WECC

Anchor Data Set 2032 ADS NREL Renewable Data Development

May 10, 2022

Jamie Austin, Chair

Overview

- NREL Renewable Data Development
  - Wind
  - Solar
  - BTM-PV

NREL Wind Data - - Pending Questions

Nine Wind Profiles for each Location

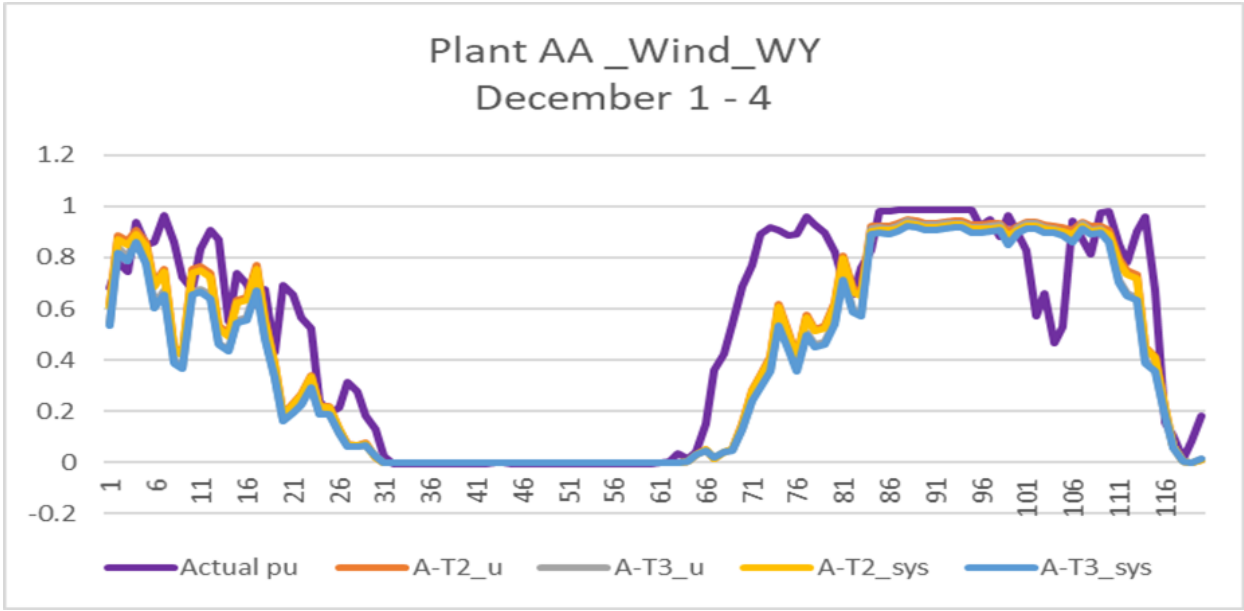
	Group A (Existing)			Group B (2020-2030 4MW)			Group C (2030+ 6MW)		
	Turbine 1	*Turbine 2*	*Turbine 3*	*Turbine 1*	*Turbine 2*	*Turbine 3*	*Turbine 1*	*Turbine 2*	*Turbine 3*
WS range	*<7.5*	*7.5-8*	*>8*	*<7*	*7-8*	*>8*	*<7*	*7-8*	*>8*
Turbine rating (MW)	1.695	1.791	1.922	4	4	4	6	6	6
Rotor diameter (m)	97	94	92	173	160	147	196	184	170
hub-height (m)	80	80	80	112	105	99	120	112	105
Specific power (W/m2)	230	260	290	170	199	236	199	226	264

- Existing - - use EIA data to determine Turban Type
- Future - - For planned, depends on how aggressive the future is with rotor growth. The way things are looking now, NREL recommends Choosing B3 or even C2
  - B3 represents turbines suitable for larger capacity and less site constrained projects.
  - C2 is more like the Midwest with 6MW class turbines.

