PLUGGING INTO THE FUTURE: AN EXPLORATION OF ELECTRICITY CONSUMPTION PATTERNS

A PROJECT REPORT

Submitted by

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CHAPTER - 1

INTRODUCTION

1.INTRODUCTION :

Analyzing Electricity Consumption in India from Jan 2019 till 5th December 2020. This data set contains a record of Electricity consumption in each states of India, here we are going to analyse State wise , Region wise and Overall Electricity consumption in India.

In this project we are trying to analyse the usage of electricity related data and able to extract some insights from the data using Business Intelligence tool. To extract the Insights from the data and put the data in the form of visualizations, Dashboard, Story with the help of Tableau tool.

Technical Architecture:
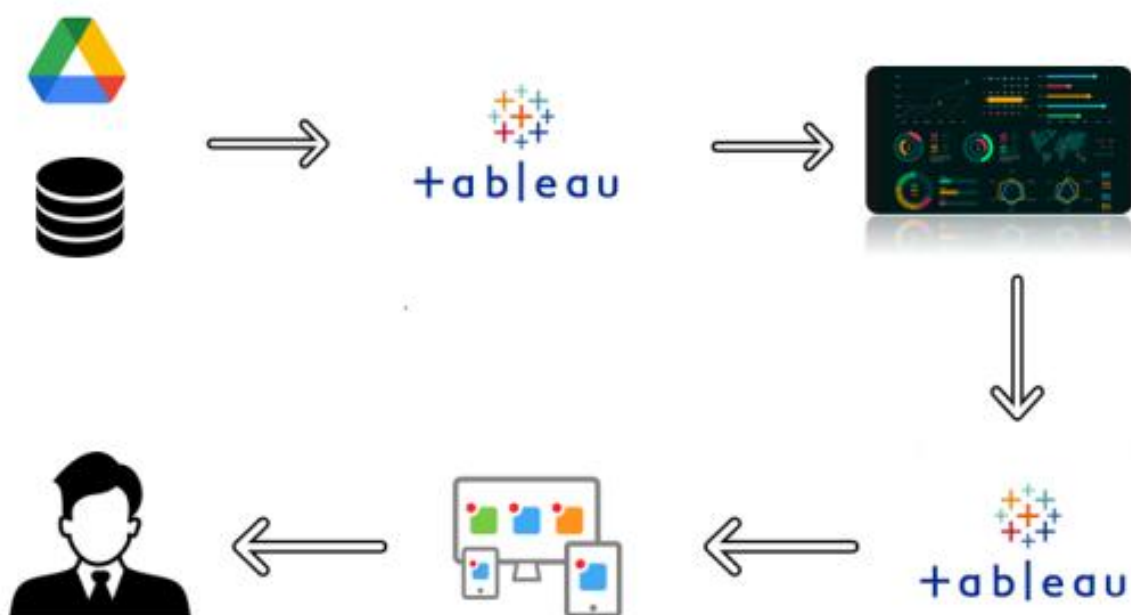
1.1 <u>OVERVIEW</u>

Project Description :

India is the world's third-largest producer and third-largest consumer of electricity. The national electric grid in India has an installed capacity of 370.106 GW as of 31 March 2020. Renewable power plants, which also include large hydroelectric plants, constitute 35.86% of India's total installed capacity. During the fiscal year (FY) 2019–20, the total electricity generation in the country was 1,598 TWh, of which 1,383.5 TWh generated by utilities. The gross electricity consumption per capita in FY2019 was 1,208 kWh.

In 2015-16, electric energy consumption in agriculture was recorded as being the highest (17.89%) worldwide. The per capita electricity consumption is low compared to most other countries despite India having a low electricity tariff.

In light of the recent COVID-19 situation, when everyone has been under lockdown for the months of March to June the impacts of the lockdown on economic activities have been faced by every sector in a positive or a negative way.

The data set is exhaustive in its demonstration of energy consumption state wise.

CHAPTER -2

PROBLEM DEFINITION & DESIGN THINKING

2.1. EMPATHY MAP

An Empathy Map is a tool used to help understand and empathize with the perspective of a particular user or customer. It is a visual representation of the user's attitudes, behaviors, emotions, and experiences that can be used to gain a deeper understanding of their needs and motivations. The Empathy Map is typically divided into **four quadrants**: **"Says," "Thinks," "Does,"** and **"Feels."** In each quadrant, the user's thoughts, feelings, actions and spoken words are recorded to help build a more complete understanding of their perspective. The Empathy Map is often used in design thinking and user experience research to help inform the design of products or services that better meet the needs of the user.

Says

It is impossible to control energy consumption

What if i pay the bill without knowing how much i was spending bill

How did i get this bill without knowing how much i was consuming

This month it was complicated to pay the energy bill

Does

I feel sad to buy electronic things

I suspect some appliances use lot of energy

I'm not controlling the power consumption

Thinks

How will i pay the energy bill this month?

How do i control the energy consumption were my children spend

I am spending too much without control it :(

Feels

I feel worried

I feel like everything out of control

I feel How do i pay this much bill??

I feel like i'm spending a lot of money

2.2 IDEATION & BRAINSTORMING MAP :

* Ideation and Brainstorming Maps are tools used to generate and organize ideas in a structured and visual way. They are commonly used in creative problem solving, innovation, and product design to generate a large number of ideas and then organize them into meaningful categories.

* Ideation and Brainstorming Maps typically start with a central theme or problem statement in the center of the map. From there, branches are drawn out to represent different categories or subtopics related to the central theme. These categories can then be further expanded with additional branches to represent specific ideas.

* The purpose of an Ideation and Brainstorming Map is to encourage free thinking and generate as many ideas as possible. It allows participants to visually see how ideas are connected and to build upon each other's ideas. The map can then be used to prioritize and refine the most promising ideas. There are many variations of Ideation and Brainstorming Maps, including Mind Maps, Spider Maps and Fishbone Diagrams.

