Tech Saksham

Case Study Report

Data Analytics With Power BI

Analysis of Commercial Electricity Consumption in Indian States

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ABSTRACT

Electricity consumption in the household sector tends to increase during peak load time. It causes a significant difference between the power used during peak load time with outside peak load time. In fact, the bigger difference will become a problem for electricity companies because the generating capacity is not optimally utilized during outside peak load time. Consumers can reduce electricity consumption during the peak load time, or divert the use of it to outside peak load time. Apart from helping the government, this also helps ease the consumer economy. This paper aims to design an electricity consumption management system that can control electrical devices in small buildings in 3 modes: first, programming automatically according to user habits, second: remote control while away from home using android, third: manual or direct control while at home. This system is designed to be as effective as possible to limit the use of electric power based on the lifestyle of consumers.

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CHAPTER1

INTRODUCTION

1.1 Problem Statement

The use of electricity has a significant impact on the environment, energy distribution costs, and energy management since it directly impacts these costs. Long-standing techniques have inherent limits in terms of accuracy and scalability when it comes to predicting power usage. It is now feasible to properly anticipate power use using previous data thanks to improvements in machine learning techniques.

1.2 Problem Solution

Renewable energy like Solar Power, of which Solar inverters are the products made by EnerTech, one of the leading solar inverter manufacturers in India, is only solution to combat India's power crisis.

1.3 Feature

- **Analysis of Electricity**: The dashboard will provide Analysis of Electricity customer data.
- **Customer Segmentation**: It will segment customers based on various parameters like age, income, transaction behavior, etc.
- **Trend Analysis**: The dashboard will identify and display trends in customer behavior.
- **Predictive Analysis**: It will use historical data to predict future customer behavior.

1.4 Advantages

*** reducing the risks of unplanned downtime;**

*** optimisation of work processes;**

*** online monitoring of electricity;**

***Analysis of electricity consumption and possible savings.**

1.5 Scope

India is the third largest producer of electricity in the world. During the fiscal year (FY) 2022–23, the total electricity generation in the country was 1,844 TWh, of

which 1,618 TWh was generated by utilities. The gross electricity consumption per capita in FY2023 was 1,327 kWh.

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.

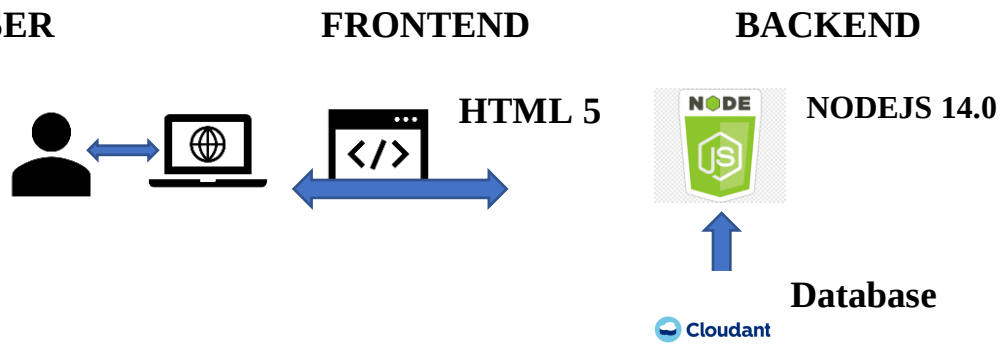
- **PowerBI Service**: This is an online SaaS (Software as a Service) service that you use to publish reports, create new dashboards, and share insights.

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

CHAPTER3

PROJECT ARCHITECTURE

3.1 Architecture



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

1. **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.
2. **Data Storage**: The collected data is stored in a database for processing. Azure SQL Database or AWS RDS can be used for this purpose.
3. **Data Processing**: The stored data is processed in real-time using services like Azure Stream Analytics or AWS Kinesis Data Analytics.
4. **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.
5. **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.

