Case Study

Optimal Power Line Route Generation with GIS

India is witnessing a drastic change in the pattern of electricity transmission, mainly due to the shift towards renewables. With these changes in place, the transmission projects are facing the pressure of quicker completions with no compromises on quality. Using GIS, the power utility sector is able to achieve the desired outcomes, while gaining higher ROI in the projects.

Project Summary

A key trend in the power sector today is the revision of the time schedule for the development of transmission projects. Due to the shorter gestation periods of renewable energy projects, the time schedule has been reduced from 36 months to 18 months. This is expected to be reduced further in times to come. Accordingly, power infrastructure companies need to expedite the development of transmission projects to evacuate power from renewable energy projects.

Sterlite Power, which is a leading global developer of power transmission infrastructure with about spanning more than 13,700 circuit kms in India and Brazil, recognized this need. To maintain its track record of commissioning power transmission projects ahead of schedule, addressing the key constraints of time and cost, Sterlite Power collaborated with Esri India to develop a first-of-its-kind integrated GIS Ecosystem for powerline route planning and finalization. The solution that emerged through this collaboration is helping the company not only achieve higher accuracy but also save significant time and cost.

Key Benefits with GIS Integration

- 1-2% Cost Impact
- ~ 23 crores savings for a 1000 km 756 kv line
- 50% lesser time in route finalization (from 60 to 30 days)
- 95%+ accuracy in route generation
- High data confidentiality: Enterprise Grade secure and multi-tenant platform
- 100% reduction in competitive threat
- 100% improvement in reliability of field survey results

What Triggered the Initiative? The Challenges

The process of power line route finalization consists of two stages, namely, route generation and in-field route survey. The manual methods of carrying out these activities, which were earlier followed by Sterlite Power, led to delays and inaccuracy due to information gaps. The major problems that the manual systems caused were as follows:

1. **Delayed Route Generation:** The manual route generation methodology used by Sterlite Power required the survey team to perform an in-field survey and collect relevant data on forests, roads, railways, existing transmission lines, etc. from multiple sources. This was a time-consuming activity. As the desktop route generation process could happen only after this collected data was combed manually, the route generation process was often delayed, leading to huge costs.
2. **Lack of Data Security and Confidentiality:** Sterlite Power bids, designs, constructs, owns and operates power transmission assets across multiple geographies. All bid-related data is highly confidential and the lack of proper access and usage controls posed a major risk to the business. Automated versioning concepts and controls were required to simplify the process for the user and maintain data sanctity.
3. **Poor Connectivity in Remote Areas:** In areas with poor or negligible network coverage, the conventional applications did not work effectively due to a lack of offline-mode support.
4. **Non-Availability of Data:** The manual systems could not provide historical field survey and associated studies data (soil/hydrology, etc.). This affected the bids.

Considering these limitations, Sterlite Power realized the need to have a more robust digital approach to route finalization and survey. In collaboration with Esri India, A huge transformation from the conventional manual survey methodology was brought, and an integrated GIS ecosystem was established. TransAnalyst + CanvasR is a first-of-its-kind integrated GIS ecosystem for route planning and finalization in India.

Solution

The route generation process has been automated via the TransAnalyst Platform and the in-field route survey is executed using the infield CanvasR app.

TransAnalyst helps Sterlite Power to plan multiple route options between two substations in a few minutes by changing the weights of different layers. It reduces 2-3 days' effort for creating any one route option, and also allows modification of the route based on real-time survey feedback. The user can also analyze the BoM/BoQ of different route options by using its CAPEX model where the tool calculates Steel Tonnage, Conductor cost, RoW (Right of Way) cost in terms of land, crop, trees, etc. and identify the best route option for bidding.

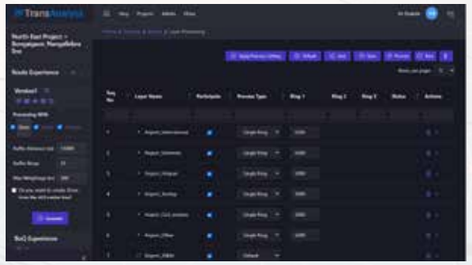

Figure 1: Configure data layers and its weightages

Sterlite Power created a Central GIS Database which acts as an intelligence platform with diverse datasets having 30+ data layers e.g., roads, railways, transmission lines, forests, water bodies, location boundaries, soil data, climate, terrain data, etc. These data layers are consistently updated.

The platform is integrated with a mobility app used to allocate and execute field surveys for transmission routes in a real-time manner for the back office to consume survey data instantly, give feedback to survey teams, adjust the routes where required, and create a fully optimized transmission line route to be consumed in the bid process.

