

Wind Power Update

By John Benson

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1. Introduction

The two most rapidly-evolving renewable energy sources: wind and photovoltaic, seem to be developing fast enough to where I need to write a significant update on these at least twice a year. My last article of these technologies was on repowering and was posted in March of this year (linked below). Since this post is for June, I suppose the pace will need to be quickened a bit, at least for now.

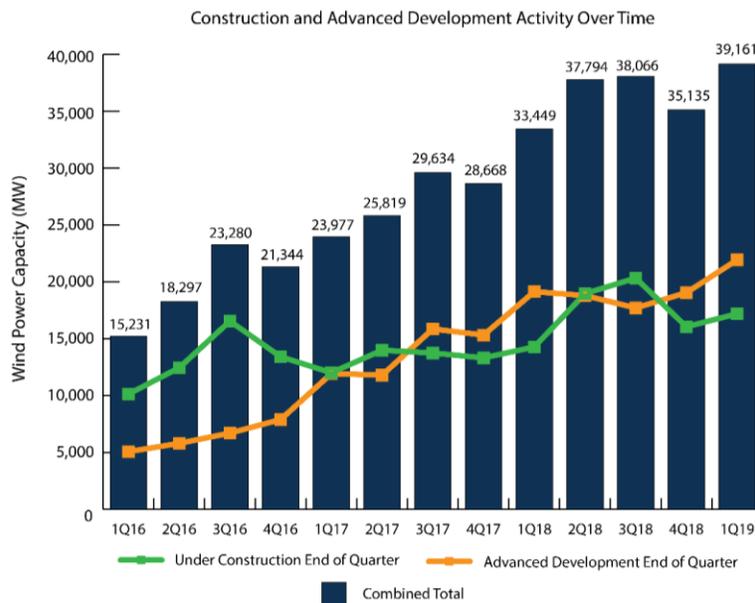
<https://www.energycentral.com/c/cp/repowering>

When my local wind farm (the Altamont Pass Area) was repowered a few years ago (2014 through 2017), I noted that the turbines that were used produced around 2 MW peak each. At that time there were a few turbines available that were slightly larger than this, but a large majority of on-shore Greenfield and repowering projects used 2 MW turbines. That is still the case for on-shore projects being developed today, but I've noted a few are starting to use the next larger on-shore class: the 4 MW turbines.

This paper will explore the recent growth of the U.S. onshore wind-power fleet that is under development, the latest turbines currently being deployed, a few sample projects, and the next generation of on-shore turbines.

2. Wind Development Growth

The wind-industry trade association referenced at the end of this paragraph tracks this market's development activity. The recent article referenced below has the most recent update on this activity, and shows continued growth (see the figure below).¹



¹ Greg Alvarez, American Wind Energy Association, "First quarter results: Records keep falling as wind pipeline hits all-time high", April 30, 2019, <https://www.aweablog.org/first-quarter-results-records-keep-falling-wind-pipeline-hits-time-high/>

Per the above reference, "... the U.S. now has 97,223 MW of installed capacity, enough to power over 30 million U.S. homes."

Please see the above link for additional details.

3. Major Turbine Vendors Projects and Products

The competitive landscape in the U.S. for utility-scale wind turbines has consolidated to three major vendors. Each of these is reviewed below.

3.1. Siemens Gamesa Renewable Energy (SGRE)

SGRE has been integrating its two parent companies since the merger was announced in 2016, and they are probably well-along in this process. Prior to the merger, Siemens was a pioneer in off-shore technology, and Gamesa had one of the most reliable on-shore wind turbines. After the merger the combined company is the largest wind-energy company in the world by installed capacity (~69 GW).²

SGRE currently offers the following on-shore wind turbines in both low-to-medium wind speed and high wind speed versions: 2.1 MW, 2.6/2.9 MW, 3.4 MW and 4.5 MW. Also, in the pipeline for delivery in 2020 is a 5.8 MW turbine.³

The following is a large project that is under construction:

Clearway Energy Group's Mesquite Star in Fisher County, Texas (northwest of Abilene). Clearway Energy has broken ground in early May, 2019 on this 419 MW project after closing the financing for the project.

