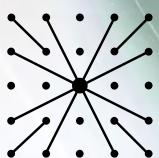


Preventive Cable monitoring:

Reducing the operating
and maintenance costs
of HV cables.



**DES – Distributed
Electrical Sensing**



synaptec
powered by **Megger**.

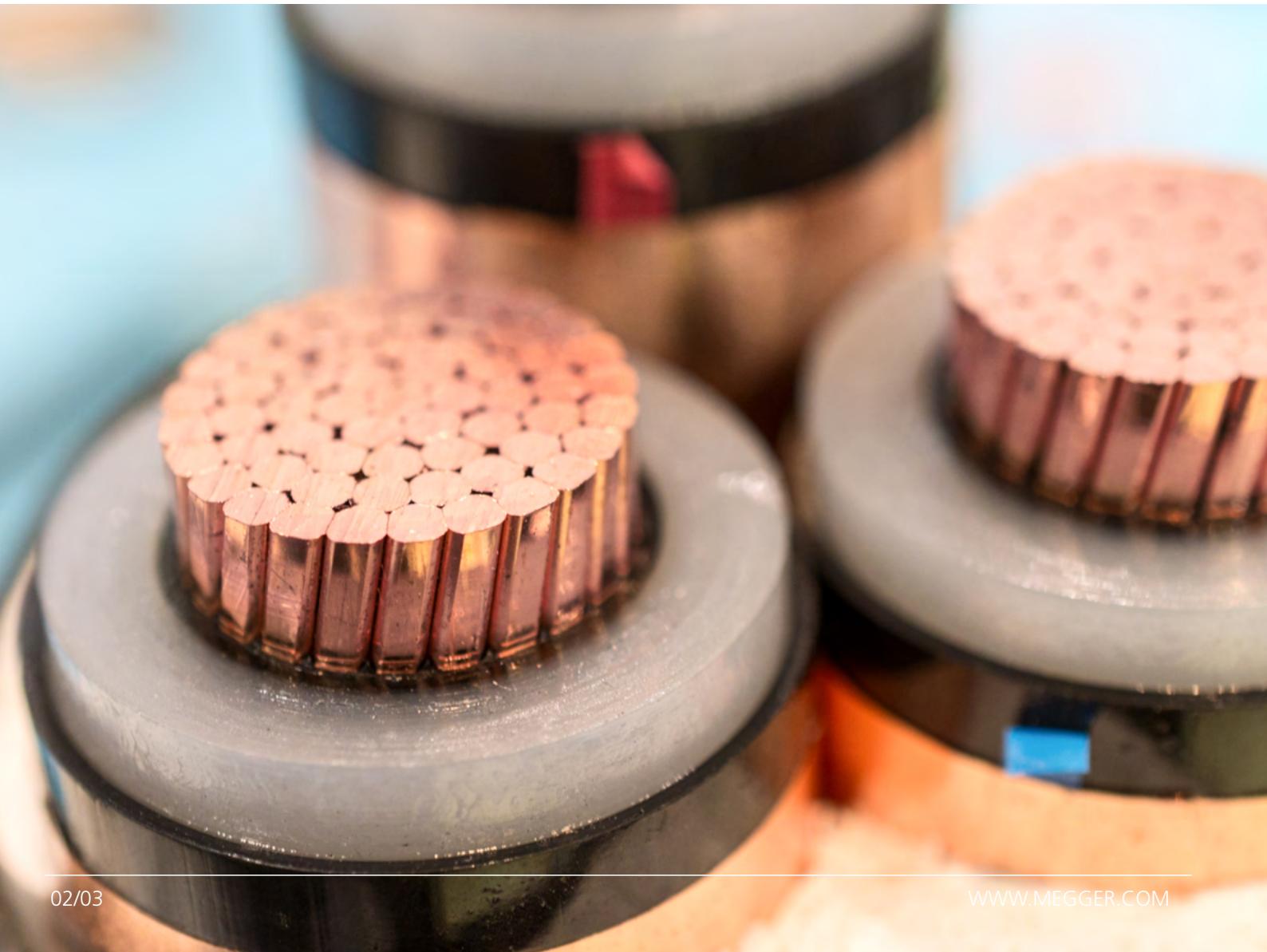
What is Greenlight?

