

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

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Harvesting Coastal Winds**



Turbines from one of the many wind farms offshore from the southeast coast of England

After driving over 5000 miles along the coasts and through four countries, we have had ample time to notice some differences and similarities. We have also been paying frequently and generously along the toll roads of Spain and Portugal and filling up with gas at \$1.10 to \$1.30/liter, roughly \$4.40 to \$5.20/gallon, a modest price to pay for what we have experienced.

At a time where energy use and climate change are frequent topics, it's been encouraging to see the progress made in each of the countries we have traversed in developing renewable energy sources. We have seen a lot of huge wind turbines, rotating with the coastal winds.

Wind power is Scotland's fastest growing energy technology with 5,328 megawatts (MW) of installed capacity, 96% of this being onshore and the rest

offshore. We saw hundreds of these along the coast where winds are strong, including one large field along the north coast, virtually adjacent to their one nuclear power plant, which is now scheduled for closure.

The siting of large wind turbines is often a concern in some regions, but multiple surveys have shown high local community acceptance for wind power in Scotland. There is further potential for expansion, especially offshore, given the high average wind speeds, and a number of large offshore wind farms are planned.

The Scottish Government has a target of generating 50% of Scotland's electricity from renewable energy by 2015, and 100% by 2020, which was recently raised from 50%! The majority of this is likely to come from wind power.

We covered a lot of English coastline and wind turbines seemed to be everywhere, onshore and offshore. England now has 6,557 wind turbines and 13,337 MW of installed capacity with 38% of this from large wind turbines mounted on the offshore seafloor in large arrays. The United Kingdom is one of the best locations for wind power in the world and they are ranked as the world's sixth largest producer, with wind now providing 9.3% of their electricity.

Polling of public opinion in England consistently shows strong support for wind power, with nearly three quarters of the population agreeing with its use, even for people living near onshore wind turbines.

Within the United Kingdom, wind power is the largest source of renewable electricity, however, politics has intervened recently and the UK's Conservative government is opposed to onshore wind power and has cancelled future subsidies for onshore wind turbines.

Driving across Spain from Barcelona on the Mediterranean to San Sebastian on the Atlantic coast was an eye opening exposure to Spain's dedication to harvesting the wind. We passed dozens of very large arrays of wind turbines, which has made them the world's fourth biggest producer of wind power. In 2014, the year-end installed capacity was 23,000 MW, 21.1% of their total electricity consumption. Six years ago, wind overtook coal as a source of electrical energy in Spain.

Portugal has also invested heavily in wind energy and has 4,731MW of installed capacity, which produces 23% of the country's electricity. Many of their wind turbines are along the coast.

For a comparison, as of June 2013, California had 5,829 MW of wind powered electricity provided by 11,883 turbines. California's wind power capacity grew by nearly 350% since 2001. As of the end of September 2012, wind energy (including that supplied by other states) supplied about 5% of California's total electricity needs. California presently ranks second nationwide in terms of capacity, behind Texas and just ahead of Iowa.

The great majority of California's wind turbines are sited in three areas, Altamont Pass east of the San Francisco Bay Area, San Geronio Pass near Palm Springs, and Tehachapi Pass southeast of Bakersfield.

A new offshore project has recently been proposed, however, that would consist of 100 floating wind turbines 15 miles offshore of Morro Bay. This would generate 1,000 MW of electricity, enough to power about 150,000 homes. Similar projects are in the planning process elsewhere in the US, and while these are a very positive step in the direction of reducing our dependence on fossil fuels, there are environmental issues that will have to be addressed as well as number of agency approvals required before such a project would be constructed.