

# Tech Saksham

## Case Study Report

### Data Analytics with Power BI

# **“Analysis of commercial electricity consumption in Indian states ”**

## **“ST ALPHONSA COLLEGE OF ARTS & SCIENCE”**

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## **Abstract**

This study investigates the commercial electricity consumption trends in various states of India, aiming to identify patterns, drivers, and potential areas for efficiency improvement. Leveraging comprehensive data sets spanning multiple years, including economic indicators, demographic factors, and energy consumption metrics, a detailed analysis is conducted. The research employs statistical methodologies, including regression analysis and time-series modeling, to uncover insights into the factors influencing commercial electricity usage. Additionally, the study explores the impact of government policies, technological advancements, and socio-economic factors on electricity consumption patterns. The findings of this analysis provide valuable insights for policymakers, energy planners, and businesses to formulate strategies for sustainable energy management and promote economic growth while ensuring energy security.

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Problem Statement

**The commercial sector plays a crucial role in India's economy, accounting for a significant portion of electricity consumption. Analyzing commercial electricity consumption in Indian states can provide valuable insights into economic activity, infrastructure development, and energy policy formulation. The primary objective of this study is to analyze and understand the patterns and trends of commercial electricity consumption across different Indian states. Specific goals include Identifying the states with the highest and lowest commercial electricity consumption, Examining the factors influencing variations in consumption patterns, Assessing the impact of policy measures and economic factors on commercial electricity usage, Providing recommendations for optimizing energy usage and promoting sustainability.**

#### 1.2 Proposed Solution

A proposed solution for analyzing commercial electricity consumption in Indian states could involve data collection, data cleaning and processing, Exploratory Data Analysis, Statistical Analysis, Predictive Modeling and visualization.

#### 1.3 Feature

- **Feature Engineering:**

Extract relevant features such as time of day, day of the week, seasonality, and

economic indicators that may influence commercial electricity consumption.

- **Economic Indicators:**

Metrics such as GDP growth, industrial production, retail sales, and employment rates can provide insights into the overall economic activity and its impact on electricity demand.

- **Sectoral Analysis:**

Breakdown of consumption by sectors such as retail, hospitality, manufacturing, IT, and services can help identify specific industry trends and drivers of electricity demand.

- **Technological Trends:**

Adoption of energy-efficient technologies, renewable energy sources, and smart grid infrastructure can affect electricity consumption patterns.

- **Demographic Factors:**

Consideration of demographic variables such as population demographics, income levels, urbanization rates, and consumer behavior can help understand consumption patterns.

- **Competition and Market Dynamics:**

Analysis of competition among businesses, market saturation, entry of new players, and consumer preferences can influence electricity consumption patterns.

## 1.4 Advantages

Commercial electricity consumption in India offers several advantages, including:

- **Economic growth:**

Commercial electricity consumption fuels various industries and businesses, contributing to economic growth and job creation.

- **Increased productivity:**

Reliable electricity supply enables businesses to operate efficiently, leading to higher productivity and competitiveness in the global market.

## 1.5 Scope

The scope for analysis of commercial electricity consumption in an Indian state can be vast and multifaceted. Here are several aspects that could be explored: trends and patterns, sectoral analysis, and assess the environmental implications of commercial electricity consumption, including carbon emissions, air pollution, and resource depletion, and explore strategies for promoting sustainable energy consumption practices. By conducting a comprehensive analysis encompassing these various aspects, stakeholders can gain valuable insights into the dynamics of commercial electricity consumption in the state and formulate informed policies and strategies to promote sustainable development and energy security.

## CHAPTER 2

### SERVICES AND TOOLS REQUIRED

#### 2.1 Services Used

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

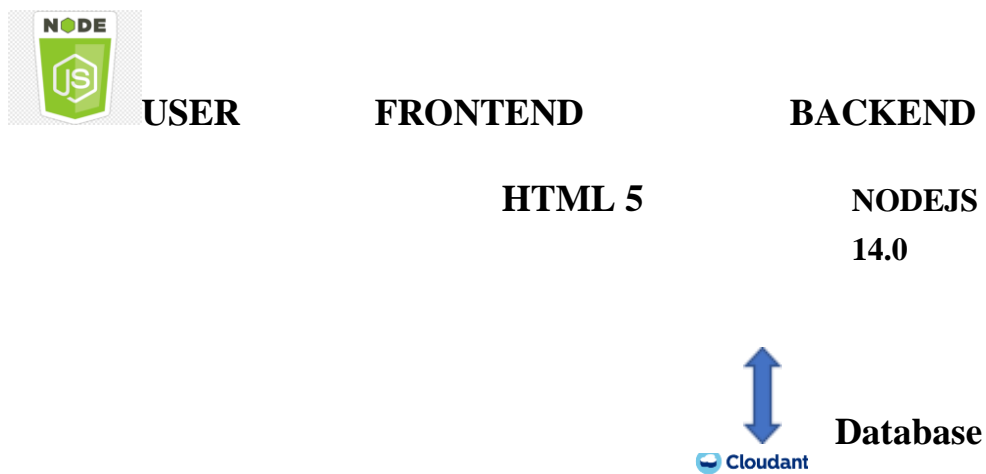
- **PowerBI Desktop:** This is a Windows application that you can use to create reports and publish them to PowerBI.
- **PowerBI Service:** This is an online SaaS (Software as a Service) service that you use to publish reports, create new dashboards, and share insights.

