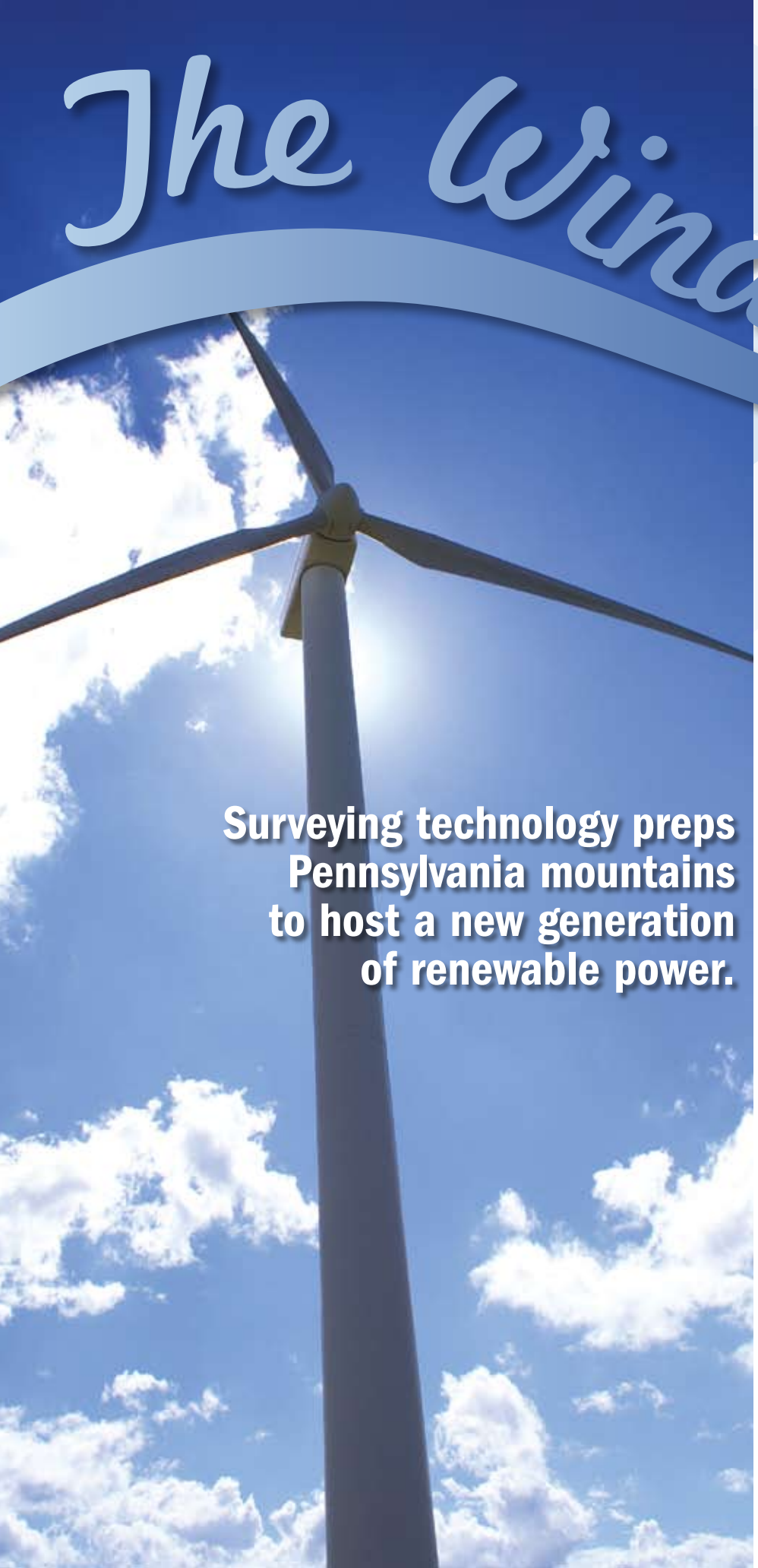
The Winds of



Surveying technology preps Pennsylvania mountains to host a new generation of renewable power.

