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Impact Study on Nelamangala to Peenya High Power Transmission Line

JULY,2024

NELAMANGALA TO PEENYA HIGH POWER TRANSMISSION LINE SURVEY AND RESEARCH PROJECT

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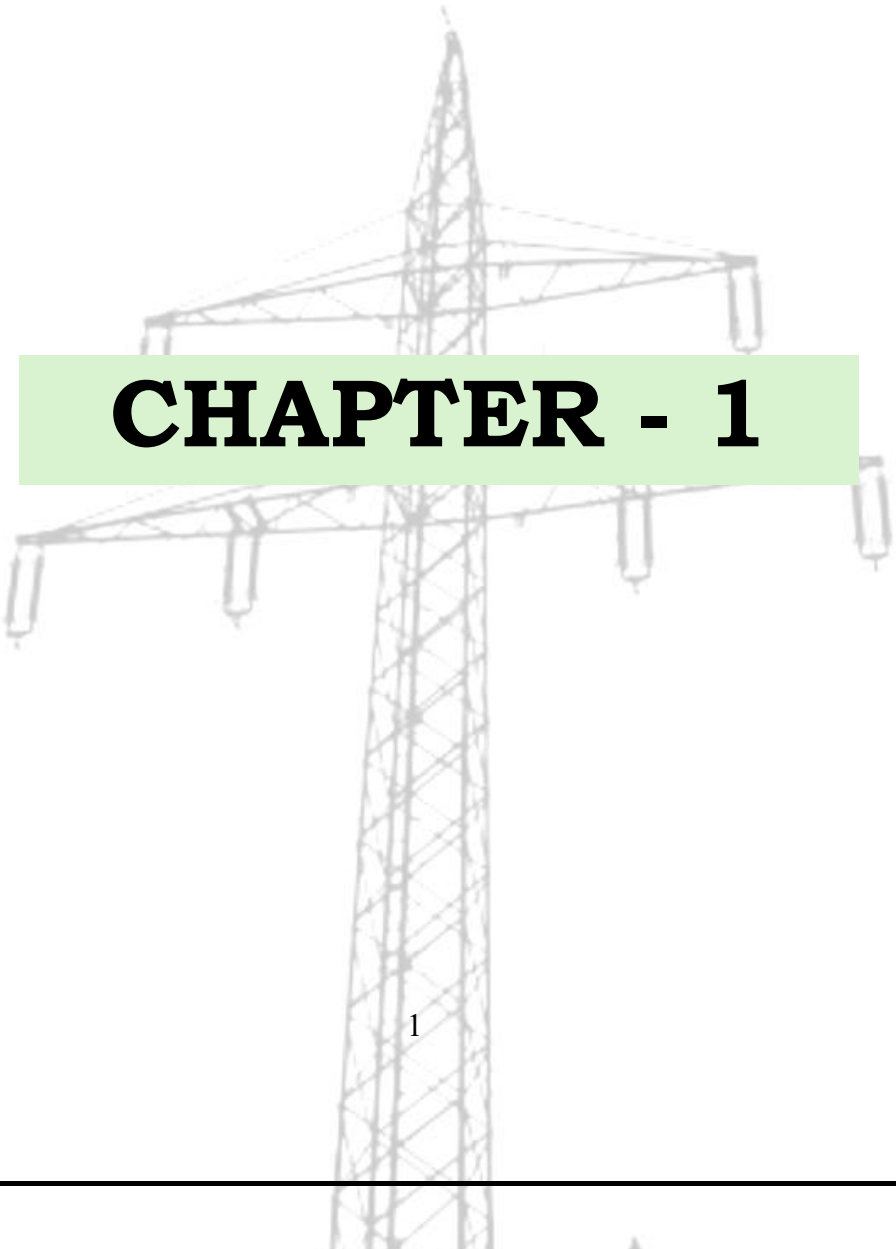


CHAPTER - 1

THE ELECTRIC TRANSMISSION LINES BETWEEN NELAMANGALA TO PEENYA

The instant issue relates to the three transmission lines that are installed between Nelamangala to Peenya and are connected with the electric substation in Peenya. The details of the three transmission lines are as follows.

1. SBT (Sharavati Brindavan Transmission) Line - 110KV
2. B1B2 Line - 220KV
3. P1P2 Line - 220KV

The SBT line is the oldest transmission line that was installed back in 1962 for the transmission of electricity from the Shravati hydroelectric power station to Peenya substation. This line has a power transmission capacity of 110KV. This transmission on line became idle in 2002 and has been idle since then. It was also told to the villagers that this line would be dismantled. However, the dismantling process never began.

Additionally, the B1B2 and the P1P2 lines are of higher power capacity when compared to the SBT line. Each of these two lines are of 220 KV power transmission capacity. These two lines were

later installed considering the increase in the power demand in the city and are currently active.

Recently in 2021, a gazette notification was issued notifying the upgradation project of the aforementioned three lines by the Karnataka Power Transmission Corporation Limited (KPTCL). Under this project, the SBT line would be upgraded to a capacity of 220KV from existing 110 KV while the each of the other two lines would be upgraded to 400KV from existing 220 KV capacity.

The SBT line which was idle since 2002 is now being attempted to reactivate after its upgradation to 220 KV. It has to be noted that the licence of this SBT line has also not been renewed from the Karnataka Electricity Regulatory Commission (KERC) which is a mandatory requisite for transmission of electricity.

The status quo of the project is that although the project commenced are there were initial works that were carried out, a stay order was obtained against the project which led to the temporary halting of the project.

The main issue in the current upgradation project is the lack of consultation and dialogue with the habitants of the villages through which these lines pass through. There are also several

irregularities in the said project which shall be discussed in detail in this report.

HISTORY OF ELECTRICITY IN KARNATAKA

Electricity is one of the basic necessities of human life and plays an important role in everyday activities. The production, procurement and transmission of electricity across India takes place through various regulatory bodies and corporations all of which are connected with a National Grid.

The production, procurement and transmission of electricity in Karnataka, like other states in India, is also managed and regulated by various bodies and corporations. There is a brief and intriguing history of electricity production and transmission in Karnataka, more specifically in Bangalore which must be taken note of.

The electricity in Bangalore does not include local production sources due to the lack of necessary resources such as dams, falls, thermal power stations etc. The electricity that is consumed in Bangalore is obtained from other parts of the state and mainly from the Sharavti and Shivanasamudra hydroelectric power station, Raichur thermal power station other Thermal and hydel stations. A brief history of electricity

and power affairs in the state and the management and regulatory bodies is discussed as follows.

The former Mysore State had the unique distinction and privilege of being among the first few in India to establish an early generation substantial hydroelectric generating station for commercial exploitation at Shivasamudram as far back as 1902. The Kolar Gold Fields, a group of fields in the southern province of Karnataka, used to have sufficient power for mining operations by installing the world's longest high-voltage transmission line. The Shivasamudram Power House capacity was eventually increased by 2 MW, totalling 42 MW to meet the mounting demands for electricity. Additionally, a 17.2 MW installed capacity Shimsha Generating Station was commissioned in operation in 1938.

Industries had to be powered up and rural areas required electricity too, hence it was natural that increased generating capacity would require more potential power sources. The first and second 48 MW stages of the Mahatma Gandhi Hydro-Electric Station were applied from 1948 to 1952.

The Bhadra Project (33.2 MW) was placed in service in 1964 and the Tungabhadra Left Bank Power House near Munirabad, with an installed capacity of 27 MW in 1975.

The State of Karnataka provided inexpensive electricity along with other infrastructure amenities that encouraged a faster pace of industrial activity. As a result, it became essential to increase power generation capacity by using the Sharavathi Valley to its fullest extent. The first 89.1 MW unit was put into service in 1964 and finished in 1977.

The establishment of numerous governmental and private companies in the State starting in the mid-1960s led to a remarkable surge in the power demand. At Raichur, the State Government established a coal-based power plant because the State's power output was totally dependent on the monsoon and vulnerable to its whims.

Up until 1957, the Government of Karnataka (formerly Mysore) controlled the transmission and distribution network in the State. After the private distribution businesses were merged with the Karnataka Electricity Board, the latter was established in 1957.

KEB was a profitable organisation up until 1986. But like other State Electricity Boards across the nation, KEB began to lose money in the following years. This was mostly because of the rise in agricultural consumption and the impact of the government's socioeconomic policies on the power industry's performance.

In an effort to enhance the electricity sector's performance and align with the Government of India's reforms, the Karnataka government released a general strategy that suggested significant and drastic changes to the industry. As a result, the Karnataka Legislature passed the Karnataka Electricity Reforms Act, 1999.

The Karnataka Electricity Board's major reorganisation and corporatization have been mandated under the Reform Bill. The Karnataka Electricity Board was abolished as part of the corporatization process, and on August 1, 1999, VVNL (Visweshwaraiah Vidyuth Nigama Limited) was established to manage the generating stations that the former Karnataka Electricity Board had been in charge of. Later on, the Karnataka Power Transmission Corporation Limited (hereinafter referred to as 'KPTCL') was established to handle transmission and distribution throughout the State.

KPTCL, KPCL, KERC AND BESCOM

Although there are various power management and regulatory bodies, the primary relevant corporations and bodies are the Karnataka Power Transmission Corporation Limited (KPTCL), Karnataka Power Corporation Limited (KPCL), Karnataka Electricity Regulatory Commission (KERC) and Bangalore Electricity Supply Company (BESCOM). A brief history and

introduction of the aforementioned corporations and bodies is discussed below.

KARNATAKA POWER TRANSMISSION CORPORATION LIMITED (KPTCL)

Karnataka Power Transmission Corporation Limited was founded on July 28, 1999, and is fully owned by the Karnataka government. It was formed under the Companies Act, 1956, and has an authorised share capital of Rs. 2182.32 crores. On August 1, 1999, the former Karnataka Electricity Board's Transmission and Distribution divisions were divided to become KPTCL.

Karnataka Power Transmission Corporation Limited's primary responsibilities include building stations and transmission lines, maintaining 400/220/110/66 KV substations, and transmitting power throughout the entire state of Karnataka. The transmission network saw the addition of numerous new lines, sub-stations, and modifications to already existing stations. It is run by Karnataka Electricity Regulatory Commission under a license.

KPTCL possesses nine 400 KV stations, thirty-three 220 KV stations, five seventeen 110 KV stations, and seventy-five 66 KV stations. As of March 31, 2024, the total transmission line in

CKMs is 42991.478. It has six transmission zones all of which are looked after by a chief engineer.

In 2022–2023, the Organisation's yearly turnover was approximately Rs. 5173.84 Crores (Provisional).

By order No. 69 BSR 2001 Bangalore, issued February 15, 2002, the government divided up KPTCL and established four distribution firms.

As a result, the power distribution function has been completely isolated from KPTCL. KPTCL is now in charge of building and maintaining stations and lines with a voltage of 66 KV or more, as well as transferring power throughout the entire state.

The Bangalore Electricity Supply Company, Mangalore Electricity Supply Company, Hubli Electricity Supply Company, and Gulbarga Electricity Supply Company are the four recently established independent distribution businesses that were registered on April 30, 2002. They have been operational since January 06, 2002. Within their respective jurisdictions, these businesses are in charge of power distribution.

Karnataka Power Transmission Corporation Limited's (KPTCL) goal is to provide its clients with affordable, dependable power

at a high standard. The KPTCL is dedicated to accomplishing this goal by:

- Promoting best practices for distribution and transmission.
- Ensuring all of its technological facilities receive high-order upkeep.
- Highlighting the highest requirements for customer care.

The KPTCL promises to maximise its human and technological resources for the benefit of all of its customers in order to become the greatest electrical company in the nation.

KARNATAKA POWER CORPORATION LIMITED (KPCL)

Karnataka's spirit of pioneering in the realm of power has resulted in a number of significant achievements. On the banks of the Cauvery River near Shivanasamudram, India, the first hydroelectric power station was established in 1902. After the completion of Bangalore City's lighting scheme, Karnataka became the first state to use alternating current. In 1902, Karnataka had the world's longest transmission line, spanning 147 km from Shivanasamudram to KGF. Additionally, it was the first state to establish a professionally managed corporation to oversee the development, construction, operation, and

maintenance of power generation projects within the state. That is the legacy that KPCL established and expanded upon. The Karnataka Power Corporation has been a driving force behind significant power sector reforms in the state for more than 40 years. These reforms have resulted in spiraling steady growth in both the industrial and economic sectors.

With an initial installed capacity of 746 MW, KPCL has developed substantially since its founding in 1970, reaching 8738.305 MW. The current installation includes 34 MW of solar power, 4.555 MW of wind power, 3679.75 MW of hydro power, 5020 MW of thermal electricity, and 370 MW of combined cycle power that is about to be commissioned. A number of these power plants were put into service a number of years ago. To maintain the health of these units, R&M activities were completed for a few of them, and more must be done for the other units due to their age and operating hours. From an industry perspective, KPCL has established a standard on the national grid. KPCL's strengths are industry-tested; its modern, advanced management principles, well-established infrastructure, and unwavering dedication to excellence enable it to handle the difficulties posed by Karnataka's growing energy demands. KPCL projects are leveraging its strengths in resource management, which span planning, funding, and project engineering.

KARNATAKA ELECTRICITY REGULATORY COMMISSION (KERC)

The Preamble of the Karnataka Electricity Regulatory Commission (condition of licence for ESCOMs) regulations, 2004 states that Four distribution licensees in Karnataka, namely Bangalore Electricity Supply Company (BESCOM), Mangalore Electricity Supply Company (MESCOM), Hubli Electricity Supply Company (HESCOM), and Gulbarga Electricity Supply Company (GESCOM) (referred to as ESCOMs for short), have been granted licenses by the KERC to distribute and retail supply electricity. These licensees will be able to conduct business as electricity distributors for a period of five years within the areas designated in their respective licenses. Under the 1999 Karnataka Electricity Reforms Act, these licenses were issued. The Electricity Act of 2003 went into effect on June 10, 2003, as announced by the Indian government. Any person engaged in the business of transmitting or supplying electricity on or before the designated date, under the provisions, among other things, of the Karnataka Electricity Reform Act 1999, shall be deemed to be a Licensee under the Electricity Act, 2003, states the first proviso to Section 14 of the Electricity Act 2003. The Companies established in accordance with the Acts listed in the Schedule—which includes the Karnataka Electricity Reforms Act, 1999 (KERA)—shall be deemed to be Licensees under the Electricity

Act, 2003, according to the fifth proviso to Section 14. The Appropriate Commission may specify any general or particular conditions that apply to Licensees covered by the first through fifth provisos of Section 14 within a year of the designated date, according to Section 16 of the Electricity Act, 2003. The Karnataka Electricity Regulatory Commission hereby makes the regulations in the exercise of the authority granted to it by Section 16 of the Electricity Act, 2003, read under the relevant provisions of the Karnataka Electricity Regulatory Commission Act, 1999.

The power procurement procedure is given under regulation no. 21 of the said regulation, the procedure is as stated below.

- 21(1) In all cases, the licensee must purchase energy and/or electrical capacity in a transparent, cost-effective manner in accordance with the Commission's approved procurement process. The licensee must also abide by any updates the Commission may issue on the creation of load forecasts, power procurement plans, and power procurement procedures.

- 21(2) With the exception of short-term purchases lasting less than six months, the Licensee is not permitted to purchase energy or electrical capacity without a commission license under condition 21(1).

- 21(3) When the Licensee has satisfied the Commission that: (a) electrical capacity and/or energy is required to meet the Licensee's service obligation in accordance with condition

    - ✓ Is consistent with the approved load forecast and power purchase plan, the authorisation required by condition 21(2) will be granted.

    - ✓ The Licensee has conducted, in a way approved by the Commission, an analysis of the financial, technical, systemic, and environmental aspects of commercially feasible substitutes for the proposals for the purchase of energy and/or electrical capacity (including plans to lower the level of demand). The Commission must decide how to proceed within 120 days after receiving the application.

- 21(4) Under no circumstances may the Licensee purchase energy or electrical capacity other than those that require compliance with the State Grid Code. In addition, the Licensee shall provide the Commission with a copy of all contracts for the purchase of energy or capacity within a month of their conclusion.

BANGALORE ELECTRICITY SUPPLY COMPANY (BESCOM)

Eight districts in Karnataka are served by Bangalore Electricity Supply Company Limited, which is in charge of power distribution (Bangalore Urban, Bangalore Rural, Chikkaballapura, Kolar, Davanagere, Tumkur, Chitradurga and Ramanagara). BESCOM is home to more than 207 lakh people and occupies an area of 41,092 square kilometres. The organization has nine circles, thirty-two divisions, 147 subdivisions, 534 section offices, and four operating zones: the Bangalore Metropolitan Area Zone (North), Bangalore Metropolitan Area Zone (South), Bangalore Rural Area Zone, and Chitradurga Zone. Karnataka started a significant reform of the power industry in 1999. The Karnataka Power Transmission Corporation Limited (KPTCL) was created in its stead when the Karnataka Electricity Board (KEB) was first dissolved. The Karnataka Electricity Regulatory Commission (KERC) was established in November 1999 as a result. In June 2002, the KPTCL-managed transmission and distribution businesses were separated as part of the subsequent stage of the Reform Process. To distribute power in Karnataka, four new distribution corporations were established. With effect from June 1, 2002, Bangalore energy Supply Company Limited (BESCOM) assumed control of the distribution of energy over eight districts from KPTCL.

JUDICIAL PRECEDENTS

POWER LINE INFRASTRUCTURE AND PRIVATE PROPERTY RIGHTS IN INDIA

1. ***Rural Litigation and Entitlement Kendra v. State of U.P., (1989) 2 SCC 504.***

Facts: The case concerned the construction of power lines over forested land owned by private individuals and communities. The landowners contended that the project would lead to environmental degradation and disrupt their livelihoods.

Provisions:

1. Forest Conservation Act, 1980: The Court emphasised the need to protect forests and the rights of indigenous communities under this Act.

2. Environment (Protection) Act, 1986: The Court required a comprehensive Environmental Impact Assessment (EIA) to be conducted under this Act before proceeding with the project.

Judgment: The Supreme Court ruled in favour of the landowners, ordering a stay on the project until an EIA was conducted, and appropriate compensation was arranged.

Significance: This case highlighted the role of environmental laws in protecting the rights of landowners, especially in ecologically sensitive areas.

2. ***Ram Kishan v. Haryana State Electricity Board, (1997) 7 SCC 267***

Facts: The Haryana State Electricity Board sought to install power lines over agricultural land owned by Ram Kishan and other farmers. The landowners argued that the installation would disrupt their farming activities and cause economic loss without adequate compensation

Provisions:

1. Land Acquisition Act, 1894: The case revolved around the proper procedure for land acquisition and ensuring fair compensation under this Act.

2. Indian Telegraph Act, 1885: Section 10: While the Act allows the government to install power lines, it requires adherence to fair compensation practices.

Judgment: The Supreme Court ruled in favour of the landowners, directing the Board to reassess compensation and consider alternative routes.

Significance: The case underscored the necessity of following due process in land acquisition and providing fair compensation under the relevant laws.

3. ***Kanwar Pal Singh v. Uttar Pradesh Power Corporation Ltd., (2010) 4 All LJ 471***

Facts: The Uttar Pradesh Power Corporation Ltd. (UPPCL) erected power transmission towers on land owned by Kanwar Pal Singh without obtaining consent or providing compensation.

Provisions:

1. Indian Telegraph Act, 1885, Section 10: While this Act permits the laying of power lines, it requires the consent of landowners or adherence to compensation provisions.

2. Land Acquisition Act, 1894: The Court found that UPPCL failed to follow the proper legal process under this Act.

Judgment: The Allahabad High Court ordered the removal of the transmission towers and directed UPPCL to negotiate with the landowners for proper consent and compensation.

Significance: This case reinforced the importance of obtaining landowner consent and following legal procedures under the Indian Telegraph Act and Land Acquisition Act.

4. ***Ratan Kumar Shukla v. Power Grid Corporation of India Ltd., (2019) 5 SCC 462***

Facts: The Power Grid Corporation of India Ltd. (PGCIL) sought to install high-voltage power lines over land owned by Ratan Kumar Shukla, who argued that the lines would reduce his property value and pose safety risks.

Provisions:

1. Indian Telegraph Act, 1885, Section 10 and 16: These sections authorise the installation of power lines but also require that affected landowners be compensated for any loss in property value or other damages.

2. Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013: The Court referenced the need for fair compensation under this modern statute, which had replaced the Land Acquisition Act, 1894.

Judgment: The Supreme Court ruled that PGCIL must either reroute the power lines or pay enhanced compensation to the landowner.

Significance: This case affirmed that state authorities must consider the impact on private property and ensure compensation under the applicable legal frameworks.

5. ***Narendra Kumar and Others v. State of Haryana and Others, (2005) 9 SCC 492***

Facts: The Haryana Government, through its power utility, sought to lay power lines across agricultural land owned by Narendra Kumar and others. The landowners objected on the grounds that the installation would cause irreparable harm to their crops and land value.

Provisions:

1. Land Acquisition Act, 1894: The dispute involved the procedures for acquiring land and the assessment of compensation.
2. Indian Telegraph Act, 1885, Section 10: The landowners argued that the state did not adequately follow the provisions of this Act, particularly concerning compensation.

Judgment: The Supreme Court ruled in favour of the landowners, emphasising that the state had not provided sufficient justification for the acquisition and had not followed the proper procedures under the relevant laws.

Significance: The case underscored the requirement for state authorities to provide clear and adequate reasons for land acquisition and ensure that the process is transparent and fair to the landowners.

6. ***M. Ramakrishna Reddy v. Andhra Pradesh Southern Power Distribution Co. Ltd., (2009) 1 ALT 221***

Facts: M. Ramakrishna Reddy, a landowner in Andhra Pradesh, contested the installation of high-tension power lines over his agricultural land by the state power utility, arguing that the lines would make his land unsuitable for farming and that the compensation offered was inadequate.

Provisions:

1. Indian Telegraph Act, 1885, Section 10: The landowner contended that the power company did not provide adequate compensation as required under this section.

2. Land Acquisition Act, 1894: The landowner also claimed that the acquisition process was flawed and did not comply with the provisions of this Act.

Judgment: The Andhra Pradesh High Court ruled in favor of the landowner, holding that the power company failed to adequately

compensate for the loss of agricultural utility and directed the company to either reroute the lines or pay higher compensation.

Significance: This case reinforced the principle that landowners must be adequately compensated for any loss of land utility, particularly when it involves agricultural land.

7. Ananta Bhalerao v. Maharashtra State Electricity Board, 2008 (6) MhLJ 561

Facts: Ananta Bhalerao, a farmer, objected to the Maharashtra State Electricity Board's (MSEB) plan to install power transmission lines across his agricultural land, arguing that the lines would negatively impact his farming operations and reduce the land's value.

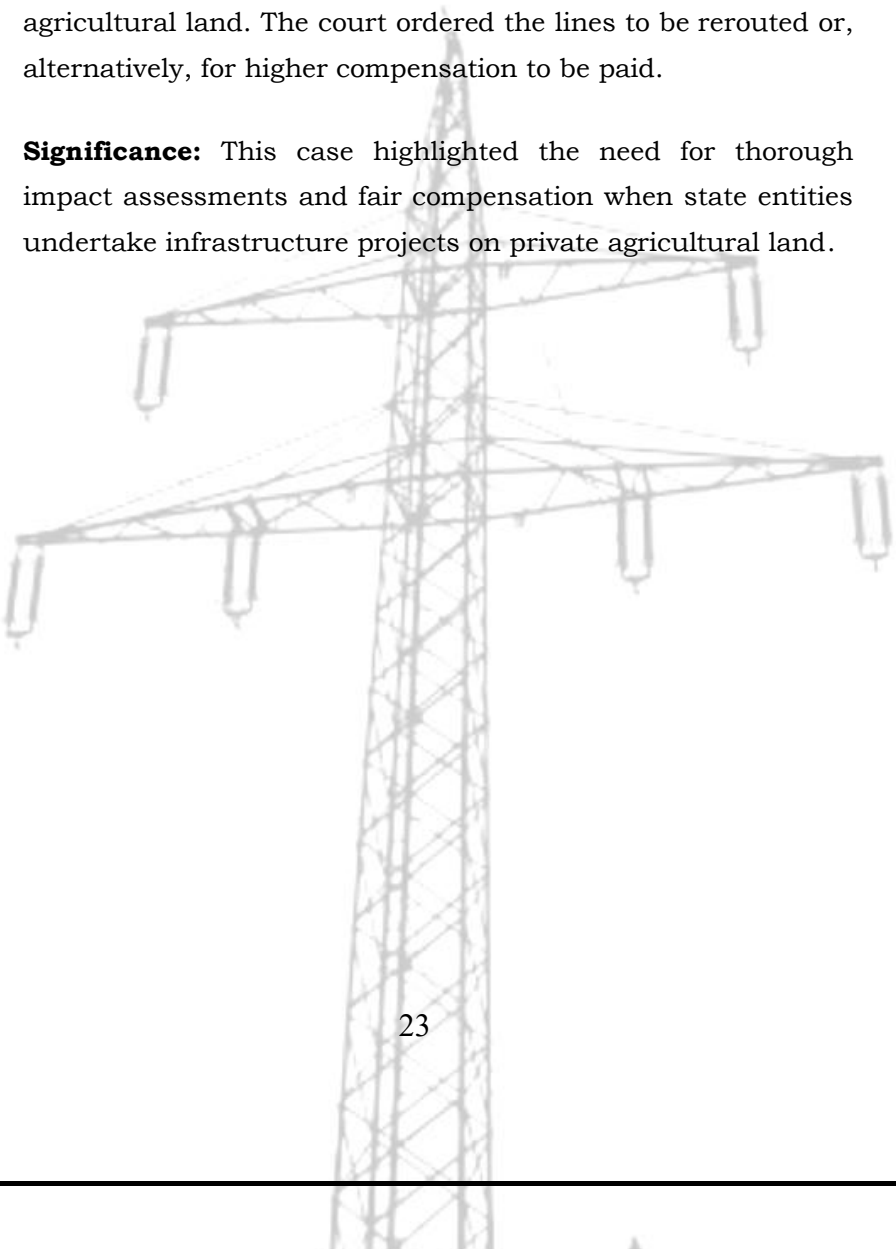
Provisions:

1. Indian Telegraph Act, 1885, Section 10: The landowner asserted that MSEB failed to provide fair compensation as stipulated by this Act.

2. Maharashtra Land Revenue Code, 1966: The landowner also claimed that MSEB violated provisions of this code concerning the use of agricultural land.

Judgment: The Bombay High Court ruled in favour of the landowner, finding that MSEB had not adequately compensated the farmer and had not properly evaluated the impact on the agricultural land. The court ordered the lines to be rerouted or, alternatively, for higher compensation to be paid.

Significance: This case highlighted the need for thorough impact assessments and fair compensation when state entities undertake infrastructure projects on private agricultural land.



8. *Ramlal v. Madhya Pradesh Electricity Board, (2007) MPWN 45*

Facts: Ramlal, a landowner in Madhya Pradesh, challenged the installation of power lines by the Madhya Pradesh Electricity Board (MPEB) across his land, arguing that the lines would diminish the land's agricultural productivity and that the compensation was insufficient.

Provisions:

1. Indian Telegraph Act, 1885, Section 10: Ramlal argued that the compensation offered by MPEB did not meet the standards required under this section.

2. Madhya Pradesh Land Revenue Code, 1959: The landowner also cited violations of this code, which governs the use and compensation of agricultural land.

Judgment: The Madhya Pradesh High Court ruled in favour of Ramlal, ordering MPEB to either reroute the lines or provide enhanced compensation to account for the reduced agricultural productivity.

Significance: This case emphasised the importance of adequately compensating landowners for the loss of agricultural

productivity and the need for state entities to consider alternative routes when installing power lines.

9. Ajit Singh v. Punjab State Electricity Board, (2010) 2 RCR(Civ) 781

Facts: Ajit Singh, a farmer, opposed the Punjab State Electricity Board's (PSEB) plan to install power transmission towers on his agricultural land, arguing that the project would severely affect his farming operations and that the compensation was inadequate.

Provisions:

1. Indian Telegraph Act, 1885, Section 10: Ajit Singh contended that PSEB did not provide fair compensation as required under this Act.
2. Punjab Land Revenue Act, 1887: The landowner also argued that PSEB violated provisions of this Act concerning the use and compensation of agricultural land.

Judgment: The Punjab and Haryana High Court ruled in favor of Ajit Singh, finding that PSEB had not followed the proper legal procedures for compensation and had not considered the full impact on the landowner's agricultural activities. The court

ordered the lines to be rerouted or for higher compensation to be provided.

Significance: This case underscored the need for state utilities to properly assess the impact of their projects on agricultural land and to follow legal procedures for compensation and land acquisition.

These cases illustrate the courts' willingness to protect landowners' rights and ensure that state entities comply with legal procedures, particularly when it comes to compensation and the impact on agricultural land. The judgments reinforce the principle that landowners should not be unduly burdened by public utility projects without receiving fair and adequate compensation under the law.

CHAPTER - 2

COMPENSATION FOR DAMAGE DUE TO INSTALLATION OF TOWERS AND TRANSMISSION LINES: LEGAL FRAMEWORK AND RECOMMENDATIONS

INTRODUCTION

The installation of transmission lines, particularly those under the B1B2, P1P2, and SBT transmission projects, is crucial for electricity distribution and infrastructure development in Karnataka. However, these installations have led to significant disputes between landowners and state authorities, primarily due to the adverse impact on private property. The Indian Telegraph Act, 1885, and the Electricity Act, 2003, provide the legal framework for such installations, including provisions for compensating affected landowners. Despite these legal provisions, the existing compensation mechanisms have been found inadequate, leading to prolonged disputes and litigation. This section addresses the legal context, challenges, and recommendations from the Law Commission's Report No. 281, with specific reference to the impact of the B1B2, P1P2, and SBT transmission lines.

LEGAL FRAMEWORK

The Indian Telegraph Act, 1885, is the primary legislation governing the laying of transmission lines, granting the government and its authorized entities the right to place telegraph lines, including electricity transmission lines, on private property. Section 10 of the Act permits such installations but mandates compensation for any damage

caused. However, in the context of the B1B2, P1P2, and SBT transmission lines, the compensation provided has often been criticized as insufficient, resulting in disputes.

The Electricity Act, 2003, also plays a critical role in regulating electricity transmission and distribution. Although the Act aims to ensure a reliable and efficient electricity supply, it lacks robust provisions for compensating landowners affected by the installation of transmission lines like B1B2, P1P2 and SBT.

