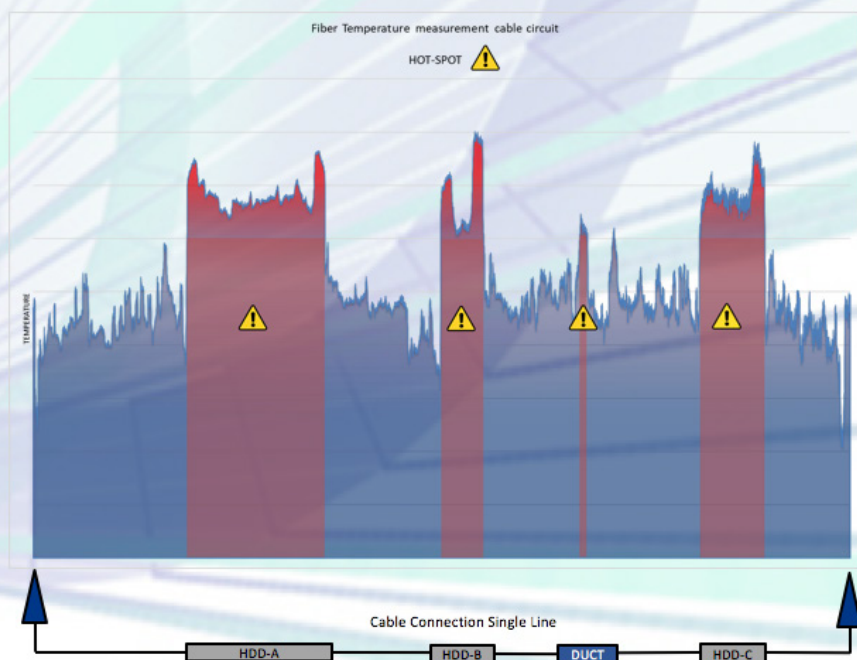


Ensol fiber optic RTTR monitoring systems



Energy Solutions B.V.
High Voltage Engineering & Consultancy

Project Statement

You have a high loaded HV-cable connection operating near its theoretical calculated limitations.

Are you sure that in practice the design assumptions are still correct? Conservative parameters taken in the design calculation can result to a cable rating that is in practice higher than given in the design. On the other hand, over years key parameters might have changed along the cable route resulting in a reduced current rating and increasing the risk of a thermal failure.

By a survey of the cable connection and monitoring cable temperatures along the cable connection or at specific HOT SPOTS this can be verified.

Why Monitoring with Ensol fiber optic RTTR systems?

RTTR = Real Time Thermal Rating

Better knowledge about your network transmission capacity when integrated optical fibers are available.

RTTR = Distributed Temperature Sensing + Dynamic Cable Rating



- To understand network limitations
- Optimize network capacity (Hot-Spot management)
- Postpone/reconsider new investments
- Controlled maintenance programs

web based monitoring system

Process steps towards RTTR monitoring:

- 1) Study of the cable circuit and environment for hotspots;
 - Based on As-Built information
 - Based on Temperature (DTS) monitoring on optical fiber cable
 - Check for any other possible thermal influence
- 2) Define most critical hotspots;
 - Ranking most critical hotspot locations
- 3) Use other temperature sensors as reference;
- 4) Measuring and recording temperatures (real time).
- 5) Recording conductor currents and voltage through SCADA system.
- 6) Calculating (RTTR) and Analysing Cable Ampacities;
 - Actual / Overload situation / Simulations / Forecasting



RTTR = Dynamic Cable Rating

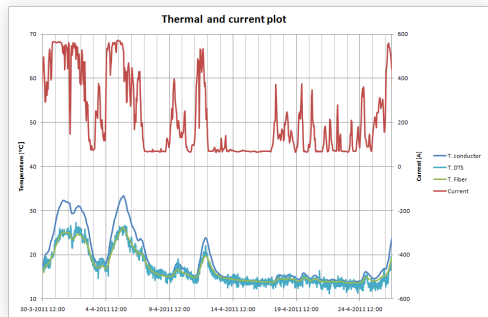
The RTTR calculation software uses the temperatures measured from the optical fibers which are integrated inside or installed close to the high voltage cable. Real time temperature measurements through the optical fibers can be done by using a Distributed Temperature Sensing (DTS) unit. The software continuously monitors the cable environment and calculates the actual rating of the measured cable connection.

Measuring the actual temperature and receiving voltage and current (and more) information through the SCADA system makes it possible to calculate duration and maximum allowed current rating for the cable in service. Also simulation and forecasting of current rating is an option.

