

“WindVAR:” unique VAR control technology

English



imagination at work





Escurillo, Spain
33x 1.5sl,
total capacity: 49.5 MW



Fenner, USA
20 x 1.5s
total capacity: 30 MW

In the world of wind power, wind project developers and utilities know and understand the challenges of grid line voltage regulation. Weak grids, coupled with wind gust fluctuations, lightning strikes, or physical interference to overhead lines can cause sudden momentary dips in voltage. The result – fluctuating grid voltage and wind turbines that continually trip off-line, which, in turn, creates greater voltage fluctuations and lost production.

Until recently, most wind power plant operators and utilities have employed capacitors to correct power factor to near unity during operation. Because these devices are slow and not able to provide fine, continuous control, they are unable to react to sudden momentary dips in voltage commonly seen in weak grid or gusty wind conditions – this, in turn, can add stress to the utility grid. To make up for these performance limitations, some wind projects have added static VAR compensators or other similar equipment. Unfortunately, these methods are expensive and complex and unable to provide an optimal solution.

Lake Benton, USA
279 x 750 kW
total capacity: 209.25 MW

WindVAR Control Performance



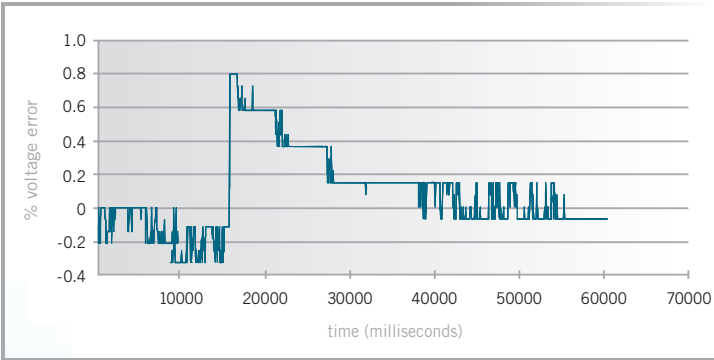
Reactive power control. Voltage support. Superior power quality. Unique GE technology.

More power to you.

Today, through GE's unique Wind Volt-Amp-Reactive ("WindVAR") electronics, voltage is controlled and regulated in real-time.

Similar to conventional utility generators, WindVAR supplies reactive power to the grid at the time its needed, in a fraction of a second, regulating system voltage and stabilizing weak grids. With the ability to supply reactive power to the grid, WindVAR opens the door to new opportunities in areas where weak rural distribution systems had discouraged new wind power applications. The addition of a wind project equipped with WindVAR electronics can actually strengthen a weak grid. This system also has the potential to provide emergency back-up support, and support to weak grids in need of transmission and distribution capital improvements. The turbine's power electronics also reduces the inrush current to about 75% of full load current during the wind turbine's start-up, and provides ride-through capability.

Somerset/Mill Run, USA
16 x 1.5 MW
total capacity: 24 MW



The graph above demonstrates the ability of the WindVAR control system to stabilize substation voltage. Note the voltage excursion at 17000 milliseconds and how WindVAR responds – stabilizing substation voltage within twenty seconds.

Steinfurt, Germany
11 x 1.5s
total capacity: 16.5 MW

How it works.

GE's WindVAR system is provided through the same power electronics employed in achieving variable speed operation. Our full line of wind turbines, from our 1,500 to 3,600 kW models, employ the company's variable speed technology to both reduce torque transients and increase the blades' ability to capture more of the kinetic energy available in the wind.

A voltage controller placed at the Point of Interconnect measures utility line voltage, compares it to the desired level, and computes the amount of reactive power needed to bring the line voltage back to the specified range. To reach the desired voltage level at the substation, the VAR controller communicates the reactive power requirement to each of the project's wind turbines via a distributed control network. Individually, each wind turbine's power processor excites the generator to produce the commanded power factor. As the power factor changes, the measured line voltage moves toward the desired voltage level, forming a closed-loop voltage control system.

The proving ground.