☼ Idea Bank ☼

DEFINE
Consumption pattern of energy shows the percentage use of different sources This pattern of energy changes over time.
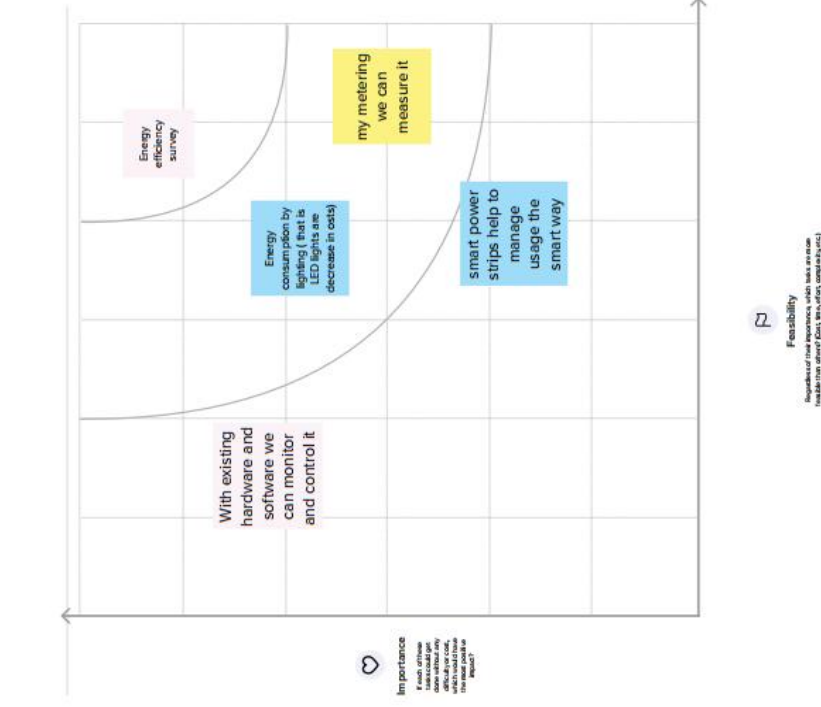
Problem
Electricity consumption was continued to go up rapidly faster than energy consumption.

What we need to do?!
We want to collect the data of electricity consumption pattern in diferrent regions

Person 1

- Improving energy efficiency can lower the utility bills
- Building management system to control your building services
- my metering we can measure it

Person 2

- Energy efficiency survey
- With existing hardware and software we can monitor and control it
- Select an energy efficient heating system that doesn't use electricity

Person 3

- Energy Audits(It can provide a list of items where deficiencies exist)
- Use a power strip to reduce your plug load
- Energy consumption by lighting (that is LED lights are decrease in osts)

Person 4

- Operational Fixes, it is the technical changes which will bear the quickest payback
- Dry your clothes and dishes naturally
- consuming less hot water will also reduce gas electricity bill

◈ Prioritize ◈

Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Feasibility
Regardless of their importance, which tasks are easier to solve (time, effort, complexity, etc.)

- Energy efficiency survey
- my metering we can measure it
- Energy consumption by lighting (that is LED lights are decrease in osts)
- smart power strips help to manage usage the smart way
- With existing hardware and software we can monitor and control it

CHAPTER - 3

# DATA COLLECTION & EXTRACTION FROM DATABASE IN MYSQL

3.1 Collect The Dataset :

Data collection is the process of gathering and measuring information on variables of interest in an established systematic fashion that enables one to answer stated research questions, test hypotheses, evaluate outcomes and generate insights from the data.

3.1.1 Understand The Data :

Data contains all the meta information regarding the columns described in the CSV files.

## 3.2: Storing Data In DB & Perform SQL Operations:
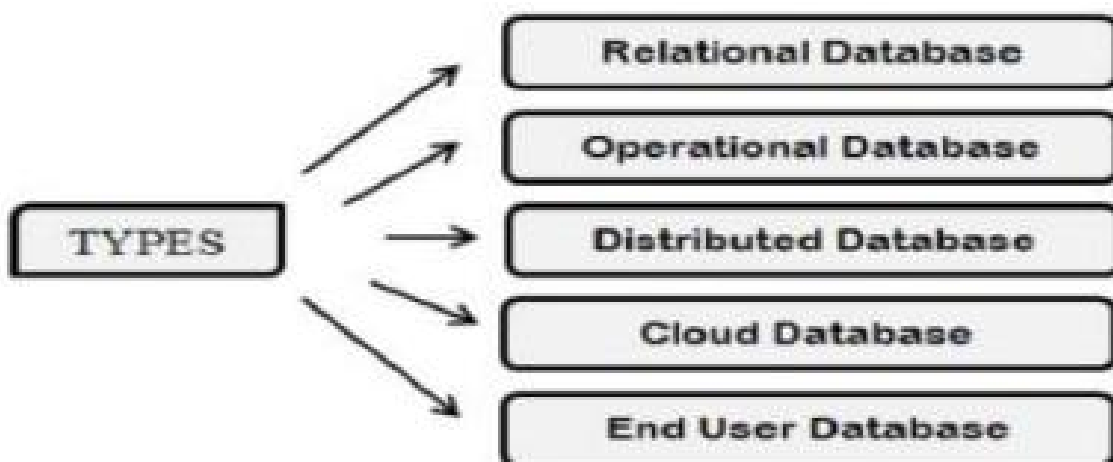
3.2.1. : Introduction To Database :

• A database is an organized collection of data, generally stored and accessed electronically from a computer system. It supports the storage and manipulation of data.

• Its ability to organize, process and manage information in a structured and controlled manner is the key to many aspects of modern business efficiency.