Mesquite Star's customers and revenue contract counterparties include several preeminent institutions, including Ecolab Inc., Brown University, Cisco Systems, Inc., and others and Clearway is pleased to have the opportunity to support them in meeting their sustainability and clean energy goals. Mesquite Star was developed through a partnership between Clearway and Hill Country Wind Power, L.P., its original developer.

The project will have a total of 118 wind turbines, supplied by Siemens Gamesa Renewable Energy. Simultaneous with financial close, Clearway issued Notice to Proceed with its EPC partner, Blattner Energy, Inc. The project is expected to begin commercial operations in early 2020.

3.2. General Electric

My other former employer (in addition to Siemens) was GE. They are also a major supplier of wind turbines in the U.S. Their product range of onshore turbines roughly parallels SGRE's, with a 2 MW class, a 3 MW class and a larger class with an operating 4.8 MW turbine and future 5.3 MW unit. They also offer turbines optimized for both low/medium wind speed, and high wind speed. The one interesting wrinkle they offer is a two-piece blade design for their largest turbines. This would seem to make transportation logistics a bit easier, and also provide for easier partial repowering projects, although I believe SGRE offers blade-extensions for the latter.⁴

The following is a large project that was recently completed:

Amazon Wind Farm Texas has the capacity to generate approximately 1 million megawatt-hours of electricity annually — enough to power almost 90,000 U.S. homes.

² Wikipedia article on Siemens Gamesa, https://en.wikipedia.org/wiki/Siemens_Gamesa

³ SGRE Website, <https://www.siemensgamesa.com/en-int>

⁴ GE Renewable Energy, Wind Energy Solutions, <https://www.ge.com/renewableenergy/wind-energy>

The wind farm, built by Lincoln Clean Energy, includes a fleet of GE wind turbines, and of the energy generated, 90 percent of this is sold to Amazon's fulfillment arm.

This project is a 253 Megawatt wind farm in Scurry County, West Texas. The farm opened in late 2017 and includes over 100 turbines which feed into the Texas electric grid.

3.3. Vestas

Vestas has similar offerings as compared to GE and Siemens-Gamesa: a 2 MW Platform, a 4 MW platform and a newly introduced EnVentus 5.6 MW Platform (first deliveries in 2020). Also like GE and SGRE, they offer separate designs optimized for low/medium wind speed, and high wind speed.⁵

The following is a large project that was recently announced:

PacifiCorp TB Flats I and II: Vestas has received an order for 459 MW of V136-4.2 MW turbines operating in 4.3 MW power-optimized mode from PacifiCorp, a subsidiary of Berkshire Hathaway Energy, for two wind projects, TB Flats I and II, located in Wyoming. Including previously purchased V110-2.0 MW turbines, the projects will have a combined capacity of 503 MW.

TB Flats I and II are part of PacifiCorp's Energy Vision 2020 initiative, a \$3.1 billion investment to expand wind power via repowering existing projects, adding 1,150 MW of new wind resources by the end of 2020, and building a 140-mile transmission line segment in Wyoming to enable wind generation.

As part of Energy Vision 2020, Vestas and PacifiCorp previously partnered on partial repowering the Marengo and Marengo II wind projects in Washington, upgrading the site's existing V80-1.8 MW turbines with V100-2.0 MW turbines.

4. Wyoming Wind and New Transmission Project

With wind, geographic diversity is important. In the western U.S. most of the really big loads are on or near the West Coast. The west also has many operating and planned wind-power projects, but frequently their output does not correspond to peak demand periods in this region. Thus bringing renewable energy from further east is important.