- **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





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

1. **Data Collection:** Real-time customer data is collected from electricity consumption . 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.
6. **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 commercial electricity consumption. It is important to ensure that all tools and services comply with relevant data privacy and security regulations.

## 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”

**Table 1: Appliance parameters**

<b>Type*</b>	<b>Average inst. load (kW)</b>	<b>Daily c (</b>
<b>n</b>	1.8	
<b>i</b>	3.2	
<b>n</b>	3.4	
<b>n</b>	0.44	
<b>n</b>	2	
<b>n</b>	0.8	
<b>c</b>	0.4	
<b>c</b>	0.12	
<b>c</b>	0.14	
<b>c</b>	0.6	
<b>c</b>	0.06	
<b>i</b>	1	

i – interruptible; n – non-interruptible.

## Modelling for appliances and electricity consumption

Electric oven	0.74	0.22	56
Microwave oven	0.23	0.07	74
Refrigerator	0.82	0.33	53
Fridge-freezer	1.9	0.56	58
Freezer	1.9	0.55	55
Colour-television set	0.91	0.27	97
Video recorder	0.3	0.09	76
Clothes-washing machine	0.8	0.20	88
Tumble-drier	0.78	0.28	49

Haryana	4	0	2	0	0	0	0	1.8	28	35.8
Karnataka	109.38	26	16.6	72.5	29.8	8	31.9	42	29	365.18
Madhya Pradesh		1	0	0	0	0	0	0	0	1
Maharashtra	24.5	0	11.5	0	40	38	71.5	33	184.5	403
Bundelk	22	0	0	6	0	0	0	24.5	10	74.5

For commercial electricity consumption in India state, the appliances and their electricity consumption is checked and valid here.

### Replacing values

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

4	Gujarat	0.50
5	Haryana	35.80
6	Karnataka	365.18
7	Madhya Pradesh	1.00
8	Maharashtra	403.00
9	Punjab	74.50
10	Rajasthan	73.30
11	Tamil Nadu	100.00

### Grouping of state by their electricity consumption:

Some state consume less electricity and more of them consume more electricity.

### Credit year -year electricity consumption

Year wise list of commissioned Biomass Power and CoGeneration Projects as on 31.03.2003	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
160.05	37.7	69.5	12	22	33	9	
	0	0	0	0	0	0	
11	0	0	16.5	85.8	33	9.8	43
0.5	0	0	0	0	0	0	
4	0	2	0	0	0	0	1
109.38	26	16.6	72.5	29.8	8	31.9	
	1	0	0	0	0	0	
24.5	0	11.5	0	40	38	71.5	
22	0	0	6	0	0	0	34
	7.8	0	7.5	8	0	8	
106	44.5	22.5	0	42.5	75	43.2	
0	0	0	0	0	0	0	
46.5	12.5	14	48.5	0	79	172	194
	0	0	0	0	0	0	
483.93	129.5	136.1	163	228.1	266	345.4	447

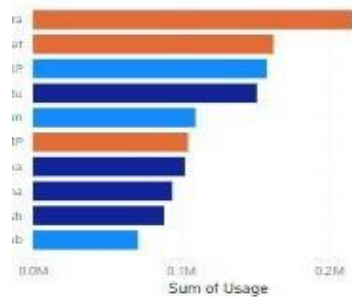
This shows year to year electricity consumption of India and it differentiated into different states and their electricity consumption is calculated.

