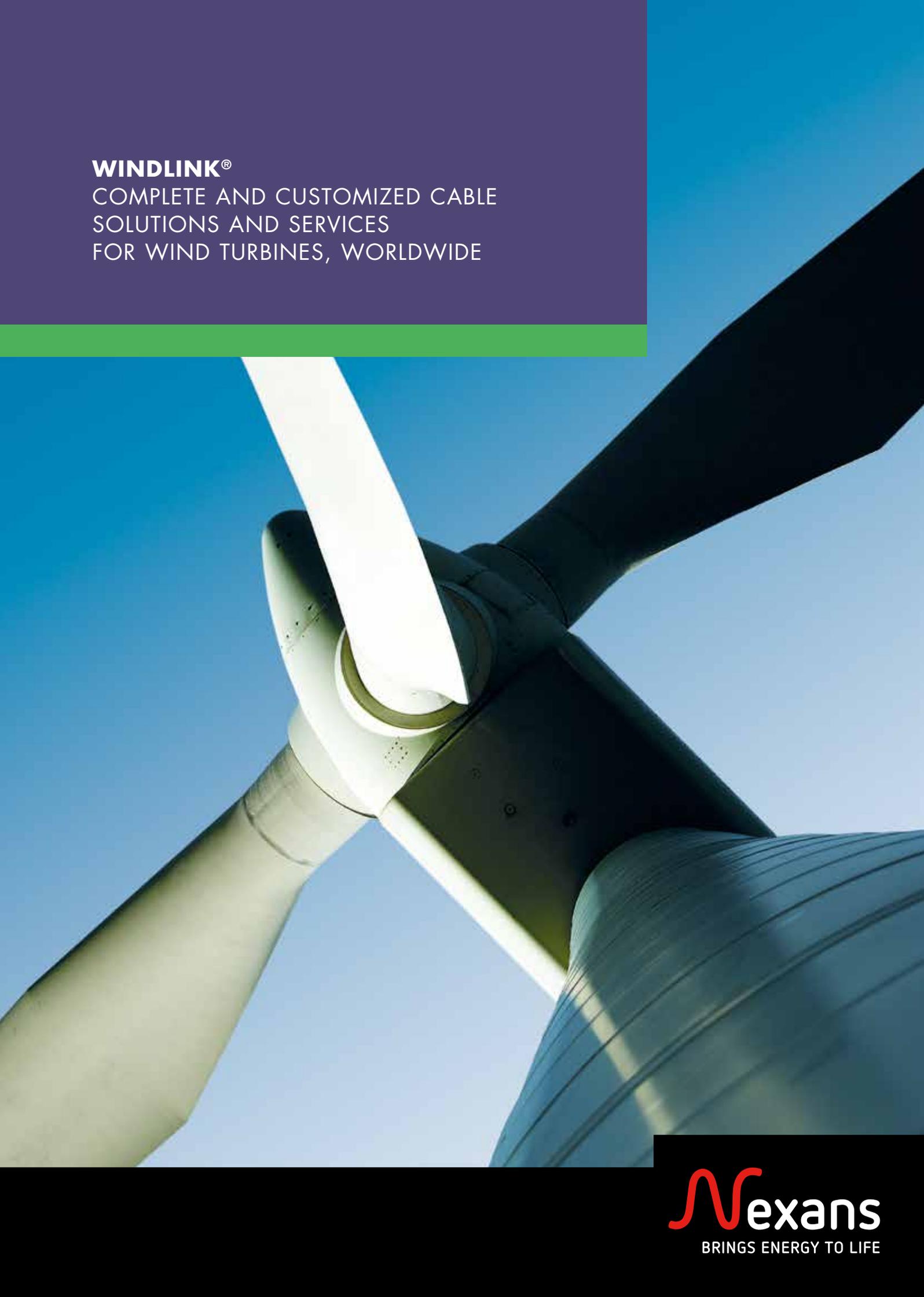


**WINDLINK®**

COMPLETE AND CUSTOMIZED CABLE  
SOLUTIONS AND SERVICES  
FOR WIND TURBINES, WORLDWIDE





## WHEN GROWTH IS IN THE WIND, **WINDLINK®** GIVES

**After several years of double digit figures, wind turbine manufacturing is continuing to adapt to slower growth in Europe, although long-term perspectives are positive, driven by China and emerging markets.**

**Canada, Brazil, Australia and South Africa are still experiencing strong growth in wind power; and India, the UK and France have untapped potential.**

**In Europe, the offshore market holds out the best promise for growth in the next decade.**

However, uncertainty and structural overcapacities have led to aggressive pricing and competition. The cost of wind turbines has continued to fall, and that has led major OEMs to find new ways to design-to-cost, improve process and optimize their drive trains and generators. This is especially critical since we are now within reach of grid parity. If only greater efficiency can be achieved, wind power will be sustainable, even without subsidies.

Since the wind turbine itself represents over 50% of ownership, much of this effort requires innovative cables and complete cable solutions to improve overall efficiency and reduce installation and over-lifetime costs.

As a wind turbine manufacturer or supplier, you want to build larger, lighter wind turbines to assure high energy output and consistent, reliable operation. That means new materials, lightweight cables, and better connectivity. To solve evolving challenges, you expect co-engineering, sound technical advice, pre-testing and easy-to-install kits.

To ensure growth, you are especially looking for cost-cutting innovations, supply chain excellence, fast delivery, and a local presence on the ground in what has now become a global industry.

