

Chapter 23

Transmission Line Routing Using Open Source Software Q-GIS

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ABSTRACT

This article contends that planning for power systems is essentially a projection of how the system should grow over a specific period of time, given certain assumptions and judgments about the future load and the size of investment in generating capacity additions, transmission facilities expansion and reinforcements. Transmission line routing is one of the most important strategic decision-making problems for both private and public sectors. The major objective of a utility is to supply demand for power with a good quality of service, through proper planning of the system. This has led to development of methods which can be used to aid the decision-making process for selecting the best alternative. Geographical Information System (GIS)-based electricity transmission system planning strategies are proposed in this article to determine an optimum routing of feeders. Existing and proposed layouts have been drawn using a GIS-based software, Quantum Geographic Information System (Q-GIS). The developed system is based on the routing of transmission lines from Barh thermal power plant situated in Bihar, India.

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1. INTRODUCTION

Due to the large amount of power involved, transmission normally takes place at high voltage (1150 kV, 750kV, 420 kV, 220 kV and 110 kV). Electricity is usually transmitted over long distances through overhead power transmission lines. Underground power transmission is used only in densely populated areas due to its high cost of installation and maintenance, and because the high reactive power, it produces large charging currents and difficulties in voltage management. A power transmission system is sometimes referred to colloquially as a “grid”; however, for reasons of economy, the network is not a mathematical grid. Redundant paths and lines are provided so that power can be routed from any power plant to any load center through a variety of routes, based on the economics of the transmission path and the cost of power. Much analysis is performed by transmission companies to determine the maximum reliable capacity of each line, which, due to system stability considerations, may be less than the physical or thermal limit of the line. Deregulation of electricity companies in many countries has led to renewed interest in reliable, economic designs of transmission networks.

One of the primary contributions to the advancement and improvement in man’s life style over the years has been the ability to use and control energy. The socio-economic and technological development of any nation and the society is largely dependent on the supply of electricity. It is one of the most important basic needs for the smooth, meaningful and productive economic life of any nation, as the growth of the economy of nations largely depend on the effective management and control of the available generated power, effective maintenance of the equipment and efficient generation of power to meet the growing demand for electricity supply. The use of electricity as a tool for socio-economic development of the nation cannot be overemphasized. Hence, there is a need to keep a comprehensive and accurate inventory of their physical assets, spatial location, both as part of normal service provision, extending the network and undertaking maintenance by the use of geospatial technique, Geographic Information System (GIS). GIS as an emerging technology is a software application, used to create and display cartographic information. In practice, however, GIS consists of five Components: software, data, procedures, hardware, and people. These five components work together to capture, store, retrieve, analyze, and display geographically referenced information. It has an added capability to analyze spatial data, through attribute and location analysis or spatial modeling. Complexity of electrical transmission power system is only a reason for introducing new technologies, GIS is shown as a useful tool for power transmission in this paper

The proposed methodology will help power system planners to make a complete solution of planning problems by finding optimum route to replace the existing route of transmission line from Barh thermal power plant to sub-station. The method proposed can replace the traditional way of planning by mathematical calculations. Use of GIS will help to consider all the geographic impacts.

GIS software use in power transmission system planning will give planners a new and efficient way of planning and implementation of the developed model. The method will reduce man-machine effort.

GIS can be proposed and implemented in diverse field of engineering. This planning method can also help civil engineers for construction of road, bridges etc.

This article has been organized as follows: Section-2 surveys the related work in the area. Section 3 provides the background on Q-GIS. Section 4 proposes the case study and results obtained. Section 5 highlights conclusion and future work.

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