KEY ISSUES AND CHALLENGES

The installation of the B1B2, P1P2, and SBT transmission lines under the current legal framework has highlighted several issues:

1. **Inadequate Compensation**: The compensation offered for the B1B2, P1P2, and SBT transmission lines often fails to reflect the true market value of the land or the extent of damage caused by these specific installations.

2. **Lack of Transparency:** The process for determining compensation related to these transmission lines has been opaque, leading to significant mistrust between the affected landowners and the authorities responsible for the installation.

3. **Prolonged Litigation:** Disputes over compensation related to these lines have frequently resulted in lengthy court battles, delaying

critical infrastructure projects and causing financial strain on the affected landowners.

4. **Insufficient Legal Recourse:** The current legal provisions under the Indian Telegraph Act, 1885, and the Electricity Act, 2003, do not provide sufficient protection to the landowners affected by the B1B2, P1P2, and SBT transmission lines, leaving them vulnerable to arbitrary decisions by the authorities.

RECOMMENDATIONS BY THE LAW COMMISSION (REPORT NO. 281)

The Law Commission, through its Report No. 281, has made several key recommendations that are particularly relevant to addressing the issues arising from the installation of the B1B2, P1P2, and SBT transmission lines:

1. **Enhanced Compensation Framework:** The Commission recommends revising the compensation rates to better reflect the actual market value of the land and the specific damage caused by the installation of the B1B2, P1P2, and SBT transmission lines. This includes regular updates to compensation guidelines based on current market trends and the specific impact on agricultural and residential land.

2. **Introduction of a Transparent Compensation Mechanism:** A clear and transparent process for determining compensation, particularly for these transmission lines, should be established. This

could include the formation of independent committees to assess damages and recommend appropriate compensation, ensuring that affected landowners are fully informed and involved in the process.

3. **Expedited Dispute Resolution Mechanisms**: The introduction of specialized tribunals or alternative dispute resolution mechanisms specifically focusing on disputes related to compensation under the Indian Telegraph Act and the Electricity Act, in the context of the B1B2, P1P2, and SBT transmission lines. This would allow for faster resolution of disputes, reducing the strain on both landowners and the judiciary.

4. **Strengthening Legal Protections for Landowners:** The Commission calls for amendments to the Indian Telegraph Act, 1885, and the Electricity Act, 2003, to provide stronger legal protections for landowners affected by the B1B2, P1P2, and SBT transmission lines. These amendments should include explicit provisions for fair compensation, timely payments, and penalties for non-compliance by the authorities.

5. **Increased Awareness and Training:** There is a need to enhance awareness among landowners about their rights and the compensation process concerning the B1B2, P1P2 and SBT transmission lines. The Commission also recommends training for officials involved in the process to ensure that they are equipped to handle compensation issues fairly and efficiently.

CONCLUSION

The Law Commission's recommendations in its Report No. 281 represent a significant step towards ensuring a fair and just compensation framework for landowners affected by the installation of transmission lines, specifically the B1B2, P1P2, and SBT projects. By addressing the key challenges of inadequate compensation, lack of transparency, and prolonged litigation, these recommendations aim to balance the need for infrastructure development with the protection of private property rights. Incorporating these recommendations into the current case will not only benefit the affected landowners but also facilitate the smoother execution of critical infrastructure projects across Karnataka.

HEALTH IMPACT ASSESSMENT OF HIGH-TENSION TRANSMISSION LINES

ELECTROMAGNETIC FIELDS (EMF) AND ENVIRONMENTAL IMPACT

Electromagnetic fields (EMF) of all frequencies, including those generated by high-tension transmission lines, are a significant environmental concern due to their rapid expansion and increasing prevalence. The spectrum of electromagnetic radiation encompasses static fields, radiofrequency, infrared, and X-ray radiation. As technology advances, the levels and types of EMF exposure have grown, particularly in densely populated areas where high-tension lines are often situated.

Current EMF Emission Guidelines: The International EMF Project categorizes the electromagnetic spectrum into various frequency ranges, including static fields (0 Hz), extremely low frequency (ELF) fields (0-300 kHz), intermediate frequencies (IF) (300 Hz-10 MHz), and radiofrequency (RF) fields (10 MHz-300 GHz). This categorization helps in understanding and managing the potential health impacts of EMF exposure from high-tension lines.

RISK ASSESSMENT IN POWER INFRASTRUCTURE

Importance of Risk Assessment: Risk assessment in the electric power sector is crucial for ensuring public safety, economic stability, and national security. This includes evaluating potential health risks associated with high-tension transmission lines, which are often situated in heavily populated areas. The primary risks include exposure to electromagnetic fields, visual interference, and noise.

Right of Way (ROW): Critical Considerations in Transmission Line Projects

Right of Way (ROW) is a pivotal factor in the planning and execution of transmission line projects. It refers to the legal right to pass through a specific route on someone's land. For high-tension transmission lines, ROW involves acquiring land or obtaining easements to ensure the safe and efficient installation and maintenance of these lines. The ROW must be carefully planned and executed to minimize the impact on the surrounding environment and communities.

1. **Preliminary Survey and Line Surveys:** Before constructing new transmission lines, a comprehensive preliminary survey is essential. Line surveys should account for various crossings, such as railways, rivers, highways, telephone wires, and existing high-voltage lines. These surveys are crucial to avoid long parallel runs with telephone lines, which can lead to induction and interference with communication systems. In the context of your project, ensuring that the ROW is appropriately planned will prevent potential disruptions and legal challenges.

2. **Safe Clearance and Crossings**: The ROW should maintain a safe clearance, especially at crossings over roads and railways. The survey should aim to have these crossings at a right angle (90 degrees) to minimize risks. While overhead crossings are generally avoided, in some cases, they are permissible, but only for Extra High Voltage (EHV) lines. Subterranean cables are preferred for low and medium-voltage lines to reduce visual and environmental impact. This is particularly relevant in your project to ensure that all crossings comply with safety regulations and do not pose hazards to the public.

3. **Acquiring Consent and Coordination**: Obtaining consent from relevant authorities, such as the P&T Department (B.S.N.L.) for lines above 33 KV, is mandatory. Proper coordination with these bodies can prevent delays and ensure that the project proceeds smoothly. In your project, this step is vital to avoid legal obstacles and ensure that all stakeholders are on board with the ROW decisions.

4. **Impact on Landowners:** The acquisition of ROW often leads to disputes with landowners, particularly if the compensation is deemed inadequate. Ensuring a fair compensation process and transparent dealings with landowners can mitigate these disputes. In your project, addressing ROW issues early and fairly will prevent prolonged litigation and foster goodwill with the affected communities.

HEALTH HAZARD ASSESSMENT AND PROTECTIVE MEASURES

Health Effects of EMF Exposure: A review of the literature on RF exposure reveals a range of health concerns. Studies have generally focused on frequencies in the low GHz range, with limited data on other biological systems, particularly wildlife. Although definitive evidence of harm remains inconclusive, there are concerns about potential biological alterations from long-term exposure to EMF.

Protective Measures:

1. **Engineering Design:** Implementing proper engineering designs can mitigate exposure, such as using appropriate separation distances from high-tension lines.

2. **Magnetic Field Protection:** Measures include restricting access to areas with strong magnetic fields and using shielding materials where feasible. However, the cost-effectiveness of shielding compared to separation distance is often debated.

3. **Administrative Controls:** Establishing designated access zones and warning signs can effectively manage exposure risks, particularly in areas near large power infrastructure.

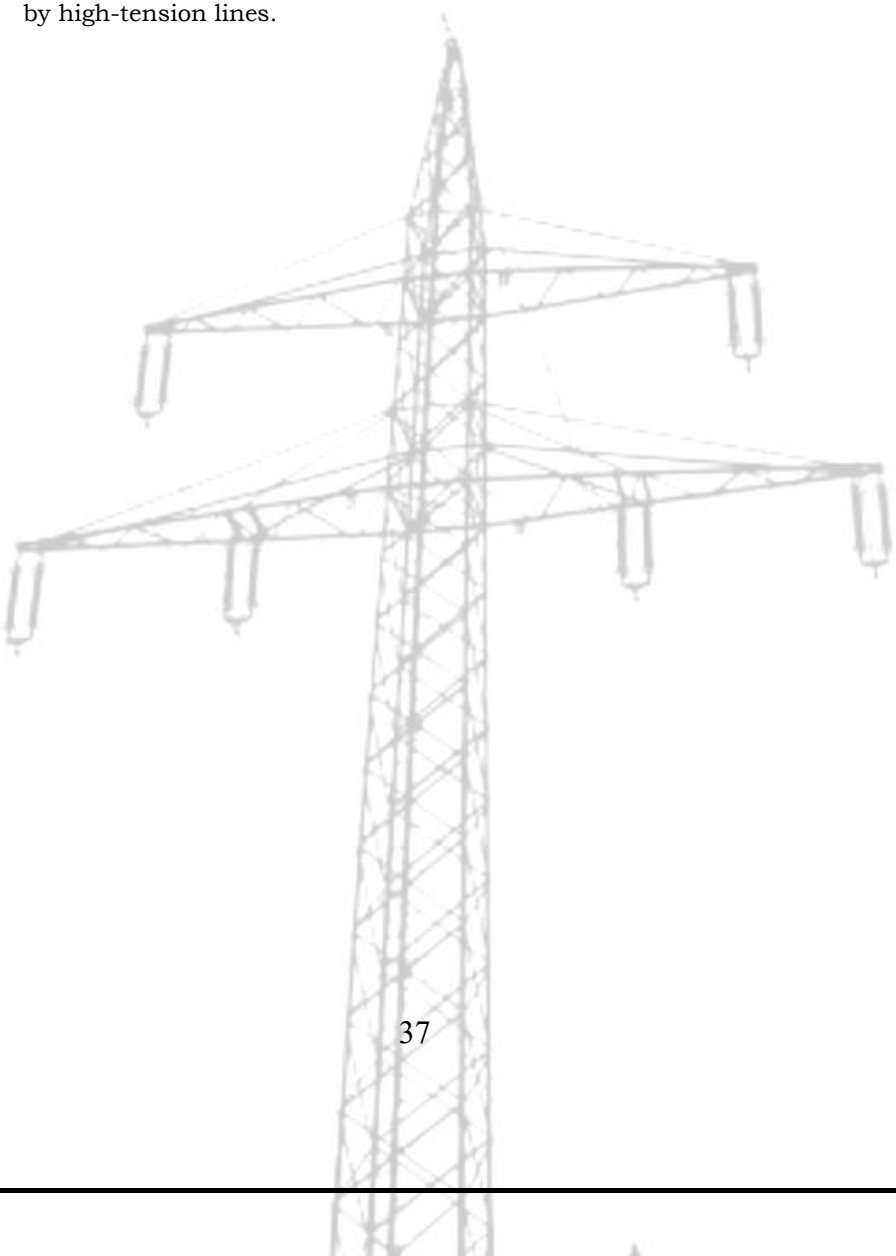
CURRENT RESEARCH AND FUTURE DIRECTIONS

Ecological Impact Studies: Research on the ecological effects of RF-EMF has identified impacts on plants and animals, although there is no clear dose-effect relationship. Ongoing studies aim to better understand these effects and inform guidelines for both human and ecological protection.

CONCLUSION

While current studies have not conclusively proven harmful effects of EMF exposure, the potential risks associated with high-tension transmission lines warrant continued research and precautionary

measures. The integration of risk assessments, engineering controls, and administrative measures is essential for mitigating potential health impacts and ensuring the safety and well-being of communities affected by high-tension lines.



CHAPTER - 3

INTEGRATION OF MOP GUIDELINES INTO THE IMPACT STUDY OF HIGH-TENSION TRANSMISSION LINES

INTRODUCTION

The construction and operation of high-tension transmission lines involve numerous challenges related to environmental, social, and regulatory aspects. The Ministry of Power (MoP) has issued comprehensive guidelines to streamline these processes, ensuring compliance, reducing conflicts, and promoting efficient project execution. This detailed integration of MoP guidelines into the impact study will address Right of Way (RoW) issues, compensation mechanisms, and mitigation strategies.

KEY AREAS COVERED BY MOP GUIDELINES AND THEIR RELEVANCE TO THE IMPACT STUDY

1. RIGHT OF WAY (ROW) ACQUISITION:

a. Compensation Framework:

Guidelines Overview: The MoP guidelines establish a framework for fair compensation, accounting for land use, socio-economic

impacts, and land value. Compensation must consider factors such as crop patterns, displacement, and loss of income.

Impact Study Integration: The study will evaluate how compensation is calculated and disbursed according to MoP guidelines. It will assess whether compensation reflects the true economic impact on landowners and whether additional benefits are provided to incentivize cooperation and reduce project delays.

b. Approval Procedures:

Guidelines Overview: MoP guidelines emphasize streamlined approval processes for RoW acquisition, requiring coordination between central and state agencies to expedite clearances.

Impact Study Integration: The study will analyze the effectiveness of these procedures in minimizing delays and bureaucratic hurdles. It will assess whether current practices align with MoP guidelines and recommend improvements if necessary.

c. Social Impact Mitigation:

Guidelines Overview: Social impact mitigation includes rehabilitation and resettlement plans to support affected

communities. The MoP guidelines stress the need for comprehensive plans to minimize disruptions and ensure community welfare.

Impact Study Integration: The study will evaluate the effectiveness of these plans in addressing social impacts, including housing, livelihood support, and community services. It will recommend additional measures to enhance social stability and acceptance.

2. TRANSMISSION LINE PLANNING AND DEVELOPMENT:

a. Technical Standards and Specifications:

Guidelines Overview: MoP guidelines provide detailed standards for the design and construction of transmission lines, including voltage levels, conductor types, and tower structures. These standards ensure safety and efficiency.

Impact Study Integration: The study will verify that the transmission line design complies with MoP technical standards. It will assess whether these standards adequately address potential environmental and safety concerns.

b. Environmental Impact Assessment (EIA):

Guidelines Overview: The MoP requires a rigorous EIA to assess environmental and social impacts, including mitigation measures and public consultations.

Impact Study Integration: The study will use MoP EIA requirements to evaluate the environmental impact of the transmission lines. It will assess the adequacy of mitigation measures and the effectiveness of public consultations in addressing community concerns.

c. Stakeholder Consultation:

Guidelines Overview: MoP guidelines emphasize the importance of stakeholder engagement in the planning process to ensure transparency and build social acceptance.

Impact Study Integration: The study will assess the extent and quality of stakeholder consultation conducted, evaluating whether local communities and other stakeholders have been effectively involved in the decision-making process.

3. TARIFF DETERMINATION AND COMPETITION:

a. Tariff Structures:

Guidelines Overview: MoP guidelines for tariff determination focus on establishing fair and transparent pricing structures for transmission services, considering cost, investment returns, and cross-subsidization.

Impact Study Integration: The study will examine how tariffs are determined for transmission services, ensuring that they align with MoP guidelines and reflect fair compensation for infrastructure usage.

b. Competitive Bidding:

Guidelines Overview: The MoP promotes competition through tariff-based competitive bidding to encourage cost-effective project development.

Impact Study Integration: The study will evaluate the impact of competitive bidding on project costs and efficiency, ensuring that it aligns with MoP's framework and contributes to cost-effective transmission infrastructure development.

4. GRID INTEGRATION OF RENEWABLE ENERGY:

a. Technical Standards and System Strengthening:

Guidelines Overview: Guidelines for integrating renewable energy focus on technical standards, grid stability, and system reinforcements to accommodate renewable sources.

Impact Study Integration: The study will assess how the transmission lines support the integration of renewable energy, including the impact on grid stability and the effectiveness of system reinforcements.

b. Market Mechanisms:

Guidelines Overview: MoP guidelines include market mechanisms such as renewable energy certificates (RECs) and feed-in tariffs to facilitate renewable energy integration.

Impact Study Integration: The study will evaluate how these market mechanisms are implemented and their impact on the transmission project's alignment with renewable energy goals.

5. GRID MODERNISATION AND TECHNOLOGY ADOPTION:

a. Infrastructure Upgradation:

Guidelines Overview: Guidelines for infrastructure upgradation include recommendations for modernizing substations, replacing conductors, and reinforcing towers.

Impact Study Integration: The study will consider how these upgradation guidelines are applied to the transmission project, assessing improvements in efficiency and reliability.

b. Technology Deployment:

Guidelines Overview: MoP promotes the adoption of advanced technologies like High Voltage Direct Current (HVDC), Flexible AC Transmission Systems (FACTS), and digital substations.

Impact Study Integration: The study will examine the deployment of these technologies in the transmission project, evaluating their impact on grid performance and efficiency.

CHALLENGES AND IMPACT

Challenges:

- Land Acquisition and RoW Issues: Challenges include land acquisition disputes, tree cutting, and legal complications. The study will use MoP guidelines to address these challenges by evaluating compensation practices, approval procedures, and mitigation strategies.

- Legal Disputes: Legal challenges related to land ownership and compensation claims can delay construction. The study will assess how MoP guidelines address these issues and recommend solutions to expedite project completion.

Impact of communities:

- Environmental and Social Impacts: The study will assess the impact of transmission lines on rural communities, farmland, and forests. MoP guidelines recommend CSR initiatives and mitigation measures to support affected communities, which will be incorporated into the study to minimize negative impacts.

- Technological Solutions: Advanced technologies and scheduling strategies will be evaluated to address RoW issues and reduce construction disruptions. The study will recommend the

application of these solutions to enhance project efficiency and community relations.

CONCLUSION

Integrating MoP guidelines into the impact study ensures a structured approach to managing the construction and operation of high-tension transmission lines. By adhering to these guidelines, the study aims to address challenges effectively, comply with regulatory standards, and promote sustainable and socially responsible project development. The alignment with MoP guidelines will enhance the project's overall success, benefiting both the infrastructure and the communities affected.

CHAPTER – 4

DETAILED ANALYSIS OF THE ELECTRICITY ACT, 2003 FOR HIGH-TENSION TRANSMISSION LINE IMPACT STUDY

INTRODUCTION

The Electricity Act, 2003 was enacted to overhaul the Indian electricity sector, replacing outdated legislation with a unified framework that promotes efficiency, competition, and transparency. It integrates laws concerning the generation, transmission, distribution, and trading of electricity, and establishes regulatory bodies and mechanisms to ensure fair practices and consumer protection. For high-tension transmission lines, this Act provides essential guidelines for Right of Way (ROW) acquisition, compensation, and the integration of various utilities.

DETAILED EXAMINATION OF RELEVANT PROVISIONS

SECTION 67: OPENING UP STREETS AND OTHER AREAS

Overview:

- **Sub-section (1):** Empowers licensees to undertake necessary activities for electricity supply or transmission, including

breaking soil, laying lines, and repairing infrastructure. This power is subject to the terms of the license and ensures that infrastructure development does not unduly inconvenience property owners or the public.

- **Sub-section (2):** Allows the Appropriate Government to set rules for the licensee's actions, including obtaining consent, compensating affected parties, and managing emergency repairs.

- **Sub-section (3):** Mandates minimal damage and inconvenience, with full compensation for any harm caused.

- **Sub-sections (4) and (5): Provide** mechanisms for dispute resolution and penalties for non-compliance.

Impact Study:

ROW Acquisition: The guidelines for obtaining consent and compensation are critical for assessing the impact on landowners and public property. The Act's emphasis on minimal disruption and compensation ensures that the ROW acquisition process is managed responsibly.

Compensation Mechanisms: Detailed rules for compensation and dispute resolution help evaluate if the current frameworks

adequately address the economic and social impacts of high-tension transmission lines.

Detailed Considerations:

- **Consent and Notification:** Ensure that consent is obtained from property owners and relevant authorities, and that notifications are provided before commencing work. This process should be examined for efficiency and transparency.

- **Compensation for Disruption:** Analyze how compensation is calculated and disbursed. Consider if it reflects the actual impact on property and whether it includes damages for temporary disruptions.

- **Emergency Provisions:** Evaluate how emergency repairs are managed and if they align with the provision for minimizing public inconvenience.

SECTION 68: INSTALLATION OF OVERHEADS

Lines Overview:

- **Sub-section (1):** Requires approval from the Appropriate Government for installing overhead lines, ensuring regulatory oversight.

- **Sub-section (2):** Specifies exceptions to the approval requirement for low-voltage lines and private premises.

- **Sub-section (3):** Grants the Appropriate Government authority to impose conditions on installations.

- **Sub-section (4):** Allows modification or revocation of approval.

- **Sub-sections (5) and (6):** Address management of interference from obstacles and compensation for removal of trees.

Impact Study:

- **Regulatory Compliance:** The requirement for prior approval ensures that high-tension lines meet safety and environmental standards. Assess how this oversight is applied and whether it effectively mitigates risks.

- **Management of Interference:** Consider how the provisions for dealing with obstacles (e.g., trees) impact the environment and whether compensation for removal is fair and adequate.

- **Approval Process:** Review the criteria and process for obtaining approval for overhead lines. Assess whether the process is thorough and timely.

- **Exceptions and Flexibility:** Analyze the exceptions to approval and their implications for regulatory oversight.

- **Interference Management:** Examine how obstacles are managed and if the provisions for compensation and removal of vegetation are sufficient to address environmental and property impacts.

SECTION 69: COORDINATION WITH TELEGRAPH

Authorities Overview

- **Sub-section (1)(a):** Requires licensees to notify telegraph authorities before laying down electrical works near telegraph lines.

- **Sub-section (1)(b):** Mandates notice for repairs or alterations near telegraph lines.

- **Sub-sections (1) and (2):** Provide flexibility for emergency situations and service line works.

Impact Study:

- **Coordination with Other Utilities:** The requirement to notify and coordinate with telegraph authorities prevents conflicts and disruptions, which is crucial for smooth project execution.

- **Emergency and Service Line Works:** Assess how the flexibility in emergency situations and service line installations affects coordination and minimizes disruptions.

Detailed Considerations:

- **Notification Requirements:** Review the process and timeline for notifying telegraph authorities. Assess whether it effectively prevents interference and ensures timely responses

- **Coordination Mechanisms:** Evaluate how well the coordination mechanisms work and if they effectively prevent conflicts between electrical and telecommunication infrastructure.

- **Emergency Provisions:** Consider how emergency work is managed and whether it impacts the overall project timeline and stakeholder coordination.

SECTION 164: GRANT OF POWERS

Overview:

- **Provision:** Allows the Appropriate Government to grant powers related to placing electric lines or plants, integrating electricity infrastructure with telecommunication networks.

- **Integration with Telecommunication Networks:** The ability to integrate electricity infrastructure with telecommunication networks facilitates efficient coordination and minimizes conflicts. This provision supports the overall planning and execution of transmission projects.

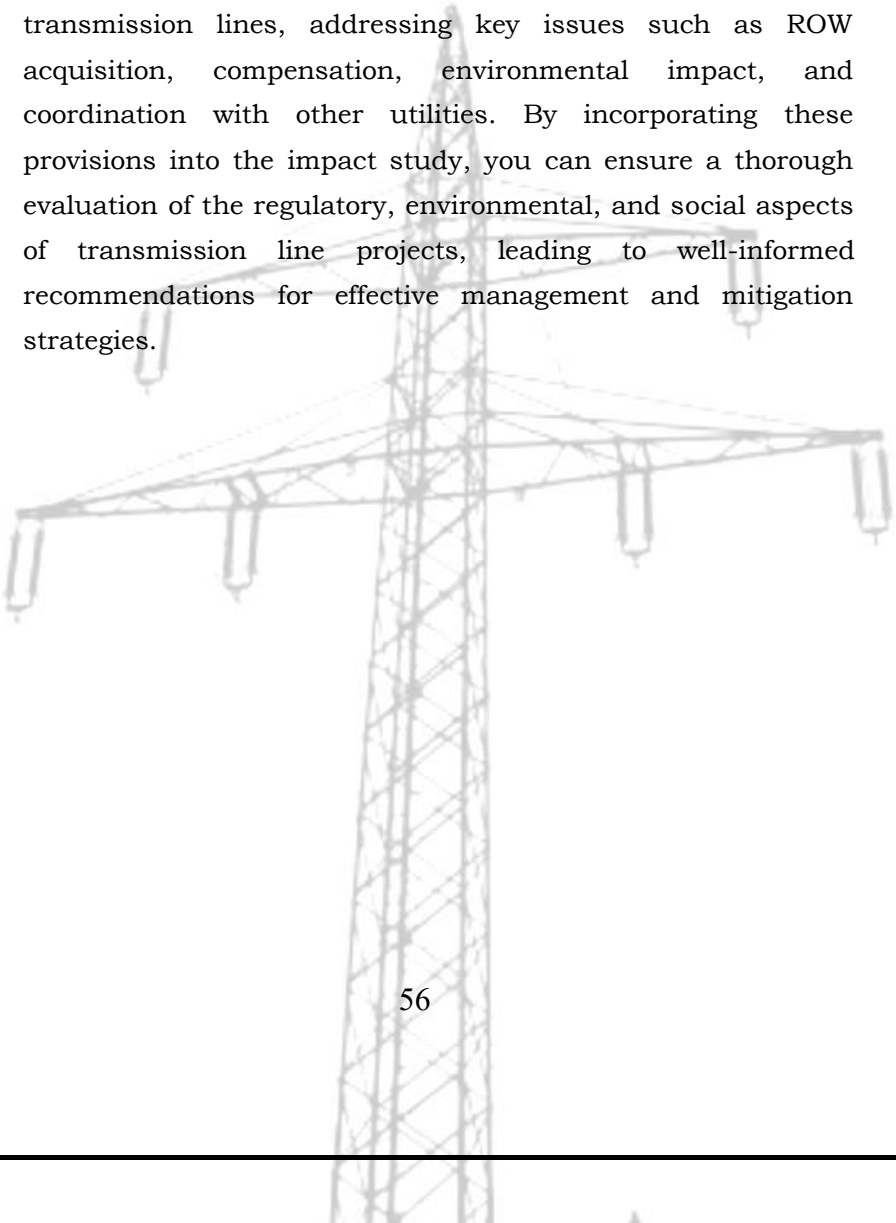
Detailed Considerations:

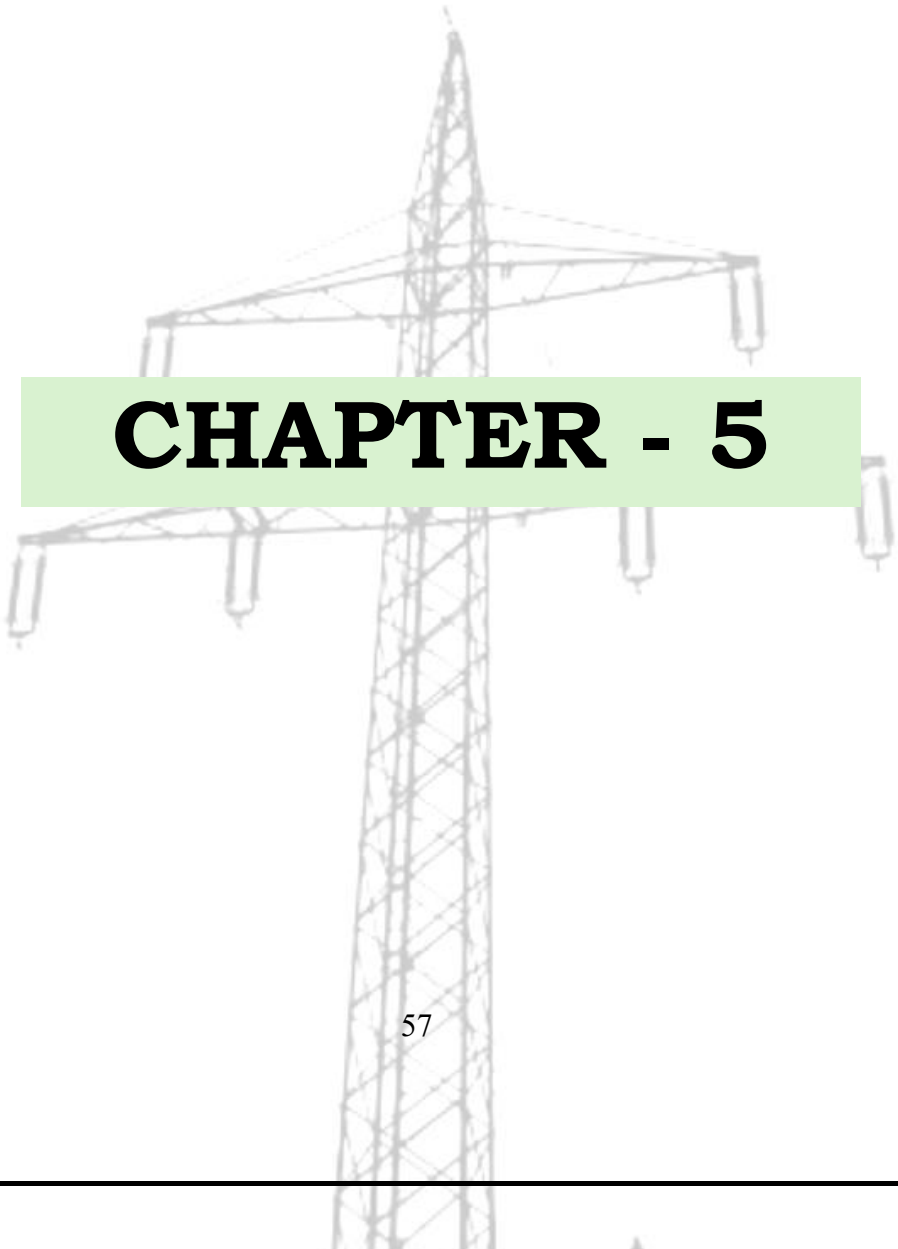
- **Power Granting Process:** Examine the process for granting powers and the conditions imposed. Assess whether it supports efficient project execution and coordination with other utilities.

- **Integration and Coordination:** Review how well the integration of electricity infrastructure with telecommunication networks is managed and whether it reduces potential conflicts.

CONCLUSION

The provisions of the Electricity Act, 2003 provide a comprehensive legal framework for managing high-tension transmission lines, addressing key issues such as ROW acquisition, compensation, environmental impact, and coordination with other utilities. By incorporating these provisions into the impact study, you can ensure a thorough evaluation of the regulatory, environmental, and social aspects of transmission line projects, leading to well-informed recommendations for effective management and mitigation strategies.





CHAPTER - 5

DETAILED EXPLANATION OF COMPENSATION FOR PRIVATE LAND ACQUISITION IN INDIA AND RELATED CASES

INTRODUCTION

Land acquisition in India is a multifaceted process influenced by legal, economic, and social factors. Central to this process is the determination of fair compensation for landowners whose property is acquired for public or private projects. This detailed explanation explores the mechanisms of compensation under Indian law, particularly the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Act, 2013 (LARR Act), and examines significant legal cases that have shaped the landscape of land acquisition in India.

