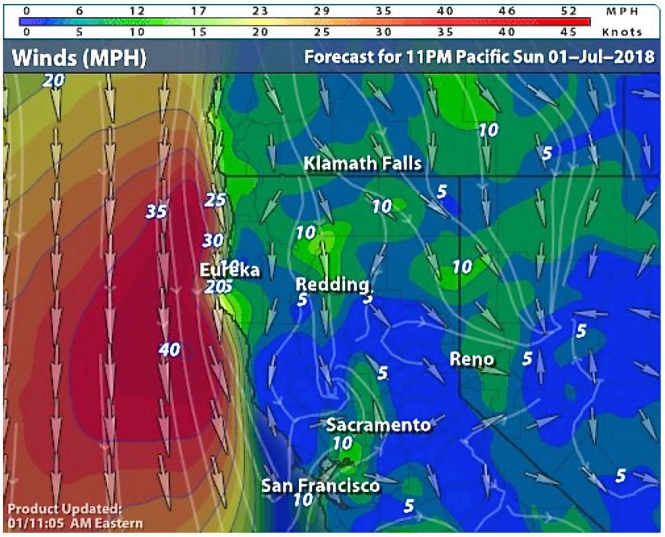
Why Wait for Fusion? We Have Solutions Now

You've probably heard the phrase, *"A solution searching for a problem."* A first-ever nuclear fusion ignition last winter by the Lawrence Livermore Lab evokes a different phrase for me because its potential contribution to the electric grid is decades away, if ever. Let's call fusion *"A solution to a problem already solved."* An alternative solution is available now—with nearly no waiting. Electric energy independence without carbon is not within our reach—it's nearly within our grasp.



Solar photovoltaic electricity is mature technology and onshore wind energy is already joined with bountiful offshore wind on the east coast. Our west coast can do even better as soon as moored and ballasted masts are finalized for our deeper waters. General Electric has developed turbines whose output is 20 megawatts each. Not so long ago, the common offshore rig produced only 6 MW. The wind resource offshore is far better than onshore, tending to be stronger and directionally more consistent. Both of these features will ease the pressure on our electric grid, particularly with the strong growth of grid-scale batteries.

Fusion may be lauded as the **"power plant of the stars,"** but our planet needs a quicker fix right now for all living things to survive in the face of global warming. That's what "sustainability" means. Though its fuel would be plentiful and cheap and its byproduct non-toxic, fusion as a baseline generating station would be very expensive and consume what every steam-based generating station does—water, in copious amounts. Even if it were ready for prototype construction today, the reactor materials are expensive and the construction sequence would be long. (As a loose comparison, the Diablo Canyon turbine rotor was laid down in 1967 for a plant that didn't begin producing power until 1983.)

With solar, we already have direct conversion of sunlight to electricity and increasingly sophisticated battery technology that can store it, both at grid scale and at home. Solar PV is, in fact, required on all new California residential buildings, and many city/county jurisdictions in California are mandating all-

electric energy for new construction to expand decarbonization. Its costs continue to drop, and this plays a role in our policy choices.

A common electric planning metric is called the Least Cost Of Electricity (LCOE). It ***compares*** the total cost of planning, permitting, constructing, and operating any given generation facility for 20 years to its power output. You estimate all those costs and divide by the expected kilowatt hours produced. This predicts the production cost per kilowatt hour. Using LCOE, nuclear (fission) costs the most, then coal, then natural gas, then solar and wind. Nuclear (fusion) would immediately top this cost list. But separate from LCOE are two other important factors that affect the less obvious costs of carbon. Those factors are speed of construction and the byproducts of emissions.

L. C. O. E.
Levelized Cost of Energy per Kilowatt hour (over 20 years)

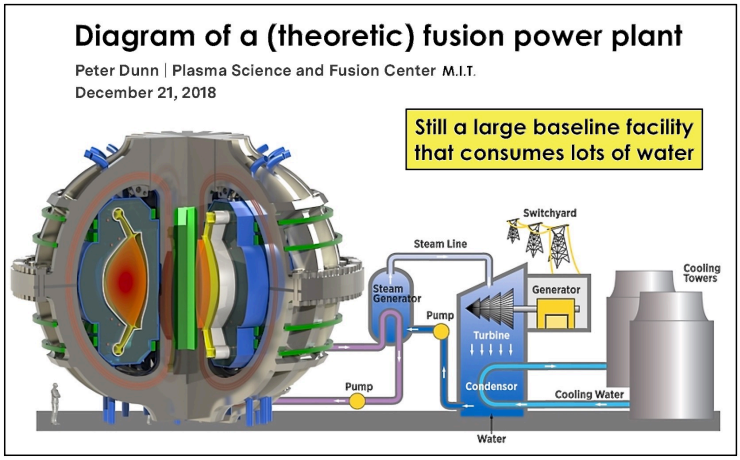
(Equals)

SUM of costs over lifetime (in $)
÷
SUM of electrical energy produced over lifetime (in Kwh)

From Wikipedia, 2019

Economists and engineers are now considering, as they should, "the social cost of carbon" (SCC) which contributes to global warming, climate change, forced migration, storm damage, wildfires, sea level rise, etc. Carbon emissions also damage human respiratory health, increasing the cost of medical care and insurance.

The bottom line? Nuclear and carbon-based electricity are expensive. What about hydropower? It's renewable but available only in certain locations, and it's dependent on rain and snow. Building more dams won't make it rain.



Solar and wind power are carbon-free renewables, they use no water, and are cheaper and faster to install than conventional power plants. The historic complaint is that they're intermittent, but this problem disappears with grid-scale batteries, some already exceeding the output of small, fossil-based power plants. Home battery installations are expanding, too. Renewables have the potential to stabilize electric rates far more than perfecting and expanding fusion power technology sometime in the future. "Better mousetraps" are already here and we should utilize them.

—Bill Martin

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