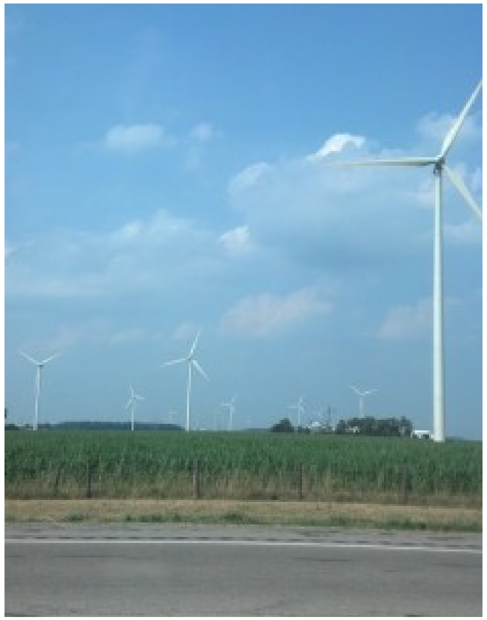
AMAZING FEATS OF WIND TURBINE ENGINEERING

Posted on June 27th, 2013 by Dan Liggett



Throughout history, there have been examples of how outstanding human ingenuity. From triumphs of historic proportions to others that fell under the radar, examples of seemingly unbelievable achievement have astounded and captured our imaginations.

Yet another feat of human engineering occurred recently. Although it did not receive the attention of other great achievements, what happened on May 31, 2013, boggles the mind nonetheless.

That day, a massive tornado touched down west of Oklahoma City. At maximum intensity, wind speed reached 296 mph, making it nearly an F-6 on the Enhanced Fujita scale. Those

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wind gusts came close to matching the strongest winds ever measured on Earth. A tornado that struck Moore, Okla., in 1999 produced gusts of 301 mph. The May 31 tornado was only the eighth tornado of F-5 magnitude to be measured in Oklahoma since 1950.

This storm was a monster. Its width extended an unbelievable 2.6 miles, making it the widest tornado in recorded history. It was on the ground for 40 minutes, covering a distance of 16.2 miles.

The tornado killed 18 people, including four storm chasers.

Amidst the loss of life and extensive property damage, the unthinkable happened. Despite taking a direct hit from the massive tornado, two wind turbines at the Canadian Valley Technology Center stood intact after the storm passed. Amazingly, the turbines, on 85- and 126-foot towers – both fully constructed and used for educational purposes – did not suffer any visible damage.

Reason dictates that two tall, relatively thin towers would not have survived a direct hit from violently twisting winds of nearly 300 mph. Reason dictates the towers would have been snapped off, the blades bent or ripped off and the mechanical systems damaged beyond repair. And, yet, these turbines defied those expectations.

Although certainly not in every case, time and time again we hear of wind farms and individual towers surviving the punishing winds of tornadoes and hurricanes. Clearly, the structural engineers of wind turbines are on to something pretty remarkable.

Wind turbines are designed specifically to harness wind, but to withstand wind as well. Today's wind turbines utilize several techniques to reduce the likelihood of damage in severe storms. Active techniques require some sort of action by the turbine or operator to protect a turbine. These techniques are used to stop turbines and halt electric generation in extreme weather. Passive techniques are built-in and require no additional activity to protect the turbine.

Most turbines are installed with turbine brakes that automatically engage if winds reach a certain speed, usually around 55 mph. When wind reaches that speed, the turbine brakes are applied and the rotor stops spinning.

Another technique is blade feathering. Turbines can be tilted, or feathered, remotely by an operator or automatically. Instead of harnessing wind, the wind is allowed to slip through the blades.

Large turbines have active yaw systems that require a small motor that moves the gearbox to point directly into the wind. That way, the turbine's aerodynamics allows wind to flow past the blades.

Structurally engineered monopoles reach up to 100 meters in height and are intended to hold in place the gearbox and blades, which combined can weigh several tons. Thicker monopoles constructed with more steel and internal structures can support more weight and withstand stronger environmental forces, such as wind and ocean waves.

Of course, in order to survive such powerful storms, a strong foundation is necessary. Most onshore large turbines have a foundation pad constructed from concrete. These pads are typically buried several feet deep to help anchor the tower. Offshore turbines, those in Europe in particular, utilize heavy concrete gravity-based structures placed on the seabed or monopoles driven many feet into the seabed to keep the tower steady in strong winds and waves.

These engineering techniques have evolved over time and, as the recent Oklahoma tornado shows, are proving highly successful in helping wind towers survive extreme conditions.

As turbine size and wind farm size have increased, however, so has the financial risk associated with wind projects. When a single turbine can cost several million dollars and one offshore wind farm can cost more than $1 billion, there is great incentive for project developers, utilities, insurance companies and customers to be assured that these expensive towers have the best possible chances of withstanding extreme weather – even historic storms like the one in Oklahoma.

In order to save on overall costs, project efficiency is a necessary component of a wind project. By achieving savings through efficiency, wind developers can invest in state-of-the-art structural engineering. In the larger picture, efficiency helps facilitate the continued development of wind power.

That's where advances engineered by geoAMPS benefit the wind industry. The Web-based software system developed by geoAMPS offers the opportunity for wind companies to realize up to 35 percent increase in project efficiency. altAMPS, one of the industry-specific software products developed by geoAMPS, provides end-to-end management of wind and other alternative energy projects.

With altAMPS, essential aspects of a wind farm project are automated. Siting of wind farms and individual turbines to achieve the highest level of performance is automated. Meeting ongoing payment obligations is automated as well, ensuring that this necessary task of operating a wind farm is done quickly and accurately. Historically, both of these processes have tied up a great deal of staff time, but the results have been less than ideal for the wind company.

altAMPS comes with time-saving tools such as lease management, meteorological tower management, royalty payment calculator, bulk update, auto reminder, payment tracker and scheduler, workflow and import/export capabilities. Its robust and configurable framework provides compressed sequence times and complies with unique businesses processes. With the added ability of access information through mobile technology, detached tools and geographic information system (GIS) mapping, altAMPS delivers process efficiency, error elimination and measured savings, all in a paperless environment.

altAMPS is technology used by E.ON Climate and Renewables North America, one of the world's largest owners of renewable energy projects, to help manage its many wind farm projects in the United States and Canada. The company selected altAMPS based on its assessment that it is one of the few software platforms with both the ability to adapt its product to meet the unique needs of a wind developer and operator, and a business philosophy that made it willing to do so.

The wind power industry is growing dramatically worldwide. From feats of engineering that allow turbine towers to survive the most extreme storms, to innovative technological advancements that make wind power production more efficient and affordable, engineering and technological advancements are helping to fuel the industry's growth.

Dan Liggett is Communications and Public Relations Manager for geoAMPS, a technology company located in the Columbus, OH, area that specializes in software solutions to manage land rights and infrastructure assets. For more information, visit www.geoamps.com, call 614-389-4871 or reach out to geoAMPS through its social media channels.

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