Tech Saksham

Case Study Report

Data Analytics with Power BI

“Analysis of Commercial Electricity Consumption in Indian state”

“A.P.C. MAHALAXMI COLLEGE FOR WOMEN”

NM ID	NAME
501ADBC8D2B7008BFC14C3008D98218C	R.LOGAPRIYA

Trainer Name

R UMAMAHESWARI

Master Trainer

R UMAMAHESWARI

ABSTRACT

This paper analyzes the commercial electricity consumption in Indian state. The study uses data from the Central Electricity Authority of India to examine the trends in commercial electricity consumption over the past decade. The paper also investigates the factors that influence commercial electricity consumption, such as economic growth, population growth, and urbanization. The findings of the study suggest that commercial electricity consumption in India is growing rapidly and that this growth is being driven by a number of factors, including economic growth, population growth and urbanization. The study also finds that there is a significant variation in commercial electricity consumption across different states in India. The paper concludes by discussing the implications of the findings for policy makers and businesses.

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

As we know, developing country like India has been promoting itself by enhancing various initiatives on all sectors and regions to achieve economic targets and for prepare to meet global competition for proclaim efficient nation. Accumulation of changes in energy consumption especially commercial energy pointed is indirectly spurs the problems on the consumption of non-commercial energy regularly consumes by rural people. Though, initiation of various commercial energy is always supports to economic growth and it never ever make worsen to that yet looking for another trend of consumption in non-commercial type and its reflects among the rural have to consider and necessary steps need to execute for the support of primary energy consumers and to boost economy level.

1.2 Proposed Solution

Gather comprehensive data on commercial electricity consumption from relevant sources such as power distribution companies and government agencies. Ensure data integrity by cleansing and organizing it for analysis, removing inconsistencies and errors. Develop predictive models to forecast future consumption, incorporating factors like economic indicators and population growth. Segment consumers based on consumption patterns, aiding in targeted interventions and energy efficiency programs. Visualize consumption distribution across the state, identifying areas for infrastructure investment and energy efficiency initiatives. Collaborate with stakeholders to validate findings and gather insights, fostering support for proposed solutions. Formulate actionable policy recommendations to optimize consumption, improve energy efficiency, and promote sustainability. Implement a robust monitoring system to track policy effectiveness and evaluate impact over time, enabling continuous improvement by implementing these steps, a comprehensive analysis can be conducted, leading to informed decisions and effective management of commercial electricity consumption in the Indian state.

1.3 Feature

Analyzing commercial electricity consumption in an Indian state involves several key features:

1. Sector-wise Consumption: Identifying consumption patterns across different commercial sectors such as retail, hospitality, manufacturing, etc. This helps in understanding which sectors are the major consumers.

2. Time-of-Use Analysis: Examining consumption patterns during different times of the day to understand peak demand periods and optimize resource allocation.

3. Energy Efficiency: Assessing the effectiveness of energy efficiency measures implemented by commercial entities and identifying areas for improvement.

4. Comparative Analysis: Comparing consumption trends across different regions or states to identify outliers or areas for policy intervention.

By incorporating these features into the analysis, stakeholders can gain valuable insights into commercial electricity consumption patterns, optimize resource allocation, and formulate informed policies to promote sustainable energy practices.

1.4 Advantages

Analyzing commercial electricity consumption in an Indian state offers several advantages:

1. Policy Formulation: Data on commercial electricity consumption can inform policymaking related to energy efficiency, renewable energy adoption, and industrial development incentives, helping the government to formulate targeted policies to support businesses and sustainable growth.

2. Environmental Impact Assessment: Monitoring commercial electricity usage allows for the assessment of the environmental impact, aiding in the development of strategies to reduce carbon emissions and promote sustainable practices among businesses.

3. Grid Stability: Understanding consumption patterns helps grid operators manage demand more effectively, ensuring grid stability and minimizing the risk of blackouts or disruptions, especially during peak usage periods.

