

## SUMMARY

### **Optimizing Load Distribution in Power Transmission Networks through Demographic and Geographical Analysis**

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Power distribution network optimization focuses on improving the efficiency and reliability of electricity delivery systems. It involves strategic load redistribution and the establishment of new network nodes to balance demand across high and low-population areas, ensuring stable and efficient energy distribution.

In power distribution, optimizing network efficiency is critical due to the varying demand across different geographic areas and the need to minimize energy losses and costs. Old transmission systems often need help with load imbalances, where highly populated areas are overloaded. At the same time, less populated regions have underutilized capacity. Advances in innovative grid technologies and data analytics now enable more dynamic load management and infrastructure planning, leading to more effective redistribution of electrical loads and the strategic placement of new distribution nodes.

The primary objective of our project is to investigate the impact of population distribution on the stability and load distribution of the power network in Odisha, India, focusing on identifying strategies to mitigate load imbalances and improve overall network resilience.

By analyzing Odisha's population distribution and load patterns, we show that we can identify nodes with high population weight that experience significant load demands and propose strategic interventions such as optimal node placement and load-sharing mechanisms to enhance network efficiency and reliability.

Our study on this project shows that geographical closeness to distribute power only partially addresses today's complex power needs. In Odisha, strategically placing new nodes and adjusting loads based on population can significantly improve network stability and efficiency, moving beyond older methods that manage population factors.

These results can help improve power distribution worldwide, particularly in fast-growing areas. By using population information in network planning, power plants can build more reliable and flexible systems, leading to fewer power outages and better service for all kinds of communities.