

HOW NEXANS IS HELPING TO DRIVE THE ENERGY TRANSITION

NOVEMBER 2016



The energy transition is not an option and Nexans solutions are making it happen

Energy production and consumption accounts for two-thirds of the world's greenhouse gas (GHG) emissions, which are having a proven effect on climate change. Driven by population growth, urbanization, the industrialization of new economies, the rapid rise in mobility and the exponential growth in communications, worldwide energy demand is expected to increase by 40% by 2040 and by 70 to 80% for electricity¹ - even though some 1.1 billion people still have no access to an electrical grid².

The energy transition presents a major challenge in satisfying the need for energy, which is inseparable from growth and quality of life, while capping our emissions to protect the climate and environment. Its success requires a radical transformation of energy systems: a change in the energy mix towards low-carbon technology, improved energy efficiency throughout the entire chain (energy production, transmission, distribution and consumption), and in all applications (buildings, transportation, communications and industry).

The Paris Climate Agreement has given renewed impetus worldwide to this aim. Signed by 180 countries in December 2015 at the end of the COP 21 meeting, it aims to keep climate change below 2°C compared with the pre-industrial era levels and to

arrive at a carbon-neutral state in the second half of the century. For the treaty to come into effect, at least 55 countries representing 55% of GHG emissions must ratify the treaty by decree or by their parliament. China and the United States, which together account for 42% of the world's emissions, ratified the climate agreement on September 3, 2016, which should have a knock-on effect on the other countries.

The European Union, which accounts for 11% of global GHG emissions, has undertaken to reduce its GHG emissions by at least 40% by 2030 (compared with 1990 levels), and is targeting an 80 to 95% reduction by 2050³. France shares this target for 2030 and is focused on reducing its end energy consumption by 50% and its GHG emissions by 75% by 2050⁴.

¹ IEA - Energy Technology Perspectives 2016.

² World Bank WDI 2016.

³ ENTSO-E, the European network of transmission system operators for electricity, responsible for the ten-year plan for developing the electricity network, estimates an investment of €150 billion will be needed to achieve these energy and climate targets in Europe by 2030.

⁴ French Law No 2015-992 on Energy Transition for Green Growth (Energy Transition Law) of August 17, 2015.

The key points of the Paris Climate Agreement



Goal : Keep global warming below 2°C and if possible below 1.5°C.



Target : Stop the rise in greenhouse gas emissions as quickly as possible in order to reach net zero emissions.



Principle : Differentiation between developed and emerging countries. The developed countries must lead the way in reducing emissions and support emerging countries with their mitigation efforts in particular by the implementation of a climate change adaptation plan. Those countries that have the means can also provide voluntary assistance.



Means : States must contribute to the climate effort (Intended Nationally Determined Contributions - INDCs), revised upwards every five years. First review in 2023. North-South technology transfers.



Funding : The rich countries must provide at least \$100bn/year starting on 2020. This amount will be revised in 2025.



New mechanism : Loss and damage. To assist the most vulnerable countries, measures need to be introduced to avoid, minimize and take into account the concrete effects of climate change.



Entry into effect : November 4, 2016, less than one year after its adoption.



To achieve these targets, it will be necessary in particular to:

- increase the availability of low-carbon electricity, especially renewable solar and wind power
- adapt electricity transmission and distribution networks, develop broad regional interconnections, and energy storage and demand management solutions in order to incorporate and consume a greater quantity of intermittent renewable energy, reduce line losses and optimize the management of electricity systems
- facilitate access to electricity for the 1.1 billion people who are not connected to a grid in order to contain deforestation and the consumption of fossil fuels as well as public health risks
- reduce transportation consumption and emissions by lowering vehicle weight and developing electric mobility, especially in urban areas that are already home to 50% of the world's population, a figure that could rise to 66% by 2050
- improve the energy efficiency of buildings and data centers.



"As the UN Secretary General Ban Ki-moon so rightly said, there is no plan B, because there is no planet B. Our energy systems have to change and we are contributing through the solutions we provide."

Arnaud Poupart-Lafarge, CEO



"Companies are in the front line of the energy transition, as they are in a position to implement it through their offerings and investment choices. This is all especially true for Nexans as our cables transport and distribute electricity for which demand and usage are constantly increasing."

Max-André Delannoy,
Vice President Strategy

Technological progress and the digital revolution can be leveraged to transform our energy systems and make them more efficient and more durable. Nexans can contribute at every stage. As a global stakeholder in the cable and cabling systems industry, we are applying our expertise and capacity for innovation to aid the energy transition.

