Tech Saksham

Case Study Report

Data Analytics with Power BI

"Analysis of Commercial Electricity Consumption in Indian State"

"Government Arts Science College for Women"

NM ID	NAME
DA301704E3C56B2AD8B4BB9E10291186	DEIVA CHITHRA.S

Trainer Name: R.UMAMAHESHWARI

Master Trainer: R.UMAMAHESHWARI

ABSTRACT

The Biggest challenges facing the electricity industry today include the need to rapidly scale the deployment of commercial technologies such as wind and solar, the further commercialization of new technologies such as carbon capture and Advanced nuclear, and the management of existing generating fleets including marginally economic nuclear plants and carbon-emitting coal and gas plants. Additionally, the power system faces challenges related to increasing interconnections and loads, the separation of the energy supply sector, and the need for power system resilience in the face of energy demands, pollution, climate change, and aging…

INDEX

CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Problem statement sets the stage for research or initiatives focused on improving electricity consumption efficiency in commercial settings, emphasizing the importance of balancing economic and environmental concerns. "Commercial establishments consume a significant amount of electricity, contributing to both operational costs and environmental impact. However, optimizing electricity consumption in commercial settings presents challenges due to varying usage patterns, equipment efficiency, and occupancy fluctuations. This problem statement aims to address the need for efficient management of electricity consumption in commercial buildings by developing innovative strategies, technologies, and policies that enhance energy efficiency, reduce costs, and minimize environmental footprint while maintaining or improving operational performance."

1.2 Proposed Solution

A proposed solution for electricity power consumption includes the use of recommender systems based on power consumption. These systems provide algorithms for efficient power consumption and can help residential customers manage their electricity bills by reminding them of their monthly

usage. Another solution is the detection of abnormal energy consumption in residential buildings using unsupervised outlier detection methods such as isolation forest, one-class SVM, and k-means. This helps in reducing operating costs for residents and allows energy providers to pinpoint overconsumption problems.

1.3 Feature

- **Load Profile Analysis**: Understanding the load profile of a commercial establishment helps in identifying peak demand periods, which can be targeted for optimization.

- **Energy Monitoring Systems**: Installation of energy monitoring systems allows real-time tracking of electricity consumption, enabling businesses to identify areas of high usage and potential inefficiencies.

- **Demand Response**: Implementing demand response strategies allows businesses to adjust electricity usage during peak demand periods or in response to pricing signals, thus reducing costs and relieving strain on the grid.

- **Energy Efficiency Technologies**: Adoption of energy-efficient appliances, lighting systems, HVAC (Heating, Ventilation, and Air Conditioning) systems, and other equipment can significantly reduce electricity consumption in commercial buildings.

- **Building Automation Systems**: Utilizing building automation systems for centralized control of lighting, temperature, and equipment can optimize energy usage based on occupancy schedules and environmental conditions.

1.4 Advantages

- **Operational Efficiency**: Efficient electrical consumption enables businesses to operate smoothly without interruptions, ensuring consistent productivity and customer service.

- **Cost Savings**: Optimizing electricity usage through energy-efficient technologies and practices can lead to significant cost savings over time, reducing utility bills and operational expenses.

- **Environmental Sustainability**: Implementing energy-efficient measures and utilizing renewable energy sources can lower carbon emissions and contribute to environmental sustainability, aligning with corporate social responsibility goals.

- **Compliance with Regulations**: Adhering to energy efficiency standards and regulations helps businesses avoid fines and penalties while demonstrating commitment to sustainability and regulatory compliance.

- **Improved Indoor Environment**: Energy-efficient lighting and HVAC systems enhance indoor air quality, comfort, and occupant satisfaction, creating a more pleasant working or shopping environment.

1.5 Scope

The scope considers factors such as budget constraints, technological limitations, building infrastructure, occupant behavior, regulatory requirements, and environmental considerations when developing and implementing electricity consumption management strategies. This scope definition provides a comprehensive overview of the objectives, boundaries, components, stakeholders, constraints, and measurement aspects involved in managing electricity commercial consumption. It

serves as a foundation for planning, implementing, and evaluating electricity consumption management initiatives in commercial establishments.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

2.2 Tools and Software used

- **Energy Audits**: Energy auditing services assess the energy performance of commercial buildings and identify opportunities for improving energy efficiency. These audits typically involve on-site assessments, data analysis, and recommendations for energy-saving measures

- **Energy Management Systems (EMS)**: EMS services involve the implementation and maintenance of software platforms or integrated systems that monitor, control, and optimize energy usage in commercial buildings. EMS may include features such as real-time monitoring, automated controls, demand response capabilities, and reporting functionalities.