3.2.2.: Creating Database And Table In MYSQL :

• Click on the database icon on the icon menu panel to create the schema.
• Give the name of the schema and click on apply.
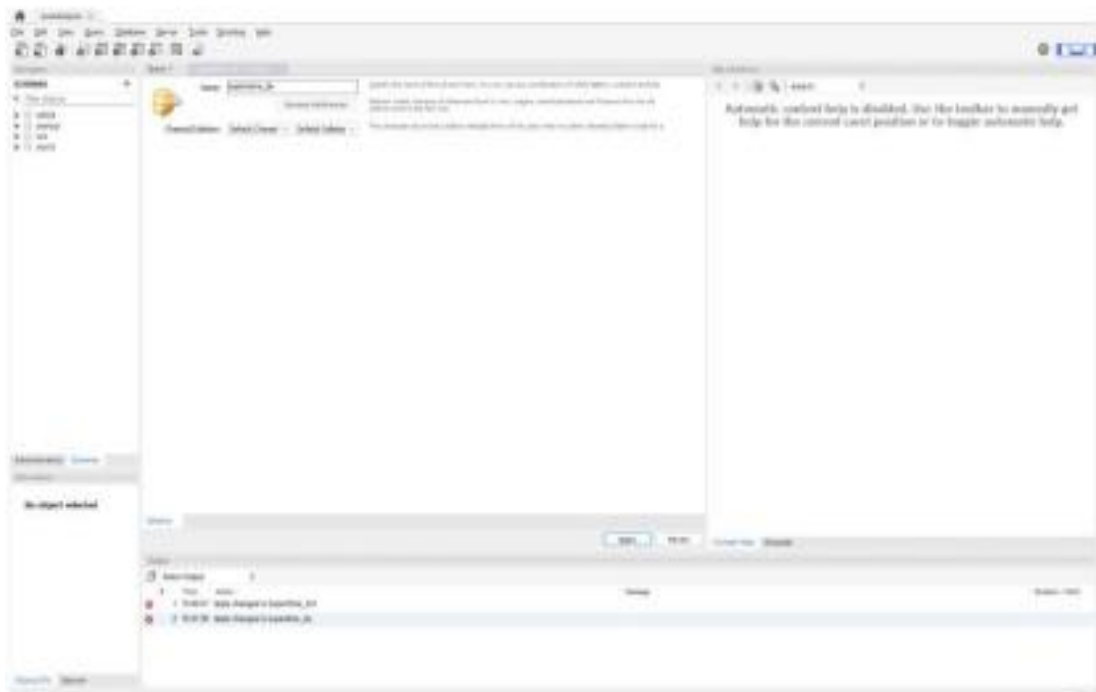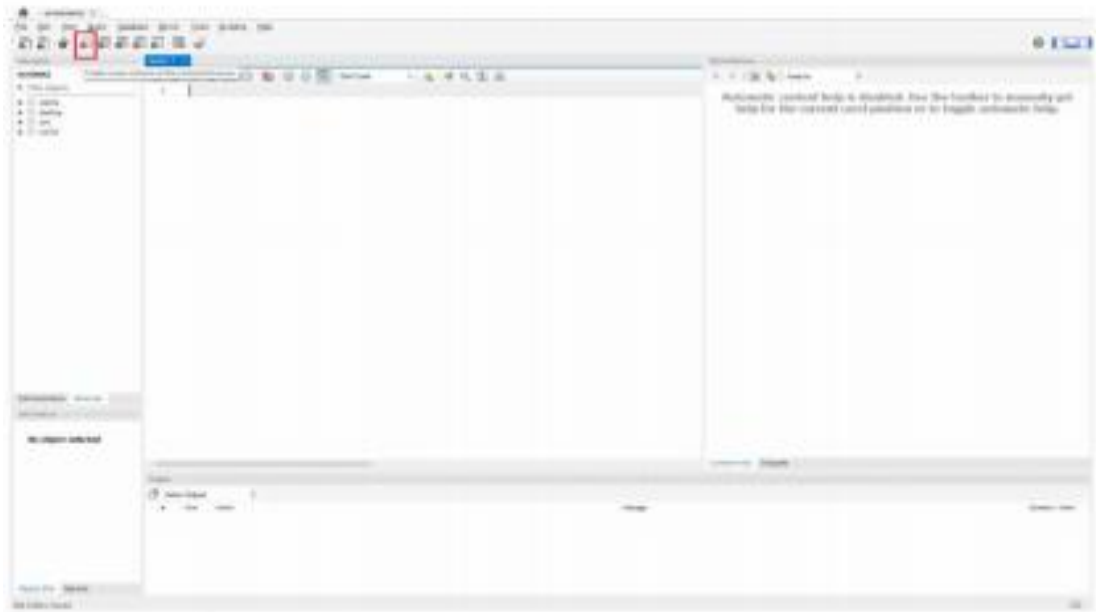
- Here you can see SQL query in SQL script for creation of new schema. Click on Apply.
- As you can see of the left panel Schema with the given name is created.
- Click on schema name and give a Right-Click on tables
- Now click on Table Data Import Wizard to load the dataset.
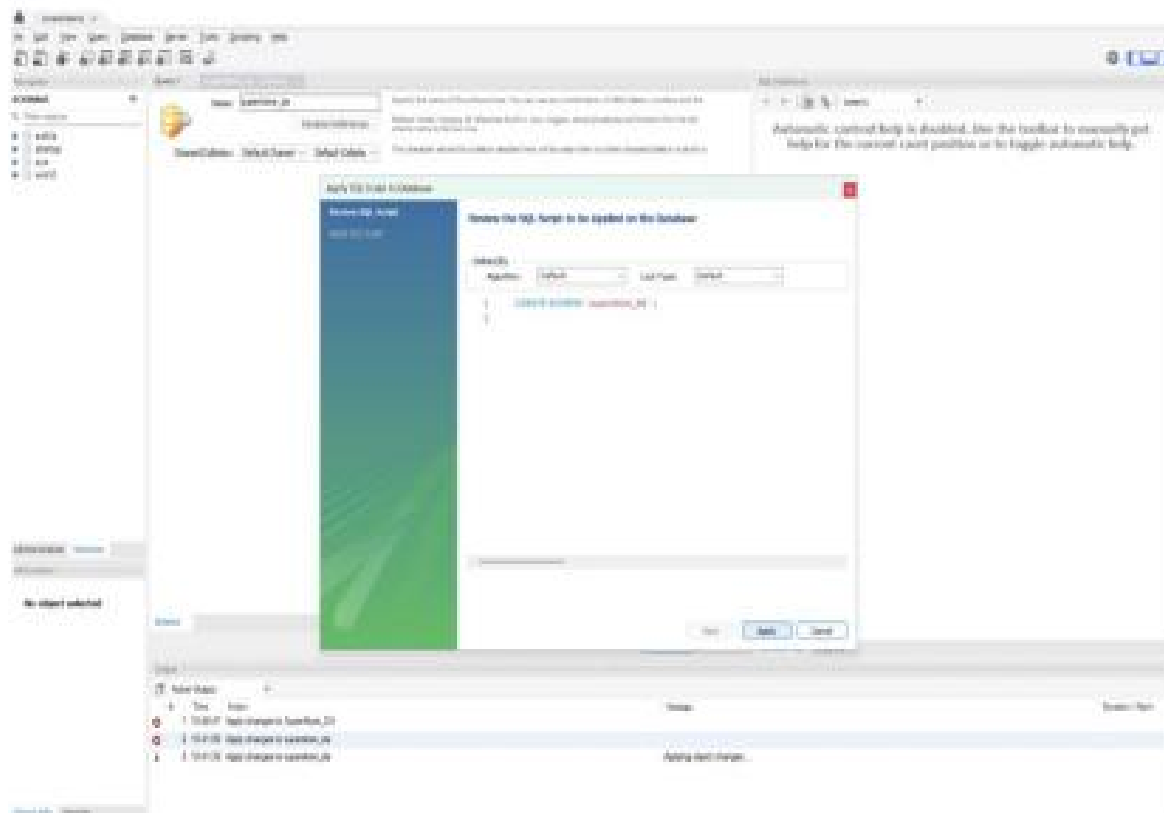
- Click on Browse and select the file in your computer to load the dataset file as a Table into that schema you created in MySQL.

