

Smart Grid Solutions

Bring your network a smart step ahead



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Linking the future

As the worldwide leader in the cable industry, Prysmian Group believes in the effective, efficient and sustainable supply of energy and information as a primary driver in the development of communities.

With this in mind, we provide major global organisations in many industries with best-in-class cable solutions, based on state-of-the-art technology. Through two renowned commercial brands – Prysmian and Draka – based in almost 100 countries, we're constantly close to our customers, enabling them to further develop the world's energy and telecoms infrastructures, and achieve sustainable, profitable growth.

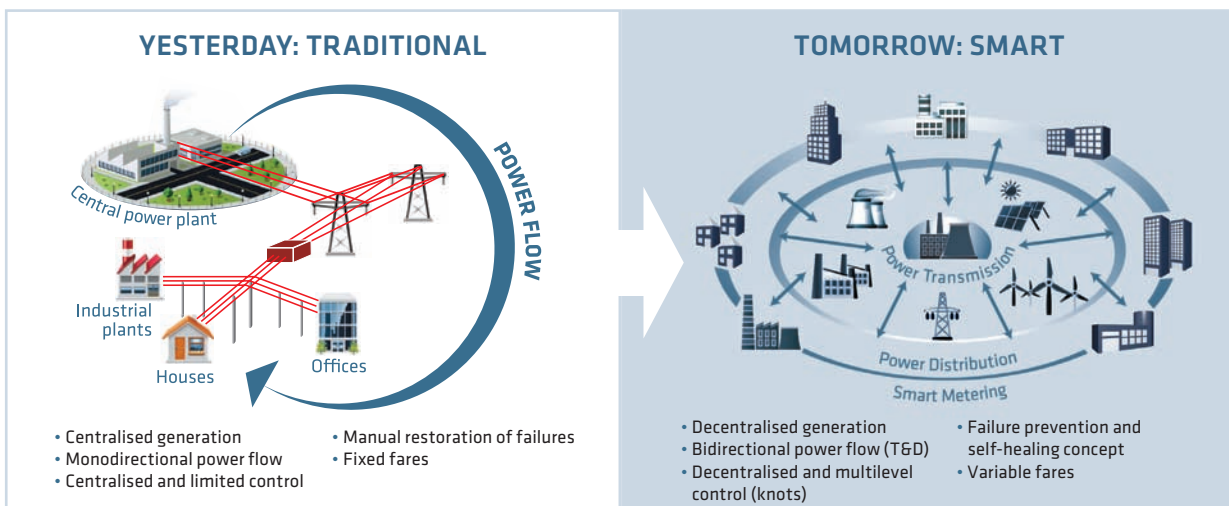
In our energy business, we design, produce, distribute and install cables and systems for the transmission and distribution of power at low, medium, high and extra-high voltage.

In telecoms, the Group is a leading manufacturer of all types of copper and fibre cables, systems and accessories – covering voice, video and data transmission.

Drawing on over 130 years' experience and continuously investing in R&D, we apply excellence, understanding and integrity to everything we do, meeting and exceeding the precise needs of our customers across all continents, at the same time shaping the evolution of our industry.

Smart Grid

A Smart Grid can be defined as an electricity network that efficiently integrates the behaviour and actions of all the users connected to it, in order to ensure an economically efficient and sustainable power system with low losses, high levels of quality, security of supply and safety.



The background

The world's population and the demand for electricity will continue to increase. This will increase global CO₂ emissions unless there is a significant change in the way that transmission and distribution networks operate.

How do we manage this balance between a sustainable future for the planet and satisfying future energy requirements?

Almost all the national governments around the world have defined a range of energy targets to be met within the next few years, supported by major initiatives and investments in Renewable Energy Sources, Energy Efficiency and Carbon Footprint Reduction.

These, in turn, will require different solutions for the generation, supply and consumption of energy.

Achieving these energy targets will not be possible without a step change in the way entire systems operate. These considerations have led to the development of the Smart Grid Concept.

