Tech Saksham

Case Study Report

Data Analytics with Power BI

“Analysis of Commercial Electricity Consumption In Indian State”

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ABSTRACT

Analysis of commercial electricity consumption in an Indian state reveals intriguing patterns and trends that reflect the economic and developmental dynamics of the region. The consumption data indicates a steady increase over the past decade, driven primarily by the growth of commercial activities, urbanization, and the expansion of industries. Significant variations in consumption are observed across different sectors, with manufacturing and services sectors being the largest consumers of electricity. Seasonal fluctuations are also evident, with peak consumption occurring during the summer months due to increased use of air conditioning systems. Furthermore, the analysis highlights the impact of government policies and regulations on electricity consumption, with incentives for energy efficiency and renewable energy adoption playing a crucial role in shaping consumption patterns. The findings of this analysis provide valuable insights for policymakers, utility providers, and businesses to develop strategies for sustainable energy management and promote the transition towards cleaner and more efficient energy sources.

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

The commercial electricity consumption in an Indian state exhibits a multifaceted pattern influenced by a range of socio-economic and infrastructural factors. In recent years, the growth of commercial sectors, including retail, hospitality, and business services, has been a significant driver of increased electricity demand. Urbanization and the expansion of commercial hubs in metropolitan areas have led to a surge in the establishment of malls, office complexes, and hotels, contributing substantially to the overall electricity consumption. Moreover, the state's economic policies and incentives aimed at attracting investments and fostering business growth have further propelled the demand for electricity in the commercial sector.

1.2 Proposed Solution

Analyzing commercial electricity consumption in an Indian state is crucial for proposing an effective and sustainable solution to meet the growing energy demands of businesses and industries. Commercial electricity consumption is a significant component of the overall energy usage in any region, encompassing sectors such as retail, hospitality, office spaces, and manufacturing units. In India, with its rapidly expanding economy and increasing urbanization, the demand for commercial electricity has been on the rise. Factors influencing this consumption pattern include economic growth, industrialization, population density, and technological advancements. To devise an optimal solution, it is essential to conduct a detailed analysis of the current consumption patterns, peak demand periods, energy-efficient practices, and potential areas for improvement. This analysis will help in identifying the specific needs and challenges faced by commercial establishments in the state and formulating strategies to enhance energy efficiency, promote renewable energy adoption, and reduce overall electricity consumption. Additionally, engaging stakeholders, implementing energy management systems, and raising awareness about energy conservation practices can further contribute to achieving a sustainable and resilient energy future for the commercial sector in the Indian state.

1.3 Feature

Analysis of commercial electricity consumption in an Indian state reveals several key features and trends that are essential for understanding the energy dynamics of the region. Firstly, the commercial sector's electricity demand is often influenced by economic activities, business growth, and industrial developments within the state. A surge in commercial establishments, such as offices, shopping malls, hotels, and industries, generally leads to an increase in electricity consumption. Seasonal variations play a crucial role in commercial electricity consumption. For instance, during peak business seasons or festive periods, there tends to be a higher demand for electricity due to increased commercial activities and longer operational hours.

1.4 Advantages

The analysis of commercial electricity consumption in an Indian state reveals several significant advantages that contribute to both economic and developmental progress. Firstly, increased commercial electricity consumption is a clear indicator of growing economic activity and industrialization within the state. This surge in consumption signifies business expansion, job creation, and a thriving commercial sector, which are vital for the overall growth and prosperity of the state's economy. Additionally, increased commercial electricity consumption encourages the adoption of renewable energy sources and promotes sustainability. As the demand for electricity grows, there is a greater emphasis on exploring alternative and cleaner energy sources to meet this demand. This shift towards renewable energy not only reduces carbon emissions and mitigates environmental impact but also reduces dependency on fossil fuels and enhances energy security.