- If you want add the dataset to existing table click on use existing table and select from the dropdown of tables lists.
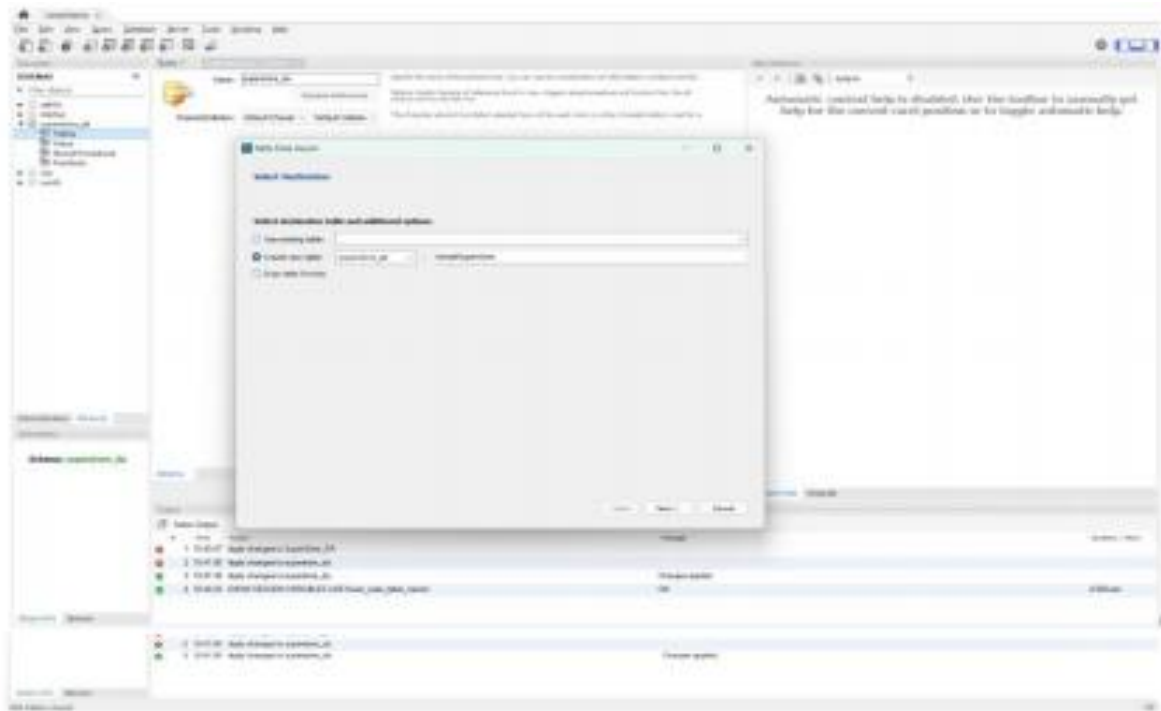
- Otherwise go with create new table and Click on **Next.**
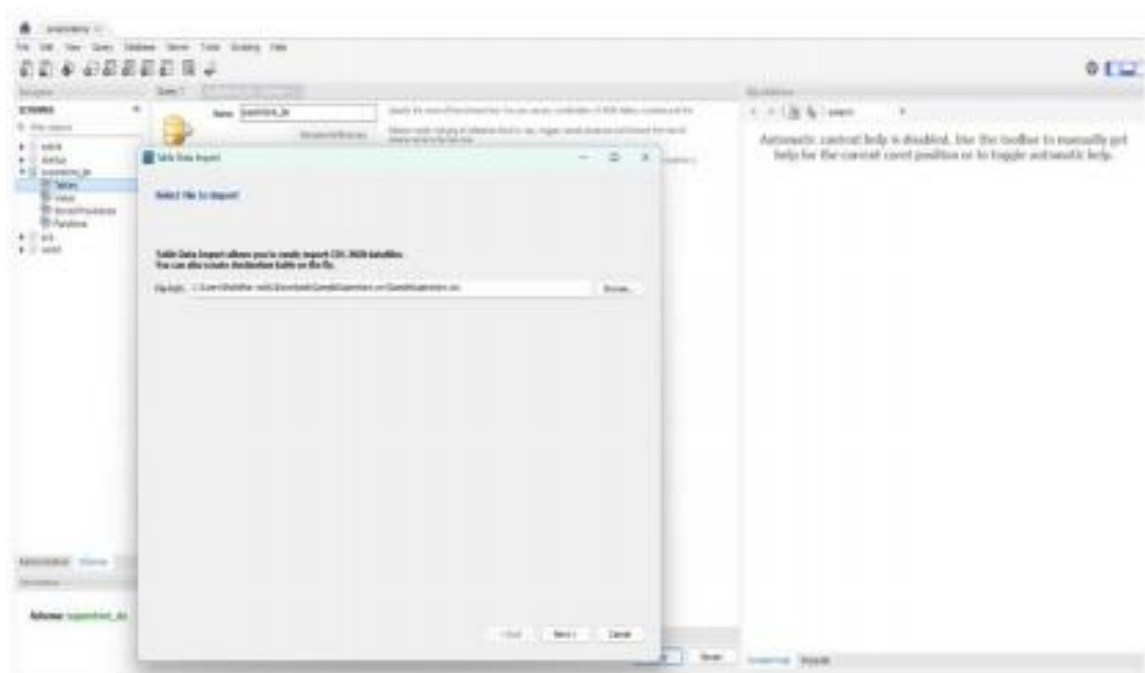
- Here you can see the dataset that loaded from the excel/csv file we have loaded and you can see the datatype of each column too.
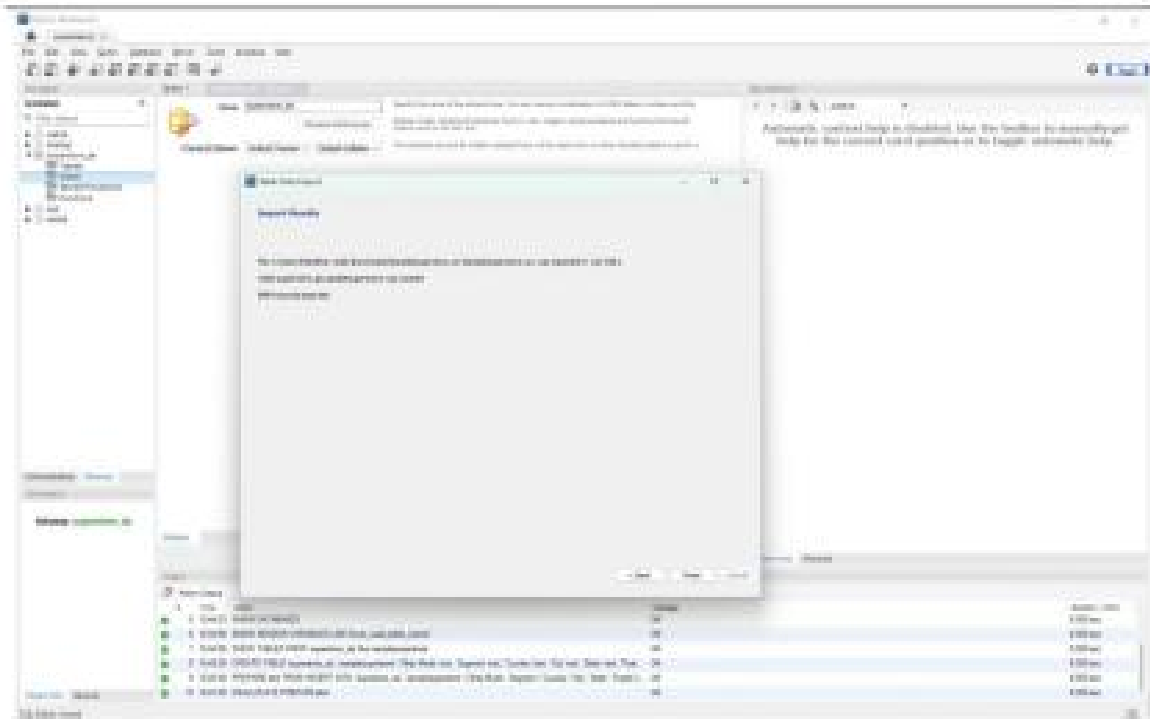
- Here you can see the total number of records/rows that are loaded.