Developing solar and wind energy

In 2040, renewable energy could account for 50% of electricity production in the European Union, 30% in China and Japan, and more than 25% in the United States and India⁵. As a partner in major projects, Nexans offers solutions to maximize wind and solar electricity production, and collect and deliver this energy to transmission and distribution networks.

Wind energy

With a record 63 GW installed in 2015 taking the total capacity up 17% to 433 GW, wind energy dominated the transformation of the world's electricity system in 2015. Furthermore, capacity is expected to double by 2020, with Europe confirming its lead in offshore wind power⁶.

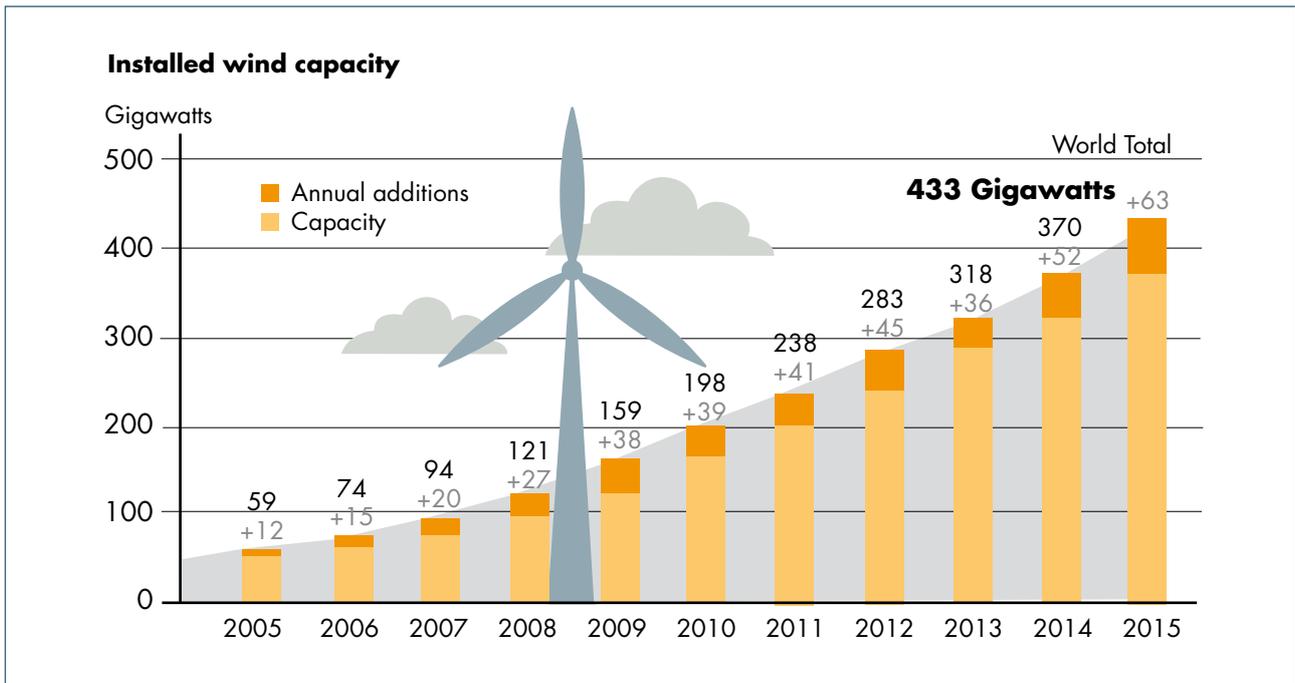
⁵ IEA – WEO 2015 – hydropower included.

⁶ GWEC - Global Wind Report 2015.



"Cables largely determine the performance of wind turbines that can include from 50 to 100 different types of cable depending on the design."

Thibaut Zumsteeg
Deputy Vice President Sales
Industry Market Line



onshore. This innovation is backed by the Carbon Trust under the UK's Offshore Wind Accelerator program.

And tomorrow?

Marine energy in the form of ocean currents and waves, tidal and marine thermal currents could total an installed capacity of 240 GW by 2050⁷. Nexans is the global leader for subsea applications and we are stepping up our research and innovation in all these fields.

⁷ IEP

- Nexans improves the operational reliability of onshore and offshore wind turbines of all sizes and under all conditions with cables able to withstand frequent torsional loading and the harshest weather conditions. We provide manufacturers with ready-to-install and connect assemblies. In one harness, these include the power, control and data cables needed to monitor and control the turbine's electronic components.