- **Lighting Design and Retrofitting**: Lighting services encompass the design, installation, and maintenance of energy-efficient lighting systems tailored to commercial spaces. This includes LED lighting retrofits, lighting controls,

daylight harvesting, and sensor integration to minimize electricity consumption while providing adequate illumination.

Tools:

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

Energy Management Software (EMS):EMS platforms provide comprehensive tools for monitoring, controlling, and analyzing energy consumption in commercial buildings.
Building Automation System (BAS) Software:BAS software enables centralized control and automation of building systems, including HVAC, lighting, and power distribution.It allows for scheduling, set point adjustments, fault detection, and optimization of energy-consuming equipment.

CHAPTER 3

PROJECT ARCHITECTURE

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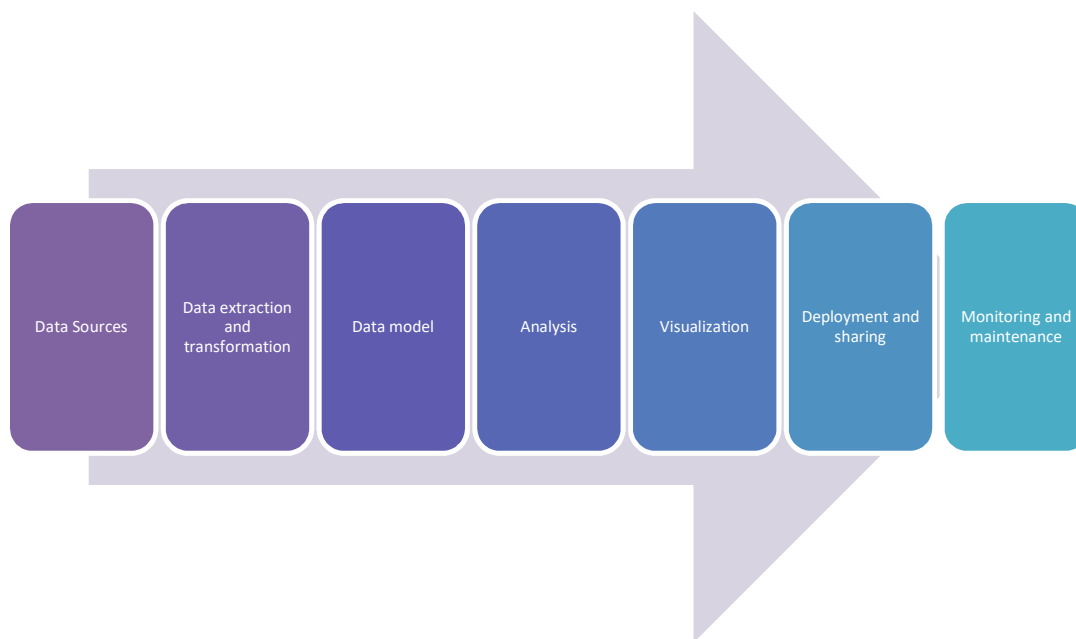
Here's a high-level architecture for the project:

1. **Data sources**: Data is often aggregated and used for policy-making, research, and analysis. Companies specialize in collecting, aggregating, and selling electricity consumption data to businesses, researchers, and governments.

2. **Data extraction and transformation**: The process of retrieving data from various sources, which could be databases, files, APIs, or web scraping. Refining and restructuring the extracted data into a format suitable for analysis or storage.

3. **Data Model**: Data modeling is the process of creating a conceptual representation of data and its relationships, typically using diagrams or formal notations..

4. **Analysis**: Analysis refers to the process of examining, interpreting, and making sense of data to uncover insights, trends, patterns, and relationships.

5. **Visualization:** Visualization is the graphical representation of data and information. It involves creating visual elements such as charts, graphs, maps, and dashboards to convey insights and patterns in a clear and effective manner.

6. **Deployment and sharing:** Deployment refers to the process of making your analysis or visualization available for use by others. Sharing refers to the act of distributing or providing access to resources, information, or content with others.

7. **Monitoring and maintenances:** Monitoring involves continuously observing, measuring, and evaluating the performance, availability, and behavior of systems, processes, or resources. Maintenance refers to the set of activities and processes performed to ensure the continued functionality, reliability, and efficiency of systems, equipment, infrastructure, or software over time.

