Tech Saksham

Case Study Report

Data Analytics with Power BI

“Analysis of Commercial Electricity Consumption in Indian State”

“Government Arts and Science College for Women”

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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 plans and carbon-emitting coal and gas plants. Additionally, the power system faces challenges related to increasing interconnections and locals, 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…

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Electricity demand is on increase. As population increases, comes more demand for electricity supply/consumption. Demand per capita is increasing due to large number of gadgets in use. Demand from developing countries is also on the rise. How can we manage customer consumption of electricity in response to supply condition, for example having electricity customers reduce their consumption at critical times. The objective of this PowerBI project is to analyze electricity consumption data comprehensively to derive actionable insights for optimization and efficiency. The project to aims to identify peak consumption periods and factors contributing to high usage, while evaluating disparities across different regions and states. Through interactive dashboards and visualizations, stakeholders will gain a deeper understanding of consumption patterns and receive recommendations for enhancing efficiency, reducing costs, and promoting sustainability in electricity usage.

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. Additionally, an energy consumption prediction approach based on improved Gaussian mixture clustering can be used for forecasting electricity consumption. This approach groups the characteristics of power time series and achieves better prediction results. Furthermore, a method for identifying abnormal electricity consumption data mining has been proposed. This method considers the spatial and temporal

characteristics of user electricity consumption data and improves the accuracy of abnormal power consumption identification.

1.3 Feature

- **Real-Time Analysis**: The dashboard refresh in real-time, allowing viewers to solve problems and spot possibilities instantly.
- **Quick Insights:** Using powerful algorithms, users can obtain exciting insights from various subsets of data.
- **Trend Analysis**: The dashboard will identify and display trends in consumption.
- **Visualization and Reporting:** PowerBI analyze data and deliver insights across the organization at all levels.

1.4 Advantages

- **Data-Driven Decisions**: Electricity department can make informed decisions based on real-time data analysis.
- **User-Friendly Interface:** Intuitive design and interactive features make it easy for users to explore and interpret energy consumption data.
- **Comprehensive Insights:** The combination of diverse visualizations provides a comprehensive overview, allowing users to identify trends, patterns, and anomalies in electricity consumption.

1.5 Scope

Creating a PowerBI project to analyze electricity consumption can involve various aspects, including data collection, visualization, and analysis. Use historical data to forecast future electricity consumption, enabling better planning and resource allocation. Analyze the effectiveness of demand response programs in reducing electricity consumption during peak periods. Integrate PowerBI with IoT devices to collect real-time electricity consumption data and provide insights for proactive management. Compare electricity consumption across different locations or facilities to identify outliers and areas for improvement.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

- **Data Collection and Storage Services**: This could be achieved through services like Azure Data Factory, Azure Event Hubs, or AWS Kinesis for real-time data collection, and Azure SQL Database or AWS RDS for data storage.

- **Data Processing Services**: Services like Azure Stream Analytics or AWS Kinesis Data Analytics can be used to process the real-time data.

- **Machine Learning Services**: Azure Machine Learning or AWS SageMaker can be used to build predictive models based on historical data.

2.2 Tools and Software used

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

Software Requirements:

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

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

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

CHAPTER 3

PROJECT ARCHITECTURE

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

1. Data Collection: It involves a combination of user-provided information, app usage data, and external sources like Market Research reports, Government Databases, Industry Publications, Social Media Monitoring.

2. Data model: Design a data model in Power BI using the cleaned data. Create relationships between different tables such as state-wise electricity consumption, population data, GDP, etc., if applicable.

