Tech Saksham

Case study Report

Data Analytics with Power BI

“Analysis of Commercial Electrical Consumption in India”

“APC Mahalaxmi college for women”

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ABSTRACT

The real-time electricity price is constantly changing, so it must be estimated from grid data associated with it. Furthermore, there are often some variations in the actual power consumption of appliances due to the uncertainty of human behavior, the characteristics of appliances, and the influence of the environment. In addition, when optimizing, serious problems such as tripping and circuit overload must be taken into account. Therefore, considering random electricity prices and random electricity consumption, in the paper, we present the models to simulate real-time changes in electricity prices and energy consumption behaviors, as well as a method to help users optimize their use of household appliances and quantify their requirements with lower electricity cost. By analyzing the experimental results, we demonstrate that our work can be used to provide a scheduling scheme for appliances that minimizes electricity costs and reduces grid pressure.

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CHAPTER 1

INTRODUCTION

- **Problem Statement**

  Now a days, humans have a greater influence on energy consumption in residential buildings than other types of buildings. Although existing studies focus on how energy consumption is affected by building technologies and occupant demographics, few studies have incorporated the impact of occupant energy use patterns. The goal of this study is to identify the features that affect energy consumption in residential buildings and to measure their predictive performance. The researchers examined the impact of occupants' energy use behaviors and the energy use patterns of home appliances on home energy consumption.

- **Proposed Solution**

Electricity is an essential resource for a thriving life. It runs our daily life. Life without electricity would be impossible to imagine now. We generate electricity using coal or natural gas. However, people do not realize the natural resources to do as are limited and non-renewable. We must conserve electricity so that we can conserve these resources. In other words, electricity serves mankind greatly. We must stop the wastage of power. The world will lose its light if there is no electricity.

Feature

Data from the Residential Energy Consumption Survey (RECS) are analyzed to select features for prediction, using multiple machine learning algorithms including support vector machine (SVM) and random forest. The results provide a list of features that efficiently predict energy consumption in residential buildings. The selected 32 features achieve 98% of the prediction performance of that from the entire 271 features. This list of effective features can be used to improve the effectiveness of energy saving programs and to educate occupants about their energy use patterns.

- **Advantages**

Easy to manage and transport:

With proper planning or management, electricity transmission is possible on a large scale over a long distance

Easily accessible and produced

Using a wide variety of renewable and non-renewable source of energy in producing electricity make it easy to assemble. Everyone can access electricity.

Reduces greenhouse emission

Electricity can be produced via renewable energy sources such as wind and solar, which are much cleaner and environmentally friendly.

Scope

all of us must understand that even a small step will go a very long way in saving electricity. For instance, if every person at each home switches on the fan when not in use, thousands of watts of electricity can be saved.Similarly, if we use our air conditioners, heaters, ovens, refrigerators and more properly, we can successfully save large amounts of electricity.Furthermore, try making use of natural light more. Do not keep the lights unnecessarily in the morning and afternoons. Make do with the natural light as it is enough. We must replace all our old appliances as they consume a lot of electricity. In other words, we must strive to make our homes energy efficient.Moreover, always remember to unplug your electrical gadgets when not in use. These devices consume at least 10% of electricity even when inactive. Thus, unplug them to save electricity. The researchers examined the impact of occupants' energy use behaviors and the energy use patterns of home appliances on home energy consumption.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

- **Data Collection and Storage Services**: Banks need to collect and store customer data in real-time. 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.

