GAS-INSULATED TRANSMISSION LINES - UNDERGROUND POWER TRANSMISSION ACHIEVING A MAXIMUM OF OPERATIONAL SAFETY AND RELIABILITY

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ABSTRACT

Gas Insulated Transmission Lines (GIL) are a means of bulk electric power transmission at high and extra high voltage. GIL consists of tubular aluminium conductors encased in a metallic tube that is filled with a mixture of Nitrogen and Sulphur Hexafluoride gases for electrical insulation.
Apart from other benefits during construction and operation the GIL design offers also in the event of an internal failure the ability to maintain the arc and its product completely within the enclosure, thus delivering a maximum of safety and reliability during operation which qualifies the system for high end engineering solutions. The particular features are discussed regarding the Limberg II project currently being under execution in Austria.

KEYWORDS

power transmission in hydro power plants; gas insulated lines (GIL); operational, constructional and environmental aspects

INTRODUCTION

Gas Insulated Transmission Lines (GIL) are a means of bulk electric power transmission at high and extra high voltage. GIL consists of tubular aluminium conductors encased in a metallic tube that is filled with a mixture of Nitrogen and Sulphur Hexafluoride gases for electrical insulation. Since the first installation of GIL in 1975, second generation GIL has been developed which is more economically viable and its design was optimized both for installation and operation. Where GIL is installed in combination with Gas Insulated Switchgear (GIS), compact solutions can be delivered. As such GIL can contribute in the mitigation of power flow problems, reduce the risks of failure of electrical transmission systems and enable the installation of optimum solutions regarding technical, economical and environmental aspects.
Due to its modular design, a GIL transmission system can cope with difficult installation requirements as well as it offers further benefits to the service after installation. Amongst other matters such as 30 years nearly maintenance free service, particular attention should be drawn on the operational reliability. Wherever bulk power transmission systems are located in galleries or similar structures or close together, a potential fire hazard is of particular concern. Due to its robust metallic enclosure GIL is significantly less affected by a potential fire compared with other power transmission facilities such as cables. On top of that it offers also in the event of an internal failure the ability to maintain the arc and its product completely within the enclosure, thus delivering a maximum of safety and reliability during operation.
The project Limberg II is mainly an extension of the existing hydro power plant close to Kaprun in Austria. Beside the installation of the power generation equipment this project is characterized by a 400 kV GIS located in the cavern and a Gas Insulated Line which connects the GIS with the overhead line on the top of the transition building. Besides its design inherent advantages the most supporting factors in relation to the use of a GIL were its reliability and safety in terms of an operational fire hazard along with the extremely low magnetic field exposure within the gallery during service. As the gallery route follows an inclination of app. 42°, particular attention is to be drawn on the installation procedure and sequence with consequences for the site logistics. The project is currently at the stage of detailed planning and engineering, commencement of site works for the construction of the GIL is expected in 2010 after completion of the gallery and related civil works.

Figure 1: Photo-mounting of pumped-storage plant project Limberg II