Greenlight is Synaptec's unique HV cable resilience solution, enabling the highest levels of cable network availability and health.

Early warning of failures

Greenlight leverages passive and permanent sensing to provide early warnings of damage and failure in cable assets, reducing the need for costly and high-risk manual inspection and scheduled maintenance, and avoiding unnecessary outages.

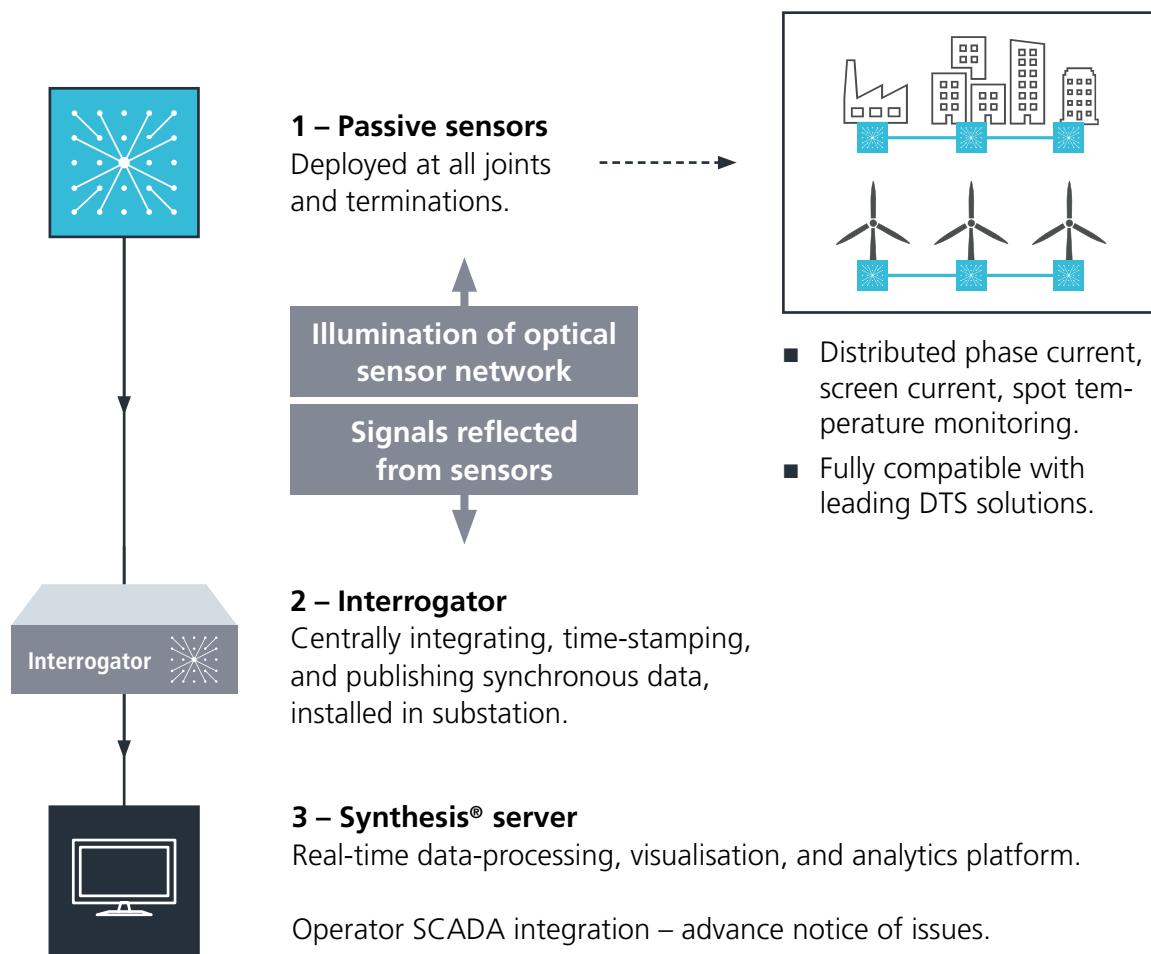
The Greenlight solution delivers high-fidelity measurements from every cable joint and termination to a real-time analysis platform, where operators can observe and react to abnormal activity on their network in advance of critical failures.



