U.S. wind repowering returns stand up against wholesale prices, for now

U.S. production tax credits (PTCs) have accelerated wind repowering activity as operators look to use technology advancements to optimize aging fleets. Falling costs and growing wholesale market exposure have pressured margins for suppliers and operators.

Most recently, PacifiCorp ordered 260 MW of turbines from Vestas to repower the Marengo 1 & 2 wind farms in Washington. The Marengo wind farms were built in 2007 and 2008, and the turbines will be upgraded from 1.8 MW models to more advanced 2.0 MW units from the second quarter of 2019, Vestas said June 29.

Repowering allows operators to install larger, more efficient turbines and introduce operations and maintenance (O&M) improvements.

Operators may choose to perform a "full repowering" of major wind farm infrastructure or a "partial repowering" where typically the existing tower and foundations are kept in place.

About 2.1 GW of U.S. online wind capacity were repowered in 2017 and more than 15 GW of capacity is "ripe" for repowering in 2018, ICF consultancy said in a report published in May. Repowering could add 300 MW of additional U.S. wind capacity in 2017-2022, according to Bloomberg New Energy Finance (BNEF).

Projects installed between 2003 and 2010, underperforming plants and those with high maintenance costs are likely candidates for partial repowering, ICF said. Similarly, turbines from suppliers no longer in business can be swapped out under a repowering program.

Extended in 2016, the PTC support program provides 10 years of tax credits at $23/MWh for greenfield and repowering projects started in 2016. The PTC drops by 20 percent for projects started in 2017 and is scaled down by 20 percent annually with zero support from 2020. This means projects started in 2018 can capture $13.8/MWh of credits.

Repowering offers output gains and operational efficiencies but tax credit is falling 20% per year. (Courtesy: ZU_09)

Partial repowering projects in 2018 can earn an Internal Rate of Return (IRR) after tax of 11 percent, according to ICF. This is based on a captured energy price of $24/MWh (flat) and capital expenditure of $950/kW.

Even with the reduced PTC level this year, "repowering can make economic sense," ICF said. But ICF warned falling margins demand more careful scrutiny of energy output gains, capital costs and O&M efficiency.

"It may make better financial sense this year than it will next year or the year after," said Chris Mertes, ICF's Wind Practice Lead and co-author of the report.

REPOWERING STRATEGIES

ICF's indicative IRR calculation is based on an increased net capacity factor and a 10-year extension of asset life.

Energy production gains are clearly a crucial driver of repowering economics. According to the consultancy, a 1 percent increase in capacity factor can increase IRR by 0.8 percent.

To qualify for the PTC, the value of the repowering project must be at least 80 percent of total plant value.

Partial repowering work can differ between projects, but longer blades are typically fitted, and it often involves the replacement of the entire rotor and the refurbishment of other parts of the wind turbine, such as the nacelle or hub, said Eric Soderlund, senior manager and structural engineer at Sargent & Lundy.

Some partial repowerings have focused primarily on generator replacement, Soderlund said.

"This is done to increase the wind turbine capacity ... PTCs are received so long as the 80/20 rule is met," he said.

In a recent report covering 23 U.S. repowering projects, partial repowering projects retained — at the very least — the existing wind turbine foundations, turbine tower,s and electrical balance of plant (BOP). Some of the projects reused yaw systems, nacelles, and generators, while replacing hubs, main shafts, main bearings, and gearboxes.

MARKET RISK

The contracting of wind-energy supplies is evolving as costs fall and subsidies are removed. While some projects will benefit from long-term PPA contracts, many will be exposed to wholesale market prices that have been flattened by the U.S. shale gas boom.

The economics of repowering can be "feasible" if captured wholesale prices are in the mid-$20's/MWh range, ICF said in its report.

A 1 percent change in wholesale prices can affect IRR by about 0.4 percent, based on the above project assumptions, it said.

Repowering projects have the advantage of actual historical site performance and market data, the ICF consultants noted.

OPERATIONS AND MAINTENANCE

Repowering decisions must also factor in O&M costs over the lifetime of the project.

