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Role of Geographical Information System (GIS) In Power Distribution In India

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ABSTRACT

GIS information/data is most adoptable, accurate and user-friendly to meet general requirements of operations and other software applications. Using main GIS application, other GIS based applications can be easily developed to meet specific requirements of users. Such systems are essential in Utility (Water, Electric, Gas), Local Government Authorities, Defense Services, Aviation, Roads, Transportation Services, Space, Mining and any multi-location business operations requirements. These utilities are managed under various GIS based domains like Utility GIS, Municipal GIS.

Keywords: Geographical Information System, GIS, Power Distribution

I. INTRODUCTION

Geographical Information System (GIS) combines location data with both quantitative and qualitative information about the location, allowing you to visualize, analyze, and report information through maps and charts. Using the technology, you can answer questions, conduct what-if scenarios, and visualize results. **GIS** is identified as a system used to manage infrastructure assets, natural resources and any objects as per requirement. It is easier to analyze and manage facility and asset data stored in GIS, making design, construction, and maintenance more efficient and profitable.

GIS is a software based system which facilitates end to end information of assets or any type of objects as required by end user on maps having desired accuracy in raster and vector forms. GIS aids geographical location, parent child relationship, unique identification, attributes, technical parameters, 2D/3D view and any other requirement customized. GIS information/data is most adoptable, accurate and user-friendly to meet general requirements of operations and other **software applications**. Using main **GIS application**, other GIS based applications can be easily developed to meet specific requirements of users. Such systems are essential in Utility (Water, Electric, Gas), Local Government Authorities, Defense Services, Aviation, Roads, Transportation Services, Space, Mining and any multi-location business operations requirements. These utilities are managed under various GIS based domains like **Utility GIS**, Municipal GIS.

Being a Distribution Company for South Mumbai (Mumbai HUB) BEST may adopt GIS practices to take advantages of GIS based application to enhance performance of operations and to maintain accuracy of data and subsequently derived parameters for Business Intelligence. GIS provides functionalities to easily author data, maps, globes, and models on the desktop and serve them out for use on a desktop, in a browser, or in the field via mobile devices, depending on the needs of the organization. Further it gives tools for building own applications for the users.

The Brihanmumbai Electric Supply and Transport Undertaking (BEST) is an enterprise of Brihanmumbai Mahanagar palika and is in the business of distributing electricity to consumers in the old city limits and also for providing public road transport (Bus transport) in

the entire city limits as well as in some adjoining areas of Mumbai city. BEST distributes electricity from Colaba in South Mumbai to Sion/Mahim in the North. The erstwhile Bombay Electric Supply & Tramways Company started supplying electricity to the Bombay city in 1905. Until 1926, the BEST had been generating its own electricity for distribution to its consumers. Later, the BEST started purchasing electricity from M/s Tata Electric Company (now Tata Power).In 1947 the Company was municipalised and came to be known as Bombay Electric Supply and Transport Undertaking, which was later changed to Brihanmumbai Electric Supply and Transport Undertaking (BEST).

The Undertaking is now well known in India for providing cost effective electricity with minimum interruptions and at stable voltage. BEST is well appreciated for the quick restoration of supply in the event of any faults developing in the distribution system. BEST also designs and executes schemes for provision and improvement of street lights in the distribution licensee area on behalf of Municipal Corporation of Greater Mumbai (MCGM) to enhance safety of road users by providing uninterrupted street lighting while also ensuring energy conservation. BEST also provides temporary street lighting during festivals on behalf of MCGM.

II. SCOPE

In order to provide the best energy solutions and to maintain the electricity distribution network in a systematic way that includes optimizing the planning process to provide best of the services to its customers, B.E.S.T has undertaken this project to implement state-of-the-art Automated Mapping/Facilities Management /Geographical Information System (AM / FM / GIS) in its Drawing Office of Network Planning department. For this to be implemented a complete network analysis was performed.