Prysmian Group commitment to Smart Grid

The Smart Grids era, raising new challenges for the entire energy sector, encourages us to go beyond the traditional cable concept by providing ultimate solutions never experienced by the market before, which suit with the new grid requirements in terms of Renewable Energy, Energy Efficiency and Carbon Footprint Reduction.

Being the number one means always staying one step ahead, that is why we intend to lead innovation in Smart Grids.

Build on your Smart Grid's pillars

The importance of cables and grid components in Smart Grid architecture is absolutely key.

This is because the usage of adequate and advanced cable technologies can enhance grid reliability and efficiency, guaranteeing correct operation in all circumstances and preventing black-outs, failures and damage of other grid components, therefore reducing maintenance costs and avoiding penalties for the grid owner/operator.

Moreover, deployment of the right solutions permits better grid exploitation and far-sighted asset management. Last but not least, considering that in each km² under our soil and over our heads are laid hundreds of km of cable, the usage of environmentally friendly cables, with a low carbon footprint and that are fully recyclable, can considerably enhance the grid's sustainability.

For all these reasons Prysmian Group, with its enormous experience and huge potential in terms of R&D, has developed a range of innovative solutions among the most advanced currently on the market. In order to help our customers understand the value added by our products and services we present our complete Smart Grid offer structured in four main sections.

These are the pillars on which you can build your Smart Grid:





Risk prevention

THE CORE FUNCTION OF A POWER GRID IS AND REMAINS ENERGY TRANSPORTATION AND DISTRIBUTION, REGARDLESS OF THE EXTRA FEATURES THAT FUTURE SMART GRIDS MAY HAVE. FURTHERMORE, THE PRIMARY FEATURES AROUND THIS CORE FUNCTION ARE, AND WILL ALWAYS BE, DOING IT IN A SAFE AND RELIABLE MANNER.

While other properties may be useful, necessary and efficient, the core function and its primary features are still the base. Looking at it this way, a grid would not be very “smart” if it was unable to monitor its own core function and accompanying primary features.

This is why intelligent systems to monitor a grid's capability to perform its core function, namely energy transportation and distribution, cannot be excluded, especially from a smart grid.

This function becomes more and more important in the Smart Grid because:

- In the future Smart Grid, current loads will be more fluctuating (e.g. wind farms and decentralised generation) causing more stress variations to several components in the grid
- Current loads and variations will be less manually controlled/more automated and therefore less conventionally predictable

If the condition of the grid's equipment is known continuously, this is a valuable information to put in place switching actions and to implement wise asset management actions.

For all these reasons, Prysmian Group has developed and tested a complete range of solutions, applicable to both new lines and old ones (which often have probability of problems), to help our customers prevent any possible risk related to cables and grid components that could threaten the grid's operation.

WIRELESS PARTIAL DISCHARGE DETECTION

PRY-CAM

Partial discharge (PD) measurement is a crucial procedure for assessing the condition of electrical systems, as it is one of the critical parameters evaluated during product manufacture, installation and after-sales.

PRY-CAM is an integrated portable instrument for automatic acquisition, processing and classification of pulse signals generated by Partial Discharge (PD) phenomena occurring in insulating materials of medium and high voltage electrical systems and components such as transformers, electrical machines, cables, GIS, etc.

The system allows accurate diagnostic measurements and continuous monitoring.

PRY-CAM key advantages:

- ✓ It can be used to prevent failures (and their related costs) by assessing the parts under test without switching them off
- ✓ Safety for operators (non-invasive measurements)
- ✓ Portability of equipment and reduced dimensions allow quick in-field measurements in any location (e.g. Wind and Solar Farms)
- ✓ Accuracy and deep diagnostic information provided: kind and exact localisation of defects



PRY CAM integrated portable instrument

WATER PENETRATION MEASUREMENT

PRY-WPM

PRY WPM system for HV and MV is the best solution to protect your grid from the risk of failure due to water penetration inside cables and grid components.

