Tech Saksham

Case Study Report

Data Analytics with Power BI

"ANALYSIS OF COMMERCIAL ELECTRICITY CONSUMPTION IN INDIAN STATE"

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ABSTRACT

Energy has been universally recognized as one of the most important input for economic growth and human development. Generally, it has defined as "Capacity to do Work" thereby, for bring out desirable design on economic level there must be need of intensive of energy performance in various sectors of the country. Perceiving commercial energy at the one of economic viability consumption has equip the present status of economic level to be boost and reach global advance in due period with identification of which are highly consumes among public and the statistics of this has brought out in this study. Electricity, LPG, Kerosene, coal and natural gas are the chosen commercial energy and data for the specified years have collected from central electricity authority CAE and Energy statistics 2015 for 2007-2014.

This study presents a comprehensive analysis of commercial electricity consumption patterns in an Indian state, aiming to provide insights into the dynamics and trends of energy usage in the commercial sector. Utilizing a dataset spanning several years, the analysis employs various statistical and machine learning techniques to uncover patterns, trends, and factors influencing commercial electricity consumption.

The study begins with an overview of the commercial sector's importance in the state's economy, highlighting its contribution to overall energy consumption. It then delves into exploratory data analysis to identify seasonal variations, peak consumption periods, and any discernible patterns within the dataset.

Furthermore, the study investigates the impact of socio-economic factors such as GDP growth, urbanization, and industrial development on commercial electricity usage. Regression analysis and predictive modeling techniques are employed to assess the significance of these factors and forecast future consumption trends.

Moreover, the study examines the effectiveness of existing energy policies and initiatives aimed at promoting energy efficiency and reducing electricity consumption in the commercial sector. Recommendations are provided for policymakers and stakeholders to enhance the effectiveness of these measures and achieve sustainable energy consumption goals.

Overall, this analysis contributes to a better understanding of commercial electricity consumption dynamics in the context of an Indian state, providing valuable insights for energy planning, policy formulation, and sustainable development initiatives.

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

1. **Define the Problem Statement**: Clearly articulate the specific objectives of the analysis, such as understanding trends, identifying patterns, or predicting future consumption.
2. **Gather Data**: Collect relevant data on commercial electricity consumption in the chosen Indian state. This data may include historical consumption patterns, demographic information, economic indicators, and any other relevant factors that could influence electricity usage.
3. **Clean and Prepare Data**: Clean the data to remove any inconsistencies, missing values, or outliers. Prepare the data for analysis by organizing it into a format suitable for statistical analysis or machine learning.
4. **Exploratory Data Analysis (EDA)**: Conduct exploratory data analysis to gain insights into the data. This may involve visualizing consumption trends over time, identifying correlations between consumption and other variables, and exploring differences in consumption patterns across different regions or sectors.
5. **Statistical Analysis**: Apply statistical techniques to analysis the data further. This could include hypothesis testing, regression analysis to identify factors influencing consumption, or time series analysis to forecast future consumption trends.

1.2 Proposed Solution

Analyzing commercial electricity consumption in an Indian state requires a multifaceted approach considering various factors such as industry types, seasonal variations, economic trends, infrastructure, and government policies. Here's a structured approach to conduct such an analysis and propose solutions:

1. **Data Collection and Analysis**:

Gather historical data on commercial electricity consumption in the state over the past few years.

Analyze trends, patterns, and seasonal variations in consumption.

Identify industries or sectors contributing most to electricity consumption.

Consider any significant events or policy changes that might have influenced consumption patterns.

2. **Industry Specific Analysis**:

Segment commercial consumers into different industries such as manufacturing, IT, hospitality, retail, etc.

Analyze the electricity usage patterns within each industry.

Identify key drivers affecting electricity consumption in each sector (e.g., production levels, operational hours, technology adoption).

3. **Infrastructure Assessment**:

Evaluate the existing electricity infrastructure including transmission, distribution, and generation capacity.

Identify any bottlenecks or inefficiencies in the infrastructure that might affect consumption or supply reliability.

4. **Economic Factors**:

Consider the overall economic health of the state and its impact on commercial activities.

Analyze GDP growth, industrial output, employment rates, and business sentiment to understand their influence on electricity demand.

5. **Government Policies and Regulations**:

Examine existing policies related to electricity pricing, subsidies, incentives for energy efficiency, and renewable energy adoption.

Assess the impact of policies on commercial electricity consumption and identify any gaps or areas for improvement.

6. **Environmental Impact**:

 - Evaluate the environmental footprint of commercial electricity consumption, including greenhouse gas emissions.