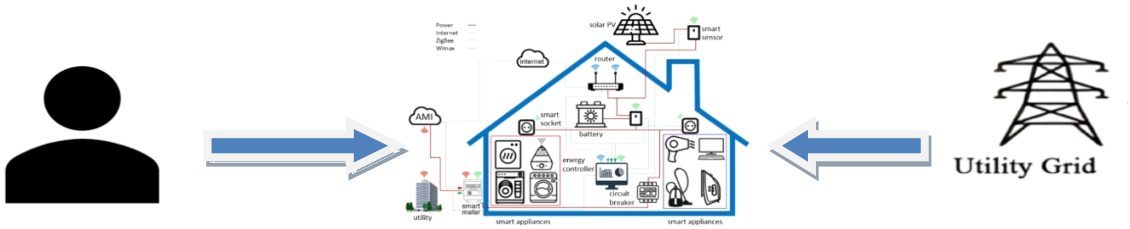
PowerBI Mobile: This is a mobile application that you can use to access your reports and dashboards on the go

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture

USER **FRONTEND** **BACKEND**



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

- **Data Collection**: Real-time customer data is collected from various sources like bank transactions, customer interactions, etc. This could be achieved using services like Azure Event Hubs or AWS Kinesis.
- **Data Storage**: The collected data is stored in a database for processing. Azure SQL Database or AWS RDS can be used for this purpose.
- **Data Processing**: The stored data is processed in real-time using services like Azure Stream Analytics or AWS Kinesis Data Analytics.

- **Machine Learning**: Predictive models are built based on processed data using Azure Machine Learning or AWS SageMaker. These models can help in predicting customer behavior, detecting fraud, etc.

- **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.

- **Data Access**: The dashboards created in PowerBI can be accessed through PowerBI Desktop, PowerBI Service (online), and PowerBI Mobile.

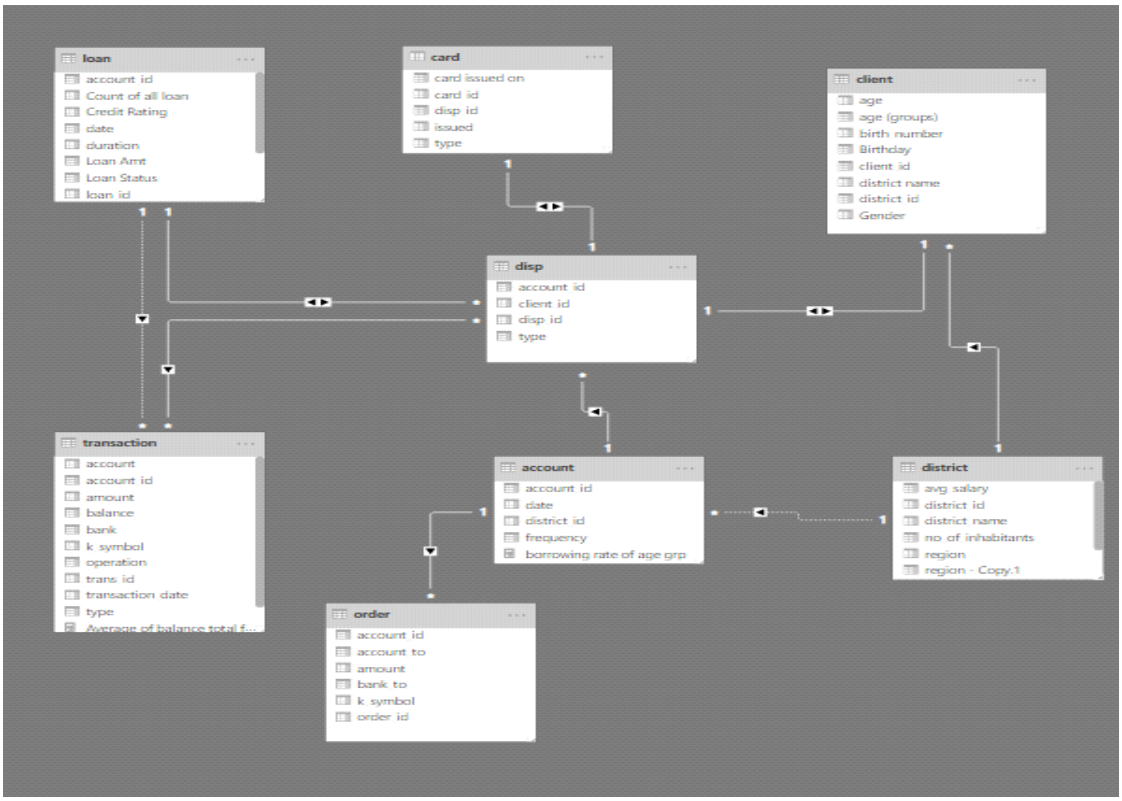
This architecture provides a comprehensive solution for real-time analysis of bank customers. However, it's important to note that the specific architecture may vary depending on the bank's existing infrastructure, specific requirements, and budget. It's also important to ensure that all tools and services comply with relevant data.

