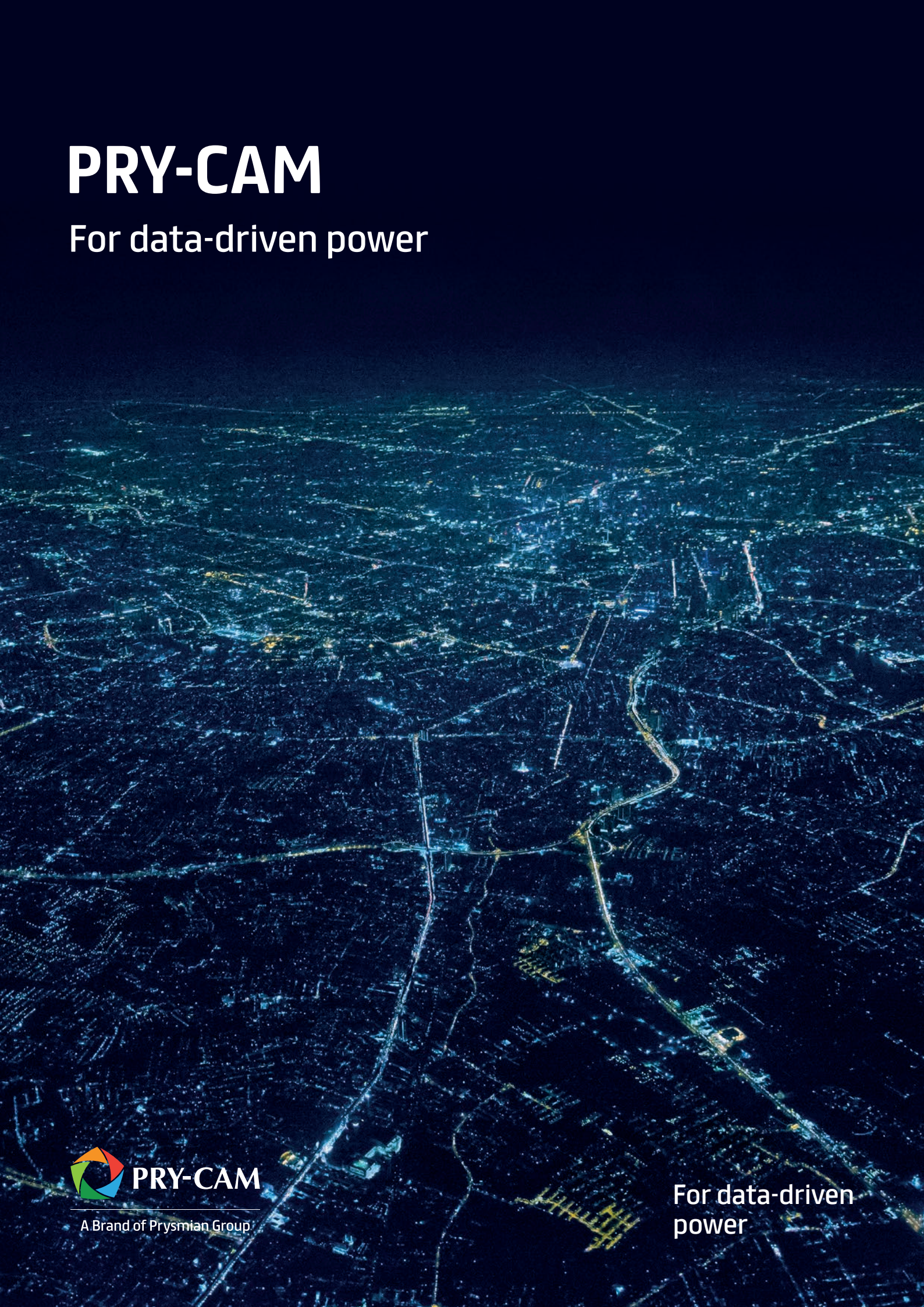
PRY-CAM

For data-driven power



PRY-CAM

A Brand of Prysmian Group

For data-driven power

We are living in an era in which our actions are more and more driven by data. The more objective the data, the stronger the impact it has on decisions and actions.