   Identify opportunities for promoting energy efficiency measures and renewable energy adoption among commercial consumers.

1.3 Feature

- . **Time Series Data**: Collect data over time to analyze consumption patterns, seasonal variations, and long-term trends.

- **Demographic Data**: Look at population density, urbanization rates, and economic indicators to understand the underlying factors driving consumption.

- **Sectoral Breakdown**: Analyze consumption across different sectors such as retail, hospitality, manufacturing, etc., to identify which sectors are the major consumers.

- *Geographical Factors**: Consider geographical features such as climate, terrain, and proximity to industrial hubs, as these can influence electricity usage.

- **Policy and Regulatory Environment**: Understand government policies, subsidies, and regulations affecting commercial electricity consumption, as they can have a significant impact.

1.4 Advantages

- **Economic Insights**: Understanding commercial electricity consumption provides valuable insights into the economic activity of the state. Higher consumption often correlates with increased business activity, investment, and employment opportunities.

- **Policy Formulation**: Data on commercial electricity usage helps policymakers formulate effective energy policies and infrastructure development plans. It can guide decisions on electricity generation, distribution, and pricing to meet the demands of businesses and support economic growth.

- **Market Research**: Commercial electricity consumption data can be valuable for market research and business planning. It provides insights into sector-specific energy requirements, consumer behavior, and emerging trends, aiding businesses in strategic decision-making and resource management.

- **Investment Attraction**: Transparent data on electricity consumption enhances investor confidence by demonstrating the state's commitment to reliable and affordable power supply. It attracts businesses seeking stable energy infrastructure, thereby promoting economic development and job creation.

1.5 SCOPE

Consider the state's demographic composition, urbanization level, industrial development, and geographic variations to understand consumption patterns in different regions and sectors. Analyze historical data to identify trends, seasonal variations, and any notable patterns in commercial electricity consumption. Look for correlations with factors like economic growth, business cycles, and regulatory changes. Break down commercial electricity consumption by sectors such as retail, hospitality, manufacturing, services, etc. Assess the relative contribution of each sector to overall consumption and analyze sector-specific trends. Evaluate the state's initiatives and policies related to energy efficiency, conservation, and renewable energy adoption in the commercial sector. Assess their impact on consumption patterns and sustainability goals. Compare commercial electricity consumption trends in the state with national averages and benchmarks to identify areas of relative strength or concern. Consider benchmarking against similar states or regions for deeper insights. Use statistical models and forecasting techniques to project future trends in commercial electricity consumption based on historical data, economic indicators, and potential policy changes. Assess the implications of commercial electricity consumption patterns on energy infrastructure planning, grid stability, environmental sustainability, and economic development goals. Identify potential policy interventions to address challenges or capitalize on opportunities. Engage with stakeholders including businesses, industry associations, government agencies, and community groups to gather insights, validate findings, and foster collaboration in addressing energy challenges: Based on the analysis, develop actionable recommendations and an implementation plan to optimize commercial electricity consumption, promote energy efficiency, and support sustainable economic growth in the state.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

To analyze commercial electricity consumption in an Indian state for various services, you would typically start by gathering data on electricity consumption from the state's power distribution authority or relevant government agencies. Then, you could categorize this consumption based on different sectors or services, such as:

1. **Retail**: Consumption by retail businesses, including shops, malls, and supermarkets.

2. **Hospitality**: Consumption by hotels, restaurants, and other hospitality establishments.

3. **Office spaces**: Consumption by commercial offices and business complexes.

4. **Entertainment**: Consumption by theaters, cinemas, and entertainment venues.

5. **Healthcare**: Consumption by hospitals, clinics, and healthcare facilities.

6. **Education**: Consumption by schools, colleges, and educational institutions.

2.2 Tools and Software used

Tools.

- . **Define Tools**: Specify what tools you want to analyze. Are you looking at specific industries, types of equipment, or overall usage patterns?
- . **Data Cleaning and Preparation**: Clean the data to remove any inconsistencies or errors. Prepare the data for analysis by organizing it into a structured format.
- **Comparative Analysis**: Compare electricity consumption across different sectors or industries within the state. Identify any trends or patterns that emerge.
- **Recommendations**: Based on your analysis, provide recommendations for optimizing electricity usage in commercial settings, improving energy efficiency, or addressing any identified issues or challenges.

Software Requirements:

- Gather relevant data on commercial electricity consumption in the chosen Indian state. This data may be available from government sources, utilities, or other reliable sources. Ensure that the data is comprehensive and covers the required time period.
- Clean the data to remove any inconsistencies, errors, or missing values. Preprocess the data as needed, such as converting units, formatting dates, or handling outliers.
- Conduct exploratory data analysis to gain insights into the data. This may involve visualizing trends, distributions, correlations, and outliers using techniques such as histograms, scatter plots, and time series analysis.

