Plugging into the Future: An Exploration of Electricity Consumption Patterns

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.

In light of the extraordinary impact of the Covid-19 pandemic and resulting lockdown measures on the energy system. COVID-19 is shifting the burden of energy costs to households through increased WFH and teleworking. Moreover, home-based working patterns influence residential energy demand by increasing energy consumption for heating, cooling, lighting, cooking, IoT devices, and other uses. Therefore, it is essential to accurately estimate the net energy impacts of teleworking for a country like India, where the spatial energy inequality is high within the urban areas.

The Electricity consumption in India during pandemic situation is low compared to normal situations. During pandemic only Households have used most of the Electricity and other all the industries, vechicle services,Malls,..etc.. are not involved in Electricity Consumtion. So Electricity demand in India was decresed.

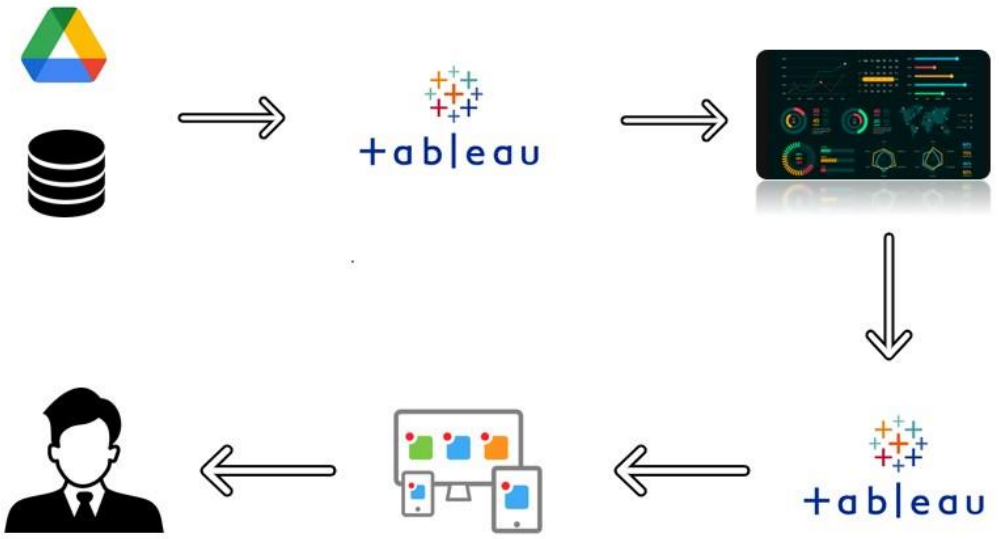
All this information about Electricity was collected based on dataset.

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

In this project we will Analyse the Electric Consumption during pandemic Situation in each states of India.

Analysing Electricity Consumption in India from Jan 2019 till 5th December 2020. This dataset 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.

Technical Architecture:



Milestone 1: Define Problem

Activity 1: Specify the business problem

In this project we will Analyse the Electricity Consumption during pandemic Situation in each States of India. And create a dataset record of Electricity consumption of each state from January 2019 to December 2020.

Activity 2: Business requirements

The business requirements for analysing analysis on electricity consumption in India. Identify the current patterns of electricity consumption in different regions and sectors of India. This information can be used to identify areas where consumption is high and areas where it is low. Identify opportunities for improving energy efficiency and reducing consumption in different sectors and regions. This information can be used to develop policies and programs to promote energy efficiency. This information can be used by government agencies, electricity providers, and investors to develop policies and make investment decisions that promote sustainable energy development and consumption in India.

To Analyse Electricity Consumption we need some requirements:

Identifying Consumption Patterns: nderstand the patterns of electricity consumption over time, such as daily, weekly, monthly, and seasonal variations. This could help businesses anticipate peak demand periods and plan accordingly.

Environmental Impact Assessment: Evaluate the environmental impact of electricity consumption, such as greenhouse gas emissions or resource depletion. Businesses may want to track their carbon footprint or assess the sustainability of their energy sources.

Energy Efficiency Analysis: Assess the effectiveness of energy efficiency initiatives or programs in reducing electricity consumption. Businesses may want to measure the impact of energy-saving measures, such as upgrading equipment, implementing energy management systems, or promoting behavior change among consumers.

Risk Management: Identify and mitigate risks associated with electricity consumption, such as supply disruptions, price volatility, regulatory changes, or security threats. Businesses may want to develop contingency plans or risk mitigation strategies to minimize potential impacts on their operations.

Activity 3: Literature Survey :

The topic of electricity consumption in India is a well-researched area, with many studies having been conducted to understand consumption patterns and trends, as well as the impact of government policies and investment opportunities.A study by (Kumar et al., 2020) analyzed the electricity consumption patterns in India and identified the major contributors to the consumption. The study found that the residential sector was the largest consumer of electricity, followed by the commercial and industrial sectors. Another study by (Jain and Rathi, 2019) analyzed the impact of government policies on electricity consumption in India. The study found that policies promoting energy efficiency and renewable energy development have had a positive impact on reducing electricity consumption in India.

India went on a complete nationwide lockdown between March 25, 2020 to May 31, 2020 as a reactive measure to contain the COVID-19 pandemic (Debnath and Bardhan, 2020). Existing evidence shows that during the first week of lockdown, all India electricity consumption dropped by 22% (~2600 GWh) as compared to the peak demand of the previous week (~3600 GWh) (POSOCO, 2021; Prayas Energy Group, 2020). As a result, the daily electricity consumption was 20–40% lower than its corresponding value in 2019 (Aruga et al., 2020). It began to reverse from May 2020 as the unlocking began in India. However, this reversal was asymmetrical across the commercial and residential sectors (Amritha Pillay, 2020). More specifically, it was reported that an increase in summer temperatures due to heatwaves and people spending more time at home during lockdown resulted in 26% more residential electricity consumption in western India (Bielecki et al., 2021; Prayas Energy Group, 2020; PTI, 2020; Thomson Reuters, 2020). Concurrently, the ownership of air conditioners went up in the

range of 22–114% compared to the pre-lockdown levels in the same region (Prayas Energy Group, 2020).

Recent studies have shown that COVID-19 is shifting the burden of energy costs to households through increased WFH and teleworking (CJ Meinrenken et al., 2020; Hook et al., 2020). Moreover, home-based working patterns influence residential energy demand by increasing energy consumption for heating, cooling, lighting, cooking, IoT devices, and other uses (Hook et al., 2020). Therefore, it is essential to accurately estimate the net energy impacts of teleworking for a country like India, where the spatial energy inequality is high within the urban areas (Gupta et al., 2020).

Activity 4: Social or Business Impact.

Social Impact: By providing access to electricity, the analysis can help to improve the quality of life for people living in areas without access to electricity, including providing access to lighting, heating, and cooling, and powering essential services such as hospitals and schools..