LEGAL FRAMEWORK

RIGHT TO FAIR COMPENSATION AND TRANSPARENCY IN LAND ACQUISITION, REHABILITATION, AND RESETTLEMENT ACT, 2013 (LARR ACT)

The LARR Act is the primary legislation governing land acquisition in India. It aims to provide fair compensation and ensure transparency in the acquisition process, while also addressing rehabilitation and resettlement for affected individuals.

KEY COMPONENTS:

Market Value of Land: The market value is the price that the land would fetch in an open market transaction. This value is assessed based on recent transactions of similar properties in the vicinity.

Determination: Government agencies typically determine this value by considering recent sales data and adjusting for factors such as land use and location.

Purpose of Acquisition:

Public vs. Private: Land acquired for public projects (like roads or schools) is often compensated at a lower rate than land acquired for private or commercial purposes. The LARR Act distinguishes between these purposes, affecting how compensation is calculated.

Influence on Value: The purpose of the acquisition impacts the compensation rate, with public projects sometimes receiving lower compensation due to the broader social benefits they are expected to deliver.

Location of Land:

- Urban vs. Rural: Urban land or land near development zones generally commands higher compensation compared to rural land. The Act acknowledges these differences and adjusts compensation rates accordingly.

- Impact of Location: Factors such as proximity to infrastructure and urbanization increase the land's market value, leading to higher compensation.

Solatium:

Solatium is an additional payment made to compensate for the inconvenience and emotional distress caused by the land acquisition.

Calculation:

It is calculated as a percentage of the market value of the land, typically 30% under the LARR Act.

KEY PROVISIONS:

Social Impact Assessment (SIA):

- Mandate: The Act requires a comprehensive SIA to evaluate the social and economic impacts of land acquisition on the affected population.

- Purpose: This assessment helps in understanding the broader implications of land acquisition, including potential displacement and loss of livelihoods.

Rehabilitation and Resettlement (R&R):

- Provisions: The Act mandates the provision of adequate rehabilitation and resettlement measures, including housing, employment opportunities, and livelihood support for affected individuals.

- Objectives: The goal is to mitigate the adverse effects of displacement and ensure that affected persons are not worse off due to the acquisition.

Consent and Right to Return (RFR):

- Consent: Landowners and affected persons must consent to the acquisition process, especially in cases involving private entities.
- Right to Return: The Act provides for the Right to Return and Rehabilitation (RFR) for those displaced by the acquisition, allowing them to return to their land if it is not used for the intended purpose.

Valuation Methods:

- Determination: Valuation methods vary and can include comparison with similar transactions, capitalization of income, and cost approaches.
- Challenges: Accurate valuation is challenging due to data scarcity, market fluctuations, and the subjective nature of property valuation.

Social Impact:

- Affected Persons: The number of people displaced, the loss of their livelihoods, and community disruption are significant factors considered in the compensation process.

- Mitigation: The LARR Act emphasizes rehabilitation and resettlement to address these impacts, aiming to provide a safety net for those affected.

Negotiation and Bargaining Power:

- Landowner Dynamics: The ability of landowners to negotiate fair compensation can vary based on their legal knowledge, unity with other affected persons, and the power dynamics with government agencies.

- Government Leverage: Government agencies often have significant leverage due to the urgency of public projects and statutory powers.

Compensation Multipliers:

- Rural Areas: Compensation in rural areas is typically twice the market value of the land.

- Urban Areas: In urban areas, compensation is increased to four times the market value, reflecting the higher land value and development potential.

Challenges and Issues:

- Under-compensation:
  - Perception: Landowners frequently perceive compensation as inadequate, leading to disputes and protests.
  - Resolution: Addressing these perceptions requires transparent and fair valuation practices.
- Delayed Payments:
  - Impact: Delays in compensation disbursement can cause financial strain on affected individuals.
  - Solutions: Timely payments are essential for reducing financial hardship and ensuring smooth acquisition processes.
- Ineffective Rehabilitation:
  - Shortcomings: Resettlement packages often fall short in meeting the needs of displaced populations, affecting their quality of life.
  - Improvements: Enhancing R&R packages and ensuring effective implementation can help address these shortcomings.
- Lack of Transparency:

- Trust Issues: The compensation process can lack transparency, leading to mistrust and allegations of corruption.
- Measures: Increasing transparency and involving stakeholders in the process can mitigate these issues.

- Implementation Gaps:
  - Bureaucratic Hurdles: Effective implementation of the LARR Act can be hindered by bureaucratic inefficiencies and lack of capacity at the ground level.
  - Capacity Building: Strengthening institutional capacity and streamlining procedures can improve implementation.

RELEVANT CASES ON LAND ACQUISITION IN INDIA

1. ***Century Rayon Limited v. IVP Limited & Ors. (2019), AIR 2020 SC 1923***

Facts

- Dispute: Century Rayon Limited and MSEDCL were involved in a dispute over the erection of electricity transmission towers on land owned by IVP Limited. IVP Limited claimed that the towers were being erected without proper permissions.

- Legal Proceedings: The trial court and High Court of Bombay issued an injunction restraining the work. Century Rayon Limited appealed to the Supreme Court.

Supreme Court Decision:

- Interim Relief: The Supreme Court set aside the injunction, acknowledging the work's progress and the public interest in completing the transmission line.

- Compensation: The Court directed Century Rayon Limited to make an additional ad hoc payment of Rs. 20,00,000/- as interim relief, pending the final outcome of the compensation dispute.

Legal Principles:

- Telegraph Act and Electricity Act: The Court examined provisions under these acts, emphasizing the need for compensatory measures in infrastructure development cases.

- Public Interest: The judgement highlighted the importance of securing public interest in infrastructure projects while ensuring the legal procedures are followed.

2. Delhi Development Authority (DDA) vs. Chandermal (2022)

Facts of the Case:

- Dispute: This case centered on whether the acquisition of land by the DDA lapsed under Section 24(2) of the LARR Act due to non-payment of compensation.

- Court's Decision: The Supreme Court upheld the High Court's decision that the acquisition had lapsed due to the DDA's failure to tender compensation.

Issues:

- Validity of Acquisition: The primary issue was whether non-payment of compensation invalidated the acquisition process.

Judgment:

- Lapsed Acquisition: The Supreme Court affirmed that the acquisition had lapsed under Section 24(2), reinforcing the importance of timely compensation.

3. ***Pune Municipal Corporation v. Harakchand Misirimal Solanki (2014), AIR 2014 SC 982***

Facts of the Case:

- Dispute: Pune Municipal Corporation failed to deposit awarded compensation within the two-year period stipulated by the Land Acquisition Act, 1894. The dispute was whether this non-compliance led to the lapse of the acquisition process.

Judgment:

- Lapsed Proceedings: The Supreme Court held that the acquisition proceedings had lapsed due to non-deposit of compensation. The land reverted to its original owners.

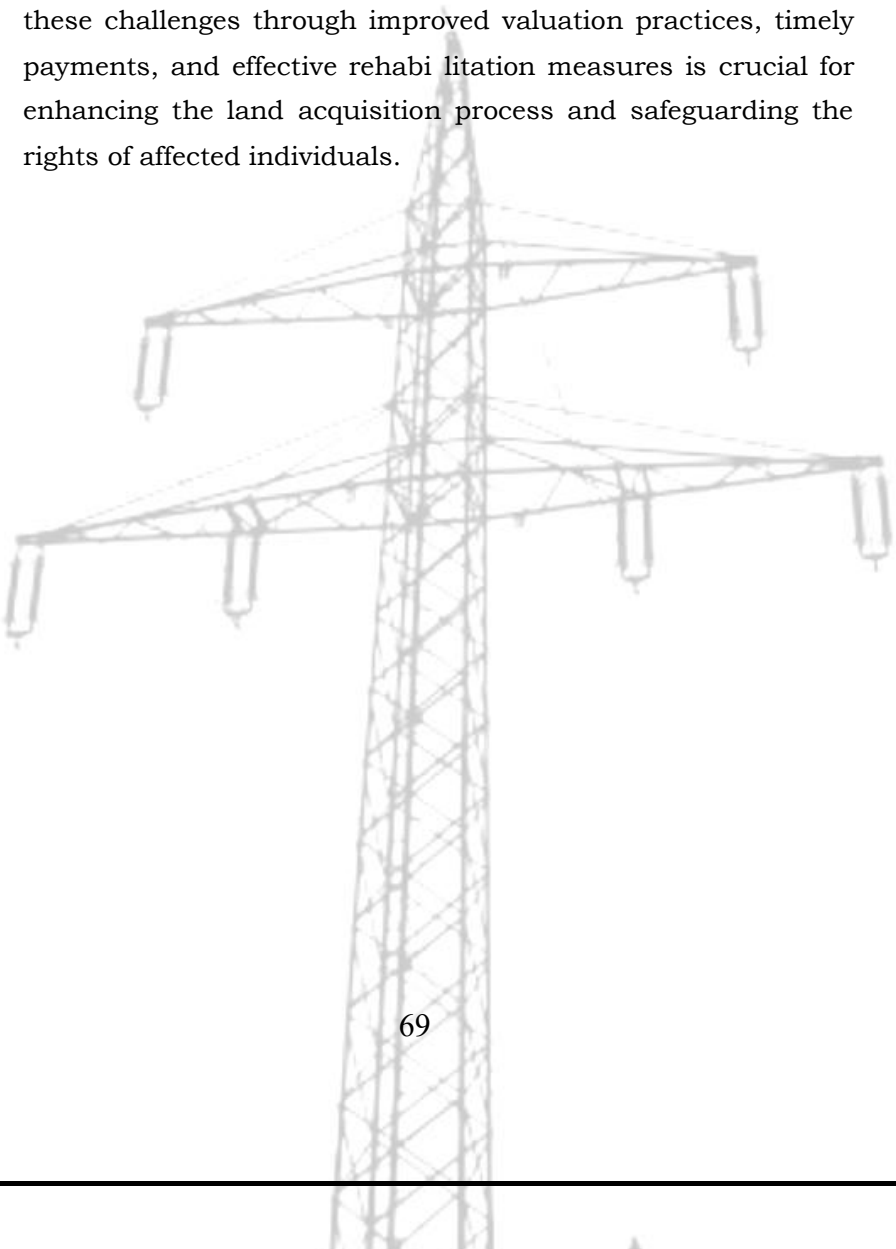
Legal Provisions:

- Land Acquisition Act, 1894: The case focused on the procedural requirements under this Act, including the timeframe for compensation deposit.

CONCLUSION

The compensation mechanism in Indian land acquisition law is designed to ensure fairness and transparency, with the LARR Act providing a comprehensive framework. However, challenges

such as under-compensation, delays, and implementation gaps persist. The legal cases discussed illustrate the complexities and evolving nature of land acquisition law in India. Addressing these challenges through improved valuation practices, timely payments, and effective rehabi litation measures is crucial for enhancing the land acquisition process and safeguarding the rights of affected individuals.



CHAPTER - 6

DETAILED ANALYSIS OF THE IMPACT OF HIGH-TENSION POWER TRANSMISSION LINES ON LOCAL COMMUNITIES

INTRODUCTION

High-tension power transmission lines, necessary for distributing electricity over long distances, can have wide-ranging impacts on local communities. These impacts extend to health, education, agriculture, and infrastructure, raising concerns among residents, medical professionals, and local governments. This comprehensive analysis explores these effects from the perspective of people living near these lines, providing insights into the challenges faced and the responses from various stakeholders.

HEALTH CONCERNS

1. **General Health Issues**:

- Electromagnetic Fields (EMFs): High-tension power lines emit EMFs, which some studies suggest might be associated with various health issues. Common concerns include:

- Headaches and Fatigue: Residents near power lines often report headaches, chronic fatigue, and other non-specific symptoms. While scientific evidence linking these symptoms to EMF exposure remains inconclusive, many individuals express concerns about potential health risks.

- Cancer Risks: There is ongoing debate over the potential link between EMFs and cancer, particularly childhood leukemia. Research has shown mixed results, with some studies suggesting a possible association while others find no significant risk.

- Psychosocial Stress:

- Anxiety and Fear: The uncertainty surrounding EMF health risks can lead to psychological stress among residents. Anxiety about potential long-term health effects can affect quality of life and lead to increased stress levels.

- Community Health Perception: Residents may also perceive an increased risk of health problems, which can lead to heightened vigilance and stress, even if scientific evidence does not confirm these fears.

2. Health of School Children:

- Impact on Cognitive Function: Parents and educators worry about the potential effects of EMFs on children's cognitive development. Some studies suggest that EMF exposure might impact concentration and learning, though evidence is still emerging.

- School Performance: Schools located near power lines may experience heightened concerns from parents and staff regarding potential health impacts on students. This can lead to increased scrutiny and pressure on educational institutions to monitor and address health concerns.

3. Medical College Students:

- Research Focus: Medical students involved in research may focus on studying the biological effects of EMFs, contributing to the body of knowledge about potential health risks. They often advocate for stricter safety standards and further research based on their findings.

- Educational Impact: The presence of high-tension power lines near medical institutions can also influence the curriculum, with increased emphasis on environmental health and safety studies.

IMPACT ON HOSPITALS

1. **Healthcare Facilities:**

- Operational Interference: Hospitals near high-tension power lines may face challenges related to electromagnetic interference with medical equipment. This interference can affect the performance of diagnostic tools and monitoring systems, potentially impacting patient care.

- Patient Concerns: Patients undergoing treatment may have concerns about the proximity of power lines. Hospitals must address these concerns by providing transparent information and ensuring that equipment and facilities are properly shielded from EMF interference.

2. **Health and Safety Regulations:**

- Compliance and Monitoring: Hospitals must comply with health and safety regulations that address electromagnetic interference. Regular monitoring and maintenance of equipment are crucial to ensure that medical services are not compromised by EMF exposure.

EFFECTS ON AGRICULTURAL LAND

1. **Crop Growth and Productivity:**

- Electromagnetic Impact on Plants: Farmers report that crops grown near power lines may suffer from reduced growth and lower yields. EMFs might interfere with plant physiological processes such as photosynthesis and nutrient absorption, potentially affecting crop quality.

- Soil Health: EMFs could potentially affect soil health by altering microbial activity. Changes in soil fertility can impact crop productivity, raising concerns among farmers who depend on their land for their livelihood.

2. Economic Impact:

- Property Value: Agricultural land near high-tension power lines often experiences decreased property values. This devaluation can affect farmers' financial stability and their ability to invest in land improvements or secure loans.

- Insurance Costs: Higher insurance premiums or difficulties obtaining coverage due to perceived risks from power lines can place additional financial strain on farmers.

EDUCATIONAL INSTITUTIONS

1. Schools and Universities:

- Infrastructure Challenges: Educational institutions located near power lines may face challenges related to infrastructure and maintenance. EMF-related concerns can affect the physical environment of schools, including potential impacts on classroom conditions and health.

CONCLUSION

The presence of high-tension power transmission lines presents multifaceted challenges for local communities. These challenges include potential health risks, impacts on education, and effects on agriculture and infrastructure. Addressing these concerns requires a balanced approach that considers both the benefits of energy infrastructure and the well-being of affected residents. Ongoing research and community engagement are crucial in developing effective strategies to mitigate the adverse impacts and enhance overall quality of life.

CHAPTER -7

COMPREHENSIVE RESEARCH REPORT ON BUFFER ZONES FOR ELECTRICITY TRANSMISSION POWERLINES

INTRODUCTION

Electricity transmission lines, especially high-tension powerlines, are integral to modern electrical grids, transporting electricity over long distances from power generation facilities to substations and distribution centers. These high-voltage lines play a crucial role in meeting the growing electricity demands of expanding urban areas. In cities like Bengaluru, where urban expansion has led to residential and commercial developments encroaching close to these powerlines, there are significant concerns regarding safety and health.

Buffer zones are crucial areas established around high-tension powerlines to ensure safety, facilitate maintenance, and minimize potential health risks. Despite their importance, there are growing concerns that existing buffer zone regulations, particularly under the Indian Electricity Act, are inadequately enforced, leading to increased risk for residents living in proximity to powerlines.

BUFFER ZONES: DEFINITION AND PURPOSE

Definition of Buffer Zones

A buffer zone is a designated area surrounding powerlines where certain land uses and activities are restricted. The primary purposes of buffer zones include:

- Ensuring Safety: To prevent interference with powerlines and reduce the risk of accidents, such as electrocution and fires.
- Facilitating Maintenance: To provide clear access for maintenance and emergency repairs, ensuring the safe operation of the transmission system.
- Minimizing Health Risks: To mitigate exposure to electromagnetic fields (EMFs) emitted by powerlines, which may be linked to various health issues.

Importance of Buffer Zones

The importance of buffer zones can be summarized as follows:

- Safety from Electrical Hazards: Powerlines carry high-voltage electricity that poses serious risks. Buffer zones help prevent accidental contact with powerlines, thereby reducing the risk of electrocution and electrical fires.

- Maintaining Operational Efficiency: Regular maintenance and emergency repairs are essential to keep powerlines functioning properly. Buffer zones ensure that these activities can be carried out without obstruction.

- Health Protection: EMFs emitted by high-tension powerlines have been associated with various health issues. Buffer zones help reduce prolonged exposure to these fields, potentially mitigating health risks.

BASIC PRINCIPLES OF ELECTROMAGNETIC RADIATION (EMR) AND ELECTROMAGNETIC FIELDS (EMF)

Electromagnetic Radiation (EMR)

Electromagnetic radiation (EMR) is energy propagated through space by electromagnetic waves. In the context of powerlines, EMR is primarily low-frequency non-ionizing radiation. This type of radiation does not have enough energy to ionize atoms or molecules but can still influence biological systems.

- Electric Fields: Produced by electric charges. These fields are present whenever voltage is applied to powerlines. The strength of electric fields decreases with distance from the source.

- Magnetic Fields: Created by the flow of electric current through powerlines. These fields are found around any conductor carrying current. Like electric fields, the strength of magnetic fields decreases with distance.

Electromagnetic Fields (EMF)

High-tension powerlines generate strong electromagnetic fields (EMFs) due to the high voltage and current they carry. The intensity of these fields is proportional to the amount of current passing through the powerlines and diminishes with increasing distance from the source.

Health Implications of EMF Exposure

The potential health effects of EMFs are a subject of ongoing research. Studies have suggested associations between long-term exposure to EMFs and various health conditions, including:

- Cancer: Some studies have linked EMF exposure to increased risks of certain types of cancer, such as leukaemia and brain cancer.

- Neurological Disorders: Prolonged exposure to EMFs has been associated with neurodegenerative diseases like Alzheimer's disease.

- Cardiovascular Issues: Research has suggested a possible link between EMF exposure and cardiovascular problems.

The US Environmental Protection Agency (EPA) advises minimizing exposure to EMFs by increasing distance from the source and limiting time spent near it.

EMPIRICAL STUDIES ON EXPOSURE TO EMR

Key Studies

Several epidemiological and laboratory studies have examined the health impacts of EMF exposure

- Tomenius (1986): A study in Stockholm County, Sweden, found that children living within 150 meters of a 200 kV powerline had a higher incidence of cancer-related diseases.

- Huss et al. (2009): Research conducted in Switzerland revealed that individuals residing within 50 meters of a 220-338 kV powerline had an increased risk of dying from Alzheimer's disease. The risk increased with the duration of residence within this proximity.

- Port Harcourt Incident (2010): In Nigeria, a tragic event occurred when 30 people living near a 330 kV powerline were electrocuted due to a snapped cable.

Implications of Findings

These studies underscore the importance of maintaining adequate buffer zones to protect public health. The correlation between proximity to high-tension powerlines and increased health risks highlights the need for stringent regulations and enforcement to ensure that buffer zones are properly implemented.

BUFFER ZONE CLASSIFICATION AND IMPLEMENTATION

Classification

Buffer zones are categorized based on the level of risk:

- 100-Metre Buffer Zone (Double-Risk Zone): This zone experiences higher risks from EMF exposure, potential electrocution, and structural failure of the powerline.

- 300-Metre Buffer Zone (Single-Risk Zone): This zone faces lower EMF exposure and reduced risk of electrocution compared to the 100-metre zone.

Implementation Steps

- Identification of Powerline Corridor: Determine the precise route of the powerline considering factors such as terrain and population density.
- Determining Buffer Zone Width: The width depends on the powerline's voltage. Higher voltages necessitate wider buffer zones, with specific measurements provided by regulatory guidelines.
- Clearing Vegetation: Remove trees, shrubs, and other vegetation within the buffer zone to prevent interference and reduce fire hazards.
- Land Use Restrictions: Enforce regulations to restrict activities within the buffer zone, including construction and planting, to prevent interference with the powerline.
- Monitoring and Maintenance: Conduct regular inspections to ensure the buffer zone remains clear and address any encroachments or vegetation growth promptly.
- Land Ownership: Negotiate easements with private property owners to establish and maintain the buffer zone.

- Public Awareness: Educate the public on the purpose of buffer zones and the importance of adhering to restrictions.

INTERNATIONAL POLICIES ON BUFFER ZONES

New Zealand

Transpower, New Zealand's state-owned electricity network operator, enforces buffer zones to prevent incompatible activities near high-tension powerlines. Construction and major earthworks are restricted within a 12-meter "Red Zone".

Vietnam

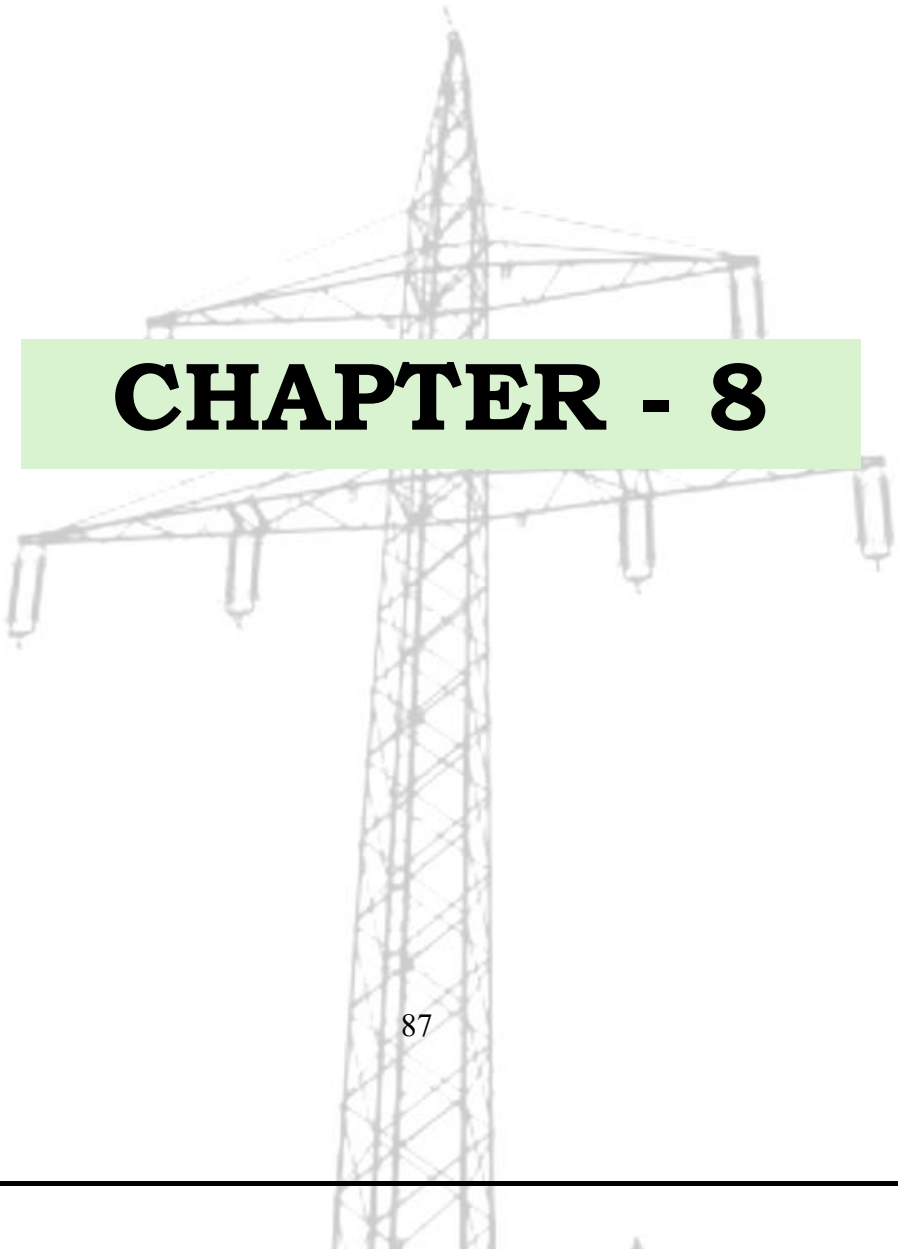
Vietnamese regulations set out requirements for buffer zones around high-voltage transmission lines. Buildings and workplaces within these zones must use non-combustible materials and maintain specific distances from powerlines to ensure safety.

United States

The US Government advises minimizing EMF exposure by increasing distance from powerlines and limiting the time spent near them.

CONCLUSION

High-tension powerlines are vital for the efficient transmission of electricity, but their proximity to densely populated areas present significant risks. Buffer zones are essential for ensuring public safety, minimizing health risks associated with EMF exposure, and facilitating maintenance operations. International guidelines emphasize the importance of buffer zones, yet Bengaluru's enforcement remains insufficient. With over 10,250 buildings identified as dangerously close to powerlines, there is an urgent need for enhanced regulatory measures, improved enforcement, and increased public awareness to safeguard community health and safety.



CHAPTER - 8

DETAILED ANALYSIS OF THE INDIAN TELEGRAPH ACT, 1885 IN THE CONTEXT OF BUFFER ZONES FOR HIGH-TENSION TRANSMISSION LINES

HISTORICAL BACKGROUND AND EVOLUTION

ORIGIN AND PURPOSE

The Indian Telegraph Act, 1885, was enacted by the British colonial administration to facilitate the installation and maintenance of telegraph lines across India. The British government sought to create a comprehensive communication network to enhance administrative efficiency and control. The Act granted the central government significant powers to build and manage telegraph infrastructure, which was critical for governance and military coordination in the vast Indian subcontinent.

Initial Implementation

The telegraph network's development began with the first line established between Calcutta and Diamond Harbour in 1850. The network quickly expanded, with the Act of 1885 formalizing the regulatory framework. The Act allowed the British authorities to use both public and private lands for telegraph

lines, which was essential for the extensive network required to cover India's diverse geography.

Post-Independence Amendments

Post-independence, the Indian government retained the Act, but several amendments were made to reflect changes in political and technological contexts. The Act was extended to cover the entire nation, including areas previously excluded like Hyderabad. Amendments were introduced to modernize the Act and align it with contemporary needs, including new communication technologies.

KEY PROVISIONS AND THEIR MODERN RELEVANCE

Definitions and Scope

- Telegraph: The term "telegraph" is defined broadly under the Act, encompassing any device used for transmitting or receiving signals. This definition has allowed the Act to remain relevant in the face of technological advancements, including radio waves and electromagnetic emissions.

- Telegraph Office: Refers to the entities or individuals involved in the maintenance and operation of telegraph services, whether by the government or licensed private entities.

- Telegraph Line: Includes the physical infrastructure used for telegraphy, such as wires and associated apparatus.

- Director General of Posts and Telegraphs: The official responsible for overseeing the implementation of the Act.

- Municipal or Local Bodies: These are local administrative units involved in managing local funds and infrastructure.

Section 10: Powers and Restrictions

- Purpose Restriction (Section 10(a)): Grants the telegraph authority powers exclusively for telegraph-related purposes. This restriction ensures that the authority's powers are used solely for public telecommunication objectives and prevents misuse for private or unauthorized purposes.

- Rights of User Only (Section 10(b)): The government acquires only the right to use property for telegraph installations and does not gain ownership. This provision protects property owners' interests by ensuring that their rights are not diminished by the government's actions.

- Local Authority Property (Section 10(c)): Prohibits the telegraph authority from interfering with properties under local authority control without permission. This clause underscores the

importance of local governance and ensures that telecommunication infrastructure development respects local administrative jurisdictions.

- Minimization of Damage and Compensation (Section 10(d)): Mandates the telegraph authority to minimize damage and provide full compensation for any harm caused to properties not under local authority control. This provision aligns with principles of fairness and accountability, essential for managing infrastructure projects near residential areas.

Section 14: Alteration of Pipes and Drains

- Notice Requirement (Sub-section a): Requires the telegraph authority to notify local authorities before altering gas or water pipes or drains. This ensures that local authorities are aware of and can prepare for any planned alterations, minimizing disruptions to essential services.

- Supervision and Satisfaction (Sub-section b): Allows local authorities to supervise the work and ensures that the alterations are done to their satisfaction. This provision protects local infrastructure and ensures that changes do not compromise safety or functionality.

Section 16: Conflict Resolution

- Intervention by District Magistrate (Sub-section 1): Empowers the District Magistrate to intervene if the telegraph authority faces resistance or obstruction. The DM can issue orders permitting the authority to proceed, balancing the need for infrastructure development with local concerns.

- Penal Consequences for Non-compliance (Sub-section 2): Imposes penalties for individuals who resist or obstruct the telegraph authority's work. This provision acts as a deterrent against obstruction and ensures compliance with the DM's orders.

- Disputes Over Compensation (Sub-sections 3 and 4): Provides a mechanism for resolving disputes over compensation for damages. The District Judge is involved in determining fair compensation and resolving issues related to entitlement and distribution.

Section 17: Removal or Alteration of Telegraph Lines

- Right to Request Removal or Alteration (Sub-section 1): Allows property owners to request the removal or alteration of telegraph infrastructure if it interferes with their property use. This provision acknowledges the property owner's autonomy and need for development.

- Financial Responsibilities and Compensation (Proviso to Sub-section 1): Requires property owners to cover the costs of removal or alteration, ensuring that the telegraph authority is not burdened with unnecessary expenses.

- District Magistrate's Role in Dispute Resolution (Sub-sections 2 and 3): Provides a mechanism for resolving disputes between property owners and the telegraph authority. The DM has discretion in decision-making, ensuring fair and balanced resolutions.

Section 20A: Breach of License Conditions

- Penalties for License Holders: Imposes fines for violating license conditions, reinforcing the importance of regulatory compliance and providing a financial deterrent against breaches.