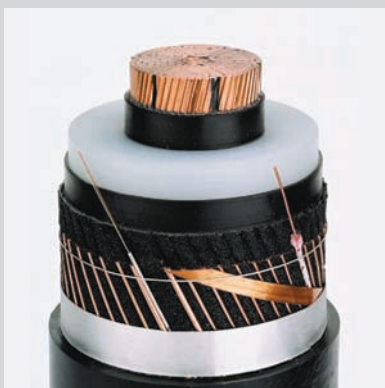
The use of a monitoring system such as WPM for the relevant class of cables helps increase the cable's reliability and reduce the amount of routine maintenance on the cable itself.

One of the main advantages of this equipment is the ability to continuously monitor possible water penetration (even in small quantities) through the metallic sheath with no need to interrupt the service.

This represents a benefit for the end user and a saving for the grid owner/operator.

Thanks to this system:

- ✓ Grid reliability is improved
- ✓ Cable's outer sheath routine tests are no longer necessary
- ✓ Highly precise location of the fault in the event of an emergency is ensured
- ✓ Possible damages caused to the outer sheath by an external event (e.g. building works) are identified in real time allowing an easier identification of possible responsibility

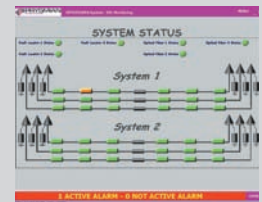


Extruded cable with embedded WPM sensor

SHEATH VOLTAGE LIMITER

PRY-SVL

PRY Sheath Voltages limiters are used to protect the sheath sectionalising insulators of HV and MV joints or terminations for specially bonded cable systems. Their purpose is to minimise the transient voltage that is produced across the sectionalising insulator during switching surges or lightning strikes, and to reduce the risk of them flashing-over.



Example of screenshot

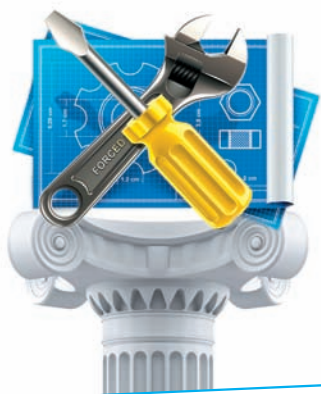
Our advanced SVL monitoring system continuously checks the status of the alarms and can produce different signals:

- Partial failure of the SVL (long-term overheating)
- Complete failure of the SVL
- Integrity of trunk fibres
- In-service operation of the monitoring system

Prysmian offers this solution integrated with specific software that monitors and records the reflected optical signals and that communicates the system components' status through a user friendly graphical user interface.

This solution:

- ✓ Reduces the risk of components' flash over
- ✓ Shows the SVLs that have failed and their location
- ✓ Reduces the requirement for system maintenance checks
- ✓ Reduces the need for people to enter the cable tunnels



Smart maintenance

Scheduled operations

Nowadays, information about the condition and reliability of grid components is a vital issue for a correct Asset Management strategy.

For older grid components, ageing and the remaining life are key parameters for determining the best time for replacement. For newer components the quality of installation is very important for a reliable operation.

Considering the huge number of part comprising a grid, this can help understand how much money, lost time and risks are possibly avoided if the right time for replacement is determined (too late means failures and too soon means too early investments) and if a correct process of installation is assured.

This is why Prysmian Group has developed an advanced system of grid components tracking that can guarantee a real saving in maintenance expenses.

Extraordinary operations

There are many causes of power failures in an electricity grid. Examples of these causes include faults at power stations, damage to electrical transmission lines, substations or other parts of the distribution system, a short circuit, or the overloading of electricity mains.

Power failures are particularly critical at sites where the environment and public safety are at risk. Under certain conditions, a grid component failure can cause current fluctuations in neighbouring segments of the grid leading to a knock-on failure of a larger section of the grid. This may range from a building, to a block, to an entire city, to an entire electrical grid.

