



KEYLIOS™

**Complete cable solutions and services
to connect photovoltaic projects**

Growing your photovoltaic potential...

Even in somber economic times, solar energy has given rise to a glowing optimism around the planet. The potential of unused spaces, like rooftops, non-arable land, and deserts is extraordinary – with developing societies often enjoying an abundance of available free sunshine. It has been calculated that less than 1% of the European landmass covered with photovoltaic modules could meet Europe's entire electricity consumption, and that 4% of the world's deserts could fully satisfy global demand.

According to a projection by the International Energy Agency, solar energy (including both photovoltaic and solar-thermal plants) is likely to provide over half of the world's power by 2060 (compared to their previous prediction of 22%).

Countries have set ambitious targets for renewable energy: 25% of total electricity production by 2025 for the US, 15% of total energy consumption by 2020 for China, and 20% by 2020 for the EU. Solar growth forecasts have been largely surpassed already, and installations are set to multiply 2.4 times by 2014, with double-digit growth annually. Led by Germany, Europe is still the market leader; however growth is booming in Japan, the US, Canada, Australia, and soon in China and India, with North African countries, mainly Morocco, waiting in the wings.

The real critical mass or momentum for solar power is grid parity, the point at which photovoltaic electricity is equal in cost or cheaper than electricity available from the distribution network. Within years, it will be achieved in areas with abundant sun and high electricity costs, like California, Japan and Italy.


As a photovoltaic panel manufacturer, junction box maker, installer, integrator, project developer or wholesaler, you want to be present in this dynamic and growing market. For that you need higher performance cable products, and a host of solutions and services to find a profitable place in the sun.

What you expect from a cable solution producer:

- Worldwide presence and international and local certification
- Local resources and plant capacity wherever possible
- Expertise that includes energy, telecommunications and grid connectivity
- Fast response time for urgent technical questions and orders
- Quality and performance, especially for module, inverter, and transformer cable solutions
- Ability to supply complete assemblies for easy installation
- Survivability and longevity especially in hot, sunny and ultra-cold environments
- Solutions and services, including simulation, technical analyses and training



...requires **KEYLIOS™** cables, solutions and services



Rather than just provide cables and components, Nexans' widely-recognized KEYLIOS™ solutions can outfit a complete solar installation, assuring that all cables and accessories are fully interoperable and compatible. Nexans' contribution to photovoltaic applications is through high-end, quality products which result in long-term performance, surveillance, monitoring and remote control, operational security and fire safety. In addition, Nexans is dedicated to offering fast delivery and support around the world, and a high level of warranty.

We produce every cable that could be used for residential, commercial or solar farm applications: from photovoltaic LV cables for linking PV panels to copper/aluminum cables carrying energy from array boxes to inverters. And we provide special halogen-free cables for secure rooftop installations, and earth/ground

cables to guard against short circuits and fires. Nexans also has several solutions (including accessories) for reliable inverter-transformer-switchgear connections. Household equipment includes special cabinets for network feed-in points. Copper and fiber-optic solutions for surveillance and control include sensor and bus cables (for tracking systems), advanced LANs, and active switches for communication and monitoring.

Beyond cables, Nexans is unique in being able to add a number of essential services for solar players: from performance and network simulation to Life Cycle Assessment (LCA). For photovoltaic cables, we analyze raw materials and processes involved in manufacturing, distribution and use. Knowledge generated allows us to design greener PV cables from the outset and reinforces expertise in this field.

KEYLIOS™, a wide range of reliable cable solutions and services for quality and performance

- World supplier of all cables for photovoltaic applications
- International certification for ENERGYFLEX® product range (TÜV, IMQ, LCIE, and UL)
- Fire performance and protection through halogen-free insulation and sheaths
- Innovative and customized coordinated energy/data solutions
- Pre-engineering and simulation for optimal network architecture
- Fast response time and On-Time-In-Full (OTIF) delivery through advanced logistics
- Simulation services and technical/R&D support for Life Cycle Assessment

KEYLIOS™, a full range of cable solutions and services...

