
From: Koehler,Birgit G (BPA) - PG-5
Sent: Thursday, June 2, 2022 7:25 AM
To: Diffely,Robert J (BPA) - PGPL-5
Cc: James,Eve A L (BPA) - PG-5
Subject: RE: can we make a map like this?

Thanks for verifying. It's so easy to get crosswise with so many numbers

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Thursday, June 2, 2022 7:23 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: can we make a map like this?

Good morning,
Looks like I goofed. Thank you for correcting.

Rob

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 7:30 PM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: can we make a map like this?

Deliberative Process Privilege; FOIA-exempt.

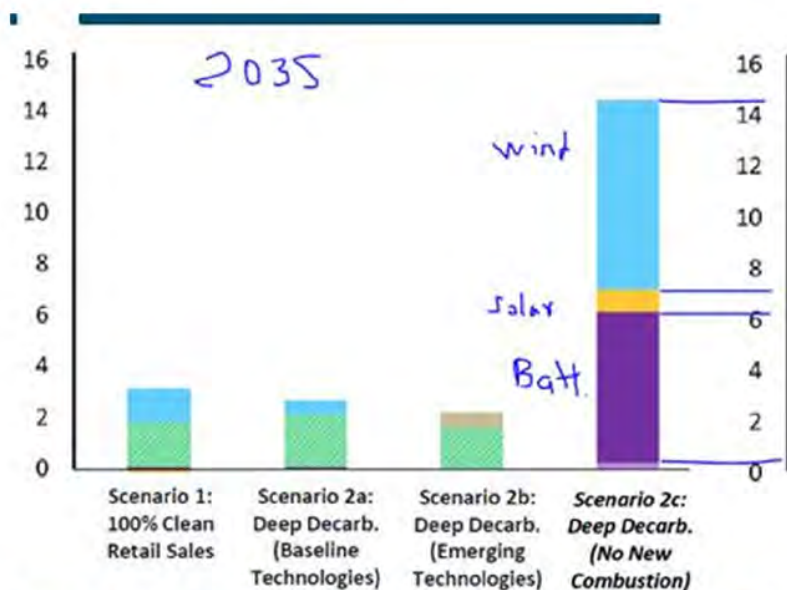
Rob,

Turns out we are trying to map Scenario 2c, which isn't on the table from you because we didn't have those results until recently. So, I started to do the math myself. And I went to look at your data versus the source you so helpfully provided. Could it be that you used the Std dev not the actual size? If I reverse your math, it looks like you used 1.7 acres/MW for solar. (e.g. 1600 MW on 4.3 square miles converted to acres/MW using 0.0015625 square miles/acre). For wind at 600 MW, 23.4 acres I get 25 acres/MW from your table, but 44.7 acres/MW from the NREL table. I'm also attaching my excel file in case you want to verify anything.

Land Use

Technology Type	Size (acres / MW)	Size Std. Dev. (acres / MW)
Photovoltaics <10 kW	3.2	2.2
Photovoltaics 10 100 kW	5.5	0.7
Photovoltaics 100 1,000 kW	5.5	0.7
Photovoltaics 1 10 MW	6.1	1.7
Wind <10 kW	30	n/a
Wind 10 100 kW	30	n/a
Wind 100- 1000 kW	30	n/a
Wind 1 10 MW	44.7	25.0

Here's what I'm coming up with,



Literally using a ruler on a screen to get the best read of MW since I couldn't find it in any of their tables
On-shore wind 7145 MW * 44.7 acres/MW from NREL * 0.001563 sq miles/acre = 500 sq miles

Solar 855 MW * 6.1 acres/MW from NREL * 0.001563 sq miles/acre = 8 sq miles

Didn't find conversion factors for batteries in those references or a quick search, but from the graph it looks like it is about 5750 MW battery (didn't see what duration and that affects the land area too, maybe it is 6 hours.)

I asked my husband if he'd like to give it a try. He came up with 65 acres. So that doesn't register next to the wind and solar.

Using Megapack, Tesla can deploy an emissions-free 250 MW, 1 GWh power plant in less than three months on a **three-acre** footprint – four times faster than a traditional fossil fuel power plant of that size.