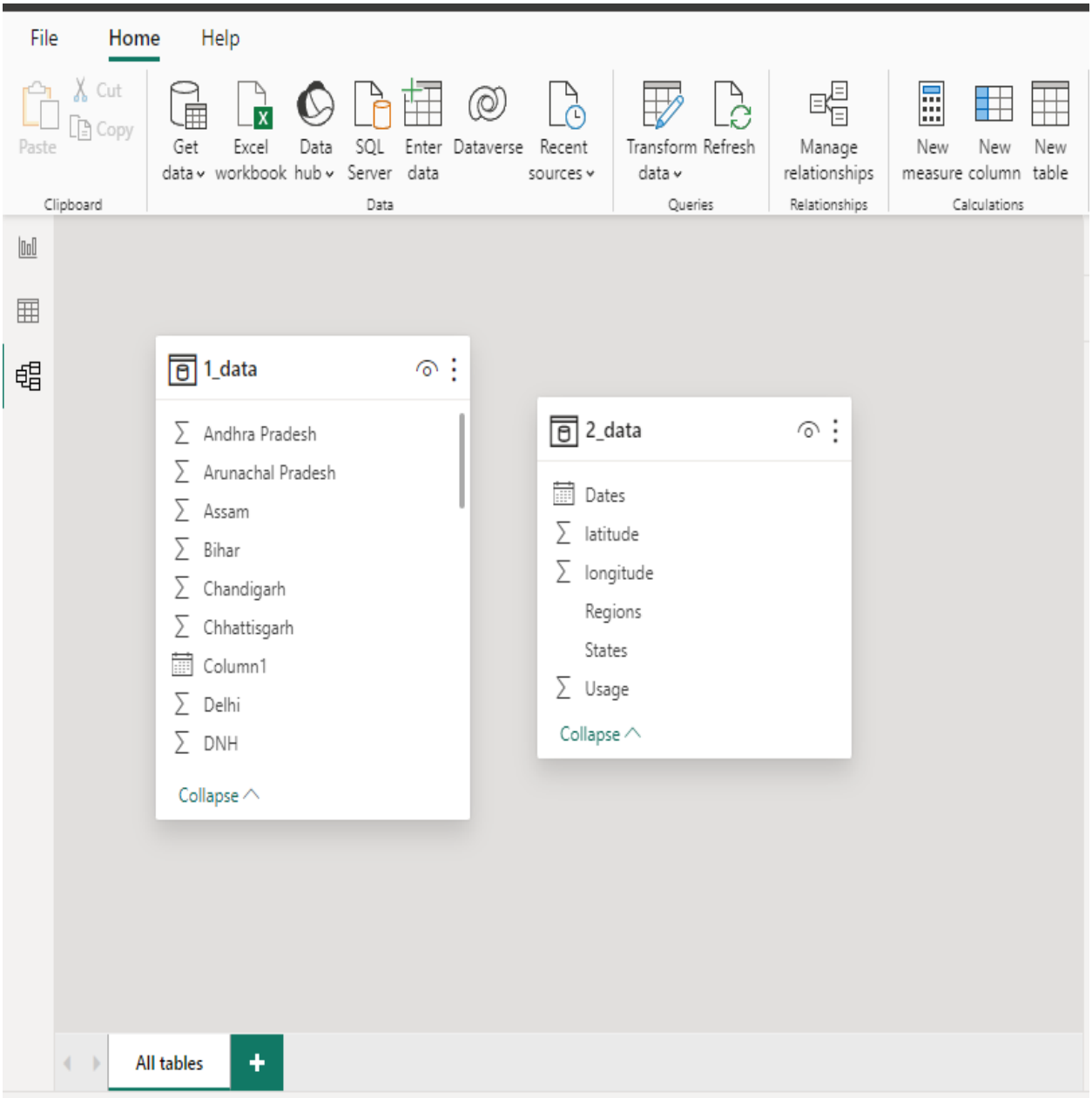
Data Access: The dashboards created in PowerBI can be accessed through PowerBI Desktop, PowerBI Service (online), and PowerBI Mobile.