When this kind of problem occurs, it is necessary to restore proper grid operation in the shortest time possible, in order to reduce financial losses (operators can incur legal problems and penalties) and risks for the population.

This is why Prysmian Group has developed extremely accurate solutions that, by continuously monitoring grid operation, permit real time reporting of failures with GPS localisation to facilitate and speed up extraordinary maintenance work.

ASSET MANAGEMENT SOLUTION

PRY Smart ADENE

Radio-frequency identification (RFID) is the use of an object (RFID tag) applied to or incorporated into a product for the purpose of identification and tracking using radio waves. PRY Smart ADENE solution is based on labels containing product details on an RFID chip and on a Bidi Code.



Advanced label

(manufacturing, installation...)

By applying this smart label to grid components an accurate history of the assets can be tracked both for new and old components. The quantity and the type of information recorded in the label can be tailor-made to customer requirements

Thanks to this solution we are able to read and write, using a dedicated tool, all the components' history without the need to be connected to an external database (big advantage in the event of emergency).

The advanced label:

- is designed and tested to have outstanding life-span
- has a guaranteed resistance to external agents such as humidity, dust and oil.
- is small (non-obtrusive tag size)
- does not require battery, thus eliminating ongoing maintenance
- has low start-up costs

Furthermore, at any point of interest along the grid, it is possible to install a ledger box in which all the information regarding the surround labels are registered and communicated in real time to the grid owner's office database where, by analysing the components' remaining life span, maintenance activity can be planned in order to:

- ✓ optimise asset management costs
- ✓ drastically reduce the risk of failures due to obsolescence

FLUID FILLED SYSTEM MAINTENANCE

PFT Solution

Most utilities and transmission operators have significant quantities of fluid-filled systems within their grids and will continue to do so for many years. Traditionally, the main method for locating cable fluid leaks has involved shutting off power to the cable circuit, excavating to gain access and then applying a liquid nitrogen freeze. This process is repeated at different locations and, on average, takes between 3 and 7 attempts before the leak is identified. These leaks can cause many thousands of litres of cable fluid to leak into the environment over the course of time.

PFT stands for Perfluorocarbon Tracers

These highly volatile compounds, with excellent electrical insulation properties, are added to the cable fluid in minute quantities and, when there is a leak, they permeate the soil and can be picked up using highly sophisticated detection equipment.

Prysmian PFT Solution offers the following three essential services required for modern fluid-filled cable maintenance:

- injection of PFT Tracers
- detection of PFT: thanks to an advanced mobile laboratory, synchronised with a GPS system, the background levels of perfluorocarbon in the atmosphere are detected by localising the leakages
- repair of the leak thanks to advanced equipment and know-how

Fluid-filled cable operators can benefit from this advanced technology by having the opportunity to:

- ✓ extend the useful life of fluid-filled cable systems
- ✓ facilitate maintenance
- ✓ reduce the environmental impact caused by cable fluid leakage



PFT mobile laboratory



REAL TIME FAILURE MONITORING

PRY Smart MMS

When a failure in your grid occurs, with PRY Smart Multi Purpose Monitoring System, the new real-time failures reporting system developed by Prysmian Group, you can have immediately on your desk the information you need to solve the problem in the shortest time possible, reducing the risk of penalties and protecting your customers from prolonged discomfort.

With this innovative solution, a combination of multi-purpose sensors and dedicated software application, the GPS localisation and the cause of the problem arrive directly on the PC screen and/or via SMS (or by e-mail) to the maintenance work force responsible.

PRY Smart MMS system is offered to the grid owner/operator together with the possibility to easily design, with the help of our experts, the best way to keep the grid under full control, by defining the best monitoring infrastructure, the main areas to be monitored and the risk factors to be analysed.