Key benefits

- **Early warning** – Supports operators in early cable fault or damage identification, enabling early intervention, avoiding costly outages and unscheduled maintenance.
- **Cost-effective** – A low cost / high return solution for monitoring health, damage, and degradation in power cables and their joints and terminations, regardless of their number distance.
- **Prevents failures** – Models cable and accessory health and behaviour to guide proactive maintenance far in advance of failures.
- **No maintenance** – Uses passive sensors which operate over distances of up to 60 km from the substation and do not require control power, maintenance, or recalibration.
- **Easily deployed** – Small, non-invasive, and easy to retrofit. Works with any HV cable (underground or subsea, i.e. solid-bonded and cross-bonded cable architectures).

How it works



Why choose Greenlight?

The industry challenge

Cable failures continue to cause significant financial and operational strain for power grid and offshore wind operators. A single event can cost over £80M in lost revenue, along with substantial outage time and repair costs.

Cable failures also account for 83% of insurance claims in the offshore wind industry, so early warning and intervention is critical to avoiding these unplanned costs, and reducing outages.

Crucially, 57% of cable downtime is now known to be due to joint and termination failures rather than the cable itself. However, effective monitoring of those remote locations is not cost-effective with conventional techniques. A comprehensive approach to passive monitoring of the full cable network is required.



57%

of downtime is due to joint
and termination failures¹

£80M+

lost income due to prevent-
able HV cable failur²s

83%

of industry-wide offshore
wind insurance costs result
from cables³

¹ CIGRE WG B1.57, 'Update of service experience of HV underground and submarine cable systems', TB 815, 2020

<https://www.e-cigre.org/publications/detail/815-update-of-service-experience-of-hv-underground-and-submarine-cable-systems.html>

² <https://www.ofgem.gov.uk/sites/default/files/2025-01/GyM-SSEC3-EE-December-2023-to-December-2024-final-direction.pdf>

³ DNV, <https://www.dnv.com/article/80-percent-of-insurance-claims-in-offshore-wind-are-related-to-subsea-cable-failures-how-can-the-industry-manage-these-risks>

Our solution

Greenlight improves availability and reduces outages by monitoring all joints and terminations, where most cable failures occur. It provides operators with permanent and continuous monitoring of these critical locations, giving early warning of damage and abnormal behaviour, reducing maintenance costs and manual effort. Passive sensing avoids the need for control power or other infrastructure at these remote monitoring locations, making it simple and cost-effective to automate reliable and accurate monitoring of these critical assets.

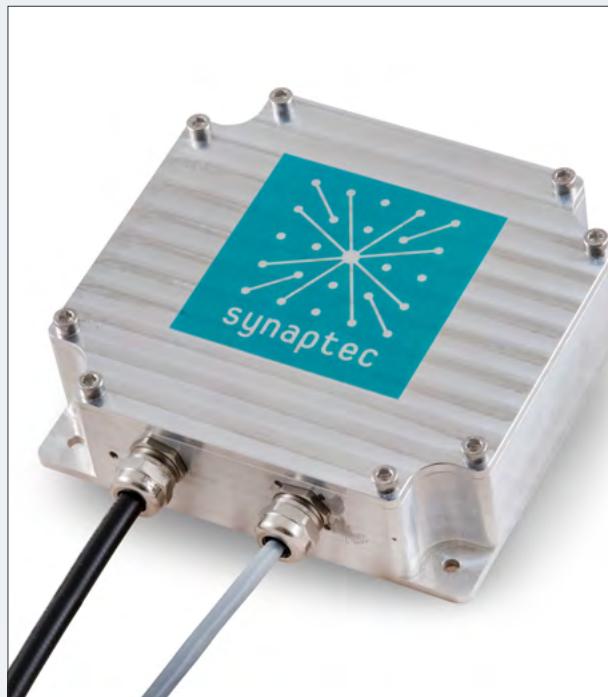
3 system components and their functionality

1 - Passive sensors

Synaptec's passive sensors combine industry-standard instrument transformers with Distributed Electrical Sensing (DES) technology, enabling remote circuits to be instrumented passively.