4. Benchmarking and Efficiency Improvement: Comparing consumption data across industries and regions allows businesses to benchmark their performance and identify opportunities for energy efficiency improvements, cost savings, and competitive advantages.

1.5 Scope

The analysis of commercial electricity consumption in an Indian state offers a wide range of scopes, including:

1. Demand Forecasting: Predicting future electricity demand based on historical consumption data and economic trends to ensure adequate supply and infrastructure planning.

2. Sector-wise Analysis: Examining consumption patterns across different commercial sectors such as manufacturing, services, hospitality, and retail to understand variations and identify sector-specific drivers.

3. Energy Efficiency Assessment: Assessing the efficiency of commercial buildings, industrial processes, and equipment to identify opportunities for energy-saving interventions and promote sustainable practices.

4. Customer Behavior Analysis: Understanding customer behavior, preferences, and consumption patterns to tailor energy efficiency programs, marketing campaigns, and incentive schemes for maximum impact.

By exploring these scopes, stakeholders can gain valuable insights into commercial electricity consumption trends, challenges, and opportunities, ultimately contributing to more informed decision-making, sustainable development, and energy security in the Indian state.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

1. Energy Management Systems (EMS): These systems help monitor, control, and optimize energy usage in commercial buildings by collecting and analyzing data from meters and sensors.

2. Data Analytics Platforms: Tools and platforms for data analytics allow for in-depth analysis of electricity consumption data, identifying trends, anomalies, and potential cost-saving opportunities.

3. Energy Auditing Services: Energy audits assess the energy performance of commercial buildings, identifying areas where energy efficiency can be improved to reduce consumption.

2.2 Tools and Software used

Tools:

- **Power BI**: The main tool for this project is Power BI, which will be used to create interactive dashboards for Analysis of commercial electricity consumption in Indian state visualization.

- **Power Query**: This is a data connection technology that enables you to discover, connect, combine, and refine data across a wide variety of sources.

Software Requirements:

- **Power BI Desktop**: This is a Windows application that you can use to create reports and publish them to Power BI.

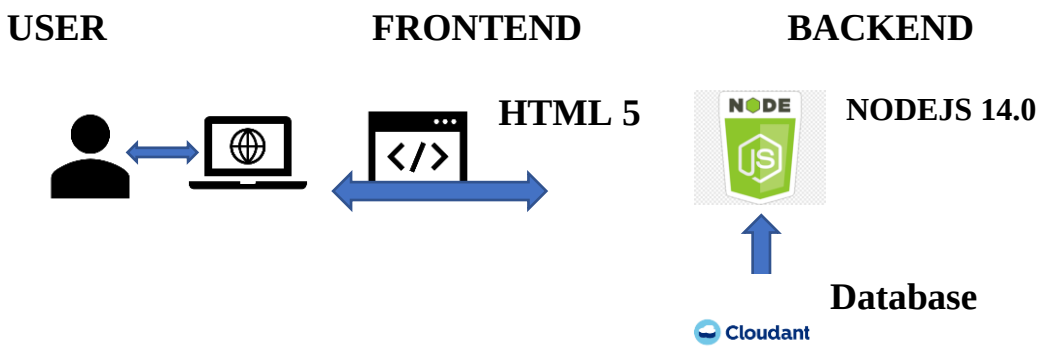
- **Power BI Service**: This is an online SaaS (Software as a Service) service that you use to publish reports, create new dashboards, and share insights.

- **Power BI Mobile**: This is a mobile application that you can use to access your reports and dashboards on the go.

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture



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

1. Data Collection Architecture: Establish a robust system to collect electricity consumption data from commercial establishments. This could involve deploying smart meters, collaborating with utility companies, and utilizing IoT devices for real-time data collection.

2. Data Storage Architecture: Design a scalable and secure data storage infrastructure to store the collected electricity consumption data. This could involve utilizing cloud-based solutions or on-premises databases with efficient data indexing and querying capabilities.

