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Comments by Willett Kempton on Docket 17-MISC-01

Additional submitted attachment is included below.

Before the California Energy Commission

Lead Commissioner Workshop on Assembly Bill 525: Offshore Wind Maximum Feasible Capacity and Megawatt Planning Goals for 2030 and 2045

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Comments by
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Maximum Feasible Capacity

Any megawatt planning goal for California must be reasonable in relation to the resource size and the load. It is unrealistic to exceed the practical area available offshore of California to place turbines, also unreasonable to exceed load of the state.

To be sufficiently accurate for planning, any offshore wind resource estimate has to consider wind speed, bathymetry in relation to foundation technology, and estimated areas excluded by competing uses or environmental sensitivities, as shown by Kempton et al (2007). Two CA offshore wind resource studies include these factors. The first is Dvorak et al (2010). Their total CA resource estimate was 79 GW (Table 4, 20-200 m, >7.5m/s). Due to not considering depths greater than 200m, Dvorak's 79 GW would be far smaller than the actual CA resource, but it sets a low bound to check other studies against.

More recently, Optis et al (2020), estimates resources using a depth cutoff (based on currently-identified technology) of 1300 m, and excluding areas of low wind speed, conflicting industry use, and environmental sensitivities. On this basis, Optis et al estimates a plausible resource area of 566,058 km2 (16.8 million acres), with a technical potential about 200 GW. The estimated areas of these two studies could become smaller or larger over time. The BOEM interagency and stakeholder process turns ocean space into lease areas which could be smaller. Conversely, in the longer term much more area (and thus MW) could be added if technology allows bottom anchoring and mooring deeper than 1300m. Nevertheless, 200 GW can be seen as an approximate resource limit based on today's floating technology. Of the two studies, the 200 GW should be used as an approximate CA resource limit as it includes the now-feasible deeper water, substantially increasing the resource over Dvorak et al's earlier estimate.

Both studies make clear that a proposed 10 GW goal is very small in relation to the California offshore wind resource.

Comparing with CA needs, CA's net summer generation capacity is 78 GW, and load is 250,000 GWh of electric energy (EIA 2020) or 28 GW_a of average power. Over the past five years, yearly peak loads have been 44 to 50 GW (CalISO 2021). Over the time frame of AB525, one might broadly expect electrification to increase electric load by very roughly 30%.

Note that to compare offshore wind with load, I have divided the revenue-salient GWh/year by 8760 h/y to yield average power, in this case 28 GW_a, which can be compared with, say 200 GW of wind capacity. Given an offshore capacity factor of approximately 50%, the 200 GW of wind nameplate capacity would provide an average 100 GW_a of power. The use of average power for both load and wind generation make the comparison straightforward, in this case, the offshore wind resource (100 GW_a) is larger than the entire state's load (28 GW_a). (Of course, comparing by average power to understand scale does not avoid the need to match generation with load in time and location.)

We can also compare CA with states that have developed thoughtful offshore wind programs. NY has a net generation capacity of 40 GW and average load of 16 GW_a, by both measures roughly half that of CA. Its current offshore wind requirement (in law) is 9 GW by 2035. In January, Gov. Hochul set an intermediate time goal for 2030 of 6 GW. (The NY Climate Leadership and Community Protection Act draft scoping plan, now in public comment, has concluded that about 20 GW of offshore wind by 2050 will be needed to meet NY's State's energy and carbon targets.) By similar measures, NJ is about ¼ the electrical demand of CA and has a firm offshore wind requirement of 7.5 GW by 2030.

In summary, a reasonable current-technology resource limit is 200 GW available to California, versus the state's generation capacity of 78 GW. By average generation and load the resource is 100 GW_a and load is 28 GW_a. As another benchmark, if we approximately scale already-required NY and NJ requirements proportionally to CA generation and load, equivalent California state targets would be approximately 20-30 GW by 2030 to 2035. That is not a recommendation but rather a direct calculation showing that such a level of offshore wind commitment is plausible and is now required by law in other coastal states.

Goals and commitments stimulate investment

The supply chain needed for Eastern and US offshore wind requirements have been quantified (SIOW 2022, Shields et al 2022). Parkison and Kempton (2022) have added the cost of, and demand for, infrastructure, including manufacturing, installation vessel, and port requirements for offshore wind (Parkison & Kempton 2022). In these three and similar publications, required supply chain and infrastructure investment is derived directly from MW and timing of state-legislated offshore wind power procurements.

The general approach for such analysis is to look at the MW required to be online each year, then work backward to the date of equipment purchase contracts and infrastructure usage. Next one compares equipment and infrastructure needs against availability in that year, and determines the amount of factory or infrastructure needed to be completed to meet the procurement target.

I am currently advising investors on development of offshore wind ports on the East Coast. The analytic process above is similar to that used by investors and by companies considering entering a new business (unlike publications, they do not reveal their results and conclusions outside the company). A small power purchase target, say, a 2 GW build followed by uncertainty for the following several years, would secure supply from established industries abroad, and for missing infrastructure would create work-arounds for the short-term. For example, builds for the first two (small) US projects, Block Island and CVOW, imported most parts (save subsea structure) from Europe, and used European installation vessels, either loaded in Canada or using feeder barges (Parkison & Kempton 2022, p 6).

Such methods and supply for small builds avoid investment yet are expensive per project, and minimally develop US industry capabilities and labor talent. Per the goals of AB525, since a small target gets built without supply chain and infrastructure, therefore after the small build the very large offshore wind resource will not be able to be developed quickly until a second, larger multi-year goal is made into a firm commitment.

On the basis of both analysis for publications and of advising on infrastructure investments, I can from experience assert that state goals, followed subsequently by procurement targets and timetables, are needed for substantial development of offshore wind infrastructure. A state planning goal starts investors and large companies assigning initial people to do serious internal analysis and planning for lease bids, then a legally-binding procurement schedule opens up the larger investments in office locations, manufacturing, vessels, and ports.

Author offshore wind Experience and Qualifications

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Dr. Kempton directs approximately 10 professional researchers and graduate students in research on clean energy technologies. He lectures widely and publishes scientific and technical articles on offshore wind power, electric transportation, and energy analysis. He led ground-breaking analysis and policy recommendations on the US offshore wind resource, cost of offshore wind power and on new deployment methods for offshore wind turbines. Also, Kempton created the concept of using electric vehicles to provide grid services, and has been awarded four patents for technologies integrating electric vehicle storage with the power grid. See https://crew.udel.edu/wind-power/ or twitter @WillettKempton

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