Photovoltaic cables

These state-of-the-art 0.6 to 1 kV cross-linked ENERGYFLEX® cables offer exceptional performance, easy installation and long-term reliability for short DC connections. They link photovoltaic panels on rooftops or solar fields, and also connect them to the array box (if one exists), or to the inverter which transforms DC solar energy into usable AC electricity. Resistant to extreme temperatures (-40°C to +120°C), ozone and UV, these zero-halogen cables are low-smoke and flame-retardant for enhanced fire security. Compliant with all existing standards (TÜV, UL, UTE, IMQ, etc.), they fit main connectors, can be color-stripped for easy installation and phase identification, meet RoHS directives, and are fully recyclable. *For Schneider Electric, Nexans supplied over 1,000 km of ENERGYFLEX® photovoltaic cables in a mere 2½ months for a photovoltaic farm in Sanpietro Vernetico, near Brindisi in southern Italy.*

LV copper and aluminum cables

These cables provide reliable, durable links between array boxes and the inverter. Nexans can also provide cables that meet requirements for class 2 protection for installers and project designers. In the US, Nexans supplies 600V or 2 kV rated solar power cables (1 kV in Canada), both suitable for direct burial. Special armored cables can be directly buried in rocky terrain or underneath roads. All of these are available with copper or aluminum conductors.

Nexans supplied 20 km of cables to Schneider Electric for a photovoltaic park in France's Durance Valley, a region which has a dozen major photovoltaic projects underway.

LV/MV jumpers

For all large ground-based photovoltaic installations, customized medium-voltage jumpers 12 kV to 42 kV connect transformers to switchgears. They are typically short and need to be flexible to fit into the solar substation. Low-voltage jumpers usually connect to inverters, with specifications varying widely according to manufacturer. They are fully-equipped at both ends with connectors and accessories.

These "plug and play" jumpers are extremely easy to install and are electrically pre-tested to guarantee efficiency in the field and avoid any trouble when energizing the photovoltaic farm.

Flexible 180°C cables for transformers

For connections to increasingly compact transformers, Nexans developed two highly flexible cable solutions. Between the transformer and the MV/HV switchgear, a medium-voltage version carries 12-20 kV, with a copper wire screen to reduce electromagnetic interference. Between the transformer and the inverter, a low-voltage version, SIWO-KUL®, handles 1 kV. Both are temperature-resistant (-60°C to +180°C) and oil-resistant.

Nexans supplies Schneider Electric for switchgear-transformer connections and Converteam (now GE) for inverter-transformer connections. They are currently installing PV networks across Europe and worldwide.

LV/MV DC busbars

For solar power plants and specific applications, low-voltage copper busbars connect the panel arrays and the inverter, or the inverter and transformer, and can replace large cross-section buried cables. In large multiple arrays, the final substation often uses MV busbars which offer both high current capacity and compactness due to their form-fitting rectangular shape. Aluminum versions can efficiently cover longer distances.

Nexans can undertake special studies to design a low-voltage busbar solution for very specific high-powered photovoltaic farms.

Cabinets for residential and commercial production

Nexans supplies cabinets fitted with fuses and switches enabling the utility to isolate the network, either from a consumer or producer perspective. *These cabinets are a major node between private and public networks and a security point for maintenance.*

Earth/ground cables

For protection against short circuits and fire, these copper cables (either shielded or unshielded) or bare copper ground conductors securely ground panel frames, assuring that a uniform earth/potential prevails throughout the photovoltaic park.

French solar energy company and installer, Sunnco, regularly uses Nexans green/yellow H07VK (450/750 V) as grounding wire for rooftop installations.