We first demonstrated the capabilities of our WindVAR selectable power factor system in cooperation with the Department of Energy (DOE) and the Electric Power Research Institute's (EPRI) Turbine Verification Program (TVP) at a wind project at Algona in North Central Iowa. Three wind turbines, installed 6.5 miles from a 69/13.8 kV 10 MVA substation, today successfully operate without voltage rise or flicker issues. The TVP specified the placement of this amount of generation in conjunction with the relatively long distance from the substation, as a demonstration of the flexibility of the WindVAR control technology.

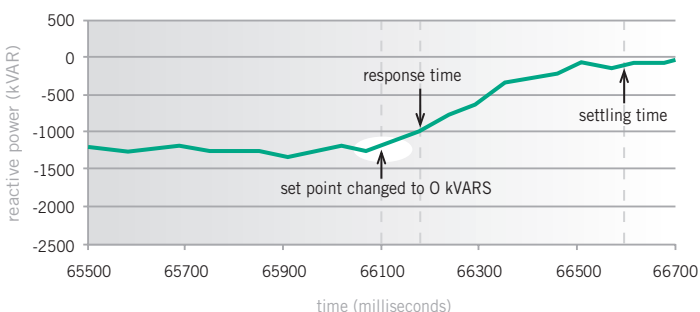
VAR Control Technology: Leading, Lagging or Unity Power Factor



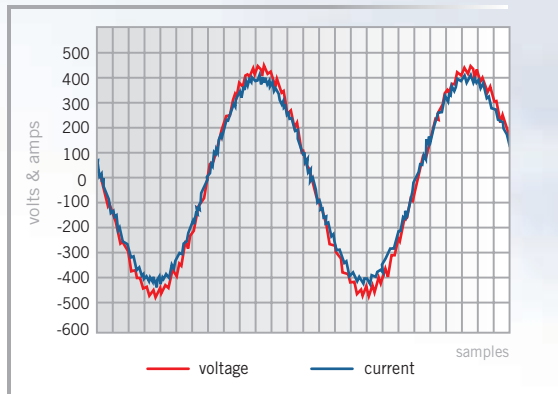
Caluengo, Spain
33x 1.5s
total capacity: 49.5 MW

Trent Mesa, USA
100 x 1.5s
total capacity: 150 MW

Reactive Power Tracking Capability



The graph (left) demonstrates the WindVAR's ability to quickly respond to changes in reactive power demand. At 66,100 milliseconds (ms) the VAR set point is changed to 0 kVARs. The VAR system responds within 100 ms, and within 400 ms, the commanded reactive power is achieved.



GE's WindVAR system enables the wind turbines to operate at unity, leading or lagging power factor (unity power factor shown above), providing the highest transmission efficiencies and enhanced voltage stability. This is particularly beneficial in weak grid applications.

Providing solutions today.

Today, more than 2,000 WindVAR equipped wind turbines operate around the globe. With the ability to supply reactive power to the grid at the time it's needed, our WindVAR electronics are fast becoming a standard feature both requested by developers and utilities, and now becoming a requirement of many interconnect agreements.

Ruelfenrod, Germany
5 x 1.5s
total capacity: 7.5 MW



Klondike, Oregon, USA
16 x 1.5s
total capacity: 24 MW



GE Energy

GE Energy is one of the world's leading suppliers of power generation and energy delivery technology. We provide our customers with equipment, service and management solutions across the power generation, oil and gas, transmission and distribution, distributed power and energy rental industries.

As one of the world's leading wind turbine suppliers, our current product portfolio includes wind turbines with rated capacities ranging from 1,500 to 3,600 kilowatts and support services reaching from development assistance to operation and maintenance. We currently design and produce wind turbines in Germany, Spain and the U.S. In Florida, USA, we also manufacture advanced wind turbine blades to assure the highest quality, advanced designs and quick on-time delivery.

Our facilities are registered to ISO 9001:2000. Our Quality Management System, which incorporates our rigorous Six Sigma methodologies, provides you with quality assurance backed by the strength of GE. We know that wind power will be an integral part of the world energy mix in this century and we are committed to helping our customers design and implement energy solutions for their unique energy needs. Every relationship we pursue bears our uncompromising commitment to quality and innovation.

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