CHAPTER 4

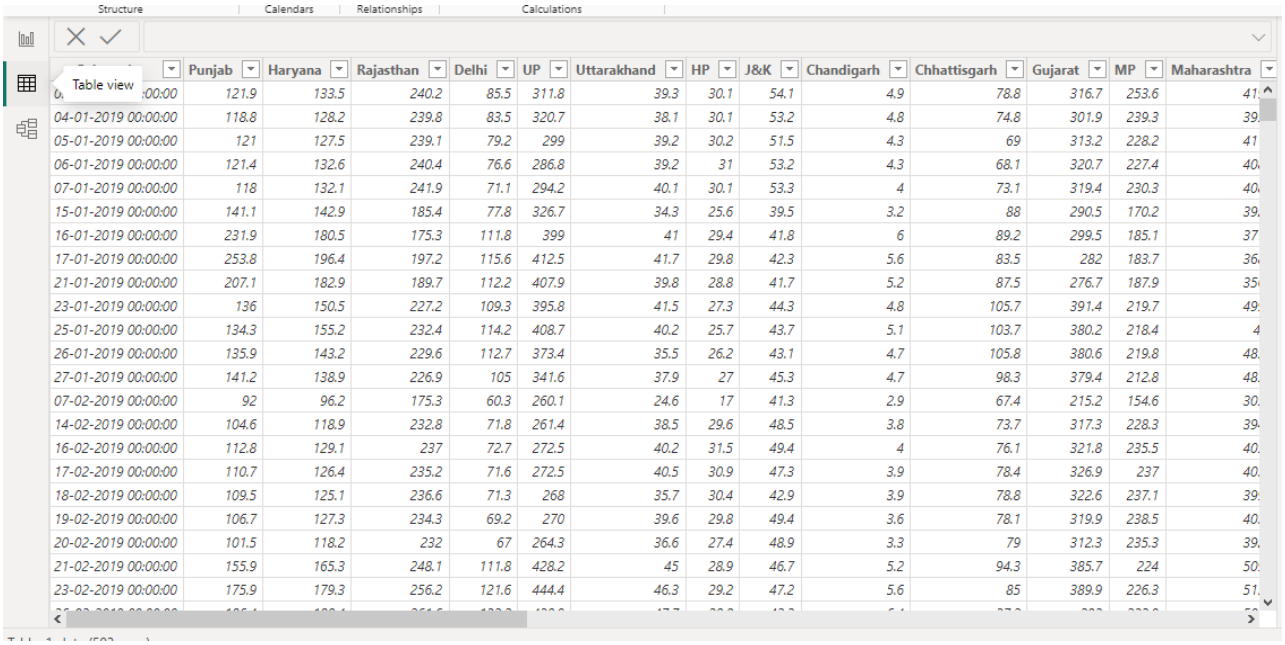
MODELING AND RESULT

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”

