

Plugging into the Future: An Exploration of Electricity Consumption Patterns

Milestone 1: Define Problem / Problem Understanding

Activity 1: Specify the business problem

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

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.

Activity 2: Business requirements

The business requirements for analyzing 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.

Activity 3: Literature Survey (Student Will Write)

A literature survey is a method of researching existing literature and studies related to a specific topic. 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.

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: Collect the dataset

The screenshot shows a data application interface with a menu bar (File, Data, Server, Window, Help) and a toolbar. On the left, there are panels for 'Connections' (listing 'Consumption' and 'Consumption (2)') and 'Files' (listing 'Consumption.csv'). The main area displays a table titled 'Consumption.csv (Multiple Connections)' with 6 fields and 16599 rows. The table has columns: States, Regions, Latitude, Longitude, Dates, and Usage. The data is organized into 14 rows, each representing a different state/region. A 'Go to Worksheet' tooltip is visible at the bottom left. The bottom status bar shows 'Data Source' and 'Sheet1'.

States	Regions	Latitude	Longitude	Dates	Usage
Punjab	NR	31.5200	75.9800	02-01-2019	119.900
Haryana	NR	28.4500	77.0200	02-01-2019	130.300
Rajasthan	NR	26.4500	74.6400	02-01-2019	234.100
Delhi	NR	28.6700	77.2300	02-01-2019	85.800
UP	NR	27.6000	78.0500	02-01-2019	313.900
Uttarakhand	NR	30.3204	78.0500	02-01-2019	40.700
HP	NR	31.1000	77.1666	02-01-2019	30.000
J&K	NR	33.4500	76.2400	02-01-2019	52.500
Chandigarh	NR	30.7200	76.7800	02-01-2019	5.000
Chhattisgarh	WR	22.0904	82.1600	02-01-2019	78.700
Gujarat	WR	22.2587	71.1924	02-01-2019	319.500
MP	WR	21.3004	76.1300	02-01-2019	253.000
Maharashtra	WR	19.2502	73.1602	02-01-2019	428.600
Goa	WR	15.4920	73.8180	02-01-2019	12.800

Activity 1.1: Understand 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 and Usage. 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

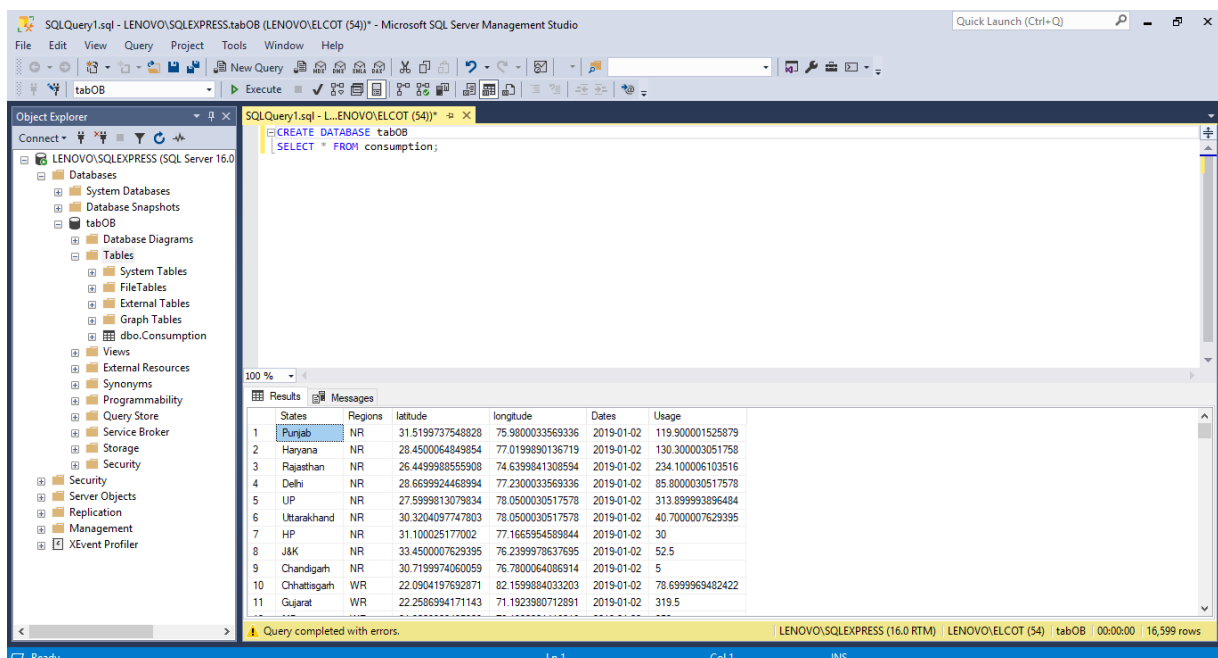
Longitude - Geographical Coordinates of States