# Dashboard

## ANALYSIS OF COMMERCIAL ELECTRICITY CONSUMPTION IN INDIAN STATES

by States and Regions

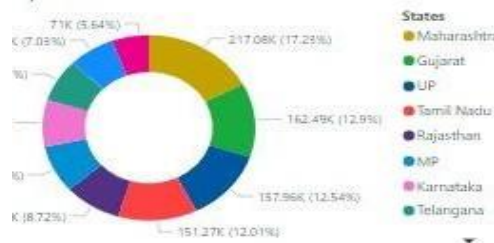
ISR WR



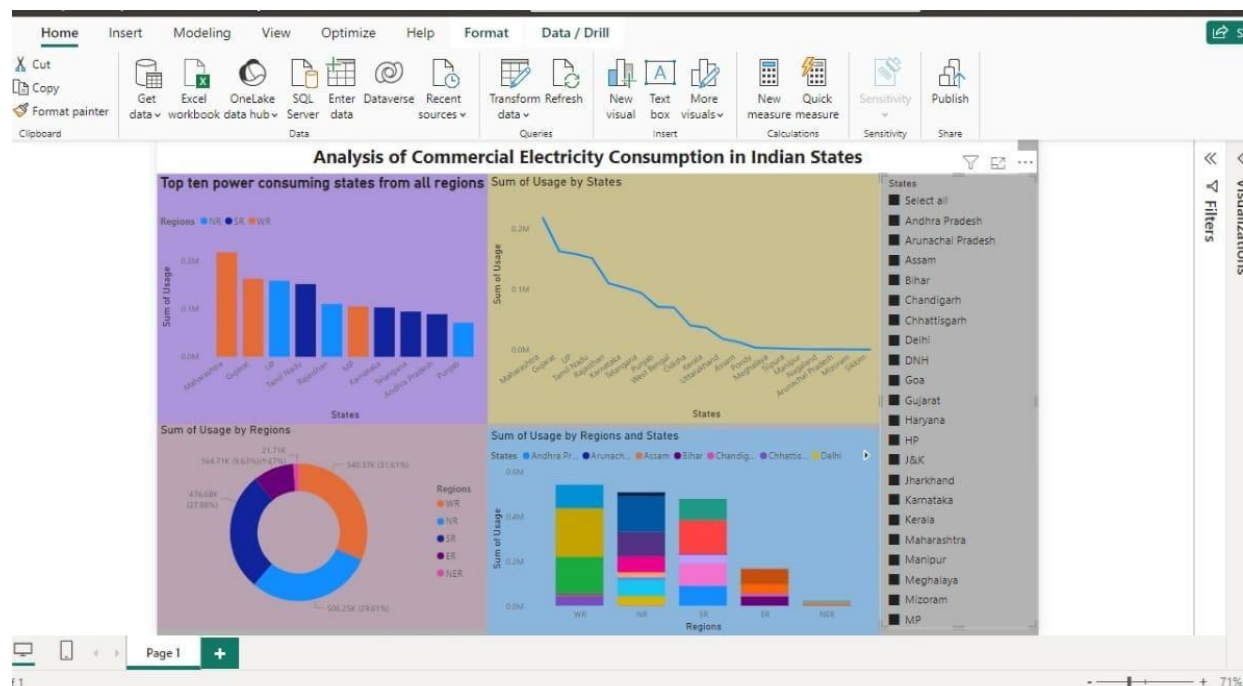
Sum of Usage by States



by States



Sum of Usage by Regions and States



## CONCLUSION

Based on the analysis of commercial electricity consumption in India state, it is evident that there are several key trends and patterns worth noting. Firstly, there appears to be a consistent increase in electricity consumption over the past few years, indicating potential economic growth and increased commercial activity within the state. Secondly, certain sectors such as manufacturing, hospitality, and retail seem to be the major contributors to commercial electricity usage, highlighting areas for targeted energy efficiency initiatives. Additionally, disparities in electricity consumption among regions within the state may suggest varying levels of economic development and infrastructure. Overall, addressing these trends and implementing strategies to promote energy efficiency could lead to sustainable development and improved energy management in the state's commercial sector.

## **. FUTURE SCOPE**

The future scope for analysis of commercial electricity consumption in an Indian state is vast and promising. Here are some potential areas for further exploration and research like temporal analysis, sectoral analysis, spatial analysis, and analyzing the adoption and impact of renewable energy technologies, such as solar or wind power, on commercial electricity consumption can provide insights into the transition to a low-carbon economy and the feasibility of renewable energy integration at scale.

By exploring these avenues, researchers and policymakers can deepen their understanding of commercial electricity consumption dynamics, inform evidence-based decision-making, and contribute to the sustainable development goals of the state and the nation.

## REFERENCES

<https://www.ceicdata.com/en/india/electricity-consumption-utilities/electricity-consumption-utilities-commercial>

## LINK

<https://github.com/rino30/project28.git>