### **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, including supply chain
- Integrated cable solutions: pre-cuts, kits, interconnectivity, accessories
- Easy assembly and installation, low failure rate, and exceptional durability
- Worldwide presence and expertise ensuring steady supply for your international projects
- Implementation assistance, cost-reduction, joint production planning
- Design engineering for critical areas, testing (temperature, stress, flexibility)



## 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, harnesses and kits. 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
- Pre-engineering 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



# WINDLINK®

## A FULL RANGE OF CABLE SOLUTIONS TO IMPROVE WIND

### 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. Whenever we supply this cable we do lifetime tests according to movement and torsion requirements.

#### Medium-voltage loop rubber cables



Similar to LV loop cables, they can handle up to 66 kV between the nacelle-based transformer and the switchgear at the base. We are supplying MV loop

cables to Vestas for all types of turbines.

#### Low-voltage fixed installation cables



Copper can be single or multicore, with EMC screening. 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 Wind, Nordex, Siemens, etc.

### 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). Available in LSZH version. Nexans has outfitted Alstom's Eco 100, its most powerful wind turbine.

#### Medium-voltage flexible cables



Available in light, flexible and compact rubber versions for large turbines (2.5–8 MW), these 1-, 3-, or 4-core cables can withstand three full twists in either direction. These cables can use standard connectors, and therefore save time and money.

#### 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 equipment suppliers.

### Complete WINDLINK® solutions for Nordex

Nordex signed a framework contract with Nexans for its WINDLINK® suite of wind turbine products, including cut-to-length, pre-connectorized cables and connectors destined for land-based wind parks across Europe. Nordex specified loop cables (450/750 V) and rigid tower cables to link the nacelle generator with the transformer at the base. Nexans' WINDLINK® goes far beyond high performance cables by offering a complete solution to meet design-to-cost requirements integrating drive trains and generators. Nexans also provided similar cable solutions for the first ever wind power project in Pakistan when Descon teamed up with Nordex to build thirty-three 1.5 MW wind turbines in Sindh province near Karachi, famous for its strong and steady coastal winds.



# TURBINE OUTPUT AND PERFORMANCE



## SOLUTIONS FOR TOWERS AND NACELLES

### Control cables



Flexible shielded cables (2 to 100 cores) are used to carry energy (300 volts 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. Our torsion- and 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. Increasingly, all cables are shielded for EMC protection.

Nexans has supplied electronic and data transmission cables to Hyundai Heavy Industries and Sinovel.

### 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. Large cores (200 microns) make connectivity easier. Nexans developed new optical fiber pre-connectorized fiber for Alstom for easy "plug and play."

### WindPower, Wobben and Vestas choose WINDLINK® solutions in Brazil

In Brazil, landscape and wind characteristics are creating a huge natural potential for wind power, initially estimated at 300–400 GW. Location of Brazil's population along the coast reduces the relative costs of long-distance transmission, while OEMs use coastal ports to transport components. Nexans Brazil is producing various LV rubber and XLPE power cables for wind turbines. This includes dedicated products for both WindPower (Impsa) and Wobben (Enercon). We are also providing MV cables for loop applications and kits to Vestas Brazil. LV copper and aluminum cables, MV rubber cables, and both LV and MV kits are all being produced locally. Brazil is increasingly being seen as a growth platform for further development in Argentina, Uruguay, Chile and Columbia.



## ACCESSORIES, KITS AND TESTING

### 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 housings 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 systems use a share-bolt connector with a rubber sleeve, or a heat

shrink. A new bi-metallic connector (copper to aluminum) with a protective roll-on tube is fast and easy to install without special tools. These connectors offer protection, insulation, short-circuit stability and long-term reliability up to 3kV

### 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. The compact design makes it easy to connect to the transformer's three phases without female units.

### Low-voltage kits



To facilitate assembly, Nexans provides pre-connectorized kits which bundle energy, control and data cables for wind turbine electronics. Also, cut-to-

length, pre-connectorized, all-power cables are supplied to tower manufacturers for generator-to-switchgear-to-main-powerline links. Nordex appreciates the consolidation of several cable types into a single purchase.

### Medium-voltage jumpers



Customized jumpers are lengths of MV cable from 1 meter to tower height, equipped on both sides with accessories to connect generators, transformers and

switchgears. 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 uplink ports and 8 copper ports for multiple applications via just one fiber. They are able to supply

connected devices (IP cameras and phones, WLAN access points) with PoE, and come with a diagnostic monitoring function. A memory card allows non-IT maintenance personnel to replace and reconfigure the switches.

## SERVICES ON THE HORIZON

### 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. Nexans designs operate reliably in the harshest sea-going conditions, while offering unsurpassed security and fire-safety.

Nexans brings energy to life through an extensive range of cables and cabling solutions that deliver increased performance for our customers worldwide. Nexans' teams are committed to a partnership approach that supports customers in four main business areas: Power transmission and distribution (submarine and land), Energy resources (Oil & Gas, Mining and Renewables), Transportation (Road, Rail, Air, Sea) and Building (Commercial, Residential and Data Centers). Nexans' strategy is founded on continuous innovation in products, solutions and services, employee development, customer training and the introduction of safe, low-environmental-impact industrial processes. In 2013, Nexans became the first cable player to create a Foundation to introduce sustained initiatives for access to energy for disadvantaged communities worldwide. Nexans is an active member of Europacable, the European Association of Wire & Cable Manufacturers, and a signatory of the Europacable Industry Charter. The Charter expresses its members' commitment to the principles and objectives of developing ethical, sustainable and high-quality cables. We have an industrial presence in 40 countries and commercial activities worldwide, employing close to 26,000 people and generating sales in 2015 of 6.2 billion euros. Nexans is listed on NYSE Euronext Paris, compartement A.

### Nexans

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