Digitization of 800 block plans which includes land base along with electric network, Scanning & attaching of associated extension sketches, site plans, layout plans, service sketches as mentioned design/data entry in order to create efficient AM/FM/GIS system, for activities of Drawing office. AM / FM /GIS Software shall automate the present activities of Drawing Office and of Planning (Network) Department.

III. OBJECTIVE

- Services for Digitization, conversion of 800 Block plans & creating a seamless digital map for BEST operational area.
- Scanning and hyperlinking only of existing Extension Sketches, Service Cards, Site Plans (S/Pl), Layout Plans (L/Pl), Substation Details, Receiving Substation Drawings, Route Plans (R/Pl), Earthing Plate Drawings (E/Pl), S/PRO, E/PRO, L/PRO, Radial Diagrams. (HV), Load Sheets to corresponding features in the 800 block plans as per the quantities.
- Digitization of Street Lighting Plans and creation of suitable database.
- Digitization of Key plan by placing a linear road network. This will be done during digitization so as to facilitate the embedding of the key plan on S/PL and M/PL. BEST will have to take a snap shot of the required area from the main database and to embed it on the S/PL and M/PL prepared by them in VISIO.
- Digitization of the HV Radial diagrams (4nos) and LV Load sheets (600nos of the 2006 year) and linking of the database.

IV. WHY GIS IN POWER SECTOR

1. Visualization Tool- A conceptual model of a GIS provides a useful way to visualize both physical & electrical layer in a single screen registered together to

a common base map or geographic area. Each layer typically contains one type of data only.

2. Flexibility In Analysis - With GIS, one can easily manipulate and carry out different task related to power system planning & management of electricity with efficient results. Such as planning or updating a new distribution network.

3. When new facilities are installed, GIS database can be updated easily to accommodate new features.

4. Thus map revision and digital mapping become easy in GIS Environment.

5. It is useful in planning a routine maintenance.

6. Customers" enquiries can be handled easily.

7. Sharing of data among different users like Urban Planners, Construction Managers, Civil Engineers is also possible

8. Ready-to-use tools.

V. METHOD USED

- G/technology is a multidimensional solution, providing powerful tools to support the facilities asset/configration management needs of the electric transmission and distribution industries.
- G/technology comes with significant out of the box functionality and is ready to be implemented via a fast track approach in order to reduce the costs and time frame typically associated with delivery and deployment of such systems.
- G/technology provides the capability to link many of the critical work flow processes into an integrated information environment,reducing the cost of designing, operating and maintaining the assets of BEST and deliver energy to customers.

VI. APPLICATION IN POWER SECTOR

- Database management.
- GIS based Electrical network mapping.
- Optimum feeder path.
- GIS based Consumer database indexing.

Metering, Billing & Collection Efficiency.

- Selection of optimal conductors.
- Energy audit and accounting practices.
- Load Flow analysis.
- Supervisory control & Data acquisition (SCADA).
- System & Distribution Automation.
- Maintenance management System.
- Management Information System.
- Load forecasting and load planning
- Inventory control.

VII. BENEFITS

With the help of GIS services like Automated Mapping / Facilities Management /Geographical Information System (AM / FM / GIS) BEST was able to successfully complete the Digitization of 800 block plans for its Drawing Office of Network Planning department.

VIII. GEOSPATIAL TECHNOLOGIES FOR POWER SECTOR

Geospatial technology has wide applications in all utility sectors, including electricity. For an electricity company, the cost of maintaining its most important assets – transmission and distribution facilities – represents a huge portion of its annual operating budgets. Geospatial technology simplifies records management for these key assets of a utility company, thus leading to a decrease in operational costs. Linking the customer and asset data to a geographic location on a map allows the service providers to look at the bigger picture and thus makes for a powerful decision-making tool.