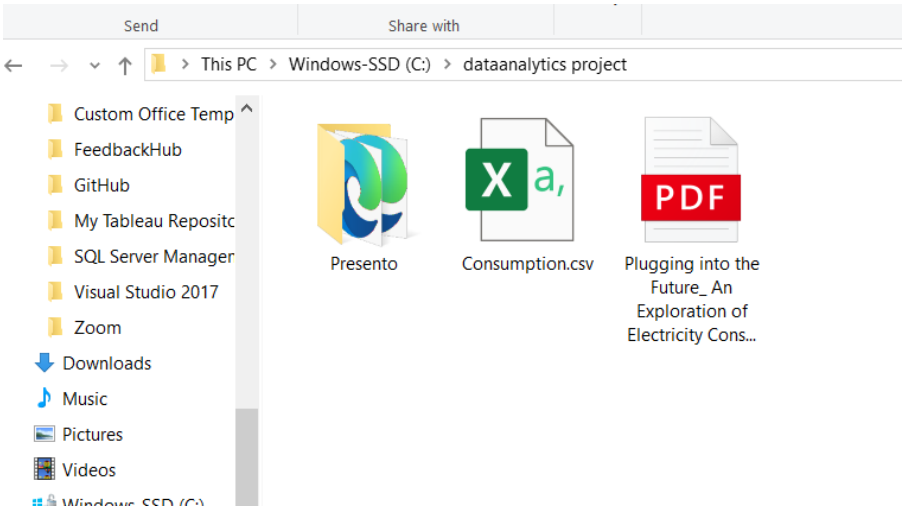
Business Model/Impact: By understanding consumption patterns and trends, the analysis can help businesses identify market opportunities and develop strategies to meet the growing demand for electricity in India.

Milestone 2: Data Collection & Extraction from Database

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, and evaluate outcomes and generate insights from the data.

Activity 1: Collecting the dataset

Please use the link to download the dataset:



Activity 1.1: Understanding the data

In Dataset Consumption.csv data is in the form of a time series for a period of 24 months beginning from 2nd Jan 2019 till 5th December 2020. Columns contains States, Regions, Latitude, Longitude, Dates andUsage. The dataset has been scraped from the weekly energy reports of POSOC.

Fields Include

States - Indian States

Regions- States in Regions on Indian Map

Latitude - States in Regions on Indian Map

Longitude - Geographical Coordinates of States

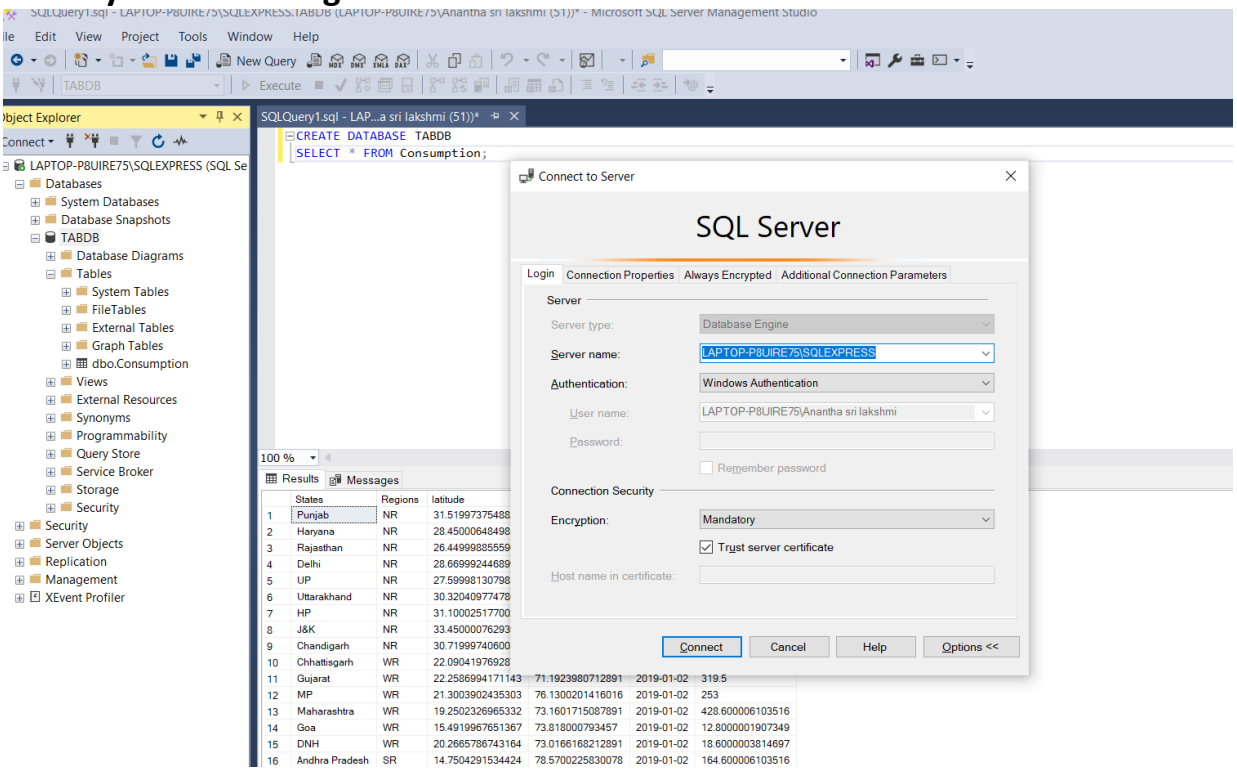
Dates - Dates of Usage

Usage - Power consumed in Mega Units(MU)

Activity 2: Storing Data in DB & Perform SQL Operations

Explanation video

Activity 3: Connecting DB with Tableau



	States	Regions	latitude			
1	Punjab	NR	31.51997375488			
2	Haryana	NR	28.45000648498			
3	Rajasthan	NR	26.44999885559			
4	Delhi	NR	28.66999244689			
5	UP	NR	27.59998130798			
6	Uttarakhand	NR	30.32040977478			
7	HP	NR	31.10002517700			
8	J&K	NR	33.45000076293			
9	Chandigarh	NR	30.71999740600			
10	Chhattisgarh	WR	22.09041976928			
11	Gujarat	WR	22.25869941711 43	71.1923980712891	2019-01-02	319.5
12	MP	WR	21.3003902435303	76.1300201416016	2019-01-02	253
13	Maharashtra	WR	19.2502326965332	73.1601715087891	2019-01-02	428.600006103516
14	Goa	WR	15.4919967651367	73.818000793457	2019-01-02	12.8000001907349
15	DNH	WR	20.2665786743164	73.0166168212891	2019-01-02	18.6000003814697
16	Andhra Pradesh	SR	14.7504291534424	78.5700225830078	2019-01-02	164.600006103516

Milestone 3: Data Preparing:

Activity 1: Prepared the Data for Visualization

Preparing the data for visualization involves cleaning the data to remove irrelevant or missing data, transforming the data into a format that can be easily visualized, exploring the data to identify patterns and trends, filtering the data to focus on specific subsets of data, preparing the data for visualization software, and ensuring the data is accurate and complete. This process helps to make the data easily understandable and ready for creating visualizations to gain insights into the performance and efficiency. This data is preprocessed initially. Lets proceed for visualization.