3. Data Processing Architecture: Develop an architecture for processing the collected data to derive insights. This may include data cleaning, aggregation, and normalization processes to ensure data quality.

4. Analytical Architecture: Implement analytical tools and techniques to analyze electricity consumption patterns. This could involve statistical analysis, machine learning algorithms for predictive modeling, and visualization tools for intuitive interpretation of the data.

5. Geospatial Architecture: Incorporate geospatial analysis to understand regional variations in electricity consumption within the state. This could involve mapping consumption patterns to geographical locations for targeted interventions and resource allocation.

6. Integration Architecture: Integrate data from various sources such as demographic data, economic indicators, and weather patterns to provide context to the analysis of electricity consumption.

7. Security and Privacy Architecture : Implement robust security measures to protect sensitive electricity consumption data and ensure compliance with privacy regulations.

8. Scalability and Performance Architecture : Design the architecture to be scalable to handle increasing volumes of data and to perform efficiently even during peak loads of data processing.

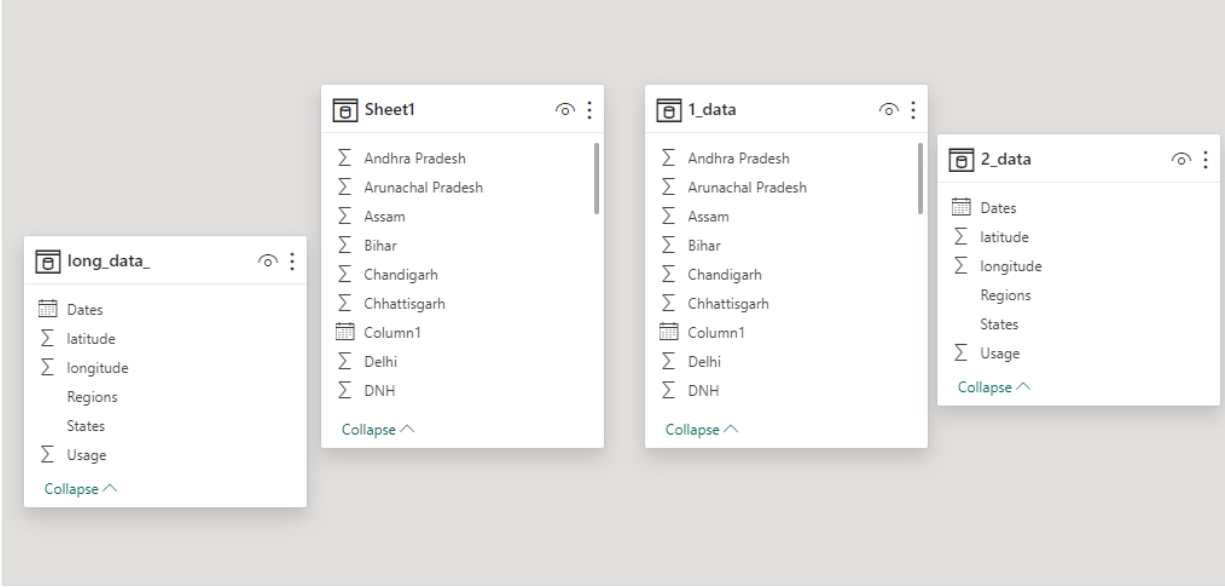
By considering these architectural aspects, stakeholders can gain valuable insights into commercial electricity consumption patterns in the Indian state, leading to informed decision-making and targeted interventions to optimize energy usage and promote sustainability.

CHAPTER 4

MODELING AND RESULT

Manage relationship

The dataset is used to understand the variations in electricity rates across different states. To manage the relationship for analysis, consider focusing on specific states or regions.