Electricity is essential to our lives and enables anything, but the way it is produced, transmitted, used, and managed has an impact on the present and on the future that is not that straightforwardly perceivable.

We have realised only recently that electricity can be read through data and that such data is key for accurate and objective diagnoses relevant to any type of electrical systems.

Since 2006 Prysmian Group has been developing, PRY-CAM, a data gathering and analysis technology based on artificial intelligence algorithms and on sensing technologies patented by the Group, deployed through a portfolio of products and services designed, developed, produced and sold by the Group itself and fully integrated with its cable systems.

The absolute need for a predictive approach

Continuity of power supply

The electrical power generated by any type of power plant is transmitted and distributed to the centres of consumption (urban areas, industrial parks, etc.) by ways of infrastructures that must ensure **continuity of supplies** and that are designed and built specifically to this purpose.

Planning of service interruptions

To ensure continuity of supplies transmission and distribution system operators, in the past, used to rely mainly on ordinary, extraordinary and, in some cases, also preventative maintenance, but over time they have realised that this was not enough.

Reduced inconveniences and financial impacts

As a matter of fact, a predictive approach has turned out to be the only way to effectively protect the continuity of the service of an electrical infrastructure, be it power transmission or distribution, and predictions can be made only based on the collection of a large volume of data related to the operation of the infrastructure itself.

Fault prediction allows to **plan service interruptions needed for maintenance and repair** of electrical infrastructures and in-stock availability of spare parts and generates benefits for all players involved in the generation, transmission and use of electricity.

In high and extra-high voltage networks, fault prediction allows not only to plan power supply outages and related back-up solutions, but also to avoid serious physical damages to an infrastructure and **reduce inconveniences and financial impacts to a minimum**.

In power distribution the benefits deriving from fault prediction and planning of power supply outages translate into preserving profitability in infrastructures that may report losses by the minute when out of service (e.g. industrial plants).

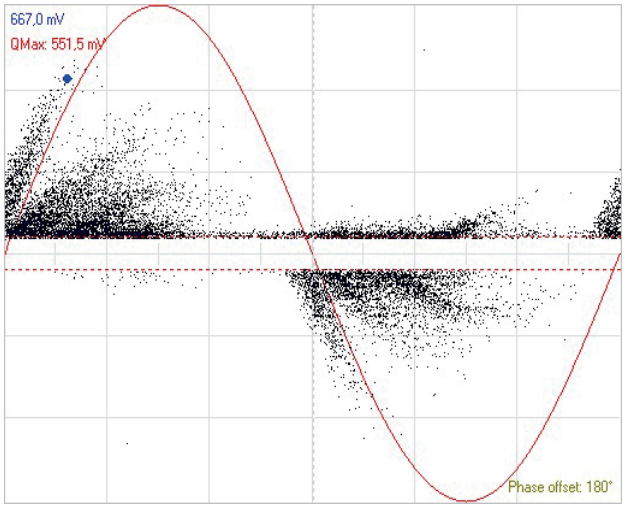
In the case of an Extra High Voltage interconnector (500 kV, 2 GW of power) losses due to non-supplied power can be up to over € 700,000 per day.

Which are the parameters to monitor?

In large electrical systems of Extra High, High and Medium Voltage data enabling a predictive approach refers to: **partial discharges, load and screen currents, temperatures, pressures, and acoustic events.**

Partial discharges are intrinsic phenomena that may occur within the insulation material (dielectric) of cables and their accessories and that, in the long run, may damage such material up to causing the failure of a whole cable system.

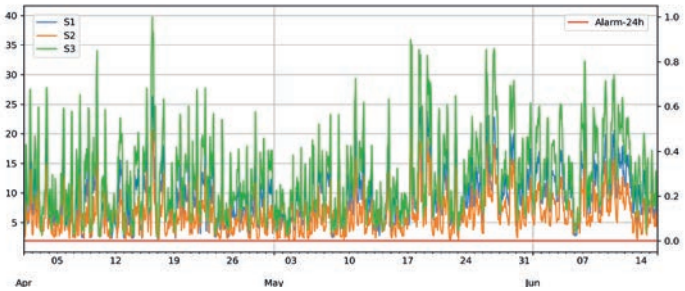
Acquisition of Partial Discharge with PRY-CAM PORTABLE in a Medium Voltage transformer



Load currents are a key parameter that identifies the current actually carried by a cable. Real-time knowledge of its exact value allows to understand if a cable is doing its job properly and, most of all, within the system's design technical limits.