- Here you can see the loaded dataset that we goby using select statement in query tab.

3.2.3 : CRUD Operations :

• CRUD is an acronym for

CREATE,

READ(SELECT),

UPDATE, and DELETE
statements in SQL
Server.

• CRUD in database terms can be mentioned as Data Manipulation
Language (DML) Statements.

3.2.4 : Basic SQL Operations :

• DDL – Data Definition Language
• DQL – Data Query Language
• DML – Data Manipulation Language
• DCL – Data Control Language
• TCL – Transaction Control Language

CHAPTER-4

INTRODUCTION TO TABLEAU

4.1.: What is Tableau?

• Tableau is a ground breaking data visualization software created by Tableau Software.

• Tableau connects easily and nearly any data source.

• Tableau allows for instantaneous insight by transforming data into interactive data visualizations called dashboards.

4.2.:Features of Tableau :
• Informative Dashboards
• Supports numerous Data Sources
• Provides Great Security
• Easy Collaboration & Sharing
• Provides Mobile Version
• Trend lines and Predictive analysis
• Availability of Geo Maps

4.3.: Products of Tableau :

• Tableau Public

• Tableau Server

• Tableau Desktop
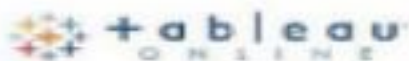
4.4.:Connecting Tableau with Data Sources :
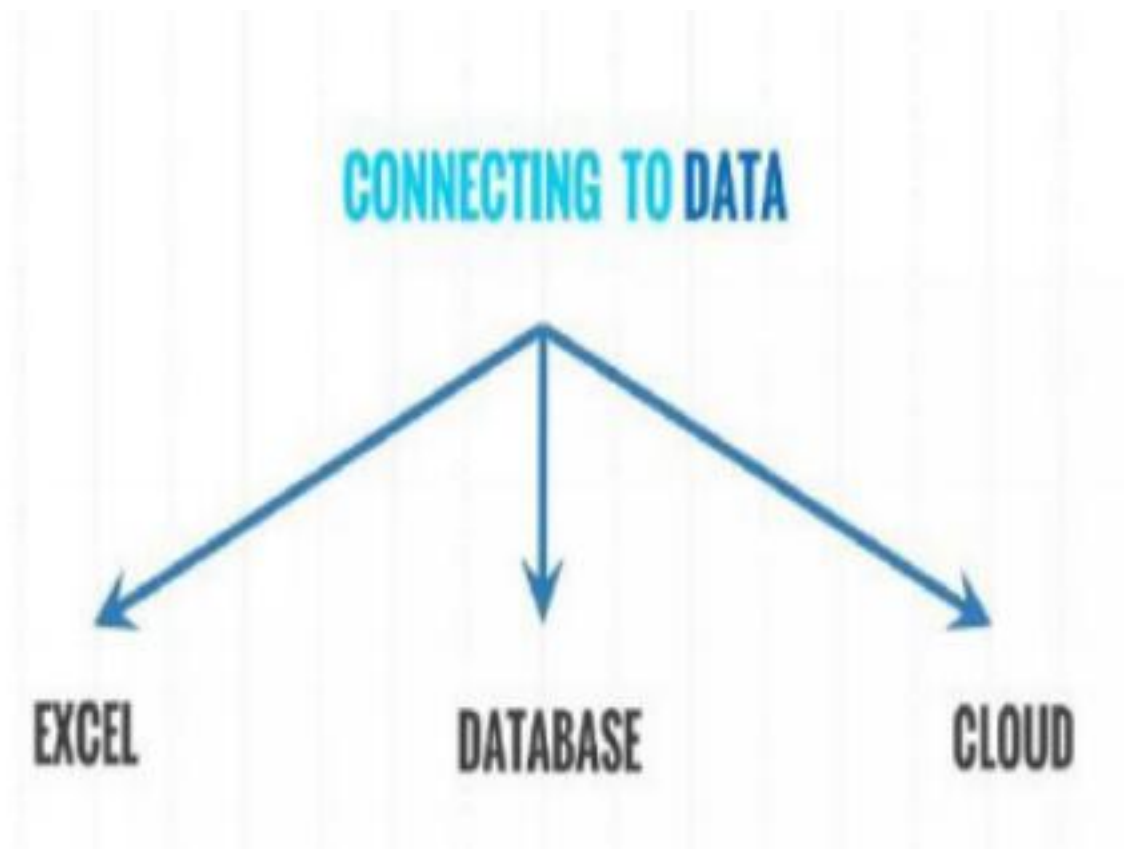
CHAPTER - 5

CONNECTING DATABASE AND TABLEAU

5.1.: Connecting Database and Tableau :

• Before you begin your analysis, you must connect to your data and then set up the data source.

• Before you can build a view and analyze your data, you must first connect Tableau to your data.

• Tableau supports connecting to a wide variety of data, stored in a variety of places.

• For example, your data might be stored on your computer in a spreadsheet or a text file, or in a big data, relational, or database on a server in your enterprise.

CHAPTER – 6

DASHBOARD AND STORIES

Regionwise State Consumption

Regions	States	2019	2020
ER	Bihar	30,008	11,821
	Jharkhand		
	Odisha	28,967	11,507
	Sikkim	466	182
	West Bengal	49,869	19,901
NER	Arunachal Pradesh	754	307
	Assam	8,979	3,575
	Manipur	895	360
	Meghalaya	2,018	821
	Mizoram	614	244
	Nagaland		311
	Tripura	1,483	
NR	Chandigarh	1,472	611
	Delhi	29,458	12,482
	Haryana	48,995	20,587
	HP	9,491	3,873
	J&K	15,915	6,350
	Punjab	49,636	21,361
	Rajasthan	78,139	31,738
	UP	112,690	45,270
	Uttarakhand	12,899	
SR	Andhra Pradesh	63,097	25,507
	Karnataka	73,077	29,589
	Kerala	25,798	10,515
	Pondy	2,653	1,106
	Tamil Nadu	106,720	44,551
	Telangana		
WR	Chhattisgarh	30,180	12,010
	DNH	5,845	2,419
	Goa	4,006	1,573
	Gujarat	115,357	47,131
	Maharashtra	154,917	62,163
	MP	74,975	

Usage axis: 0K 100K 200K

Top N

Year of Dat..

2019
- Maharashtra 154,917
- Gujarat 115,357
- UP 112,690
- Tamil Nadu 106,720
- Rajasthan 78,139

2020
- Maharashtra 62,163
- Gujarat 47,131
- UP 45,270
- Tamil Nadu 44,551
- Rajasthan 31,738

Bottom N

Year of Dat..

2019: Sikkim, Mizoram, Arunachal Prade.., Nagaland, Manipur

2020: Sikkim, Mizoram, Arunachal Prade.., Nagaland, Manipur

States legend: Andhra P.., Arunacha.., Assam, Bihar, Chandiga.., Chhattis.., Delhi, DNH, Goa, Gujarat, Haryana, HP, J&K, Jharkhand, Karnataka, Kerala, Maharas.., Manipur, Meghala.., Mizoram, MP, Nagaland, Odisha, Pondy, Punjab, Rajasthan, Sikkim, Tamil Na.., Telangana, Tripura

Top N: 5
Bottom N: 5

Dashboard 1 | **Dashboard 3**

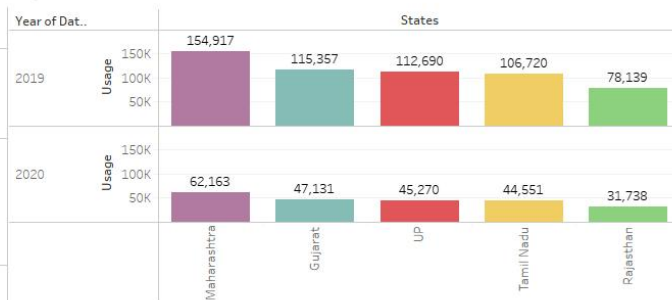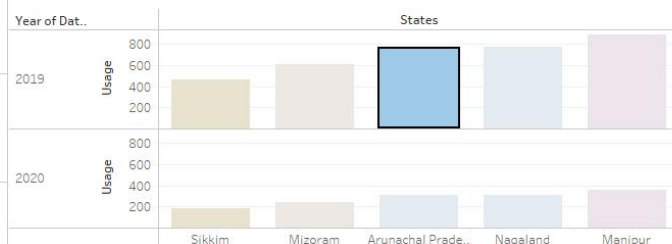Tabs: tate Consumption | Quarter wise Usage | Usage by Year | Metro City States | Year Wise Consumption in Region | Sheet 17 | Dashboard 1 | **Dashboard 2** | Dashboard 3 | Story on Electricity Consum...