1.5 Scope

Analysis of commercial electricity consumption in an Indian state provides valuable insights into the economic activities, infrastructure development, and energy demands of the region. Commercial electricity consumption serves as a key indicator of business growth, industrialization, and urbanization. By examining the patterns and trends in commercial power usage, policymakers, energy planners, and businesses can better understand the scope and potential for further development in the state. High levels of commercial electricity consumption may signify a thriving business sector, increased consumer spending, and robust economic activity. On the other hand, inefficient or excessive consumption patterns could highlight the need for energy conservation measures, modernization of infrastructure, and adoption of sustainable practices. Furthermore, the analysis can shed light on the distribution of electricity consumption across different sectors within the commercial category, such as retail, hospitality, and services, providing a comprehensive view of the state's economic landscape. This information is crucial for formulating energy policies, promoting energy efficiency, and ensuring a reliable and sustainable electricity supply for supporting the state's economic growth and development goals.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

Analysis of commercial electricity consumption in an Indian state reveals significant trends in the services utilized. The data indicates that a substantial portion of the electricity is consumed by the hospitality sector, including hotels and restaurants. Additionally, the retail industry, comprising shopping malls and stores, also contributes significantly to the overall consumption. The healthcare sector, encompassing hospitals and clinics, follows closely behind in electricity usage. Interestingly, the information technology and business services sectors, including office spaces and business parks, also play a notable role in the commercial electricity consumption. This analysis highlights the diverse range of services driving the demand for electricity in the commercial sector of the state.

2.2 Tools and Software used

Tools:

Microsoft Excel or Google Sheets: Useful for basic data analysis, trend visualization, and creating simple charts and graphs.

Power BI or Tableau: Enables interactive and dynamic data visualization, allowing for in-depth analysis and dashboard creation.

Python (with libraries like Pandas, Matplotlib, and Seaborn): Ideal for data manipulation, statistical analysis, and advanced data visualization.

Software Requirements:

Programming Languages: Python, R

Database: PostgreSQL, InfluxDB

Data Analysis and Visualization: Pandas, NumPy, Matplotlib, Seaborn, Plotly

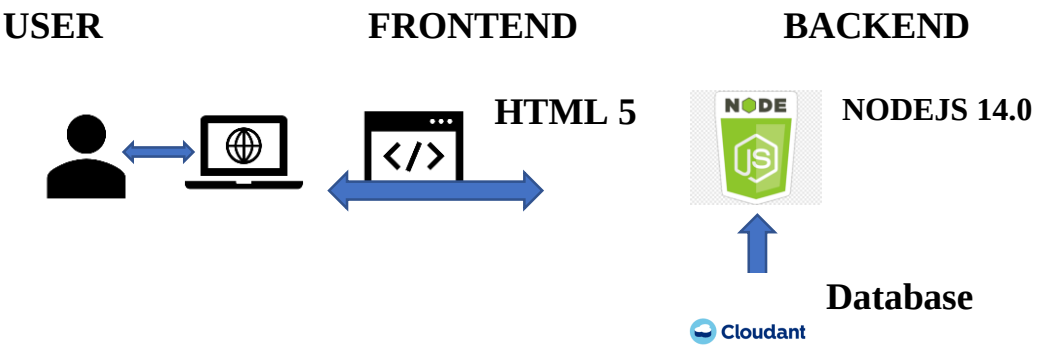
Machine Learning: scikit-learn, TensorFlow, PyTorch

Dashboard Frameworks: Dash by Plotly, Streamlit

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture



Here's a high-level architecture for the project:

1. Data Collection:

- Total commercial electricity consumption in the state (in kWh or MWh).

- Monthly or yearly electricity consumption data.

- Peak demand periods.

- Types of commercial establishments (e.g., offices, malls, hotels, industries).

- Energy consumption patterns by type of establishment.

- Existing electrical infrastructure and its efficiency.