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03-01-2019 00:00:00	121.9	133.5	240.2	85.5	311.8	39.3	30.1	54.1	4.9	78.8	316.7	253.6
04-01-2019 00:00:00	118.8	128.2	239.8	83.5	320.7	38.1	30.1	53.2	4.8	74.8	301.9	239.3
05-01-2019 00:00:00	121	127.5	239.1	79.2	299	39.2	30.2	51.5	4.3	69	313.2	228.2

States	Regions	latitude	longitude	Dates	Usage
UP	NR	27.59998069	78.05000565	02-01-2019 00:00:00	313.9
UP	NR	27.59998069	78.05000565	03-01-2019 00:00:00	311.8
UP	NR	27.59998069	78.05000565	04-01-2019 00:00:00	320.7

States	Regions	latitude	longitude	Dates	Usage
UP	NR	27.59998069	78.05000565	02-01-2019 00:00:00	313.9
UP	NR	27.59998069	78.05000565	03-01-2019 00:00:00	311.8
UP	NR	27.59998069	78.05000565	04-01-2019 00:00:00	320.7
UP	NR	27.59998069	78.05000565	05-01-2019 00:00:00	299
UP	NR	27.59998069	78.05000565	06-01-2019 00:00:00	286.8
UP	NR	27.59998069	78.05000565	07-01-2019 00:00:00	294.2
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UP	NR	27.59998069	78.05000565	10-01-2019 00:00:00	284.2
UP	NR	27.59998069	78.05000565	11-01-2019 00:00:00	281.4
UP	NR	27.59998069	78.05000565	12-01-2019 00:00:00	298.6
UP	NR	27.59998069	78.05000565	13-01-2019 00:00:00	310
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UP	NR	27.59998069	78.05000565	18-01-2019 00:00:00	426
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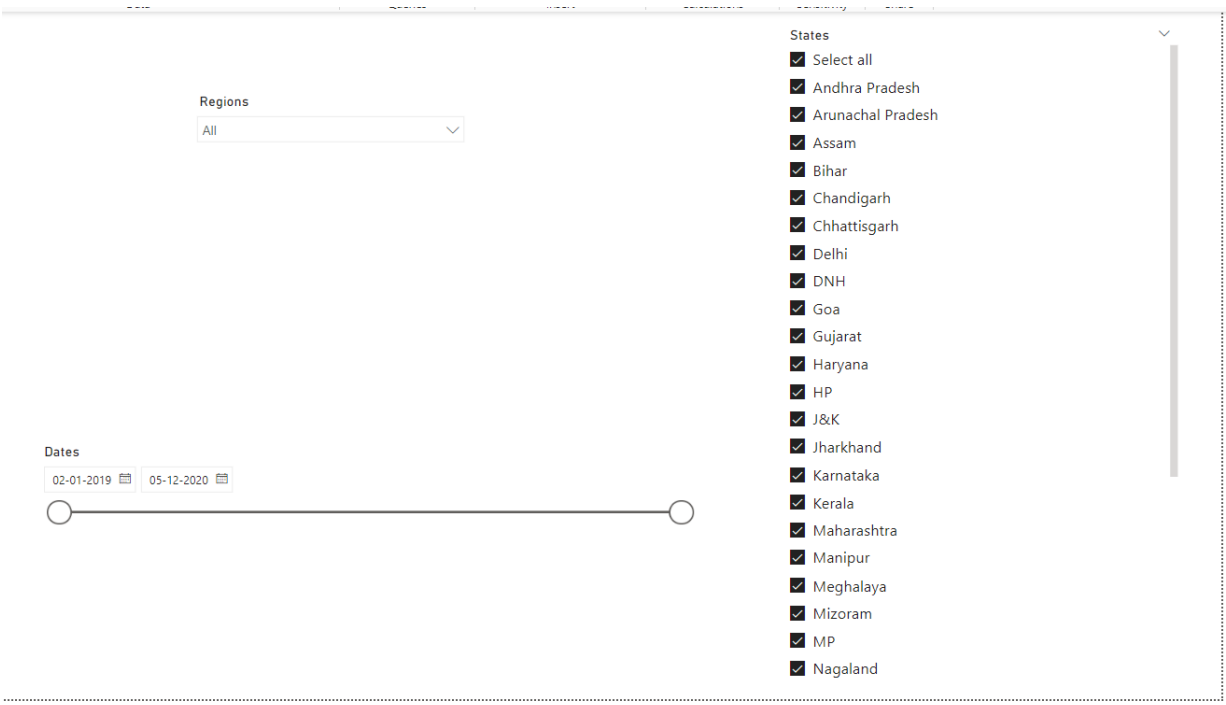
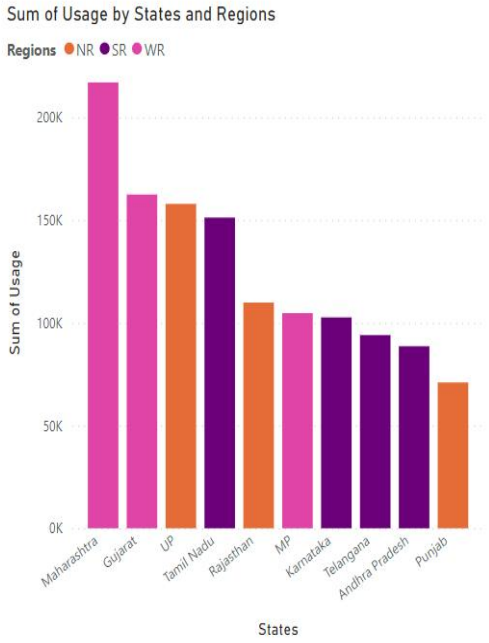
UP	NR	27.59998069	78.05000565	24-01-2019 00:00:00	410.9