CHAPTER 4

MODELING AND RESULT

Manage relationship

The “disp” file will be used as the main connector as it contains most key identifier (account id, client id and disp id) which can be use to relates the 8 data files together. The “district” file is use to link the client profile geographically with “district id”



Manage relationships

Active	From: Table (Column)	To: Table (Column)
☑	card (disp_id)	disp (disp_id)
☑	client (district_id)	district (district_id)
☑	disp (account_id)	account (account_id)
☑	disp (account_id)	loan (account_id)
☑	disp (client_id)	client (client_id)
☑	order (account_id)	account (account_id)
☑	transaction (account_id)	disp (account_id)
☐	account (district_id)	district (district_id)
☐	transaction (account_id)	loan (account_id)

Edit relationship

Select tables and columns that are related.

card

card_id	disp_id	type	issued	card issued on
1005	*9285*	classic	931107	*Sunday, 7 November 1993*
104	*588*	classic	940119	*Wednesday, 19 January 1994*
747	*4915*	classic	940205	*Saturday, 5 February 1994*

disp

disp_id	client_id	account_id	type
1	1	1	OWNER
2	2	2	OWNER
4	4	3	OWNER

Cardinality

One to one (1:1)

Cross filter direction

Both

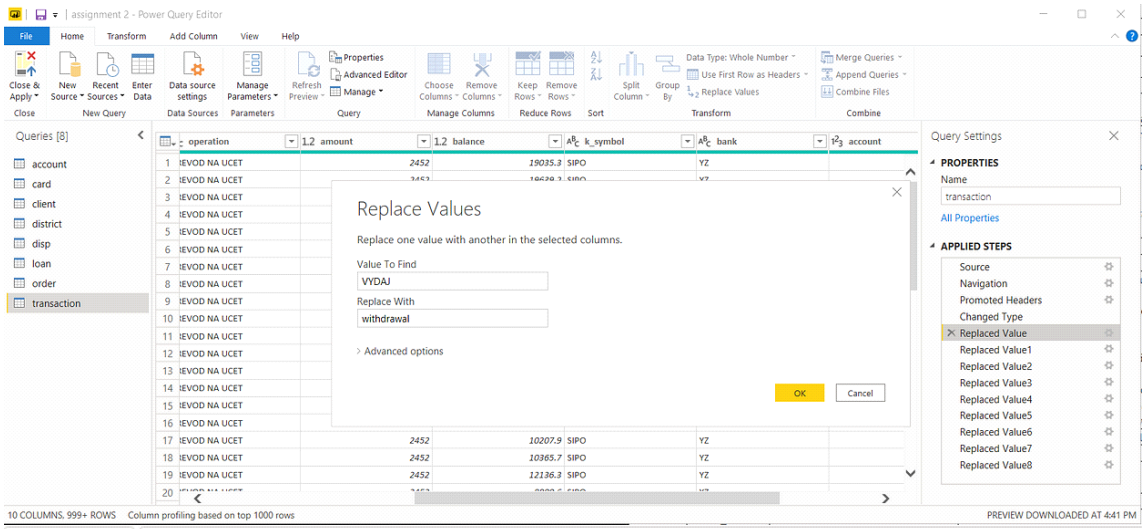
☑ Make this relationship active

☐ Apply security filter in both directions

☐ Assume referential integrity

Replacing values

Set some fields to English for easy understanding, we replace values to English with the Power Query Editor.