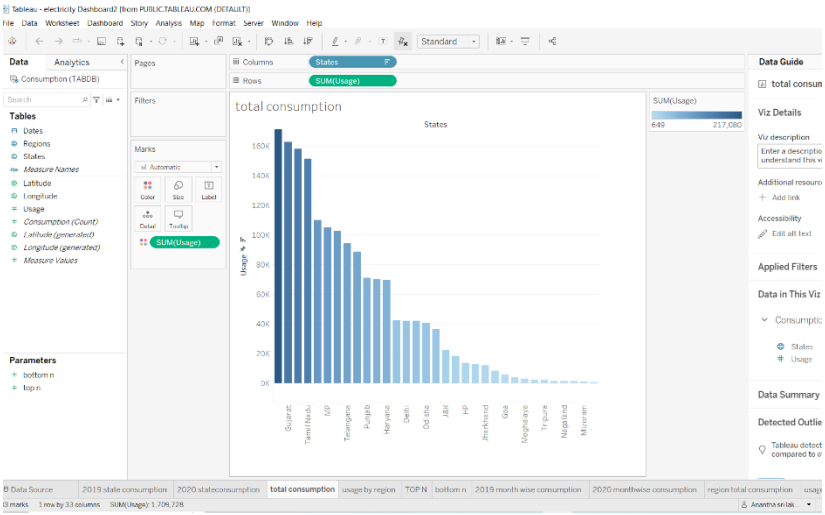
Milestone 4: Data Visualization:

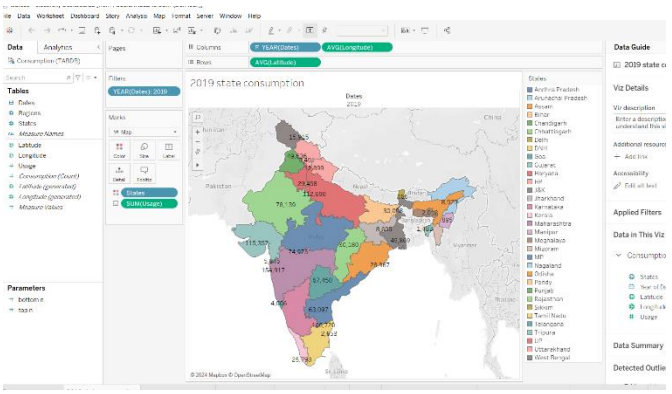
Data visualization is the process of creating graphical representations of data in order to help people understand and explore the information. The goal of data

visualization is to make complex data sets more accessible, intuitive, and easier to interpret. By using visual elements such as charts, graphs, and maps, data visualizations can help people quickly identify patterns, trends, and outliers in the data.

Activity 1: No of Unique Visualizations

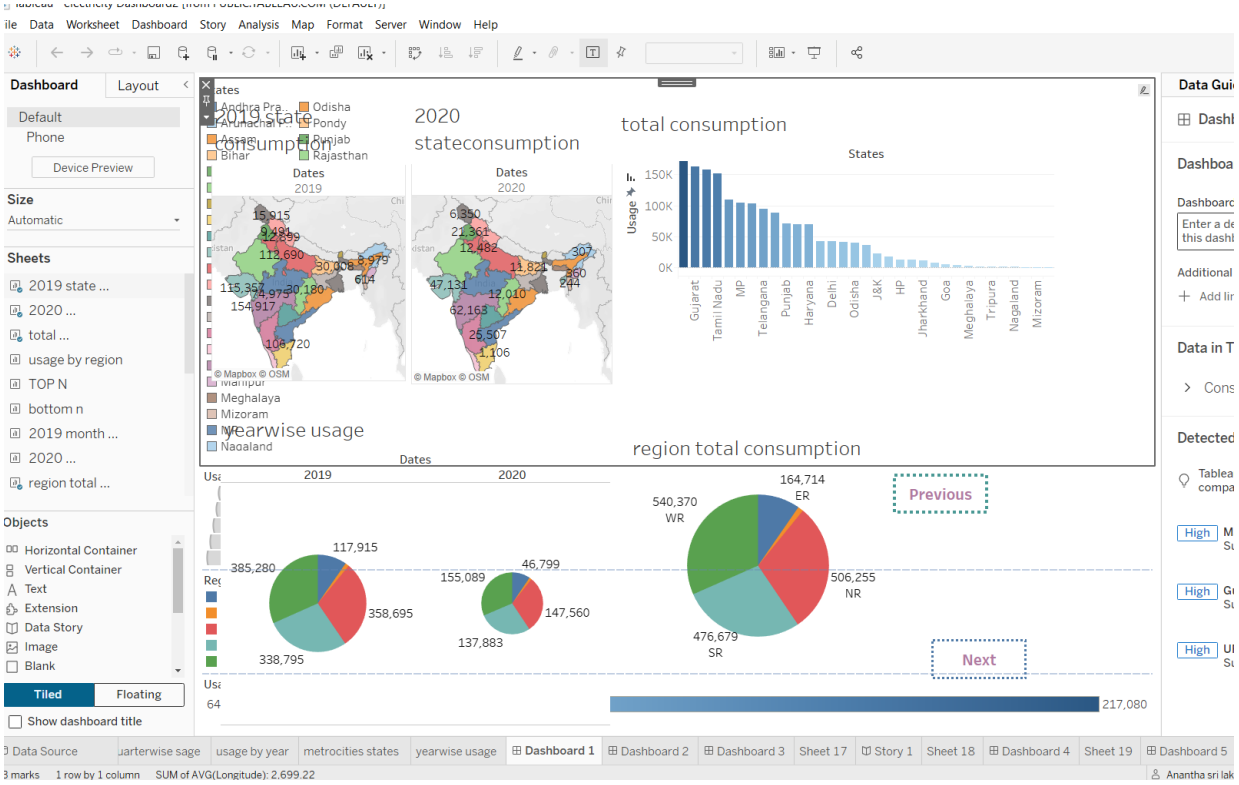
The number of unique visualizations that can be created with a given dataset. Some common types of visualizations that can be used to analyze the performance and efficiency of Radisson Hotels include bar charts, line charts, heat maps, scatter plots, pie charts,Maps etc. These visualizations can be used to compare performance, track changes over time, show distribution, and relationships between variables, breakdown of revenue and customer