Aging turbines incur higher O&M costs, and the average turbine age in North America will rise from 5.5 years in 2015 to 11 years by 2025, IHS Markit said in a recent report.

U.S. O&M costs are forecast to rise from $45,000-$50,000/MW per year for turbines aged between five and 10 years, to about $50,000-$60,000/MW per year for turbines aged between 10 and 15 years, IHS Markit said.

According to ICF, O&M contracts for new projects currently range between $15,000 and $25,000 per MW per year.

"The O&M cost delta is a significant driver in the economics of a repower project: A $5/kW-yr difference in our base case makes for a difference in IRR of 1.4 percent," the ICF consultants said.

Market competition also has spurred a widening choice of repowering "add-ons" that can further reduce costs over the lifetime of the asset.

Original equipment manufacturers (OEMs) are now offering repowering packages that include upgrades to main equipment as well as O&M, grid, and forecasting solutions.

In one example, GE supplied the turbines for Leeward's Sweetwater 1 & 2 repowering project along with O&M services and tax equity financing through the GE Energy Financial Services arm.

"Repowering is so much more than simply providing new wind-turbine equipment," Anne McEntee, GE Renewable Energy vice president and Services CEO, said in 2017. "We're bringing the entirety of GE to the table for our customers, providing options for servicing, grid solutions, forecasting, and tailored financing solutions."

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Be Power and ABB team up for power generation project

Paolo Martini, managing director of Be Power. (Courtesy: Building Energy)

Be Power and ABB will cooperate in the Dispatching Service Market (MSD). Be Power is the Digital Green Utility of the Building Energy Group with a business model based on the synergies between the markets of energy and mobility. This model aims at integrating the opportunities arising from the opening of the MSD to widespread facilities of power generation (demand/response) with a proprietary infrastructure of charging stations and e-vehicle fleets. The partnership with ABB — a technological leading player in the industrial automation and power grids as well as in the electrification products, robotics, and motion control solutions — will allow Be Power to join the Terna pilot project that has opened the participation to the MSD also to the distributed gener-

ation, including the generating units powered by renewable sources and storage systems.

By setting up the pilot project (AEEG SI Resolution 300/2017), the national grid operator intends to optimize the provision of dispatching resources encouraging a wider participation in this market as already happens in some European countries. Hence, consumption and production units of any size and technology — including non-significant generating plants with capacity lower than 10 MVA — can offer dispatching services through an "aggregator" by establishing production, consumption, and mixed units (UVAP, UVAC and UVAM).

Be Power will enter the Market for Dispatching Services as "aggregator" through its subsidiary 4energia, the energy trader specialized in purchase of electricity from independent producers managing more than 700 MW of the total capacity in the last years, while ABB will provide services of advanced analysis, aggregation, and data management through its advanced services, ABB Ability™ Collaborative Operations. ABB will be responsible for creating, qualifying, and managing the Aggregated Virtual Units (UVA) assigned to the MSD for production and/or consumption with the relevant measurement devices in each plant (UPMx) and the installation of a central unit (UVAx) to gather the data toward the Terna grid. All the data will be processed by the ABB AbilityTM Collaborative Operations Center in Genoa.

"We are proud to take part in the pilot project of Terna entering the Market for Dispatching Services together with ABB, a company specialized in the development of this technology," said Paolo Martini, managing director of Be Power. "Thanks to this partnership as 'Aggregator,' we will benefit from the consolidated experience in trading of our subsidiary 4energia to offer the energy producers and consumers an additional value through the optimization of their assets. The companies that will join our grid will be able to obtain additional margins by entering more profitable markets."

"This pilot project fully understands the essence of the ABB Ability Collaborative Operations, a true evolution in the data analysis and aggregation, said Danilo Moresco, head of the Power Generation & Water Unit in Southern Europe. "This new approach is able to gather in a unique circular flow the plant data as well as both the Be Power and the ABB control centers in an ongoing exchange of accurate and timely pieces of information to optimize the performance of the monitored assets."

MORE INFO www.buildingenergy.it.