The Future Blows In

With Renewable Energy on the Rise, Surveyors are Harnessing New Opportunities

In the rapidly expanding business of renewable energy in the U.S., wind power stands tall as the fastest-growing sector. In 2008, about 7,500 MW was installed, and wind now provides about 1.5 percent of total U.S. electricity generation. The U.S. Department of Energy (DOE) has defined a scenario in which 20 percent of U.S. energy can come from wind power by 2030 if the appropriate investments are made in technology and transmission infrastructure; several states have enacted legislation establishing even more aggressive goals.

The increasing demand for wind energy is creating opportunities for surveyors. Large-scale wind farms cover hundreds of acres of land (and, in some cases, water) and affect thousands more. Virtually all of these installations require cadastral, engineering and construction surveys.

A prime example of the new "Big Wind" industry is the Cedar Creek Wind Energy Project in northeastern Colorado. Located about 190 km (120 mi) northeast of Denver, Cedar Creek is the biggest wind farm in Colorado and one of the largest in the U.S. It's in an ideal location for wind power with strong, steady winds, ample open space and more than two million consumers nearby. The plant began operations in November 2007 and produces 300 MW of electricity annually—enough to supply power to 90,000 homes. Westwood Professional Services, headquartered in Minneapolis, Minn., was selected to provide the surveying for the project.

Planning on the Cedar Creek project was well under way when Westwood's survey crews went to work in January 2006. The project called for an array of 274 wind turbines spread over 12,950 ha (32,000 acres). More than 24 km (15 mi) of overhead collection lines were needed to gather electricity from the individual turbines. To connect Cedar Creek to the region's electricity grid, a 230-kV transmission line was needed to carry the electricity 110 km (70 mi) to an existing switching station. Before serious construction could begin, a mountain of survey work had to be completed.

Project owners gave Westwood maps that showed proposed locations of the turbines, power-collection systems and transmission lines. The sites for the turbines were leased from numerous landowners; Westwood needed to write the property descriptions for the leases. In addition to creating descriptions for easements and rights-of-way for the transmission lines, Westwood conducted surveys for the numerous access roads and collection lines and prepared ALTA (American Land Title Association) surveys (detailed descriptions and maps that meet ALTA requirements) for all of the affected parcels.

PLSS and Wide-Open Spaces

The project was a classic exercise in surveying under the U.S. Public Lands Survey System (PLSS). Most of the easements were aliquot descriptions and required complete section breakdowns. Westwood researched federal and county survey records and gathered input from local surveyors and landowners. The team needed to recover or restore many section corners that had not been visited since the original surveys. Westwood's crews found more than 1,000 section and quarter corners and restored roughly 150 corners that they determined to have been lost or obliterated. Many of the markers were stone monuments with no roads or fence lines to help crews find them. "It's a fascinating feeling when you recover one of the old stones," said Westwood project development manager Rick Haglund, LS. "You really become connected with the surveyors who were there more than a hundred years ago."

Cedar Creek provided an ideal environment for GNSS surveying, and Westwood relied on GNSS exclusively for the project. The crews used Trimble R8 and Trimble 5700 GPS systems connected to Trimble TSC2 controllers running Trimble Survey Controller Software. Westwood often uses Trimble VRS networks on survey projects and Haglund likes the speed, convenience and reliability that a VRS delivers. But there is no VRS coverage in this part of Colorado, so Westwood crews used static GPS and Trimble Geomatics Office Software to establish coordinates for approximately 40 new base stations.

Remote Project Management

The work to establish coordinates for the new control points illustrated Westwood's tight project management. Most of the data processing was done at their Minnesota office by a dedicated GPS processing team. Using Trimble Geomatics Office, the team computed the coordinates for the control points and analyzed the results of each day's Real Time Kinematic (RTK) work. The office team also prepared information that the field crews used to search for existing monuments and to conduct cadastral and construction stakeout.

When the control was in place, the survey work turned to RTK. Before construction of the transmission line could start, Westwood needed to complete a strip survey 110 km (70 mi) long during one of the harshest winters in the region's history. "The snow, cold and wind combined to make things very difficult," Haglund recalls. "We had to call in D8 bulldozers to clear snow to work on the surveys for the transmission line." As the year moved

into spring and summer, the physical challenges changed to include extreme heat and rattlesnakes. The surveyors completed the ALTA work in five months, meeting the project schedule. Wind farm construction began in the summer of 2006, and work on the transmission lines started in the autumn.

In addition to the cadastral and construction surveys, the Westwood team assisted in siting decisions for several wind turbines. While wind farms generally have contiguous layouts, changes due to local conditions were common. For example, the Cedar Creek project is adjacent to the Pawnee National Grassland, an area known to be prime habitat for raptors. Locations for many turbines changed when wildlife experts raised concerns that a turbine would adversely impact a sensitive site. Turbine locations also considered existing farm facilities, pipelines and roadways.

Throughout the project, Westwood maintained communications with the field crews, project owners and contractors—in part by setting up a secure FTP site online for the project where the stakeholders could receive maps, descriptions and other information. By the time the project was completed, Westwood had delivered nearly 100 sheets of detailed ALTA survey drawings in electronic and hard-copy formats. Less than 20 months after the first surveys, power began flowing from Cedar Creek. The entire project was completed on time and on budget.

From Challenge to Opportunity

Westwood's success at Cedar Creek was no accident. The firm had already developed methods for working in large, remote sites. And by using dedicated experts in GNSS fieldwork, CAD and data processing, project teams could complete projects with speed, quality and consistency. Knowing that the bulk of large wind and solar energy projects will be in the western U.S., Westwood has created a team focused on the specialized work needed to create and document the aliquot descriptions common to PLSS projects.

Nearly 75,000 new wind turbines will be required to meet the DOE's 2030 energy scenario. The new turbines will be supported by uncounted miles of transmission lines and access roads. It all translates into an enormous amount of surveying. With their Trimble technology and innovative project management, Westwood's success will be a breeze.

See feature article in POB's March issue: www.pobonline.com