Section 21: Unauthorized Telegraphs

- Fines for Unauthorized Use: Prevents the use of unauthorized telegraphs and ensures that all telecommunication activities adhere to legal requirements.

IMPLICATIONS FOR BUFFER ZONES AROUND HIGH-TENSION TRANSMISSION LINES

Relevance of the Act to Modern Infrastructure

While the Indian Telegraph Act, 1885, was designed for telegraphy, its principles can be applied to modern infrastructure management, including high-tension transmission lines. The Act's provisions on property rights, compensation, and conflict resolution are relevant for managing buffer zones around high-tension lines, which are crucial for mitigating the health risks associated with electromagnetic fields (EMFs).

Buffer Zones and EMF Regulations

- Buffer Zones: These are designated areas around high-tension transmission lines intended to minimize exposure to EMFs and protect public health. The principles of minimizing damage and compensating affected parties, as outlined in Section 10(d), are

applicable to managing these zones. Ensuring that property owners are compensated for any impact on their land is essential for maintaining public trust and compliance.

- Health and Safety: The Act's emphasis on minimizing damage and ensuring safety can be extended to managing the health risks associated with EMFs. Buffer zones help reduce exposure levels and mitigate potential health impacts, aligning with the Act's principles of protecting property owners and public interests.

Legal Framework and Dispute Resolution

- Conflict Resolution Mechanisms: The Act's provisions for resolving disputes and ensuring compliance, particularly those in Section 16, provide a framework for addressing conflicts related to buffer zones. The District Magistrate's role in adjudicating disputes and ensuring fair compensation aligns with managing conflicts between infrastructure development and property interests.

- Compensation for Affected Parties: The Act's provisions for compensation and financial responsibilities ensure that property owners are fairly compensated for any damage or disruption caused by infrastructure projects. This is crucial for

maintaining balance and addressing grievances related to high-tension transmission lines.

Ensuring Compliance and Safety

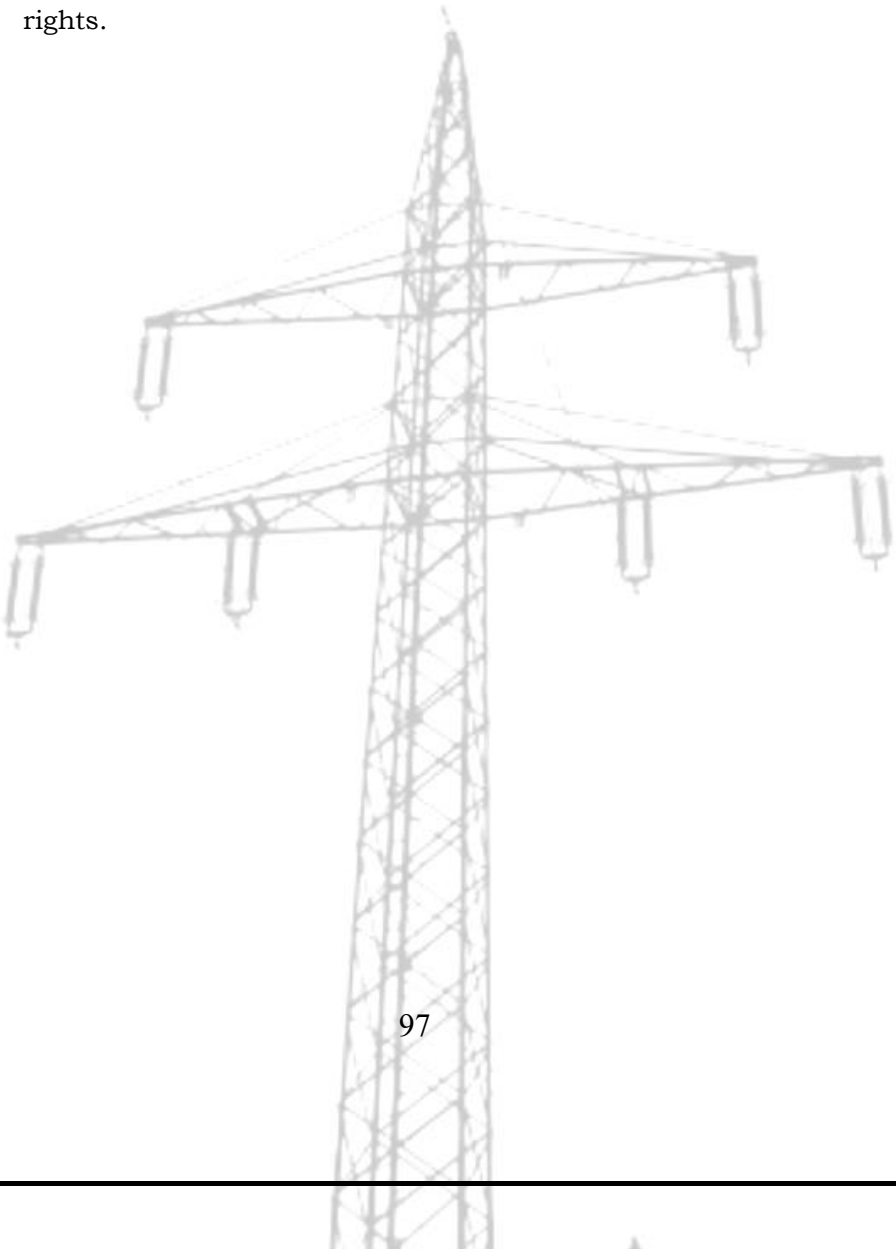
- Penalties for Non-compliance: The Act's provisions for penalties and fines, as seen in Sections 20A and 21, underscore the importance of regulatory compliance. These provisions ensure that telecommunication activities, including those related to buffer zones, adhere to legal standards and protect public interests.

- Unauthorized Use: Preventing unauthorized use of telecommunication infrastructure ensures that all activities related to high-tension transmission lines comply with legal requirements. This helps maintain safety standards and regulatory integrity.

CONCLUSION

The Indian Telegraph Act, 1885, while initially designed for telegraphy, provides foundational principles that remain relevant for modern infrastructure management. Its provisions on property rights, compensation, and conflict resolution are applicable to managing buffer zones around high-tension transmission lines. By aligning these principles with contemporary needs, including health and safety considerations

related to electromagnetic fields, the Act's framework can effectively support the development and regulation of critical infrastructure while protecting public interests and property rights.



CHAPTER – 9

GROWTH OF BANGALORE CITY AND EXTENSION OF BBMP IN 50 YEARS

Bangalore, the capital of Karnataka, has witnessed an extraordinary transformation over the last five decades, evolving from a quiet, garden city into a sprawling metropolitan hub. This growth has been largely influenced by the city's strategic positioning as an IT and industrial powerhouse, leading to unprecedented urban expansion. This rapid development necessitated the extension and reorganization of the city's municipal governance under the Bruhat Bengaluru Mahanagara Palike (BBMP). A critical aspect of this growth has been the role of infrastructure development, particularly the Karnataka Power Transmission Corporation Limited (KPTCL), in meeting the city's burgeoning energy demands.

Historical Context: Early Stages of Bangalore's Growth

In the early 1970s, Bangalore was characterized by its colonial charm, renowned for its educational institutions, public sector undertakings (PSUs), and lush greenery. The Bangalore City Corporation (BCC), established in 1949, was tasked with managing the city's civic infrastructure. However, its jurisdiction was relatively limited, covering an area of about 70 square

kilometers. The city's population at that time was around 1.7 million, with urban development largely concentrated in central areas such as M.G. Road, Jayanagar, and Malleswaram.

The IT Revolution and Urban Sprawl

The 1980s and 1990s marked a significant turning point for Bangalore, driven primarily by the IT revolution. The establishment of key technology parks, such as Electronics City in 1978 and

Whitefield's International Tech Park in 1994, catalyzed an influx of IT companies. This, in turn, attracted a large, skilled workforce, propelling rapid population growth. Between 1981 and 1991, Bangalore's population swelled from 2.9 million to 4.1 million, and the city began to outgrow its existing boundaries.

The expansion of the IT sector brought about a boom in real estate and urban development. Suburban areas, once considered peripheral, were quickly absorbed into the urban sprawl, transforming Bangalore into a polycentric city. The infrastructure demands of this expansion put immense pressure on the existing civic administration, leading to the first significant expansion of the BCC in 1986, when it was renamed Bangalore Mahanagara Palike (BMP)

Formation and Expansion of BBMP

By the early 2000s, the need for a more extensive and coordinated municipal governance structure became evident. In 2007, the Bangalore Mahanagara Palike was reorganized as the Bruhat Bengaluru Mahanagara Palike (BBMP). This reorganization was monumental, expanding the city's jurisdiction from 225 square kilometers to 709 square kilometers. The BBMP absorbed seven City Municipal Councils (CMCs) – Rajarajeshwari Nagar, Bommanahalli, Mahadevapura, K.R. Puram, Yelahanka, Dasarahalli, and Byatarayanapura – along with one Town Municipal Council (TMC) and 110 villages.

This expansion was driven by the need to bring suburban and peripheral areas under a unified administrative framework, allowing for more coordinated urban planning and infrastructure development. The BBMP was tasked with managing everything from roads, waste management, and water supply to public health and urban planning across a vastly increased area.

Role of KPTCL in Supporting Urban Growth

Parallel to the expansion of BBMP, Bangalore's rapid urbanization required substantial enhancements in its energy

infrastructure. The Karnataka Power Transmission Corporation Limited (KPTCL), established in 1999 after the unbundling of the Karnataka Electricity Board (KEB), played a crucial role in this regard. As the city expanded, so did its energy needs, particularly with the growth of energy-intensive sectors such as IT, manufacturing, and real estate.

KPTCL was responsible for the transmission of electricity from generating stations to various distribution companies (DISCOMs) across the state, including Bangalore. The growing demands of the city necessitated significant investments in transmission infrastructure, including the establishment of new substations and the upgrading of transmission lines to cater to the increased load.

For instance, the construction of high-voltage transmission lines through areas like Nelamangala and Peenya, which are part of Bangalore's industrial corridors, was vital in supporting the city's industrial and residential growth. These developments were closely linked with the city's expansion under BBMP, as they ensured that newly incorporated areas had the necessary energy infrastructure to support development.

Challenges of Rapid Urbanization and Infrastructure Strain

The rapid urbanization of Bangalore brought with it a myriad of challenges. The extension of BBMP, while necessary, highlighted the gaps in urban infrastructure, particularly in newly incorporated areas. These areas often lacked basic amenities, and the existing infrastructure was inadequate to support the growing population. Traffic congestion, waste management issues, water scarcity, and air pollution emerged as significant concerns.

Energy infrastructure, managed by KPTCL, also faced challenges. The increased load from residential and industrial expansion required constant upgrades to the transmission network. The integration of renewable energy sources, such as solar and wind, into the grid became essential to meet the city's energy needs sustainably. Moreover, the installation of new transmission lines often led to conflicts between the state and private landowners, requiring careful negotiation and compensation frameworks.

Recent Developments and Technological Integration

In recent years, both BBMP and KPTCL have embraced technological advancements to address the challenges of urban growth. The BBMP has implemented several smart city initiatives, focusing on digital governance, traffic management,

waste disposal, and public health. The introduction of Geographic Information System (GIS) mapping, online portals for civic services, and real-time monitoring systems has enhanced administrative efficiency and transparency.

KPTCL, on its part, has focused on modernizing the transmission network. The deployment of Supervisory Control and Data Acquisition (SCADA) systems has improved the monitoring and management of electricity flow, reduced transmission losses and enhancing reliability. The integration of renewable energy into the grid has also been a priority, aligning with Bangalore's growth as a green city.

Future Prospects: Sustainable Urban and Infrastructure Development

As Bangalore continues to expand, the future of the city lies in sustainable urban development. The BBMP will play a crucial role in ensuring that growth is managed in a way that balances economic development with environmental preservation. Strategic urban planning, investments in public infrastructure, and citizen participation will be essential to address the challenges of urbanization.

Similarly, KPTCL's role will be pivotal in supporting Bangalore's growth by ensuring a stable and sustainable energy supply. This will involve continued investments in transmission infrastructure, the integration of smart grid technologies, and the expansion of renewable energy sources. As the city grows, it will be essential for BBMP and KPTCL to work in tandem, ensuring that urban development and infrastructure planning are closely aligned.

The growth of Bangalore over the last 50 years is a remarkable story of transformation. The extension of BBMP was a necessary step to manage the rapid urbanization that accompanied the city's rise as a global IT hub. Simultaneously, the role of KPTCL in expanding and modernizing the energy infrastructure has been critical in supporting this growth. As Bangalore looks to the future, the lessons learned from the past five decades will be invaluable in guiding its development into a sustainable, world-class city that continues to thrive on innovation and inclusivity.

TREND OF ENERGY DEMAND IN LAST 25 YEARS IN BANGALORE AND SUBURBS AROUND BANGALORE

It has been an 18-year tenure of Bangalore Electricity Supply Company Limited (BESCOM) in Karnataka's electricity distribution business. Currently, eight Karnataka districts are

included in BESCOM's service region. For example, Chikkaballapur, Kolar, Tumkur, Davanagere, Chitradurga, Ramanagara, and Bangalore Urban and Rural.

Through regulations, the Commission has provided guidelines for creating the load forecast, the power procurement plan, and the power procurement procedure:

- KERC (Conditions of License for ESCOMs) Regulations of 28-04-2004,
- KERC (Load Forecast) Regulations of 02-04- 2009.

In order to maintain consistency in approach, the Commission has instructed Distribution Licensees to adhere to the Forecast methodology periodically implemented by CEA through the aforementioned Load Forecast regulations. In addition, it states that, in order to meet the CEA's requirement under Section

73(a) of the Electricity Act of 2003, the prediction based on the most recent Electric Power Survey of India (EPS) will serve as the reference point. Approximately half of the energy and demand requirements for Karnataka State are met by BESCOM. 50% of BESCOM's energy and demand requirements are urban in Bangalore alone. Bangalore Urban alone therefore accounts for 25% of the State's overall energy and demand requirements. For

distribution businesses to understand the makeup of future electricity demand, forecasting electricity demand is a crucial job. For categories like irrigation pump sets and Bhagya Jyothi installations, we need to integrate historical assessment with statistical/probability-based modelling in order to produce more accurate forecasts. Even though BESCOM has historical data going back to FY-03, it is believed that growth projections from previous years will be more accurate for years to come. The idea of taking into account a small amount of historical data stems from the way the power industry has changed recently, enacting new laws to boost market competition and increase the amount of electricity produced from renewable sources.

According to information obtained from BESCOM engineers, Bangalore's electrical load has progressively climbed starting April 2023, going from 7% to 19% in various months. While 3505 Mw was the peak demand in Bangalore in 2022–2023, this year's usage has exceeded 3632 Mw. Increased consumption is anticipated as a result of the unpredictable monsoon, urban heat, island phenomenon, and a shortage of lung areas that leads to warmer days.

The total number of BESCOM customers as of June 2023, was 13.33 million. The utility serves 14,920 high-tension (HT), 0.20 million low-tension (LT), 1.04 million commercial, 7.5 million

households, and 0.87 million agricultural customers. The remaining customers fall into several groups. 25,967 MUs of electricity were sold to different consumer categories in 2017–18. 19678.23 MUs of this fell into the metered category, and the remaining MUs fell into the unmetered category. 1,185 MUs were LT sales and 8,204 MUs were HT sales of the total amount of power sold under the metered category. Agricultural consumers' irrigation pump sets fall under the unmetered category.

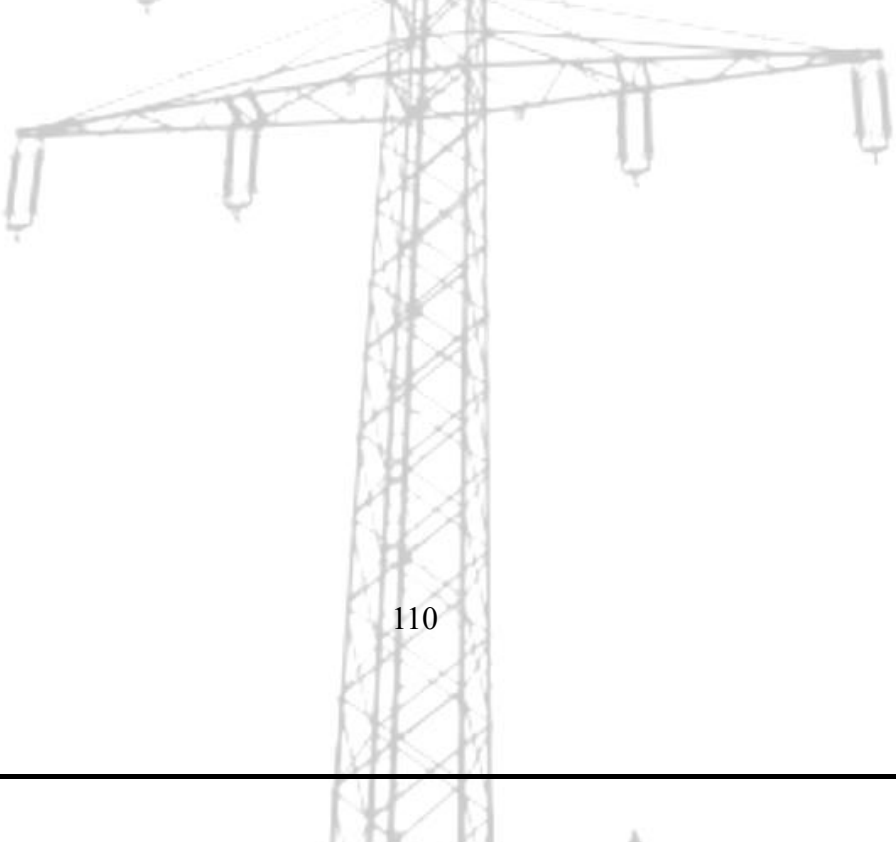
In the past, the AT&C loss of BESCOM has continuously outperformed the national average. Over time, there has been a progressive improvement; in FY06, it was 34.25%, but in FY22, it was less than 11%. Owing to the favourable demographic makeup of its clientele, BESCOM has expanded its digital collection through a number of programs throughout the years. Because of this, the business was able to control cash inflow even during COVID-19 lockdowns. However, because of the very restricted normative transmission and distribution (T&D) loss trajectory, BESCOM has not been able to generate any significant incentive revenue. Bangalore Metropolitan Area Zone (North), Bangalore Metropolitan Area Zone (South), Bangalore Rural Area Zone, and Chitradurga Zone are the four operating zones of BESCOM. With a population of about 20.7 million and a consumer base of over 13.33 million, it covers an area of

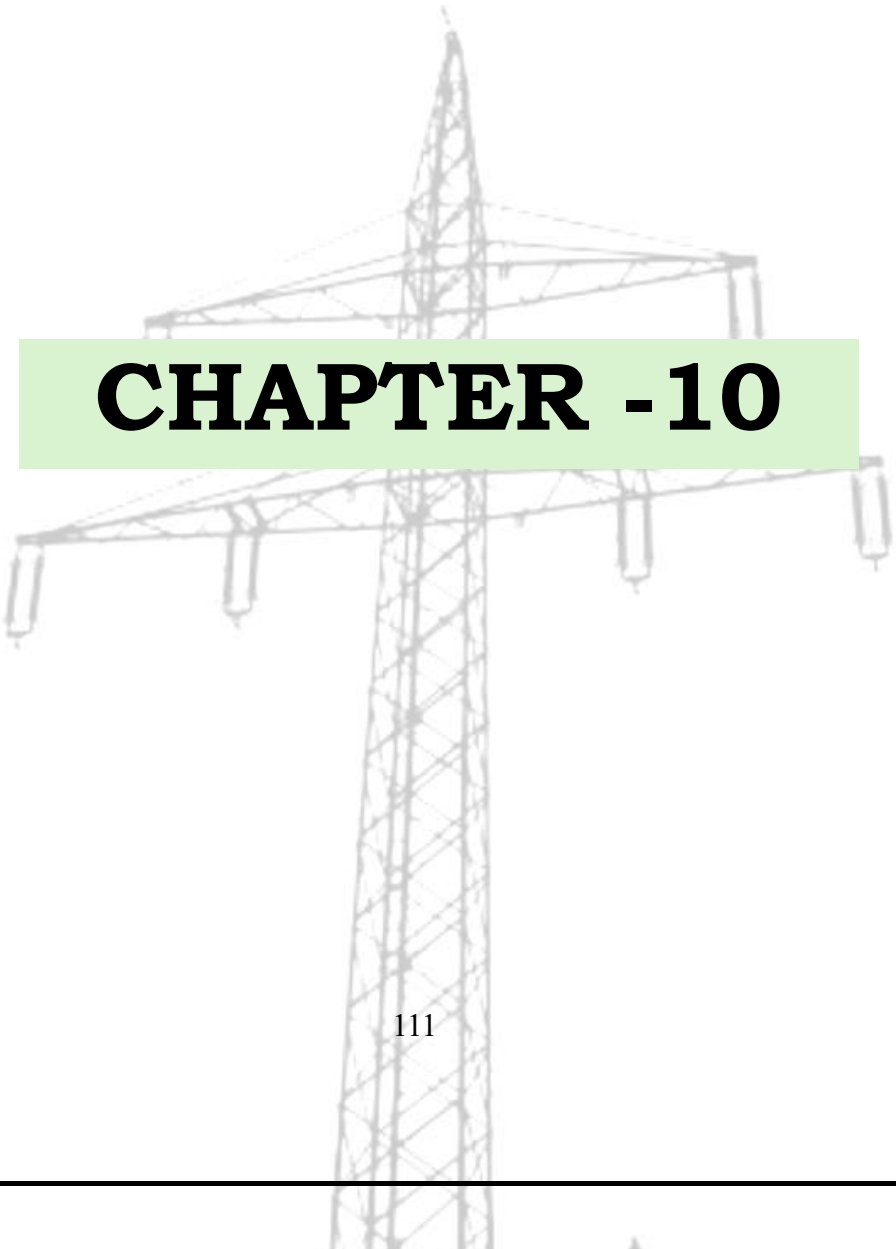
41,092 square KMs. BESCOM's distribution license will be valid starting on June 10, 2004, and it will last for 25 years.

Bangalore uses roughly 2300 MW (Mega Watt) of electricity every day. In other words, the city receives an average of 2300 MW of power transmission throughout the day (although there are notable variations in peak and non-peak hour usage). Approximately one-third of the state's electricity is used by Bangalore. The average daily demand in Karnataka is 6000 MW. Bangalore uses 42 million Units (MU) of energy per day on average, compared to the state's 140 MU. 42 MU of energy are consumed during the day as a result of the 2300 MW of transmission.

The Energy Department's data indicates that on February 12, 2024, the state's peak demand was 17,220 MW, and on April 5, 2024, the state's greatest average daily consumption was 332 million units. In order to fulfil the enormous demand, the state's thermal power plants have also been operating at full capacity. The state experienced a summer-like situation starting in August 2023 because to the failure of the monsoon, which caused the three thermal power plants to collectively produce close to 22,000 million units of power last year. As a result, the demand increased significantly.

The revenue demand in the Bescom jurisdiction has increased by around 300% in the last ten years as a result of rising power consumption and a growing customer base. The total revenue demand was Rs 11,560 crore in 2013–14 and rose to Rs 34,945.16 crore in 2023–24. Senior Bescom officials ascribed the sharp increase to expanding patterns in electricity usage across all industries. In every way, Bengaluru has expanded dramatically during the past ten years. Power consumption has surged due to an increase in the number of industries, residential connections, and electrical appliance usage everywhere. Over the past ten years, there has been an almost 25% increase in power consumption.





CHAPTER -10

HISTORY SPECIFIC TO THE THREE LINES IN QUESTION

There is a long history about the three lines in question, related to the electricity connection and supply to the city of Bangalore. The same has been discussed below in detail.

SARASVATHI RECEIVING STATION

The Sharavathi Receiving Station (SRS) was founded on January 25, 1965. SRS, Peenya MUSS functions as an industrial substation, switching substation, and transformer substation as needed. It's a substation outside. There are thirteen 66 KV lines and six 220 KV lines in total. Nelamangala, which has 220 kV lines for NL-2, NL-3, and NL-4, is the primary source of incoming power. The voltage levels that the station is transmitting are 220 KV, 66 KV, and 11 KV.

Power is supplied by this station to CPRI (220KV), Subramanyapura, and the NRS. On the other hand, power is both exported and imported via the Hebbala (220 KV) line. The Subramanyapura line is idle, so we can draw from it whenever we need extra load. This station provides 66KV service to 13 outgoing lines, which are stepped down to 11KV via the use of

20MVA transformers. There are four banks and thirty-one 11KV feeders among the eleven KV lines.

The substation has four power transformers, rated at 150MVA (3 Nos.) and 67.5MVA (1 No.), to lower the voltages from 220KV to 66KV. To step down from 66KV to 11KV, it has three transformers rated at 20MVA and one transformer rated at 31.5MVA. The entire station has been earthed using GI and MS plates, measuring 0.9–1 meter.

Two battery rooms exist, one of which is operational and the other disassembled and vacant. The Exide battery firm has granted the SRS substation an appropriate maintenance certificate due to the 50-year-old lead acid battery sets. Set A and Set B, both comprising 110 cells and offering a 220V DC voltage, make up the operational battery room.

There are two bus bars at the station: North Bus, South Bus, and North Bus A and B. North Bus A is expanded upon by North Bus B. An auxiliary transformer with a 500KVA rating powers the whole substation.

SPECIFICATIONS OF THE THREE TRANSMISSION LINES

- It is one of the oldest substations in Bengaluru, with all types of circuit breakers and a Mitsubishi transformer made in Japan (the oldest transformer in the MUSS).

- It has 220KV North and South buses, in addition to an extended North bus that is installed.

- The main incoming lines to this MUSS come from Nelamangala, both directly and indirectly through Hebbala.

- A control room on the second level uses ABBRTU HMI software to monitor and operate the NL-3 line. It also contains 66KV North and South Bus. The program allows the line's MW and MVAR to be seen on the monitor.

- SAS is situated next to the current control room, which is used to monitor NL-2. As part of an all-inclusive substation control and monitoring system, the Sub-station Automation System, or SAS, offers protection, control, automation, monitoring, and communication capabilities.

- There is an old battery compartment with 1000AH capacity that was maintained in 1987 and linked to power in 1993. Led-peroxide batteries are housed in glass containers. It has been certified by Exide Company and has been in service for fifty years.

- BMRCL and Brindavana, the two 66KV feeders in Peenya SRS MUSS, are sent via Under-Ground Cable (UGC). • This station is equipped with a double break and single break GOS isolator.

- Every line connected to the SRS MUSS has its own Bay Control Unit (KIOSK), which allows for remote control. Additionally, remote control from an SLDC or the Control Room is possible.

NOTE: There isn't much information available about the transmission lines pertaining particularly to the 3 lines. The information that is mentioned is merely about the SRS substation.

REPORT ON GAPS, WRONGDOINGS AND LIMITATIONS IN THE CASE OF ENHANCEMENT OF TENSION POWERLINES FROM PEENYA TO NELAMANGALA

The proposed Neelamangala to Peenya transmission line, which involves drawing a fresh line and upgrading an existing line, is a clear example of systemic flaws in India's infrastructure development. The project, which is controversial because of its proximity to residential areas, shows an example of disregard for public health, environmental concerns and legal frameworks. The main problem is that there is no comprehensive assessment

of the impact on the environment. The decision to run power lines in highly developed areas shows a serious concern for public health and safety. Exposure to electric fields, a known health problem, increases the voltage from 220 kV to 400 kV.

Residents of villages and areas along the 16.5 km Peenya-Nelamangala road are all set after the Karnataka Power Transmission Power Corporation Limited started upgrading a power transmission line high along the stretch. KPTCL is upgrading 220 KV DC line to 400 KV multi-circuit line as part of a plan to set up 2x500 MVA, 400/220kV at Peenya to replace 220/66kV SRS Peenya substation.

The line to be replaced will pass through densely populated areas of Nelamangala, Danojipalya, Arashinakunte, Shivanapura, Geejagadahalli, Narayanpalya, Domarahalli, Thippenahalli, Indirangara, Kote Cross, Doddabidarkallu, Nelagadaranahalli and Peenya II Stage etc. This project aims to reduce energy loss, save energy, and solve problems such as low voltage and power outages. It is still unclear about the purchase of land and the payment of compensation, work has begun to upgrade the lines, and the contractor is installing poles and laying new overhead lines.

The existing line was cut, and KPTCL officials are saying that they are upgrading the capacity of the existing cables and not

installing new cables. However, it seems that the local authorities are not interested in the questions of the local population about the consequences of increasing the capacity of the line. Estimated roughly more than 30,000 residents of the area will be affected by the power line upgrade project after KPTCL. Residents claim they built houses, schools, and apartments on their land many years ago, and are now building a large tower nearby. It will be difficult for residents to live under/near power lines. And they're also concerned about possible health effects on children who live near power lines. It is important to question how clearance has been given by respective departments to build any sort of buildings under RoW and near the buffer zone.

The lands of the residents were utilized for the purpose of erecting high-tension power lines and for erection of electrical towers. KPTCL compensation to the residents for utilisation of their lands for erection of transmission lines as well as for erection of electrical towers. However, the residents are not satisfied with the quantum of compensation awarded by the KPTCL. The potentiality of the land and also the commercial value of the land under the powerline will decline exponentially. It is due to the restrictions in utilisation of the land that ultimately reduces the value of the land. And also the potential health impacts on the people in close proximity.

The issue is the utilization of the residents' lands for the erection of high-tension transmission lines and for the erection of electrical towers which pass very close to the buildings, schools etc. It cannot be disputed that the erection of a high voltage electrical line through/over any agricultural land by the KPTCL in the exercise of powers conferred on them under Section 10 of the Telegraph Act, 1885. It is to be noted that diminutive value is to be assessed taking note of the potentiality of the lands, its utilization, fertility of the land commercial value of the land etc.

Undoubtedly, due to the construction of the transmission line and the upgrading of the existing line to a higher capacity, residents will not be able to use the area as before. Residents cannot plant trees below the lifeline, but the land is not lost from agriculture. Even if the land is not occupied by the KPTCL the ownership of the land remains with the land owners. According to the statement, landowners are not prohibited from using the land under the power line. But the economic, health and environmental aspects have been largely ignored. When power lines go into buildings most owners are forced to build smaller buildings and use the land for different purposes rather than having the right to use it as they wish. and they are still afraid of the health effects of the health problem. Radiation from High Voltage Lines. However, based on this power line project and

potential problems, we can point out some areas where holes or faults may occur.

