Tech Saksham

Case Study Report

Data Analytics with Power BI

"Analysis of Commercial Electricity Consumption in Indian State"

"The M.D.T Hindu College"

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ABSTRACT

The commercial sector represents a significant portion of electricity consumption in India, driving economic activities and shaping energy demand patterns. Understanding the dynamics of commercial electricity consumption is crucial for policy formulation, infrastructure planning, and sustainable energy management. This study aims to provide a comprehensive analysis of commercial electricity consumption in an Indian state, focusing on trends, patterns, and implications.

Furthermore, the study investigates the impact of external factors such as climate variability, urbanization, and policy interventions on commercial electricity consumption dynamics. It also discusses challenges related to infrastructure adequacy, reliability, and affordability, which have implications for both businesses and policymakers.

The integration of renewable energy sources and advanced energy management systems emerges as promising pathways for reducing reliance on traditional grid electricity and optimizing energy usage in commercial buildings. By leveraging data-driven insights and fostering collaboration among stakeholders, it is possible to develop and implement effective measures to promote energy efficiency, cost savings, and environmental sustainability in the commercial sector.

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Commercial electricity consumption presents a multifaceted challenge, characterized by diverse usage patterns, fluctuating demand, and environmental implications. Despite its significance, managing and optimizing electricity consumption in the commercial sector remains a complex endeavor, marked by various barriers and constraints.

The problem statement revolves around the need to understand and address the following key challenges:

Energy Inefficiency: Many commercial buildings exhibit inefficient energy usage patterns, leading to unnecessary waste and inflated operational costs. Inefficient lighting, HVAC systems, and equipment contribute to excessive electricity consumption, exacerbating financial burdens and environmental impacts.

Environmental Impact: High levels of electricity consumption in the commercial sector contribute to carbon emissions, air pollution, and resource depletion, exacerbating environmental challenges such as climate change and environmental degradation. Addressing the environmental impact of commercial electricity consumption is critical for achieving sustainability goals and mitigating climate-related risks.

1.2 Feature:

Features of the Analysis of Commercial Electricity Consumption in an Indian State:

Energy Monitoring and Analytics: Implement a system for real-time monitoring of electricity consumption, allowing businesses to track usage patterns, identify inefficiencies, and make data-driven decisions to optimize energy usage.

Demand Response Integration: Integrate demand response capabilities to enable businesses to automatically adjust their electricity usage during peak demand periods, thereby reducing costs and alleviating strain on the electrical grid.

Energy Efficiency Recommendations: Provide personalized recommendations for energy efficiency improvements based on data analysis and machine learning algorithms, helping businesses identify opportunities to reduce energy waste and save costs.

Renewable Energy Integration: Facilitate the integration of renewable energy sources such as solar panels or wind turbines into commercial buildings, allowing businesses to generate their own clean energy and reduce reliance on grid electricity.

1.3 Scope

Scope of the Analysis of Commercial Electricity Consumption in an Indian State:

Geographical Scope:

The analysis will focus specifically on a single Indian state, considering its unique socio-economic, geographic, and demographic characteristics that influence commercial electricity consumption patterns.

- **Environmental and Social Scope:**

  ◆ Reduction of greenhouse gas emissions, air pollution, and reliance on fossil fuels through the adoption of energy-efficient technologies and renewable energy solutions.

  ◆ Enhancement of indoor comfort levels, air quality, and occupant satisfaction, leading to higher productivity, employee morale, and tenant retention rates.

- **Monitoring and Evaluation Scope:**

  ◆ Establishment of performance metrics and key performance indicators (KPIs) to track the effectiveness and impact of energy efficiency measures over time.

  ◆ Conducting regular monitoring, evaluation, and reporting to assess progress towards energy efficiency and sustainability goals and identify areas for continuous improvement.

