Belgian experience with real time temperature system in combination with distributed temperature sensing techniques

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In the late 90's, the Belgian TSO Elia decided to integrate optical fibres in the cable systems of 150kV for temperature monitoring. Up till now these fibres were used for ad-hoc temperature measurements on the cable circuits by means of a mobile distributed temperature system (DTS) system. The goal of this technique was to locate hot spots in the circuit and to verify the ampacity calculations made during the engineering of the circuit. There was no direct need for permanent temperature measurement due to the low load of these cable systems. Meanwhile the situation has changed and several cables are already and will be highly loaded due to decentralized and renewable energy production, especially wind energy production. The load situation in the grid is changing rapidly from a unidirectional to a bidirectional network. At this moment there is a need from operations side to use a permanent real time thermal rating (RTTR) system on the 150kV underground cable link of Koksijde-Slijkens due to the higher and fluctuating load, in order to continuously optimize the load capacity.

Description of the temperature monitoring system

All new HV cable circuits starting from 110kV are equipped with integrated optic fibres (FO) in one phase (figure 1). These FO are located under the outer sheath of the cable. Two different types of FO are used: multimode (MM) FO and single mode (SM) FO. The MM fibres are used for temperature measurements with DTS systems, due to the higher accuracy and the lower spatial resolution. The SM fibres are used for longer ranges, where the MM DTS systems are not capable to measure the complete cable length. For the 150kV cable between Koksijde and Slijkens a DTS system was installed on de SM FO.

Figure 1: HV cable 110kV with integrated F.O.

Dynamic Line Rating

The first fixed RTTR monitoring system will be installed in the 33 km link 150kV Koksijde-Slijkens (type EAXeCeW 87/150kV 1x2000/211) by the end of 2014. This link transports high loads due to the connection of the first offshore wind farms and increasing loads with future connection of Belwind 2 and Northwind. The data of the DTS is transferred over the SCADA network to the control center. The real time input of the actual current and ambient temperature allows to calculate the maximum load in permanent conditions, maximum overload capacity for a given time, maximum time for a given overload,.. With the technique of RTTR Elia has the opportunity to follow up the load of the cable system in real time and have an idea of the maximum instant load and the overload capabilities.

The goal of the paper is to present the experience of Elia with installation of the RTTR system and to explain first insights about the overload capability of the 150kV link of Koksijde-Slijkens by using an RTTR system.