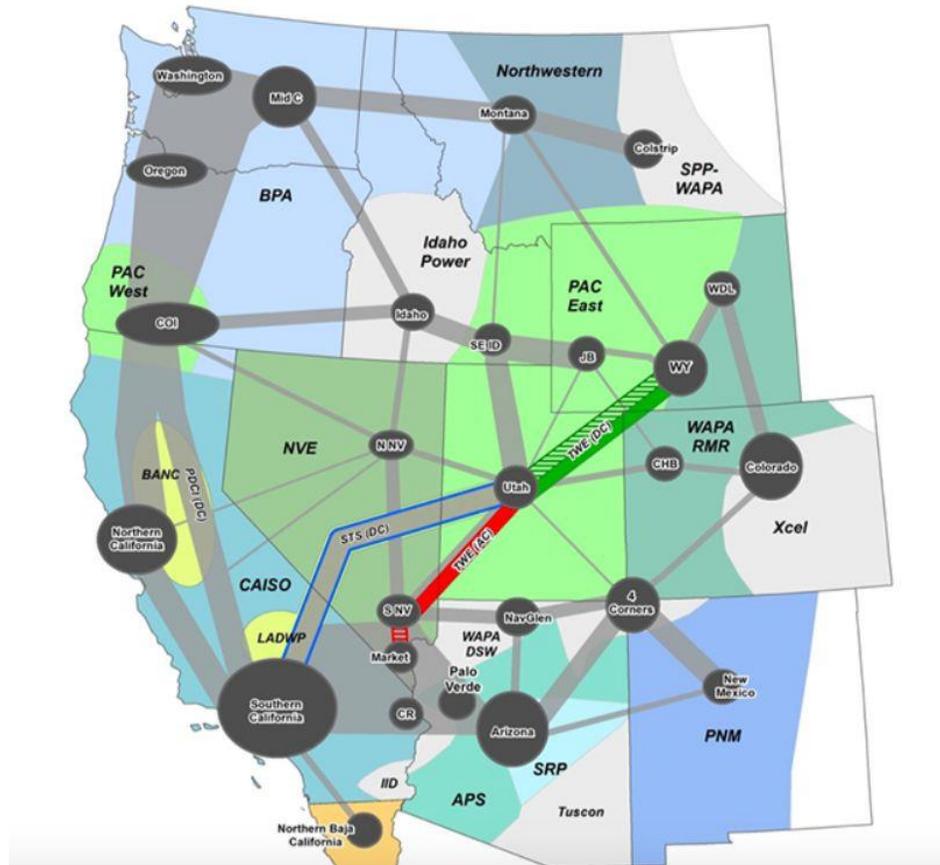
A major new transmission line that runs from Wyoming to Nevada's Hoover Dam (see map below) is being developed. This \$3 billion transmission project, the TransWest Express Transmission Project, hopes to bring several gigawatts of new wind power from Wyoming to West Coast electricity markets.⁶

TransWest is a subsidiary of the Anschutz Corp., the private holding company of oil billionaire Philip Anschutz. Anschutz Corp. bought the rights in to the Trans West project in 2008. Anschutz Corp. also owns the Power Company of Wyoming, a subsidiary that's developing the 3-gigawatt Chokecherry and Sierra Madre Wind Energy Projects in southwestern Wyoming. This region has been identified as one of the best wind resources in the country (also see the PacifiCorp Wyoming project referenced in the prior subsection).

⁵ Vestas Website, <https://www.vestas.com/>

⁶ Jeff St. John, Greentech Media, "\$3 Billion Transmission Project Wins Key Permit in Quest to Bring Wind Power to the West Coast", April 23, 2019, https://www.greentechmedia.com/articles/read/transwest-wins-key-permit-for-transmission-to-bring-wyoming-wind-power-to-t?utm_medium=email&utm_source=Daily&utm_campaign=GTMDaily

There are at least two other transmission projects being worked on to carry power from Wyoming westward, including the Zephyr Power Transmission Project, which has been in the works since 2011, and the proposed Gateway West and Gateway South projects from the PacifiCorp utility Rocky Mountain Power.



The TransWest Express Transmission Project is currently projected to be constructed from 2020 to 2023.⁷

5. Off-Shore Wind

At this time we will not look at off-shore wind, as a large majority of these are still, well, off-shore (in Europe and elsewhere). The largest turbines currently being deployed off-shore are larger than 10 MW. We may look at these in a future post, as U.S. off-shore projects have finally started to show signs of growth.

⁷ TransWest Express LLC Web Site, <http://www.transwestexpress.net/index.shtml>