- Identify relevant features that may impact commercial electricity consumption, such as economic indicators, population density, industrial activity, and seasonal factors. Engineer new features if necessary to improve model performance.

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture

USER	FRONTEND	BACKEND

HTML 5

NODEJS 14.0

Database

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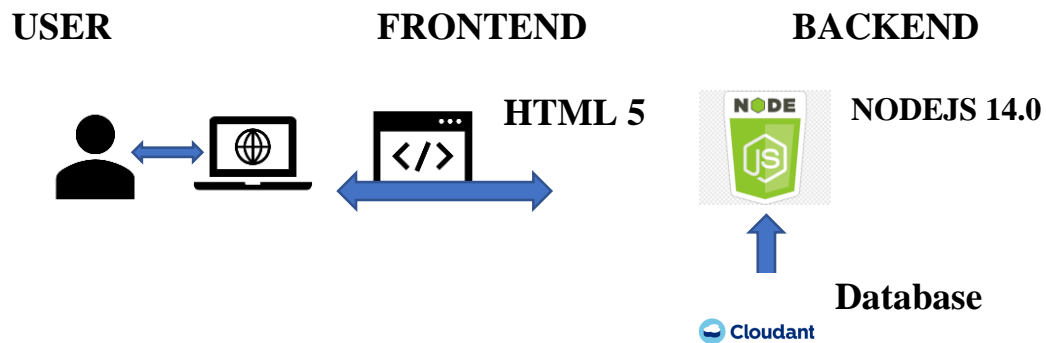
Here's a high-level architecture for the project:

- ****Data Preprocessing**: Clean and preprocess the collected data to handle missing values, outliers, and inconsistencies. This step may involve data normalization, transformation, and aggregation to make it suitable for analysis.**

- **Exploratory Data Analysis (EDA)**: Conduct EDA to gain insights into the patterns, trends, and relationships within the data. Visualize the data using charts, graphs, and statistical measures to identify key factors influencing commercial electricity consumption.

- **Feature Engineering**: Identify relevant features or variables that could impact commercial electricity consumption, such as economic indicators, population density, industrial activities, and weather conditions. Engineer new features if needed to capture complex relationships.

- **Model Selection**: Choose appropriate machine learning or statistical models to predict commercial electricity consumption based on the available features. Consider models like linear regression, decision trees, random forests, or neural networks depending on the complexity of the data and the desired level of accuracy.

- **Model Training and Evaluation**: Split the data into training and testing sets to train the chosen model(s). Evaluate the model's performance using appropriate metrics such as mean absolute error, mean squared error, or R-squared. Fine-tune the model parameters if necessary to improve performance.

- **Deployment Architecture**: Design a high-level architecture for deploying the developed model(s) into a production environment. This architecture should consider factors such as scalability, reliability, security, and integration with existing systems

- **Monitoring and Maintenance**: Implement monitoring mechanisms to track the performance of the deployed model(s) in real-time and detect any anomalies

or drifts. Regularly update the model(s) with new data and retrain them as needed to maintain accuracy and relevance over time.

By following these steps, you can develop a robust high-level architecture for analyzing commercial electricity consumption in an Indian state and derive actionable insights to support decision-making processes.