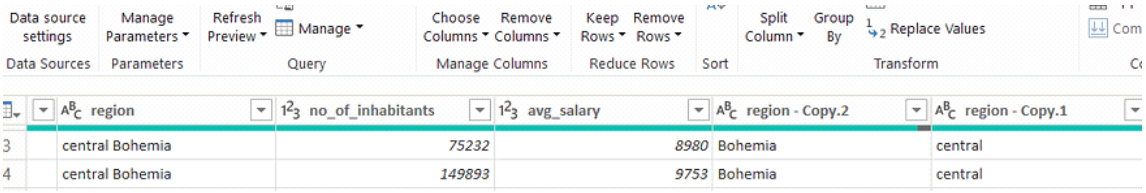


client_id	birth_number	district_id	Gender	Birthday	age	age (groups)
2	450204	1	M	04/02/1945	54	36 -54 Baby Boomers

type	+/- transaction	"PRIJEM" stands for credit "VYDAJ" stands for withdrawal
k_symbol	characterization of the transaction	"POJISTNE" stands for insurance payment "SLUZBY" stands for payment for statement "UROK" stands for interest credited "SANKC. UROK" sanction interest if negative balance "SIPO" stands for household "DUCHOD" stands for old-age pension "UVER" stands for loan payment

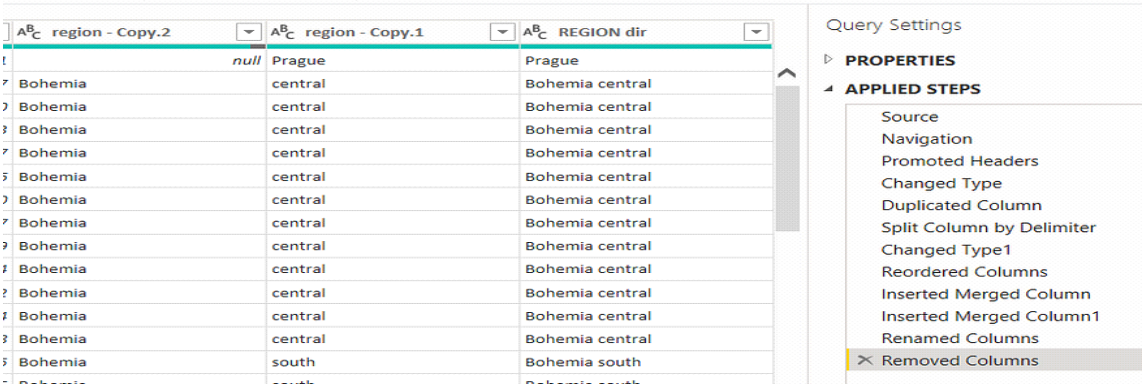
Changing the order of Region name at Power Query

Duplicate the “district /region” then split column using space as delimiter.



	region	no_of_inhabitants	avg_salary	region - Copy.2	region - Copy.1
3	central Bohemia	75232	8980	Bohemia	central
4	central Bohemia	149893	9753	Bohemia	central

Then merge column by Region and direction. Refer to applied steps for details.