That is 83.3 MW/Acre,

So $5700\text{MW}/83.3\text{MW/Acre} = 65\text{Acres}$

That is 22.8GWH of storage in a 4 hour format.

Using 4,385 Tesla Megabucks.

1000 megapacks cost \$1,654,927,950 installed, so 4384 megapacks would be \$7.3B

This is a big project. Tesla has only deployed 5GWH of storage so far.

Info from: <https://www.tesla.com/megapack/design> for cost and number of packs
and <https://www.tesla.com/blog/introducing-megapack-utility-scale-energy-storage#:~:text=Using%20Megapack%2C%20Tesla%20can%20deploy,creating%20seamless%20renewable%20energy%20plants.>

for acreage.

Mark

Here's what I came up with for rough map ideas if the 500 square miles are correct

Map idea, showing wind is way bigger than area for two reservoirs. Could redo with 4 reservoirs and skinnier boxes



Debate: FOA Exempt

Map idea, Seattle



Caliberate, FOIA Exempt 8

From: Diffely, Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>

Sent: Monday, May 23, 2022 9:00 AM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: can we make a map like this?

Here is a high level estimate based on NREL. [Land Use by System Technology | Energy Analysis | NREL](#)
E3 studies rely mostly on gas/H2 and wind. For offshore, the NREL report [Offshore Wind Market Report: 2021 Edition](#) (energy.gov) – I used the estimated acres from 5 projects in the New York Bight

	E3						
	S0 No Policy	S1 100% Clean Retail Sales	S1a 100% Clean Retail Sales (no carbon price)	S2 - Deep Decarb	S2a1 - Deep Decarb no combustion	S2a2 - Deep Decarb no gas	S2a3 - Deep Decarb emerging tech
Year	2035	2035	2035	2035	2035	2035	2035
Reliability Metric	PRM	PRM	PRM	PRM	PRM	PRM	PRM
Gas (MW)	2300	1800	2200	2000			1500 (H2)
DR (MW)							
Solar (MW)		-500			1500	1600	
Batteries (MW)		100	100	200	6000	300	
Wind (MW)	200	1300		600	9400		600
Offshore Wind (MW)						13000	
Pumped Storage (MW)					300		
Conservation (MW)					10	10	
SMR (MW)							600
Wind (Sq Miles)	7.8	50.8	0.0	23.4	367.2	0.0	23.4
Offshore Wind (Sq Miles)						1204.4	
Solar (Sq Miles)		-1.3	0.0	0.0	4.0	4.3	0.0

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, May 23, 2022 8:29 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: can we make a map like this?

E3 provided the amount of solar already. Not sure when we will get the land area from them. We could ask this afternoon.

For Rob's FYI: Katie is working to improve the E3 non-technical version of the ppt. We're hoping to get that done very quickly because it is urgent that we get back to CEQ and DOE as quickly as possible.

In fact, we should discuss with E3 (and amongst ourselves) if we are far enough along that we can schedule that meeting. Many people would be happy if we could do it next week.

From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Monday, May 23, 2022 7:56 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: can we make a map like this?

Great! Thanks for your quick response.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Monday, May 23, 2022 7:56 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: can we make a map like this?

Sure

E3 is planning to provide the land use (number of acres) across their scenarios, so we should have these numbers soon.

From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Monday, May 23, 2022 7:53 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: can we make a map like this?

Hi Rob,

I'm helping Power make the E3 presentation less technical so regular folks can understand it. Would you help make a map like this, to show the solar foot print in the PNW if the lower Snake River dams are removed? This visualization is something that BPA execs have pointed to as a good example of how we could communicate the impacts. [An Assessment of the Diablo Canyon Nuclear Plant for Zero-Carbon Electricity, Desalination, and Hydrogen Production | Energy \(stanford.edu\)](#)



Figure 1-7: Hypothetical spatial footprint of 18 GW of PV compared to the San Francisco metro area
(Credit: Lucid Catalyst LLC)



4. Impact of differing operating patterns on capacity value of Diablo Canyon

Katie Pruder Scruggs
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