EIA 860 Data

Capacity | # of Turbines | Turbine Rating (MW) | wind speed | hub height (feet) | hub height (m) | Group T1, T2, T3

	Group A (Existing)		
	Turbine 1	*Turbine 2*	*Turbine 3*
VS range	*<7.5*	*7.5-8*	*>8*
urbine rating (MW)	1.695	1.791	1.922
otor diameter (m)	97	94	92
ub-height (m)	80	80	80
pecific power (W/m2)	230	260	290



Addressing Low-Capacity Factor (CF)

- Q: NREL provided Hourly-Shapes for all substations in the Western Interconnect, for the purpose of covering for future plants. This had contributed to less than 1% annual CF at substations without renewables.
- A: ignore
- Q: WECC added several future wind facilities without valid geo-coordinates, hence resulted in having relatively low-capacity factors. Did you include these in your assessment?
- A: conduct your comparison on a capacity weighted approach. Or, use better representative shapes from a nearby plant.

Recommended

- Regarding locations 10-20% capacity factor
  - I have less concern for capacity factors in this range as they are often valid.
  - This can be cross checked against LBL Wind Land-Based Market Report 2021 (here; image below).

- Regarding locations with <10% capacity factor
  - These are more concerning and would suggest using a proxy site for locations.
  - In general, it's difficult to know the right path for future locations - plants with an install date >2022. If ignoring these for now, we are left with 14 sites that have this issue.
  - Further, if you focus in on sites > 20 MW, the count of issue sites drops to 5.
  - I would suggest using these proxy sites (Offending site | proxy site)
    - Wind-Pine Canyon1WT120 | Pine Tree90WT135
    - Thurston Wind1WT152 | Something is wrong with this site. I cannot find any sites in this county and its coordinates were marked as incorrect.
    - Spring Valley 11WT149 | Milford I1WT5
    - Bear Mountain1WT102 | Moose Lake1WT15
    - Dokie Wind1WT144 | Meikle Wind1WT184.6
    - Quality Wind1WT142.2 | Moose Lake1WT15

Capacity factor site < 20% in Alameda County, CA.

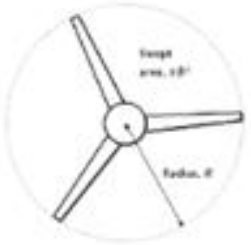
Specific Power

Land-Based Wind Market Report, 2021

BERKELEY LAB

What is Specific Power?

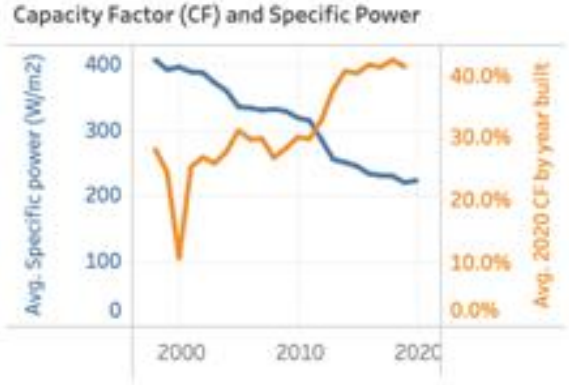
A wind turbine's specific power is the ratio of its nameplate generation capacity rating (watts) to its rotor swept area (m2). All else equal, a decline in specific power should lead to an increase in capacity factor (CF).