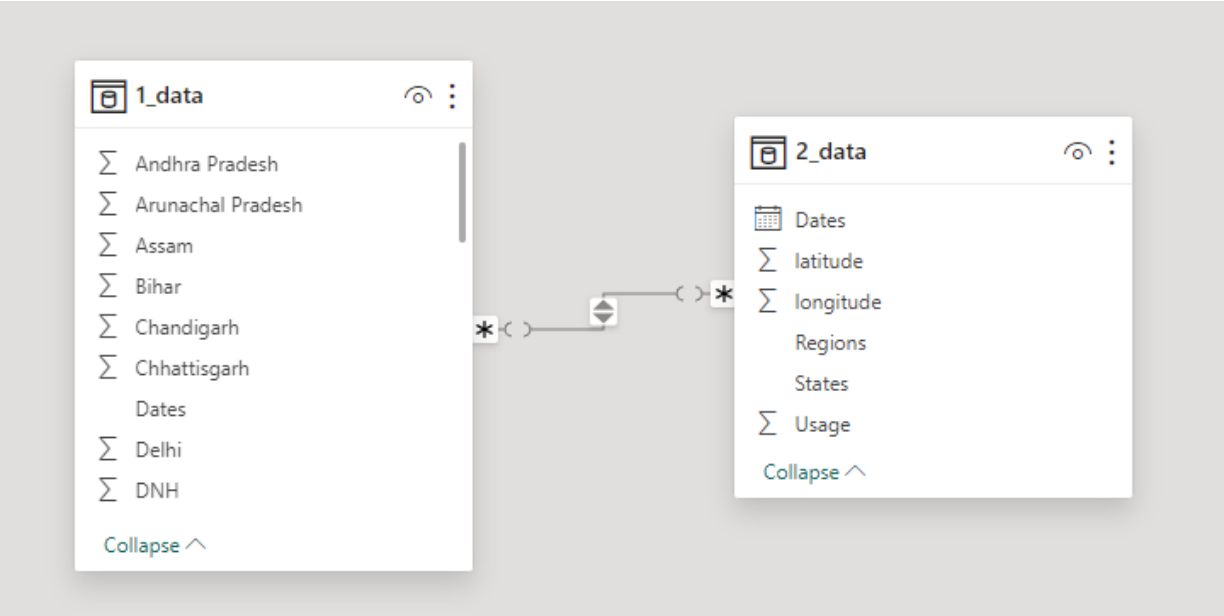
3. Data Visualization: The processed data and the results from the predictive models are visualized in real-time using PowerBI. PowerBI allows you to create interactive dashboards that can provide valuable insights into the data.

