Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

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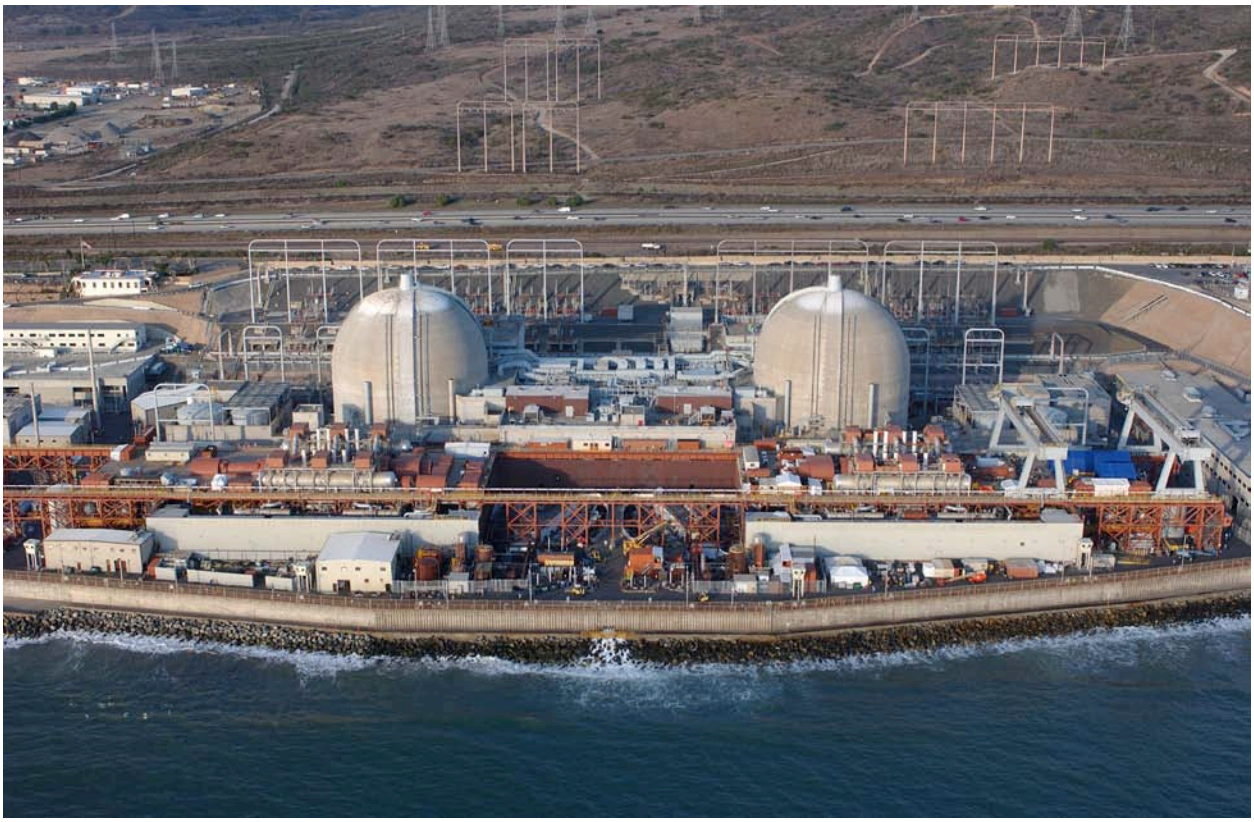
Energy and the oceans–part 2



The San Onofre Power plant is one of only two commercial nuclear power plants in California.

Important questions about energy confront our newly elected political leaders: What sources of energy will we depend on in the future? How long will they last? What are the impacts of using different energy sources?

In my last column, I wrote that U.S. oil reserves are limited, and even if we decide to increase drilling offshore, it would take at least 5 years to get a platform ready to drill. Well, it's always encouraging to learn that people actually read this column; the president of a Texas offshore wind power company wrote to correct my statement regarding how long it would take to get a drilling rig ready. "Actually," he said, "if you placed an order today for a drilling vessel, it will take 8 years and a

$4 million nonrefundable deposit, on a $200 - $500 million investment." Offshore drilling isn't as easy as it sounds, and it isn't an immediate or long-term solution.