However, based on this power line project and potential issues, we can outline some potential areas where gaps or wrongdoing might occur:

Potential Gaps or Wrongdoing:

- **Non-compliance with environmental regulations:** Failure to conduct proper environmental impact assessments, and disregard for ecological concerns.
- **Land acquisition issues:** Improper land acquisition procedures, lack of compensation for affected landowners, Landowners are receiving inadequate compensation for the acquisition of their land or encroachment on private property.
- **Construction quality and safety:** Allowed construction practices in RoW, negligence in safety measures which may lead to accidents or damage to property.
- **Potential health impacts:** The potential health risks associated with increased electromagnetic fields from the higher voltage line might not have been thoroughly evaluated. Complete neglect of assessments of potential health impacts due to this project.

- **Lack of clear policies and regulations:** Ambiguous or outdated regulations related to power line projects, hinder efficient implementation and oversight. Absence of regulations on construction houses near high-tension lines, working under the RoW and buffer zone clearance.

- **Ineffective oversight:** Failure to monitor KPTCL and other departments' activities adequately, leading to violations and non-compliance. It is evident that there are multiple noncompliance issues but were given clearance.

- **Ignoring public concerns:** Disregarding public objections or complaints related to the power line project. The project has been planned without adequate consultation with local residents, leading to their concerns being overlooked.

- **Route Selection:** The route selection for this project should be away from residential areas. Although the existing lines pass through the residential areas, this route will not be sustainable. The alternative routes should be analysed. There is a lack of comprehensive environmental impact assessment

- **Economic Impacts:** The project might have negative economic impacts on local businesses and property values due to its proximity to residential areas. The landowners' right to enjoy the property is limited.

The total disregard for the socio-economic consequences of the residents is a serious criticism of program planning and implementation. All the information is related to the priority of infrastructure development based on human welfare. The program appears to have various non-compliance issues. Failure to comply with laws designed to protect the environment and the rights of citizens is a serious administrative error. Transparency and accountability, are key components of good government. Decision-making processes lack transparency and public discourse tends to be formal.

The Neelamangala-Peenya power line project is indicative of a larger systemic problem: the prioritisation of economic growth over sustainable development. This is a powerful reminder of the need for a paradigm shift in infrastructure planning, with equal emphasis on environmental protection, public health and social justice. This project shows the consequences of ignoring the human and environmental costs of development. The Neelamangala-Peenya power line project represents a systemic failure in infrastructure development. Beyond immediate concerns about environmental impacts, public health and land rights, there is negligence in proper planning, implementation and management.

Although the project is justified by improved energy supply, there is no real cost-benefit analysis that takes into account the health effects, environmental damage and social problems. The decision to increase the voltage to 400 kV without a comprehensive study of the health consequences is a reckless game with public health. The forceful acquisition of land without adequate compensation plans is a blatant violation of human rights. There is no clarity of purpose in the decision-making process and suppression of public opposition.

This project is a reminder of the urgent need for a paradigm shift in infrastructure development. Ecological, social and economic factors must be taken into account. Investing in environmental impact assessments, managing public information and ensuring that project results are shared is important.

LEGAL PROCEDURES FOR INSTALLING AND ENHANCING TRANSMISSION LINES IN INDIA

The Indian Telegraph Act, 1885, is an important part of legislation that governs the establishment, maintenance, and operation of telegraphs, which now include telecommunication lines and electricity transmission lines. The Act, coupled with other relevant laws such as the Indian Electricity Act, 2003, and various environmental regulations, lays down the procedures for

both the installation of new transmission lines and the enhancement of existing ones. The Indian Telegraph Act, 1885, was originally enacted to facilitate the establishment of telegraph lines across India. Over time, its scope has expanded to include modern telecommunications and electricity transmission lines. The Act grants significant powers to the government and its authorized agents, allowing them to place and maintain telegraph and transmission lines across private and public properties. However, it also imposes certain obligations and safeguards to protect the rights of property owners and ensure that public interest is served.

LAW PROVISIONS UNDER THE ACT:

Section 10: Powers of the Telegraph Authority:

Section 10 of the Indian Telegraph Act, 1885 states that the governing the installation of transmission lines. It provides the telegraph authority with broad powers to place and maintain telegraph lines and posts on any immovable property, whether it is public or private.

Placing and Maintaining Lines:

Under Section 10(a), the telegraph authority has the power to place and maintain telegraph lines and posts under, over, along,

or across any immovable property. This provision applies to the installation of new transmission lines as well as the enhancement or modification of existing ones. The term "immovable property" includes land, buildings, and other structures.The authority is required to exercise these powers in a manner that causes the least inconvenience to the property owner. This includes minimizing damage to the property and ensuring that the placement of lines does not obstruct or interfere with the owner's use of the land.

Compensation for Damage

Section 10(b) mandates that the telegraph authority must pay compensation for any damage caused to the property during the installation or maintenance of transmission lines. This includes damage to crops, structures, and other immovable property. The compensation amount is determined based on the extent of the damage and the value of the property affected.In cases where there is a dispute over the amount of compensation, Section 10(c) allows the matter to be referred to the District Magistrate or Collector. The decision of the Magistrate or Collector is final and binding on both parties.

Section 16: Resolution of Disputes

Section 16 of the Indian Telegraph Act, 1885, outlines the procedure for resolving disputes that may arise during the installation or enhancement of transmission lines. This section is particularly relevant when a property owner objects to the placement of lines on their land.

Intervention of the District Magistrate

If a property owner objects to the installation of transmission lines, the telegraph authority can seek the intervention of the District Magistrate. The Magistrate is responsible for considering the objections and making a decision based on the public interest and the impact on the property owner. The Magistrate has the power to either refuse the request or grant permission with conditions. These conditions may include specific requirements for the placement of lines or the payment of additional compensation to the property owner.

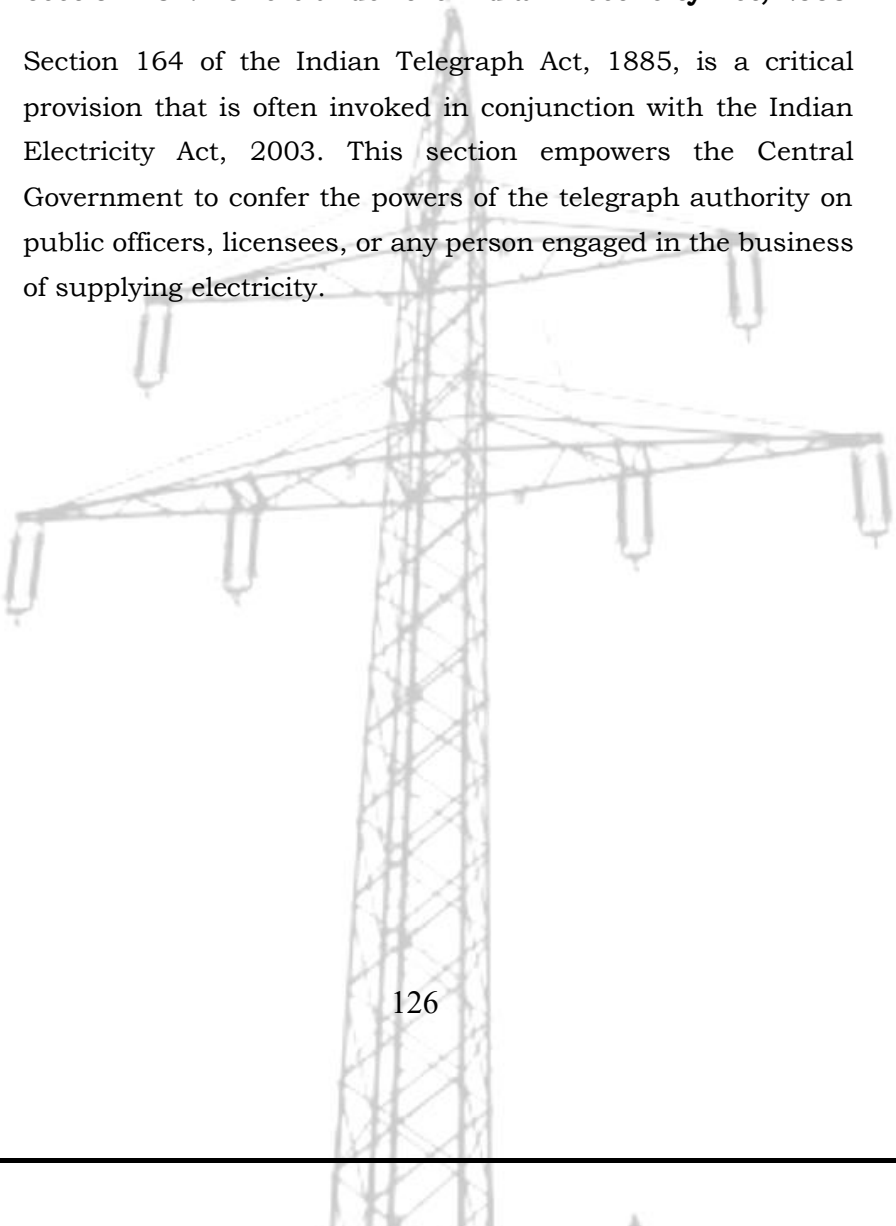
Appeal to the District Judge

Section 16 also provides a mechanism for appealing the decision of the District Magistrate. If the property owner or the telegraph authority is dissatisfied with the Magistrate's decision, they can

appeal to the District Judge within a specified period. The District Judge's decision is final and cannot be further appealed.

Section 164: Powers under the Indian Electricity Act, 2003

Section 164 of the Indian Telegraph Act, 1885, is a critical provision that is often invoked in conjunction with the Indian Electricity Act, 2003. This section empowers the Central Government to confer the powers of the telegraph authority on public officers, licensees, or any person engaged in the business of supplying electricity.



Grant of Powers

Under Section 164, the government can issue an order conferring the powers of the telegraph authority on entities involved in electricity transmission. This includes the power to place and maintain electric supply lines, which are treated as telegraph lines for the purposes of the Act. The entities granted these powers can exercise them in the same manner as the telegraph authority, including accessing private property for the installation and maintenance of transmission lines.

Right of Way (RoW) Permissions

One of the most significant aspects of Section 164 is the ability to obtain Right of Way (RoW) permissions. RoW refers to the legal right to pass through or access another person's land for a specific purpose. In the context of transmission lines, RoW permissions allow the placement of lines across private property without transferring ownership of the land. Obtaining RoW permissions is often a contentious issue, as property owners may be reluctant to allow transmission lines on their land. However, Section 164 provides the legal basis for obtaining these permissions, subject to the payment of compensation for any damage caused.

Enhancement of Existing Transmission Lines

The enhancement or upgrading of existing transmission lines is a common requirement to meet increasing demand for electricity or to improve the reliability of the power supply. The procedures for enhancing existing lines are similar to those for installing new lines, with some additional considerations.

Upgrading Capacity

Enhancing existing transmission lines often involves upgrading the capacity of the lines to carry more electricity. This may require the replacement of conductors, poles, or other infrastructure. The telegraph authority or the entity authorized under Section 164 must ensure that the upgrades are carried out with minimal disruption to the property and the surrounding environment.

Environmental and Safety Considerations

When enhancing existing transmission lines, it is essential to consider environmental and safety regulations. This includes obtaining necessary clearances from environmental authorities, especially if the upgrades involve cutting trees, disturbing wildlife habitats, or crossing environmentally sensitive areas. Safety is another critical consideration, as upgrading

transmission lines can pose risks to both workers and the public. The entity responsible for the upgrades must comply with safety standards and regulations to prevent accidents and ensure the safety of all parties involved.

Compensation and Dispute Resolution

The issue of compensation is central to the installation and enhancement of transmission lines. The Indian Telegraph Act, 1885, provides mechanisms for determining and paying compensation to property owners affected by these activities.

Determining Compensation

Compensation is determined based on the extent of damage caused to the property, the value of the land, and any loss of use or enjoyment of the property. The telegraph authority or the authorized entity is responsible for assessing the damage and offering a fair compensation amount to the property owner. In cases where the property owner and the authority cannot agree on the compensation amount, the matter can be referred to the District Magistrate under Section 10(c). The Magistrate's decision is final, but the property owner has the right to appeal to the District Judge under Section 16.

Dispute Resolution Mechanisms

Disputes related to the installation or enhancement of transmission lines can arise over various issues, including the placement of lines, the amount of compensation, and the conditions imposed by authorities. The Indian Telegraph Act, 1885, provides several mechanisms for resolving these disputes, including intervention by the District Magistrate and appeals to the District Judge.

In addition to the legal remedies provided by the Act, parties may also explore alternative dispute resolution (ADR) mechanisms such as mediation or arbitration. ADR can offer a quicker and less adversarial way to resolve disputes, especially in complex cases involving multiple stakeholders.

Environmental and Other Regulatory Clearances

The installation and enhancement of transmission lines often require environmental and other regulatory clearances, especially if the project affects environmentally sensitive areas, forest land, or indigenous communities. These clearances are mandatory and must be obtained before any work can begin.

Forest Clearance under the Forest (Conservation) Act, 1980

If the transmission lines pass through forest areas, clearance must be obtained under the Forest (Conservation) Act, 1980. This process involves submitting a proposal to the relevant forest authorities, who will assess the environmental impact of the project and determine whether it is in the public interest to grant clearance. The clearance process may also involve consultations with local communities, especially if the forest land is used by indigenous or tribal groups. The authorities may impose conditions on the project, such as afforestation or the payment of compensation for the loss of forest cover.

Environmental Impact Assessment (EIA)

An Environmental Impact Assessment (EIA) may be required for large transmission projects or those that affect sensitive environments. The EIA process involves a detailed assessment of the potential environmental impacts of the project, including effects on air and water quality, wildlife, and ecosystems. The EIA report is typically subject to public consultation, where stakeholders can provide input on the project's environmental implications. Based on the EIA, the environmental authorities may grant or deny clearance for the project, or impose conditions to mitigate environmental harm.

Other Regulatory Clearances.

In addition to forest and environmental clearances, other regulatory approvals may be required depending on the location and scope of the project. For example, if the transmission lines cross rivers or other water bodies, clearance may be required from the relevant water authorities. Similarly, if the project affects land owned by the government or other public entities, clearance may be required from the land-owning.

URBANISATION AND TWIN CITIES OF BANGALORE

Urbanization is a process and a reliable measure of a region's progress. In terms of the population explosion expansion in urban centres, Bangalore Urban District has been witnessing an abnormally high pace of urban growth. Bangalore had 1.6 million residents in 1970. A rapid growth spurt was caused within the decade by the establishment and growth of public sector institutions like the Indian Space Research Organization, Bharat Electrical Limited, and Hindustan Machine Tools. This was quickly followed by further growth as the city gained traction in the textile and information technology industries. Over 11 million people now call Bangalore home, having grown at a 45 percent annual rate by the 1980s. The city limits expanded from 70 square kilometers in 1941 to 710 square kilometers in 2011, reflecting the growing population. In 2014,

Bangalore was renamed Bengaluru. Since then, Bengaluru has become the nation's liveliest metropolis, drawing a sizable portion of foreign direct investment and growing to become the world's fourth-largest technological cluster. Bengaluru is the most active city in the world.

Bangalore was home to the headquarters of several significant research and development organizations by the 1970s, including ISRO, DRDO, and NAL. This implied that scholars, engineers, and scientists from around the nation will someday move here as well. Children in the colonies connected to the numerous institutions grew up speaking many languages because their families spoke diverse dialects. Bangalore became the new industrial center of India due to a surge in information technology, which also made the city look exactly like California in the United States. The DNA of the city was impacted over time by these modifications.

Bengaluru's economic transformations and expanding job market are driving up urbanization rates. Within its borders, the city currently adds 500 families and 80,000 square meters of built-up space every day; this trend is predicted to continue well into the upcoming ten years. At the moment, the average Bengaluru resident uses 80 square meters of land, 1406 kwh of electricity annually, and 135 LPCD of water per day.

By 2025, Bengaluru's urban cover is expected to rise to 1,323 sq km, or 58%, according to a study on the pattern of land use change. The Bengaluru Local Planning Area, which is 1,314 sq km in size and for which the Bangalore Development Authority (BDA) intends to amend the Master Plan 2041, is already smaller than the projected urban cover of 1,323 sq km for 2025.

A legal or social agreement between two geographically and politically diverse locations with the aim of fostering cultural and commercial relationships is known as a twin city or sister city relationship. Numerous cities have engaged in cultural exchanges and other activities throughout history that could be compared as sister-city or twin-city relationships. The Karnataka state government is committed to advancing Mysuru's development to match that of Bengaluru city by launching a number of infrastructural projects and by making mysuru a twin city of bangalore like that of Hosur, Hubli, Dharwad, Mangalore, etc. In order to enhance the tier two cities, such as Hubballi-Dharwad, Mangaluru, and Belagavi, infrastructural initiatives similar to those in Bengaluru would be undertaken.

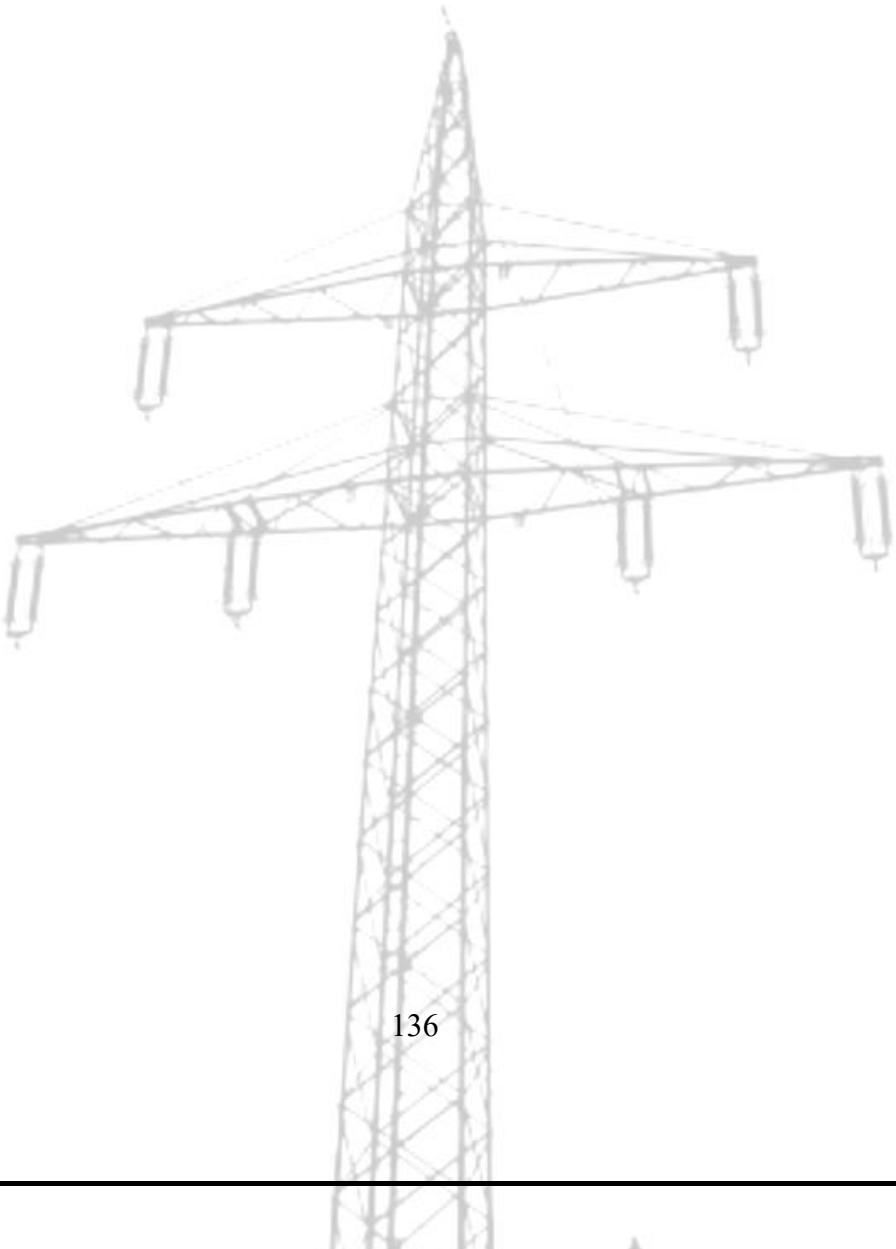
With the increase in development and urbanization in bangalore more such twin cities are formed, earlier which use to be in the outskirts of bangalore are now included and considered a part

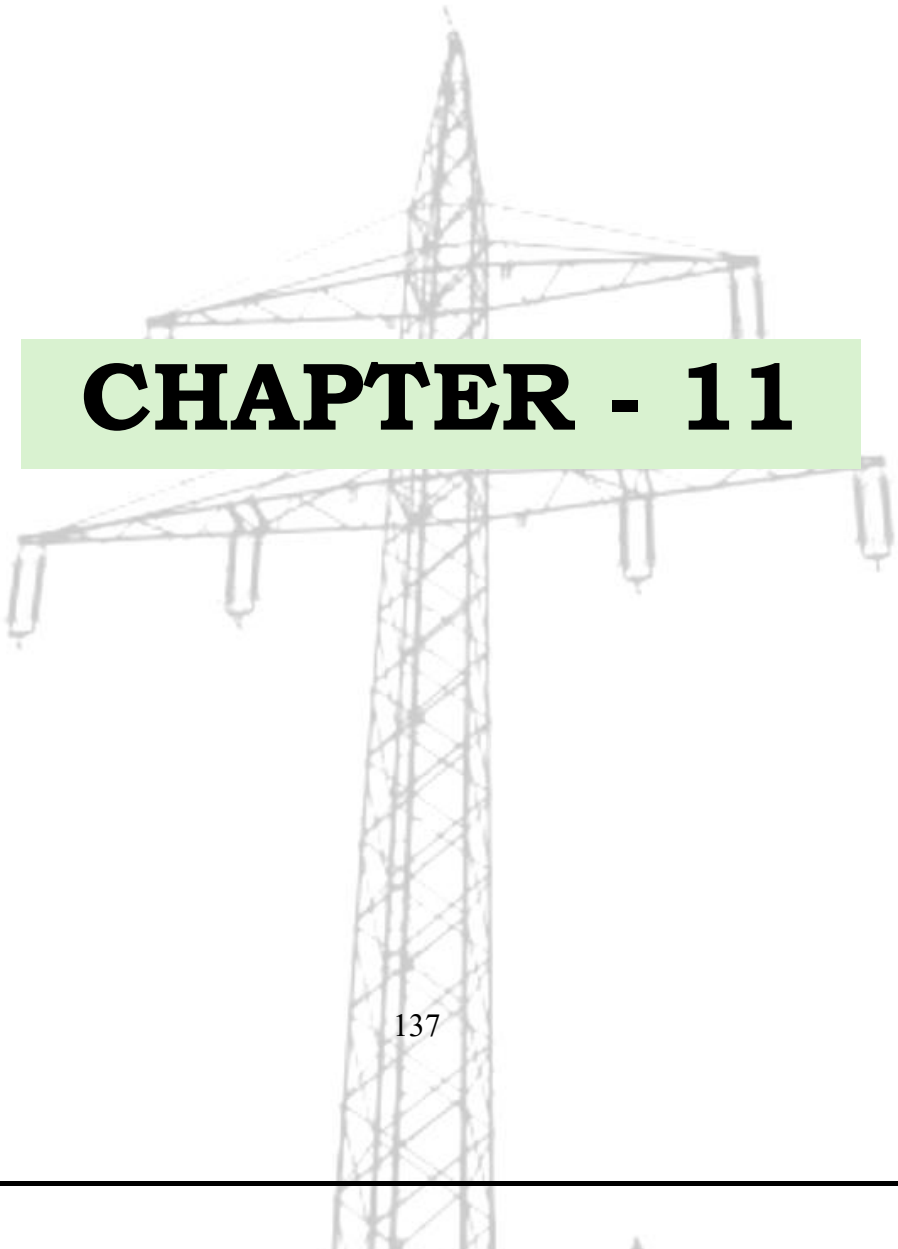
of bangalore and any development to the city to be made keeping in mind all such twin cities to bangalore. Also, such twin cities being included in bangalore has only further increased the demands of resources consumed per day ny people of bangalore whether be it electricity usage, land or water availability. Which further increases the supply demand of such resources and often leads to scarcity of such resources due to the lack of its availability.

The Indian state of Karnataka is home to the twin cities of Hubli and Dharwad. In terms of area, Hubli-Dharwad is the second-largest municipality in Karnataka, behind the state capital Bangalore, which ranks second among all cities. After Bangalore, Hubli-Dharwad constitutes the state's second-largest urban agglomeration. World renowned for its tradition and culture is Mysuru. Thus, unlike any other twin city in the nation, Mysuru and Bengaluru provide their citizens with a healthy work-life balance. Though for different reasons, Bengaluru and Mysuru are both well-known throughout the world.

Declaring that the Mysuru Urban Development Authority (MUDA) has estimated that around Rs 2,000 crore is needed for the work, Minister Suresh said that as part of the twin-cities initiative, four to five flyovers or grade separators will be

constructed across the outer ring road, including near Manipal Hospital connecting Bengaluru-Mysuru Expressway to address traffic bottlenecks.





CHAPTER - 11

REPORT ON TRANSMISSION LOSSES

Transmission losses, also known as power losses, occur when electricity is transported through power lines from generating stations to end consumers. These losses are inevitable to some extent, but can be significantly reduced with careful planning, technological improvements, and policy changes. Transmission losses primarily fall into two categories: technical losses and non-technical losses. While technical losses result from physical factors such as the resistance of transmission wires, non-technical losses occur due to theft, faulty meters, or inefficient billing systems. This article will provide a detailed discussion of both types of losses and strategies for addressing them.

UNDERSTANDING TRANSMISSION LOSSES

Technical Losses

Technical losses are intrinsic to the physical nature of power transmission. As electricity moves through the transmission lines, some energy is lost as heat due to the resistance of conductors. These losses increase with distance and the amount of current being transmitted. The primary sources of technical losses include:

- **Conductor Resistance:** Electrical energy is dissipated in the form of heat as current flows through transmission lines. The longer the distance, the higher the resistance, and the greater the loss.

- **Transformer Losses:** Energy is lost when voltage is stepped up or down in transformers during transmission. These losses are known as core losses and copper losses, both of which result in heat production.

- **Leakage Currents:** In an electrical system, small amounts of current can leak through insulation materials or other pathways, contributing to losses.

- **Inductive and Capacitive Effects:** The interaction between electric and magnetic fields in high-voltage power lines can create inductive and capacitive losses, reducing the efficiency of power transmission.

Non-Technical Losses

Non-technical losses occur due to human factors rather than the inherent nature of power transmission. These includes:

- **Electricity Theft:** In many regions, illegal connections or tampering with meters result in significant losses. This is a

major issue in developing countries where weak enforcement allows consumers to access electricity without paying for it.

- **Metering Inaccuracies:** Faulty or poorly calibrated meters may record lower consumption than actual usage, leading to revenue losses for power companies.

- **Billing Inefficiencies**: Ineffective billing systems or delays in meter reading can lead to uncollected payments, exacerbating financial losses for utility companies.

STRATEGIES FOR REDUCING TECHNICAL LOSSES

IMPROVING TRANSMISSION INFRASTRUCTURE

One of the most effective ways to reduce technical losses is to invest in better transmission infrastructure. This involves upgrading or replacing old equipment and adopting modern technologies designed to enhance efficiency.

- **Use of High-Voltage Lines:** As electricity travels longer distances, higher voltages are used to minimize losses. High-voltage transmission reduces the current flowing through the lines, which in turn reduces heat losses due to resistance. Increasing the voltage of transmission systems (e.g., from 220 kV to 765 kV) can significantly lower technical losses.

- **Advanced Conductors:** Conventional conductors like aluminum or copper are prone to energy loss through heat dissipation. Using advanced conductors such as High-Temperature Low-Sag (HTLS) conductors, which have better thermal and electrical properties, can help reduce transmission losses.

- **Underground Cabling:** In densely populated urban areas or regions prone to extreme weather, underground cabling can reduce exposure to the elements, lowering the risk of transmission line failures and minimizing losses.

- **Digital Monitoring Systems:** Installing smart grid systems and digital sensors allows real-time monitoring of the power network. These technologies can detect issues such as line faults, overloads, and excessive heating, enabling utilities to take preventive measures and optimize energy flows.

EFFICIENT TRANSFORMER MANAGEMENT

Transformers are a key component of any transmission network, stepping up voltage for long-distance transmission and stepping it down for distribution to consumers. However, transformers also account for a significant portion of technical losses.

- **Energy-Efficient Transformers:** Replacing old, inefficient transformers with modern energy-efficient ones can reduce copper and core losses. Modern transformers are designed with better materials and cooling systems, which reduce heat dissipation.

- **Optimal Loading:** Operating transformers within their optimal loading limits can minimize losses. Overloading or underloading transformers can lead to higher energy losses, so it's essential to monitor their load and maintain them within an efficient range.

REACTIVE POWER COMPENSATION

Reactive power refers to the energy used to maintain the voltage levels necessary for the transmission of electricity. While it doesn't directly contribute to powering devices, reactive power is essential for maintaining system stability. However, excess reactive power can lead to higher losses in transmission systems.

- **Capacitors and Reactors:** Installing capacitors and reactors in the transmission network can help compensate for reactive power. Capacitors store and release energy, balancing voltage levels and improving overall system efficiency.

- **Synchronous Condensers:** These machines generate or absorb reactive power as needed, ensuring that the system operates within its optimal voltage range. By managing reactive power more efficiently, utilities can reduce transmission losses.

STRATEGIES FOR REDUCING NON-TECHNICAL LOSSES

STRENGTHENING ANTI-THEFT MEASURES

Electricity theft is a serious problem in many parts of the world, particularly in regions with inadequate enforcement or weak governance. Reducing theft requires a combination of technological, legal, and administrative measures.

- **Smart Meters:** One of the most effective tools for combating electricity theft is the installation of smart meters. Unlike traditional meters, smart meters provide real-time data on electricity consumption and can detect anomalies, such as sudden drops in consumption that may indicate tampering.

- **Remote Monitoring Systems:** Remote monitoring systems allow utility companies to track electricity flow at various points in the network. This enables them to quickly identify areas where theft may be occurring and take immediate action.

- **Legal Enforcement:** Stronger legal frameworks and penalties for electricity theft are necessary to deter individuals from engaging in such activities. Increasing fines and criminalizing theft can reduce these losses.