CHAPTER 4

MODELING AND RESULT

Manage relationship

These two datasets contains many-to-many relationship
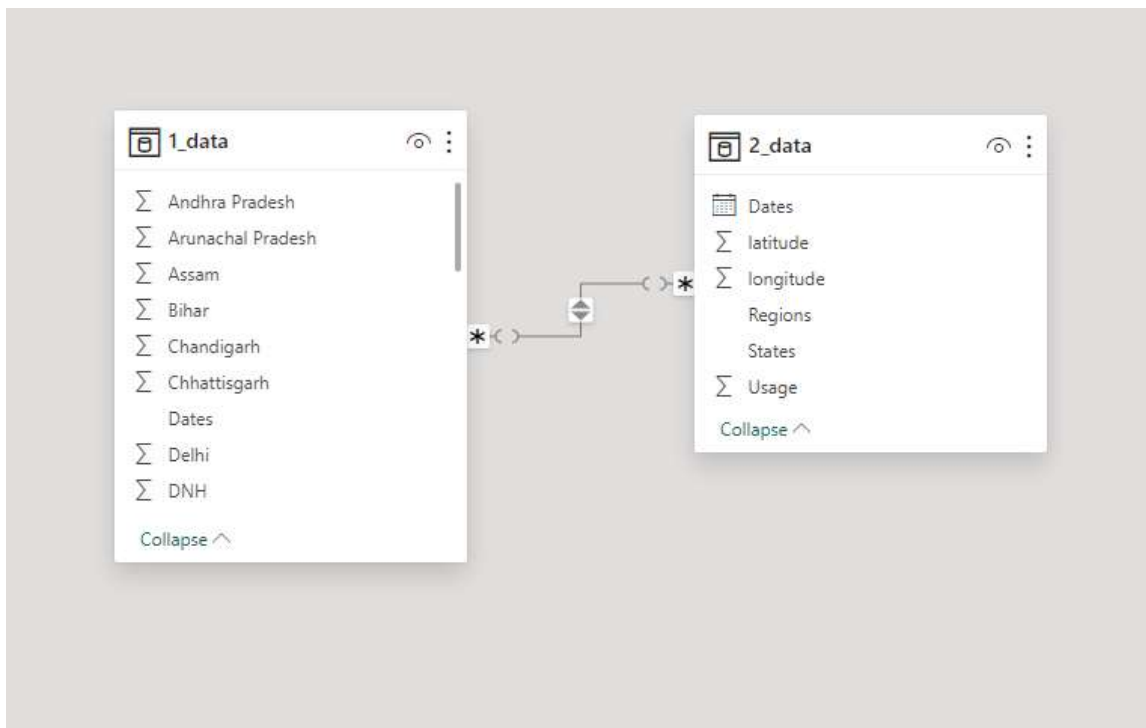
Edit relationship

Select tables and columns that are related.

1_data

Dates	Punjab	Haryana	Rajasthan	Delhi	UP	Uttarakhand	HP	J&K	Chandigarh
03-01-2019 00:00:00	121.9	133.5	240.2	85.5	311.8	39.3	30.1	54.1	
04-01-2019 00:00:00	118.8	128.2	239.8	83.5	320.7	38.1	30.1	53.2	
05-01-2019 00:00:00	121	127.5	239.1	79.2	299	39.2	30.2	51.5	

2_data

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

Cardinality	Cross filter direction
Many to many (*:*)	Both

☑ Make this relationship active   ☐ Apply security filter in both directions

☐ Assume referential integrity

Changing Column Types

Define the type of the column using Power Query

- Dataset 1

= Table.TransformColumnTypes(#"Promoted Headers",{{"Column1", type datetime}, {"Punjab", type number}, {"Haryana", type number}, {"Rajasthan", type