CHAPTER 4

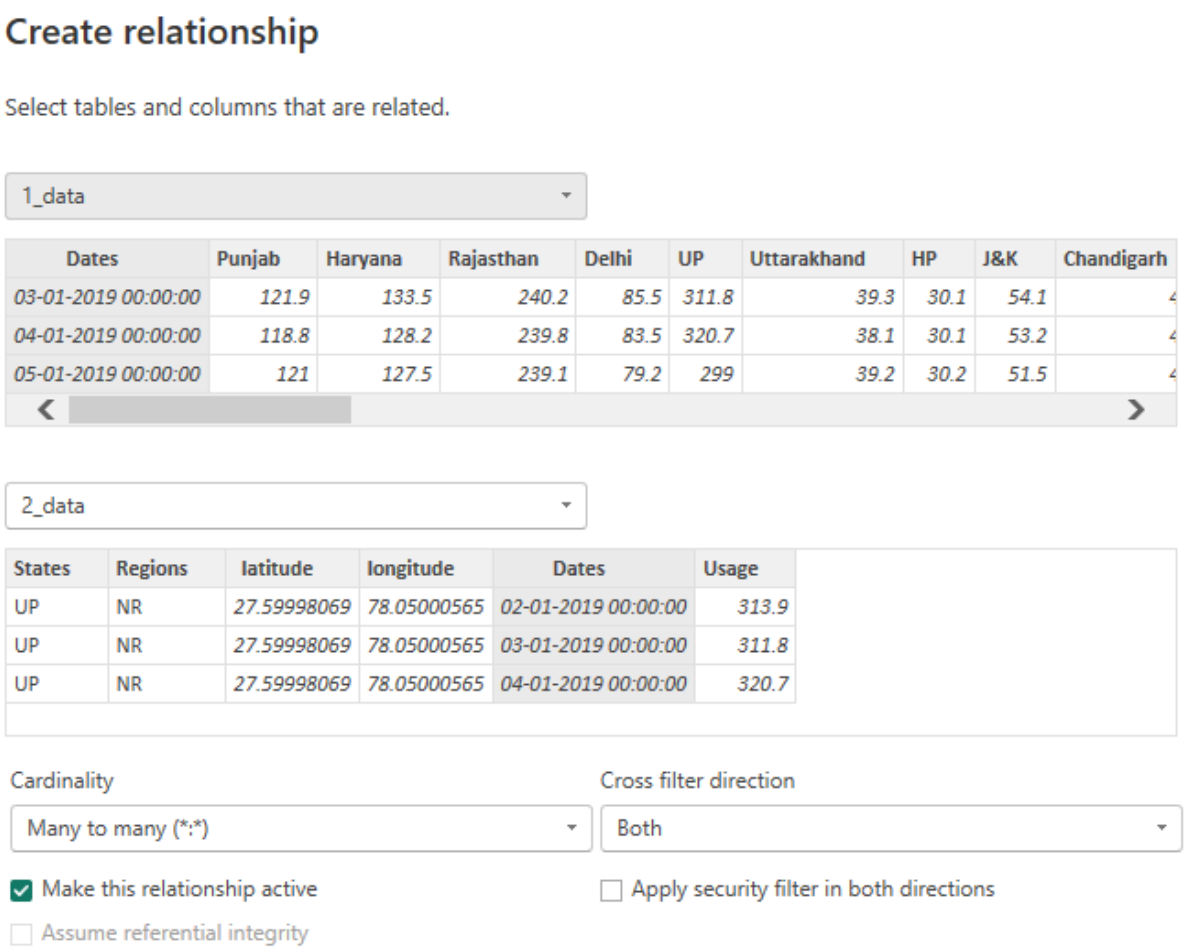
MODELING AND RESULT

Manage relationship

These two datasets contains many-to-many relationship



Edit relationship



Changing Column Types

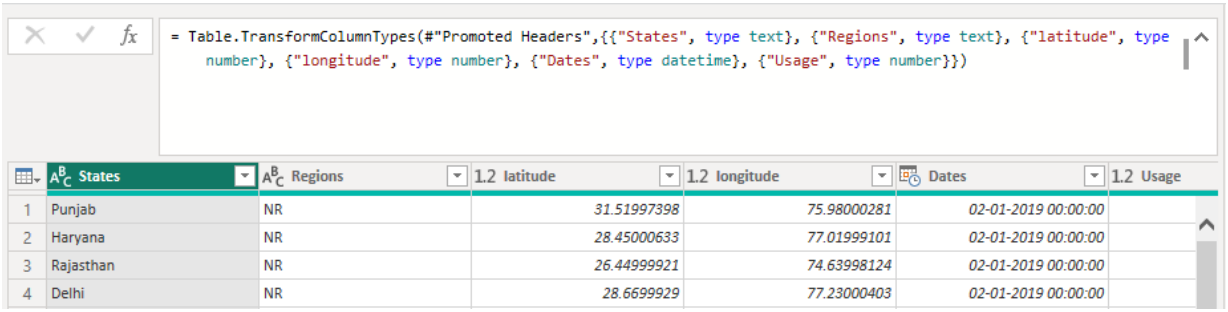
Define the type of the column using Power Query

- **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}})

- **Dataset 2**

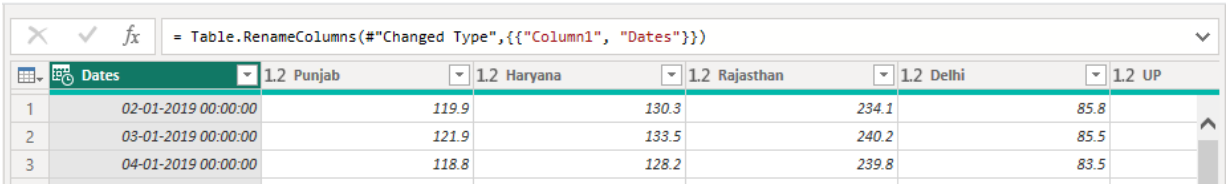


```
= Table.TransformColumnTypes(#"Promoted Headers",{{"States", type text}, {"Regions", type text}, {"latitude", type number}, {"longitude", type number}, {"Dates", type datetime}, {"Usage", type number}})
```

	States	Regions	latitude	longitude	Dates	Usage
1	Punjab	NR	31.51997398	75.98000281	02-01-2019 00:00:00	
2	Haryana	NR	28.45000633	77.01999101	02-01-2019 00:00:00	
3	Rajasthan	NR	26.44999921	74.63998124	02-01-2019 00:00:00	
4	Delhi	NR	28.6699929	77.23000403	02-01-2019 00:00:00	

