GITL as Solution for Indian High Voltage Overhead Transmission System

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Abstract— GITL technology is used world-wide level for more than 45 years. Basically air insulated substations converted in gas insulated substations also as an overhead line replaced by GITL. GITL as an underground connected line in power plants. In last 45 years of GITL history, it will know for high power transmission capabilities. Firstly in world-wide level GITL installed in Switzerland at Geneva airport and Bangkok, Thailand within substations. Second generation of gas insulated transmission line installed over a long distance as a better alternative of overhead transmission line. In second generation many countries adopted gas insulated transmission line technology like China, Germany etc. This paper discuss with how GITL technology fulfill the future needs of high power transmission in India.

Keywords: component; GITL: GasInsulated Transmission Line, GIS; Gas Insulated Substations

I. INTRODUCTION

As GITL system adopted by worldwide, change the real scenario of high voltage overhead transmission lines. The history of gas insulated system is as: In the South America's Itaipu, A hydropower generated in the Argentina/Uruguay border area is delivered to Brazil over 800 km away [1]. The Itaipu hydropower station went into operation in 1987, with two high-voltage DC systems a total of 6300MW was transmitted to the electric load centre .The operating voltage of 735 kV AC with gas-insulated switchgear [GIS] used inside the dam. USA's Pacific Inter-Tie project which transmits with 3100 MW (in many steps of up-gradation) of DC + 500 V. This is from Oregon's water dams to the metropolitan area of Los Angeles. The total distance of about 1360 km.

A. *Reality at world-wide level*

In Southern China, many DC lines are in operations, over 1000–1500 km into the industrial centres of Shenzhen and Guangzhou in Southeast China. Previously total power of more than 12000 MW is transmitted over several overhead lines. Now a new step in the technology of high-voltage DC power transmission started in 2010, with a higher transmission voltage range of ±800 kV DC. On the other hand as AC voltage, 1100 kV was introduced for long transmission lines voltage level. In China on a 600 km long transmission line in the year 2009. Also the world's first ±800 kV DC converter station is installed in China [2].

II. THE BASIC CHALLENGE

In India also, some long-distance transmission lines have been installed to get electric energy for the large metropolitan areas like Mumbai, Delhi or Kolkata. More high-voltage DC lines are under consideration, and investigations into new 1200 kV AC systems are underway. In China and India, some more long-distance and high-power transmission lines are planned. The main reason is to bring energy from remote areas of regenerative resources (e.g., hydropower dams) to the metropolitan and industrial centres far away [3].

Due to high power transmission the increase of currents, which increase in voltage, cause a second way to increase the power of transmission lines. There are two main problems related to increased in currents: heat and mechanical forces. The heat is produce at rated currents of constant flow, which is the status of normal operation the transmission line system. These currents are the design values for conductor diameters and thickness of wall, and are dimensioning part of the overall transmission system. These currents are also a measure of the cost: the more material, the more cost of the system. The second heat dimensioning comes from the short-circuit ratings, which can have currents of 63 kA, 80 kA or even 100 kA for 1 s or 3 s, depending on the network configuration[4]. These extremely high current values increase the heat mainly in any contact system and may increase the temperature above the limit values. Besides the heat, the electromagnetic forces between the conductors need to be withstood by the design, which may result in costly design measures (e.g., increasing the number of fixing insulators). The current rating of electric transmission networks limits the increase in power transmission. The costs of design might increase strongly, and the technical solution might become uneconomical. The current rating is linked to the dimensioning, which is why with each step to a higher voltage rating the current rating also takes a step up[5].

A. *Talcher-Kolar High voltage DC Line*

The Talcher–Kolar HVDC system, otherwise known as the East–South interconnection II is a 1450 km HVDC transmission connection between the eastern and southern regions in India connecting four states namely Odisha, Andhra Pradesh, Tamil Nadu and Karnataka. The system has a transmission voltage of ±500 kV and was originally put into service in March 2003,[1] with a rated power of 2000 MW. In 2007 the scheme was upgraded to 2500 MW.

B. *Phagi Gas Insulated Substation*

The most awaited project includes end-to-end commissioning of the GIS bays, including substation automation and relay panels. The bays will be an extension to the Rajasthan Rajya Vidyut Prasaran Nigam Ltd's (RRVPNL) existing 765 kV substation at Phagi, which was also commissioned by GE earlier using Air Insulated Switchgear (AIS) technology. The Phagi substation is a part of the transmission scheme that involves implementation of Ajmer - Phagi 765 kV line, along with associated bays, to facilitate the evacuation of renewable energy getting generated in solar parks at Bhadla, Fatehpur and Bikaner to various beneficiaries.

III. CONCLUSION

Once the 765 kV GIS bays are installed at Phagi, the state will be able to evacuate around 1,000 megawatt (MW) of additional renewable energy from these solar plants. This will result in the effective utilization of more green energy by the state and lower reliance on coal as the source of power generation. Rajasthan is a leader in renewable energy among Indian states and is aiming for 37.5 GW of renewable energy generation by 2025. Of this amount, grid-connected solar projects are expected to account for 24 gigawatts; wind for about 4 GW and hybrid sources for the remaining generation.

REFERENCES

[1] Koch H., To solve bottle-necks in the European Transmission Net, IASTED, Benalm´adena, Spain, 06/2005.
[2] Koch H., AC Bulk Power Systems in Metropolitan Areas Application, IEEE/PES T&D Asia Pacific, Dalian, China, 08/2005
[3] Chakir A., Koch H., Gas Insulated Transmission Lines for High Power Transmission over Long Distances, UPDEA, Senegal, 04/99.
[4] Henningsen C.G., Kaul G., Koch H., Sch¨utte A., Plath R., Electrical and Mechanical Long-Time Behaviour of Gas-Insulated Transmission Lines, CIGRE Session 2000, Paris.
[5] Koch H., Gas-Insulated Line (GIL) of the 2nd Generation, IEEE Conference AC/DC Power Transmission, 2001.