Innovation. We are reducing the cost of wind turbines with a new range of low voltage aluminum cables that are 40% lighter than copper, but just as strong while being more cost-effective.

- Nexans provides turnkey solutions for collecting electricity from offshore and onshore wind farms and connecting them to the existing grid: medium voltage cables to collect the electricity produced by the wind turbines, high voltage cables to export the power onshore, fiber optic cables to monitor facilities, and connection accessories. Our cables connect more than 2,600 MW of offshore power to onshore grids.

Innovation. We are keeping pace with the ramp-up of offshore wind turbine capacity with a new generation of 66 kV subsea cables and connection accessories - more than double the usual voltage - to export the electricity



References

- Blyth (UK): interconnection cables for the subsea link between the offshore wind turbines and the onshore grid of the world's first offshore wind farm to use a 66 kV cable.
- London Array (UK): HV cabling for the world's largest offshore farm, 175 turbines, 630 MW.
- Anholt (Denmark): MV cabling for Denmark's largest offshore farm, 111 turbines, 400 MW.
- Belwind-Northwind (Belgium): HV cable to export the production from two wind farms to the onshore grid, 381 MW.
- Beatrice (Scotland): consortium with Siemens T&D, HV connection to the onshore grid of an offshore wind farm with 84 turbines, 588 MW.
- Hywind (Scotland): cabling for the 1st floating wind farm, 5 interconnected turbines, 30 MW.

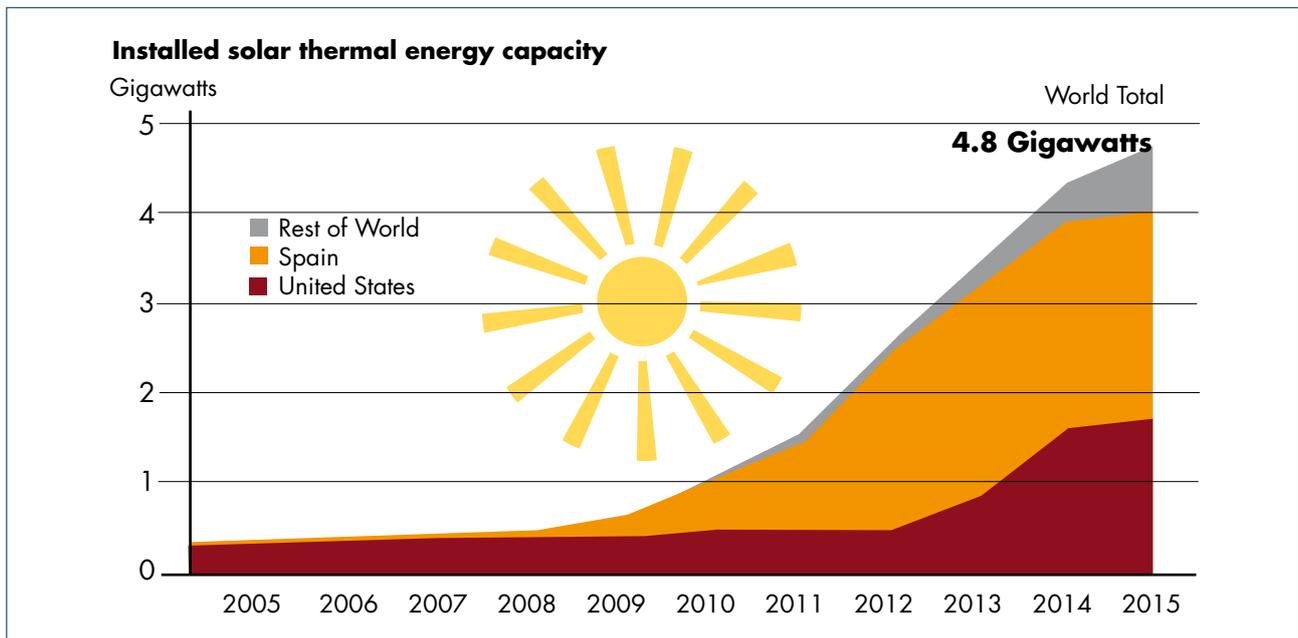
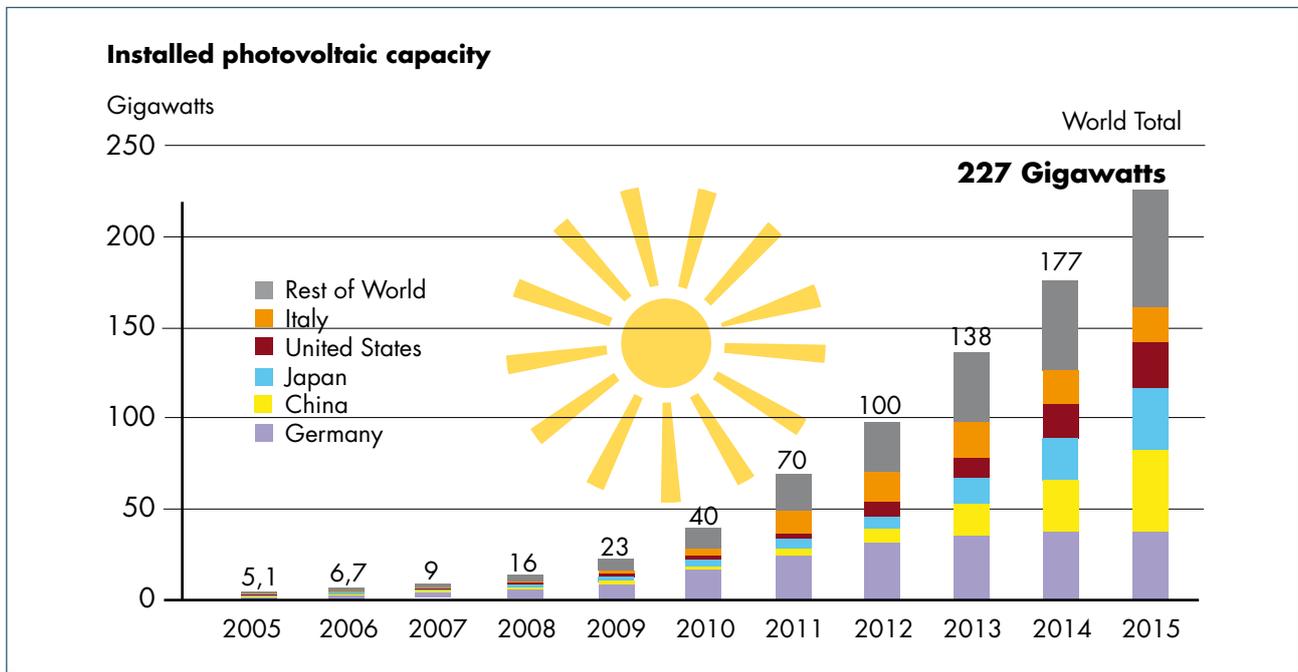
- Onshore wind (Brazil): 150 turbines with cabling and interconnection for Suzlon.