Rename column

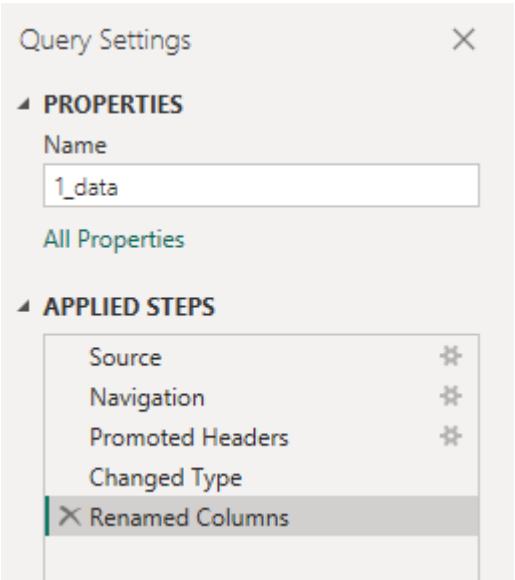
Rename the column using Power Query



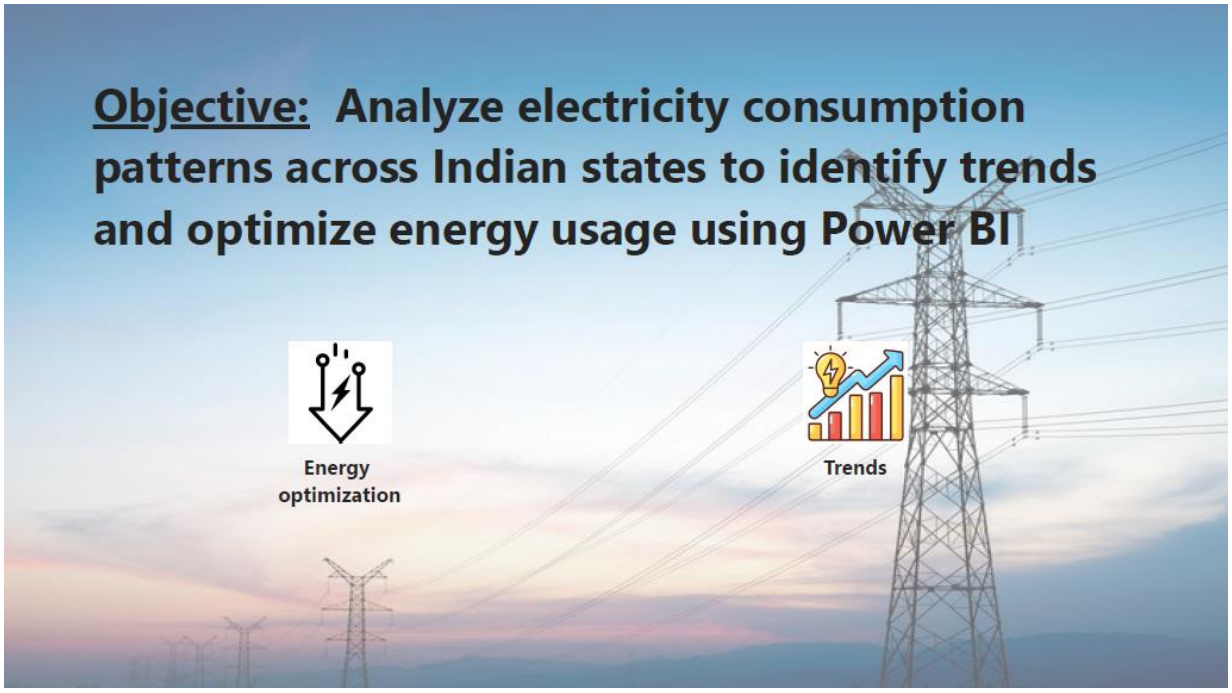
```
= Table.RenameColumns(#"Changed Type",{{"Column1", "Dates"}})
```