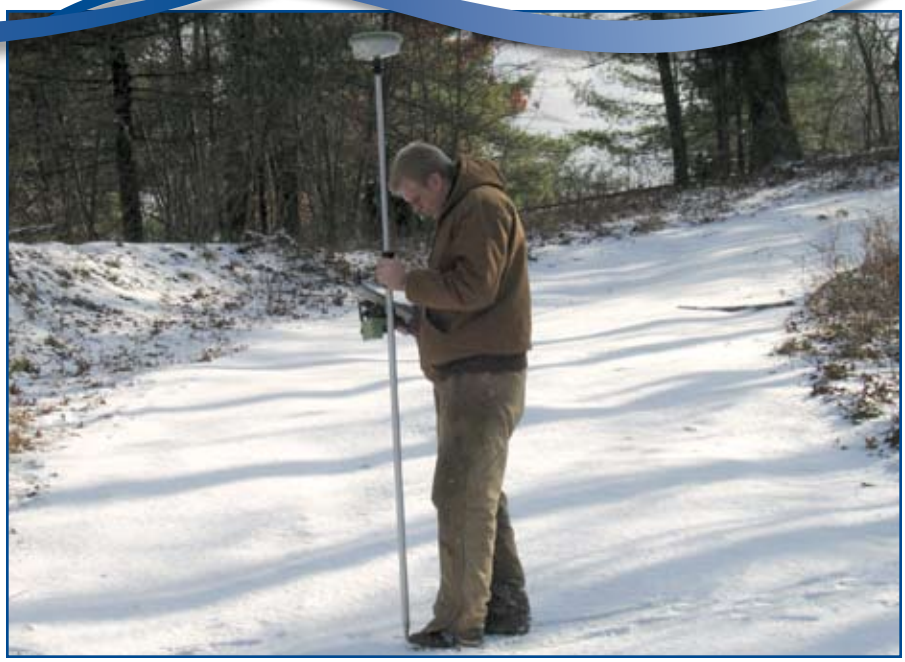
Set amid the Allegheny Mountains near Altoona, Pennsylvania, the Allegheny Ridge Wind Farm will be the state's largest wind farm and one of the largest in the mid-Atlantic region when complete in a few years. Under development by Gamesa Energy USA, a wholly owned subsidiary of Spanish wind-energy company Gamesa Group, the first phase of the project was completed in October 2007 and includes 40 turbines able to produce 80 megawatts of renewable power. The second phase, called the North Allegheny Wind Farm LLC, is in progress and will include 35 windmills.

Each windmill stands 290 feet high and has rotor blades in excess of 150 feet. The enormous turbines will be precisely positioned within a 10-square-mile piece of property on the Allegheny Plateau, an area known for year-round sustained winds of at least 15 miles per hour. But before these giant rotor blades can begin to turn, surveyors had to trek the undeveloped property aided by two entirely different power sources: wireless networks and space-based satellites.

During the project, Steckbeck Engineering and Surveying, a full service civil and infrastructure consulting firm in Lebanon, Pa., has relied on GPS tools and techniques. A real-time reference station network of continuously operating reference stations has also provided a foundation for quick and highly accurate mapping and survey support enabling the Steckbeck team to move the North Allegheny phase of the wind farm project forward.

Change

BY VICKI SPEED



Surveyors rely on versatile tools, including this Leica System 1200 GPS-driven survey system, to gather existing topographic data in the snow-covered Pennsylvania hills.

Steckbeck's overall task includes a forest clearance and right of way survey, subsequent utility surveys, the development of a complete as-built data file–and a long hike along the beautiful Allegheny Ridge.

Reference Connections

As the largest natural region in the state, the Allegheny Plateau is a scenic beauty. Workers have had no shortage of stunning views to take in during the construction of the Allegheny Ridge Wind Farm, which began in early 2007 soon after Gamesa engineers defined the optimal positions for the first 40 turbines.

Steckbeck surveyors set out to mark the necessary forest-clearance zones and survey right of way to reach the wind farm site located some five miles from the closest major highway. Knowing that the area's rugged topography and plentiful vegetation would limit line of sight in the initial setup, the surveyors looked to establish a reference network in the vicinity that would provide enough coverage for RTK GPS techniques.

A first approach to the project led Steckbeck surveyors to rely on one of its Leica Geosystems (**www.leica-geosystems.us**) SR530 dual-frequency geodetic RTK receivers as a base station located at the company's Everett office about 25 miles from the site. This receiver provided 100-percent coverage of the project area and facilitated continuous GPS operation throughout the project.

Steckbeck has also relied on the Pennsylvania Reference Station Network controlled by local dealer Precise Geosystems Inc. as a backup resource for data and system accuracy checks. Using the reference station network, which includes a series of eight permanently operating real-time GPS receivers that cover eastern and south central Pennsylvania, surveyors were able to receive instant RTK positions on the coordinate system of their choosing. This allowed them to set up their Leica SmartStation, which is comprised of robotic and GPS equipment that can be used interchangeably anywhere, or their Leica System 1200 GPS receivers.