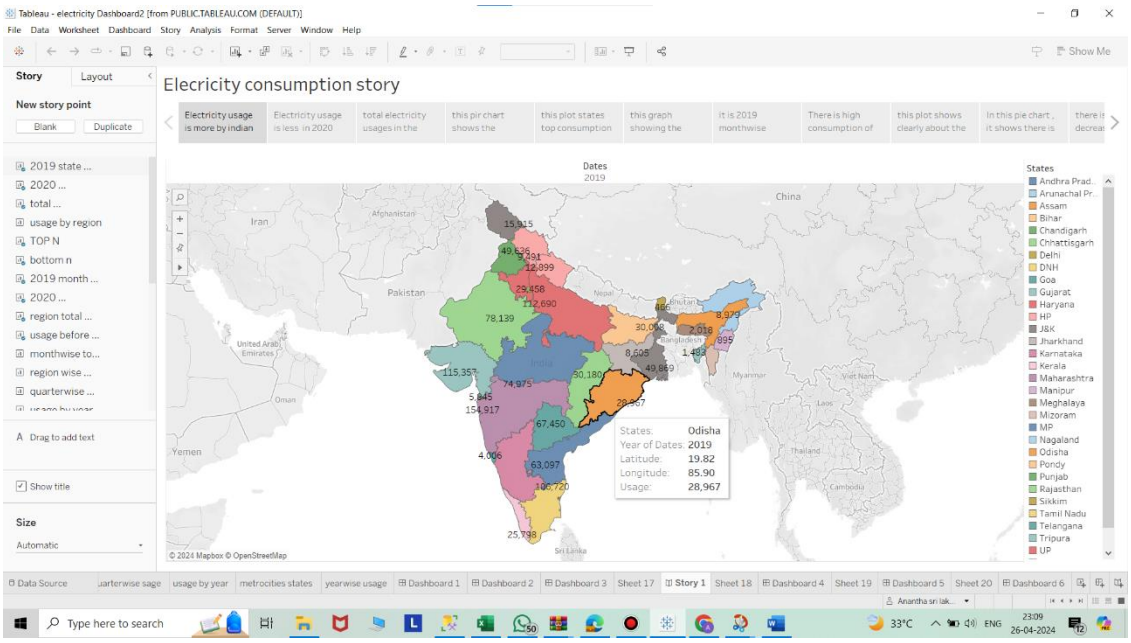
Milestone 5: Dashboard creating

A dashboard is a graphical user interface (GUI) that displays information and data in an organized, easy-to-read format. Dashboards are often used to provide real-time monitoring and analysis of data, and are typically designed for a specific purpose or use case. Dashboards can be used in a variety of settings, such as business, finance, manufacturing, healthcare, and many other industries. They can be used to track key performance indicators (KPIs), monitor performance metrics, and display data in the form of charts, graphs, and tables.



Milestone 6: Story

A data story is a way of presenting data and analysis in a narrative format, with the goal of making the information more engaging and easier to understand. A data story typically includes a clear introduction that sets the stage and explains the context for the data, a body that presents the data and analysis in a logical and systematic way, and a conclusion that summarizes the key findings and highlights their implications. Data stories can be told using a variety of mediums, such as reports, presentations, interactive visualizations, and videos.