CHAPTER 4
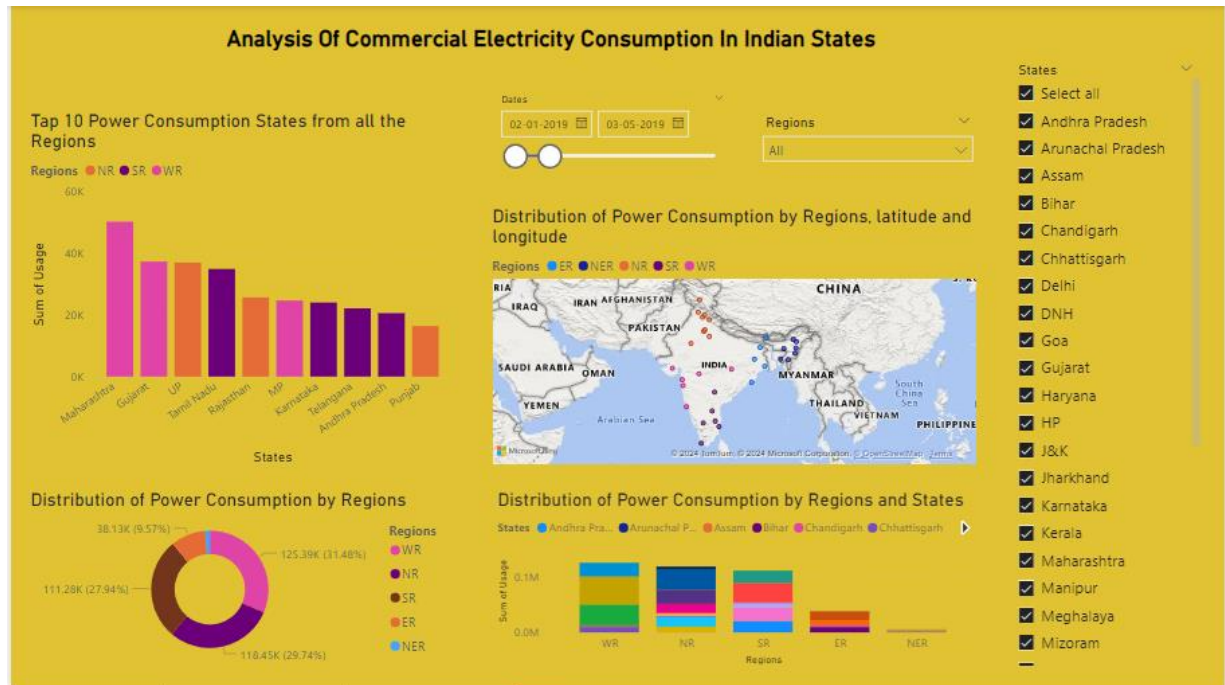
MODELING AND RESULT

Manage relationship

The "data" file will be used as the main connector as it contains most key identifier (states,regions,Dates) which can be use to relates the 2 data files together. The "states" file is use to link the client profile geographically with "state "
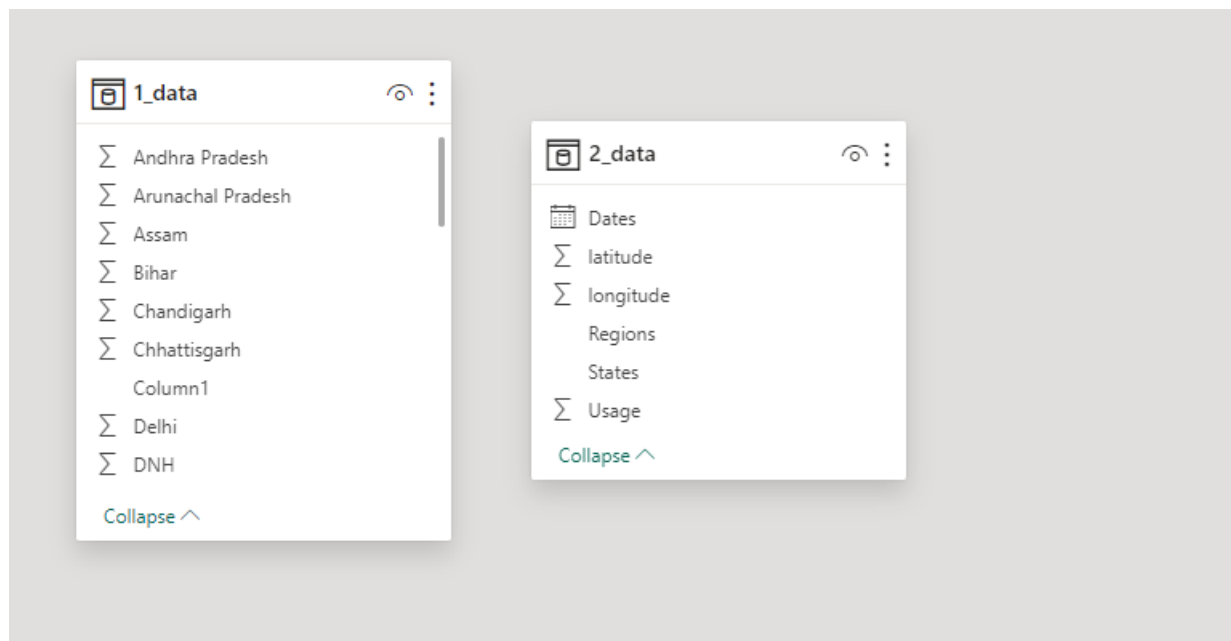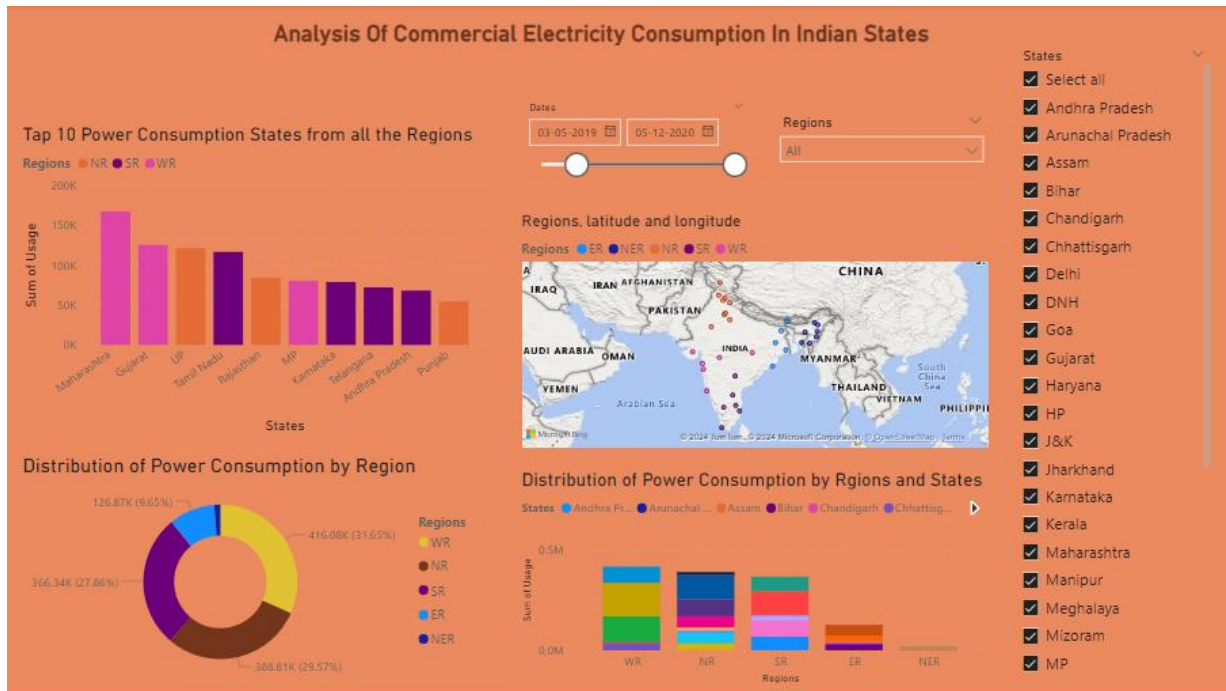
Dashboard