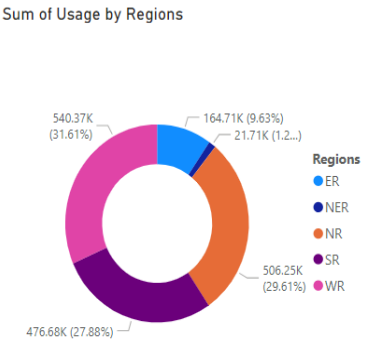
2_data (16,599 rows)

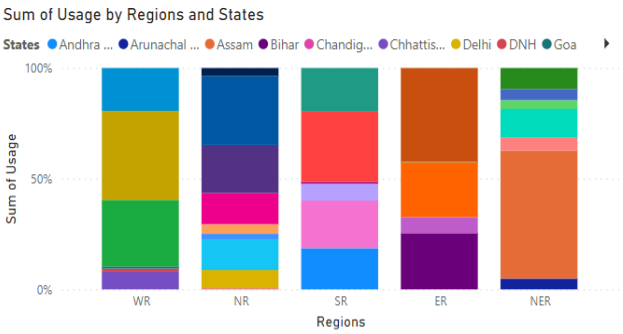
Column1	Punjab	Haryana	Rajasthan	Delhi	UP	Uttarakhand	HP	J&K	Chandigarh	Chhattisgarh	Gujarat	MP	Maharashtra
03-01-2019 00:00:00	121.9	133.5	240.2	85.5	311.8	39.3	30.1	54.1	4.9	78.8	316.7	253.6	41.
04-01-2019 00:00:00	118.8	128.2	239.8	83.5	320.7	38.1	30.1	53.2	4.8	74.8	301.9	239.3	39.
05-01-2019 00:00:00	121	127.5	239.1	79.2	299	39.2	30.2	51.5	4.3	69	313.2	228.2	41
06-01-2019 00:00:00	121.4	132.6	240.4	76.6	286.8	39.2	31	53.2	4.3	68.1	320.7	227.4	40.
07-01-2019 00:00:00	118	132.1	241.9	71.1	294.2	40.1	30.1	53.3	4	73.1	319.4	230.3	40.
15-01-2019 00:00:00	141.1	142.9	185.4	77.8	326.7	34.3	25.6	39.5	3.2	88	290.5	170.2	39.
16-01-2019 00:00:00	231.9	180.5	175.3	111.8	399	41	29.4	41.8	6	89.2	299.5	185.1	37
17-01-2019 00:00:00	253.8	196.4	197.2	115.6	412.5	41.7	29.8	42.3	5.6	83.5	282	183.7	36.
21-01-2019 00:00:00	207.1	182.9	189.7	112.2	407.9	39.8	28.8	41.7	5.2	87.5	276.7	187.9	35
23-01-2019 00:00:00	136	150.5	227.2	109.3	395.8	41.5	27.3	44.3	4.8	105.7	391.4	219.7	49.
25-01-2019 00:00:00	134.3	155.2	232.4	114.2	408.7	40.2	25.7	43.7	5.1	103.7	380.2	218.4	4
26-01-2019 00:00:00	135.9	143.2	229.6	112.7	373.4	35.5	26.2	43.1	4.7	105.8	380.6	219.8	48.
27-01-2019 00:00:00	141.2	138.9	226.9	105	341.6	37.9	27	45.3	4.7	98.3	379.4	212.8	48.
07-02-2019 00:00:00	92	96.2	175.3	60.3	260.1	24.6	17	41.3	2.9	67.4	215.2	154.6	30.
14-02-2019 00:00:00	104.6	118.9	232.8	71.8	261.4	38.5	29.6	48.5	3.8	73.7	317.3	228.3	39.
16-02-2019 00:00:00	112.8	129.1	237	72.7	272.5	40.2	31.5	49.4	4	76.1	321.8	235.5	40.
17-02-2019 00:00:00	110.7	126.4	235.2	71.6	272.5	40.5	30.9	47.3	3.9	78.4	326.9	237	40.
18-02-2019 00:00:00	109.5	125.1	236.6	71.3	268	35.7	30.4	42.9	3.9	78.8	322.6	237.1	39.
19-02-2019 00:00:00	106.7	127.3	234.3	69.2	270	39.6	29.8	49.4	3.6	78.1	319.9	238.5	40.
20-02-2019 00:00:00	101.5	118.2	232	67	264.3	36.6	27.4	48.9	3.3	79	312.3	235.3	39.
21-02-2019 00:00:00	155.9	165.3	248.1	111.8	428.2	45	28.9	46.7	5.2	94.3	385.7	224	50.