ENERGYFLEX®
photovoltaic cables



Fiber optic and data
transmission cables



LV copper and aluminum cables



LV-MV jumpers



Flexible 180°C cables for transformers



LV/MV DC busbars



Cabinets for residential and commercial production



Sensor and bus cables for tracking systems



Active switch systems for communication and monitoring



Life Cycle Assessment (LCA) services

...to improve solar performance and power flow



Earth/ground cables

Fiber optic and data transmission cables

To assure high data transmission capacity for backbones (from solar fields to distant control centers) or for Local Area Networks for monitoring and control, Nexans' unitube or multitube cables can be installed in conduits or directly buried. They are waterproof, rodent-resistant and offer Electromagnetic Compatibility (EMC) in energy-dense areas. Copper data cables (LiYCY and SFTP) are used for telemetry to monitor inverters, and for weather station sensors to read environmental and panel temperatures, light intensity and windspeed, while SFTP cables are used for Ethernet networks. Coaxial cables can be used to connect surveillance cameras.

Nexans offers a full range of FO connectors, patch cords and panels, indoor/outdoor closures, cabinets and splicing frames for individual fiber management.

Sensor and bus cables for tracking systems

Controlled tracking solutions can provide up to 40% more efficiency than fixed solar layouts. Nexans provides 2-5 core sensor cables (up to 24 V) to transmit information so as to constantly adjust solar panels to follow the sun, while taking into account ambient weather conditions. Bus cables connected to a Central Processing Unit (CPU) use established astronomical data and positioning software to follow the sun's course.

Nexans rugged and reliable sensor cables eliminate the need for a CPU and extensive data lines. Each panel unit adjusts itself independently for the highest possible yield, and continues to function autonomously if other trackers fail, thus assuring energy continuity.

Active switch systems for communication and monitoring

These small and rugged iSwitch systems contain up to 3 fiber-optic uplink ports and 8 twisted pair copper ports. With the optical fiber arranged in ring or star structures, they use their copper links to exchange data with and provide Power over Ethernet (POE) to distributed IP surveillance cameras, WLAN access points, VoIP phones or multifunctional terminals. Switches can also be used for control and monitoring applications, and have inbuilt fiber-optic/copper cable diagnostic functionalities.

Nexans' memory card allows non-IT maintenance personnel to replace and reconfigure switch systems quickly and inexpensively.

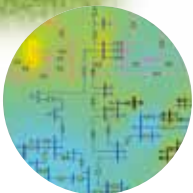
Life Cycle Assessment (LCA) Services

Nexans LCA services evaluate the environmental impact of any cable through the cycle of production, distribution, installation, use, and recycling. This allows OEMs and solar park designers to compare cables used in terms of environmental impact to arrive at an informed choice about the best solution.


For a Siemens project in Le Mées in southeast France, Nexans was able to assess its photovoltaic cable according to 11 key indicators which included raw material, energy, water and ozone depletion, global warming (CO₂), air toxicity, air acidification and hazardous waste production.

Simulation services

To find the ideal solar park architecture and the right cables, Nexans uses various simulation software programs to provide points of comparison to improve reliability, reduce losses, increase safety and improve power flow. *With its simulation software programs, Nexans is able to evaluate different photovoltaic cable solutions and thus support customers in finding the most suitable photovoltaic product.*



Simulation services



Nexans' **KEYLIOS™** for sustainable PV energy

GLOBAL EXPERTISE

As the world's leading cable manufacturer, we have a unique geographical, industrial and commercial presence in all markets. We also work closely with the entire chain of solar players, including panel and junction manufacturers, systems integrators, wholesalers, installers and project developers.

LOCAL PRESENCE

Nexans is increasingly a "glocal" company, combining global reach with sensitivity to local production needs and solar projects. Operating on all continents, we are able to follow installers, project developers and OEMs everywhere, often working with local resources to organize technology transfers and training.

INNOVATION

With a long acquired expertise in cable design, materials, standards, and technology, we have continued to expand our offer, moving from being a product supplier to being a responsive provider of solutions and services, backed up by the R&D resources of our Nexans Research Center (NRC).



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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