Besides, the ability of GIS to integrate with other software like ERP or SCADA in an organization makes it an easy to use tool for every utility organization. GIS plays a significant role in power generation, transmission and distribution. GIS is an

effective tool that can bind together the various pieces of an electricity distribution system and thus ensure better asset management, improved customer service, improved outage management and more accurate data. The DMS system from SCADA gives the information on which transformer is off in case of a tripping. Another major advantage is asset management, which can give a reality check of things at ground level.

A smart grid is a computerised electric utility grid, which entails adding two-way digital communication technology to various devices in a grid. Each individual device in the grid is fitted with sensors to gather various types of data such as power consumption, voltage, fault detection etc. Another feature is the two way communication that takes place between the field device and the utility's operations centre. Integration of GIS with other available software can also enhance the efficiency of the distribution system. Integration with SCADA (Supervisory Control and Data Acquisition), ERP (Enterprise Resource Planning) and SAP (System Application & Products) can provide real-time data from these systems on a geographical view of the electrical network. Both SCADA and GIS are key operational tools in electricity distribution, and integration between the two results in increased efficiency.

For Tata Power Delhi Distribution, successful software integration has resulted in improved operational efficiency. Arup Ghosh, Senior Advisor, Tata Power DDL says, "All our assets, including the distribution and transmission networks, are on GIS. Further, the GIS is integrated with our ERP and SCADA, which means that the entire asset management cycle, from planning for and implementing the assets at site to maintaining and finally retiring the assets, is supported by our GIS." He adds, "We do find value in GIS, there are 18+ lakh assets of Tata Power DDL on field. GIS helps us track of our assets." Another step in addressing the revenue challenges is Smart Meter. Smart Metering is still at a nascent stage in India, where it is being tested and implemented by only a few utilities equipped with technology and deep pockets to do so. However, it provides a sea of possibilities in streamlining and advancing energy infrastructure. Tata Power is the first Indian power utility to launch the Automated Demand Response (ADR) project with smart meters in Delhi. It is one of the first projects in the world where ADR and AMI (Advanced Metering Infrastructure for Smart Meters) are conceptualized together. The project is implemented in partnership with IBM, Honeywell, Landis+Gyr with participation of select industrial and commercial consumers of Tata Power Delhi Distribution; and has been rolled out post the approval of the Delhi Electricity Regulatory Commission (DERC). This was a pilot project and soon the company is planning to pilot it in West Bengal and Maharashtra.

As a stepping stone towards implementing smart grid practices for power distribution utilities, Tata Power Delhi Distribution (TPDDL) has launched a 'Smart Grid Lab' for demonstration of various foundational and advanced operational technologies, information technologies and benefits derived by convergence of information and operational technologies. The focus will be towards hands-on demonstration of new technologies, products and operations for different organisations and institutions including utilities. In the smart grid lab, visitors can see various smart technologies that have been implemented in the field by TPDDL. The smart grid journey starts with the advanced distribution management system (ADMS) and represents one of its kind implementation in India. ADMS would replace the conventional SCADA-DMS-OMS with features like integration of smart meter data/distributed generation integration and single data model from GIS.

Although geospatial technology has been implemented by a large number of utility companies

across the globe, there are a number of challenges that hinder the further growth and usage of this technology. Arup Ghosh cites mapping the assets and keeping the asset register up to date is another hurdle that needs urgent attention. “Mapping the assets was a major challenge. Our first challenge was to get suitable land based maps and to turn them into vector maps. Another challenge was to fully map all the assets, which required us to find those assets, correlate those with paper records and then mapping that effectively in GIS,” says Ghosh. The next challenge is to keep the asset register updated. “People tend to replace assets on site or take those out for repairs. Keeping track of all of that on a real time basis is a big challenge,” he adds. He also pinpointed government’s role, “The authorities need to see that the data is re-engineered and is non-isolated.

IX. CONCLUSION

1. Better customer services
2. Reduction of technical losses
3. Energy audit and accounting
4. Trouble call management
5. Real time operation of distribution network
6. Better revenue protection
7. Long term distribution planning etc.

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