



Desalination - Energy Down the Drain

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This is a guest essay by Debbie Cook, former Mayor of Huntington Beach, CA and ASPO-USA Board member. Debbie recently lost the election for the 46th Congressional district in California. It is a testament to our nations current focus that we have few leaders like her in DC aware that energy and natural resources are ultimately what we have to spend. Her essay looks at the energy required to turn ocean water into potable water. The interrelationships of energy and water in our social systems will be paramount going forward--as we need water to procure most energy and energy to procure most water. And we are learning that more money won't magically procure more of either.

Energy Down the Drain

The Next Worst Idea

The next worst idea to turning tar sands into synthetic crude is turning ocean water into municipal drinking water. Sounds great until you zoom in on the environmental costs and energetic consequences. It may be technically feasible, but in the end it is unsustainable and will be just one more stranded asset.

In 2003, I was one of two elected officials invited to serve on the [California Desalination Task Force](#). The task force was the result of Assembly Bill 2717 (Hertzberg), authorizing the Department of Water Resources to study desalination facilities and “report on potential opportunities and impediments...”

For nearly a year, an unwieldy group of individuals representing a multitude of agencies, industry, and environmental organizations convened around the state to study and prepare a report with their recommendations. As you can imagine, the membership was largely divided into two camps—those with a horse in the race and those without.

The Task Force provided me with the opportunity to learn about this emerging technology but more importantly, to learn about the relationship between [water and energy in California](#). Within a few years my interest in water had blossomed into an [obsession](#) with our energy future and peak oil. It is my knowledge of our energy and resource constraints that leads me to reject ocean desalination as the water of our future.



Figure 1: reverse osmosis membranes

The Water/Energy Nexus

Make no mistake, California has a serious water crisis. But it cannot be addressed in isolation of our energy crisis. The problem was summed up perfectly in a 2005 California Energy Commission (CEC) [presentation](#) title: “There is no electricity crisis in California the water agencies can’t solve —or make worse.”

Water is energy. According to the CEC, 10% of all electricity production in California is consumed in moving water around the state; another 9% for treating, disposing, pumping, heating, cooling, and pressurizing water.

Energy demand is at its highest July 1 to September 15. The hottest days of the year also coincide with the highest water demand. Maintaining adequate electricity reserves is becoming a challenge in California. According to California’s Energy Action Plan, “Because natural gas is becoming more expensive... reducing consumption of electricity and diversifying electricity generation resources are significant elements of plans to reduce natural gas demand...” There is no more energy intensive water source than ocean desalination.