Screen currents are a side effect of the electricity transmitted by a cable system and, regardless of the system's configuration, they always tend to be kept at the lowest level possible. This is because the effect of these currents on a cable's metallic screen limits the cable's current carrying capacity. Keeping these currents under control allows the cable to carry the maximum current.

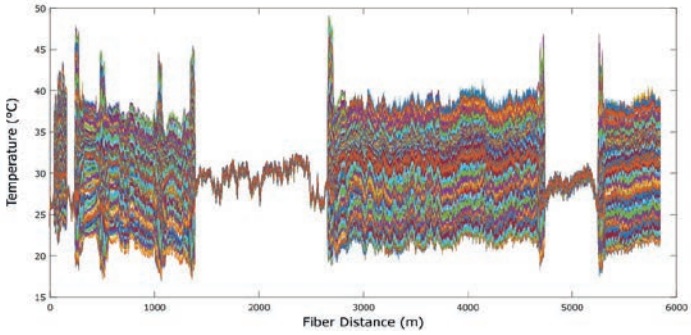
Screen currents trending in an Extra High Voltage (380 kV) underground cable (three-phase AC system) with single-point bonding configuration



Note: The straight red line indicates the status of the alarms (0 = none)

In an electrical system, **temperature** is a function of the ability to dissipate the heat generated by the current flow in a cable. The maximum rating of a cable is closely linked to the cable's ability to dissipate heat. An abnormal localised temperature increase is, therefore, a symptom that the cable, at the point where the abnormal temperature increase has been detected, is not able to carry the maximum current.

DTS temperature chart showing measurement taken every 10 mins over a time period of 24 hrs on a hybrid underground cable system



Note: The underground cable section can be easily identified by the reduced variation in temperature vs the overhead line.

Pressure in an electrical system is measured to check the correct level of various insulating fluid or gas materials. It is useful to verify that network components such as oil-immersed transformer terminals, gas insulated switchgear (GIS) and transition joints are filled with the correct amount of insulating material, otherwise they could trigger failures.

In recent years a technology that allows to monitor even the **acoustic events** that can occur in the vicinity of a cable has become increasingly popular. This technology applies to high voltage underground or submarine cables equipped with optical fibre, and allows detection of different types of acoustic events, from the least worrisome (earthmoving, trains, passage of ships) to the most potentially dangerous to damage a cable, like excavators, anchors or fishing.

The adoption of an integrated monitoring system has proven effective for the operator of a transmission system or a cable connection to identify malfunctioning conditions and prevent potential disastrous events, allowing timely interventions

