

# Pilot desalination will produce water for 1 cent per gallon

The pilot desalination plant at the Long Marine Lab that opened in March 2008 will provide planning data to design and construct a full-scale plant by 2015, <http://www.scwd2desal.org>. The cost to generate freshwater on campus might be of interest to UCSC long-range planners.

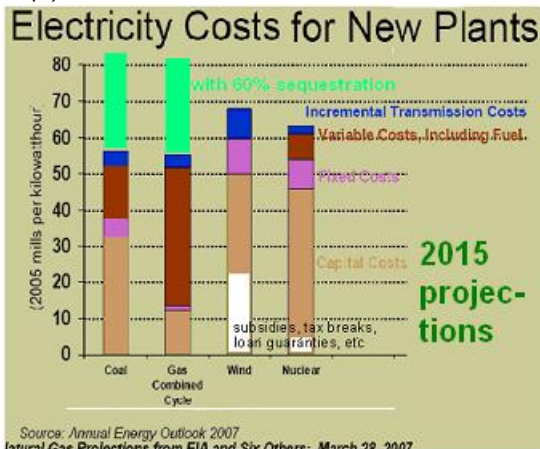
To get started, I estimated Santa Cruz's desalinated water costs by analogy with the Perth salt water reverse osmosis project (1).

The Perth salt water reverse osmosis (SWRO) project at a glance  
[http://www.energyrecovery.com/installations/documents/Perth\\_CS109EE.pdf](http://www.energyrecovery.com/installations/documents/Perth_CS109EE.pdf)

Total 1 <sup>st</sup> pass capacity, gallons/day	42,000,000 [160,000 m <sup>3</sup> /day]
Permeate capacity gallons/day:	38,000,000 [144,000 m <sup>3</sup> /day]
SWRO train capacity, gallons/day	3,500,000 [13,500 m <sup>3</sup> /day]
Number of SWRO trains	12
Membrane water recovery rate	43%
SWRO energy consumption	8.8 Wh/gallon [2.32 kWh/m <sup>3</sup> ]
Total plant energy consumption	13>14 Wh/gallon [~3.5 kWh/m <sup>3</sup> ]
Efficiency	20 to 97%
Total SWRO plant cost	above 300 M\$ <sub>2006</sub>
Power generation	wind-farm offset

My current take on the cost elements of Santa Cruz desalinated water is:

**Electricity.** By 2015 LML and UCSC electricity costs (2) will be from 8 to 20 ¢/kWh should natural



gas prices at Moss Landing stay flat ('from') or should escalate (3) at the 2008 rate ('to'). The cost of full-scale plant energy consumption will then be from **0.12 to 0.3 ¢/gallon**

**Capital.** For the 1.1>1.3x10<sup>10</sup> gallons/year Perth project the 2008 cost of capital may be as low as **0.07 ¢/gallon** with substantial subsidies. But huge subsidies in Santa Cruz may not last long and the

2015 unit cost of capital may be as high as **0.20 ¢/gallon**.

**Operations and maintenance.** O&M costs have been historically about 1.3 times cost-of-capital, i.e. O&M unit costs may be from **0.09 to 0.26 ¢/gallon** in a full-scale desalination plant at UCSC.

**Storage, distribution and delivery.** By late 2009 there ought to be a far more realistic and well-thought out plan than my subjective 2006 views. The Santa Cruz full-scale desalination plant will have the capacity of eventually desalinating 4 million gallons of potable water a day. My personal opinion last year was that SD&D would be from **0.2 to 0.3 ¢/gallon**, should the plant be located out of sight at the northernmost edge of the campus. Now (July 2008) I sense that this guess is geographically incorrect.



To summarize: I would say that Santa Cruz's potable water could be produced on the UCSC campus for **half to one ¢/gallon** and if pressed for a specific most-likely number, I'd say **0.85 ¢/gallon**.

The last value is about 2/3 of the way between the extremes of 0.5 and 1.0 ¢/gallon and assumes a triangular probability-of-occurrence skewed to the highest extreme, as usual for yet-to-be designed public projects.

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(1) Patrick Barta, *Amid Water Shortage, Australia Looks to the Sea*, **The Wall Street Journal**, March 11, 2008. A report of the use of almost-zero-carbon-footprint wind energy in combination with efficient pressure exchangers in the Perth salt water reverse osmosis project that began operations in 2006.

Technologies of desalination are also reported in:

1a. <http://www.water-technology.net/projects/perth/>

Illustrates the largest desalinator in the world powered by renewable energy.

1b.

[http://www.energyrecovery.com/installations/documents/Perth\\_CS109EE.pdf](http://www.energyrecovery.com/installations/documents/Perth_CS109EE.pdf)

How pressure exchangers in the Perth plant reduce energy consumption

1c. <http://www.desalination.ucla.edu/>

describes evolving cost-effective potable, irrigation, and consumptive water technologies.

(2) Residents near the UCSC Marine Science Campus paid in early 2008 11.5 ¢/kWh baseline, 13.1¢/kWh for 1>1.3 \* baseline, and 22.7 ¢/kWh for 1.3>2 \* baseline. Santa Cruz residential water consumption plus ready-to-serve charges may range from 0.8 to 1.2 ¢/gallon at the residential faucet.

(3)

[http://www.eia.doe.gov/eia\\_conference\\_2008.html?featureclicked=1&](http://www.eia.doe.gov/eia_conference_2008.html?featureclicked=1&) and  
<http://www.eia.doe.gov/oiaf/aeo/conf/handouts.html>

(4) The symbols '\$' and '¢' are here meant to be the inflation-adjusted dollars and cents with their invariant-with-time purchasing power.

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## Postscript

the ~~strike~~throughs were in reaction to writing City Councilmen Coonerty and Fitzmaurice that:

*The Westside doesn't need to be a water-poor community for much longer.*

*A soon to be credentialed, certified and regulatory-OKed desalinator with a yearly 30 million gallon capacity - - currently operating at the Long Marine Lab - - will be available for relocation in a year.*

*In my opinion, a student would learn valuable skills in investigating the sizable net benefits of transferring the pilot plant to 2120*

*Delaware Ave next to Redtree project.*

*I'd be available to help in this study.*

At this time I'd like to rescind the hasty opinion and suggestion for a relocation study, a topic much better covered by designated consultants.

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