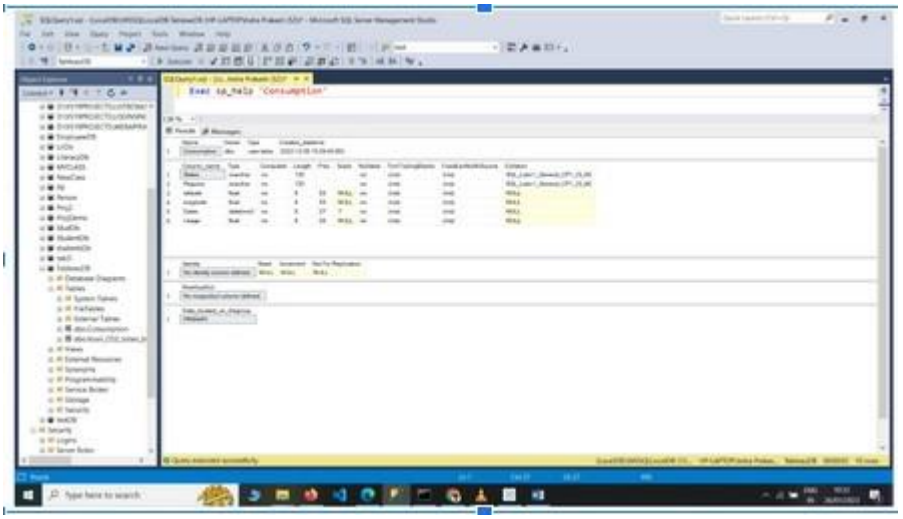


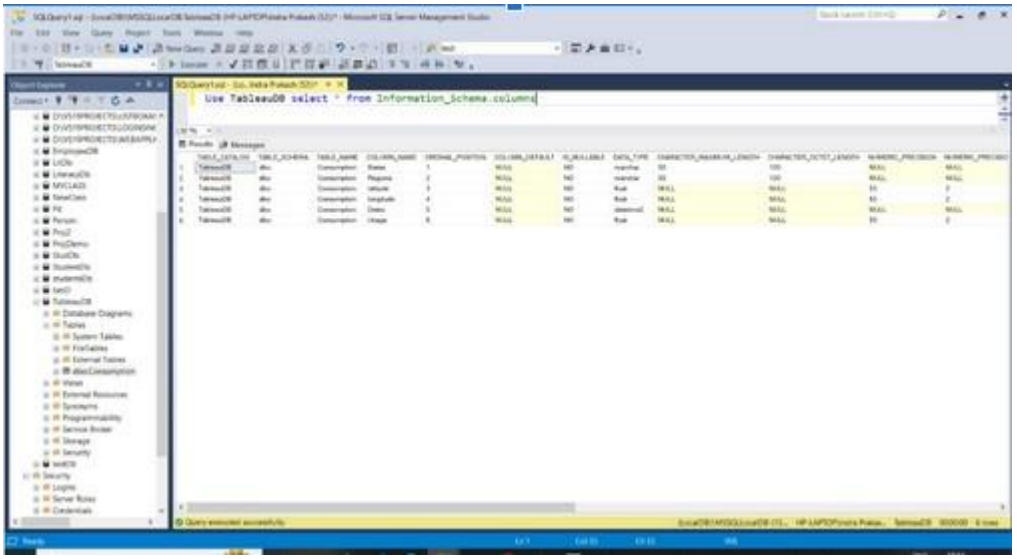
Milestone 7: Performance Testing

Activity 1: Amount of Data Rendered to DB

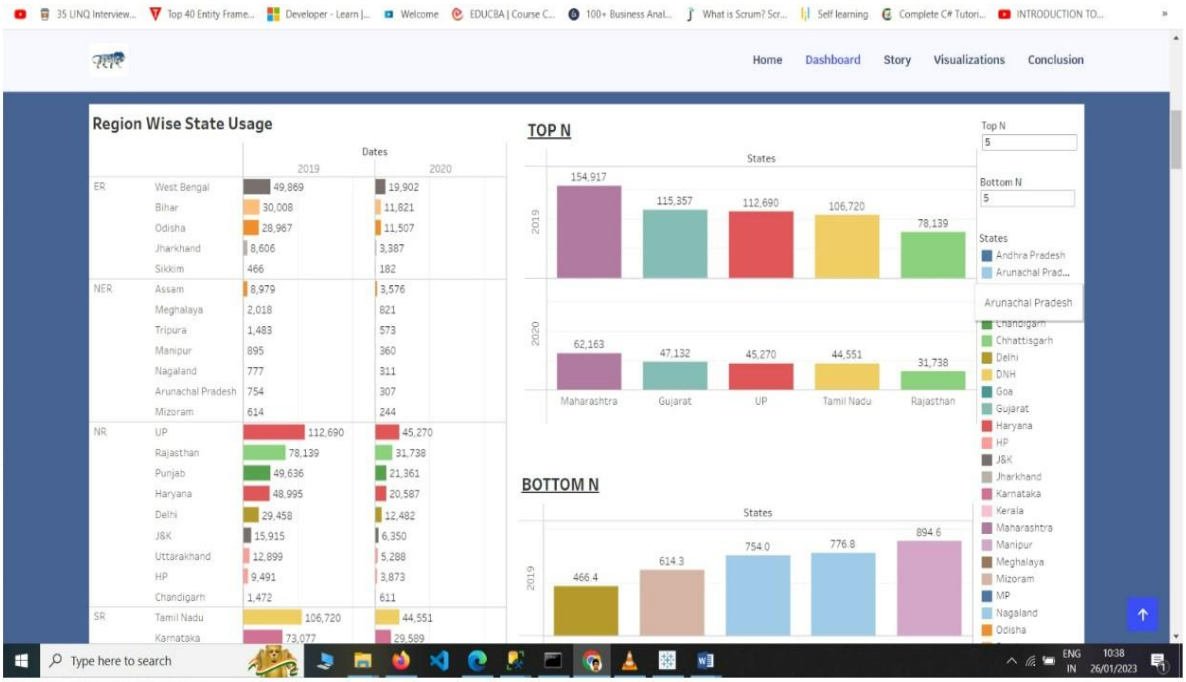
The amount of data that is rendered to a database depends on the size of the dataset and the capacity of the database to store and retrieve data.

Open the MySQL Workbench, go to the database then click to expand the tables,select the table and click on (i) button to get the information related to table such as column count,table rows etc.





Activity 2: Utilization of Data Filters



Activity 4: No of Visualizations/ Graphs

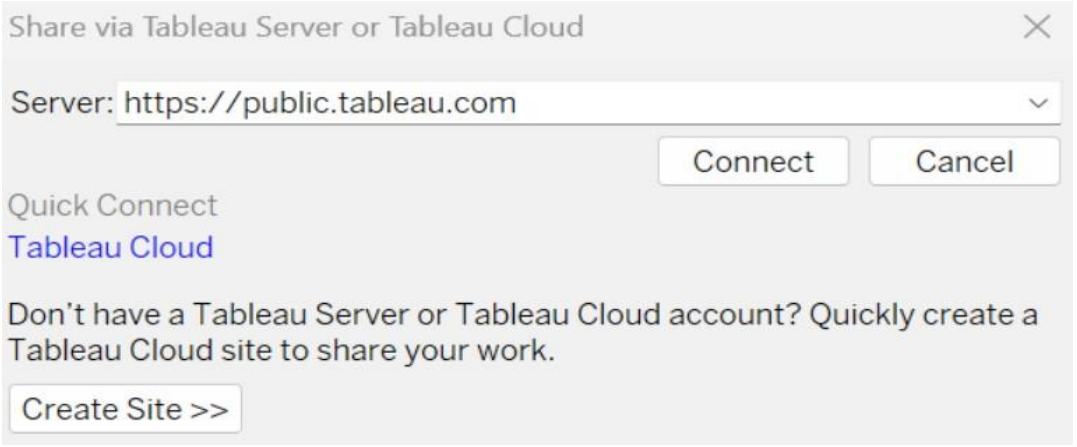
- 2019 State Consumption
- 2020 State Consumption
- Total Consumption
- Usage By Region
- Top N and Bottom N
- 2019 and 2020 Monthwise Consumption
- Total Consumption Region Wise
- Usage Before and After Lockdown
- Region wise State Usage
- Quarter Usage
- Metro city State usage
- Usage by year

Milestone 8: Web integration

Publishing helps us to track and monitor key performance metrics, to communicate results and progress. help a publisher stay informed, make better decisions, and communicate their performance to others.

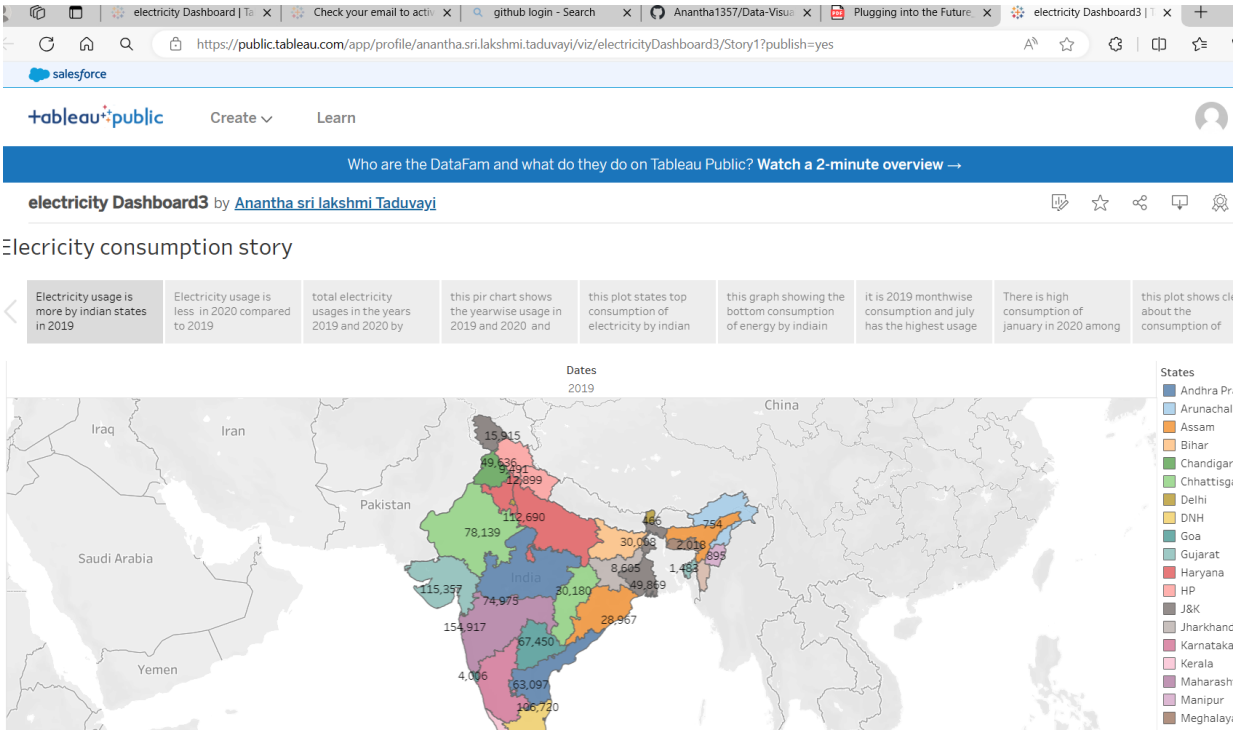
Publishing dashboard and reports to tableau public