Solar power

The installed photovoltaic (PV) capacity worldwide increased by 28% in 2015 to 227 GW, to which is also added the 4.8 GW capacity of solar thermal energy (STE).

By 2050, solar power could provide 27% of the world's electricity production using PV (16%) and STE (11%) technology. This would avoid the emission of six billion metric tons of CO₂ annually, or the equivalent of almost all the transportation sector's emissions today⁸.

⁸ IEA - Energy Technology Perspectives 2015 Mobilizing Innovation to Accelerate Climate Action.



- Nexans maximizes the safety, life span, availability and production of solar facilities. Our halogen-free cables ensure safety in the event of a fire. They operate from minus 40°C to plus 120°C, are ozone- and UV-resistant, and are covered by a complete end-of-life recovery solution. Our servo-control solutions can increase the output of a PV facility by 40% by directing each panel to track the position of the sun. Our quick installation service reduces capital outlay and our remote monitoring systems facilitate preventive maintenance.

Innovation. Our BE-FAST cable allows for 30% to 50% faster and more exact cabling for PV facilities: the operation is carried out by hand without the need for any cutting tools.

Innovation. We have designed a hybrid power/data cable that is 90% pliable for solar thermal energy power plants. Its gooseneck structure combines flexibility with mechanical performance.

And tomorrow?

The performance of PV panels should double by 2030 and the cost of the electricity produced should fall 25% by 2020, 45% by 2030 and 65% by 2050. The electricity from solar thermal energy facilities should be competitive within 10 to 15 years and the installed capacity is set to reach around 37 GW by 2025⁹.

⁹ IEA, *Energy Technology Perspectives*, 2015.



“Our simulation software helps our clients determine the ideal architecture for a solar farm and the choice of cables most suited to their production, reliability and safety targets.”

