The Water Problem is Really an Energy Problem **October 2015**

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The critics of the Carlsbad desalination project have rightly identified its energy consumption as a drawback, and it is true that this facility will draw 34 MW[1] of power from the grid when it is running at full production of 50 MGD. This is equivalent to 16,000 kWh per million gallons of production. Over the course of a year, if run at capacity, the plant will use around 300 million kWh of electrical energy, while generating 18.25 billion gallons or 56,000 acre feet of fresh water. Even if the plant uses electricity generated from natural gas this will create over 360 million pounds of CO_2 emissions per year.[2] Despite renewable sources suppling a portion of this energy, the facility will still have a significant carbon footprint.

We should keep in mind that desal water is not alone in requiring energy. Every water supply has its own energy requirements. For instance, water delivered from the State Water Project requires up to 14,000 kWh per million gallons, just slightly less than desal water. Recycling wastewater is also energy intensive. This really puts the spotlight on the essential problem: it takes energy to produce and deliver water, no matter where it comes from. Furthermore, in times of drought, one cannot simply choose to use a less energy intense supply since these supplies may be dry. This leaves us in a situation where the only choice might be to either load the atmosphere with more carbon or go without the water. Neither of these are good solutions.

California is struggling to decarbonize its power supply, and reduce the impact of power generation on the oceans. There are plans to decommission many existing power plants that are near the coast, and switch others from water to air cooling, which reduces their capacities and creates large heat loads directly on the atmosphere. All of these actions will make water supply from any source more difficult, especially desalinated water. The outcome could be a future of scarcity of both water and power in the California and the rest of the West.

But, what if there was another option? What if California could decarbonize its power supply using a combination of renewable sources when they are available, with an abundant base supply provided by advanced nuclear reactors? Many people do not realize that there is a whole new generation of nuclear reactors under development that are based on designs that were demonstrated in the 1960's, but dropped in favor of pressurized water reactors. These new reactors use molten salt, not pressurized water, for cooling, and are fueled by Thorium. As a bonus, the best designs breed more fuel than they consume, so they are renewable supplies. They operate at high temperatures, so they are ideally suited for power generation. The waste heat from the system can then be used to co-generate distilled water using thermal distillation. At times when there is excess energy on the system due to high solar radiation or wind conditions, the excess can be diverted to production of more water using either thermal or reverse osmosis processes. In other words, the excess energy can be stored as water. This is the real water-energy nexus, and could supply California with water and power for thousands of years.

So, the choice we have to make is whether we are going to apply ourselves to re-inventing nuclear, and marrying it to renewables and desalination technologies, or if we are going to have a continuously diminishing or intermittent supply of water and energy as natural gas supplies are depleted, and wind and solar are not able to provide the required base load. Just look at places like Syria and Yemen to see where this leads. The United States is currently blessed with an abundance of natural gas. This provides us with a few years or decades during which to develop and commercialize the new generation of nuclear reactors. If we wait until the gas is gone to start, it will be too late. We need to start now by educating ourselves about the new generation of reactors and lobby congress to fund development of full scale demonstration of Thorium molten salt reactors. If we do this we can have a stable water and energy supply that is free from carbon.

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[1] Peter Tymkiw, Arcadis Engineering. Presentation at AWWA meeting in Las Vegas, October 2015

[2] At 1.21 lbs of CO2 per kWh from natural gas. Source: www.eia.gov/tools/faqs/faq.cfm?id=74&t=11