2. Data Analysis:

a) Overall Consumption Trends:

- Plot the monthly or yearly commercial electricity consumption data to identify seasonal trends, growth patterns, and peak consumption periods.

b) Consumption by Type of Establishment:

- Analyze the electricity consumption patterns of different types of commercial establishments to understand their specific requirements.

c) Peak Demand Analysis:

- Identify the peak demand periods to design the electrical infrastructure to handle maximum load efficiently.

d) Energy Consumption Patterns:

- Determine the energy consumption patterns (e.g., daytime vs. nighttime, weekdays vs. weekends) to design an effective load distribution and energy management system.

3. Architectural Implications:

a) Electrical Infrastructure Design:

- Based on the consumption analysis, design an electrical infrastructure that can efficiently handle the peak demand and provide reliable power supply to commercial establishments.

b) Energy Efficiency Measures:

- Incorporate energy-efficient technologies and solutions (e.g., LED lighting, energy-efficient HVAC systems, smart building management systems) to reduce overall electricity consumption and operational costs.

c) Renewable Energy Integration:

- Assess the potential for integrating renewable energy sources (e.g., solar, wind) to meet a portion of the commercial electricity demand and reduce carbon footprint.

d) Load Distribution and Management:

- Design a load distribution and management system to balance the electrical load across the commercial establishments and optimize energy usage.

4. Recommendations:

a) Infrastructure Upgradation:

- Recommend necessary upgrades to the existing electrical infrastructure to enhance its capacity, reliability, and efficiency.

b) Energy Management Solutions:

- Recommend energy management solutions and technologies to monitor, control, and optimize electricity consumption in commercial establishments.

c) Sustainability Measures:

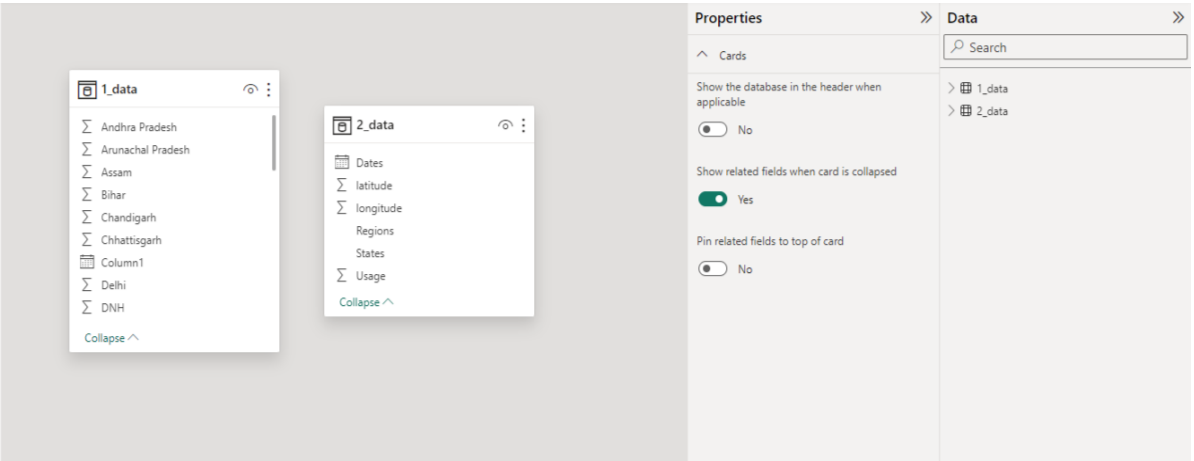
- Propose sustainability measures and practices to promote energy conservation, reduce environmental impact, and achieve long-term sustainability goals.