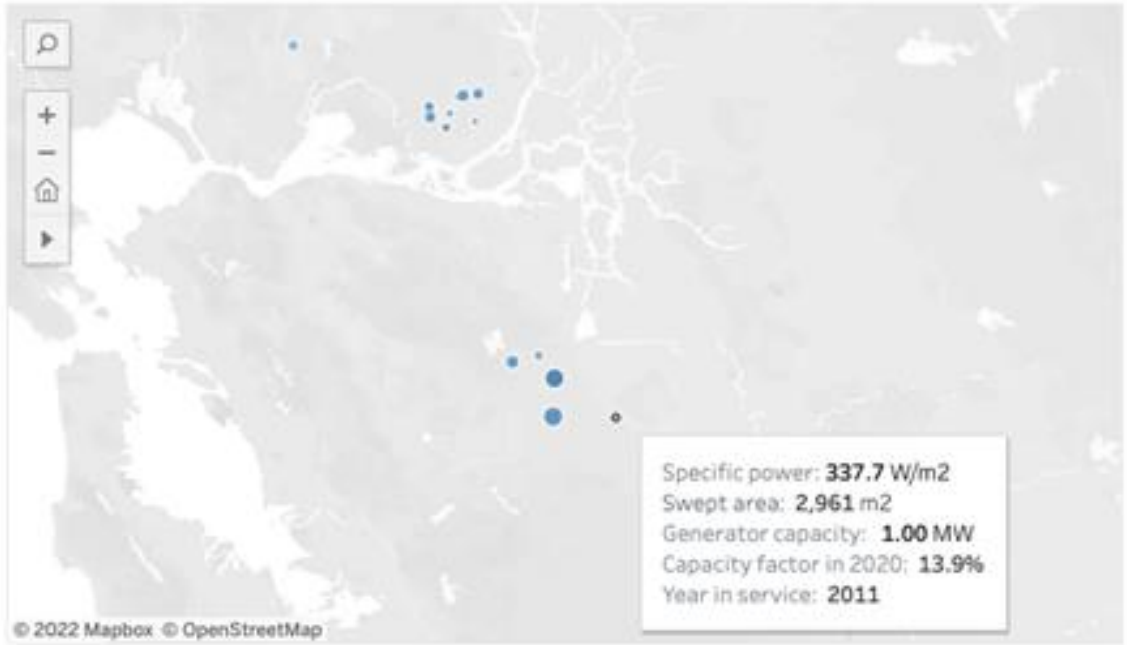


In recent years, companies have been choosing lower specific power machines to improve performance and to be able to deliver energy in more hours, thus maximizing revenues.

On the map, lower specific power is shown with a bigger circle and higher capacity factors are shown in blue. CF data is from 2020, and is thus not available for projects that came online in 2020.