The main benefits provided by this solution are:

- ✓ reduction of costs and risks due to incorrect grid operation
- ✓ improved efficiency of extraordinary maintenance activity

ADDITIONAL MAINTENANCE SERVICES OFFERED BY PRYSMIAN GROUP:

Preventive service

- After Installation Tests
 - Periodical Checks
 - Inspections on Ancillary Systems
- Defects-Related Risk
 - Sample Tests
 - System Inventory



Benefits

- Optimal Exploitation
- Increased Reliability
- Reduced Unplanned Outages Time

Emergency service

- 24h/7d Availability
 - Fault Location
 - Repair
- Emergency Caps
- Spare Parts Stock



Benefits

- Reduced Unplanned Outages Time



Load management

ONE OF THE KEY CHALLENGES RELATED TO SMART GRID DEPLOYMENT IS UNDOUBTEDLY THE EFFICIENT INTEGRATION OF THE RENEWABLE ENERGY SOURCES INTO THE GRID SINCE THEIR UNPREDICTABILITY, IF NOT PROPERLY MANAGED, CAN CREATE SERIOUS PROBLEMS FOR THE GRID'S OPERATION.

This integration will lead to a real improvement in the overall environment by reducing dependence on oil and other traditional energy sources, but it requires a profound change in the way electrical systems are managed.

Another important challenge relates to Energy Efficiency and to the Smart Metering concept. To reduce the risk of failures related to energy peaks, and to improve the quality and service of the supply to all the users connected to the grid, the ideal Smart Grid architecture should be designed to efficiently manage power loads, by directing flows from areas where generation exceeds the demand towards areas where electricity demand is exceeding the production; this starts with efficient management of electricity within buildings and is strictly related to Smart Home, Smart Appliances and Building Management concepts.

To help its customers to win these big challenges, Prysmian Group has developed a complete system for optimising power loads' management and an advanced hybrid cable that represents the ideal solution for Smart Building Architecture.

ADVANCED MONITORING SYSTEM

PRY Opto-Power

PRY Opto-Power, known also as RTTR (Real Time Thermal Rating) is a complete monitoring system for HV and MV power cables and grid components that can evaluate the admissible overloads, which are continuously calculated taking into account not only the line's current conditions but also its ongoing thermal transients and the thermo-dynamic characteristics. In the same way, the environmental thermal characteristics variation (e.g. soil drying rate) are continuously monitored and their effects on ampacity capability are taken into account to update, modify and correct in real time the system's forecast.

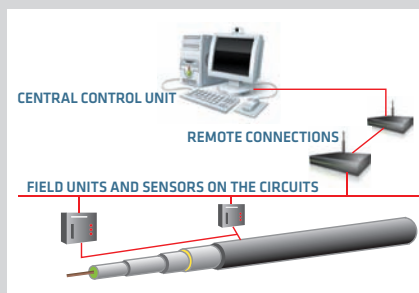
The system, therefore, can calculate in real time:

- conductor temperature
- permitted current in stable condition
- possible power overloads (both in the short and long term)
- evolution of the thermal transient and heat dissipation
- future overheating of a line's parts

PRY Opto-Power uses a software application to convert the data coming from the distributed sensor equipment and translate it into a real-time format of the power system's direct performance.

The main benefits offered by this advanced system are:

- ✓ optimal exploitation of grid potential
- ✓ drastic reduction of overload risks
- ✓ real-time information about grid operation



Opto-Power system installed on underground tunnel cable system. Circuit length 13 km. Single core cable length 40 km



POWER & COMMUNICATION LV CABLE

AFUMEX DUO

An entire world through the electrical cable...

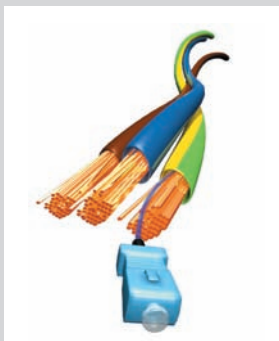
Afumex Duo is the LV Hybrid cable for individual branches that, by including optical fibre, is able to reach homes without power and communication bandwidth restrictions using a single cable.