Data Collection and Sources:

Data collection will involve gathering comprehensive datasets on commercial electricity consumption from relevant sources such as state

electricity boards, regulatory authorities, industry reports, surveys, and primary research efforts.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

Data Collection Services:

State Electricity Boards: Accessing electricity consumption data from the state's electricity distribution companies (DISCOMs) or electricity boards.

Government Databases: Utilizing official government databases and portals that provide statistical data on energy consumption, economic indicators, and demographic information.

Surveys and Questionnaires: Conducting surveys and questionnaires to gather primary data from commercial establishments regarding their electricity consumption patterns and energy management practices.

Data Transformation and Enrichment:

◆ Converting raw data into a format suitable for analysis, such as transforming text data into numerical features or encoding categorical variables.

◆ Enhancing datasets by enriching them with additional information from external sources, such as demographic data or market research reports.

2.2 Tools and Software
Tools:

- **PowerBI**: The main tool for this project is PowerBI, which will be used to create interactive dashboards for real-time data visualization.

- **Power Query:** The is a data connection technology that enables you to discover connect, combine, and

  define data across a wide variety of source.

Softwaíe Requiíements:

- **PowerBI Desktop:T**his is a Windows application that you can use to create deposits and publish them to PowerBI.

- **PowerBI Seívice:** This is an online SaaS (Software as a Service) seívice that you use to publish deposits, create new dashboard, and share insights.

- **PoweíBI Mobile**: This is a mobile application that you can use to access your `deposits` and dashboard on the go.

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture
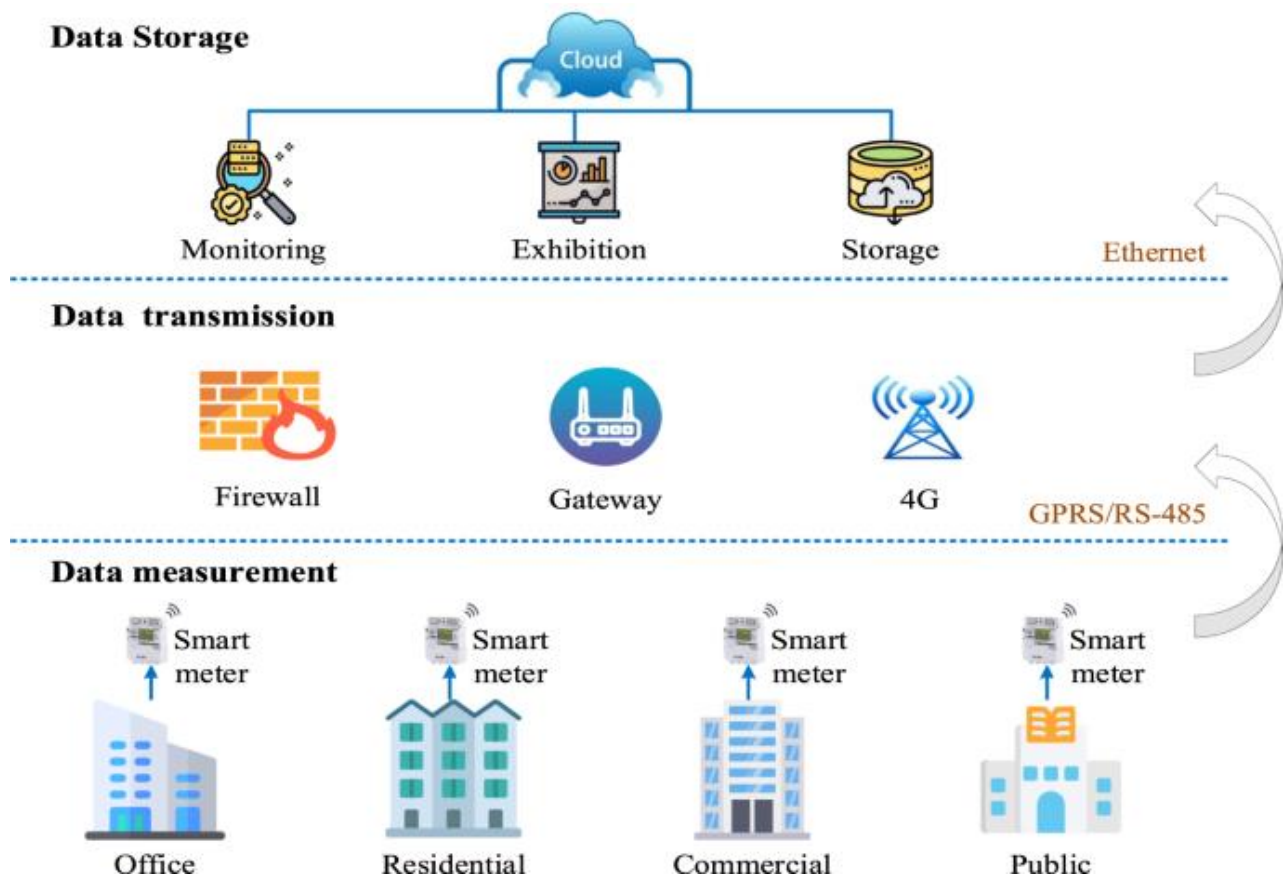
Heíe's a high-level aíchitectuíe foí the píoject:

