Tall Tales of Wind Farm Construction

Size matters.

The components used to build wind farms are very big and that affects everything about constructing them. The current generation of wind farms are bigger and more spread out, too, and they are growing in number.

Wind turbines are an important tool to slow global warming — generating electricity sustainably and reducing the use of fossil fuels in power plants. Energy companies are investing increasingly in wind. The industry has developed a way of setting up wind farms on other people's properties, across farmland and forests, sometimes involving multiple landowners. The towers are spread out, minimizing the environmental and noise impact of a concentrated forest of turbines. The land owners participate in the profits — as do adjacent property owners affected by the presence of the turbines — bringing them regular income with very small impact on their land or its other uses.

"I've had dairy farmers tell me that their best cow is a turbine," relates one veteran of wind farm construction.

Wind farms started in the West, but they are appearing across the country now. Two in particular, in Illinois and New York, illustrate the challenges and achievements of constructing a wind farm.

BLUESTONE COUNTRY

Bluestone Wind Farm in upstate New York is 6,000 acres located on a series of ridges in Broome County. It has 26 turbines scattered across the properties of a variety of local landowners in the towns of Sanford and Windsor. It's a forested area. There are some dairy farms, but the main industries are logging and bluestone mining.

The wind farm is being built with construction management by The Wesson Group, which did the site work, laid the massive foundations and built the collection system that strings together the widely separated turbines. A separate contractor is erecting the towers, which is expected to begin in April 2022.

The project began in the dead of winter, 2021, clearing the land. Wesson Group Executive Vice President Scott Lewis describes it as probably the most challenging wind farm the company has built because of the terrain. Unlike many farms built on relatively flat farmland, Bluestone crosses hills and valleys with an elevation gain of about 1,300 feet, in a rural area where some of the roads are little more than logging trails. Clearing has to be done in the winter to avoid impacting

two species of migratory bats; they are away for the winter.

By spring, they'd cleared the turbine sites in the forest (on schedule) and could began improving the roads. The longest components of the wind turbines, the blades, are shipped in a single unit 240-feet long. "To deliver the parts, the roads have to have very subtle height changes," explains Lewis, "and we have to have large horizontal curves so we can get around the corners." They installed over 11 miles of roads.

The foundations are circles, 45' wide at the base tapering to about 18' at the top. They are 10-12 feet deep, with 60 tons of rebar in each one. "They are challenging because the concrete placements are so large. You have to have a continuous supply, because you can't have cold joints. Those pours will last eight to 10 hours nonstop." Because of the remoteness of the location, they set up a concrete batching plant on-site. The space around the tapered sides is then backfilled; the weight of the soil is part of the engineering to resist overturning of the tower.

While the foundations are being placed and cured ("The center of that thing may not cool for 10 days," comments Lewis), The Wesson Group is also building the collection system, which Lewis estimates to be about 200,000 feet total. It goes through valleys and over hills. All of the cabling is buried, mostly by trenching. At one place it has to cross a wetland area with a trout stream. Wesson is doing a directional drill down one slope of the valley and up the other side, three bores 2,000 feet long on each side, to run the cable without disturbing the wetland.

Foundations are expected to complete before winter 2022. Then tower erection will begin.

Each turbine sits on top of a tube about 350 feet tall, usually split into five, six or seven sections. It takes a 750-ton or 1,000-ton class crane to hoist them, and it is difficult to do safely because, obviously, they're being erected in a high-wind

sites pretty challenging," explains Fassbender. They needed sufficient flat area to assemble the 415-foot rotors horizontally on the ground.

The tower foundations are 65 feet in diameter and 10 feet deep, about 450 cubic yards of steel-reinforced concrete in each. In some instances, the water table was so high that the hills couldn't be lowered without encountering buoyancy problems. "There was a turbine located on a little hill that we wanted to drop a bit, and we only had 18 inches before we got into a buoyancy concern."

The project was on a tight six-month schedule, and they'd done extensive coordination with all the related parties. But one severe storm began a cascade of delays. They started erection in late July 2020, when the daily winds are, historically, milder. A derecho with high wind speeds blew through, downing power lines and causing havoc in the community. The utility company was tied up getting customers back online and delayed the work they had scheduled to do for Boldt: burying powerlines where the new site-access roads needed to cross existing roads. Blocked by powerlines, scheduling conflicts ensued.

Delays pushed erection further into autumn when the winds pick up. Tower sections can be erected in moderate wind, but rotors cannot. Lifting the rotor is tricky. It has to be hoisted horizontally and then swung down into vertical position for installation, and it is an enormous sail designed to catch the wind. The wind limit for rotor lifts was 16 miles per hour.

The winds only died down at night. "We ended up chasing that low-wind window into the evenings," recalls Fassbender. "We worked a flex shift, coming in at 9 or 10 p.m. and working until midmorning when the wind started to come back up again."

To switch to night work and do it safely, they brought light towers, eight to 10 for each turbine. They kept the crew contained so they knew where everyone was at all times. They also had to dress the crew for cold weather, as October nights began to dip below freezing.

Despite delays, the entire project, all 32 towers and the collection system, were completed on time and on budget by the November 2020 deadline. Fassbender credits the success to good collaboration. "It's something that Boldt takes a lot of pride in, making sure we sit down all the key parties at the front end of the project, and talk through all those key milestones, so there shouldn't be surprises on the back end. Having those conversations up front was really key to completing the project."

About the Article

Written by Steven H. Miller and republished from Constructor Magazine, a publication of Associated General Contractors of America. The Associated General Contractors of America works to ensure the continued success of the commercial construction industry by advocating for federal, state, and local measures that support the industry; providing opportunities for firms to learn about ways to become more accomplished; and connecting them with the resources and individuals they need to be successful businesses and corporate citizens.

Photos:

1. A tower foundation at the Bluestone Wind Farm, fully formed and reinforced, and ready for concrete. Photo by Dennis Lee Photography, Courtesy of The Wesson Group
2. A tower section ready to lift into position at the Lone Tree Wind Farm. Photo by Kroeger Photography, Courtesy of The Boldt Company