This allows **combined installation of power and optical fibre conductors in individual branch circuits** (from the switchboard to each of the general control and circuit breaker panels) allowing a substantial saving in cost and time.

With its large optical fibre transmission capacity, this cable is suitable for use in applications that require high information capacity carriage.

For these reasons, Afumex Duo:

- ✓ can represent the best cabling solution to make Smart Home appliances communicate with Smart Metering, allowing efficient management of power and data flows within buildings
- ✓ is the optimal solution wherever there is a need for combined data and power carriage, allowing cost and time saving

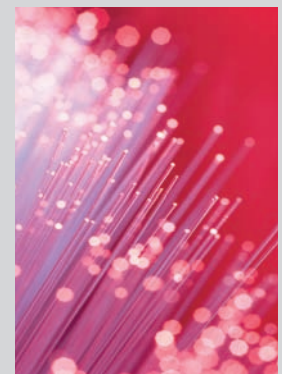



Focus on optical solutions

Prysmian Group is an integrated manufacturer able to control all the elements which compose the value of an efficient Smart Grid system

Along with the Copper cables delivering the power all around the network, Prysmian Group is capable to manufacture totally in-house the Fibre Optic, the Optical Cables and the Connectivity needed to handle the integrated Control System. The best in class quality of the fiber optic produced inside the Prysmian Group is of a paramount importance for the sensitivity of a system that must be able to capture any minimal variance of all the critical parameters, as well as the cable and the connectivity protecting it.

The wide portfolio of Solutions, ranges from the hybrid cables where the optical core is embedded into either the copper conductor or wrapped around it, to the purely optical system to be installed beside the power lines.



ADDITIONAL NETWORK DESIGN SERVICES OFFERED BY PRYSMIAN GROUP:

- Load Flow Assessment
- Optimal Power Flow Design
- Technical Assessment
- Financial Assessment
- Feasibility Studies

**Benefits**

- Optimal Solution
- Optimal Exploitation



Environmental impact

THE FUTURE DEVELOPMENT AND INTEGRATION OF RENEWABLE ENERGY SOURCES WILL BE KEY FOR OUR PLANET'S SUSTAINABILITY.

But energy generation is just part of the problem. Other aspects need to be considered to make a grid truly environmental friendly. Among these, the carbon footprint of grid components is surely one of the most important. This must be evaluated both when the components are manufactured and when they operate in the grid during their life span.

For this reason, Prysmian Group has decided to make environmental and territorial protection part of its business objectives: products are designed and created in compliance with international industry standards with the goal of improving environmental performance, cutting the use of harmful substances, reducing pollution and improving recyclability.

This is why, besides providing its technologies to renewable energy infrastructures such as wind and solar plants, **Prysmian Group has developed specific environmental friendly solutions and technologies to enhance grid sustainability at every stage.**

“Prysmian’s aim is to partner utilities engaged in upgrading and developing their electrical grids while seeking to reduce the environmental impact of such grids”

Fabio Romeo,
Senior Vice President Business Energy, Prysmian Group

ECO- SUSTAINABLE MV CABLE

P-Laser

✓ CO₂ equivalent emission reduced by 80%*

P-Laser is the first eco- sustainable MV cable for electrical grids. It provides the ideal solution with which to deliver enhanced grid reliability, whilst enjoying operational and environmental benefits.

With P-Laser, you are better placed to meet your environmental responsibilities and make less impact on the planet, by providing energy in a way that safeguards the future for all of us. This is because it uses:

- 100% eco- friendly thermoplastic** and fully recyclable materials***
- zero-gas technology, which means increased energy efficiency and reduced greenhouse gas emission

✓ Operating temperature range increased by 20%

P-Laser can operate at temperatures as high as 130°C. So, in the event of emergencies or grid congestion, it delivers greater capability, meaning your grid reliability is not compromised and you mitigate the risk of financial penalties due to service interruption.



