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	STUDY COMMITTEE D2 INFORMATION SYSTEMS AND TELECOMMUNICATION

2017 Colloquium
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NordBalt fibre optical transmission system

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NordBalt is an HVDC (High Voltage Direct Current) and fibre optical cable connection between Nybro in Sweden and Klaipeda in Lithuania. The total length of this cable connection is 450 km. NordBalt was taken into full operation in spring 2016 with substations and cable systems delivered by ABB. NordBalt is owned 50 % by Svenska Kraftnät in Sweden and 50 % by Litgrid AB in Lithuania.

When Ignalina nuclear power station was closed down in 2009, Lithuania turned from power exporting to power importing country in one night. Since 2010 Lithuania has imported around two thirds of all consumed electricity. The Lithuanian power system was connected to Latvia, Russia and Belarus. The supply of the electricity was restricted to local generation and transmission capacities mainly subject to centralised and Russian controlled power system.

A national power exchange was launched in Lithuania in 2010. Prices of the electrical power became quite high due to a number of reasons: neighbouring countries had little overcapacity, power market was fragmented and lacked liquidity.

The discussion of building a power cable connection between Sweden and Lithuania started in 2007. With a significant support from European Union the decision to build this connection was taken. ABB was selected to deliver both cable systems and HVDC substations after the procurement. The contract was signed in December, 2010.

There was lots of experience from other HVDC projects during the project planning process. SWEPOL link between Sweden and Poland taken in operation in 2000 had problems to rent reliable communications links between substations, therefore the project manager for this project highly recommended to install an optical cable in NordBalt.

It was then decided to install two electrical cables together with one optical fibre cable in NordBalt project.

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Since the distance between substations is 450 km while subsea cable is 400 km, it was impossible to use our standard telecom transmission system. There were two alternatives to solve this problem: One is to have the active equipment for signal regeneration in the sea; the other is to install ROPA (Remote Optically Pumped Amplifier). ROPA is considered to be the most suitable when using low attenuation fibres for a distance between 300 km and 600 km.

Optical cables with active regeneration are deployed in most cases of long distance overseas connections. It requires separate electrical power supply for active regenerators. Active regeneration is also more expensive with quite few fibres in these cables.

The usage of ROPA depends very much on the links' length. Several ROPA can be installed in a standard subsea joint. For NordBalt it was decided to use a fibre optical cable with ROPA.

The optical subsea cable for NordBalt has 48 fibres: 16 pairs with ROPA installed on the receiving side and 16 fibres have the direct connection for future technology.

There is a termination point at Swedish side close to the land fall in order to reduce the optical connections' length. The fibre length in total for the subsea transmission system is 417 km.

Transmission Equipment is delivered by Huawei Marine Networks Co., Ltd. It consists of DWDM system type BWS 1600S with High power Raman-Pumps. Initially the system is equipped for 4 x 10 Gbit/s channels. This can be upgraded to minimum 35 x 10 Gbit/s channels in the system. It should also be possible to install 100 Gbit/s systems on this fibre installation.

Telecommunication system is mainly used for the operation of NordBalt HVDC link.