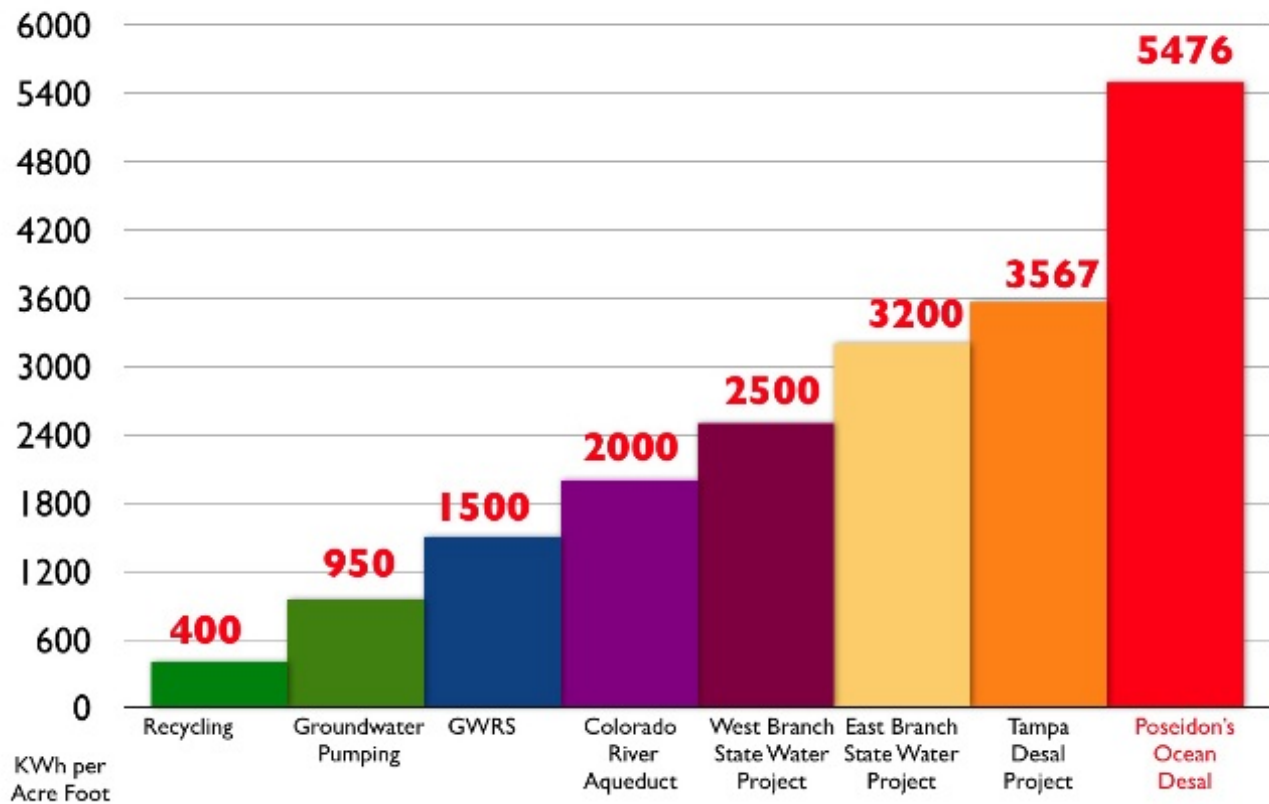


Figure 2: Electricity consumption of various California water sources

Power plants require water for cooling. Along the California coast, almost half of our existing electricity generation facilities utilize [once-through cooling](#) technology resulting in the intake of 17 billion gallons per day of water. This results in the [impingement and entrainment](#) of millions of marine organisms. While dry cooling can reduce the impacts on the marine environment, conversion is expensive, [controversial](#), and limits a desalination proponent's plans for bootstrapping onto an existing intake/outfall pipe.

The Long Beach Water Department has been operating a demonstration desalination project for many years experimenting with a more responsible [under ocean floor seawater intake and discharge](#). Long Beach has [pledged](#), "not to pursue seawater desalination unless our research efforts determine it can be done cost-effectively, with little or no environmental impact."

A Mirage in the Desert

The teaser horse in California's ocean desalination race is a private water company called [Poseidon Resources](#). They and their lobbyists have spent the last 10 years wooing water boards, legislators, and consumers into believing technology could keep California's growing population satiated.

With the complicity of numerous [water agencies](#), Poseidon has been largely successful. Most Southern Californians have been convinced that ocean desalination is a good thing—a *new* drought-proof source of water in a state with diminishing resources. Many environmentalists believe that this *new* water will be a surrogate for water withdrawals from endangered rivers and streams in Northern California. Residents have been told that the projects will be constructed at no cost to the taxpayer and will produce water that is comparably priced to imported water.

Unfortunately the claims don't hold up to scrutiny.

All Politics is Local

The regulatory hurdles to ocean desalination are [daunting](#). The Poseidon adventure in California spans more than a decade beginning with a proposed [project](#) in Carlsbad California—a project that is still in the permitting process (despite their website's claims to the contrary).

By comparison to Huntington Beach, their Carlsbad proposal was an easy sell. San Diego imports almost all of its water from the Metropolitan Water District at a price close to \$800/AF. In San Diego, *water independence* is at least as motivating as *energy independence* is to most Americans—and about as achievable.

In 2002 Poseidon filed an [application](#) with the City of Huntington Beach for a 50 million gallon/day project that would utilize existing intake and outfall pipelines belonging to AES, a global power company with generation and distribution businesses. Surrounding AES in the Southeast area of the city is a hodge-podge of land uses including large gas-oil tanks, a wetland, a wildlife care facility, a sanitation district, a mobile home park, a waste dump-site, and hundreds of cranky homeowners who believe the area is an industrial dumping ground. In other words, Poseidon chose to become part of a long history of distrust between the industrial users, the city, and the residents. While Huntington Beach does not have interest in this new water source, it will be sharing the costs of a new water tank that had already been approved for the area.

As a member of the [Orange County Water District](#), Huntington Beach meets most of its water needs from a well-managed aquifer, with only 25% of its water imported from MWD at roughly \$580/AF. In fact, to augment its water supply, OCWD embarked on its own desalination project using effluent from its next door neighbor the Orange County Sanitation District. This partnership helped OCS D avoid construction of another outfall pipe and provided OCWD with a less energy intensive process. Granted, water costs are sure to go higher for all Californians as we struggle with a warming climate and growing population, but energy costs will rise right along water.



Figure 3: AES 450 MW natural gas power plant, Huntington Beach, CA

In 2006, despite years of public protest, Poseidon won city approval and moved on to wrangling with other regulators and legal challengers. They also continue to seek a public partner so that they will be eligible for subsidies from the Metropolitan Water District.

Like corn ethanol, ocean desalination would not be remotely competitive without huge subsidies. In this case, \$250 per acre foot plus publicly constructed and operated pipelines. So much for the pledge of, “no taxpayer money.”

It is anyone’s guess how long MWD will continue these subsidies. But there is an even better captive market than thirsty California. The Southern Nevada Water Authority is salivating at the chance to trade MWD for Colorado River water. Perhaps we are seeing the first signs of another stranded asset: the Colorado River Aqueduct.

