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

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Tidal power

Aerial view of the La Rance tidal power station along the coast of France, the world's first and largest.

Several columns ago I started to write about energy from the ocean and it has become a far more involved topic than I originally envisioned, and also one that has generated considerable feedback. But, we're not finished with ocean energy quite yet.

Although not widely used, tidal power has the potential for significant future electricity generation. Tides are more predictable than the wind and solar radiation, but there is a periodicity to the tides, which limits how many hours each day they can be utilized. Interestingly, using tidal energy isn't a new concept at all. As far back as the 12th century, water wheels driven by the tides were used to power gristmills and sawmills.

Because the ocean's tides are caused by the gravitational pull of the Moon and Sun on the Earth's oceans, tidal power is essentially inexhaustible. A tidal energy turbine or generator could use the daily or twice daily flow of water into and out of an enclosed bay or estuary, or anywhere else tidal currents are confined, to generate electricity. The greater the water level difference between high and low tides, or the higher the tidal current velocities, the greater the potential for tidal energy generation.

It also produces no harmful by-products so it's clean. Sounds like a great idea, so why haven't we developed tidal power plants? Well, there are a few. There are essentially two different ways for harnessing tidal power- either by using the tidal currents themselves, or with a tidal barrier, which would work much like a dam on a river. The first and only large tidal dam or power station was completed over 40 years ago at St. Milo, along the English Channel coast of France. It has 240 megawatts of capacity, enough for about 190,000 homes (each megawatt or MW of electricity is enough to serve the power needs of about 800 average U.S. homes). A barrier or dam with built-in turbines was constructed across the entrance to the La Rance estuary where the maximum tidal range is 44 feet. That's huge. Electricity is generated on both the flood and ebb tides as the turbines can run in either direction.

A much smaller 20 MW tidal power plant, the first in North America, was built in 1984 on an inlet in the Bay of Fundy in Nova Scotia. However estuaries are highly productive and very sensitive ecosystems and disruption with a dam is a significant concern. Equally important, there are only a limited number of bays or estuaries that are suitable for tidal dams, and the best estimates indicate that using all of these globally would only generate about 1% of the world's electricity needs.

The second and more likely approach is using underwater turbines placed in areas with large tidal currents, also known as tidal stream generators. These could be utilized wherever tidal currents are confined or concentrated, the Golden Gate, the Strait of Gibraltar or entrances to large bays or rivers, for example. Since tidal stream generators are still in their infancy, no standard technology has yet emerged as the winner; but a number of different designs are being developed, with some close to large-scale installation. Canada just completed the first such system on southern Vancouver Island in 2006. Modern advances in turbine technology may eventually see large amounts of power generated where natural tidal current flows are concentrated, such as along the coast of Canada. Although several prototypes have shown promise with many companies making bold claims, they have not yet

been operated commercially or over extended periods of time. But there is optimism.