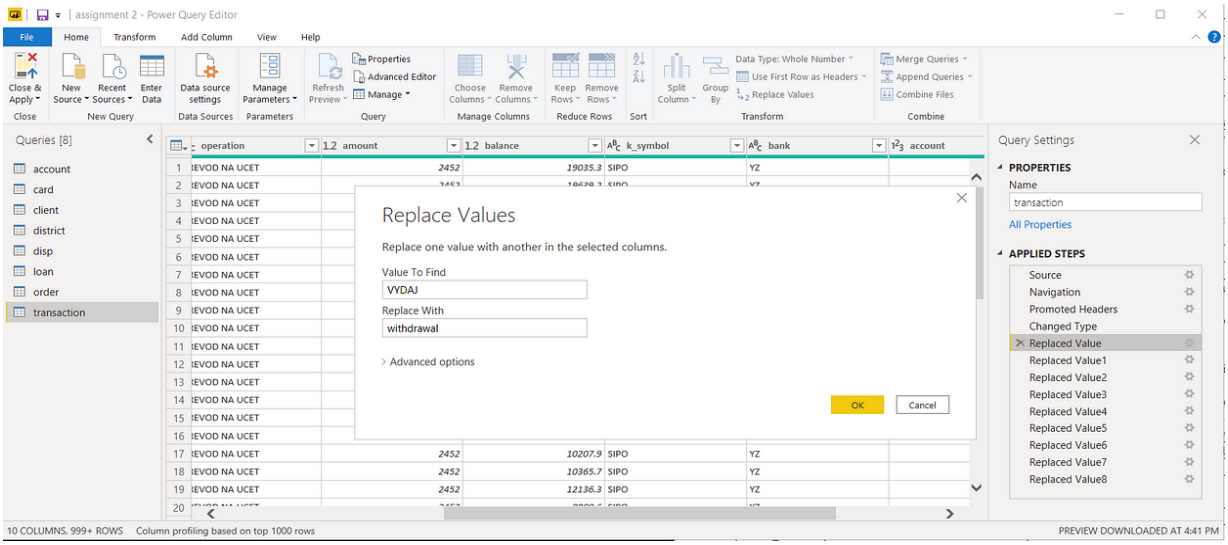

File
Home
Help
Cut
Copy
Paste
Get data
Excel workbook
Data hub
SQL Server
Enter data
Dataverse
Recent sources
Transform data
Refresh
Manage relationships
New measure
New column
New table
Clipboard
Data
Queries
Relationships
Calculations
1_data
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Chhattisgarh
Column1
Delhi
DNH
Collapse
2_data
Dates
latitude
longitude
Regions
States
Usage
Collapse
All tables

DATA MODEL



	Punjab	Haryana	Rajasthan	Delhi	UP	Uttarakhand	HP	J&K	Chandigarh	Chhattisgarh	Gujarat	MP	Maharashtra
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.

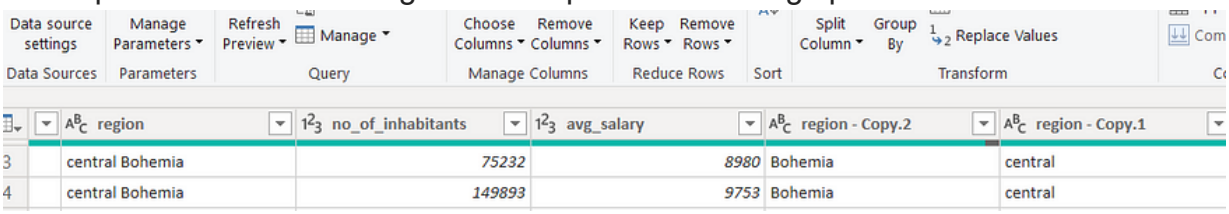
TABLE



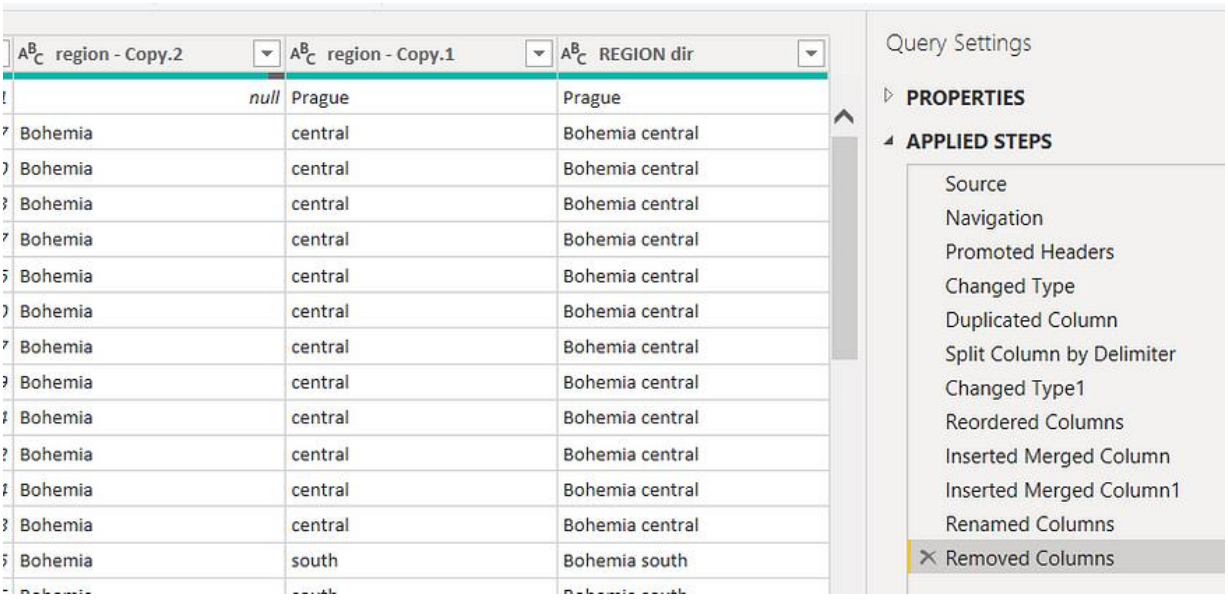
type	+/- transaction	"PRIJEM" stands for credit "VYDAJ" stands for withdrawal
k_symbol	characterization of the transaction	"POJISTNE" stands for insurance payment "SLUZBY" stands for payment for statement "UROK" stands for interest credited "SANKC. UROK" sanction interest if negative balance "SIPO" stands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



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



Grouping of age by ranges

As the customers' age ranges from 12 to 88, we shall group them into different generation age range for easier profiling, we will group the ages into 5 groups.