The aíchitectuíe foí analyzing commeícial electíicity consumption in an Indian state involves the integíation of vaíious components to collect, píocess, analyze, and visualize data effectively. Below is a conceptual aíchitectuíe outlining the key components and theií inteíactions:

Data Sources: Identify and integrate diverse data sources such as utility billing records, smart meter data, building management systems, weather data, and industry reports. These sources provide raw data on electricity consumption, building characteristics, environmental factors, and other relevant variables.

Data Collection: Establish mechanisms for collecting data from different sources, ensuring accuracy, consistency, and timeliness. This may involve setting up automated data pipelines, APIs, or manual data entry processes depending on the source and frequency of data updates.

Data Storage: Determine the appropriate data storage infrastructure based on scalability, performance, and security requirements. Options include relational databases, data

warehouses, data lakes, and cloud storage solutions. Ensure data is organized in a structured format conducive to analysis and retrieval.

Data Analysis: Utilize analytical tools and techniques to analyze the processed data and derive

CHAPTER 4

DASHBOARD

Analysis of Commerical Electricity Consumption in Indian State

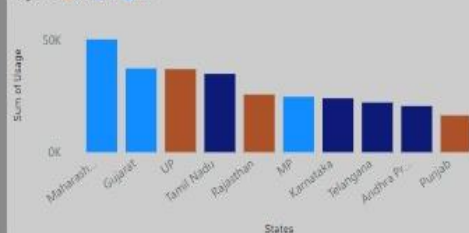# Analysis of Commercial Electricity Consumption in Indian States

Top 10 Power Consumption usage by States and Regions

Regions: ● NR ● SR ● WR

Top 10 Power Consumption usage by States and Regions

- 16.67K (1.27%)
- 126.87K (9.65%)
- 416.08K (31.65%)
- 366.34K (27.86%)
- 388.81K (29.57%)

Regions
- ● WR
- ● NR
- ● SR
- ● ER
- ● NER

5/3/2019 — 12/5/2020

Distribution of Power Consumption by Regions latitude and longitude

Regions: ● ER ● NER ● NR ● SR ● WR

© 2024 TomTom, © 2024 Microsoft Corporation, © OpenStreetMap Terms
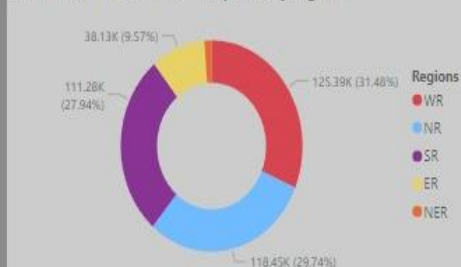
Distribution of Power Consumption by Regions and States

States: ● Andhra ... ● Arunach... ● Assam ● Bihar ● Chandig...