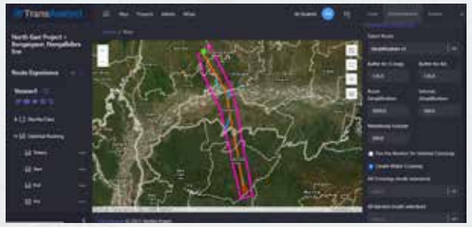

Figure 2: Generate multiple route options

Benefits

Higher ROI, significant savings in time in completion of projects, higher accuracy of data, reduced field visits, and real-time updates – the benefits of the solution have been many.

1. **Improved Data Accuracy:** The routes generated by TransAnalyst are based completely on pre-approved data. This, coupled with a lesser number of iterations, gives over 95% accuracy in route generation.
2. **Higher Revenue:** The new automated process significantly improves the confidence level in the data and impacts the ROI of the project positively. The company is looking at savings of about INR 23 crores in a 1,000 km project.
3. **Near Real-Time Data Capture:** From survey to route generation and feasibility reporting, automation and digitization have led to in-sync, real-time operation. With CanvasR, the surveyors are now able to provide real-time inputs through mobile apps which get updated in desktop systems in the office in real-time. This reduces the risk of continued visits to the field and thus leads to huge savings in terms of time and cost.

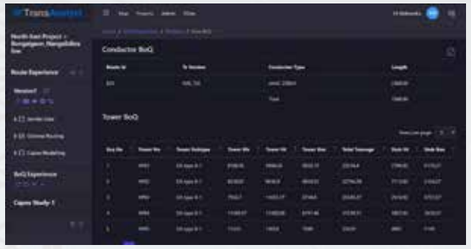

Figure 3: Tower and Conductor BoQ report

4. **Lesser Time Spent in Projects:** The solution for route generation not only delivers an accurate route but also does that in less than one hour for a 200 km route while adhering to all the business rules. Earlier this used to take 3-4 days. The process of data generation also now takes a maximum of 1-2 hours, which used to take 6-8 days earlier. Overall, the integrated GIS ecosystem allows Sterlite Power to save on an average 2-4 months in a project. By reducing the number of survey iterations, the solution is helping it to directly achieve more than 50% time reduction in route finalization.
5. **High Level of Data Security:** TransAnalyst and CanvasR are extensively integrated systems. As a result, data flows seamlessly between the two apps and stays within the ecosystem. This directly eliminates the need to export the data out of this secured ecosystem - ensuring a high level of data security and confidentiality. Moreover, since data stays within a secured ecosystem, team members can access the survey data during any phase of the project. This is unlike the existing industry prevalent system, wherein, access to data is prohibited after a specific tenure.
6. **Offline Work Mode:** In areas with poor or negligible network coverage, the conventional applications do not work effectively due to a lack of offline mode support. With offline-mode support, CanvasR enables data syncing seamlessly and accurately irrespective of the network connectivity. The maps along with the route data are downloaded and saved locally on the surveyor's device. This data is automatically accessed and presented on the app's map screen in case of poor or no network. This facility ensures that the team is able to carry out their work irrespective of the network connectivity status and required information is captured and synced once a reliable network connectivity is established.

Organizational Profile

Sterlite Power is a leading private sector power transmission infrastructure developer and solutions provider with projects covering approximately 13,700 circuit kms of transmission lines across India and Brazil. The company has a portfolio of high-performance power conductors, extra high voltage (EHV) cables, and optical ground wires (OPGW). The company provides bespoke solutions for the upgrade, uprate and fiberization of existing transmission infrastructure projects. It was the sponsor of IndiGrid, India's first power sector InvIT, listed on Bombay Stock Exchange Limited and National Stock Exchange of India Limited. The company was also recognized at The Economic Times Innovation Awards 2020 and is a recipient of awards from the International Project Management Association (IPMA).

"The solution has been helping us gain a significant advantage in winning bids and delivering unmatched outcomes in powerline route finalization projects. With Trans Analyst + CanvasR, the route optimization process takes not more than 3-4 days while providing better accuracy using continuous feed from the field. With these tools in place, we are looking at about 1-2% savings in costs in each project. The reason we chose Esri India as a partner for establishing this GIS ecosystem for powerline route optimization is due to the extensive support the company provides. The availability of resources, flexibility and the in-depth knowledge base are other factors that made the choice easier."

- Trilok Chouhan, AVP, GIS, Corporate IT, Sterlite Power