

Greenlight®

HV cable health monitoring

Current and temperature measured at every joint and termination, and along the whole route, on the fibre already laid with the cable. Powered by Synaptec's Distributed Electrical Sensing.

synaptec

Greenlight. Powered by DES.

Cable health, measured where cables fail

Greenlight watches every joint and termination for the first signs of damage, and the whole route for the heat that precedes a failure. One system shows you the health of your HV cable, joints, and terminations, and tells you which accessory to fix before it causes an outage.

Introduction

Greenlight® is Synaptec's HV cable health monitoring solution for underground and subsea cables. It finds damage and degradation at every joint and termination before they cause an outage, and it does so with nothing powered along the route.

Greenlight is built from three sensing modules on the fibre already laid with the cable. Distributed Electrical Sensing (DES) measures phase and screen current at every joint and termination. Point temperature sensing (PTS) measures temperature at the same joints and terminations. Distributed temperature sensing (DTS) measures temperature along the whole route. All three are read in the substation on one time base and analysed on one platform, so a temperature rise at a joint can be checked against the current flowing there, and a current anomaly against the temperature at the same place.



Key benefits

- **Works with any HV cable.** Any HV cable, from any manufacturer, underground or subsea, solid or cross-bonded. Retrofits at link boxes, joint bays, and landfalls on circuits already in service. You choose your cable and your monitoring separately.
- **Phase and screen current at every joint.** Passive sensors measure phase and screen (sheath) currents at every joint and termination, over standard telecoms fibre, at more than 60 km from the substation. Screen currents contain the earliest electrical indicators of bonding faults, water ingress, or failing joints.
- **Nothing to power or maintain at site.** The sensors are passive. They need no control power, no data network, no batteries, and no recalibration. Install once and they report for the life of the cable.
- **Electrical and thermal data together.** Current and temperature are compared location by location: a hot joint is confirmed by its current, and a current anomaly by its temperature. Fewer false alarms, earlier warnings.
- **Event counts at every location.** Greenlight counts events at every joint and termination, so you can see where activity is building and target maintenance before a failure.
- **Ready to extend.** Real-time thermal rating and distributed acoustic sensing can be added as modules on the same fibre and the same platform.

What Greenlight measures and what you get

At every joint and termination

Phase current, screen current, and temperature, from passive sensors on split-core current transformers and passive temperature transducers. Early warning of bonding faults, water ingress, and degradation, located to the accessory.

Along the whole route

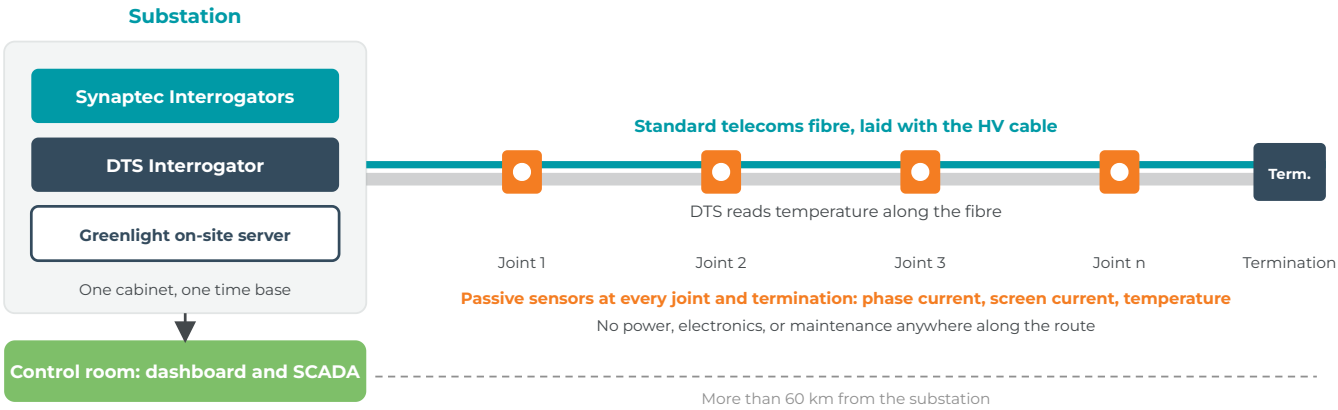
A continuous temperature profile from the fibre itself. Hot spots and cold spots between joints, the thermal history of every section, and fibre integrity.

In one platform

The Greenlight analytics correlate electrical and thermal data at every location, remove seasonal effects, and raise alarms and event records into your SCADA. Data stays on your own server.