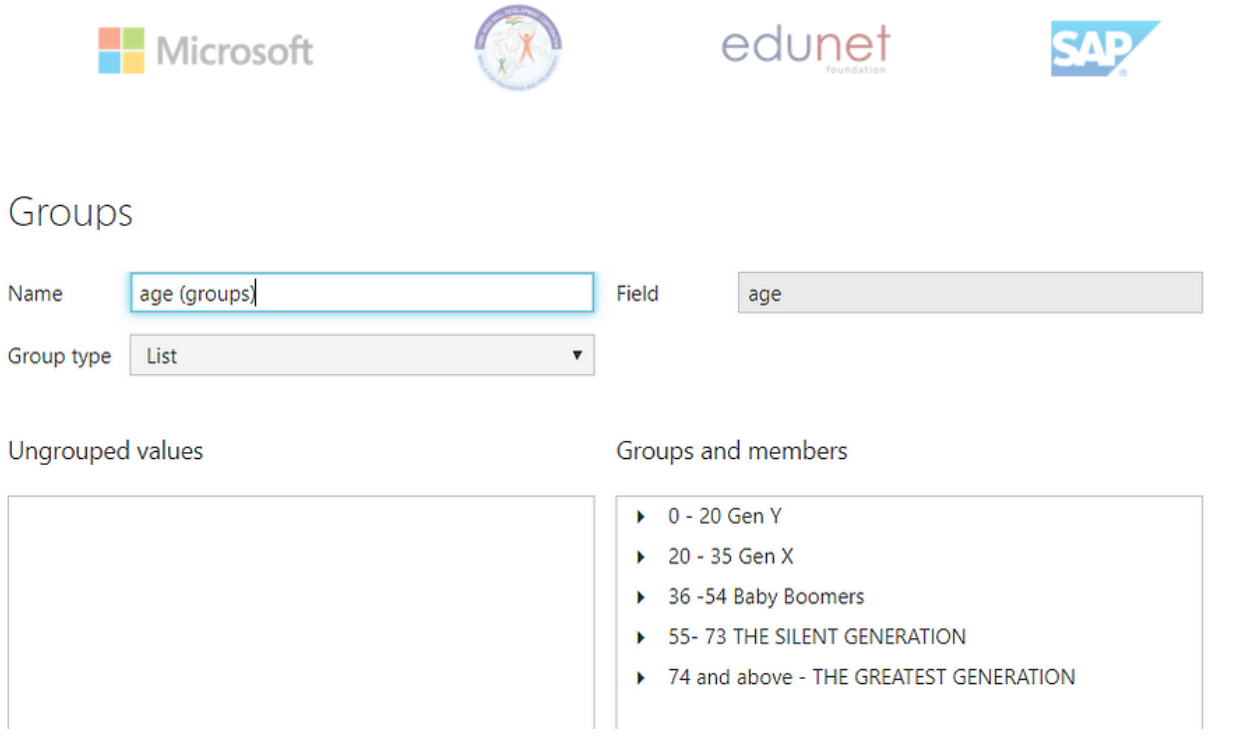
The Gen Y are youths,

Gen X are young working adults, some starting their families

Baby Boomer are working adults with families.

The silent Generations some are working and retired, living on pensions.