number}, {"Delhi", type number}, {"UP", type number}, {"Uttarakhand", type number}, {"HP", type number}, {"J&K", type number}, {"Chandigarh", type number}, {"Chhattisgarh", type number}, {"Gujarat", type number}, {"MP", type number}, {"Maharashtra", type number}, {"Goa", type number}, {"DNH", type number}, {"Andhra Pradesh", type number}, {"Telangana", type number}, {"Karnataka", type number}, {"Kerala", type number}, {"Tamil Nadu", type number}, {"Pondy", type number}, {"Bihar", type number}, {"Jharkhand", type number}, {"Odisha", type number}, {"West Bengal", type number}, {"Sikkim", type number}, {"Arunachal Pradesh", type number}, {"Assam", type number}, {"Manipur", type number}, {"Meghalaya", type number}, {"Mizoram", type number}, {"Nagaland", type number}, {"Tripura", type number}})
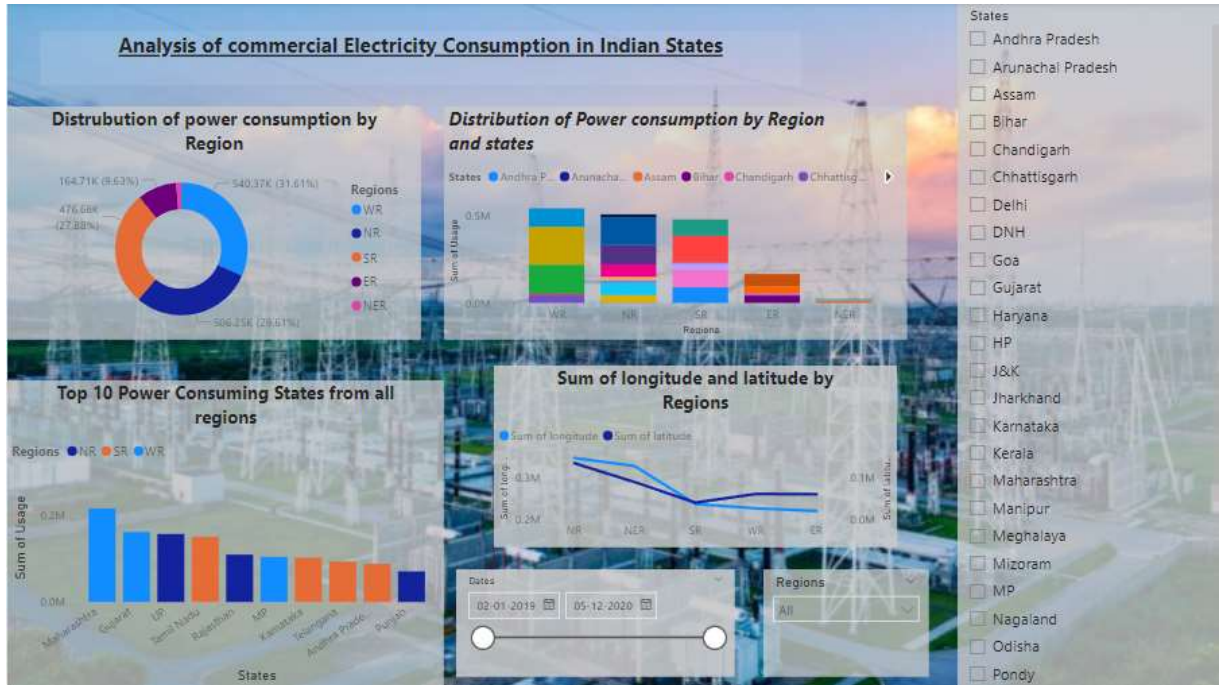
Rename Column

Rename the column using Power Query

```
= Table.RenameColumns(#"Changed Type",{{"Column1", "Dates"}})
```

Dates	1.2 Punjab	1.2 Haryana	1.2 Rajasthan	1.2 Dell
1	02-01-2019 00:00:00	119.9	130.3	234.1
2	03-01-2019 00:00:00	121.9	133.5	240.2
3	04-01-2019 00:00:00	118.8	128.2	239.8
4	05-01-2019 00:00:00	121	127.5	239.1

Dashboard

Analysis of commercial Electricity Consumption in Indian States

CONCLUSION

In conclusion, managing electrical commercial consumption is a critical endeavor that requires a multi faceted approach to optimize energy usage, reduce costs, and minimize environmental impact. Efficient electrical consumption practices lead to reduced utility bills and operational expenses, enhancing the financial viability and competitiveness of businesses. By minimizing energy wastage and transitioning to renewable energy sources, commercial establishments can lower carbon emissions and contribute to environmental conservation efforts Engaging employees, customers, and communities in energy conservation initiatives builds trust, strengthens relationships, and demonstrates a commitment to environmental stewardship.

FUTURE SCOPE

The future scope for electricity commercial consumption is vast, with ongoing technological advancements, evolving consumer preferences, and shifting regulatory landscapes shaping the trajectory of the industry. Further integration of smart grid technologies will enable more efficient management of electricity distribution, improved demand response capabilities, and enhanced grid reliability. Advanced metering infrastructure (AMI), distribution automation, and grid-edge intelligence will play pivotal roles in optimizing commercial electricity consumption. The deployment of energy storage solutions, such as batteries and advanced storage technologies, will continue to grow. Energy storage systems offer opportunities for load shifting, peak demand reduction, and integration of renewable energy sources, thereby enhancing grid flexibility and resilience for commercial consumers. The rise of decentralized energy systems, including micro grids and distributed generation, will empower commercial establishments to generate, store, and manage their electricity locally. This trend will enable greater energy independence, cost savings, and reliability, especially in regions prone to grid outages or fluctuations.