce a concentrated brine solution that is discarded, Dobozy says he will adopt a technique that will generate marketable crystalline salt.
Stephen Outram/Unique Planet



Water filtered by the Aquadam's on-site and renewably powered plant would be stored in a smaller reservoir before being piped to on-shore wells. The shore-side platform will support facilities for desalination and secondary filtration.

Stephen Outram/Unique Planet

saltwater contamination, the Aquadam will be divided into compartments – much like an oil tanker – so that if one compartment becomes contaminated or leaks, others are secure.

When water leaves the dam it will be piped to storage wells on the foreshore and then pumped uphill – using renewable energy – to customers. Dobozy anticipates that local governments and private investors in the Aquadam would have a license to use the water.

'In the same way that agricultural operations will need a water license to draw water from a river, investors in the Aquadam, who need a guaranteed supply of water, would receive a license for a specified amount of water each year,' Dobozy says.

'This will help us raise the capital to begin the project, and provide an immediate customer base.'

While the technical and economic feasibility of constructing the Aquadam is more fully assessed, initial impressions by those who have seen the concept are favourable.

'It's the technical engineering considerations that will determine the project's viability,' says civil engineering consultant, Danny Hanna, of the Hannas Group, 'But it's a grand concept on a scale I've not seen before, and if it works it's certainly something the country will benefit from.'

Could the benefits flow?

The environmental benefits of the Aquadam could be huge, as water from land-based dams could gradually be returned to rivers. Most of Australia's rivers contain dams throughout their catchment areas and as more water is drawn from them, river systems and related ecology degrade (see pages 11 to 18). Dobozy doesn't expect the Aquadam would replace river-based dams completely, but thinks it could provide capacity enough to reduce our reliance on rain, and give something back to the environment.

'Studies have shown that household needs account for 8% of fresh water use,' Dobozy says.

'If we could take this 8% from Aquadams and pump 8% more water into our rivers for environmental flows, we could make significant steps towards rehabilitating them.'

With some five billion people expected to experience water shortages by 2025, the need for a bold solution to our fresh water crisis is apparent. On Queensland's

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Gold Coast – the proposed site of the first Aquadam – the storage capacity of the region's Hinze Dam is some 163 500 million litres. After several years of drought it is now struggling at 20–60% capacity to supply 460 000 residents and two million visitors a year. In order to meet this demand, councils will need to enforce water restrictions this summer, once again. In contrast, one Aquadam could supply a population the size of Sydney, all the time.

'Councils and governments should be searching for better long-term solutions for supplying more fresh water to the population, rather than restricting the current supply,' Dobozy says.

'Dams on rivers were the answer 50 years ago, but they can't supply enough water now, and they destroy the ecosystem. The most abundant supply of water is in the ocean and we have the technology to access that water and generate more than we need, without negative environmental side-effects.'

Gold Coast Federal Member for Moncrieff, Mr. Steven Ciobo, has expressed his strong support for the Aquadam and its implementation in Australia saying 'As the driest continent on Earth, it is now important we think outside the square when it comes to devising new ways of providing our most precious resource.'

CSIRO's Manufacturing and Infrastructure Technology division has recently expressed an interest in the project's evolution, offering expertise and possible assistance with a development team.

Getting involved

To advance the project, Dobozy is organising several brainstorming workshops in the coming months to involve people from different fields of expertise. The workshops will crystallise the planning and engineering of the Aquadam and the source the best technologies.

'I want to implement best practice immediately so that we don't have environmental or technical problems 30–50 years down the track,' Dobozy says.

The workshops will show computer simulations of the Aquadam, including the collection, treatment and supply processes, energy generation, mechanics and associated infrastructure. Dobozy is inviting anyone interested in being involved professionally with the realisation of the project to contact him at his company Unique Planet.

More Information:

Australian Water Association: www.awa.asn.au

'New dams are threatening the world's largest rivers' Article on WWF website, 22 June 2004. www.panda.org/about_wwf/what_we_do/freshwater/news/news.cfm?uNewsID=13770

Water in a dry land: issues and challenges for Australia's key resource. Environment Australia, 2000. www.deh.gov.au/water/quality/pubs/waterdryland.pdf

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