Innovative solutions for real challenges

PRY-CAM SYSTEM

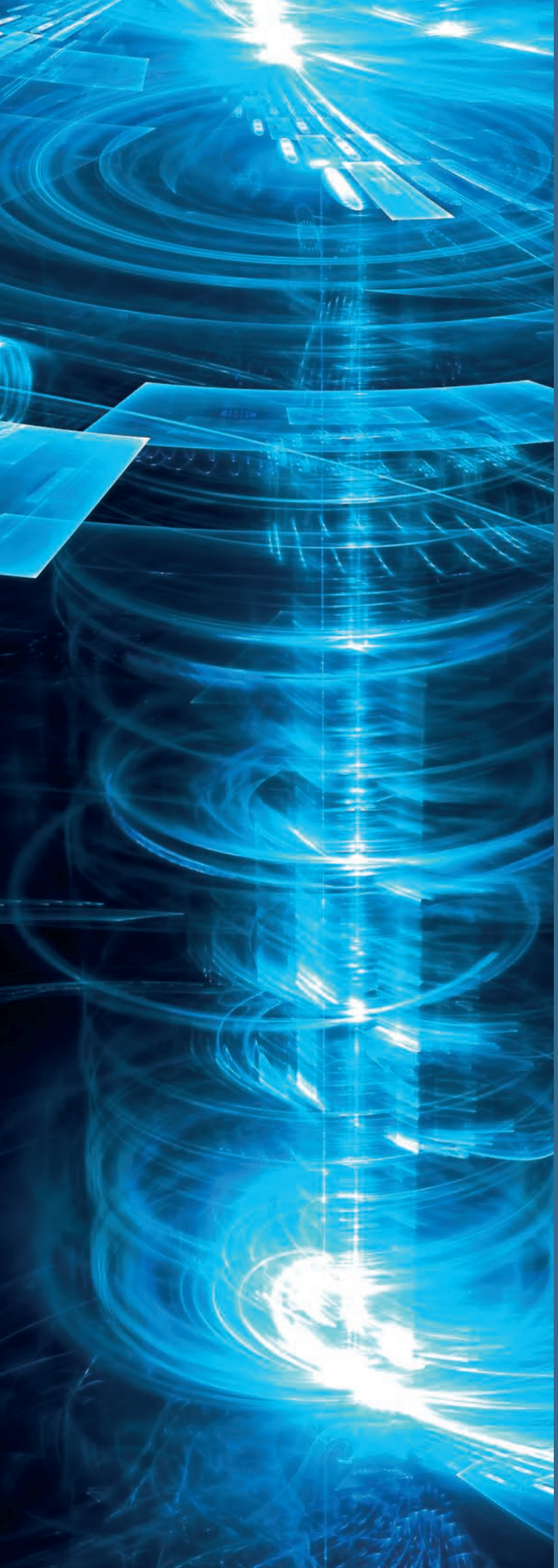
Prysmian Group provides transmission and distribution systems' operators with **PRY-CAM SYSTEM** integrated cable monitoring solutions.

PRY-CAM SYSTEM is an integrated system that gathers various devices (GRIDS, GATE, D-LOG and DTS among the most used), which monitor the main parameters that enable to assess the health condition of an electrical system. Data collected is stored on a private cloud platform, available and updated in real time. Proprietary algorithms generate warning alerts in the case of abnormal conditions.

PRY-CAM PORTABLE

The installation of an electrical system's fixed monitoring solution has several financial, logistic, functional, and operational implications. The most consistent strategic approach is to carry out a preliminary assessment with the support of a spot measurement service for partial discharges and screen currents. These are the two main indicators of cable systems' health conditions, also if they are already installed or even in service.

For this type of service, Prysmian Group provides **PRY-CAM PORTABLE**, a portable wireless device for the automatic acquisition, measurement and classification of pulse signals generated by partial discharge phenomena that may occur in the insulation materials of high and medium voltage cables and accessories and in electrical components such as transformers, motors and converters.



Track Record

Number of spot PD measurements available via cloud
6,000,000+

Fixed monitoring systems installed
900+

DTS systems installed
200+

Number of recurring customers
150+

PD diagnosis reliability rate
100%

PRY-CAM HOME

The need to collect data to understand the efficiency of an electrical system, to ensure its safety and to plan maintenance avoiding disruptions or, worse, financial losses is not exclusive just to power transmission and distribution. It affects equally also more everyday-life applications like domestic electrical systems.

More than 80% of domestic fires are caused by electrical faults. This is because the electrical installation is an invisible of a home and is rarely considered a subject to wear and aging. As a consequence, its maintenance may be limited, none at all or carried out only following a fault when it is too late.

This is why the installer community agrees that it would be appropriate to promote a more widespread electrical installation safety culture, through the knowledge of the characteristics of the systems and the structures installed in a home, in order to responsibly and adequately plan maintenance and avoid potential risks.

Data collection and analysis plays a key role also when it comes to Low Voltage electrical systems. In order to provide electricians, installers and maintenance operators with a solution that is simple to use, performs the tests rapidly and sufficiently in depth, Prysmian Group has developed **PRY-CAM HOME**.