23-02-2019 00:00:00	175.9	179.3	256.2	121.6	444.4	46.3	29.2	47.2	5.6	85	389.9	226.3	51.

Dashboard









CONCLUSION

In conclusion, the analysis of commercial electricity consumption in the Indian state using Power BI reveals key insights into consumption patterns, trends, and potential areas for optimization. Through visualizations and data-driven analysis, it's evident that understanding peak consumption periods, identifying high-demand regions, and optimizing energy distribution can lead to more efficient resource allocation and cost savings. Additionally, exploring factors influencing consumption, such as economic activity and seasonal variations, can further inform decision-making for stakeholders in the energy sector. Overall, leveraging Power BI for such analysis provides a powerful tool for enhancing energy management strategies and driving sustainable development in the region.

FUTURE SCOPE

The future scope of this project is vast. With the advent of advanced analytics and machine learning, PowerBI can be leveraged to predict future trends based on historical data. Integrating these predictive analytics into the project could enable the bank to anticipate customer needs and proactively offer solutions. Furthermore, PowerBI's capability to integrate with various data sources opens up the possibility of incorporating more diverse datasets for a more holistic view of customers. As data privacy and security become increasingly important, future iterations of this project should focus on implementing robust data governance strategies. This would ensure the secure handling of sensitive customer data while complying with data protection regulations. Additionally, the project could explore the integration of real-time data streams to provide even more timely and relevant insights. This could potentially transform the way banks interact with their customers, leading to improved customer satisfaction and loyalty.

REFERENCES

https://www.kaggle.com/datasets/twinkle0705/state-wise-power-consumption-in-india

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