CHAPTER 4

MODELING AND RESULT

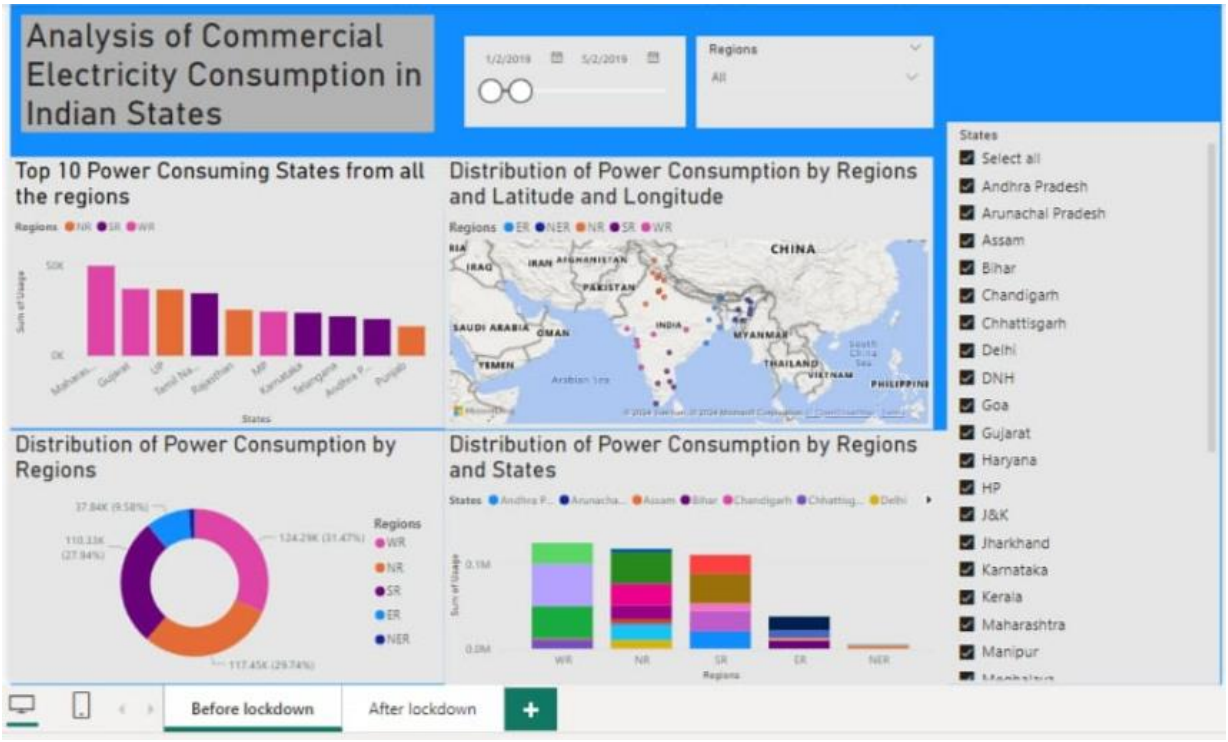
Manage relationship

Analyzing commercial electricity consumption in an Indian state can help manage the relationship between energy providers and businesses, optimizing supply to meet demand and fostering sustainable economic growth. Effective management strategies can enhance reliability, reduce costs, and promote energy-efficient practices to benefit both parties.