Utilising passive sensing techniques, a Passive Secondary Converter (PSC) encodes the secondary electrical quantity of a CT or VT into an analogue optical signal in standard single-mode telecoms fibre.

Multiple PSCs are multiplexed over a single-fibre and monitored at a central location by Synaptec's DES Interrogator. This technique enables many remote instrument transformers to be digitised and centralised, and new instrument transformers to be installed outside the substation fence. Similarly, fibre-based temperature sensors can be located at remote joints and terminations, which allows combined electrical and thermal analysis to find early evidence of damage.



Passive sensors: no power or maintenance required.

2 - Interrogators

Synaptec Interrogators are the core component in all our monitoring systems, centrally gathering, time-stamping and publishing synchronous data from passive Synaptec sensors. The data can be streamed to existing protection relays and SCADA systems.

Modular and scalable, Interrogators fully support any mix of Synaptec's electrical and mechanical sensors, making them ideal for long range, multi-point condition monitoring of cables and terminations.



Interrogator to be installed in the substation.

3 - Synthesis®

Synthesis® is Synaptec's real-time data-processing, visualisation, and analytics platform, which identifies early causal factors in cable health. The software generates unique data and insights, from assets or locations previously unobserved.



Early warning, only with Greenlight



Synaptec's systems generate unique data and insights from assets or locations previously unobserved. Full high-fidelity waveforms from each monitoring location allow identification of deviations and correlations in electrical and mechanical stresses that lead to failure. Until now it has not been economical to continuously monitor these remote locations. Greenlight identifies early causal factors leading to future failure so the asset operator avoids outages and can de-risk cable operation.

1

Distributed cable data visualisation

Provides a real-time dashboard overview of processed data from all cable sections, joints, and terminations. Visually highlights abnormal behaviour, such as excessive temperature correlated with electrical measurements at a joint or termination, to enable more focused maintenance work.

2

Calculation and visualisation of the ratio of phase-to-screen current

There is a strong body of research and industrial experience which highlights that many common failure modes of cables joints and terminations can be determined from online monitoring of screen currents, at multiple locations along a cable. One example, as highlighted by a CIGRE B1 report¹, is that monitoring the ratio of phase-to-screen current simultaneously at all joints can quickly highlight typical installation errors or other asset degradation issues at the joint or termination location. Exposing these trends over time, and the relative behaviour at multiple joint locations, provides continuous insight of the cable health. When issues occur, it is clear from the data exactly where they are located, which facilitates targeted maintenance work.

