Greenlight®

The complete optical monitoring solution for power cables

synaptec
powered by Megger

Introduction

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

Greenlight tightly integrates Synaptec's proprietary Distributed Electrical Sensing (DES) with best-in-class Distributed Temperature Sensing (DTS) from Viavi Solutions (VIAVI), a global leader in optical instrumentation, to deliver the most comprehensive cable monitoring platform available.

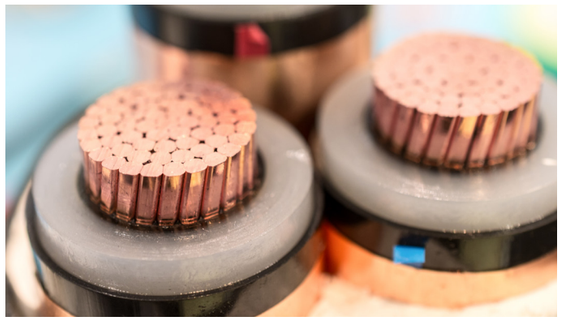
Overview

Greenlight combines Synaptec's proprietary Distributed Electrical Sensing (DES) technology with integrated Distributed Temperature Sensing (DTS) from VIAVI to provide early warnings of damage and failure in cable networks, reducing the need for costly and high-risk manual inspection, 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 the number or 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).
- **Best-in-class DTS** – Integrated Distributed Temperature Sensing from VIAVI provides continuous thermal profiling along the full cable length, with up to 80 km range and dual wavelength Raman technology for automated calibration.



Greenlight system architecture

DES passive sensors

Deployed at all joints and terminations, including:
- Phase current sensors
- Screen current sensors
- Temperature sensors

Integrated with VIAVI DTS, DAS, and DSS

Optical Interrogators

Centrally integrating, time-stamping, and publishing synchronous data, installed in substation.

Onsite server

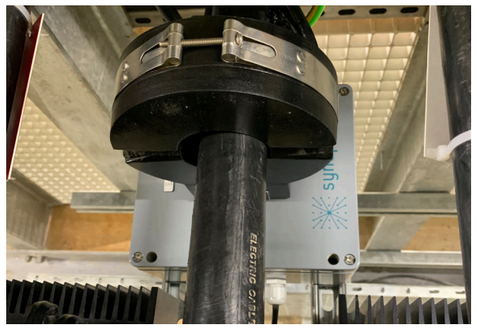
Greenlight software visualisations, and automated analytics in real-time

Data Insights

We help you interpret reports and insights

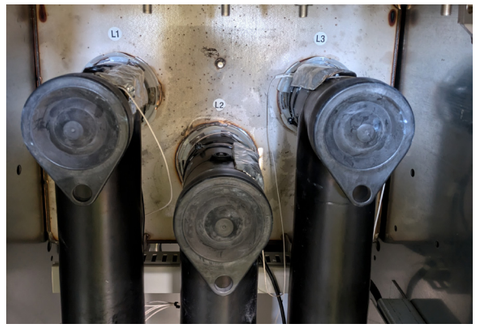
Optical interrogators

Passive current sensors



Greenlight visualisation

Passive temperature sensors



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[1] in lost revenue, along with substantial outage time and repair costs.

Cable failures also account for 83%[2] 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%[3] 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.

£80M+

lost income due to preventable HV cable failures[1]

83%

of industry-wide offshore wind insurance costs result from cables[2][3]

57%

of failures are located within the joints and terminations[3]

Our solution

Greenlight improves availability and reduces outages by monitoring at all joints and terminations. 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. Greenlight's sensing technology operates without any control power, data networks or ongoing maintenance. Install once, and Greenlight delivers early warnings for decades.

Fewer unplanned outages
Increased availability

Targetted maintenance
Lower O&M cost

Safely optimise capacity
Peak demand flexibility

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

2 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

3 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

How it works

Passive sensors

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

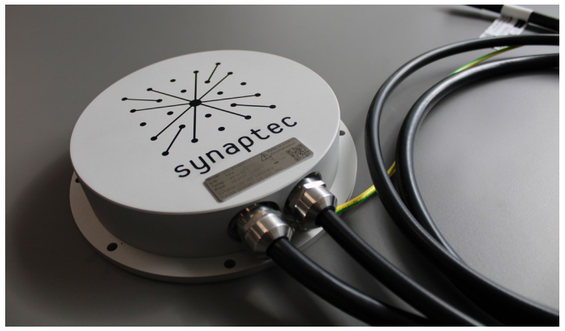
Utilising passive sensing techniques, a Passive Secondary Converter (PSC) encodes the secondary electrical quantity of a CT or VT into an analogue optical signal in standard single-mode telecoms fibre.

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.

Interrogators

Synaptec Interrogators are the core products 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.



Passive sensors: no power or maintenance required.

Distributed Temperature Sensing (DTS)

Synaptec has established a strategic alliance with VIAVI – a global leader in optical test and measurement instruments – to integrate best-in-class Distributed Temperature Sensing into the Greenlight platform. VIAVI's DTS solution is based on Raman scattering technology, which instruments the temperature along a fibre optic cable with high spatial resolution and accuracy.

The integrated DTS delivers dual wavelength source measurement for automated temperature calibration, single-ended operation requiring only one fibre for both DTS and OTDR measurements, and flexible support for up to 80 km distance with up to 24 channels. An integrated Rayleigh Optical Time-Domain Reflectometer (OTDR) provides continuous fibre integrity monitoring, bend detection, and optical loss/attenuation measurement – all in a single 2U rack-mounted unit.

By combining Synaptec's DES electrical monitoring with VIAVI's DTS thermal monitoring within the Greenlight platform, operators gain a complete picture of cable health – correlating electrical behaviour with temperature profiles to identify degradation earlier and with greater confidence than either technology alone.

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

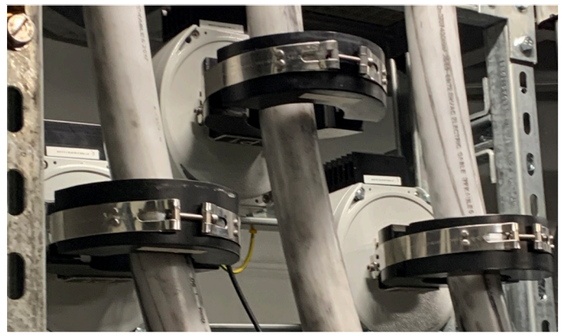
Synaptec's systems generate unique data and insights from assets or locations previously unobserved. Full high-fidelity electrical waveforms from each monitoring location, combined with continuous distributed temperature profiles from the integrated VIAVI DTS, allow identification of deviations and correlations in electrical, thermal, and mechanical stresses that lead to failure. Until now it has not been economical to continuously monitor these remote locations with this depth of instrumentation. 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 – including continuous DTS thermal profiles along the full cable route. Visually highlights abnormal behaviour, such as excessive temperature from DTS data 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 report[2] , 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 for the following scenarios:

- 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

[2] 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

Greenlight dashboard

Spot temperature increase identified at one joint location.

Evolving trend of ratio of phase current to screen.

Abnormal group of ratio of phase current vs. screen current.

Improve availability and reduce outages

- Continuous processing of all sensor data, 24/7
- Automatically searches for outliers in data from all configured sensors, and groups of sensors
- Generates event records for any detected anomalies
- Interfaces with operator's SCADA system for alarms

Accuracy in all conditions

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

Transform your network today

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