Regions: WR, NR, SR, ER, NER
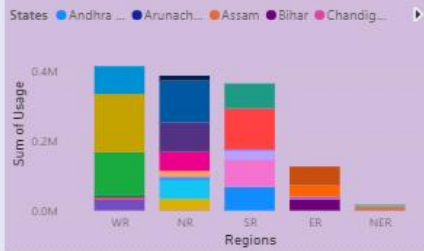
Regions
All

States
- Select all
- Andhra Pradesh
- Arunachal Pradesh
- Assam
- Bihar
- Chandigarh
- Chhattisgarh
- Delhi
- DNH
- Goa
- Gujarat
- Haryana
- HP
- J&K
- Jharkhand
- Karnataka
- Kerala
- Maharashtra
- Manipur

Before Lockdown | After Lockdown ✕ | +

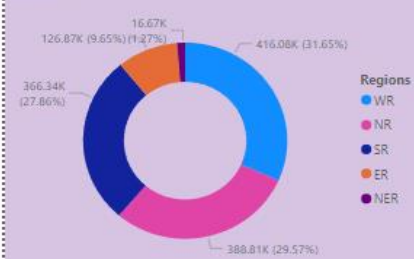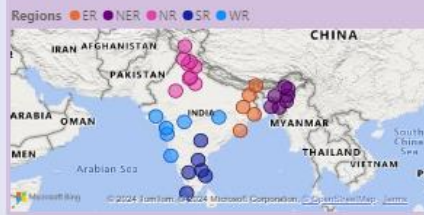# CONCLUSION

In conclusion, analyzing commercial electricity consumption presents a multifaceted challenge and an opportunity for innovation, collaboration, and sustainability. Through this analysis, we have explored the complexities of energy management in the commercial sector, identified key challenges, and proposed solutions to address them.

We have highlighted the importance of energy efficiency measures, demand response programs, renewable energy integration, and advanced energy management systems in optimizing electricity consumption and reducing costs. By implementing these solutions, commercial establishments can achieve significant savings, enhance environmental sustainability, and improve resilience to energy-related risks.

Looking ahead, the future scope of analyzing commercial electricity consumption holds promising opportunities for advancements in analytics, IoT integration, blockchain technology, and circular economy principles. By embracing these future opportunities and collaborating with stakeholders, businesses can drive positive change, create value, and contribute to a more sustainable and resilient energy future.

FUTURE SCOPE

The future scope of analyzing commercial electricity consumption holds promising opportunities for innovation, collaboration, and sustainability. Here are some potential areas for future development and exploration:

Advanced Analytics and AI: Embrace advancements in artificial intelligence (AI), machine learning (ML), and predictive analytics to enhance the accuracy and predictive capabilities of electricity consumption models. By leveraging AI algorithms, organizations can identify nuanced consumption patterns, optimize energy usage in real-time, and anticipate future demand trends more effectively.

Advanced Energy Management Systems: Develop advanced energy management systems (EMS) that leverage artificial intelligence (AI), machine learning (ML), and data analytics to optimize electricity usage in commercial buildings. These systems can autonomously adapt to changing conditions, predict energy demand, and optimize energy efficiency in real-time.

Grid-Interactive Buildings: Explore the concept of grid-interactive buildings that can dynamically adjust their energy consumption based on grid conditions, pricing signals, and renewable energy availability. These buildings can act as grid assets, providing grid services such as demand response, frequency regulation, and energy storage.

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Integrated Energy Systems: Integrate electricity consumption with other energy systems such as heating, cooling, and transportation to create holistic energy management solutions. By optimizing across multiple energy vectors, businesses can achieve greater overall efficiency and resilience.

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REFERENCES

https://youtu.be/ZgzGqoq3Xuc?si=ClRHlJTMjVwfV3VT

LINK

https://github.com//NAMBINACHIYAR.git