Temperature measurements:

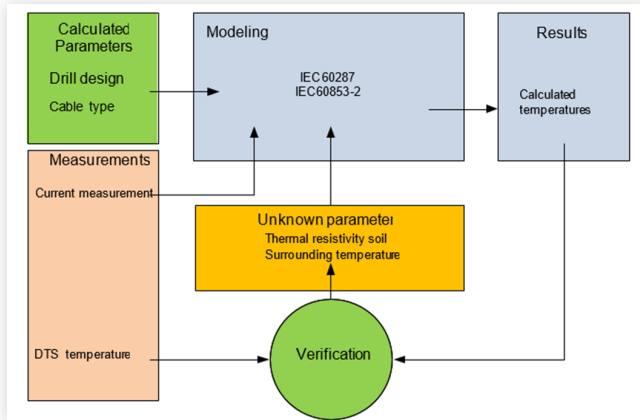


Installation cable system

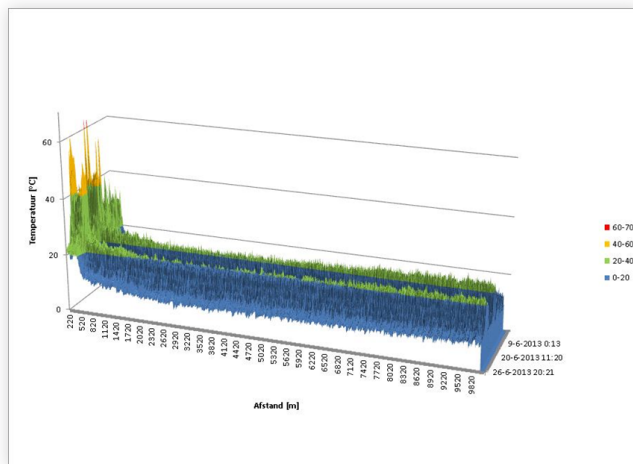


Current and Temperature

Cable Temperature Monitoring System Modelling:



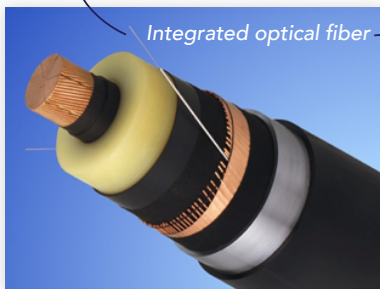
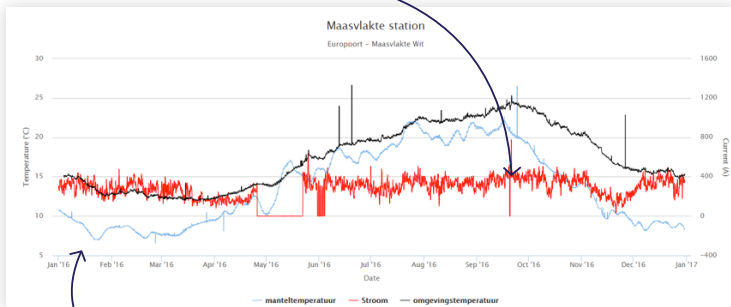
Real time Temperatures in CTMS:



Measurement result from CTMS:



Current measurements



HV-landcable



submarine-cable

Benefits – Key Features:

Proven design

- Over 10 years RTTR experience EnSol
- Over 25 years of cable system design knowledge and expertise available
- Accurate
- Safe
- Total cable length monitored, including cable surroundings
- Offshore as well as onshore cable application

Real time measuring results

- Actual current rating
- Overload calculations
- Simulations / forecasting

Economical monitoring solution

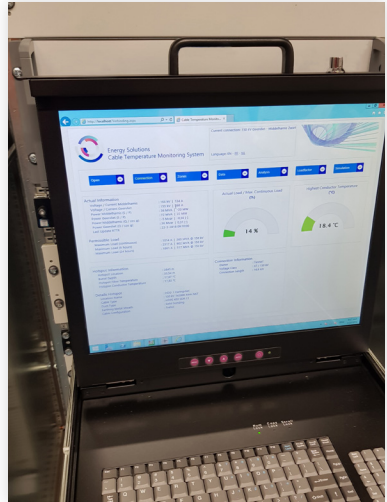
- Modular software design
- Connecting to any type and fabricate of DTS machine
- Single Mode / Multi Mode application

Safe Operation

- No galvanic connections
- 4G/LAN/WAN data transmission

User friendly

- Easy installation
- Web based
- Patches and updates by remote access



References (shortlist)



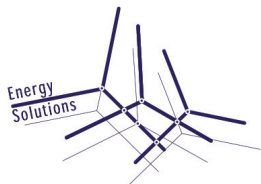
Land cable

(length monitored, approx):

• TenneT R380kV Zuidring	14	km
• TenneT R380kV Noordring	9	km
• TenneT Noordzeekanaal	1	km
• Joulz 150kV Middelharnis	30	km
• RTE PACA	66	km
• Elia Koksijde – Slijkens	32	km
• Elia Blauwe Toren	10	km
• Elia Stevin	9	km
• Tata Steel	2	km

Offshore Windfarms:

• Gemini	95&105	km
• Sandbank (8x)	9–15	km
• Dudgeon (2x)	43	km
• Lubmin 281	94	km
• Nobelwind	11	km
• Northwind	14	km
• Belwind	55	km
• Rentel	40	km
• TenneT Borssele		
Alpha/Beta	62/68	km



Ampèreweg 27
2627 BG Delft
The Netherlands
Tel. +31(0)15-7505460
info@ensol.nl