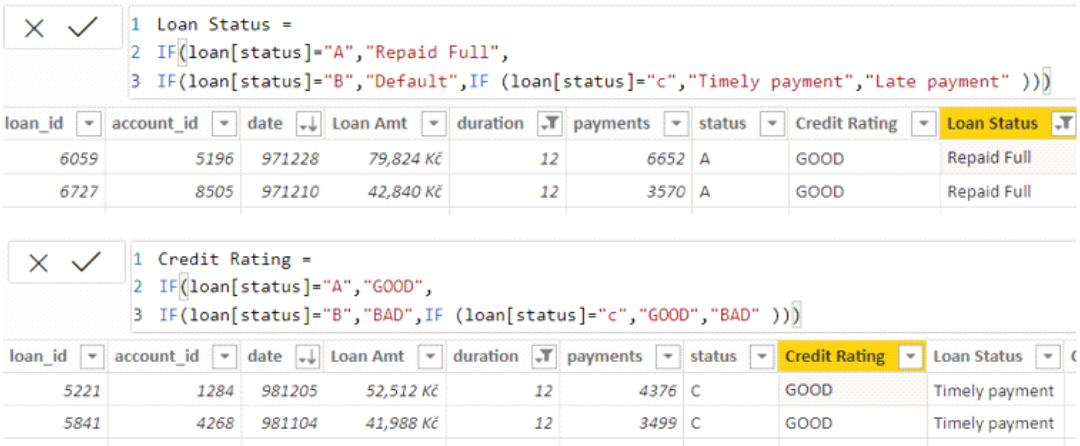


	region - Copy.2	region - Copy.1	REGION dir
	null	Prague	Prague
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	central	Bohemia central
	Bohemia	south	Bohemia south

Credit Rating and Loan Status

As the Loan status uses A, B, C, D which are not reader friendly. We can add a column to represent what it stands for, we also simplify the classification of those with late or default on payment as bad credit, refer to the table below for details on the new columns added.

Status in "loan" data	New column "loan status"	New column "credit rating"
'A' stands for contract finished no problems	Fully Repaid	Good
'B' stands for contract finished loan not payed	Default	Bad
'C' stands for running contract OK so far	Timely Payment	Good
'D' stands for running contract client in debt	Late payment	Bad



```
1 Loan Status =
2 IF(loan[status]="A","Repaid Full",
3 IF(loan[status]="B","Default",IF (loan[status]="c","Timely payment","Late payment" )))
```

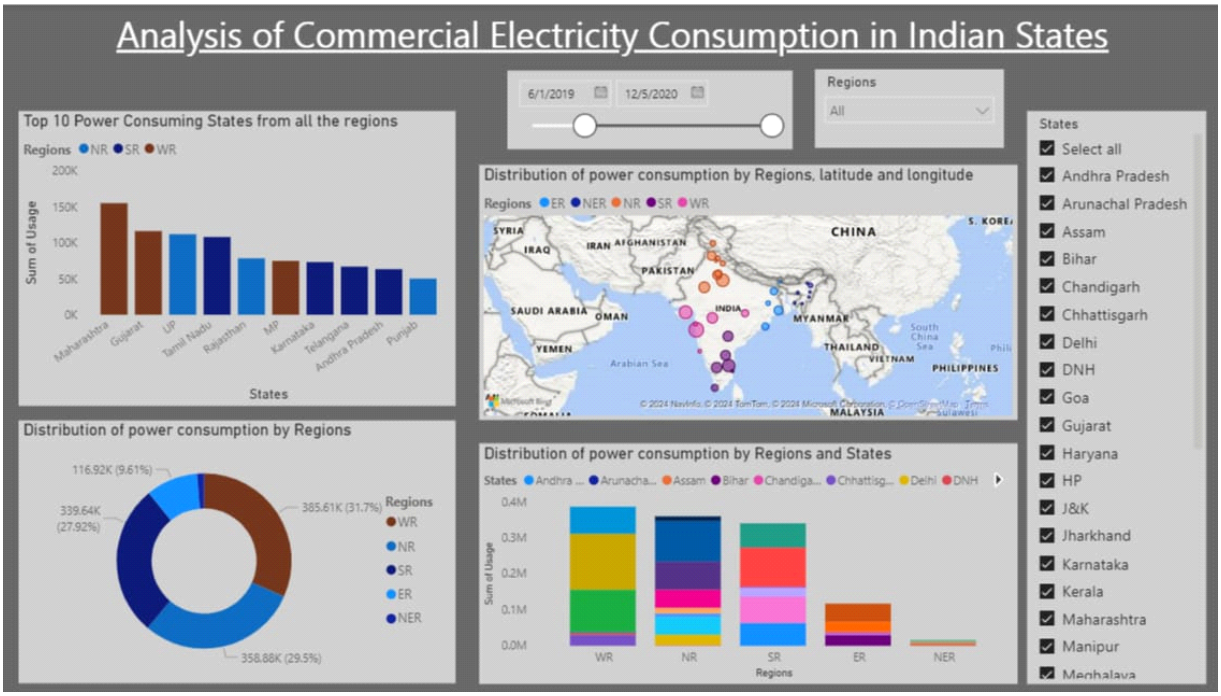
loan_id	account_id	date	Loan Amt	duration	payments	status	Credit Rating	Loan Status
6059	5196	971228	79,824 Kč	12	6652	A	GOOD	Repaid Full
6727	8505	971210	42,840 Kč	12	3570	A	GOOD	Repaid Full

```
1 Credit Rating =
2 IF(loan[status]="A","GOOD",
3 IF(loan[status]="B","BAD",IF (loan[status]="c","GOOD","BAD" )))
```