BEFORELOCKDOWN

AFTERLOCKDOWN

CONCLUSION

The project titled "Analysis of Commercial Electricity Consumption in an Indian State" has meticulously utilized Power BI to dissect and understand the commercial electricity consumption patterns during the critical period of 2019–2020, marked by the COVID-19 lock downs. The analysis has illuminated the stark changes in energy usage, providing a narrative of resilience and adaptability within the commercial sector. By leveraging Power BI advanced data visualization and analysis capabilities, the project has offered actionable insights that are crucial for strategic energy management and policy formulation. This study not only reflects on the past but also equips stakeholders with the knowledge to navigate future challenges, ensuring sustainable energy consumption in the evolving commercial landscape.

FUTURE SCOPE.

- **Data Analysis**: Use statistical techniques and tools to analyze the collected data. This could involve time series analysis, regression analysis, correlation analysis, etc., to understand relationships between variables and forecast future consumption.

- **Scenario Analysis**: Conduct scenario analysis to understand how different variables or events (e.g., economic changes, policy implementations, technological advancements) could impact future electricity consumption.

- **Risk Assessment**: Identify potential risks and uncertainties that could affect the accuracy of the forecast. This could include factors like geopolitical instability, regulatory changes, or technological disruptions.

- **Recommendations**: Based on the analysis, provide recommendations for policymakers, utilities, and businesses on strategies to manage and optimize

commercial electricity consumption. This could include promoting energy efficiency measures, investing in renewable energy sources, or implementing demand-side management programs.

- **Monitoring and Adaptation**: Continuously monitor actual electricity consumption against forecasted values and adjust strategies as needed to ensure alignment with changing conditions and goals.

REFERENCE

https://medium.com/analytics-vidhya/analysis-of-bank-customers-using-dashboard-in-power-bi-a366f2b3e563

https://www.scribd.com/document/565385888/Final-Report

https://www.sciencedirect.com/science/article/abs/pii/S0140988320304047

LINK

https://github.com/BUVANA-S/Buvanasundari-power-BI-PROJECT?tab=readme-ov-file#buvanasundari-power-bi-project