A super-digital underground link to improve asset management policy

Nicolas **COUTURIER**, Mathilde **FABRE**, RTE (France), nicolas.couturier@rte-france.com, mathilde.fabre@rte-france.com

ABSTRACT

RTE has decided to dive into deep monitoring solutions. To do so, a 225 kV underground cable link is going to be equipped with all sorts of monitoring equipment: DTS and DAS (using both embedded and external optical fibers), RTTR, sheath current and PD-measurements. This experimentation is designed to serve two purposes:

- *Identify the benefits and drawbacks of an embedded optical fiber compared to a self-optical cable laid in parallel;*
- *Test a set of sensors and monitoring materials in order to assess their relevance (one from another as well as together), for a better and digitalized maintenance and operation.*

By monitoring all major failure root causes, RTE heads for a smarter asset management strategy.

KEYWORDS

Monitoring; DTS; RTTR; DAS; Embedded optical fiber; Partial Discharge; Sheath current measurement; Asset management.

AUTHOR NAMES & AFFILIATIONS

Nicolas COUTURIER, Mathilde FABRE, RTE (France)
nicolas.couturier@rte-france.com,
mathilde.fabre@rte-france.com

INTRODUCTION

RTE, the French TSO, is willing to accelerate the development of **monitoring solutions**, cornerstone of any good **asset management policy**. Nowadays, this kind of supervision equipment often uses optical fibers, at least for communication purposes but sometimes as a sensor itself. This is the case for DTS and DAS units.

For the past two decades, RTE has systematically laid optical cables in parallel of underground cable links for telecommunication applications. Approximately 10 cm away from the power cables axis and at the edge of the concrete/soil interface (Fig. 1), these fibers are well-located for environment change detection with DTS (maintenance purposes).

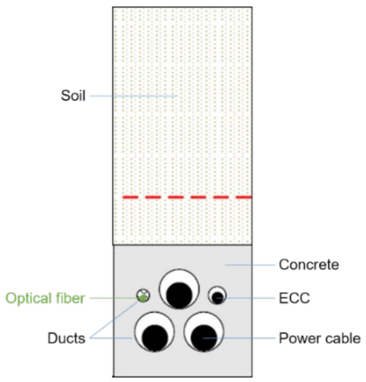

Fig. 1: Typical laying configuration

However, after several experiments, the external optical fiber cable installed according to RTE's standard has been declared too far from power cables to actually capture dynamic temperature changes, and thus hope for an effective RTTR function. This strong assessment is consolidated by the monitoring system of the HVDC interconnector link between Spain and France. The monitored optical fiber is laid in its own duct along the route, except for the 8 km tunnel, where the fiber is **strapped to the power cable**. The graph below (Fig. 2) shows the measured temperature during a power test. For 10 straight hours, the load was flat and at maximal capacity. The temperature rise on the strapped fiber began instantly and stopped as soon as the power went off, for a total increase of 6°C. On the other hand, the 'typical' fiber didn't witness anything.

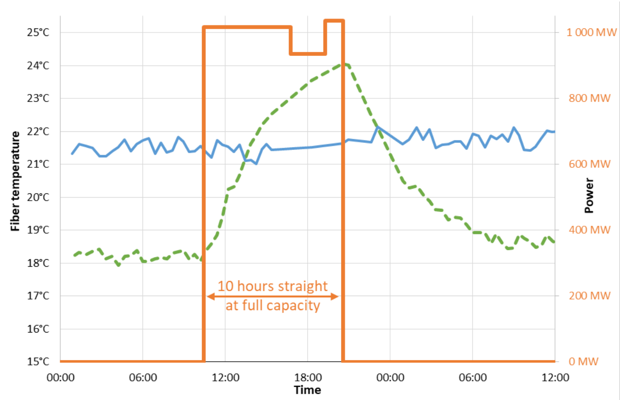

Fig. 2: Temperature measurements of an external fiber (blue straight) and a strapped one (green dash) during a 10 hour full power test

Therefore, for the first time at RTE, a power cable with embedded optical fibers is going to be installed on the grid, along with several health assessment sensors. This live experiment will have two main goals:

- Compare the benefits and drawbacks of the embedded fiber compared to the classical external optical cable (in terms of costs, installation convenience, monitoring performances, etc.);
- Upgrade our asset management policy, from maintenance as well as operating points of view.

CONTEXT

Due to the superposition of an increasing load in the South West part of France with the maximizing need for transfer capacity between Spain and France, the **two 225 kV lines between Argia and Mouguerre** (1 & 2) appear as a major bottleneck. These two links have underground sections of 3 km starting from Argia substation, which are limiting the capacity by 50%. Thus, it has been decided to upgrade the underground sections to match the OHL capacity, by pairing the two existing ones and adding a third underground 2500 mm² (optimized) copper cable (Fig. 3).