

## ...WINDLINK® gives you reliability, confidence and security

Rather than just provide cables and components, Nexans' widely-recognized WINDLINK® solutions can outfit a complete wind turbine, assuring that all elements are fully interoperable and compatible. When we develop new products, like light aluminum or high-temperature energy cables, we do tests with connectors and power accessories under live conditions and mechanical stress to ensure compatibility and durability as an entire system.

We produce every cable in the nacelle, tower and base: from connection cables for generators, loop cables and fixed installation cables... to sensor, control, Fieldbus, Profibus, and optical fiber cables, including all connectors, accessories and medium-voltage jumpers, sets (pre-cut cables) and kits (pre-connected cables).

Moreover, we manufacture active equipment, like intelligent Ethernet switches that can consolidate diverse applications: monitoring, IP telephone, IP camera surveillance, diagnostics, tower access and climate control... all on one fiber via Virtual Local Area Networks (VLANs).

Nexans has a proven reputation for cable reliability and technical expertise, and substantial production capacity worldwide to assure OEMs of product availability, especially in emerging markets. High-quality cables and components keep wind parks operating, avoiding power losses and costly shutdowns. That's why we offer reliability, confidence and security based on our wide experience in parallel fields, like automation, material handling, and offshore installations.

### **WINDLINK®, a wide range of reliable cable solutions for quality and performance**

- World supplier of all cables for wind turbines
- Innovative and customized wind power solutions
- Customized sets and special kits for easy end-assembly
- On-Time-In-Full (OTIF) delivery through advanced logistics
- Fire performance and protection through halogen-free insulation and sheaths
- Technical and R&D support for total life management
- International certification including UL/CSA, standardization and interconnectivity



Global expert in cables and cabling systems

With energy as the basis of its development, Nexans, worldwide leading expert in the cable industry, offers an extensive range of cables and cabling systems. The Group is a global player in the infrastructure, industry, building and Local Area Network markets. Nexans addresses a series of market segments: from energy, transport and telecom networks to shipbuilding, oil and gas, nuclear power, automotives, electronics, aeronautics, material handling and automation. Nexans is a responsible industrial company that regards sustainable development as integral to its global and operational strategy. Continuous innovation in products, solutions and services, employee development and engagement, and the introduction of safe industrial processes with limited environmental impact are among the key initiatives that place Nexans at the core of a sustainable future. With an industrial presence in 40 countries and commercial activities worldwide, Nexans employs 23,700 people and had sales in 2010 of more than 6 billion euros. Nexans is listed on NYSE Euronext Paris, compartment A.

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**N**exans



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**WINDLINK®**

**Reliable, high-performance cable solutions  
for wind turbines worldwide**

# When growth is in the wind...

The international wind power industry is continuing to grow, with over 30 Gigawatts added yearly worldwide, and 13% compounded annual growth rate projected to 2014. Europe reflects this average, largely sustained by its offshore expertise.

The Americas are set to grow by a slightly lower 10%, driven by renewable energy legislation; and Asia Pacific will increase by 15% to meet China's and India's urgent power needs. Even in dark economic times, the environment is a public concern, and the 20-20-20 goal fixed by the European Commission is still relevant: 20% renewable energy by 2020. The US would like to see this goal reached by 2025, and China is striving for 15% by 2020. Wind power is still very much a driving force.

Of the four leading wind turbine manufacturers, three are European. However, new players in China and India are adding to a rich mix of OEMs. Meanwhile, European manufacturers are looking at opportunities for expansion in the Asia Pacific region, and are anxious to explore the new offshore market which is expected to show a compounded annual growth rate of 45% from 2009 to 2015.

As a turbine manufacturer or Tier 1 supplier with global ambitions, you wish to be present wherever the action is.

You want to produce locally, and expect fast and efficient delivery in the three major zones of development: Asia (40%), North America (30%) and Europe (30%). You want to build larger, lighter wind turbines to assure high energy output and consistent, reliable operation. That means new materials, lighter cables, and better connectivity. For problem-solving, you expect sound technical advice. Finally, because you want to save money, you are looking for cost-cutting innovations, improved supply chain, and intelligent systems for remote management.