System architecture

Everything active sits in the substation. Along the route there are only passive sensors and the fibre already laid with the cable.



Where	Equipment	What it does
Joints and terminations	Split-core CTs with passive sensors for phase and screen current; passive temperature transducers	Measure the electrical and thermal condition of every accessory, with no power or electronics at site
The fibre route	Standard fibres in the cable or alongside it	Carry the sensor signals and act as the temperature sensor along the full length
Substation	Synaptec Interrogators; DTS Interrogator; on-site server	Reads every sensor on one time base, measures temperature along the route, and runs the analytics
Control room	Greenlight dashboard; SCADA interfaces	Shows the whole circuit in one view and passes alarms and event records to your systems

Greenlight modules

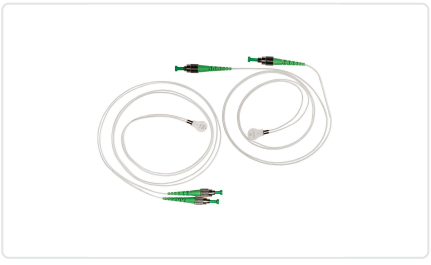
Module	Measures	You get
DES	Phase and screen currents at every joint and termination, sampled at up to 4.8 kHz and time-stamped centrally	Early warning of joint, termination, and bonding faults, located to the accessory; event records
PTS	Temperature at every joint and termination, from passive temperature transducers read by a DMS Interrogator	Hot joints and terminations, checked against the current flowing through them
DTS	A continuous temperature profile along the cable, from the fibre itself	Hot spots and cold spots along the route; thermal history of every section; fibre integrity
Greenlight software	Every sensor against its own history and against the others on the circuit, with seasonal effects removed	Alarms only for real changes; event records; one view of the circuit



Synaptec Interrogator in a substation rack in Mumbai



Passive sensor installed in a joint bay in Mumbai



Passive temperature transducer: no power or maintenance required

Why monitor the whole HV cable

The industry challenge

Cable failures are expensive and slow to repair. A single HV cable failure can cost more than £80M in lost revenue, and cables account for 80% of insurance claims in offshore wind. On land, 57% of HV cable downtime comes from joints and terminations rather than the cable itself, and those are the places conventional monitoring does not reach.

Temperature alone finds a hot joint once it has started to fail. Current alone finds an electrical fault without its thermal cause. Measuring both, at the same places and on the same time base, finds the problem earlier and with fewer false alarms.

Screen current: where most cable problems show first

The current flowing in the metallic screen or sheath at each joint depends on the bonding arrangement, the condition of the link box and earthing, and the state of the insulation. A change in screen current, or in its ratio to the phase current, points to a bonding fault, water ingress, or a deteriorating joint long before a failure, and the comparison between joints shows which one. Greenlight measures it continuously at every joint and termination. Utilities and tender specifications often call this sheath current monitoring.

Monitoring that belongs to the network operator

HV cable systems monitoring can be designed into a cable at manufacture and bought with it, or specified and procured on its own. Greenlight is designed for the second route, so the monitoring belongs to you, works on any cable you own, and is not tied to one cable supplier for the life of the asset.

	Greenlight	Monitoring designed into the cable at manufacture
Cable supplier	Any manufacturer, any contractor	The cable supplier's own
Circuits already in service	Retrofit at link boxes and joint bays, without disconnection of the circuit	Designed in at manufacture
Procurement	Specified and tendered on its own terms, compared on performance	Priced inside the cable package
Current measurement	At every joint and termination, on standard fibre	Varies by supplier
Interfaces	IEC 61850, IEC 60870-5-104, Modbus, DNP3, OPC UA; secure REST API	Varies by supplier
Data	Held on your own server, behind your firewall	Varies by supplier

57%

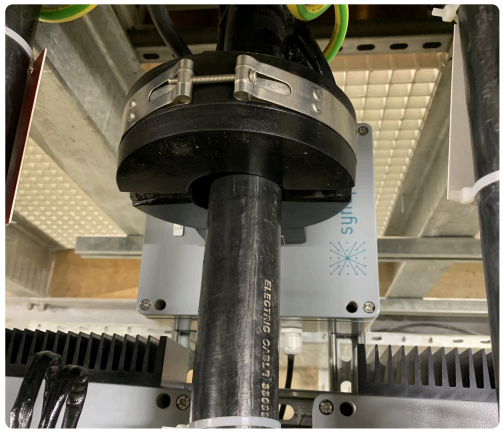
of HV cable downtime is caused by joints and terminations[1]

