

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

#232 March 19, 2017

Energy—Where Have We Been and Where Are We Going?

Our planet's nearly 7.5 billion people use a lot of energy, and some of us use a lot more than others. Whether we measure it in barrels of oil or terawatt hours of electricity, it's a lot of energy, and the amount continues to increase.

Of the highest per capita users of energy, the oil-rich nations of Saudi Arabia, Kuwait, United Arab Emirates, Qatar, Brunei, and Bahrain are at or near the top of the list. Then there are the cold countries, Iceland, Finland, Norway and Canada, which are also big users of energy, presumably much of it used to keep warm. The USA is up there at number ten for other reasons, a very high standard of living.

Global energy use increased 350% between 1965 and 2014. Until very recently, most of the increase was in fossil fuels - coal, oil and natural gas- that still provide about 85% of our global energy. In the USA, we are about 81% dependent on fossil fuels, with oil providing 35%, natural gas 28% and coal, which is declining, at 18%.

Renewables make up an increasing percentage, however, now about 9.4% of total global energy use and they generate 18.3% of the electricity. Renewable sources provided 9.8% of total USA energy in 2016, and 13.5% of our electricity.

Two years ago, Governor Brown signed legislation requiring California to generate ½ of our electricity from renewable energy sources by 2030. This builds on the state's existing standard that requires 33% of our power to be produced from renewables by 2020, just three years from now.

Are we even close? We're well on our way, but as always there are challenges ahead. We at 28.4% renewable now with hydroelectric making up 14.1%, solar 13.4%, wind 6.7%, geothermal 6.1%, and biomass 2.9% (for some odd reason, although hydropower is completely renewable every time it rains, it isn't counted in reaching our target goals).

California leads the nation in most things that matter, and ranks first in the nation in our installed solar capacity. In 2013 we more than doubled our solar energy from the previous year, and in 2014, it doubled again. This is important progress.

Electrical power generation from the wind increased by 400% between 2001 and 2014, although we are still second in the USA behind Texas. Nearly 90 percent of that came from four windy mountain passes: Altamont Pass in Alameda County, San Geronio Pass in Riverside County, and Tehachapi Pass and the Alta Wind Center in Kern County.

Texas also leads the nation in an undesirable measure, that of carbon dioxide emissions from energy production, with 11.8% of the national total. California is actually number two with 6.6% of the total. In the last 25 years, however, despite our population growth and expanding economy, California leveled off and actually reduced our carbon dioxide emissions by 1.6%. Texas, on the other hand, increased their emissions by over 14%.

Unlike fossil fuels, which literally took millions of years to form, are finite resources with historically volatile prices, and that produce greenhouse gases with their well-understood impacts on global climate, renewables can provide a fixed price and inexhaustible and sustainable sources of clean electricity.

We are not yet running completely out of fossil fuels, but we are running out of atmosphere, where nearly half of all of that carbon dioxide ends up. The nearly two million tons each hour we put into the atmosphere is warming the planet, changing the climate and leading to a global rise in sea level as more ice melts.

The Stone Age didn't end because we ran out of stones, but because humans discovered better and more efficient ways of doing things. The same can be said for fossil fuels. There are limits to what is still in the ground, although there is not complete agreement on just how much is still buried in the Earth or under the seafloor.

Sooner or later, we are going to have to rely on renewable or sustainable sources of energy, because the oil, gas and coal are going to be exhausted. Not today, not next year, but it's going to happen, and the sooner we make a major shift to renewables the more of the planet and its atmosphere, ocean, climate and civilization we can stabilize and preserve. Right now we are running a giant experiment, without a gear to reverse what we are doing.