IMPROVING METERING AND BILLING SYSTEMS

Inaccurate metering and inefficient billing processes also contribute to non-technical losses. Addressing these issues can significantly enhance revenue collection and reduce overall losses.

- **Automated Meter Reading (AMR):** AMR systems allow utility companies to read meters remotely, eliminating the need for manual meter reading. This reduces errors, improves accuracy, and ensures timely billing.

- **Prepaid Metering Systems:** Prepaid electricity meters allow consumers to pay for electricity in advance. This not only reduces the risk of unpaid bills but also encourages consumers to use electricity more responsibly.

- **Regular Calibration of Meters**: Ensuring that all meters are regularly calibrated and maintained can help prevent discrepancies between actual and recorded electricity usage.

OTHER STRATEGIES AND MEASURES

- **Policy and Regulatory Measures:** Governments and regulatory bodies play a crucial role in addressing transmission losses. Policies that encourage investment in infrastructure, promote energy efficiency, and enforce penalties for theft and inefficiency can have a substantial impact.

- **Incentives for Energy Efficiency:** Governments can offer incentives for utilities and consumers to invest in energy-efficient technologies. This can include subsidies for advanced transmission infrastructure, tax breaks for energy-efficient transformers, or grants for smart grid systems.

- **Strict Enforcement of Standards:** Regulatory bodies should enforce strict standards for the construction and maintenance of transmission infrastructure. Ensuring compliance with these standards can reduce technical losses and improve the overall efficiency of the power network.

- **Encouraging Private Investment:** In many countries, public utilities lack the resources to invest in necessary upgrades.

Encouraging private investment through public-private partnerships (PPPs) or other mechanisms can help bridge this gap.

UNDERGROUND TRANSMISSION LINES SAFETY

Underground transmission lines are increasingly being used to transmit electricity in densely populated urban areas, environmentally sensitive regions, or places prone to extreme weather conditions. Although these lines come with higher installation costs compared to overhead lines, they offer several advantages, including reduced visual impact, enhanced safety, and greater reliability. This article explores the safety measures that must be taken when installing underground transmission lines and discusses several notable projects that have successfully implemented underground power transmission systems.

Overview of Underground Transmission Lines

Underground transmission lines, unlike their overhead counterparts, are buried beneath the surface and usually insulated with materials such as polyethylene, cross-linked polyethylene (XLPE), or paper-insulated lead-covered (PILC) cables. These lines are designed to carry high-voltage electricity over long distances, and they play a critical role in delivering power to homes, businesses, and industries. Despite the many benefits, underground transmission systems pose unique challenges related to safety, maintenance, and installation. The cables are buried deep, making repairs more complex, and they require specific safety measures to ensure long-term performance and the protection of both workers and the public.

Safety Measures for Underground Transmission Lines

The installation and operation of underground transmission lines involve strict safety standards and procedures to ensure the reliability of the network and the safety of people in proximity to the lines. These safety measures include proper design, material selection, insulation, grounding, monitoring, and routine maintenance.

DESIGN AND PLANNING CONSIDERATIONS

- **Proper Route Selection:** The route for underground transmission lines must be carefully chosen to avoid areas with high seismic activity, areas prone to flooding, or locations with unstable soil conditions. This minimizes the risk of damage to the cables and ensures long-term reliability.

- **Depth of Burial:** The depth at which transmission lines are buried is crucial for safety. Typically, high-voltage cables are buried at least 1-1.5 meters below the ground. In some cases, the cables are placed even deeper, depending on the local geology, the proximity of other utilities, and potential exposure to human activities such as construction.

- **Separation from Other Utilities:** Underground transmission lines must be laid at a safe distance from other utilities, such as water, gas, and communication lines, to prevent accidental damage during repairs or installations of other infrastructure. Strict adherence to utility separation guidelines is essential for safety.

- **Trench Design:** The trenches used to bury underground transmission cables are reinforced to prevent collapse and ensure stability. Protective barriers, such as concrete slabs or

warning tapes, are installed above the cables to alert future construction crews to the presence of high-voltage lines.

INSULATION AND CABLE MATERIALS

- **High-Quality Insulation:** Underground transmission cables must be equipped with robust insulation to prevent electrical faults and ensure safety. XLPE insulation is commonly used due to its high dielectric strength, temperature resistance, and durability. Insulated cables help prevent the risk of electrical shock, minimize energy loss, and protect the cables from moisture and chemical exposure.

- **Sheathing and Armor:** In addition to insulation, underground cables are typically sheathed with protective layers of materials such as polyethylene or metal armor. This additional layer protects the cables from physical damage due to ground movement or excavation activities.

- **Thermal Management:** Since underground cables do not have the same air-cooling benefits as overhead lines, thermal management is a critical consideration. Special materials, such as heat-resistant backfill (thermal backfill), are used around the cables to dissipate heat and prevent overheating, which could lead to insulation failure.

GROUNDING AND SHIELDING

- **Grounding Systems:** Proper grounding is essential for underground transmission lines. A grounding system provides a low-resistance path to the earth, preventing dangerous voltage buildup and protecting both equipment and personnel from electrical hazards. Grounding also mitigates the risk of power surges caused by lightning strikes or electrical faults.

- **Electromagnetic Shielding:** High-voltage transmission lines produce electromagnetic fields (EMFs), which can interfere with other utilities or sensitive electronic equipment. Shielding is used to contain these fields and reduce their impact on nearby infrastructure. Metallic sheaths or specially designed shielding materials are incorporated into the cable design.

MONITORING AND MAINTENANCE

- **Cable Monitoring Systems:** Modern underground transmission lines are equipped with real-time monitoring systems that track the condition of the cables, detect faults, and monitor temperature and voltage levels. These systems provide valuable data that can be used to schedule preventive maintenance and avoid costly repairs or power outages.

- **Periodic Inspections:** While underground cables are designed for durability, they still require periodic inspections to ensure their integrity. Techniques such as ground-penetrating radar (GPR) and thermography are used to assess the condition of buried cables without the need for excavation.

NOTABLE UNDERGROUND TRANSMISSION PROJECTS

Several major projects around the world have successfully implemented underground transmission lines, demonstrating the feasibility and benefits of these systems in diverse environments. Below are a few examples of notable underground transmission projects.

LONDON POWER TUNNELS PROJECT (UK)

One of the most ambitious underground transmission projects in recent years is the London Power Tunnels project. Launched by National Grid, the project involves constructing a network of tunnels under the city to house high-voltage cables. These cables replace aging overhead lines, improving the reliability of London's power supply while minimizing the visual impact on the city's skyline.

The project includes the construction of 32 kilometers of tunnels, with the cables buried up to 60 meters below ground.

Safety Measures: The tunnels are designed with reinforced concrete to prevent collapse, and advanced ventilation systems are in place to manage the heat generated by the cables. The cables are also monitored using state-of-the-art systems that track temperature and load conditions in real-time.

Environmental Considerations: The project minimizes disruption to London's urban landscape and reduces the need for frequent maintenance, contributing to the long-term sustainability of the city's power grid.

TRANSBAY CABLE PROJECT (USA)

The Transbay Cable Project is a 53-mile (85 km) high-voltage direct current (HVDC) underground and underwater cable system that transmits electricity from Pittsburg, California, to San Francisco. This project was implemented to address the increasing demand for electricity in the San Francisco Bay Area. The HVDC cable, capable of carrying 400 megawatts of power, runs primarily underwater, but it also includes several underground segments as it approaches densely populated areas.

Safety Measures: The project uses XLPE-insulated cables with advanced shielding to prevent electromagnetic interference with

nearby infrastructure. Extensive monitoring systems are installed to track the condition of the cable and ensure reliable power delivery.

Advantages: The Transbay Cable Project has significantly improved the reliability of San Francisco's power supply while minimizing the need for overhead transmission lines, which could be vulnerable to natural disasters such as earthquakes.

WESTERN LINK PROJECT (UK)

The Western Link Project, completed in 2019, is another major underground transmission initiative. It involved the construction of a 262-mile (422 km) high-voltage direct current (HVDC) cable system connecting Scotland and Wales. The purpose of the project was to transport renewable energy generated from wind farms in Scotland to consumers in the south of the UK.

The project includes both underground and underwater sections, with the underground portions located in sensitive areas to avoid disturbing the natural environment.

Safety Measures: The cables are buried at depths of 1-3 meters, depending on the terrain, and are protected by robust insulation and shielding to prevent faults. Regular inspections and

monitoring systems ensure the long-term reliability of the transmission network.

Environmental Impact: By transporting renewable energy, the Western Link Project contributes to the UK's goals of reducing carbon emissions and transitioning to a cleaner energy grid.

CROSSRAIL POWER SUPPLY PROJECT (UK)

The Crossrail Power Supply Project, associated with the London Crossrail railway system, involved the installation of underground cables to supply power to the new rail network. This project was critical in ensuring a reliable electricity supply for one of the largest infrastructure projects in Europe. The underground transmission lines are housed in specially designed tunnels that run parallel to the railway system.

Safety Measures: The project employs advanced insulation and monitoring technologies to ensure that the power supply remains stable even in the event of system faults. The cables are also protected by reinforced concrete tunnels to prevent accidental damage.

Challenges: One of the key challenges of the project was ensuring that the underground cables did not interfere with

existing infrastructure, including London's historic sewer and water systems.

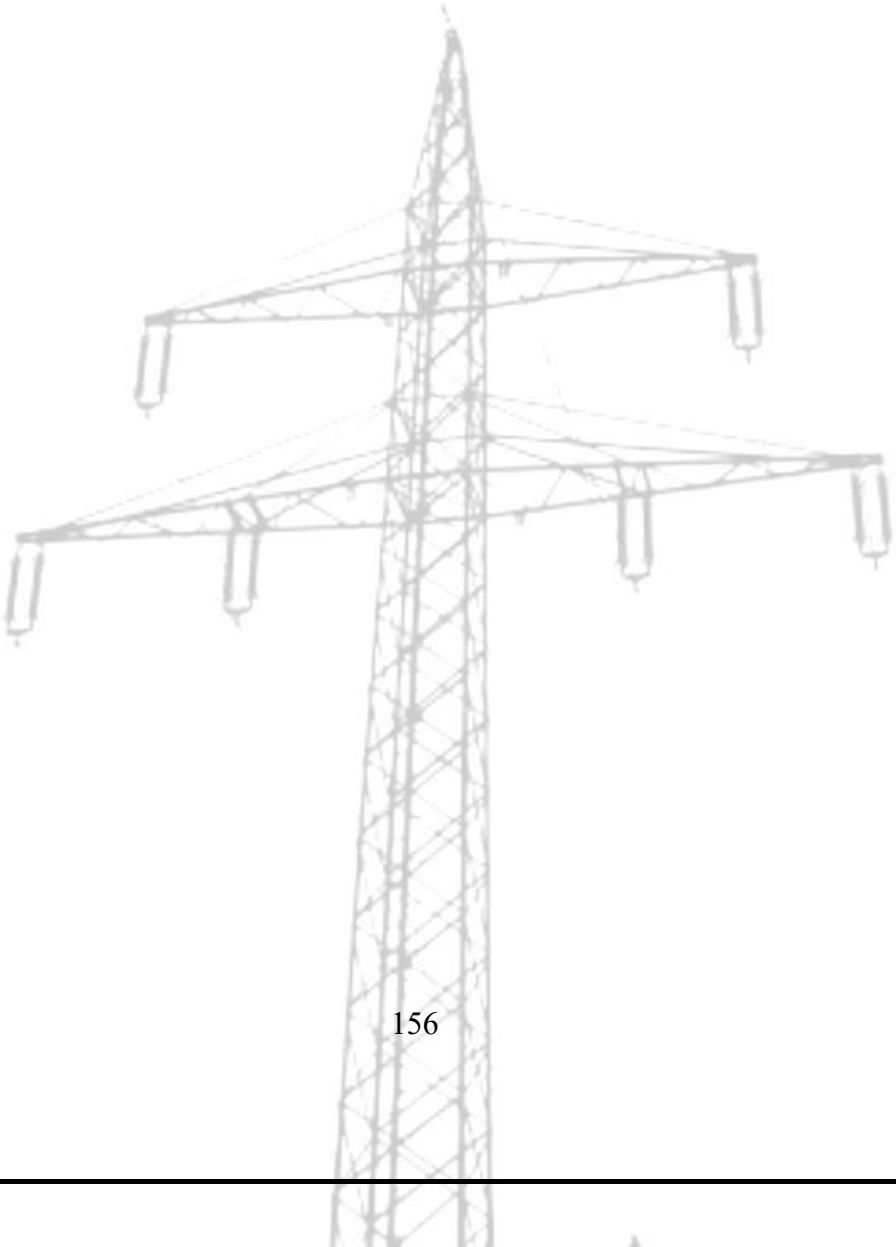
SIGNIFICANT UNDERGROUND TRANSMISSION LINE PROJECTS IN INDIA

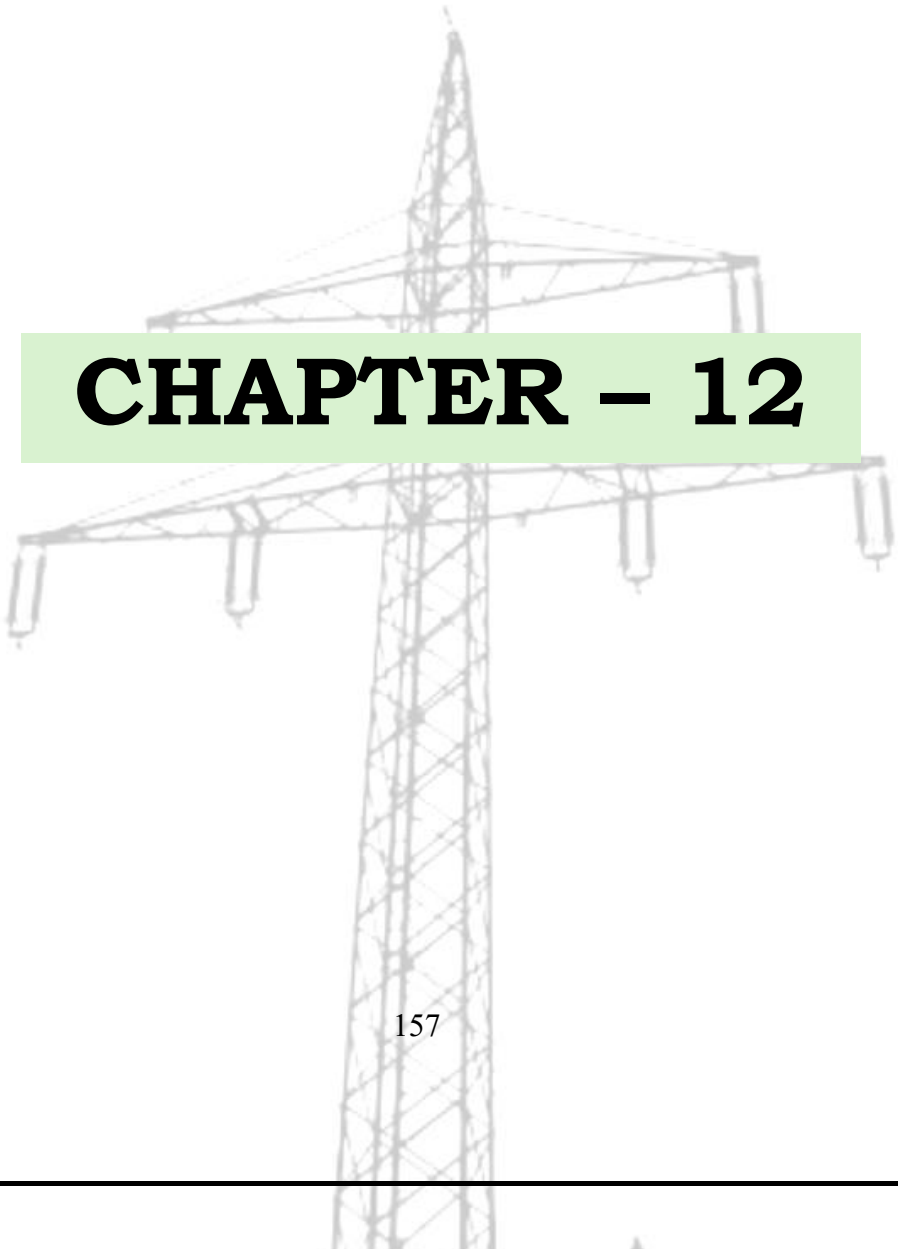
Maharashtra, especially Mumbai, has initiated underground transmission projects to improve the reliability of the city's power supply. The city is densely populated, making overhead lines impractical in many areas. The Mumbai Power Grid Project includes extensive underground cable networks to ensure uninterrupted electricity to the metropolitan region.

Delhi has also developed a comprehensive underground transmission network to meet the capital's power needs. The Northern Grid Substation Project is part of a larger plan to modernize the city's power infrastructure and minimize disruptions.

Chennai and other urban areas in Tamil Nadu have embraced underground transmission as part of their modernization efforts. The TANGEDCO (Tamil Nadu Generation and Distribution Corporation) Underground Cable Project has been undertaken to improve power supply stability in Chennai.

Kolkata, one of India's oldest cities, has adopted underground power lines, notably in areas with historical significance and high population density, to prevent damage and power outages.





CHAPTER – 12

DEVELOPMENT OF BANGALORE OVER THE YEARS

Bengaluru, Karnataka's vibrant capital, is one of India's fastest-growing cities, known as the "Silicon Valley of India" for its important role in expanding the Information and Communication Technology (ICT) industries. This multicultural metropolis has drawn tourists and businessmen alike, signifying India's economic integration with the world.

Bengaluru has become a leader in service-based industries thanks to the growth of IT and other sectors including textiles, light engineering, and defence, as well as the economic liberalisation that started in the early 1990s. The city's quick economic and geographic growth has been fuelled by this expansion, which has turned it from a tranquil retirement community into India's IT hub. The IT/ITES sectors, large public sector companies like BEL, BEML, and HAL, as well as sizable hardware and apparel industries, are what define the city's landscape and have all played a crucial role in its huge in-migration and quick development.

Apart from its industrial and technological capabilities, Bengaluru has emerged as the country's centre for start-ups, promoting creativity, augmenting GDP contributions, and

broadening the economic base to generate a multitude of job prospects. With several universities located in the city and its environs, it is also a significant hub for education.

Bangalore had 1.6 million residents in 1970. A rapid growth spurt was caused within the decade by the establishment and growth of public sector institutions like the Indian Space Research Organisation, Bharat Electrical Limited, and Hindustan Machine Tools. This was quickly followed by further growth as the city gained traction in the textile and information technology industries.

HISTORY OF BANGALORE

Three major historical periods can be used to trace Bengaluru's development: pre-colonial, colonial, and post-independence. The basis of Bengaluru as a fortified colony was laid in 1537 by Kempegowda, a monarch of the Vijayanagara Empire, who built a mud fort. Important markets like Chikkapete were established during this time, and by the 17th century, Bengaluru had developed into the commercial hub of India under the control of Tipu Sultan of Mysore. The colonial era in Bengaluru began in the 18th century with the arrival of British influence. Huge open expanses that are now Cubbon Park and Lalbagh divided the British-established cantonment from the city's market regions. During this time, there were more job opportunities, which

encouraged individuals to settle outside the cantonment and cause urban growth.

The planning and development of the city moved into a new stage after independence. A City Improvement Trust was established in 1945, and the Bangalore City Corporation was formally founded in 1949. The Bangalore Development Committee's 1952 Outline Development Plan marked the beginning of the city's more than 65-year planning history. The Karnataka Town and Country Planning (KTCP) Act, 1961, gave the planning process official legal support.

The Government of Karnataka (GoK) formed the Bangalore Development Authority (BDA) in 1976 under the Bangalore Development Authority Act, 1976, to guarantee coordinated development within the city. This act established a single agency to handle all planning, development, enforcement, and scheme implementation responsibilities. For the Local Planning Area (LPA), the BDA is the principal planning and development authority.

Three major plans, the Comprehensive Development Plan (CDP) of 1984, the CDP of 1995, and the Revised Master Plan of 2015, have been used to manage and plan the city's growth under the direction of the BDA. They are all designed to address the needs and challenges of Bengaluru's expanding LPA.

BANGALORE DEVELOPMENT AUTHORITY

The Bangalore Development Authority (BDA) was established on January 6, 1976, by virtue of a distinct Act of the State Legislature known as the BDA Act 1976. The developmental responsibilities of the former CITB and the planning responsibilities of the City Planning Authority were consolidated into one authority.

The previous City Improvement Trust Board was replaced in 1976 by the Bangalore Development Authority. The BDA's main objectives included the planned development of Bangalore, the construction of high-quality infrastructure, the provision of location and services, and meeting the housing needs of the impoverished.

The BDA has given 76,000 sites to private individuals for the development of residential homes since its founding. Additionally, in order to meet the perceived needs of the specific community, more than 800 civic amenity sites have been made available for usage by a variety of public utilities and organisations.

- **Silicon Valley of Asia**

Bangalore, the tech city with the greatest rate of growth in the world, is home to the R&D centres of some of the biggest names in the business, such as Amazon, Microsoft, Facebook, and Google. Over four million people are employed in India's IT sector, which generates over €120 billion in export revenue annually.

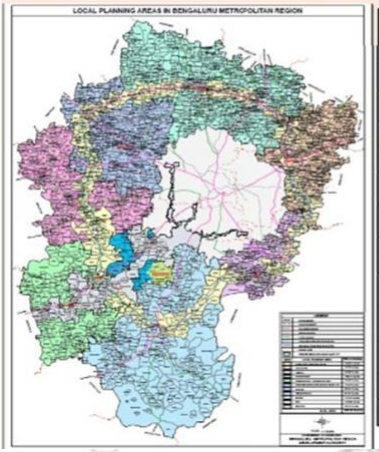
- **World-class infrastructure**

  Bangalore is home to numerous top-notch technology parks with first-rate facilities. The entire city is focused on innovation, and it was recognised as the world's fastest-growing tech hub in 2021. That's one of the reasons it's the home of visionaries with big dreams, unicorn firms, and major players in the tech world.

- **Bangalore Metropolitan Region Development Authority**

  The Karnataka government established the Bangalore Metropolitan Region Development Authority (BMRDA) in 1985 under the BMRDA Act, making it an independent organisation. The organisation was established to oversee, plan, and manage the areas within the Bengaluru metropolitan region's orderly growth. Additionally, the BMRDA occasionally carries out surveys. The resulting reports are utilised to construct city plans.

Local Planning Areas within BMR



Areas within BMR	Area in Sq. Kms.
1. BDA	1219.50
2. BMICAPA	426.24
3. RUDA	172.52(37 Villages)
4. Anekal LPA	264.09 (122 Villages)
5. Nelamangala LPA	681.67 (317 Villages)
6. Magadi LPA	690.94 (222 Villages)
7. Hoskote LPA	475.48 (265 Villages)
8. Kanakapura LPA	1498.12 (235 Villages)
9. BIAAPA	1127.97 (485 Villages)
10. STRR LPA	1019.52 (331 Villages)
11. Bidadi-LPA	141.54 (38 Villages)
12.Channapatana	439.11 (116 Villages)
Total	8005.00 Sq Kms

Source: BMRDA website

BMRDA core functions

Surveys

The BMRDA conducts surveys, as was previously noted, and uses the results to generate reports.

Structure plan

A structured plan is required for the development of the Bangalore Metropolitan Region (BMR), and the BMRDA ensures that it is prepared. The Authority is also in charge of making sure that the development projects are completed according to the plan of organisation.

Schemes

In order to carry out the structure plan, the BMRDA is also in charge of creating as many schemes as required.

Coordination

In order to carry out town planning schemes and the general development of the Bangalore Metropolitan Region, the BMRDA must also collaborate with other organisations, including the Bangalore Development Authority, the BBMP, the Bangalore Water Supply and Sewerage Board, the Karnataka Slum Clearance Board, the Karnataka Electricity Board, the Karnataka Industrial Areas Development Board, and the Karnataka State Road Transport Corporation.

Finance

Every plan and project needs funding, which the BMRDA must provide in order to support local governments in carrying out their numerous projects around the metropolitan area. Periodically, the government may also assign the Authority additional duties

The expansion of the city

Bengaluru's expansion has significantly encroached upon neighbouring areas. In the north, Bengaluru has nearly connected with Nelamangala and Dabbaspete, and Chikkaballapur is also in close proximity. Devanahalli has been incorporated into Bengaluru. To the south, Bengaluru has extended past Bidadi, with at least 30 Kilometers of Mysore Road still considered part of the city. On the eastern front, Electronic City has reached Hosur in Tamil Nadu, and KR Puram has approached OMR, progressing toward Hoskote.

This unchecked growth and disorganized development pose risks for real estate exploitation, inadequate infrastructure, and a potential decline in Bengaluru's overall reputation. The focus on making Bengaluru the central hub has led successive governments, across all political parties, to overlook the development of other significant cities in Karnataka.

Mysore and Mandya, though receiving some development due to political influence, still receive a much smaller share compared to Bengaluru. The contributions of politicians from this region in advocating for their areas are notable, though the disparity in development remains.

Belgaum, often confused with Belgium, is labelled as the 'second capital' of Karnataka but has seen minimal development. Despite having a substantial foundry cluster and receiving its first Indian-constructed railway flyover after 75 years, the city remains underdeveloped compared to its potential.

Hubli-Dharwad has substantial potential as an economic counterpart to Northern Karnataka but has been largely neglected. Despite the presence of influential politicians from this region, development has been limited to projects like the BRTS and a tech park that did not succeed. The strategic location of these cities, being closer to ports and Mumbai, has not been fully utilized.

Mangalore, a key port city on the west coast of India, has seen limited development beyond its tourism and educational sectors. The contrast with Gujarat's successful development of port cities like Surat is striking.

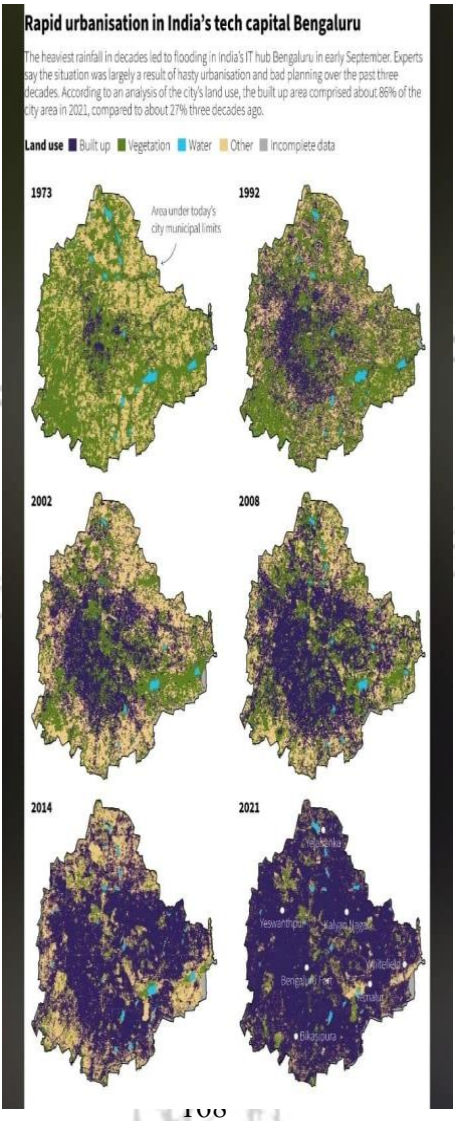
Gulbarga (Kalburgi) and Bellary, with their thermal plants and proximity to steel and manufacturing hubs in central India, have also seen limited progress. The development in these regions has not matched the scale of their potential.

Karnataka's development should not rely solely on Bengaluru. The stark disparity in population density between the capital city and other areas highlights the urgent need for broader development. Many youths from across Karnataka migrate to Bengaluru due to the lack of employment opportunities in their hometowns, exacerbating regional development imbalances.

Traveling beyond the Bengaluru-Mysore belt reveals significant contrasts in infrastructure and development. The state's tourism slogan, "One State - Many Worlds," underscores this division between Bengaluru and the rest of Karnataka.

It is imperative for the state government to consider and invest in the development of cities beyond Bengaluru to ensure balanced and comprehensive growth across Karnataka.

URBANISATION OF BANGALORE OVER THE YEARS



BEST INTERNATIONAL PRACTICES FOR HIGH-VOLTAGE POWERLINES

In today's society, the distribution of power is crucial for supplying electricity to residences, companies, and factories. It guarantees the smooth transmission of electricity from power stations to consumers, providing power to vital structures and supporting our daily activities.

An essential component for the operation of our interconnected society is a dependable and effective power distribution system.

Nevertheless, as the need for electricity continues to grow and distribution networks become more intricate, it is crucial to implement top-notch strategies to guarantee efficiency and safety in power distribution.

High-voltage power lines are essential for distributing electricity to communities around the world. Following recommended guidelines guarantees security, dependability, and effectiveness.

Listed below are a few notable foreign customs.

Prioritization of safety

- Regular Inspections: Enforcing strict inspection timelines to detect possible dangers, such as rust, drooping cables, or damaged insulators.

- Keeping clearance zones clear around powerlines is important for preventing accidents and ensuring the safety of the public.

- Implementing bird guards or other protective methods to reduce bird-related incidents.

- Raising public awareness through education campaigns about the risks of powerlines and the significance of safety.

- Utilizing top-notch materials like weather-resistant conductors and insulators to improve durability and reliability.

- Utilizing advanced construction methods, like helicopter-assisted installation, to enhance efficiency and mitigate risks.

- Routine Upkeep: Establishing a thorough maintenance schedule to promptly address issues and avoid breakdowns.

- Environmental factors, like vegetation management and soil erosion prevention, should be taken into account during construction and maintenance.

Advancements in technology and creativity.

- Utilizing smart grid technologies to enhance grid efficiency, reliability, and resilience.

- Utilization of advanced monitoring systems for detecting faults and anomalies in real-time.

- Utilizing condition-based maintenance tactics to prioritize maintenance activities according to the health of assets.

- Remote Operations: Implementing remote operations capabilities to reduce the need for on-site personnel.

Compliance with regulations:

- Ensuring strict compliance with local, national, and international regulations for powerline construction, operation, and maintenance.

- Continuous Improvement: Consistently evaluating and revising regulations to align with technological advancements and industry standards.

- Third-Party Audits: Carrying out audits by third parties to evaluate adherence and pinpoint areas for enhancement.

Response to emergencies:

- Plans for being ready: Creating thorough plans for responding to power failures, incidents, and natural calamities.

- Training and practices: Regularly organizing training and drills to guarantee personnel readiness in responding efficiently to emergencies.

