A Case Study on Substation Load and Transmission Line Losses in 220kV Receiving Station

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Abstract— The substation is the heart of the power system. Growing demand of power can be fulfilled by establishing new substations. New substation is located near the load centers as far as possible to minimize the line losses. The substation electrical equipment should be in an efficient working condition to derive reliable and efficient operation, optimum utilization, reduced down time, minimizing revenue loss etc. Investigations of failure of equipments and taking preventive and corrective actions to avoid similar failures in future are the key to improvement.

Proper maintenance of substation equipment will ensure long life, trouble- free service and good quality power to the consumers. In this view, this paper gives the details of transmission loss in electrical substation under taken at 220/66KV receiving station, Davanagere.

Keywords— *Power transformer, Transmission line, Feeders, Current transformers, Voltage transformers, Relays, Breakers.*

1 INTRODUCTION

Karnataka Power Transmission Corporation Limited is a registered company under the Companies Act, 1956 was incorporated on 28-7-1999 and is a company wholly owned by the Government of Karnataka with an authorised share capital of Rs. 1000 crores. KPTCL was formed on 1-8-1999 by carving out the Transmission and Distribution functions of the erstwhile Karnataka Electricity Board.

Karnataka Power Transmission Corporation Limited is mainly vested with the functions of Transmission and Distribution of power in the entire State of Karnataka. It operates under a license issued by Karnataka Electricity Regulatory Commission. KPTCL purchases power from Karnataka Power Corporation Limited, which generates and operates major power generating projects in the state consisting of Hydel. Thermal and other sources. KPTCL purchases power from KPC at the rate fixed by the State Govt. from time to time.

The State of Karnataka, with availability of cheap electric power, and other infrastructure facilities, was conducive for increased tempo of industrial activity. It became necessary therefore, to augment power generating capacity by harnessing the entire potential of the Sharavathi Valley. The first unit of 89.1 MW was commissioned in 1964 and completed in 1977.

The generating capacity of the Shivasamudram Power House gradually increased to 42 MW in stages. To meet the increasing demand for power, the Shimsha Generating Station, with an installed capacity of 17.2 M.W, was commissioned in the year 1938. The power demand was ever on the increase, for industries and rural electrification, and additions to generating became imperative. The 1st stage of 48 MW and 2nd stage of 72 MW of the Mahatma Gandhi Hydro-Electric Station were commissioned during 1948 and 1952, respectively.

This paper presents a case study on substation load and transmission line losses in 220kV receiving station.

2 TRANSMISSION LINE

Electricity is a cornerstone on which the economy and the daily lives of our nation's citizens depend. This essential commodity has no substitute. Unlike most commodities, electricity cannot easily be stored, so it must be produced at the same instant it is consumed. The electricity delivery system must be flexible enough, every second of the day and every day of the year, to accommodate the nation's ever changing demand for electricity. There is growing evidence that both private and public action are urgently needed to ensure our transmission system will continue to meet the nation's needs for reliable and affordable electricity in the 21st century.

TABLE 1: Consumption of 220kV Line

Name of the lines		220KV Lines Present reading	Previous reading	Consumption export	Consumption import
G3 K*1600	import	857334	856101	0	1972800
	export	5035	5035	0	0
G2 K*1600	import	678699	677991	0	1132800
	export	419901	419901	0	0
G1 K*1600	import	901625	900180	0	2310400
	export	4795	4795	0	0
S2 K*1600 000	import	300.25	299.11	0	1888000
	export	7.69	7.67	32000	0
S1 K*1600	import	65463	65463	0	0
	export	843676	842218	2332800	0
			Total Net Energy	4220800	5448000

TABLE 2: Consumption of 66kV Line

Name of the lines K*240		66kv line Present reading	Previous reading	Consumption export	Consumption import
Sokke	export	159584	158210	322560	0
	import	358965	358965	0	0
Industrial	export	666438	665879	134160	0
	import	0	0	0	0
Davangere	export	703417	702213	288960	0
	import	0	0	0	0
Chitradurga1	export	869650	868875	187920	0
	import	120101	120101	0	0
Chitradurga2	export	728049	727734	75600	0
	import	379747	378711	0	248640
Harihar Hospet	export	447388	446367	245040	0
	import	0	0	0	0
Shimoga	export	292173	292102	17040	0
	import	435839	435308	0	127440
Harapanali	export	66465	66383	19680	
	import	160576	160247	0	78960
			Total net energy	1493760	455040