£80M+

lost income from a single preventable HV cable failure[2]

80%

of offshore wind insurance claims relate to cables[3]



Split-core CT on an HV cable, with its passive sensor mounted behind

- **Fewer unplanned outages**
  Increased availability
- **Targeted maintenance**
  Lower O&M cost
- **Longer asset life**
  Repair on your schedule, not after a failure

1 CIGRE WG B1.57, Update of service experience of HV underground and submarine cable systems, TB 815, 2020. 2 Ofgem final direction, GyM-SSEC3, December 2024. 3 DNV, insurance claims in offshore wind related to subsea cable failures.

How it works

Passive sensors

Synaptec's passive sensors combine industry-standard instrument transformers with Distributed Electrical Sensing. Split-core current transformers fit around the cable or bonding lead for retrofit without disconnection, and a Passive Secondary Converter (PSC) instruments the CT secondary, encoding it as an optical signal on single-mode telecoms fibre with no power supply or electronics at the sensor. Many sensors share one fibre and are read from the substation, more than 60 km away. Passive temperature transducers sit alongside them at joints and terminations, so electrical and thermal measurements come from the same places.

Synaptec Interrogators

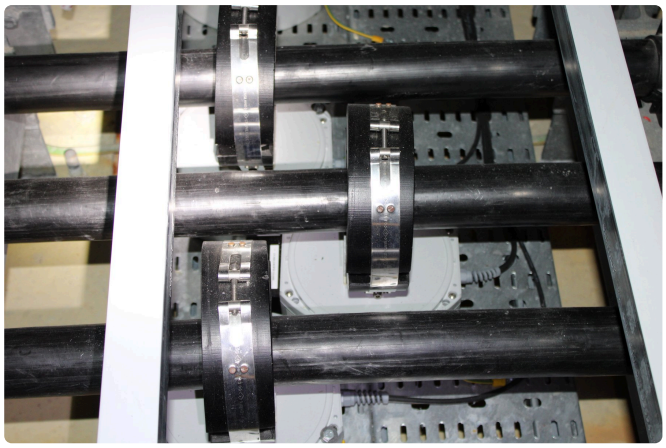
Rack-mounted Synaptec Interrogators in the substation read every sensor on one time base. DES and mDES Interrogators read the current sensors, sampling at up to 4.8 kHz, and DMS Interrogators read the passive temperature transducers. Their measurements pass to the Greenlight server, where the analytics capture an event record whenever behaviour changes.

Distributed temperature sensing

Greenlight integrates a DTS Interrogator that uses the fibre itself as a continuous temperature sensor along the full route. The temperature profile is correlated with the electrical measurements at each joint, so a hot spot is confirmed by its current and a current anomaly by its temperature.

Greenlight software

An on-site server records, stores, and correlates all of the data inside your network. The analytics search every sensor and every group of sensors for behaviour that has changed, remove seasonal effects, and raise alarms and event records into your SCADA by IEC 61850 or IEC 60870-5-104. A secure REST API makes the data available to your own systems.



Split-core CTs fit around each cable for retrofit without disconnection



PSC-1 Passive Secondary Converter: no power supply or electronics at the sensor

Modules that can be added

DES, PTS, and DTS form the core of Greenlight. These modules can be added on the same fibre and the same platform.

Real-time thermal rating (RTTR)

A Greenlight module delivered in close partnership with cable thermal rating specialists. It combines the temperature measured along the route with the current measured at the cable, and reports conductor temperature and the load the circuit can carry for the hours ahead.

Distributed acoustic sensing (DAS)

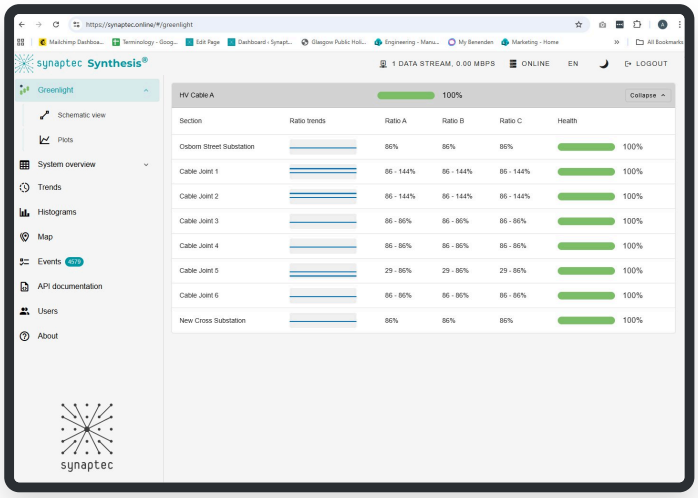
Detection, classification, and location of digging, drilling, and heavy plant along the route before the cable is struck, on the same fibre.