- Working closely with local authorities, such as emergency services and public utilities, to ensure a united and coordinated response.

- Countries can guarantee the safe, reliable, and efficient functioning of their high-tension powerline systems by adopting these best practices.

NATIONS WITH ESTABLISHED EXPERTISE IN POWERLINE TECHNOLOGIES

1. The company chose to introduce a new product line due to customer requests. Subterranean Powerlines (Germany, Netherlands)

How it operates: High-tension powerlines are usually supported by tall pylons but can also be placed underground in urban or environmentally delicate locations. To prevent damage from water, ground movement, or construction, the cables are typically insulated and housed in concrete or protective ducts.

Challenges: The cost of installing underground lines is much higher than overhead lines, up to 10 times more expensive. Yet, these expenses can be balanced out by lower long-term upkeep costs and decreased interruptions from weather conditions such as storms, strong winds, and ice.

Advantages: Reduced visual clutter, decreased weather exposure, and a decreased risk of damage or power failures.

Moreover, buried powerlines are a safer option for both humans and animals and can be installed in densely populated urban areas without using up precious land.

2. Advanced Surveillance & Error Identification (USA, Canada)

The way it functions: Advanced technologies such as Phasor Measurement Units (PMUs) are being incorporated into modern power grids to monitor the grid's electrical condition in real-time. These systems are able to identify irregularities in the voltage and current of the powerlines and forecast potential failures in advance. Operators are promptly notified when a malfunction is identified, and automated systems can redirect power to ensure continued supply.

Obstacles: Introducing real-time monitoring and smart grid systems at the beginning can be expensive and complicated. Furthermore, substantial data processing capabilities are required.

Advantages: Detecting faults early decreases blackout risks, shortens repair durations, and maintains grid reliability. Anticipatory maintenance helps cut costs by resolving issues before they develop into costly repairs.

3. Incorporating renewable energy into Smart Grids in Denmark and Australia.

The way it operates: Intelligent grids are electricity networks that utilize digital communication technology to identify and respond to local fluctuations in electricity consumption. These systems enable better control of renewable energy sources like wind and solar, which produce irregular output. The intelligent grid adapts to changes in supply and demand, making sure electricity is distributed efficiently without causing overload in any section of the grid.

Challenges arise when trying to implement a smart grid due to the high cost of upgrading traditional grid infrastructure. Cybersecurity measures are required to safeguard the grid against digital threats as well.

Advantages: Incorporating renewable energy enhances environmental sustainability and decreases dependency on fossil fuels. Smart grids enhance energy efficiency, minimize losses, and enable increased decentralized power production (for instance, households equipped with solar panels can feed surplus electricity back into the grid).

4. Management of plants and prevention of wildfires (Australia, California, USA)

The way it operates: Managing vegetation around powerlines is essential in wildfire-prone areas to lower the chances of fires triggered by electrical sparks. Power companies routinely cut trees and remove vegetation to establish a protective area, preventing powerlines from being in danger of contact with branches or sparking fires in case of harm. In certain areas, powerlines are fitted with sensors that cut off the electricity automatically if the lines are harmed or make contact with trees.

Challenges: Continuing to maintain vegetation can be both laborious and expensive, particularly in isolated regions. It also necessitates precise alignment with landowners and government entities.

Advantages: Effective vegetation control lowers the chance of wildfires, leading to potential life-saving benefits, property protection, and the prevention of extensive power outages. It enhances the safety and reliability of the grid as well.

5. Technology for High-Voltage Direct Current (HVDC) (China, Sweden)

The process involves using HVDC technology to transmit electricity across extended distances. In contrast to conventional AC transmission, which encounters high power losses during long distances, HVDC is more effective. This is done by changing AC to DC at the beginning of the line and then changing it back to AC at the receiving end.

Obstacles: HVDC systems require converter stations at both ends of the transmission line, increasing upfront construction costs. Nevertheless, beyond 600 kilometers, the reduced energy loss compensates for the expenses.

Advantages: HVDC enables the effective transmission of electricity over long distances while reducing energy wastage. It also allows for improved incorporation of renewable energy sources by transmitting power from areas with abundant renewables (such as wind farms) to cities requiring electricity.

6. Devices to protect birds (Spain, UK)

Powerlines present a considerable danger to birds, particularly larger species that may not notice the wires in time to prevent accidents. In order to address this issue, countries such as

Spain and the UK utilize bird diverters, which are tools that enhance the visibility of power lines to birds, or reflective markers that deter birds. Additional techniques involve protecting powerlines in regions with a large bird population.

Obstacles: Putting up bird diverters or markers can be a lengthy process and needs consistent upkeep to make sure they work.

Advantages: These actions aid in decreasing the number of bird deaths, especially for species at risk of extinction. Additionally, they reduce interruptions to the power grid resulting from birds hitting power lines.

7. Involvement and remuneration of the community (France, UK)

How it operates: Building new power lines can be contentious, particularly in regions where they might impact the scenery or the local ecosystem. Nations such as France and the UK have established methods to involve local communities prior to the start of construction. Public discussions, evaluations of environmental effects, and payment plans for landowners affected contribute to alleviating worries.

Challenges: Involving the community can extend the approval timeline for new infrastructure projects, while compensation increases the total expenses.

Advantages: Establishing trust with nearby communities minimizes the chance of facing resistance and setbacks. It also guarantees that powerline projects can advance smoothly and receive public backing.

8. Insulated cables are used in areas with a high risk of danger in Japan and Switzerland.

The process involves utilizing insulated cables in urban areas or regions susceptible to severe weather to avoid short circuits, electrocution, and other mishaps. These cables are equipped with layers of protective insulation that protect against damage caused by the environment, ensuring safety for both humans and animals.

Obstacles: Insulated cables cost more than uninsulated cables, and their installation needs proper planning to meet safety regulations.

Advantages: Implementing insulated cables enhances the safety and dependability of the grid, particularly in congested regions with increased accident susceptibility.

9. Integration and Design related to aesthetic (France, Italy)

In certain countries, they opt to create powerlines and pylons in a manner that reduces their visual impact in picturesque or culturally important areas. In Italy, certain pylons have been created to integrate with the surroundings or to be visually attractive, for instance. France has also implemented innovative pylon designs in areas rich in cultural heritage.

Obstacles: Creating and constructing personalized powerline structures may come with a higher price tag compared to typical pylons.

Advantages: Decreasing the visual footprint of power infrastructure can lessen resistance to new powerlines and protect the charm of scenic or historically important locations.

10. Trading electricity across borders between Nordic countries in Europe.

European countries, particularly in the Nordic region, have set up interconnected power grids that enable the trading of electricity between nations. This is especially beneficial for maintaining a balance between supply and demand, allowing countries to either exchange excess power or import electricity

when needed. Nations with substantial renewable energy capability, such as Norway with its hydropower resources, have the ability to sell electricity to nearby countries.

Obstacles: Achieving cross-border grid integration necessitates strong collaboration among nations, alongside uniform regulations and interoperable grid infrastructure.

Advantages: This method improves energy security and efficiency, lowers energy expenses for users, and enables optimal utilization of renewable energy sources. It additionally assists in stabilizing the grid by allocating power to areas of highest demand.

These practices from other countries demonstrate the ways in which they are innovating to enhance the effectiveness, security, and environmental footprint of high-voltage powerline structures.

MAJOR TECHNOLOGIES USED IN HIGH-VOLTAGE POWER LINES

- **Optical Ground Wire (OPGW)** is a kind of overhead ground wire that includes optical fibers to enable the simultaneous

transmission of both electrical power and communication signals.

- Utilizing sensors and monitoring systems to evaluate the condition of powerline components and plan maintenance based on their health status is called **Condition-Based Maintenance (CBM).**

- Utilizing drones or helicopters with advanced cameras and sensors for efficient and safe inspection of powerlines.

- Utilizing smart devices and systems to enhance power distribution, enhance dependability, and allow for better regulation of the grid - **Smart Grid Technology.**

- Devices that improve the control and stability of power grids, enabling more effective transmission of power, are known as **Flexible AC Transmission Systems (FACTS).**

- Underground cables are utilized in specific regions to minimize the chances of outages caused by weather events or other disruptions.

NEW DEVELOPMENTS IN HIGH-VOLTAGE POWERLINE TECHNOLOGY.

Integration of renewable energy: Adding more solar and wind power to the power grid.

Microgrids are being created to improve reliability and resilience by running independently or alongside the main grid.

Energy storage systems: Utilizing technologies like batteries or pumped hydro to manage supply and demand and lessen dependence on fossil fuels.

Digitalizing substations involves replacing old equipment with digital components to enhance efficiency, reliability, and enable remote monitoring.

Wireless Transmission

Both Nikola Tesla and Hidetsugu Yagi tried to create methods for transmitting power wirelessly on a large scale during the late 1800s and early 1900s, but they were not successful in attracting commercial interest.

Laser Motive achieved victory in the NASA 2009 Power Beaming Challenge in November 2009 by utilizing a ground-based laser transmitter to power a cable climber vertically for 1 km. The system generated a maximum of 1 kW of power at the receiver's side.

In August 2010, NASA enlisted private companies to develop laser power beaming systems for low earth orbit satellites and to launch rockets with laser power beams.

Research has been conducted on wireless power transmission for delivering power from solar power satellites to Earth. A strong array of microwave or laser transmitters will send power to a rectenna. Any project involving solar power satellites will encounter significant engineering and economic obstacles.

Subterranean Power delivery

Electricity can be transported through power cables underground. Underground cables do not require right-of-way, are less visible, and are impacted less by weather conditions. Nevertheless, insulation is necessary for cables. Costs for cable installation and excavation are significantly more expensive compared to overhead construction. Finding and fixing faults in buried transmission lines is a more time-consuming process.

In certain cities, cables are protected by metal pipe and insulated with dielectric fluid, typically oil, that is stationary or circulated using pumps. In case of an electrical malfunction causing damage to the pipe and leaking dielectric, liquid nitrogen is utilized to freeze sections of the pipe for the purpose of draining and repairs. This lengthens the timeframe for repairs

and drives up expenses. The temperature of both the pipe and its surroundings is constantly monitored during the repair process.

The thermal capacity of underground lines restricts the amount of overload or re-rating that is possible. Long underground AC cables with high capacitance limit their capacity to transmit valuable power beyond 50 miles (80 kilometres). The capacitance of DC cables does not impose limitations on their length.

High-tension electricity lines are critical infrastructure in modern society. Following best practices in construction, maintenance, and operation is critical to ensuring safety, dependability, and efficiency. Countries around the world have used a variety of techniques and technology to improve their powerline systems, such as enhanced monitoring, condition-based maintenance, and the use of renewable energy sources. Nations can assure a long-term, sustainable, and robust electrical grid by constantly changing and adapting to new challenges.

CHAPTER -13

AN OVERVIEW ON POWER DISTRIBUTION

Bangalore, as a major metropolitan area, faces unique challenges and opportunities in power distribution. With its rapid urbanization and technological advancements, ensuring reliable and efficient power distribution is crucial for sustaining its growth. Power distribution in Bangalore is a complex system managed by the Bangalore Electricity Supply Company (BESCOM). As one of India's largest and fastest-growing cities, Bangalore has seen a steady rise in electricity demand due to its urbanization, IT boom, and growing population. The city relies on a well-structured power distribution network that spans substations, transformers, and distribution lines to ensure reliable supply to residential, commercial and industrial consumers.

1. Demand and Supply

Peak Power Demand as of 2024, Bangalore's peak power demand is between 5,000 to 6,000 MW. On certain occasions, this can spike further, especially during summer months and periods of high industrial activity.

- Power Supply Sources: BESCOM draws electricity from various sources, including:

- Thermal power from Raichur, Bellary, and other generating stations.
- Hydropower from Sharavathi, Kali and other dams in Karnataka.
- Renewable energy from wind and solar power plants.
- External supply: BESCOM also procures electricity through the Indian Energy Exchange (IEX) during periods of shortfall.

2. Substations

Substations play a crucial role in stepping down high-voltage electricity for distribution across the city. BESCOM operates a comprehensive network of substations, which are classified based on voltage levels:

- 220/66 kV Substations: These handle high-voltage power from Karnataka Power Transmission Corporation Limited (KPTCL) and step it down to 66 kV for further distribution.
- Number of 220/66 kV Substations: Bangalore has approximately 12 substations at this voltage level, strategically located to supply bulk power to major areas.

- 66/11 kV Substations: These are the primary substations that step down voltage to 11 kV for local distribution. They are critical for powering residential and commercial areas.

- Number of 66/11 kV Substations: There are around 145 substations in Bangalore at the 66/11 kV level.

- 33/11 kV Substations: These substations serve as intermediate points, stepping down the voltage from 33 kV to 11 kV for distribution to areas that have smaller, localized demand.

- Number of 33/11 kV Substations: Approximately 25 substations of this type operate across Bangalore.

- Total Substations: Bangalore has over 182 substations managed by BESCOM, distributed evenly to ensure stable voltage regulation and meet the city's high demand.

3. Distribution Lines

The distribution network in Bangalore includes both High Tension (HT) and Low Tension (LT) lines that carry electricity from substations to consumers:

- High Tension (HT) Lines: Voltage levels of 66 kV, 33 kV and 11 kV are distributed via HT lines, primarily used to supply power to industrial consumers and for further distribution to residential transformers.

- Length of HT lines: Bangalore has approximately 85,000 km of HT lines. These lines connect the substations to transformers and industrial zones.

- Low Tension (LT) Lines: LT lines carry electricity at lower voltages (440V/230V) from distribution transformers to end consumers.

- Length of LT lines: The LT network spans over 1.2 lakh km, ensuring last-mile connectivity for residential and commercial consumers.

- Underground Cabling: In densely populated or high-traffic areas like the Central Business District (CBD), BESCOM has initiated underground cabling projects to replace overhead

lines. Currently, over 1,000 km of underground cabling has been completed with plans to expand further.

4. Transformers

Transformers are a vital component in the distribution system, stepping down high voltage for safe and usable electricity levels for consumers.

- **Distribution Transformers:**

Total Number: BESCOM operates over 1.5 lakh distribution transformers across Bangalore, which are installed at various locations such as residential neighbourhoods, commercial areas, and industrial zones.

Capacity: These transformers typically step-down voltage from 11 kV to 440V/230V, suitable for domestic and commercial use.

- **Power Transformers:**

Power transformers are located in substations and step-down voltage from higher levels (220 kV or 66 kV) to the distribution level of 11 kV.

Capacity: Power transformers at substations typically range from 20 MVA to 100 MVA, depending on the substation size and the demand of the area it serves.

5. Distribution Sections

Bangalore's distribution network is divided into four operating zones, each further subdivided into divisions and subdivisions for effective management:

Bangalore Metropolitan Area Zones:

- **Bangalore North Zone:** Includes areas like Malleswaram, Yelahanka, and Hebbal. This zone is heavily residential but also supports growing IT hubs like Manyata Tech Park.
- **Bangalore South Zone:** Covers areas such as Jayanagar, Bannerghatta, and BTM Layout. It has a mixed demand from both residential and commercial sectors.
- **Bangalore East Zone:** Covers key areas like Indiranagar, Whitefield and Marathahalli, known for their high-density IT and commercial complexes.

- **Bangalore West Zone**: Includes areas like Rajajinagar and Vijayanagar, with a strong industrial presence alongside residential neighbourhoods.

Each zone is further divided into:

- **Divisions:** Bangalore has 40 BESCOM divisions, each handling several subdivisions.

- **Subdivisions:** There are 130 subdivisions, responsible for localized operations such as maintenance, billing, and handling consumer issues.

6. Power Management and Automation

BESCOM has implemented several initiatives to improve the efficiency and reliability of its distribution system:

- SCADA (Supervisory Control and Data Acquisition): SCADA systems allow remote monitoring and control of substations and feeders. This system helps BESCOM detect faults quickly and manage loads more efficiently. Bangalore's SCADA system currently covers all major substations and feeders, with a control center in operation 24/7.

- Smart Meters: BESCOM is rolling out smart meters across the city, with over 1 lakh smart meters already installed. These meters provide real-time consumption data, reducing manual reading errors and enabling faster detection of faults or tampering.

- Feeder Segregation: Bangalore's distribution network includes 11 kV feeders segregated into two main categories:

- Domestic Feeders: Supplying residential consumers.

- Industrial Feeders: Dedicated to industries to ensure minimal interruptions and load fluctuations.

- Total number of feeders: Over 2,200 11 kV feeders operate across Bangalore to cater to diverse loads.

7. Challenges and Future Plans

- **Transmission and Distribution (T&D) Losses:** BESCOM faces T&D losses estimated at around 13-15%. These losses are being addressed through infrastructure upgrades, underground cabling, and the adoption of smart grid technologies.

- **Grid Modernization:** BESCOM is moving toward a smart grid system to integrate automation in grid management, reduce

downtime, and improve efficiency. Future includes extending smart metering across all consumer segments and further expanding SCADA coverage.

- **Renewable Energy Integration:** BESCOM has been promoting rooftop solar installations, with a target of generating 200 MW of rooftop solar energy in Bangalore by 2025.

This extensive and continually evolving system ensures that Bangalore can meet its growing energy needs efficiently while maintaining reliability and minimizing outages.

8. Recent Developments in Bangalore's Power Distribution Network

Bangalore, often referred to as India's Silicon Valley, has witnessed rapid urbanization and industrial growth over the past few decades. This expansion has put immense pressure on the city's power distribution network, prompting the need for continuous upgrades and modernization to ensure reliable electricity supply. In recent years, several key developments have taken place in Bangalore's power distribution network, addressing both demand growth and technological advancements.

- **Smart Grid Implementation:** One of the most significant developments in Bangalore's power infrastructure is the introduction of smart grid technology. This initiative is led by the Bangalore Electricity Supply Company (BESCOM), which has begun implementing smart grid systems to enhance the reliability and efficiency of electricity distribution.

- **Smart Meters:** BESCOM has started deploying smart meters across residential and commercial areas. These meters allow for real-time monitoring of electricity consumption, giving both consumers and the utility better control over energy use. As of 2023, over 100,000 smart meters have been installed, with plans to cover the entire city in the coming years.

- **Load Management:** Smart grids enable automated load management, allowing BESCOM to balance electricity demand more efficiently, reducing the risk of blackouts during peak demand periods.

- **Outage Detection and Response:** Smart grids have also improved BESCOM's ability to detect outages in real time, allowing for quicker response times and minimizing disruption to consumers.

9. Expansion of Substations and Transmission Lines

To keep up with the growing electricity demand in Bangalore, BESCOM and the Karnataka Power Transmission Corporation Limited (KPTCL) have undertaken major infrastructure projects, including the expansion of substations and transmission lines.

- **New Substations:** In the last five years, Bangalore has added over 15 new substations to its network, with an emphasis on addressing high-demand areas such as the IT corridor and industrial zones. These substations play a critical role in stepping down high-voltage electricity for distribution to consumers.

- **Transmission Line Upgrades:** KPTCL has been upgrading existing transmission lines to reduce transmission losses and increase the capacity of the network. Recent projects include the upgrading of the 220kV and 66kV transmission lines to improve the reliability of power delivery to both residential and industrial consumers. These upgrades are designed to handle higher loads while reducing technical losses, ensuring a more efficient flow of electricity across the city.

10. Underground Cabling and Safety Enhancements

As part of its ongoing efforts to modernize the city's power distribution network, BESCOM has also initiated the conversion

of overhead power lines to underground cabling in several key areas.

- **Underground Cabling:** This project, which started in densely populated and highdemand areas such as the Central Business District (CBD) and major residential hubs, reduces the risk of power outages caused by weather events and tree falls, while improving the visual aesthetics of the city. As of 2024, approximately 250 km of underground cables have been laid in Bangalore, with plans to expand this initiative to other parts of the city.

- **Safety:** By shifting to underground cabling, the risk of accidents caused by exposed power lines has been significantly reduced, improving public safety and minimizing service disruptions due to maintenance.

- **Renewable Energy Integration:** To reduce dependence on conventional power sources and promote sustainability, Bangalore has been integrating renewable energy into its grid. Karnataka, the state in which Bangalore is located, is a leader in renewable energy production, especially solar power.

- **Solar Power Projects:** BESCOM has been promoting rooftop solar installations for residential and commercial consumers,

offering incentives for solar power generation. As of 2023, Bangalore's rooftop solar capacity has surpassed 1,000 MW, contributing significantly to the city's overall electricity supply.

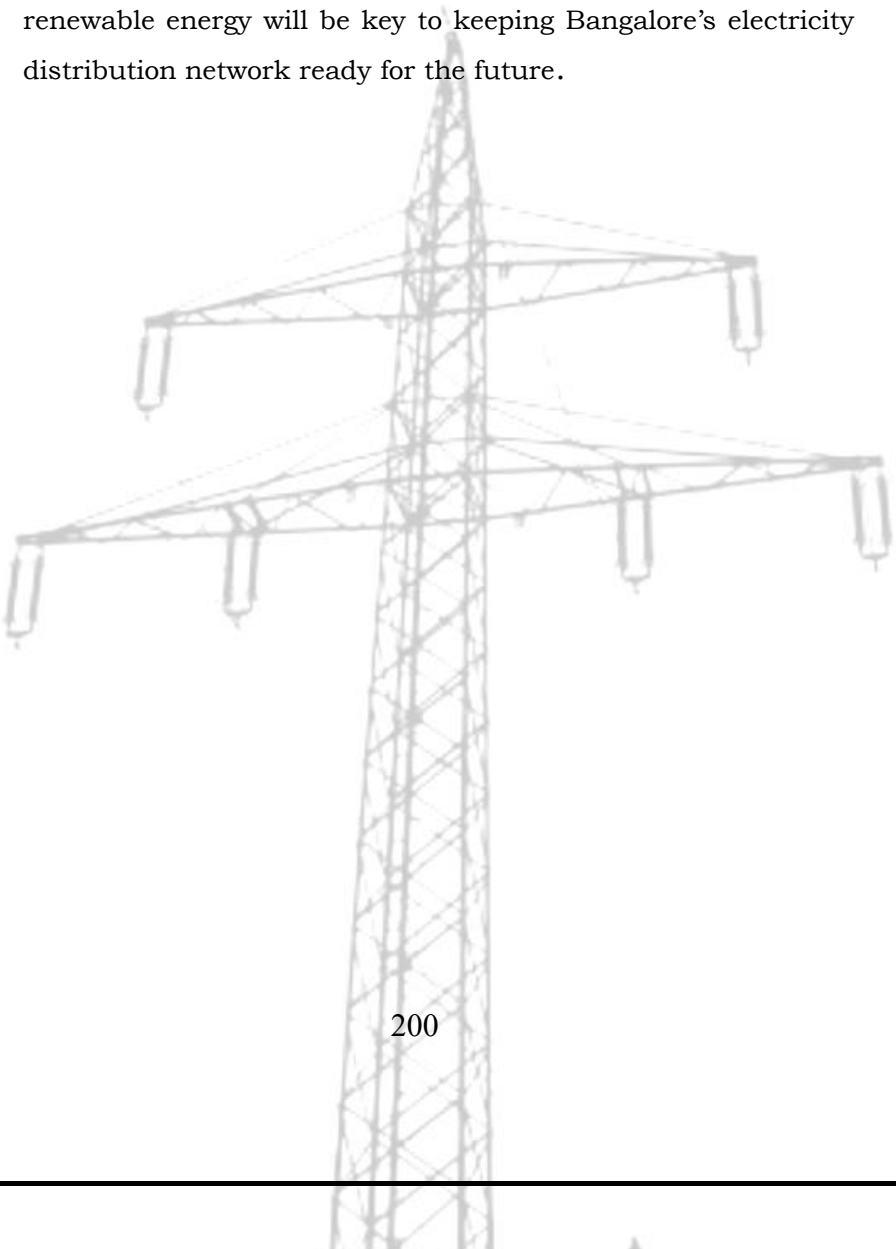
- **Net Metering:** The net metering system, introduced by BESCOM, allows consumers to sell excess solar power back to the grid. This encourages consumers to adopt solar power, easing pressure on the grid during peak hours.

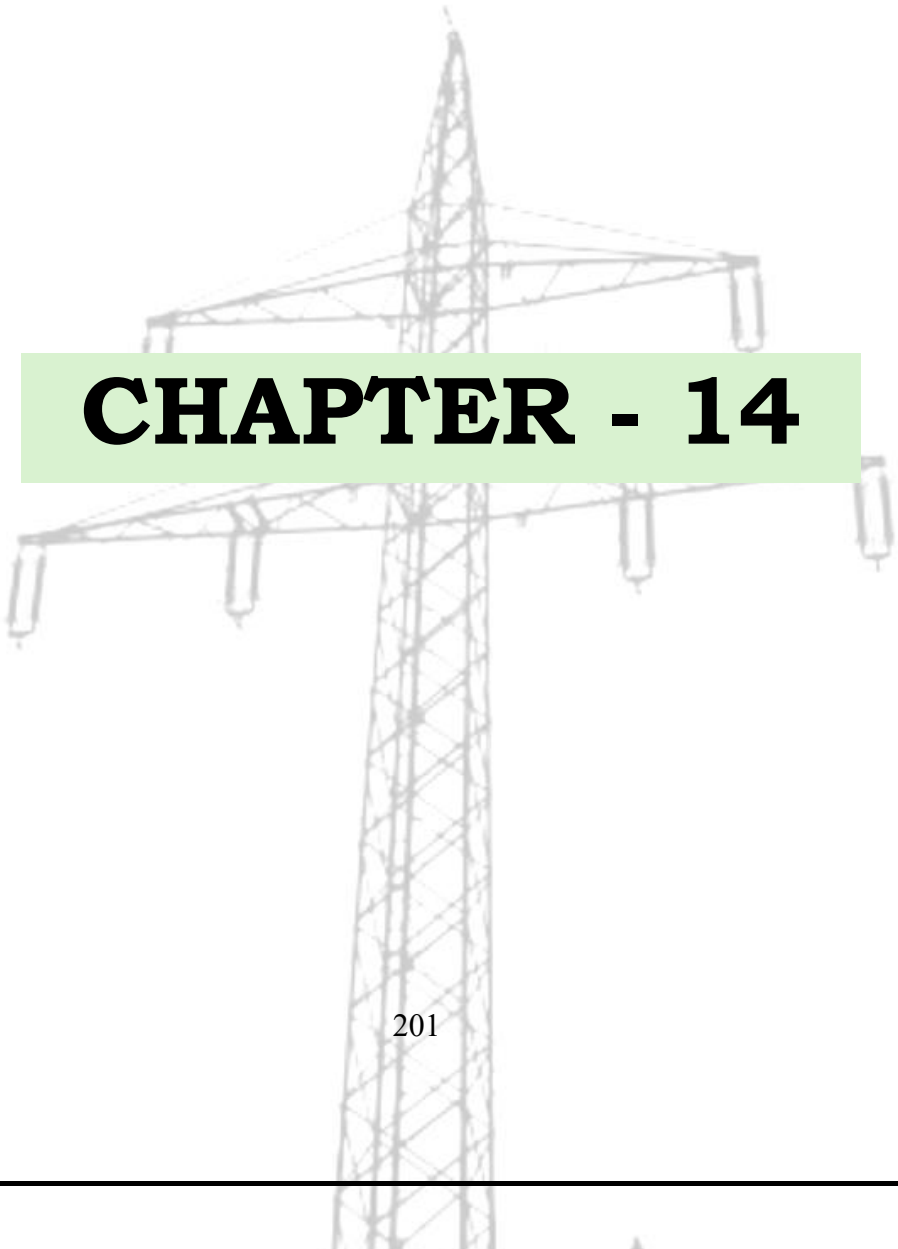
CONCLUSION

Bangalore's power distribution network is evolving to keep pace with the city's rapid growth. The implementation of smart grids, the expansion of substations, and the increasing reliance on renewable energy sources like solar power are helping to make electricity supply more reliable and efficient. One of the most important recent developments is the shift to underground cabling, which not only improves the city's resilience to power outages caused by weather or accidents but also enhances public safety and the overall look of the city.

In addition, advances in automation and digital systems are making it easier to manage electricity distribution, while demand-side management programs encourage consumers to use energy more efficiently. As Bangalore continues to grow, these efforts—particularly the push toward underground

cabling—are essential in ensuring the city has a power system that is both sustainable and resilient enough to meet the needs of its people. Continued investment in infrastructure and renewable energy will be key to keeping Bangalore's electricity distribution network ready for the future.





CHAPTER - 14

THE PROJECT DETAILS

Document Source: Karnataka Power Transmission Corporation Limited (KPTCL), Hebbal, Bengaluru.

Purpose: Responding to a Right to Information (RTI) request about high-voltage power line conversion to underground cabling within Bengaluru and surrounding areas over the last five years.

Proposed Infrastructure Development:

- Construction of a 220kV Multi-Circuit (MC) line with AAAC Moose conductor along a 14.07 km route from the 400/220kV Nelamangala Station to the Cable Terminating Tower (CTT) near Brindavana LILO point.

- Various underground (UG) cable routes planned with specific lengths and connections to substations, such as Peenya, Rajajinagar, and Sahakarnagara, for improved power supply.

Dismantling Operations:

- Decommissioning the existing 110kV SBT line along a 14.07 km stretch.

- Removing sections of the 220kV idle corridor line near the Peenya Substation.

Challenges:

- Existing 110kV SBT lines are disconnected, leaving sections idle.

- Construction of a 400kV source line from Nelamangala to the proposed Peenya substation requires a 180-day shutdown of the 220kV B1&B2 lines.

Goals:

- Strengthen the 220kV transmission network for reliability and to cater to the rising demand in Bengaluru.

- Maintain continuous power supply during the construction phase through alternative feeds.

- Improve connectivity among Nelamangala, Peenya, Brindavana, and other substations.

Implementation Plan:

A provisional schedule suggests an 18-month timeline for project completion from the issue of the Detailed Work Award.

Post-Commissioning Benefits:

- Enhanced power supply reliability to downstream substations.

- Alleviation of network loading issues and uninterrupted power during contingencies.

Project Overview:

Karnataka Power Transmission Corporation Limited (KPTCL) issued an enquiry for electrical infrastructure work, including underground (UG) cable installation and terminal bay construction

Scope of Work:

- Conversion of an existing 220KV DC overhead line near 220/66KV EPIP GIS Station to 220/11KV ITPL EHT Consumer Station using 1000sqmm XLPE insulated lead-sheathed UG cable (approx. 2.90 km route).