loan_id	account_id	date	Loan Amt	duration	payments	status	Credit Rating	Loan Status
5221	1284	981205	52,512 Kč	12	4376	C	GOOD	Timely payment
5841	4268	981104	41,988 Kč	12	3499	C	GOOD	Timely payment

Dashboard


Analysis of commercial electricity consumption in India


Analysis of Commercial Electricity Consumption in Indian States
6/1/2019
12/5/2020
Regions
All
Top 10 Power Consuming States from all the regions
Regions NR SR WR
Sum of Usage
States
Maharashtra
Gujarat
UP
Tamil Nadu
Rajasthan
MP
Karnataka
Telangana
Andhra Pradesh
Punjab
Distribution of power consumption by Regions, latitude and longitude
Regions ER NER NR SR WR
CHINA
INDIA
PAKISTAN
AFGHANISTAN
IRAN
IRAQ
SYRIA
SAUDI ARABIA
OMAN
YEMEN
MYANMAR
THAILAND
VIETNAM
PHILIPPINES
MALAYSIA
Arabian Sea
Distribution of power consumption by Regions
116.92K (9.61%)
339.64K (27.92%)
385.61K (31.7%)
358.88K (29.5%)
Regions
WR
NR
SR
ER
NER
Distribution of power consumption by Regions and States
States Andhra ... Arunacha... Assam Bihar Chandiga... Chhattisg... Delhi DNH
Sum of Usage
Regions
States
Select all
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Chhattisgarh
Delhi
DNH
Goa
Gujarat
Haryana
HP
J&K
Jharkhand
Karnataka
Kerala
Maharashtra
Manipur
Meghalaya

CONCLUSION

Electricity is a second source of energy that can be received from the conversion of another energy source, such as natural gas, nuclear power, coal, and other natural resources. Electricity is a basic part of nature, one of our most widely used forms of energy. Energy Efficiency covers wide-ranging topics related to energy efficiency, energy savings, energy consumption, energy sufficiency, and energy transition in all sectors across the globe. Coverage includes energy efficiency policies at all levels of governance enabling social, organizational, and economic factors of sufficient and efficient behavior and decisions; analysis and modeling of energy efficiency performance, measures, policies, outcomes, and impacts; energy management systems and energy services; the role of energy efficiency and demand-side management in energy planning, energy markets and risk assessment; local sustainable energy planning; energy behavior; acceptability of policy, technology, and new energy systems; and emerging technologies and approaches to improve energy consumption.

FUTURE SCOPE

India is the world's third-largest energy consuming country, thanks to rising incomes and improving standards of living. Energy use has doubled since 2000, with 80% of demand still being met by coal, oil and solid biomass. On a per capita basis, India's energy use and emissions are less than half the world average, as are other key indicators such as vehicle ownership, steel and cement output. As India recovers from a Covid-induced slump in 2020, it is re-entering a very dynamic period in its energy development. Over the coming years, millions of Indian households are set to buy new appliances, air conditioning units and vehicles. India will soon become the world's most populous country, adding the equivalent of a city the size of Los Angeles to its urban population each year. To meet growth in electricity demand over the next twenty years, India will need to add a power system the size of the European Union to what it has now.

REFERENCES

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

LINK

https://github.com/krishnakayathri/Analysis-of-Commercial-Electricity-Consumption-in-Indian-States/upload/main