Quarter wise Usage

2019: Q3 326,221 | Q2 301,654 | Q4 299,914 | Q1 288,416
2020: Q1 238,717 | Q2 147,463 | Q4 54,900 | Q3 52,444

2019 Monthwise Consumption

Q1: January 101,306 | February 87,276 | March 99,834
Q2: April 103,151 | May 101,728 | June 96,776
Q3: July 118,600 | August 105,274 | September 102,347
Q4: October 102,443 | November 93,289 | December 104,183

Usage legend: 52,444 — 326K

Year of Dates: 2019, 2020

Month of Dates: January, February, March, April, May, June, July, August, September, October, November, December

Usage by Year

2019: January 101,306 | February 87,276 | March 101,728 | April 103,151 | July 118,600 | August 102,347 | October 102,443 | November 93,289
2020: January 85,319 | March 77,012 | April 78,242 | May 53,559 | June 15,661 | July 17,131 | August 17,178 | September 18,134 | October 18,537 | December 18,281

2020 Monthwise Consumption

Q1: January 85,319 | February 76,385 | March 77,012
Q2: April 78,242 | May 53,559 | June 15,661
Q3: July 17,131 | August 18,134 | September 17,178
Q4: October 18,537 | November 18,082 | December 18,281
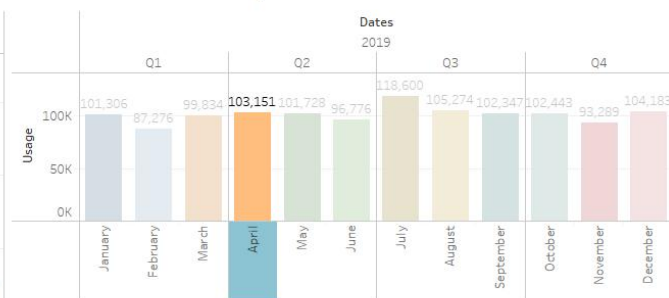
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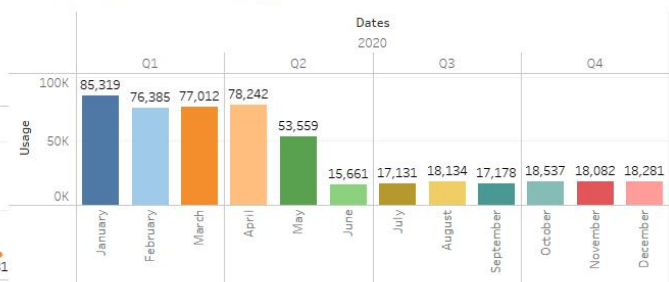
2019 State Consumption

2020 State Consumption

Year Wise Consumption in Region

ER 117,915
WR 385,280
NR 358,695
SR 338,795

2020
ER 46,799
WR 155,089
NR 147,560
SR 137,883

States
- Andhra Pradesh
- Arunachal Pradesh
- Assam
- Bihar
- Chandigarh
- Chhattisgarh
- Delhi
- DNH
- Goa
- Gujarat
- Haryana
- HP
- J&K
- Jharkhand
- Karnataka
- Kerala
- Maharashtra
- Manipur
- Meghalaya