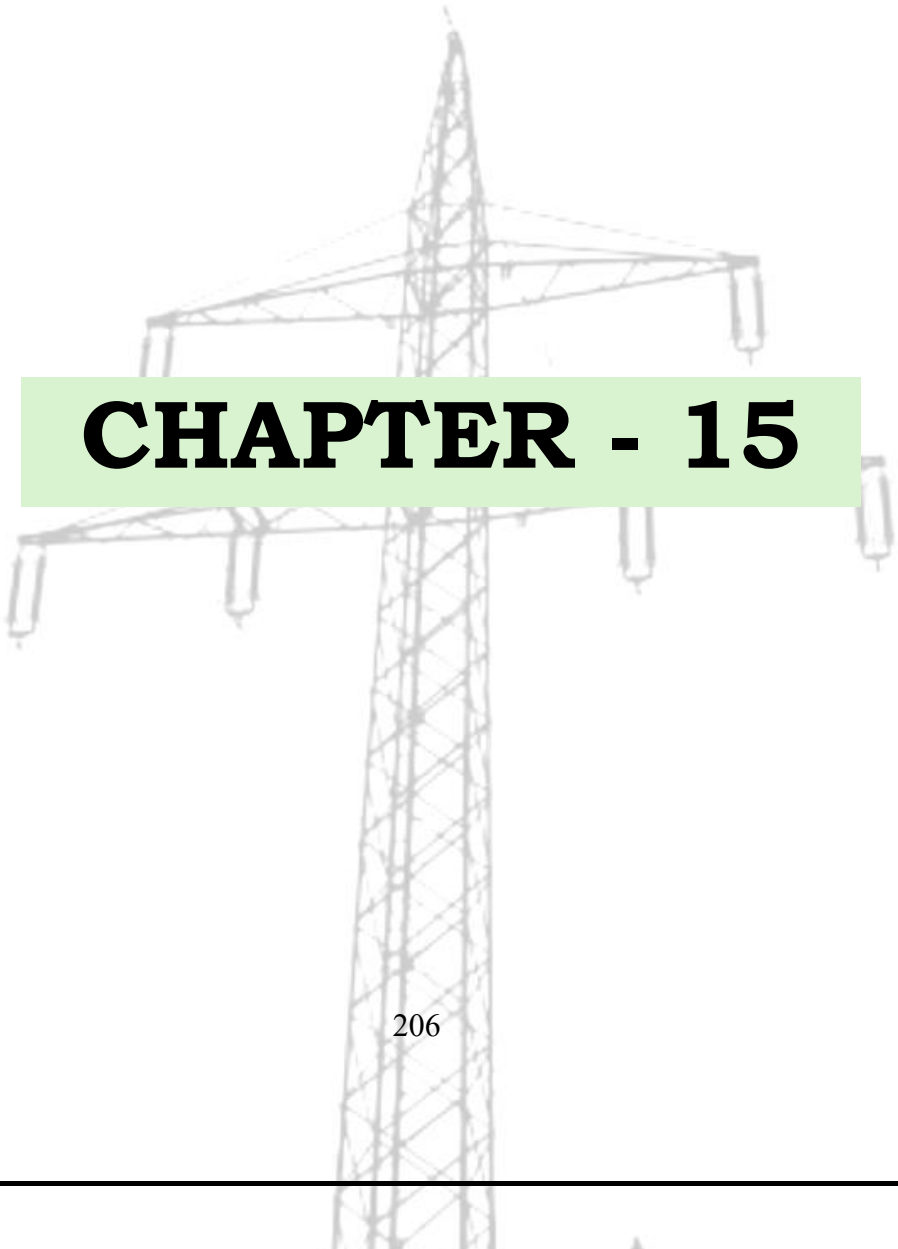
- Running a single circuit of 220KV UG cable from 400/220KV Hoody Receiving Station to 220KV ITPL EHT Consumer Station (approx. 3.083 km route).

- Construction of GIS module terminal bays at EPIP GIS Station and Hoody Station for terminating UG cables.

- Turnkey execution: Supply of materials, equipment, erection, civil works, testing, and commissioning

Contract Details:

- Award given to Universal Cables Ltd. in consortium with KEC International Ltd., Gurgaon.
- Includes supply of indigenous equipment/materials and mandatory spares.
- Bid details include quantities, technical specifications, and contract terms.
- Several amendments and clarifications issued during the bid evaluation process



CHAPTER - 15

A STUDY ON THE LIVES AROUND THE THREE ELECTRIC LINES

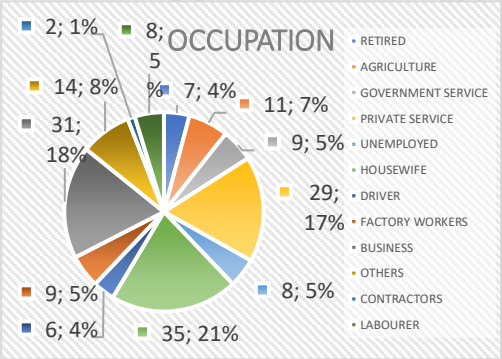
A team of around 60 students of CMR University – School of Legal Studies conducted a survey along the three electric lines stretching over a length of around 4 Kms. The survey project was organised by the Legal Aid Trust in collaboration with the Legal Services Clinic, CMR University School of Legal Studies.

The primary data that was collected was concerning the nature of property, occupations and source of income of the residents, number and age of dependants on a property etc., which is organised and reported in the form of statistical data. The data collected represents the nature of lives that the project would impact. The statistical data for each electric line is reported separately. The data primarily aims to highlight the socio-economic conditions of the habitants and the population that is going to be impacted by the line upgrade project. The data collected during the survey is represented below in tabular and graphical form.

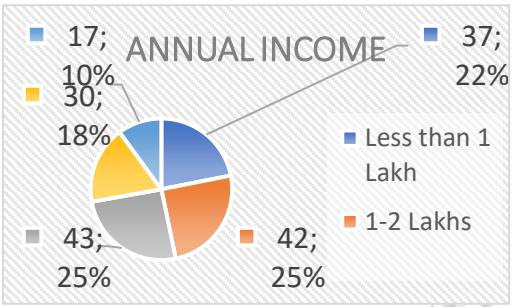
LINE 1

There were around 169 households in the vicinity of electric line 1 with a total population of around 750 individuals living in the impact zone. The information relating to the households in the close proximity of the first line is represented as follows

OCCUPATION AND ANNUAL INCOME



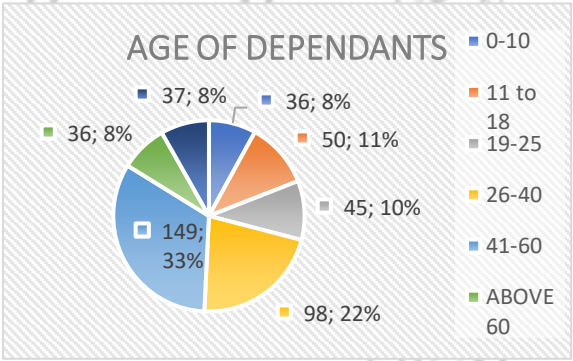
RETIRED	7
AGRICULTURE	11
GOVERNMENT SERVICE	9
PRIVATE SERVICE	29
UNEMPLOYED	8
HOUSEWIFE	35
DRIVER	6
FACTORY WORKERS	9
BUSINESS	31
OTHERS	14
CONTRACTORS	2
LABOURER	8



LESS THAN 1 LAKH	37
1-2 LAKHS	42
2-4 LAKHS	43
ABOVE 4 LAKHS	30
N/A	17

AGE OF DEPENDANTS

Out of the population of 700 from 169 households in the vicinity of Line 1, there were around 450 dependents whose age-related information was obtained during the survey.

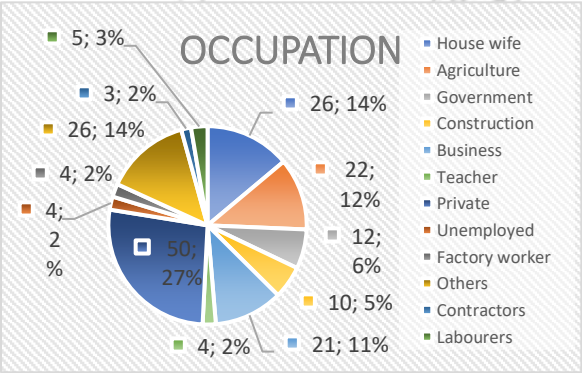


0-10	36
11-18	50
19-25	45
26-40	98
41-60	149
ABOVE 60	36
N/A	37

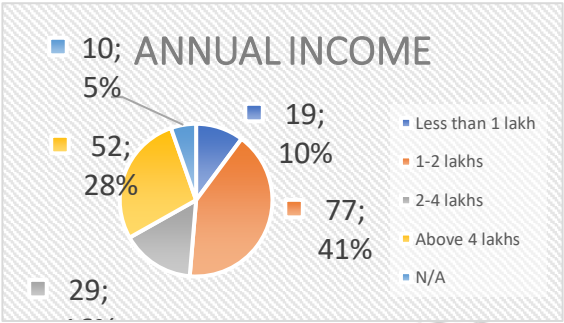
LINE 2

There were around 187 households in the vicinity of electric line 2 with a total population of around 650 individuals living in the impact zone. The information relating to the households in the close proximity of the second line is represented as follows.

OCCUPATION AND ANNUAL INCOME



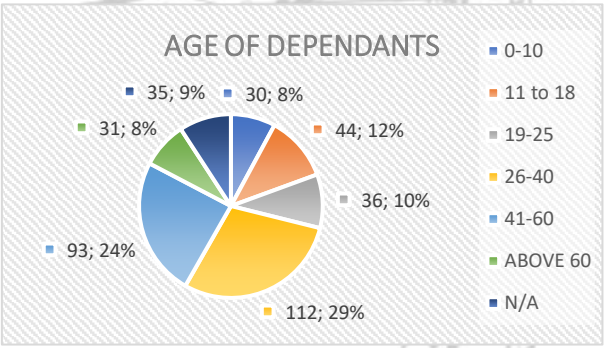
HOUSE WIFE	26
AGRICULTURE	22
GOVERNMENT	12
CONSTRUCTION	10
BUSINESS	21
TEACHER	4
PRIVATE	50
UNEMPLOYED	4
FACTORY WORKER	4
OTHERS	26
CONTRACTORS	3
LABOURERS	5



LESS THAN 1 LAKH	19
1-2 LAKHS	77
2-4 LAKHS	29
ABOVE 4 LAKHS	52
N/A	10

AGE OF DEPENDANTS

Out of the population of 700 from 169 households in the vicinity of Line 1, there were around 450 dependents whose age-related information was obtained during the survey.

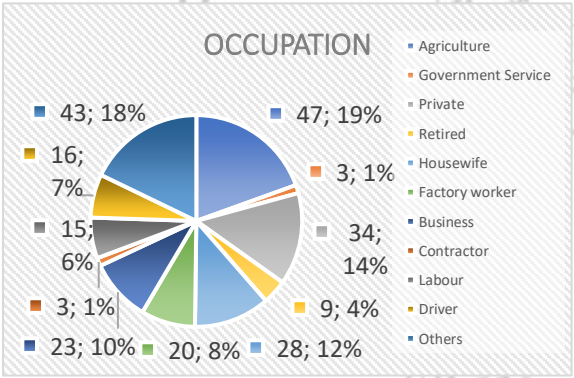


0-10	30
11-18	44
19-25	36
26-40	112
41-60	93
ABOVE 60	31
N/A	35

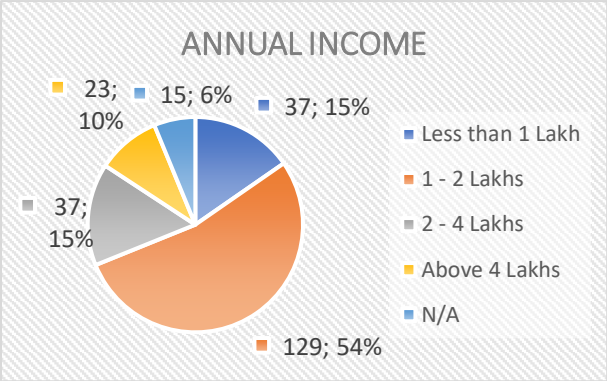
LINE 3

There were around 241 households in the vicinity of electric line 2 with a total population of around 800 to 850 individuals living in the impact zone. The information relating to the households in the close proximity of the third line is represented as follows.

OCCUPATION AND ANNUAL INCOME



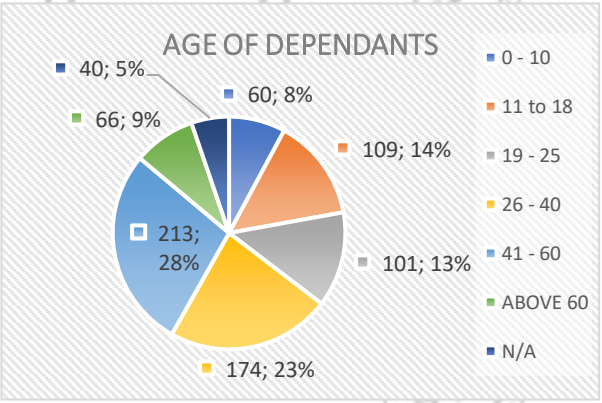
AGRICULTURE	47
GOVERNMENT SERVICE	3
PRIVATE	34
RETIRED	9
HOUSEWIFE	28
FACTORY WORKER	20
BUSINESS	23
CONTRACTOR	3
LABOUR	15
DRIVER	16
OTHERS	43



0 - 10	60
11 - 18	109
19 - 25	101
26 - 40	174
41 - 60	213
ABOVE 60	66
N/A	40

AGE OF DEPENDANTS

Out of the population of 650 from 187 households in the vicinity of Line 2, there were around 380 dependents whose age-related information was obtained during the survey.



LESS THAN 1 LAKH	37
1-2 LAKHS	129
2-4 LAKHS	37
ABOVE 4 LAKHS	23
N/A	15

SUMMARY OF THE FINDINGS

Overall, a population of around 2200 to 2300 from about 597 households was residing in the vicinity of the electric lines and their properties were well within the impact/buffer zone of the electric lines. The major highlights of the survey include the economic condition of the households and the age of the population that is likely to be impacted. Some of the important highlights are as follows.

1. The electric lines were likely to impact and were currently impacting a population of around 2200 to 2300 individuals from 597 households (which is exclusive of the empty lands and majorly includes constructions).

2. Around 17.5% of the population of whose age-related data is obtained is either a senior citizen or a minor which makes them highly prone to the effects of Electric and Magnetic fields.

3. More than half of the households had an annual income equal to or less than Rs. Two lakh per annum.

4. More than half of the households or properties were self-acquired.

5. More than 50% of the population belonged to the backward classes.

6. More than 2/3rd of the properties was residential in nature while the remaining 1/3rd was either used for commercial purposes, agriculture or was empty land or any other use.

ECONOMIC CONDITION OF THE HOUSEHOLDS

1. The annual income of around 75% of the households was less than or equal to Rs. Four Lakh per annum.

2. The annual income of around 57% of the households was less than or equal to merely Rs. Two Lakh per annum.

3. Only 17% of the households had an annual income of above Rs. Four lakh per annum.

The data concerning the annual income of the 597 households highlights and reflects the economic conditions of those households. When more than 3/4th of the them and more than half of them have an annual income of less than or equal to four lakh and 2 lakhs respective, the impact of the electric upgradation project is going to be extremely severe as the lack of proper compensation or the devaluation of the property would cause financial losses to the households pushing them towards further poverty and impacting their lives as a whole.

AGE OF THE POPULATION LIKELY TO GET AFFECTED

1. Around 8.5% of the 1483 individuals were equal to or less than a mere age of 10 years.

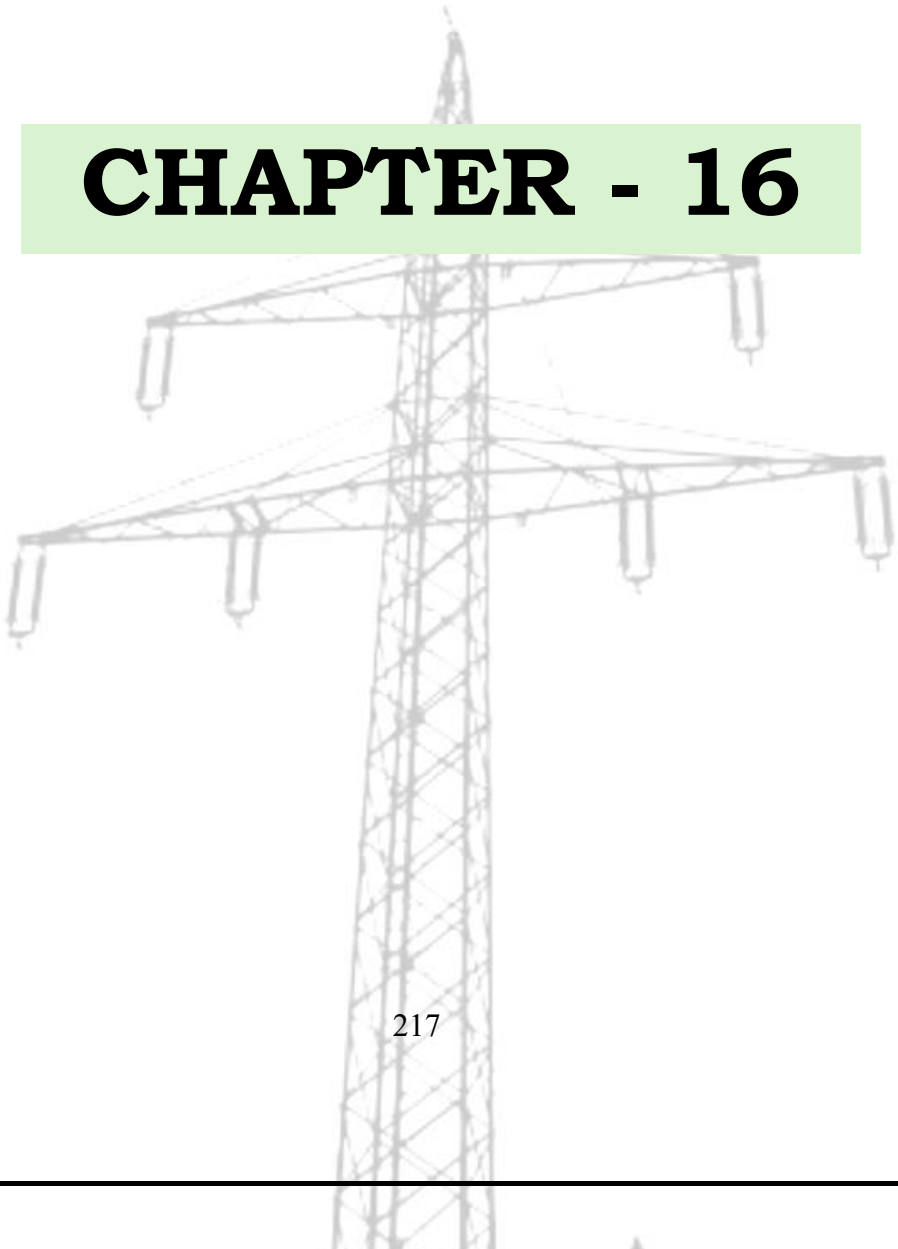
2. Around 22% of the 1483 individuals were less than or equal to 18 years of age.

3. Around 34% of the 1483 individuals were equal to or less than the age of 25 years.

4. Around 9% of the 1483 individuals were of above 60 years of age.

The data concerning the age of the population highlights that nearly 43% of the population is either very young or old and the effects due to the electric and magnetic fields that are likely from the electric lines may primarily impact the health of this 43% of the population. As per the World Health Organisation (WHO), some of the common health impacts due to electric and magnetic fields include headaches anxiety, sleep disturbance, fatigue, nausea etc. There are other impacts as well and some of them are severe in nature.

CHAPTER - 16



VOICE OF THE AGGRIEVED

As part of our outreach, we spoke to residents and conducted a ground-level survey to understand how people are being affected by the ongoing transmission line project.

Here's what they shared with us — in their own words and spirit.

"It's not just a sound: it's loud and disturbing," said one resident. Especially during heavy rains, the noise from the high-voltage current becomes unbearable. Families say it's affecting their children, disrupting their routines, and even damaging home appliances. What upset many was that they received no prior notice from KPTCL before this project began.

Another person shared, "The noise gets worse when it rains. We weren't even informed that something like this was going to happen." This lack of communication came up again and again in conversations.

A mother was visibly distressed when she told us, "My kids say they can feel small shocks, they're scared all the time. And we can't even get a proper phone signal here anymore." She added that they're constantly anxious, and it's hard to concentrate on daily tasks.

“It’s no longer safe to live here,” said a man who described hearing buzzing noises and feeling tingling shocks when it rains. He’s now looking for other places to stay, even though he’s lived there for years. Like others, he was never informed in advance about the project.

One woman who has lived in the area for two decades said, “We’re not against development. But why was this done without even talking to us?” She and others feel that underground cabling would’ve been a better solution. “We worked hard, saved money, and bought this land for our children’s future. Now we’re being forced to fight for it,” she said, frustrated that no compensation or support has been offered.

A farmer told us, “I have over an acre of land — and now it has a huge structure on it. When it rains, we feel shocks and hear loud noises. It’s become unsafe.” He believes underground lines would be safer and cause less disruption.

A woman added that even from a distance, the power lines have caused her kitchen appliances to burst. “If this is the impact from far away, imagine how bad it is for people living closer.” She said they were told the lines were just temporary and now they fear long-term health risks. “We weren’t warned and now we’re offered compensation that’s only a fraction of the land’s value. How can we just accept that after building our lives here?”

An elderly man who lives alone said, “This is my only home. If I’m asked to leave, where do I go?” He suggested the lines should be routed through open land, not through residential areas. He also raised concerns about new construction restrictions: “They say we have to leave 30 feet on both sides of the line. For small plot owners, what’s left? Where do we even build a home?”

A woman struggling financially said, “I’m worried about my family’s health. If someone falls sick, we can’t afford treatment.” Her daughter, who previously had seizures, has gotten worse, and doctors have referred her to NIMHANS. But “Even ₹5,000 for treatment is too much for us right now,” she said, urging officials to relocate the project to vacant areas instead of putting low-income families at risk.

Another resident recalled how KPTCL officials had simply said the voltage was being increased. “They said it would help everyone. But all we want is peace and safety, not to live in fear under power lines,” she told us.

Finally, a person working in Bangalore shared his disappointment. “I bought this land to retire in peace. They told me it was safe and DC-approved. But now I’m being asked to leave, even though I’m not near the line.” He added, “I’m not against progress, just don’t let it come at the cost of people’s lives and homes.”

CHAPTER – 17

PHOTO GALLERY


GPS Map Camera
Bengaluru,KA,India
Thippenahalli, Bengaluru, 560073, KA, India

CONCLUSION

The impact study on the Nelamangala to Peenya High Power Transmission Line sheds light on the social, economic and environmental consequences of the proposed upgrade. Once a predominantly agricultural region, this area has undergone significant urbanization over the past two decades. Today, it is home to a thriving residential community, schools, hospitals, and other essential facilities, many of which fall within the impact or buffer zone of the proposed high-voltage lines.

The study reveals deep-seated concerns among residents, particularly regarding health risks due to high radiation levels, property devaluation, and the lack of transparency in decision-making. Radiation measurements conducted during the survey show that levels exceed recommended safety limits, posing serious health risks, especially to children and the elderly. The findings also highlight financial vulnerabilities, with over 75% of affected households earning less than ₹4 lakh per annum, making them highly susceptible to economic hardship if their properties lose value or if fair compensation is not ensured.

Most concerning is the absence of proper public consultation and informed consent. Residents express frustration over being excluded from discussions on a project that directly impacts their lives and livelihoods. The study strongly advocates for

greater transparency, stakeholder engagement, and ethical decision-making in large-scale infrastructure projects.

Given the changing landscape and increased urban settlements, it is crucial to explore better alternatives that balance development with public welfare. Potential solutions include relocating the transmission lines, underground cabling, or adopting advanced shielding technologies to minimize risks. Authorities must prioritize public health, safety, and fair compensation to ensure that development does not come at the cost of human well-being.

Infrastructure projects should be designed not just for progress but for inclusive and sustainable growth. The voices of the affected communities must be heard, and their rights must be protected. The true measure of development lies not in technological advancement alone but in ensuring that no citizen is left behind in the name of progress.

REFERENCES

- https://wri-india.org/blog/unlock-bengaluru-driving-next-wave-urbanisation
- https://thescalers.com/bangalore/
- https://bmrda.karnataka.gov.in/info-1/Introduction/en
- https://bdabangalore.org
- DGM(COSTING), Chapter 04 Forecast, Bescom.karnataka.gov.in, 22 Nov, 2021
- Niranjan kaggere, Times of India, Rising mercury level, WFO sends energy demand soaring in b'luru, 19 Oct, 2023 https://timesofindia.indiatimes.com/city/bengaluru/rising-mercury-levels-wfo-send-energy-demand-soaring-in-bluru/articleshow/104538850.cms.
- BESCOM: High level of operational and financial performance, 10 July, 2019 https://powerline.net.in/2019/07/10/bescom/.
- Bangalore electricity supply company limited, 08 June, 2023 https://www.careratings.com/upload/CompanyFiles/PR/202306120642_Bangalore_Electricity_Supply_Company_Limited.pdf .

- Navya P K, where does Bangalore's power comes from?, 05 Nov, 2012 https://citizenmatters.in/4648-bescoms-power-sources/

- Deccan Herald, Karnatakas power demand touched historic high during summer, 11 June, 2024 https://www.deccanherald.com/india/karnataka/karnatakas-power-demand-touched-historic-high-during-summer-3061066.

- Deccan Herald, Power hungry bengaluru triples bescom's revenue demand in 10 years, 05 July, 2024

- https://www.deccanherald.com/india/karnataka/bengaluru/power-hungry-bengaluru-triples-bescom-s-revenue-demand-in-10-years-3093243.

- EMF: Electric and Magnetic Fields Associated with the Use of Electric Power

- https://www.mdpi.com/2076-3417/14/6/2654#B1-applsci-14-02654

- https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/non-ionizing/emf/health-risk

- Ma, L., & Cong, X.H., Social Stability Risk Assessment of NIMBY Major Projects by OWA, Matter-Element, and Cloud Model, 36 J. Intell. & Fuzzy Sys. 2545 (2019).

- M., Understanding and Overcoming the NIMBY Syndrome, 58 J. Am. Plan. Ass'n 288 (1992).

- International EMF Project. (n.d.). Electromagnetic fields and public health. World Health Organization. Retrieved from https://www.who.int/initiatives/the-international-emf-project

- Karipidis K., Brzozek C., Bhatt C.R., Loughran S.P., & Wood A., What Evidence Exists on the Impact of Anthropogenic Radiofrequency Electromagnetic Fields on Animals and Plants in the Environment? A Systematic Map Protocol, 10 Environ. Evid. 39 (2021).

- Cucurachi, S., Tamis, W. L. M., Vijver, M. G., Peijnenburg, W. J. G. M., Bolte, J. F. B., & De Snoo, G. R. "A Review of the Ecological Effects of Radiofrequency Electromagnetic Fields." Environmental International 51 (2013): 116–140.

- Int'l Programme on Chem. Safety, Environmental Health Criteria 137: Electromagnetic Fields (300 Hz to 300 GHz), at 1 (World Health Org. 1993)

- (2022) Right of way (ROW) challenges in the construction of transmission lines. Available at: https://www.eprmagazine.com/special-report/right-of-way-row-challenges-in-the-construction-of-transmission-lines/ (Accessed: 11 August 2024).

- Goverment of India, Ministry of Power (no date) Ministry of Power. Available at: https://powermin.gov.in/en/content/guidelines-resolutions-notifications-transmission (Accessed: 11 August 2024).

- Government issues compensation guidelines for transmission line right of Way - MERCOM India (no date) Mercomindia.com. Available at: https://www.mercomindia.com/compensation-guidelines-transmission-line (Accessed: 11 August 2024).

- https://www.sciencedirect.com/science/article/abs/pii/S0195925517304432#preview-section-cited-by

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9732734/#B23

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9722376/

- https://www.sciencedirect.com/science/article/abs/pii/S0096300314007048

- https://www.sciencedirect.com/science/article/abs/pii/S0169204614000693
- https://ehtrust.org/electromagnetic-fields-impact-tree-plant-growth/
- https://www.birdlife.org/state-of-the-worlds-birds/
- https://www.sciencedirect.com/science/article/pii/S2667064X23000659?via%3Dihub&__cf_chl_tk=sL4MKOpC6VOxOYvqxnTYGyW9U398aOrItySFVS.oLew-1723214612-0.0.1.1-5780#bib0065
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9732734/#B23
- IEO, 2016
- Bamigbola, O.; Ali, M.; Oke, M. Mathematical modeling of electric power flow and the minimization of power losses on transmission lines. Appl. Math. Comput. 2014, 241, 214–221.
- Cardoso Junior et al., 2014
- Michaelson SM, Lin JC. Biological Effects and Health Implications of Radiofrequency Radiation. New York and London: Plenum Press; (1987).

- Kumar G, (2010) Report on Cell Tower Radiation. Submitted to Secretary, DOT, Delhi. Pp.1-50
- State of the world birds 2022
- Tempesta, T.; Vecchiato, D.; Girardi, P. The landscape benefits of the burial of high voltage power lines: A study in rural areas of Italy. Landsc. Urban Plan. 2014, 126, 53–64.
- C. Ouhibi et al., Salt Stress Mitigation by Seed Priming with UV-C in Lettuce Plants: Growth, Antioxidant Activity and Phenolic Compounds, 38 Scientia Horticulturae 121 (2014).
- S. Mori, Y. Hasegawa & Y. Moriguchi, Color Strategies of Camellias Recruiting Different Pollinators, 207 Phytochemistry Art. No. 113559 (2023).
- S. Kaur et al., Sensitivity of Plants to High Frequency Electromagnetic Radiation: Cellular Mechanisms and Morphological Changes, 29 Plant Physiology and Biochemistry 34 (2023).
- Karnataka power transmission corporation limited, History, https://kptcl.karnataka.gov.in/info-1/History/en.
- Karnataka power transmission corporation limited, About us, https://kptcl.karnataka.gov.in/info-1/About+Us/en.

- Karnataka power transmission corporation limited, Mission statement, https://kptcl.karnataka.gov.in/info-1/Mission+Statement/en.
- Bangalore electricity supply company limited, About us, https://bescom.karnataka.gov.in/info-1/ABOUT+US/en.
- Karnataka electricity regulatory commission (condition of licence for ESCOMs) regulation, 2004