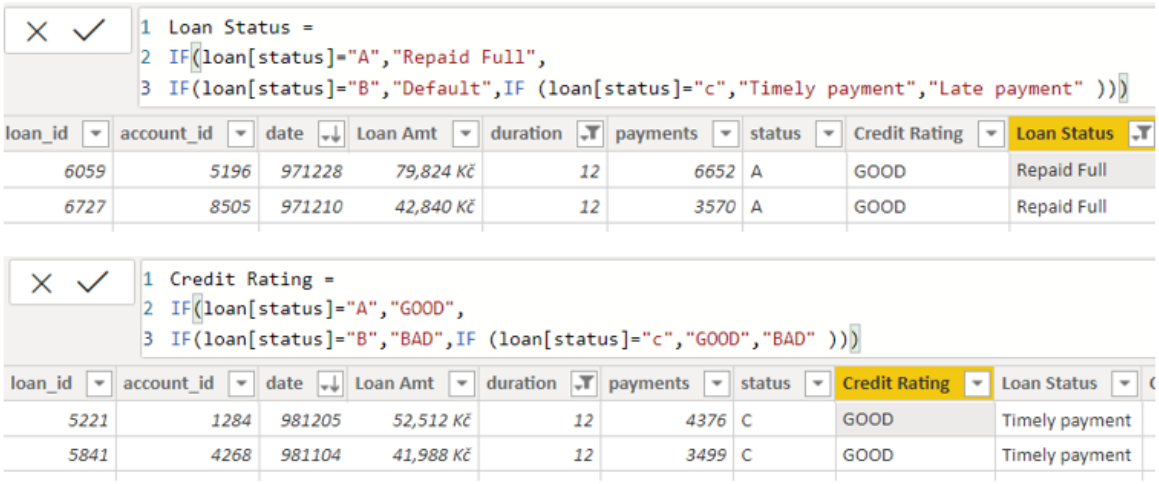
The greatest Generation, retired elderly living on pensions.



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" )))
```

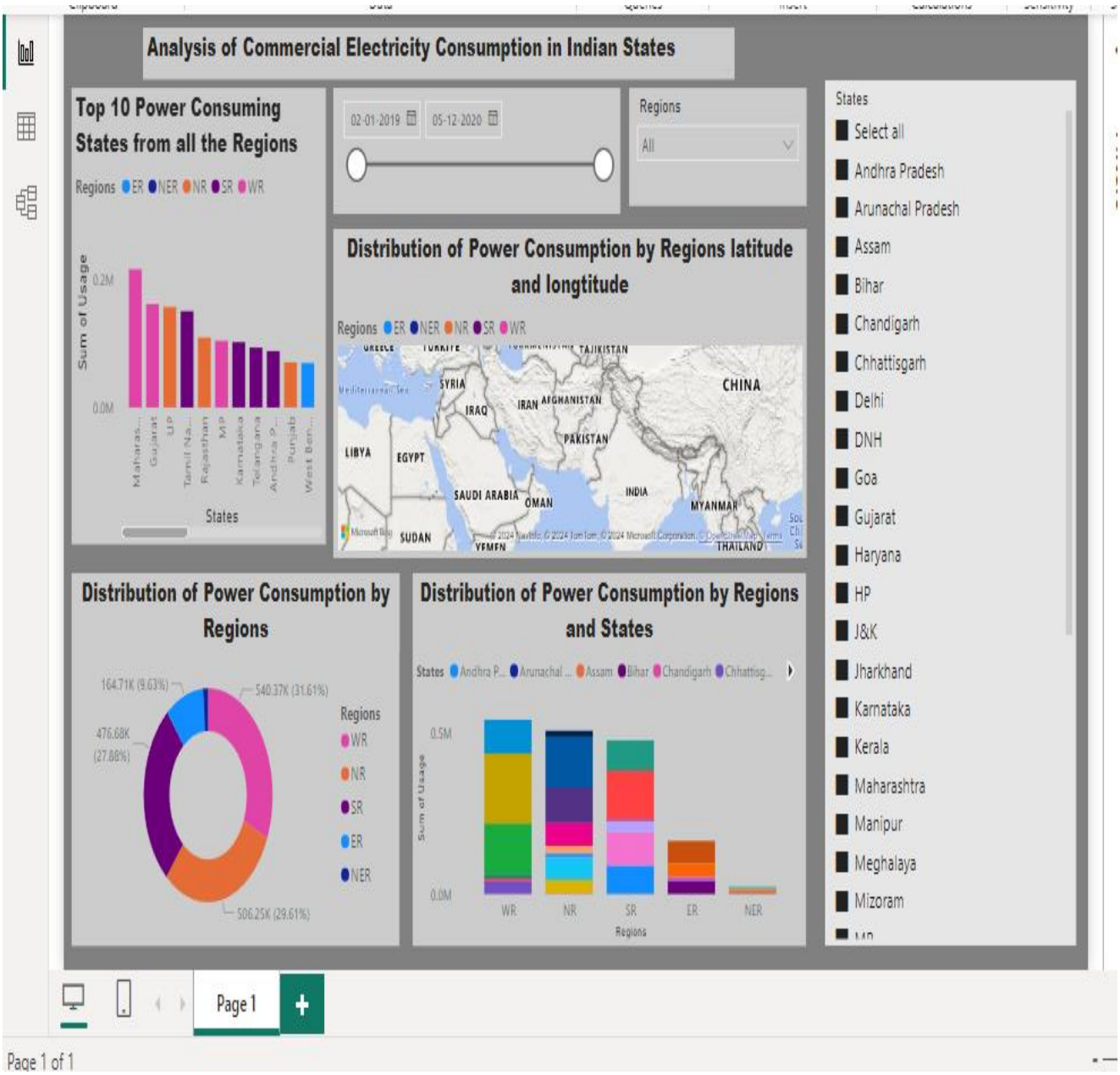
loan_id	account_id	date	Loan Amt	duration	payments	status	Credit Rating	Loan Status
6059	5196	971228	79,824 Kč	12	6652	A	GOOD	Repaid Full
6727	8505	971210	42,840 Kč	12	3570	A	GOOD	Repaid Full