3 RESULTS AND DISCUSSIONS

Total import energy of 220kv line is 5.9034mu and total export energy of 66kv line is 5.71456mu. Finally percentage loss of transmission line within the substation is calculated using formula

$$\text{Percentage loss} = \frac{\text{import energy} - \text{export energy}}{\text{import energy}}$$

The total transmission losses of 220/66kv line are 3.19%. Station consumption and load per day for a month of July 2010 is shown below:

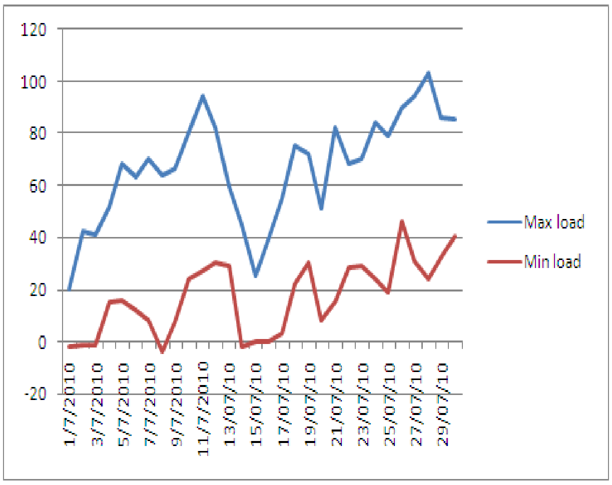

Fig. 1: Load(MW) versus Month (July)

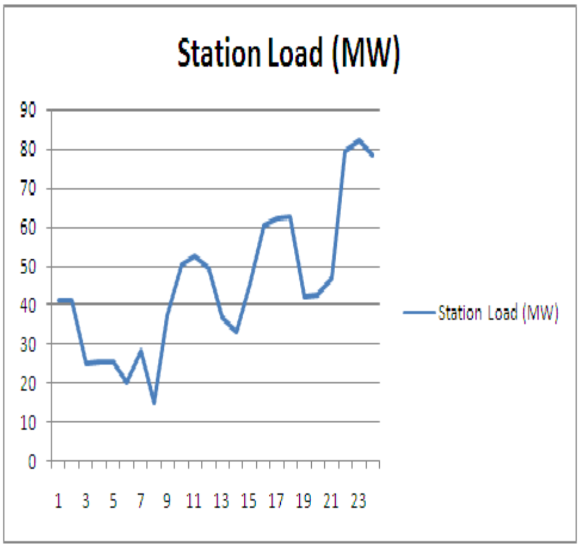

Fig. 2: Load (MW) versus Time (Hours)

4 CONCLUSION

The power system establishing the substations near load centers makes it possible to supply quality and reliable power by the utilities at competitive prices by minimizing losses in the initial cost of transmission and distribution network.

The following aspects play a vital role in providing reliable and quality power to the consumers by the substations:

1. Establishing substations near the load center makes it possible to supply quality and reliable power by the utilities competitive prices by minimizing losses in transmission and distribution.
2. Proper design of substation and by the use of efficient equipment provides a high level of service continuity

and flexibility of operation reducing the cost of operation and maintenance.

3. Planned maintenance schedule keeps the substation equipments in proper condition to provide efficient operation with reduced down time.
4. Selection of site plays a very important role in construction of substation.

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REFERENCES

[1] Ying Xiao, Y. H. Song, Y. Z. Sun, "Power Flow Control Approach to Power Systems With Embedded FACTS Devices", *IEEE Transactions on Power Systems,* Vol. 17, No. 4, November 2002.

[2] John J. Paserba, Fellow, "How FACTS Controllers Benefit AC Transmission Systems".

[3] D. J. Gotham and G. T. Heydt, "Power flow control and power flow studies for systems with FACTS devices," *IEEE Trans. Power Syst.*, vol. 13, pp. 60–65, Feb. 1998.

[4] M. Noroozian and G. Andersson, "Power flow control by use of controllable series components," *IEEE Trans. Power Delivery*, vol. 8, pp. 1420–1429, July 1993.

[5] L. Gyugyi, C.D.Schauder, K.K.Sen "Static Synchronous Series Compensator: A Solid-State Approach to the Series Compensation of Transmission Lines". WM120-6 PWRD, IEEE PES Winter Meeting. 1996.

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