Usage
- 493,523
- 600,000
- 800,000
- 1,000,000
- 1,216,205

Regions
- ER
- NER
- NR
- SR
- WR

Usage
182 — 154,917

Total Region Consumption

ER 164,714
WR 540,370
NR 506,255
SR 476,679

Total Consumption

Dashboard 2

State Consumption | Quarter wise Usage | Usage by Year | Metro City States | Year Wise Consumption in Region | Sheet 17 | **Dashboard 1** | Dashboard 2 | Dashboard 3 | Story on Electricity Consum...
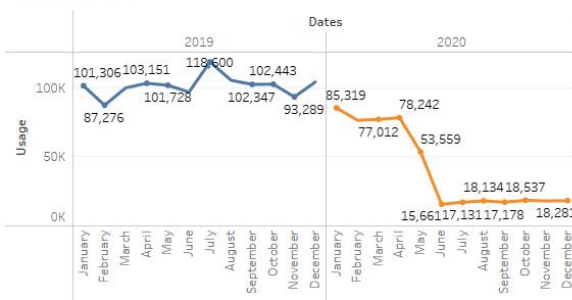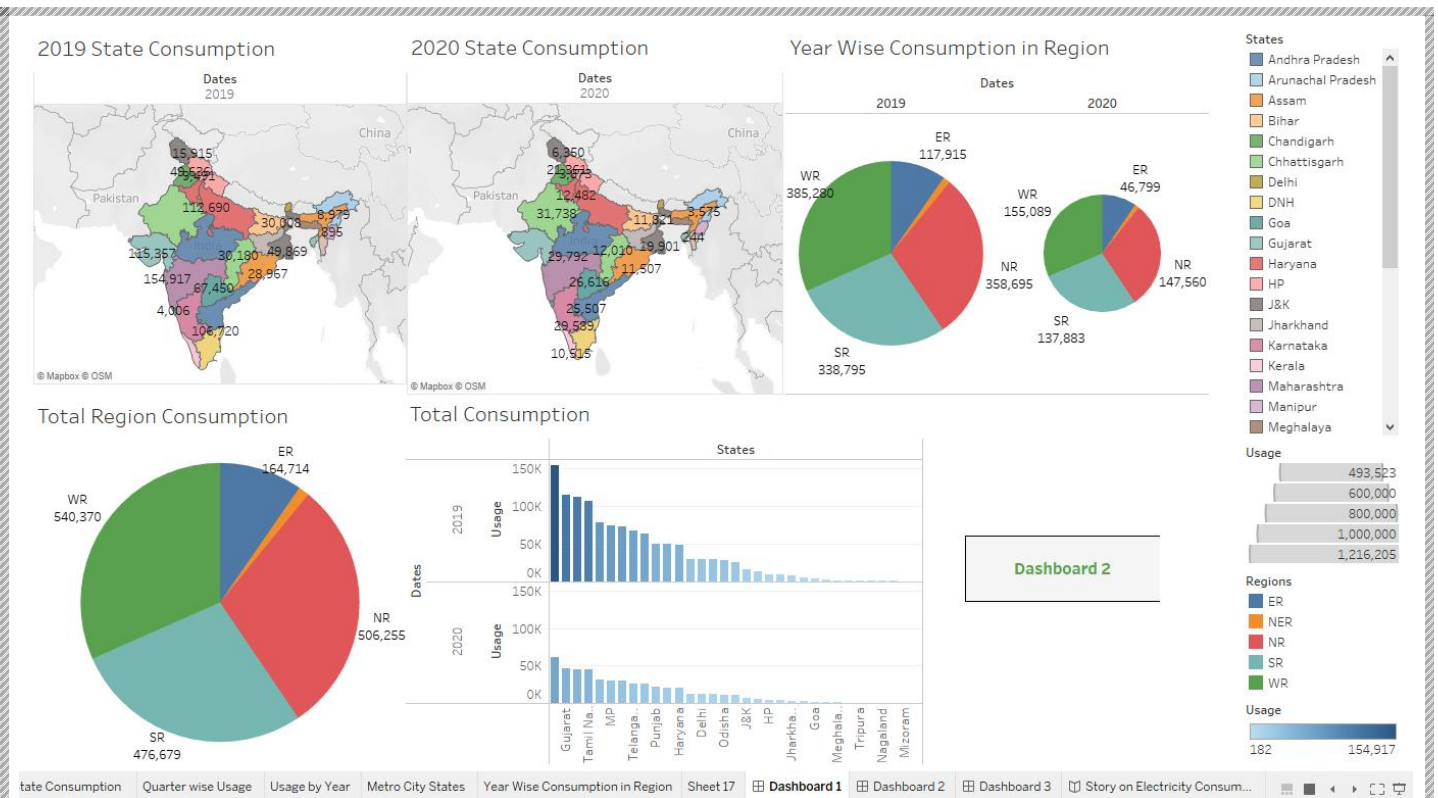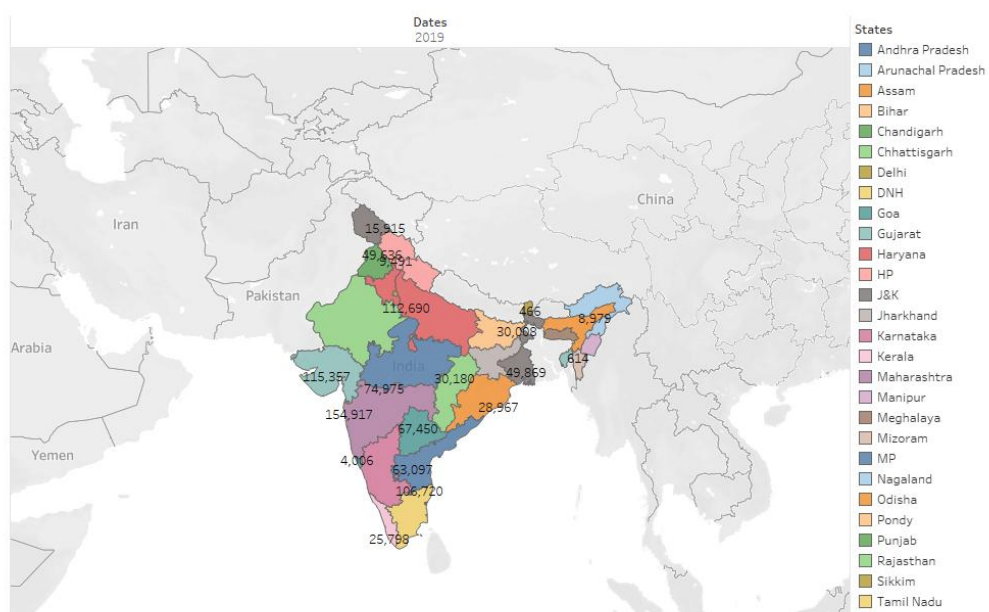
STORY

Story on Electricity Consumption in India

Electricity Consumption by Indian States in 2019 | Electricity Consumption by Indian States in 2020 | Bar plot for Total Electricity Consumption by Indian | Regionwise plot clearly State Consumption in 2019 is | Plot defines Top Consumption by Indian States in year 2019 | Plot defines Bottom Consumption by Indian States in year 2019 | In Y Con wa

States
- Andhra Pradesh
- Arunachal Pradesh
- Assam
- Bihar
- Chandigarh
- Chhattisgarh
- Delhi
- DNH
- Goa
- Gujarat
- Haryana
- HP
- J&K
- Jharkhand
- Karnataka
- Kerala
- Maharashtra
- Manipur
- Meghalaya
- Mizoram
- MP
- Nagaland
- Odisha
- Pondy
- Punjab
- Rajasthan
- Sikkim
- Tamil Nadu