François Renier
Photovoltaic Market
Segment Manager

References

- Cestas (France): Europe’s largest PV facility. Annual production of 350 GWh, or enough to power a city with a population of 240,000, peak power of 305 MW. One million solar panels on a 250 ha site. 5,000 km of cables
- Cellino San Marco (Italy): Italy’s largest PV facility.
- Enbridge Sarnia (Ontario): Canada’s largest PV facility
- Fonte Solar I & II (Brazil): Brazil’s largest PV facility.

Adapting electricity transmission and distribution networks

Inseparable from development, electricity is critical for a growing number of applications: worldwide demand is therefore set to increase by 70 to 80% by 2040. Nexans is contributing to meeting this demand by facilitating the integration of renewable electricity, improving network resilience and energy efficiency, and providing new ecological and safe solutions for powering cities that will house an additional 2.5 billion people by 2050¹⁰.

¹⁰ UN, *World Urbanization Prospects*, 2014 Revision.

“The instrumentation used for electricity networks and new materials are paving the way for safer, more efficient and longer-lasting energy systems.”

Pierre Kayoun
Corporate Vice President
Technology & Innovation



INTEGRATING AND CONSUMING MORE RENEWABLE ENERGY

Wind farms and solar power plants produce electricity intermittently depending on the wind and sun, and not always when power is most needed. When production is insufficient, gas-, oil- or coal-fired plants provide the additional electricity required but add to our CO₂ emissions. When output exceeds demand, the surplus is lost because the network must not be overloaded and there is often no large-scale storage solution.

- Nexans is securing the interconnection of intermittent solar and wind power resources that can impact the stability of power systems. Our superconducting fault current limiters (SFCL) kick in instantly, like mega-fuses, to protect networks in the event of a short circuit. We are the world leader for this technology.

Example. The City of Birmingham in the UK has incorporated two of our SFCLs into its grid resulting in fewer power outages and lower CO₂ emissions.

- Nexans facilitates the recovery and consumption of green electricity. True electricity highways based on our high-voltage direct current (HVDC) subsea cables allow interconnected countries to make the most of installed renewable energy capacity by exchanging their surplus production. Nexans is the world leader for these high-voltage subsea links that can also be used to replace the thermal generators used on islands and offshore platforms with environmentally friendly generation.

Example. We are installing the high voltage direct current (HVDC) subsea interconnections (525 kV) between Norway and Germany (Nordlink, 700 km) and Scotland (NSL, 730 km). These links will enable the three countries to exchange their excess hydropower (Norway), wind and solar power (Germany) and wind power (Scotland).

Example. In Canada, we are installing a high voltage subsea link to supply Newfoundland Island with hydropower generated in Labrador.

And tomorrow?

In Europe, the construction of an electricity transmission and distribution network interconnecting the large wind power regions of the north and west with the solar power in southern Europe's Mediterranean region, together with the hydropower basins in Scandinavia would provide an outlet for green electricity production and a solution to demand in the large consumption areas. This infrastructure would strengthen Europe's energy independence and security.



Connecting wind farms to the national grid boosts the percentage of green energy in the overall portfolio and reduces CO₂ emissions."

Philippe Gastineau

Vice President Sales and Marketing
High Voltage Business Group

FURTHER STRENGTHENING NETWORKS

Climate change is bringing violent storms and greater extremes of heat and cold that are a threat to electricity grids.

- Nexans supplies cables able to withstand extreme weather events affecting overhead high voltage lines, and extra high voltage underground cable systems that facilitate the partial undergrounding of overhead lines.

Innovation. Our Aero-Z cables for overhead power lines reduce the drag caused by high winds, vertical oscillations, corrosion and snow accumulation. At the same time, they enable a 10% increase in the continuous current-carrying capacity (ampacity) for the same cable diameter and reduce by 15% the losses due to heating at equal ampacity.



"Subsea interconnections between countries increase the opportunities for sharing renewable energy, and secure electricity supply at a lower cost."

Vincent Dessale

Executive Vice President Submarine
High Voltage Business Line

REDUCING LINE LOSSES

The resistance of conductor materials (Joule effect) is the leading cause of losses in transmission and distribution networks¹¹. The development of cables with higher heat resistance and superconducting solutions can reduce these losses and improve network security.

- Nexans is reducing losses in underground lines.

Innovation. Our new generation of EDRMAX cables delivers 17% energy savings compared with the previous generation and can be directly undergrounded, thereby reducing the size of trenches and speeding up work.

- Nexans provides high energy efficient solutions that secure power supply in the increasingly constrained environments in built-up areas.