"Through our stations and the Pennsylvania network, we were able to tie our GPS rovers to multiple stations, providing coverage throughout the wind farm project and much of southern Pennsylvania," says Rex Clark, PLS, Steckbeck's director of surveying and lead surveyor on the Allegheny Ridge Wind Farm project.

A Walk in the Woods

The first phase of the wind farm project required Clark and his survey team to map the planned forest clearance area and lay out a road network wide enough to handle the heavy industrial equipment, including the large tractor-trailers and cranes that were needed to haul and set the turbines.

With an operational reference station network online, Steckbeck surveyors hoisted backpacks with mobile survey equipment, winter wear and some food and set out into the Pennsylvania wilderness.

Clark recalls: "We had six weeks to define the entire ten-mile roadway in the middle of winter. There were days that we were five to six miles from any modern convenience. Fortunately, our survey equipment is highly mobile. The right equipment and quality all-weather gear kept us moving."

He opted for the flexibility of robotic technology and selected the Leica Geosystems' System 1200 SmartStation, a robotic combination that offers mobility and accuracy in a portable system, allowing a user to do a setup and survey at the same time. The System 1200 includes an

The road to Pennsylvania's Allegheny Ridge Wind Farm site needed to accommodate large tractor-trailers used to transport the wind turbines and blades to the individual positions as well as the cranes used to erect the towers and blades.

RTK GPS receiver and a TPS 1200 total station. The SmartPole incorporates an RTK rover with a remote control total station.

On any given day, Clark and two other team members began a three- to five-mile trek along the proposed roadway, working closely with the forest-clearing and roadway construction contractors.

With the SmartPole in hand, they marked site-clearance boundaries every few hundred feet along the proposed roadway establishing control points with RTK and simultaneously measuring to these points with the total station to resect the position. Since both TPS and GPS were available, the team didn't worry about overhead obstructions, such as dense tree coverage, blocked satellite links or line-of-sight restrictions around heavily forested areas. The Pennsylvania Reference Station Network provided a final check and verification of the boundary network orientation and coordinates.

The road network layout took Clark and two others approximately six weeks to complete. This GPS-based network not only benefited Clark and his survey team, it also benefited the contractor.

"The terrain is very steep in some of the proposed areas," Clark says. "Oftentimes, the contractor and owner would want to shift the roadway path a little to avoid steep inclines. They relied on our ability to redesign the horizontal layout of the roadway as quickly as possible to keep on schedule."

Barry Poet, site superintendent for Horst Construction, the project's general contractor, adds, "We valued Rex Clark and the Steckbeck team's contribution on this project as it required a lot of coordinated effort to keep our site teams on schedule and the Gamesa team satisfied with our progress."

By early April 2007, construction crews began grading the 60-foot-wide roadway to the site of the wind farm. Clark says that during this segment of the project he was particularly pleased with the robotic technology's ability to close open-ended traverses. "We'd lay out the clearing area, set the ground control, and the construction crews would roll through and wipe out the control," he says. "We were continually losing ground control, [but] the SmartStation allowed us to eliminate additional traverse after the initial construction had taken out our previous control. We can set up and establish coordinates anywhere we have GPS capability." He adds, "Bottom line, we could not complete this project under the given schedule any other way."

The newly established roadway set the course for the next phase of the wind farm generation project, which includes utility surveys and as-built conditions.

Power Paths

A typical wind farm incorporates an array of systems designed to gather, store and convert wind energy into electricity and then distribute that energy to a power facility. As part of the second phase surveying effort, Steckbeck surveyors are tasked with locating existing utilities throughout the Allegheny Ridge's 10-square-mile site as well as tracking the volume of excavated materials at each of the turbine positions and the roadway.

Clark believes that robotic technology is key to achieving Steckbeck's strategic goal of expanding in both its geographic service areas, taking on larger, more complex projects. In the last five years, the firm has doubled in size and anticipates similar expansion over the next five. In fact, GPS and the growing availability of reference station networks have opened the door for Steckbeck surveyors to go where the wind blows–and beyond.

The turbine blades measure in excess of 150 feet from tip to tip. The towers stand 290 feet high in columns that are more than 12 feet in diameter to accommodate the necessary wind generation and storage equipment.

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