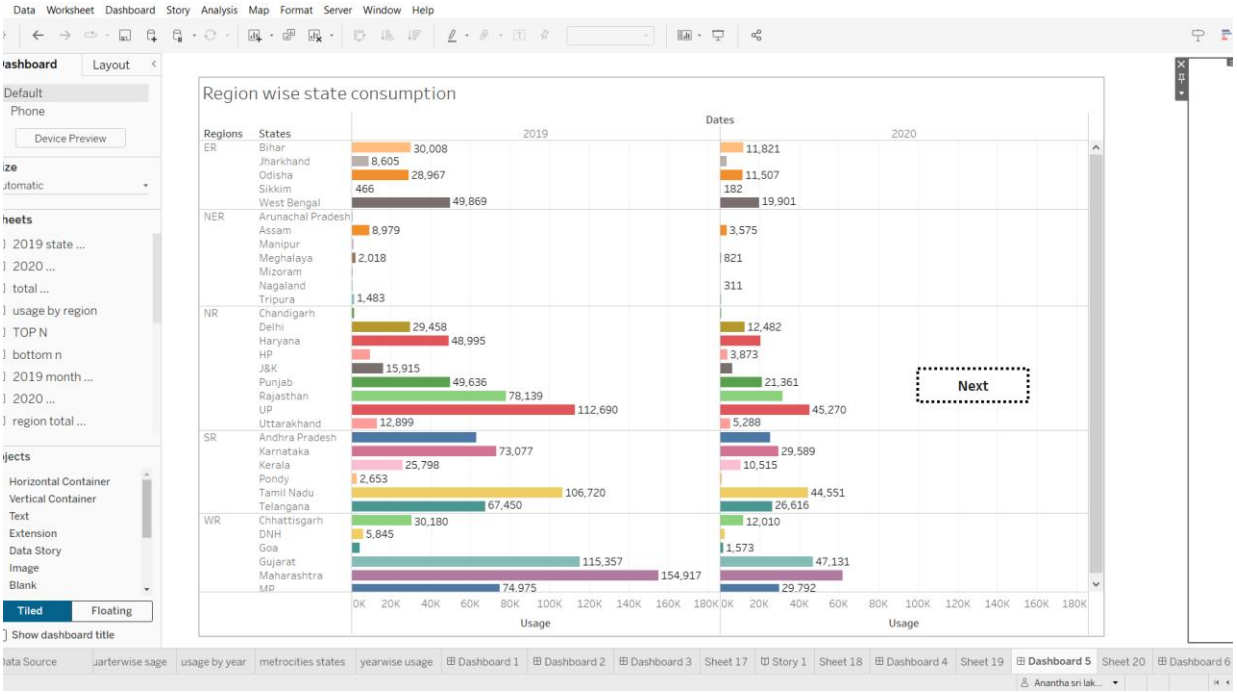
Step 1: Go to Dashboard/story, click on share button on the top ribbon