PRY-CAM HOME analyses key electrical parameters in the home promptly and generates a technical annex of the tests carried out to certify an electrical installation, thus providing peace of mind to both electricians and homeowners.

PRY-CAM HOME is not just the right solution that makes the certification of electrical installations at home easier and more effective for electricians, and grants installations' longevity and safety.
PRY-CAM HOME also helps homeowners understand potentially risky situations that are invisible to the eye, by highlighting the hidden symptoms of potential system failures. in order to call an electrician at the right time.

Conclusions

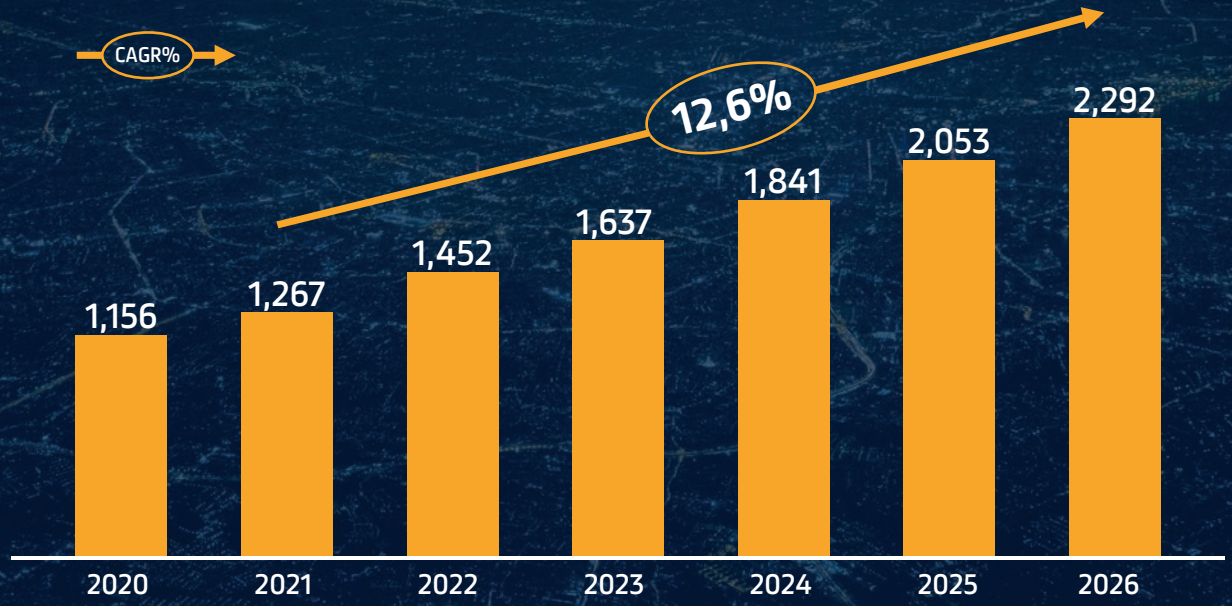
The entire electrical power industry is increasingly adopting a new philosophy, with respect to the management of electricity, that is based, regardless of the voltage class, on electrical systems data collection and cloud-based real-time data accessibility, as shown by the monitoring systems market growth forecast for the next five years.

Power systems have become increasingly complex. We can't just wait any longer for a fault to occur, receive a wanting alert and intervene.... Faults must be predictable.

With its **PRY-CAM** technology, Prysmian Group has managed to transform this philosophy into an offer of products and services for its customers, who increasingly choose to rely on the Internet of Things to bring forward a real revolution in monitoring and managing their electrical assets.

For more information:
https://www.prysmiangroup.com/en/markets/asset-monitoring-systems-and-electronics

Integrated Monitoring Systems Market Estimate and 2020-2026 Growth Forecasts
(Mln USD, CAGR %)



Sources: Global Partial Discharge Monitoring System Market Insights 2026 – Fior Market Research LLP 2020

Prysmian Group

Linking the Future

Prysmian

Draka

General Cable

PRYSMIAN GROUP
Via Chiese, 6 – 20126
Milano / Italy
T +39 02 64491
info.prycam@prysmiangroup.com

prysmiangroup.com

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