```
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

Values of such as “account Id” have also been set as Text. And District name have been categorized as place to be use for the map to show the sum of the inhabitants in each region.

DASHBOARD


Analysis of Commercial Electricity Consumption in Indian States
Top 10 Power Consuming States from all the Regions
Regions ER NER NR SR WR
Sum of Usage
0.2M
0.0M
States
02-01-2019
05-12-2020
Regions
All
Distribution of Power Consumption by Regions latitude and longtitude
Regions ER NER NR SR WR
CHINA
IRAN
AFGHANISTAN
IRAQ
SYRIA
PAKISTAN
LIBYA
EGYPT
SAUDI ARABIA
OMAN
INDIA
MYANMAR
SUDAN
YEMEN
THAILAND
Distribution of Power Consumption by Regions
164.71K (9.63%)
540.37K (31.61%)
476.68K (27.88%)
506.25K (29.61%)
Regions
WR
NR
SR
ER
NER
Distribution of Power Consumption by Regions and States
States Andhra P... Arunachal ... Assam Bihar Chandigarh Chhattisg...
0.5M
0.0M
Sum of Usage
WR
NR
SR
ER
NER
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
Mizoram
Page 1
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CONCLUSION

The project “Analysis of Commercial Electricity Consumption in Indian States” using PowerBI has successfully demonstrated the potential of data analytics . The Analysis of Electricity Consumption of consumer data has provided valuable insights into consumer behavior, preferences, and trends, thereby facilitating informed decision-making. The interactive dashboards and reports have offered a comprehensive view of customer data, enabling the identification of patterns and correlations. This has not only improved the efficiency of data analysis but also enhanced the bank’s ability to provide personalized services to its customers. The project has also highlighted the importance of data visualization in making complex data more understandable and accessible. The use of PowerBI has made it possible to present data in a visually appealing and easy-to-understand format, thereby aiding in better decision-making.

FUTURE SCOPE

Business Intelligence or BI is an elaborate concept inclusive of a lot of aspects such as data analytics, visualization, infrastructural practices, and data mining. The goal is to make data-driven decisions and help companies grow. Power BI is one of the most celebrated Business Intelligence tools today. Power BI developer: Job role, Salary and Future is being searched a lot by those who are planning to acquire new skills. However, we will cover all these aspects later in this article.

Individuals who have completed their power bi training and certification have higher chances of excelling in this field. Since the demand for Power BI professionals is growing, we are going to discuss the job role, salary, and future scope of Power BI Developer in this blog.

According to our knowledge, Power BI will be one of the most demanded products shortly. One of the key things about this is that it works and looks like an advanced version of Excel, so people find it easy and flexible to use without much of a hiccup.

The future looks bright, and pursuing a career in the Power BI field will be one of the top-rated jobs in India and worldwide.

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