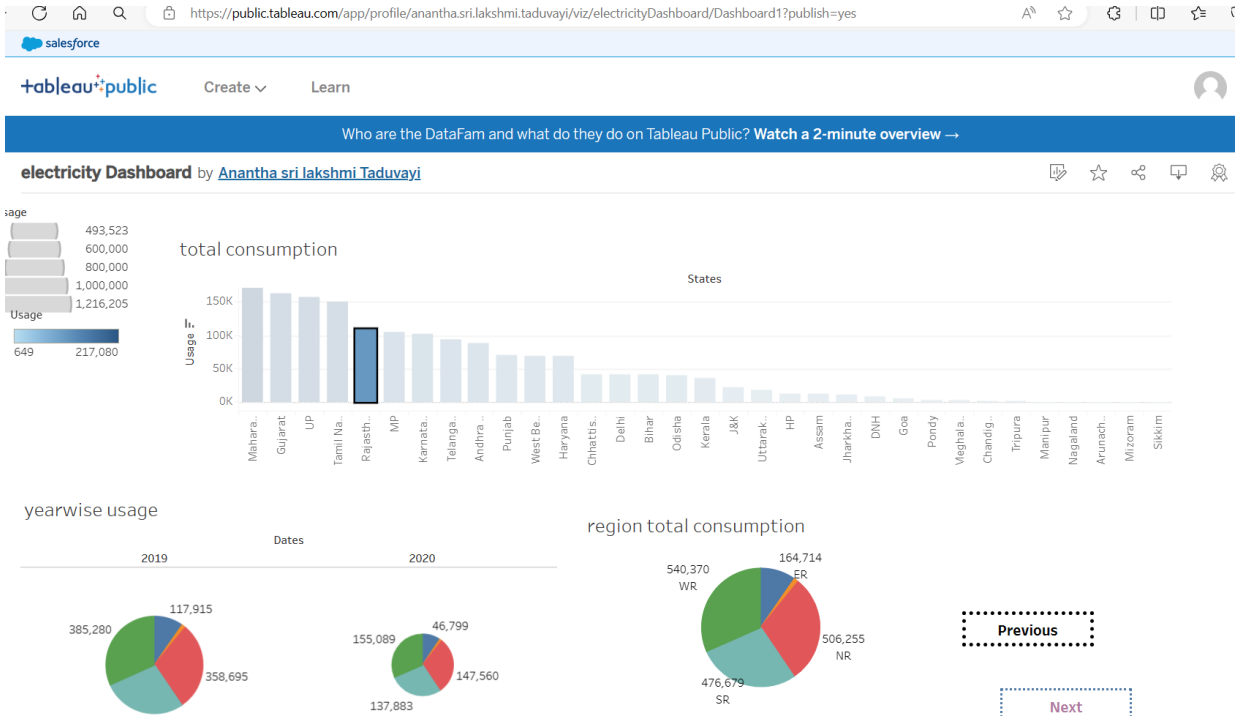


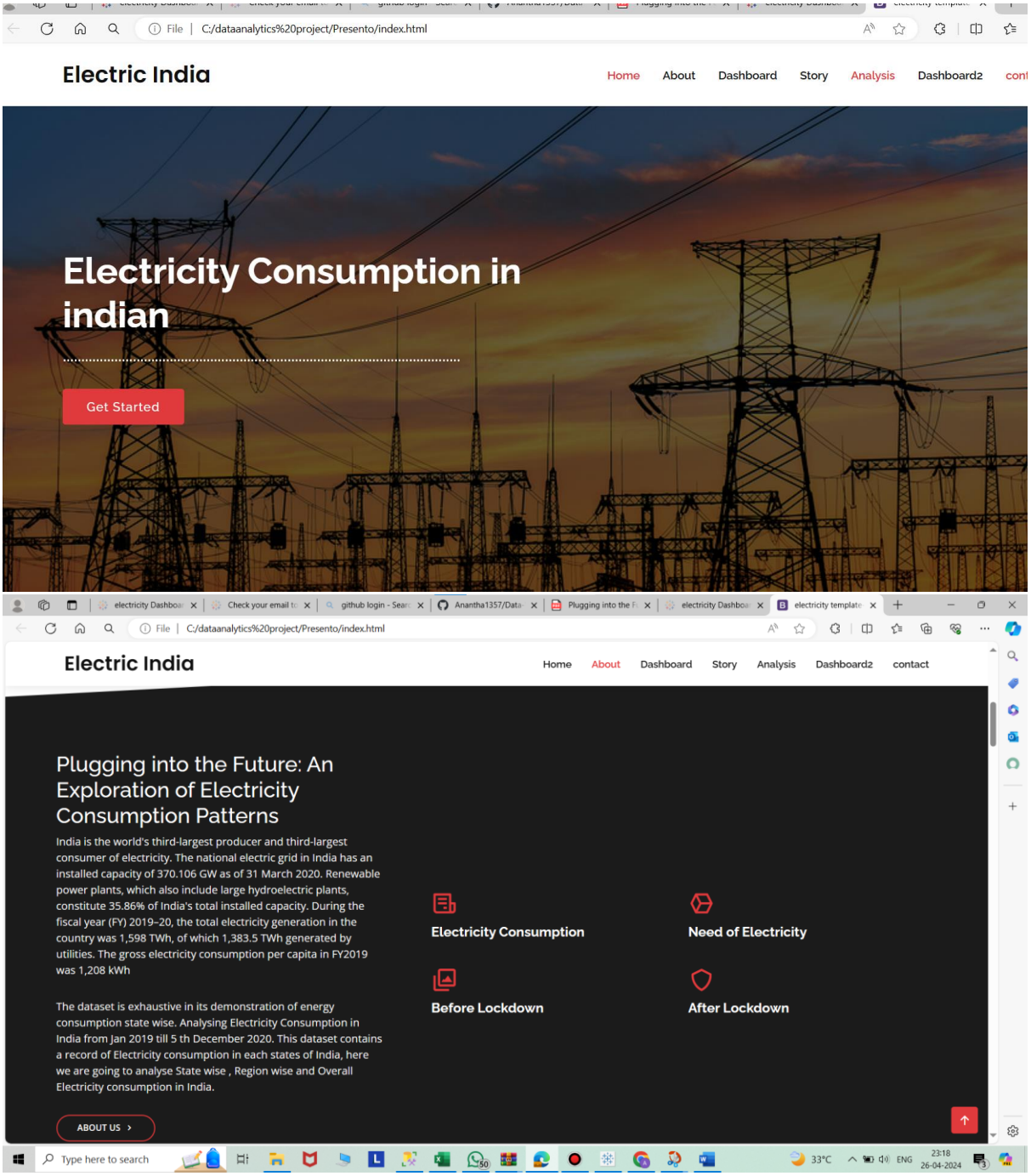
Step 2**:** Once you click on connect it will ask you for tableau public user name and password

Publication and outputs:




Region wise state consumption
Dates
2019
2020
Regions
States
Usage
Next
Dashboard 5


https://public.tableau.com/app/profile/anantha.sri.lakshmi.taduvayi/viz/electricityDashboard/Dashboard1?publish=yes
Who are the DataFam and what do they do on Tableau Public? Watch a 2-minute overview →
electricity Dashboard by Anantha sri lakshmi Taduvayi
total consumption
States
Usage
yearwise usage
Dates
region total consumption
Previous
Next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Electric India
Home
About
Dashboard
Story
Analysis
Dashboard2
Electricity Consumption in indian
Get Started
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About
Dashboard
Story
Analysis
Dashboard2
contact
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ABOUT US
Electricity Consumption
Need of Electricity
Before Lockdown
After Lockdown
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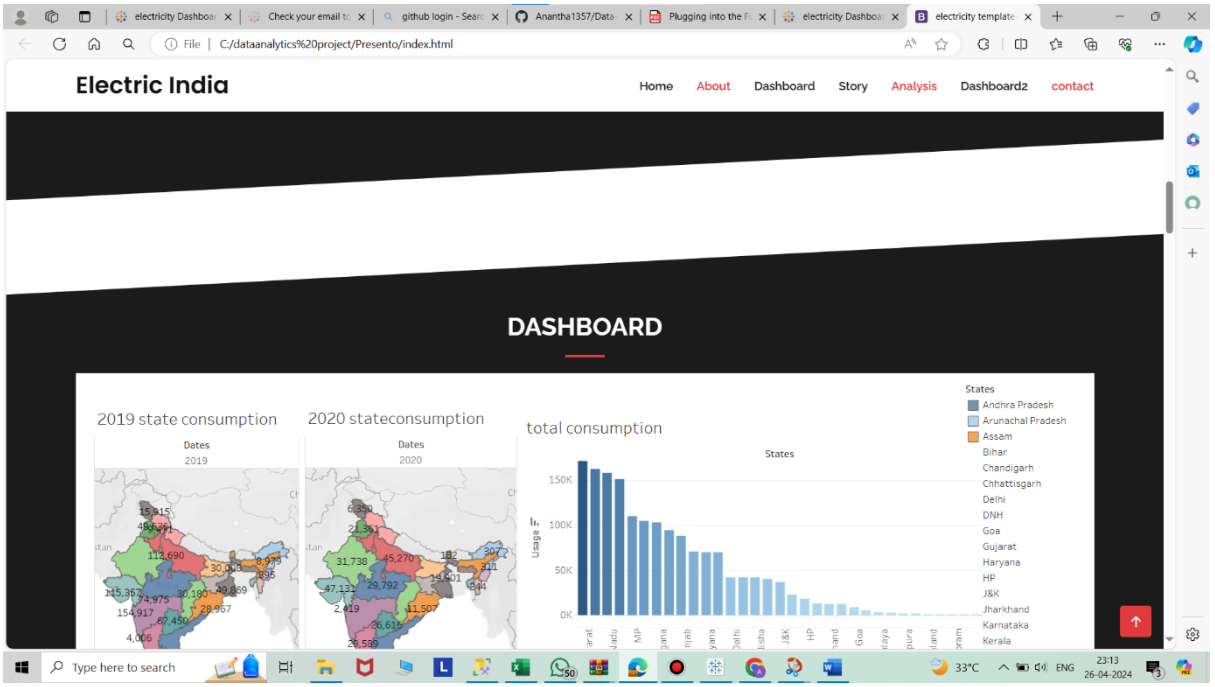
Electric India
Home
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Dashboard
Story
Analysis
Dashboard2
contact
DASHBOARD
2019 state consumption
2020 stateconsumption
total consumption
Dates
2019
Dates
2020
States
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Chhattisgarh
Delhi
DNH
Goa
Gujarat
Haryana
HP
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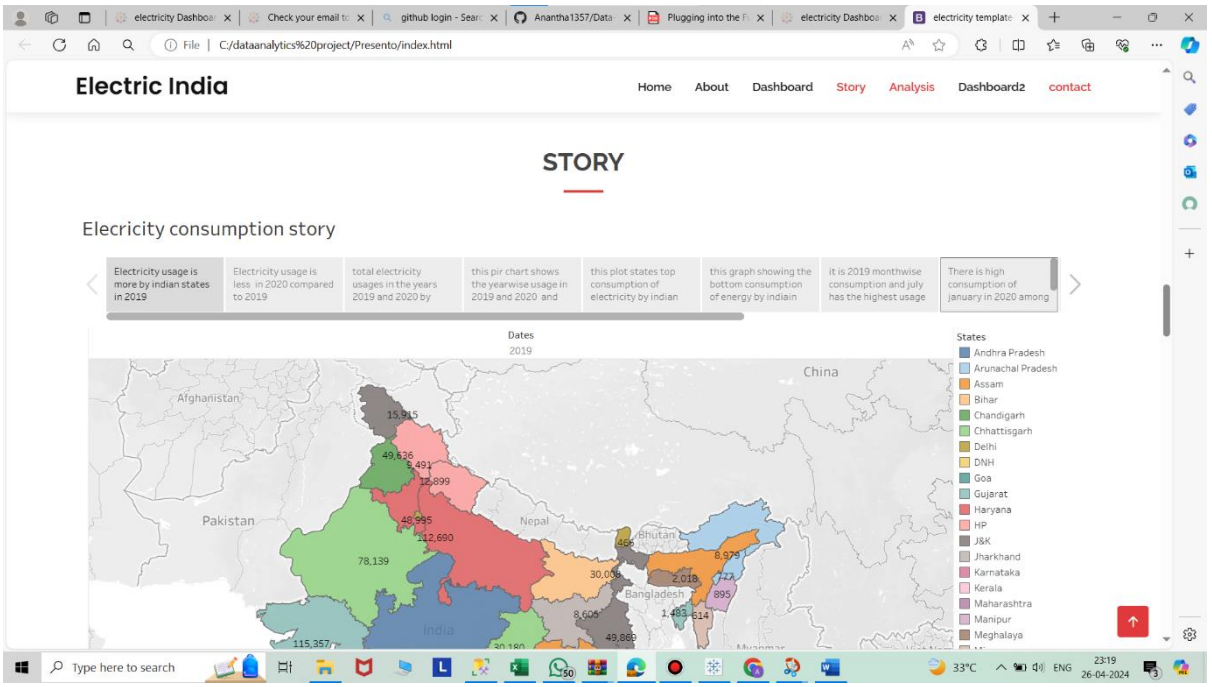
Electric India
Home
About
Dashboard
Story
Analysis
Dashboard2
contact
STORY
Elecricity consumption story
Electricity usage is more by indian states in 2019
Electricity usage is less in 2020 compared to 2019
total electricity usages in the years 2019 and 2020 by
this pir chart shows the yearwise usage in 2019 and 2020 and
this plot states top consumption of electricity by indian
this graph showing the bottom consumption of energy by indiain
it is 2019 monthwise consumption and july has the highest usage
There is high consumption of january in 2020 among
Dates
2019
China
Afghanistan
Pakistan
Nepal
Bhutan
Bangladesh
India
15,915
49,626
5,491
12,899
48,995
112,690
78,139
30,036
2,018
8,973
895
1,483
614
8,605
115,357
49,889
States
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Chhattisgarh
Delhi
DNH
Goa
Gujarat
Haryana
HP
J&K
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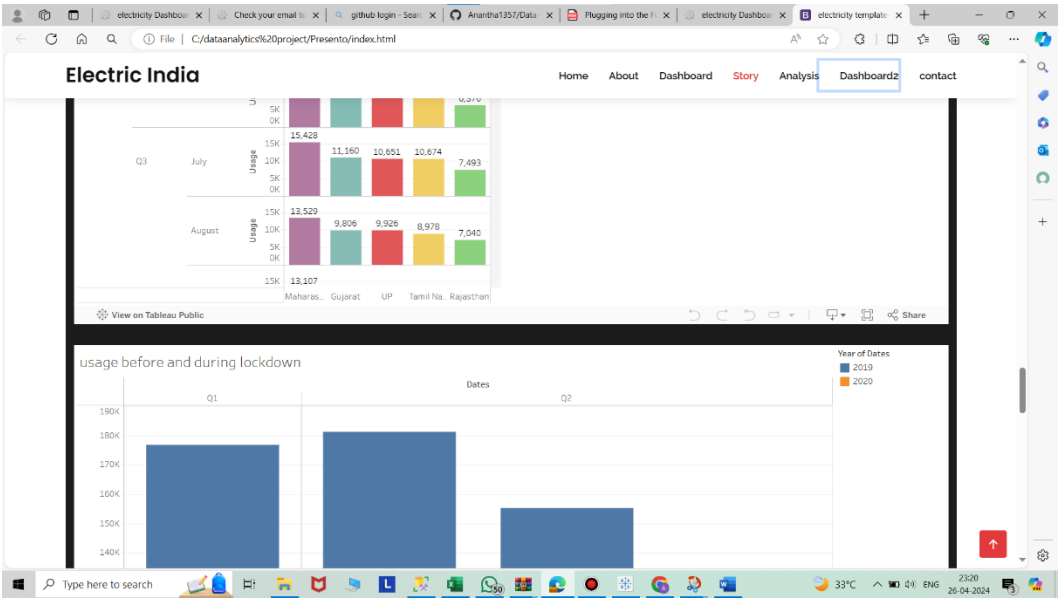