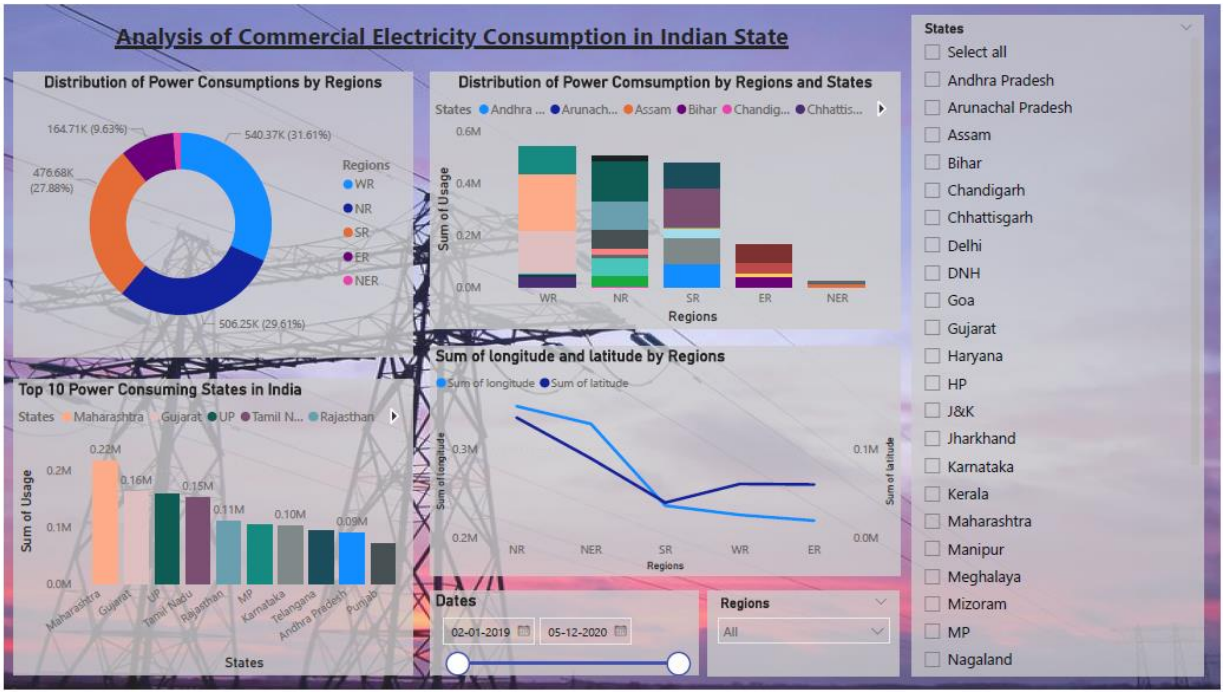
	Dates	Punjab	Haryana	Rajasthan	Delhi	UP
1	02-01-2019 00:00:00	119.9	130.3	234.1	85.8	
2	03-01-2019 00:00:00	121.9	133.5	240.2	85.5	
3	04-01-2019 00:00:00	118.8	128.2	239.8	83.5	

Refer to applied steps for details.



Dashboard





CONCLUSION

The data analysis Electricity Consumption PowerBI project offers comprehensive insights into electricity usage trends, consumption patterns, and potential areas for optimization. By utilizing PowerBI's robust analytical tools and visualization capabilities, key stakeholders can gain a deeper understanding of energy consumption dynamics, identify inefficiencies, and implement targeted strategies to improve resource utilization and reduce costs. This project underscores the significance of data-driven decision-making in enhancing energy efficiency, sustainability, and overall operate performance in the context of electricity consumption. In conclusion, the data analysis of electricity consumption using PowerBI provides a clear and actionable understanding of energy usage patterns. Above insightful visualizations underscores the value of data-driven insights in shaping more effective energy management strategies for a greener and more efficient future.

FUTURE SCOPE

The future scope for data analysis of electricity consumption using PowerBI is primising and expansive. Incorporate machine learning algorithms within PowerBI to forecast future electricity consumption based on historical data, seasonal trends, weather patterns, and other relevant factors. Integrate PowerBI with IoT devices and smart meters to enable real-time monitoring of electricity consumption. Compare electricity consumption data across different facilities, departments, or time periods to establish benchmarks for energy efficiency. Utilize Power BI to analyze historical demand response events and their impact on electricity consumption. By identifying opportunities to optimize demand response strategies, organizations can reduce peak demand charges, improve grid stability, and enhance overall energy efficiency. By exploring these future directions, organizations can leverage PowerBI to unlock deeper insights, drive continuous improvement, and achieve tangible benefits in managing electricity consumption effectively.

LINKS

https://github.com/SahayaBarbaralPricy/PowerBI.git