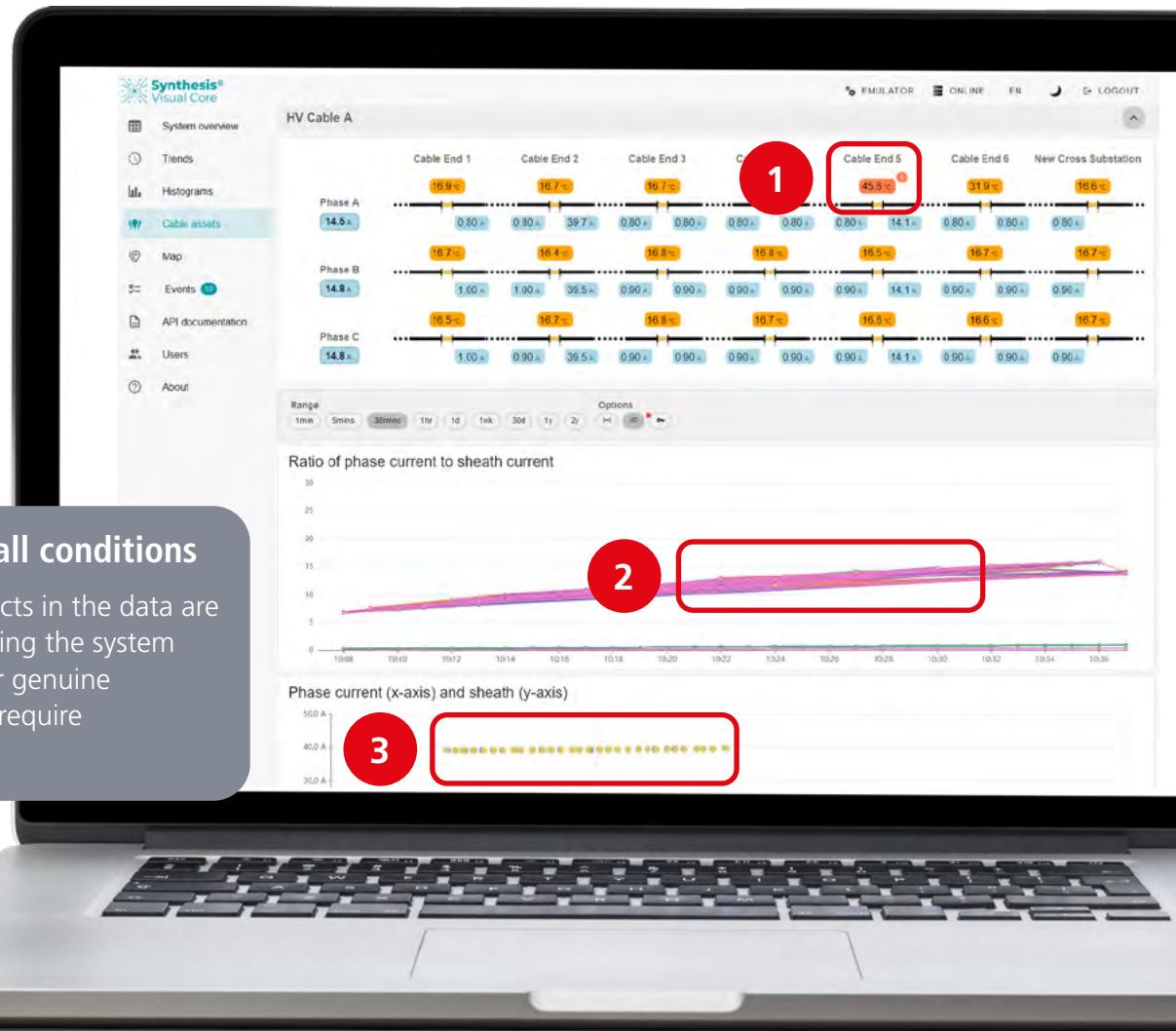
3

Outlier analysis for cable assets

The system automatically finds important outliers

- A deviation in any individual sensor's data, compared to normal behaviour
- A deviation in any individual sensor's data, compared to other sensors at different locations
- Abnormalities in computed metrics such as the ratio of phase-to-screen current, and the differential between screen current measured at each end of a cable section

¹ CIGRE B1 WG B1.60, 'Maintenance of HV Cable Systems', CIGRE B1, Technical Brochure 825, 2021. [Online]. Available: <https://www.e-cigre.org/publications/detail/825-maintenance-of-hv-cable-systems.html>



Accuracy in all conditions

Seasonality effects in the data are removed, ensuring the system only triggers for genuine deviations that require intervention.



Continuous, live visibility of asset state and damage, 24/7



Automatically searches for outliers in data from all configured sensors, and groups of sensors



Automated alerts for abnormal system operation



Generates event records for any detected anomalies



Interfaces with operator's SCADA system for alarms

Talk to an expert and transform your network

synaptec@megger.com



synaptec
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The Synaptec system is built and owned by Synaptec Ltd.
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