State Consumption | Quarter wise Usage | Usage by Year | Metro City States | Year Wise Consumption in Region | Sheet 17 | Dashboard 1 | Dashboard 2 | Dashboard 3 | **Story on Electricity Consu...**

CHAPTER - 7

CONCLUSION

Electricity Consumption States

- Maharashtra is the Highest Electricity consumption user of India.
- Gujarat is the Second Highest Electricity consumption user of India.
- Sikkim is the Lowest Electricity Consumption user of India .

Electricity Consumption before and during Lockdown in India

- Electricity consumption was more in 2019 in month of March-June before Lockdown
- Electricity Consumption was less in 2020 in month of March-June during the Lockdown

<u>Electricity Consumption in Quarters</u>

- Electricity Consumption in 2019 for Quarter 3 was Highest.
- Electricity Consumption in 2019 for Quarter 1 was Lowest.
- Electricity Consumption in 2020 for Quarter 3 was Lowest.
- Electricity Consumption in 2020 for Quarter 1 was Highest.

<u>Electricity Consumption in Regions</u>

- Total Electricity consumption in Western Region is Highest.
- Total Electricity consumption in North Eastern Region is Lowest.
- Electricity Consumption in 2020 for Quarter 3 was Lowest.
- Electricity Consumption in 2020 for Quarter 1 was Highest.