## **What you expect from a cable producer:**

- A complete range of quality wind turbine cables and accessories
- Light, flexible cables that can handle torque, temperatures, oil, heat, vibration
- Technical innovation that keeps pace with the wind industry
- Customized products and services, sets, kits, interconnectivity, and accessories
- Easy assembly and installation, low failure rate, and exceptional durability
- Worldwide presence and expertise ensuring steady supply for your international projects



# WINDLINK®: a full range of cable solutions...

## ● SOLUTIONS FOR TOWERS

### Low-voltage loop rubber cables

These cables (up to 1kV) reliably transmit energy produced in the generator to the transformer, usually located at the base of the tower. They come in Low-Smoke Zero-Halogen (LSZH) versions, and are also oil, abrasion, UV and ozone-resistant.

*Nexans has supplied Alstom Ecotècnia, Nordex and Vestas. The compounds we have developed can operate from -40°C to +90°C, making them ideal for both hot and cold climates.*

### Medium-voltage loop rubber cables

Similar to LV loop cables, they can handle up to 35 kV between the nacelle-based transformer and the switchgear at the base.

*For Germany's first offshore project, Alpha Ventus, Nexans delivered 6 kV 150 mm<sup>2</sup> cable to equip Areva-Multibrid wind turbines.*

### Low-voltage fixed installation cables

Copper can be single or multicore, with EMC screening. Although aluminum singlecore are larger, they weigh half as much, making them cheaper, and easier to handle and install in high towers.

*Nexans has supplied a wide range of LV installation cables to Alstom Ecotècnia.*

### Medium-voltage fixed installation cables

Connecting the loop cable and bottom of the tower, these cables are rubber-insulated or XLPE, halogen or halogen-free, and carry from 12/20 kV or 18/30 kV.

*Nexans developed a specific MV cable for Spain's Alstom Ecotècnia, and has been an important supplier to Finland's WinWinD.*

## ● SOLUTIONS FOR NACELLES

### Low-voltage 120°C flexible cables with EMC

For linking generators to transformers positioned high up in the nacelle, Nexans produces LV silicone cables that can endure intense heat (120°C).

*Nexans has outfitted Alstom Ecotècnia's Eco 100, its most powerful wind turbine. These cables are available in LSZH versions.*

### Medium-voltage flexible cables

Available in light, flexible and compact rubber versions for large turbines (2.5 to 6 MW), these 1, 3, or 4-core cables can withstand three full twists in either direction.

*Nexans is providing flexible MV cables to Areva-Multibrid for Germany's first major offshore wind farm.*

### Medium voltage 180°C singlecore cables

Siwo-Kul™ flexible silicone-insulated singlecore connection cables carry high current in hot conditions, up to 180°C. Multicore versions also exist.

They are used as output connections from the winding bars of Class H generators, and for current converter cabinets.

*These durable, environmentally-safe cables are supplied to all major MV generator manufacturers worldwide involved in wind turbine technologies.*



Active switch systems



Medium-voltage jumpers



Low-voltage sets and kits



Low-voltage loop rubber cables



Medium-voltage loop rubber cables



Low-voltage fixed installation cables



Medium-voltage fixed installation cables



Low-voltage 120° flexible cables



Medium-voltage flexible cables



Medium-voltage 180° singlecore cables



Control cables



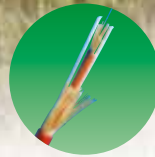
Medium-voltage connectors



Low-voltage connectors



Fiber-optic accessories



Fiber-optic cables



Electronic and data transmission cables



# ...to improve wind turbine output and performance

## SOLUTIONS FOR TOWERS AND NACELLES

### Control cables

Flexible shielded cables (2 to 100 cores) are used to carry energy (300V to 1kV) and low frequency signals to control the motor drive or the generator for breaking, positioning or optimizing rotor RPMs. Special sheathing is available for ultra-low temperatures, while smaller LIHCH cables are halogen-free. *Nexans delivers to Escha, Siemens and WinWinD. Our oil-resistant cables are designed to last for 20 years and more.*