Too Costly to Flush

The story of desalinated water has been largely one of unkept promises. Tampa Bay is a typical case. In 1999 Tampa Bay Water received a binding [commitment](#) for water at \$557/AF. By 2004 costs were updated to \$827. By 2008, after a month of operation, it was [estimated](#) the wholesale cost to be \$1100/AF. Even if this were an inclusive accounting, there are two factors that work in Tampa’s favor: the salinity of the source water and their electricity rate. Both are critical to calculating water costs.

In 2003, Water International estimated that 44% of the cost of desalination was the energy component. But whose energy costs were they using, Florida or California? Or maybe Saudi Arabia? In 2002, Oil and Gas Journal ran a story on desalination facilities in Saudi Arabia. They

reported construction costs of 30 facilities at \$20 billion, \$4 billion for operations and maintenance, and water at \$1356/AF. While there are differences between the thermal process used in Saudi Arabia and the reverse osmosis projects in the U.S., the cost of natural gas in Saudi Arabia at that time was 75¢/Mcf—a fraction of what we pay in the U.S.

California's checkered history with ocean desalination is equally unhelpful. Of those projects that have operated, the following costs have been [reported](#):

- Gaviota Oil and Gas Processing Plant: \$4000/AF
- Santa Catalina Island (built and operated by Southern California Edison): \$2000/AF
- U.S. Navy, San Nicolas Island: \$6000/AF
- PG&E Diablo Canyon Power Plant: \$2000
- City of Moro Bay: \$1,750/AF

The City of Santa Barbara built a plant in the 1990s but never operated it. The [Yuma Desalting Plant](#) may be the biggest white elephant in the world. At the time it was built in the late 1980's, it was the world's largest reverse osmosis plant capable of desalting 72 million gallons per day. The \$245 million project was constructed to comply with the 1944 treaty with Mexico to reduce salinity of Colorado River water from 2900 ppm to 115 ppm. The estimated cost of operations and management was \$24 - \$29 million per year. I'm told it has never operated except for tests.

This paltry record coupled with a lack of transparency in the industry keeps everyone guessing. It is difficult to challenge the wildly optimistic numbers that are perpetually paraded out at public meetings and in the press. Environmental documents can sometimes fill in a few blanks. The Huntington Beach EIR states that the Poseidon project will require 5476 kWh/AF. If Poseidon were paying a Florida rate of 4.5¢/kWh the cost of electricity alone would be \$246/AF. If they paid what the average Californian pays (which includes bond repayment for the 2001 energy crisis)—12¢/kWh—their electricity costs alone would be \$657/AF. Poseidon stated at one of the Task Force meetings that it was planning on electricity at 6¢/kWh—a rate that is not available to any industrial user in the state. With those kinds of savings they could perhaps purchase enough lobbying to get special dispensation.

Too much Water

One thing for sure, ocean desalination is not about California's water crisis. We live in a desert and use too much water. Our water needs can be solved if we follow the lead of agencies like [Irvine Ranch Water District](#) and take appropriate measures: allocation based rate structures, smart timers, landscaping codes, and conservation. Ocean desalination is an example of our complete failure to recognize stark realities—water, food, energy, soil, air, and oceans are limited and our population and consumption keeps growing. Once again we are applying a technical fix to an adaptive challenge.



Figure 4: Typical California landscaping

We are rapidly approaching the time when we will not have enough money to throw at our problems. We may be there now or we may be able to squeak out a few more stranded assets before our future catches up with our present. I'm betting on business as usual.

Debbie Cook is the former Mayor of Huntington Beach, President of Post Carbon Institute, and board member of ASPO-USA.

****Addendum**

Since transparency is not a virtue practiced by proponents of ocean desalination, finding data from existing facilities is often a slog through countless documents. After writing this article I discovered the California PUC resolution granting Southern California Edison a 2007 rate increase. SCE is the overall water provider for the island. The following paragraph from the CPUC resolution puts the energy intensity of ocean desalination into perspective:

Producing fresh water from sea water by desalination is a highly energy intensive process and should be utilized only when no other economical water supplies are available. This is illustrated by the fact that for Catalina Island in 2005 desalinated water accounted for only 25% of total water production, but desalination accounted for

approximately 70% of total electricity usage.

Also gleaned from the report is that the overall energy intensity (75% local water/25% ocean desal) of Catalina's water system is approximately 4000 kwh/AF. The CPUC approved a 3 tiered rate, roughly calculated below:

- Tier 1 (up to 2500 gallons): \$2000/AF
- Tier 2 (2501-10,000 gallons): \$5000/AF
- Tier 3 (over 10,000 gallons): \$7200/AF

As a point of comparison, the average Huntington Beach household uses 9000 to 10,500 gallons per month. I have seen many desalination reports quote water rates from Catalina of \$2000/AF. It is now clear that using that figure is misleading at best.



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