Innovation. Light and resistant, our Lo-Sag aluminum alloy aerial conductor with composite core significantly increases line transmission capacity and overload. It operates at up to 180°C and expands 10 times less than a conventional conductor. As a result, it delivers the same level of security with lower pylons at greater intervals (spans of up to 2.5 km).

Innovation. Our superconducting transmission solution for urban centers, AmpaCity, transports five times more power than a standard cable with the same diameter, virtually without any line loss, with a smaller footprint and without the need for any substations located within the city. It includes a current fault limiter to protect the cable from short circuits. Following the world first installation in

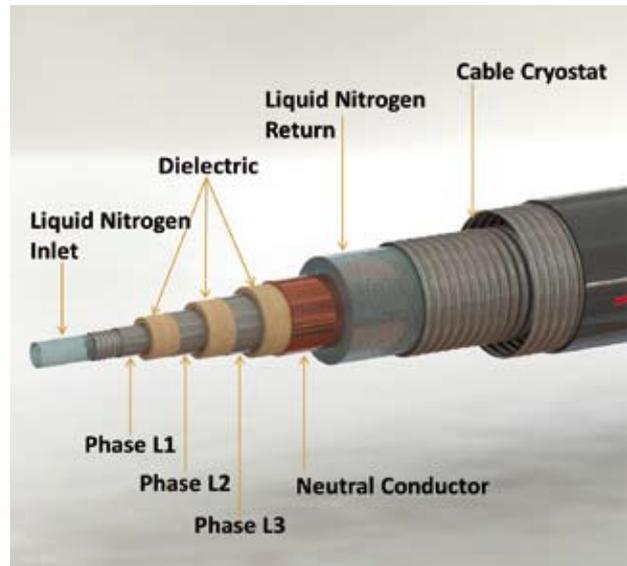


"Our smart grid accessories help energy suppliers manage peak demand and optimize management of their networks."

Marc Mertens
Executive Vice-President Power
Accessories Business Group

Essen, Germany, Chicago in the United States has opted for this promising solution to improve the resilience of its grid.

This project is being implemented with AMSC whose very high capacity superconducting wires are used in



our superconducting cables. Nexans and AMSC have signed a partnership agreement to speed up the rollout of these solutions in North America.

¹¹ In France, around 2% for transmission and 6% for distribution – Sources: RTE, ERDF.



"Superconducting solutions facilitate and secure city center power supply. Nexans is the global leader in this promising technology."

Frank Schmidt
Head of Superconductor
Activity Business Line

OPTIMIZING ELECTRICITY SYSTEM MANAGEMENT

The purpose of smart grids is to utilize equipment that makes the electricity system more reliable, more eco-friendly, efficient and economical. Smart grids can capture and process the wealth of data needed to make better use of renewable energy production as well as storage, transmission and distribution capacity. They can also provide demand response and peak load consumption management, while enabling remote equipment management. The net effect is that smart grids can significantly reduce the environmental and climate footprint associated with energy production and consumption.



“Power line communication is a robust and economical solution to enable smart use of existing networks.”

Jacques Goudeau
Directeur des programmes R&D

- Nexans helps operators manage their distribution grid in real time by integrating decentralized electricity production, managing peaks and controlling equipment remotely.

Innovation. Our coupler uses the distribution lines to transmit smart meter data. Simple and economical, this solution based on power line communications (PLC) enables the distribution grid operator to use its own network to manage all its equipment in an integrated way.

And tomorrow?

By automatically adjusting production and consumption, smart interconnected networks will make it possible to optimize the consumption of intermittent renewable energy at the local, national and continental levels: a prerequisite for the success of the energy transition in Europe.

Facilitate access to electricity

1.1 billion people, with more than half in Sub-Saharan Africa, do not have access to electricity. This is mainly in rural areas and in the slums that spring up as a result of galloping urbanization in emerging countries¹². According to UN-Habitat, 40% of urban dwellers could be living in slums by 2030.

Access to electricity is a major challenge for the social and economic development of emerging countries and their citizens. It is also a way of acting to save the climate by managing deforestation and the consumption of fossil fuels that emit GHGs.

- Nexans facilitates the electrification of emerging countries. We support companies engaged in major electrification programs by providing a simple, comprehensive and easy-to-manage product line. This is Neogrid that includes all the equipment needed to install a power line: cables, transformers, junction boxes, circuit-breakers, prefabricated substations and accessories. It also includes training and engineering consulting to ensure equipment interoperability. A single interface simplifies finance and order management.