### Electronic and data transmission cables

Thermoplastic Modified (TPM) 2 to 5-core sensor multicore and multipair cables measure wind speed, temperatures, and performance parameters, while 2-core Fieldbus cables are used in parallel with energy cables to digitally control all electronic and mechanical devices. 2-core Profibus cables deliver up to 12 Mbit/s for complex control services; and data transmission cables offer Industrial Ethernet speed for EDP through 2-pair (Cat 5) or 4-pair (Cat 6 and 7). Encoder/feedback cables, which link the control unit to motors, come in both analogue and digital versions. Increasingly, all cables are shielded for EMC protection. *Nexans has supplied electronic and data transmission cables to Korea's Hyundai Heavy Industries.*

### Fiber-optic cables

To assure high data transmission capacity for monitoring and control, Nexans' rugged, halogen-free FO cables offer Electromagnetic Compatibility (EMC) in energy-dense areas. They are very flexible and can handle high torsion. Singlemode or multimode fiber cables are available, while large cores (200 microns) make connectivity easier. *Nexans sells pre-cut and pre-connectorized fiber to Alstom Ecotècna and other important manufacturers in Europe for easy "plug and play" installation.*

### Fiber-optic accessories

Nexans produces a full range of indoor/outdoor waterproof and pressurized closures to protect, store and splice fibers. A range of cassettes and splicing frames optimize individual fiber management. *These cabinets and watertight closures are solid, reliable and fully-protected against the elements; they are easy to install and service, and require virtually no maintenance.*

### Low-voltage connectors

Able to withstand thermal cycling and tower vibration throughout a turbine's lifetime, our recommended systems use a share-bolt connector with a wraparound rubber sleeve. It offers protection, insulation, short-circuit stability and long-term reliability for connections up to 3 kV. *In Germany, Nexans (GPH) supplies thousands of connectors and sleeves to the leading OEMs in wind turbine and power utility applications.*

### Medium-voltage connectors

Nexans safe-to-touch T-shaped connectors are designed for the new generation of compact switchgears and transformers, and can also accommodate the larger cross-sections of large turbines and cable-to-cable connections. *Nexans is widely present in Germany (through Siemens) and accounts for 90% of the UK market, while in China, Siemens and ABB are installing Nexans systems in Inner Mongolia.*

### Low-voltage sets and kits


To facilitate assembly, Nexans provides sets and pre-connectorized kits which bundle energy, control and data cables into one harness for the monitoring and control of all wind turbine electronics. *Among other OEMs, Nordex appreciates the consolidation of several cable types into a single purchase which can be installed quickly and easily.*

### Medium-voltage jumpers

Customized jumpers are lengths of MV cable from 1 m to several tens of meters equipped on both sides with accessories to connect generators, transformers and switchgears. *Prefabricated jumpers have been supplied to Siemens. All jumpers are pretested in the factory to assure immediate and fault-free installation.*

### Active switch systems for communication and monitoring

These small and rugged switch systems contain up to 3 fiber optic SFP (Small Form Factor Pluggable) uplink ports and 8 TP (twisted pair) copper ports to realize multiple applications via just one fiber. They are able to supply connected devices – like IP cameras, WLAN access points and IP telephones – with PoE (Power over Ethernet), and come with a fiber optic and copper cable diagnostic monitoring function. *Nexan's memory card allows non-IT maintenance personnel to replace and reconfigure switch systems quickly and inexpensively. This is mainly suited to offshore turbines.*



Nexans'  
**WINDLINK®**  
for sustainable  
wind energy

**GLOBAL EXPERTISE**

Nexans has broad experience in land-based and offshore wind turbines of all types and sizes. Mastering both LV and MV energy cables and all necessary control cables, we are proven integrators who can supply complete systems, as well as customize cables and accessories.

**LOCAL PRESENCE**

Because the wind power industry is increasingly global, Nexans has organized its production and delivery logistics to support turbine producers anywhere in the world, and that includes obtaining pre-qualification in many countries, and providing interconnective commercial off-the-shelf products.

**TECHNICAL LEADERSHIP**

Nexans is creating the knowledge and technology needed to sustain an expanding industry which is constantly moving to larger megawatt turbines. Our innovative products are easy-to-install and have proven their ability to survive for long periods in extremely tough environments.