To learn more about US wind energy, see http://WindReport.lbl.gov



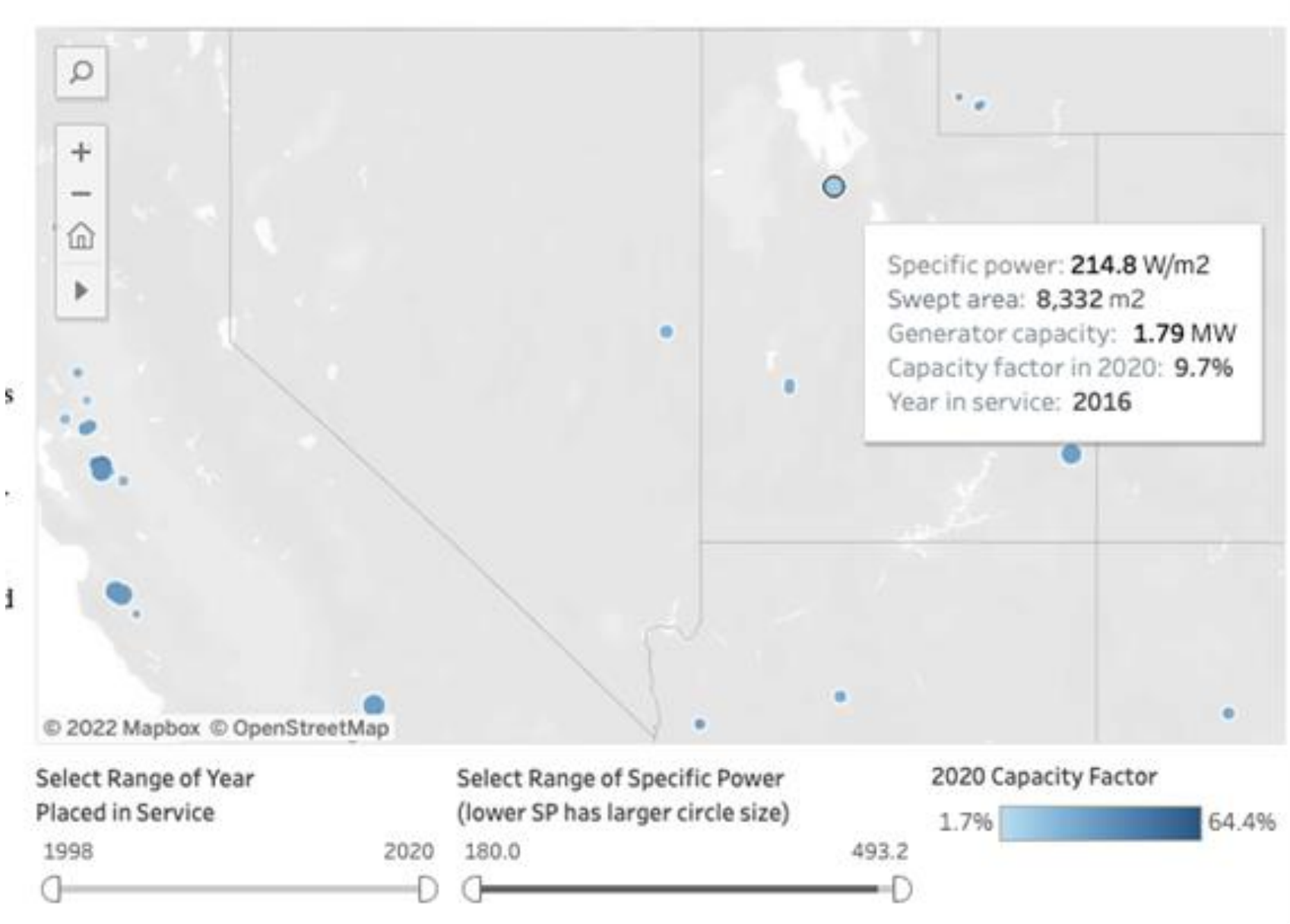


Select Range of Year Placed in Service
1998 2020

Select Range of Specific Power (lower SP has larger circle size)
180.0 493.2

2020 Capacity Factor
1.7% 64.4%

Capacity factor site <10% in Utah



BTM-PV

Data Available

Option	BTM-PV Data	Data Points (WECC wide
1	BAA	40
2	County	440
3	City	2300

	2018		2032	
	Shape	Capacity	Shape	Capacity
dGen	x	x	x	x
EIA 861		x		

	2018						2032					
	LSE	State	City	County	Load Bus	BAA	LSE	State	City	County	Load Bus	BAA
L&R						X						X
dGen			X	X	X	X			X	X	X	X
EIA 861	X	X										

WECC 2032 ADS

Modeled 2032 BTM-PV by County

1. L&R forecast allocated to county (Modeled capacity); can be calculated based on the NREL 2032 dGen
2. dGen unitized BTM-PV shape by county
3. GV Input: Calc distribution of load busses by county (distributed to bus)

Motion - - Use the followings for BTM data in the 2032 ADS:

1. Modeled Load “Gross” = L&R (Load + BTM); monthly capacity and energy
2. Base 2018 hourly load shape := BAA hourly shape + BAA BTM-PV shape (dGen) * Installed BTM-PV capacity (dGen)
3. 2032 BTM-PV capacity: model on the supply side (not greater than 500 generators)

Wind Turbine Technology Assumptions

	Group A (Existing)				Group B (2020-2030 4MW)				Group C (2030+ 6MW)		
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Losses (initially started with 16.7%)

- 10% haircut losses are modeled and meant to capture electrical (e.g., parasitic consumption, etc.), turbine performance (high wind hysteresis), and environmental (degradation). 10% losses applied until wind speed reaches max power curve output, then a linear loss reduction is applied until reaching turbine-cutout speed.
- Wake losses were modeled using a generic 8D rotor spacing layout and the Park Wake Model. Wake losses are time varying.

All turbine power curves were run for every location – existing, near-future, and future locations.

Additional information and power curves available on the WECC PCDS FTP website

Utility-scale PV Technology Assumptions

Existing/near-future facilities

- EIA Data provided within the L&R database and was used to model specific (Array type, DC/AC ratio, nameplate capacity, azimuth angle, and tilt angle.)
- For locations with 2-axis, modeled standard 1-axis assumptions
- For locations with missing array types, 1-axis tracking system was used
- For locations with missing DC/AC ratio, 1.3 used.
- For locations with missing azimuth, 180 degrees used.
- For locations with missing tilt angle, 0 degrees for tracking and 20 degrees for fixed arrays used.
- Losses in all instances were assumed at 11.07% (typically 14.07%, however removing grid availability loss assumptions)

Future facilities (GridView Bus locations)

- Two array types modeled for all locations: 1-axis tracking at 0 degrees tilt, fixed-tilt at 20-degree tilt
- Each location modeled a range of DC/AC ratios from 1-1.6 in 0.1 increments.
- 1 MWac nameplate modeled for all locations, adjusted to MWdc using DC/AC ratio for SAM modeling.
- Losses for all locations 11.07%

WECC

Electric Reliability and Security for the West

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