There are some potential sources of energy that could come directly from the ocean—wave power, tidal or current power, offshore wind power, and ocean thermal energy conversion. But before I discuss those, which are still in early stages of development and installation, I want to cover another major source of energy that has been a part of California's energy history.

Nuclear power had its origins in a December 1953 speech by President Eisenhower on "Atoms for Peace." The first commercial nuclear generator in the U.S. started up in Pennsylvania in 1957. California got the second one, built on Humboldt Bay in 1963. In the next decade there was a big push by the power companies to go nuclear in California. Three additional nuclear plants were constructed (Rancho Seco near Sacramento, Diablo Canyon near San Luis Obispo, and San Onofre in Orange County) and 6 more proposed. All but one of these were on the coast where they could use the Pacific Ocean for the billions of gallons of water required daily to cool the reactors.

One of these was proposed in 1969 in our own backyard on the coastal terrace just north of Davenport. Some long-time residents may recall the full story, but the upshot was that the proposal was doomed by a growing popular movement that questioned the safety of nuclear plants and radioactive waste disposal. Local communities opposed not only the Davenport plant but also those proposed at Point Arena, Bodega Head (where excavation for the reactor core ran into a branch of the San Andreas Fault and was abandoned), Moss Landing, Malibu, and Long Beach.

Humboldt Bay was shut down in 1976 due to concerns over faulting and earthquakes. Then came the failure of the Three Mile Island nuclear plant in Pennsylvania in 1979 and the explosion of Chernobyl in the Soviet Union in 1986, which heightened public concerns about plant safety. Rancho Seco was shut down in 1989 by a public vote after only 12 years of operation. Only Diablo Canyon and San Onofre are still operating in California.

In 2005 there were 441 nuclear power plants operating globally, while 111 had been shut down. These plants, however, only provide about 15% of the world's electricity; fossil fuels still provide 67%. In the U.S. we have 103 operating nuclear plants that provide about 20% of our electrical power. Because of continuing safety concerns, the lack of an acceptable solution for long-term disposal of nuclear

waste, as well as the very high cost of plant construction, no new nuclear power plants have been built in the U.S. since 1973. California voters some years ago passed a measure preventing construction of any new nuclear plants in California until a permanent solution to waste disposal was developed. That still has not happened.

Some people, however, are reconsidering the nuclear power option due to growing concerns about fossil fuel consumption and the resulting carbon dioxide emissions and global warming. The Nuclear Regulatory Commission, which licenses nuclear plants, recently reported that 21 power companies say they will seek permission to build 34 new nuclear plants.

There are two primary ocean impacts associated with existing nuclear plants. Both are related to the vast volumes of cooling water used. Diablo Canyon and San Onofre each use about 2.4 billion gallons of water per day. The intake pumps pull in small and large organisms that either die on the filtering screens or, if small enough to pass through, die in their transit through the plant. The discharged water is about 20 degrees warmer than it was when pumped out of the ocean, and the discharge also increases turbidity. The result of all this is a shift in the species that can live in the waters near a plant. These "once-through" cooling systems may not be allowed for any new plants under current EPA rules.

A more fundamental question, however—especially considering Senator McCain's call for building 45 new nuclear plants by 2030 and 100 eventually—is whether we have the uranium resources to power these plants. The best estimates of the global reserves of uranium that can be mined economically is about 6 million tons. Existing nuclear power plants use 77,000 tons a year. At this rate, the reserves would last about 80 years. However, this rate of usage wouldn't reduce our dependence on fossil fuels or reduce carbon emissions. If we were able to somehow build enough nuclear plants very quickly to replace all fossil fuel usage, our global uranium consumption would be about 1.3 million tons per year. At this rate, our known reserves would last less than 5 years.

An overnight conversion from fossils fuels to nuclear isn't going to happen, but recently the Group of Eight major industrial countries agreed to reduce carbon emissions by 50% by 2050. Using a gradual transition, uranium reserves would last about 10 years. Add in additional uranium that some geologists believe might be available, but more expensive to find and recover, and we might be able to extend this an extra 10-20 years.

Considering the enormous costs ($5 to $7 billion per reactor today) and the large number of nuclear power plants being contemplated to replace fossil fuels, the U.S. could be courting disaster if it chose this route with nothing but blind faith in the continued availability of uranium. There are many good reasons why we need to begin to focus our efforts very seriously on renewable energy options.