Early warning in one dashboard

Early warning of cable damage

Greenlight's analytics run continuously on the on-site server, searching every sensor and every group of sensors for behaviour that has changed. The dashboard shows the whole circuit in one view: every joint and termination, and the temperature profile along the route.

Function	What it does
One view of the circuit	Processed data from every HV cable section, joint, and termination, with the temperature profile along the route. Abnormal behaviour, such as a joint running hot while its current is normal, is highlighted for maintenance
Derived metrics	Measured and trended at every joint. Changes in correlations and relationships, or differences between joints, reveal installation errors, bonding faults, and water ingress long before a failure (CIGRE TB 825)
Outlier analysis	Finds deviations in any sensor against its own history, against other sensors on the circuit, and in derived metrics such as the screen current difference across a section. Seasonal effects are removed, so only real changes raise an alarm
Alarms and records	An event record for every anomaly, and event counts by joint and termination that show where activity is building, so maintenance can be targeted before a failure. Alarms to your SCADA by IEC 61850 or IEC 60870-5-104, and a secure REST API for your own systems



Greenlight dashboard: the health of every section of the circuit in one view

How Greenlight is delivered

Synaptec leads the project from design to handover and is your single point of contact. Your preferred contractor or Synaptec's local partner installs the equipment, and first-line support is provided locally. Software licences are perpetual, paid once.

Stage	Who
Design, specification response, and project lead	Synaptec
Passive sensors, Synaptec Interrogators, DTS, and software platform	Synaptec
Installation, splicing, cabinets, and site works	Your preferred contractor or Synaptec's local partner
Commissioning and training	Synaptec
Support	Synaptec, with local first-line support where a partner is in place. Software licences perpetual, paid once

Proven in service

Greenlight uses the same Synaptec Interrogators and passive sensors as Synaptec's cable protection schemes, so the two share one service record. In more than 1.5 million sensor-hours of operation, no Synaptec sensor has ever failed in service.

Application	Experience
Transmission and distribution utilities	Cable protection and monitoring on HV circuits across Europe, the Middle East, and India
Offshore wind	Cable systems monitoring on North Sea wind farms, including Dogger Bank, Hywind Scotland, and Aberdeen Bay
Urban underground cables	Sheath current monitoring and cable protection on 110 kV and 220 kV circuits for both private utilities serving Mumbai

>1.5 million
sensor-hours of operation (October 2026)

>60 km
from the substation to the furthest passive sensor

0
sensor failures in service



Commissioning at an offshore wind onshore substation



Synaptec Interrogator in service at a 220 kV substation in Mumbai

In service: Adani Electricity Mumbai, 220 kV Aarey to Borivali

Greenlight® screen current monitoring at 12 joint bays on a 12.7 km underground double circuit, retrofitted to the existing link boxes with the circuit in service. The first data after commissioning showed screen current at one joint bay on one circuit at more than ten times the level elsewhere. The analysis located the cause to a high-resistance bonding connection at an uninstrumented joint bay two sections away. The operator found it there, re-torqued it during a scheduled visit, and the excess current disappeared. No outage was taken and no confined-space survey was needed.

Full case study available on request.


A monitored joint bay on the Aarey to Borivali route

Talk to us about your HV cable network

Start with one circuit. We will review the route, the fibre, and the accessories, and propose a monitoring design with a budget price, at no cost. Most circuits can be fitted without an outage.

Greenlight®. Powered by DES.

Synaptec designs and manufactures passive optical sensing for power networks. Founded in Glasgow in 2015, Synaptec supplies protection and monitoring systems to transmission and distribution operators and offshore wind operators across Europe, the Middle East, Asia, and beyond.

synaptec

Synaptec Ltd
Suite G8, CityPark
368 Alexandra Parade
Glasgow G31 3AU, UK
T: +44 (0)141 488 3664
E: info@synapt.ec
W: synapt.ec

MA-090 Rev.07 The contents of this document are provided for informational purposes only and are subject to change at any time without notice. Greenlight is a registered trade mark of Synaptec Ltd.