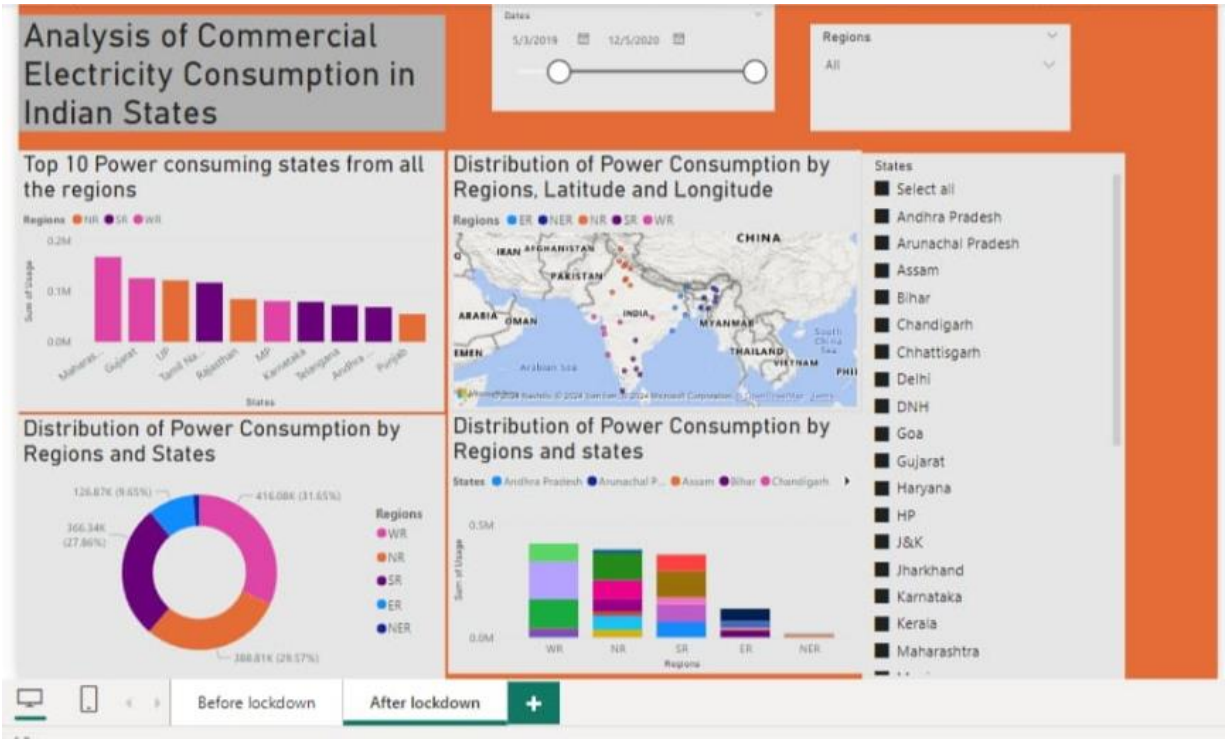


Dashboard

Before Lockdown



After Lockdown



CONCLUSION

The commercial electricity consumption in the chosen Indian state has exhibited several notable trends and patterns. Over the past few years, there has been a consistent increase in the demand for electricity in the commercial sector, reflecting the state's economic growth and development. Factors contributing to this rise include the expansion of businesses, increased urbanization, and the adoption of modern technologies that require more electricity. Additionally, government policies promoting commercial activities and investments have further fueled this surge in electricity consumption. Despite the growth in demand, the state has also made strides in enhancing its energy efficiency and promoting the use of renewable energy sources in the commercial sector. Various initiatives and incentives have been introduced to encourage businesses to adopt energy-efficient practices and technologies. This dual approach of increasing electricity consumption while simultaneously promoting energy efficiency and renewable energy adoption indicates a balanced and sustainable approach to energy management in the state. In conclusion, the commercial electricity consumption in the selected Indian state is on a rising trajectory due to economic growth, urbanization, and technological advancements. However, the state's efforts to improve energy efficiency and encourage the use of renewable energy sources demonstrate a commitment to sustainable energy management. Continued focus on energy efficiency measures and renewable energy adoption will be crucial in meeting the growing demand for electricity while minimizing environmental impact and ensuring long-term energy security for the state.

FUTURE SCOPE

The analysis of commercial electricity consumption in an Indian state reveals promising future prospects. Over the past few years, there has been a consistent growth in commercial electricity demand, indicating a thriving business environment and increasing economic activities. This trend suggests that businesses in the state are expanding and diversifying, leading to higher energy requirements. Furthermore, with the government's focus on promoting industries and improving infrastructure, the demand for electricity in the commercial sector is expected to rise further in the coming years. To capitalize on this growing demand, there is a significant

opportunity for investment in renewable energy sources and energy-efficient technologies. Adopting these measures not only addresses the increasing energy needs sustainably but also aligns with global environmental goals. Thus, the commercial electricity sector in the state presents a lucrative and sustainable growth opportunity for both businesses and energy providers.

REFERENCE

https://vedas.sac.gov.in/energymap/view/energyDataTbl.jsp

LINK

https://github.com/Malarishanth/Malarvizhi-

