

Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Distinguished Professor of Earth and Planetary Sciences, UC Santa Cruz.

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Fresh Water From The Sea

Three months ago I reached deep into my own past as an undergraduate geological sciences student at U.C. Santa Barbara and wrote about my excitement in reading popular press stories at the time about how our future would include food from the sea, minerals and energy from the ocean floor, fresh water from salt water, and even living under the sea in marine habitats or offshore cities.

Over a half a century has passed, and as I've discussed in subsequent columns, the oceans unfortunately aren't yet and may never be able to provide for many of human civilization's resource needs. Even though the oceans cover 71 percent of the Earth's surface and contain 97% of the Earth's water, they don't have enough fish to feed all the hungry people on the planet, and they aren't going to provide all of the mineral resources we seem to need.

Other than pumping oil out of the sedimentary rocks beneath the seafloor, using ocean energy has mostly evaded our efforts to date. While the utilization of clean and renewable energy from the wind is growing rapidly around the planet, 97% of the 341,000 operating wind turbines are still sited on land.

Fresh water from the ocean has been a similar story with just one percent of all the world's drinking water today coming from desalting sea water; but like offshore wind power, the trend globally is for a significant increase in the years ahead. As

the planet continues to get warmer and drier, we can expect that the droughts and water shortages experienced around the world today will get worse.

Between 2015 and 2017, the number of desalting plants around the world grew by 7.6% to 19,372, although many of these are small. The total volume of fresh water produced expanded in this same two-year period by 6.9% to 24.5 billion gallons per day.

Not surprisingly, almost half (44%) of all of this capacity is located in the Middle East and North Africa where there is precious little fresh water available and no other viable options. This area is very hot, there isn't much rain, and there are very few streams.

Israel produces about 40% of its entire domestic water needs from brackish or salt water. Saudi Arabia alone accounts for 17% of the global production of fresh water from seawater, and presently has the world's largest desalting plant, which produces 193 million gallons per day.

Abu Dhabi in the United Arab Emirates recently announced plans to build the world's largest desalination plant, which is projected to open in 2021 and will produce 200 million gallons per day.

There are nearly 2,000 desalination facilities in the United States, and facilities using brackish water are growing faster than those using ocean water directly due to lower costs of removing lesser amounts of salt. At present, California has five active desalination plants drawing water directly from the ocean, with about a

dozen others pending or in various stages of design, funding or environmental analysis.

As of 2013, California had 24 plants using brackish water with three more in design or construction phases, and 17 others proposed. Earlier this year, state water officials approved \$34.4 million in grants from a 2014 water bond to help fund eight desalination projects around the state as part of an effort to increase California's water supply following the recent five-year drought.

In December of 2015, the largest desalination plant in the United States was completed at Carlsbad in northern San Diego County. The original proposal for this facility was first put forward 25 years ago in 1993 after five years of drought. San Diego only averages about 12 inches of rain annually and as a result, must import 90% of its water. The drought hit them hard.

Like many coastal communities where large industrial facilities (such as a desalination plant) have been proposed, there was no shortage of opposition. The concerns raised were the same as those that have been brought up for virtually every proposed desalination plant: energy consumption, costs, impingement and entrainment of marine life in the water intake system, and brine discharge into the ocean.

Surfrider Foundation, San Diego Coastkeeper and the Coastal Environmental Rights Foundation each filed lawsuits against the plant, but none of these proved to be successful. As you may guess, there is more to this story but it will have to wait.