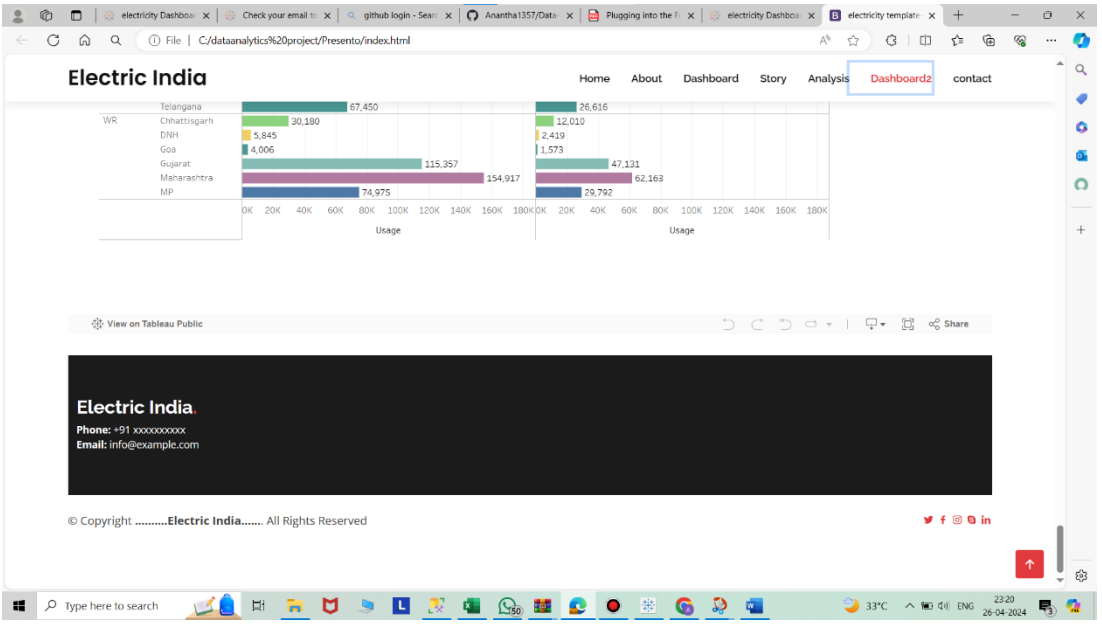

Overall video link: https://drive.google.com/file/d/1DHWF_Zvr6js3wxwz6iprZL1DTzJDTv28/view?usp=drivesdk