Solidarity. The Nexans Foundation supports access to electricity for underprivileged communities, especially rural, worldwide. We support the sustainable and low-carbon solutions (hydro, solar and wind power) proposed and implemented by associations working in the field.



And tomorrow?

Cities will be at the heart of the energy transition. Without any change in policy, their primary energy demand will increase by 70% by 2050 (compared with the 2013 level) and their carbon emissions will be 50%¹³ higher. In the emerging economies, where population and urban growth is strongest, much of the national energy infrastructure has yet to be created. But cities are directly dependent on this infrastructure for connecting dwellings to the drinking water distribution and wastewater collection networks.

This is an opportunity to speed up the deployment of clean energy technology and at the same time to encourage a behavioral shift¹⁴: an aim shared by the C40 network of 85 cities representing a total population of 600 million people, 25% of the world's GDP and 70% of GHG emissions.

¹² World Bank WDI 2016.

¹³ IEA, 6 Degree Scenario (including indirect emissions from power and heat generation).

¹⁴ IEA, Energy Technology Perspectives 2016, Towards Sustainable Urban Energy Systems.

Reducing transportation consumption and emissions

Transportation accounts for 23% of the world's CO₂ emissions from fossil fuel use¹⁵, as well as other pollution emissions that are hazardous for human health, especially in urban areas. Reducing vehicle weight, developing electric motors charged from low-carbon sources, the rollout of shared transportation, smart systems and multi-modal solutions based on user and vehicle connectivity are all priority areas for improving sustainable mobility.

Lighter vehicles

It is necessary to reduce the weight of an internal combustion vehicle by 10 to 12 kilos to save one gram of CO₂ per km traveled. For cars, trucks, light rail, trains, metros, ships and aircraft reducing the overall weight is a target shared by all manufacturers spurred on by increasingly stringent regulations and standards.

- Nexans helps achieve these targets with finer and lighter cables able to withstand high temperatures because of our exclusive alloys and high-performance insulation materials.

Innovation. Designed to power multimedia and onboard navigation systems, our Datagreen cables meet the same specifications as copper cables but at half the weight, with less volume, increased tensile strength and temperature resistance of up to 125 °C.



Develop electric mobility

To keep global warming below 2°C, at least 20% of road vehicles need to be electric and charged from low-carbon sources by 2030 according to the IEA.

- Nexans provides safe and effective cabling solutions enabling hybrid and all-electric vehicles to operate. Capable of installation in extremely small spaces, our power supply cables can withstand up to 3,000 hours' operation at 180 °C in the presence of aggressive substances and are highly compatible with electromagnetic environments in order to ensure the sound operation of control and safety equipment.

¹⁵ ITF 2015 Transport Outlook.

"We work closely with manufacturers and OEMs to ensure the security and safety of hybrid and all-electric vehicles. For example, BMW's i3 and i8 electric vehicles are 100% equipped with Nexans cable harnesses."

Andreas Wolf

Executive Vice President of the Automotive & Industrial Wire Harnesses Business Group



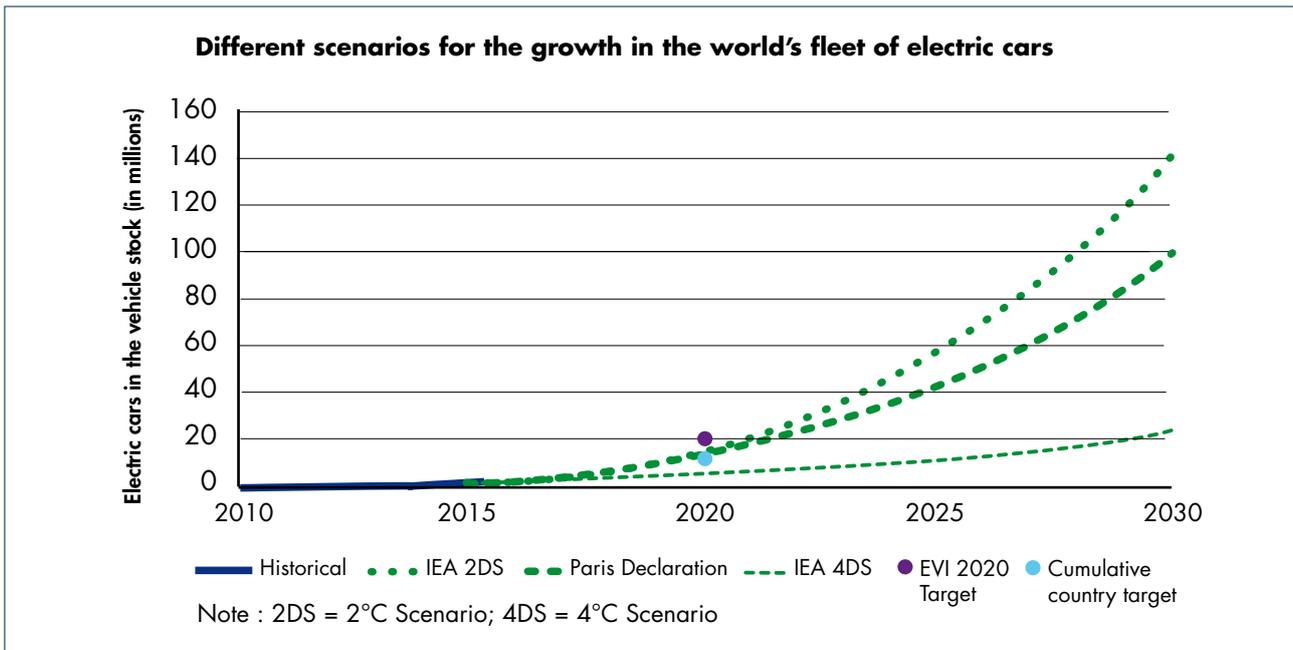
- Nexans, in partnership with the startup G2mobility, is providing a complete solution to facilitate the rollout of smart charging infrastructure for electric vehicles: it includes connection infrastructure, charging stations with a capacity of 3 to 22 kWh, power management and supervision systems