✓ Superior service thanks to production time cut from days to hours

The process of producing P-Laser is more efficient and reliable than previously achievable. Without the degassing process and thanks to the possibility of uninterrupted, single-line production, you receive the cable you need, faster and in a form that is fully compatible with your existing grids.

HD 620 under approval: P-Laser will be approved at European Union level

* Refers to the end-of-life phase of Life Cycle Assessment (LCA) evaluation

** HTPE: High- performance Thermoplastic Elastomer

*** Thanks to fully recyclable materials, 500 kg of high quality plastics are recovered from every 1km of 185mm² cable core section

ECOLOGICAL LV CABLE

AFUMEX GREEN

Afumex Green is the world's first ecological LV cable

This cable replaces part of the polymer, derived from petroleum, with green polyethylene, a 100% renewable material obtained from sugar cane becoming the most ecological one in the market, in addition to being the safest for electrical installations.

This step is part of the company's initiative to offer its customers environmentally sustainable products, by reducing CO₂ emissions.

It is estimated that for each ton of green resin produced, up to 2.5 tons of carbon dioxide are captured and fixed from the atmosphere.

Afumex Green:

- ✓ reduces CO₂ emissions
- ✓ does not contain lead or other heavy metals in its composition
- ✓ like the entire Afumex range, it does not propagate flames in the event of fire and has low smoke and toxic gas emission, which make it the safest in the market
- ✓ has extra sliding properties and double insulation layer
- ✓ has greater thermal resistance, 20% more than traditional cables, which makes it resist twice the time in overcharge situations, restricting the occurrence of short circuits, the main cause of fires.



ECO-FRIENDLY TRANSMISSION LINE

High Temperature Overhead Lines

Same Lane Double Strain

The modern Utilities often have to deal with network capacity upgrade issues in conjunction with environmental restrictions. The construction of new lines is indeed often very critical due to lack of available land, difficulties in getting the permissions and environmental concerns.

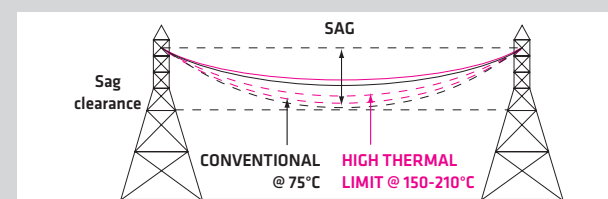
High temperature conductors for overhead lines are specially designed especially to solve this problem, allowing existing lines to be upgraded by increasing the ampacity from to 1.5 to 2 times by replacing only the conductors, without the need to either build another line or raise the existing pylons and therefore guaranteeing a better convenient solution in terms of total cost of ownership and environmental impact.

Our special-property conductors use a combination of aluminium-clad Invar (a special Fe-Ni alloy with very low thermal expansion coefficient) for the core, and super thermal resistant Al-Zr alloy for the conductive layer.

Thanks to the use of these innovative technologies our customers can now have conductors of a similar size and mechanical properties to standard ACSR or AAAC but without any deterioration if exposed to high operating temperatures. Another important benefit offered by high thermal resistant conductors is the lower thermal expansion coefficient, allowing a sag reduction at high temperature.

The main benefits compared with traditional conductors are:

- ✓ ampacity increase up to 2 times for using the same conductor cross-section
- ✓ SAG reduction
- ✓ fully compatible with ACSR or AAAC grids
- ✓ total cost of ownership reduction for the Utility



SAG reduction

Prysmian Group supports its customers in finding the best way to upgrade their grid at any stage.

Contact our Smart Grid experts to discover more about the many opportunities we can offer you to boost your grid's performance (see back cover).

Prysmian Group is member of many associations and working groups with the aim at creating an efficient and sustainable future for the energy sector.

Linking power grids to sustainability

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