Innovation. We are participating in the Eco2charge program that aims to roll out quickly, at the best possible cost, charging infrastructure at individual sites. Eco2charge includes a power management system, additional PV generation and electricity storage in recycled electric car batteries.

Our solution optimizes the site's electricity demand and reduces civil engineering work.

And tomorrow?

Electric vehicles will be at the heart of tomorrow's sustainable transportation systems. The Paris Declaration on Electro-Mobility and Climate Change & Call to Action targets 100 million electric cars and 400 million electric two- and three-wheelers by 2030. The IEA's 2DS (2 °C scenario) is even more ambitious setting its sights on 150 million electric cars by 2030.



Increasing the energy efficiency of buildings and data centers

The residential and tertiary sectors account for 40% of the world's energy consumption. The growth of megacities, the growing number of very tall buildings and property complexes, and the increasingly dense energy and data networks needed for their operation underpin the growing demand for durability. New standards encourage renovation and new builds that incorporate energy savings, safety, durability and recyclability.

- Nexans supports the construction and renovation of sustainable buildings from design to installation: our Building Tomorrow Today approach combines safety and energy efficiency with a minimal ecological footprint.

More than 1,500 Nexans products have a PEP ecoPassport® that details their environmental profile and energy consumption throughout their entire life cycle.

Innovation. Our EcoCalculator application helps professionals choose the most appropriate low voltage cable solution that will deliver the best possible energy efficiency, reduce the environmental impact of an installation and ensure the safety of people in the event of a fire.

Reference

Nexans is the first cable manufacturer to have been awarded the Singapore Green Building Council (SGBC) certification, which is recognized worldwide.

- Nexans maximizes the energy efficiency of datacenters. A 10,000 sq. m data center consumes as much energy as a city with a population of 50,000 people, up to 50% of which is used for cooling¹⁶. Our cabling solutions set the benchmark for resistance to heating and their transmission capacity.

Innovation. Our EMAC¹⁷ system for smart energy consumption and cooling management continuously determines the capacity needed, manages and plans the load, warns in the event of a problem and suggests solutions.

And tomorrow?

Buildings will not just be energy efficient, they will produce electricity and will have electric vehicle charging facilities. Many vehicles are not used every day: their batteries could store the excess electricity produced by the building ready for use during morning and evening peak periods of consumption. Tomorrow's smart local grids will make this happen.

¹⁶ Syntec.

¹⁷ Environmental Monitoring & Access Control.

"Our smart infrastructure management solutions significantly reduce data center energy consumption."

Damien Simon
Marketing Manager
Middle East, Russia, Africa





Nexans' commitment to the energy transition also means:



22,700 metric tons of copper recycled



81% of suppliers support our CSR charter



570,000 beneficiaries of low-carbon renewable energy thanks to the support of the Nexans Foundation

100% of its business covered by ISO 9001 or 9002 quality assurance



73% of its plants ISO 14001 certified



34% of investments devoted to energy efficiency of our equipments



95% of our production waste recovered



Nexans

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