Dates - Dates of Usage

Usage - Power consumed in Mega Units(MU)

Activity 2: Storing Data in DB & Connect DB with Tableau

Storing Data in DB



The screenshot displays the Microsoft SQL Server Enterprise Manager interface. The left pane shows the 'Object Explorer' with the 'tabOB' database selected. The right pane shows the 'SQLQuery1.sql' script with the following query:

```
CREATE DATABASE tabOB
SELECT * FROM consumption;
```

The 'Results' pane at the bottom shows the output of the query, which is a table with 6 columns: States, Regions, latitude, longitude, Dates, and Usage. The table contains 11 rows of data, with the first row highlighted in blue.

States	Regions	latitude	longitude	Dates	Usage
Punjab	NR	31.5199737548828	75.9800033569336	2019-01-02	119.900001525879
Haryana	NR	28.4500064849854	77.0199890136719	2019-01-02	130.300003051758
Rajasthan	NR	26.4499988555908	74.6399841308594	2019-01-02	234.100006103516
Delhi	NR	28.6699924468994	77.2300033569336	2019-01-02	85.8000030517578
UP	NR	27.5999813079834	78.0500030517578	2019-01-02	313.899993896484
Uttarakhand	NR	30.3204097747803	78.0500030517578	2019-01-02	40.7000007629395
HP	NR	31.100025177002	77.1665954589844	2019-01-02	30
J&K	NR	33.4500007629395	76.2399978637695	2019-01-02	52.5
Chandigarh	NR	30.7199974060059	76.7800064086914	2019-01-02	5
Chhattisgarh	WR	22.0904197692871	82.1599884033203	2019-01-02	78.6999969482422
Gujarat	WR	22.2586994171143	71.1923980712891	2019-01-02	319.5

The status bar at the bottom indicates that the query was completed with errors. The status bar also shows the connection details: 'LENOVO\SQLEXPRESS (16.0 RTM) | LENOVO\ELCOT (54) | tabOB | 00:00:00 | 16,599 rows'.

Connect DB with Tableau

Tableau - Book1 - Tableau license expires in 12 days

File Data Server Window Help

Consumption (tabOB)

Connection: ☒ Live ☐ Extract Filters: 0 | Add

Consumption

Need more data?
Drag tables here to relate them. [Learn more](#)

Consumption 6 fields 16599 rows 100 rows

Name	Consumption	Consumption	Consumption	Consumption	Consumption	Consumption
States	Regions	Latitude	Longitude	Dates	Usage	
Punjab	NR	31.5200	75.9800	02-01-2019	119.900	
Haryana	NR	28.4500	77.0200	02-01-2019	130.300	
Rajasthan	NR	26.4500	74.6400	02-01-2019	234.100	
Delhi	NR	28.6700	77.2300	02-01-2019	85.800	
UP	NR	27.6000	78.0500	02-01-2019	313.900	

Go to Worksheet

Data Source Sheet 1

Tableau - Book1 - Tableau license expires in 12 days

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Consumption (tabOB)

Search

Tables

- Dates
- Regions
- States
- Measure Names
- Latitude
- Longitude
- Usage
- Consumption (Count)
- Measure Values

Columns

Rows

Sheet 1

Drop field here

Drop field here

Drop field here

Drop field here

Select or drag data
Use the Shift or Ctrl key to select multiple fields

Data Source Sheet 1

Milestone 3: Data Preparation

Activity 1: Prepare 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.

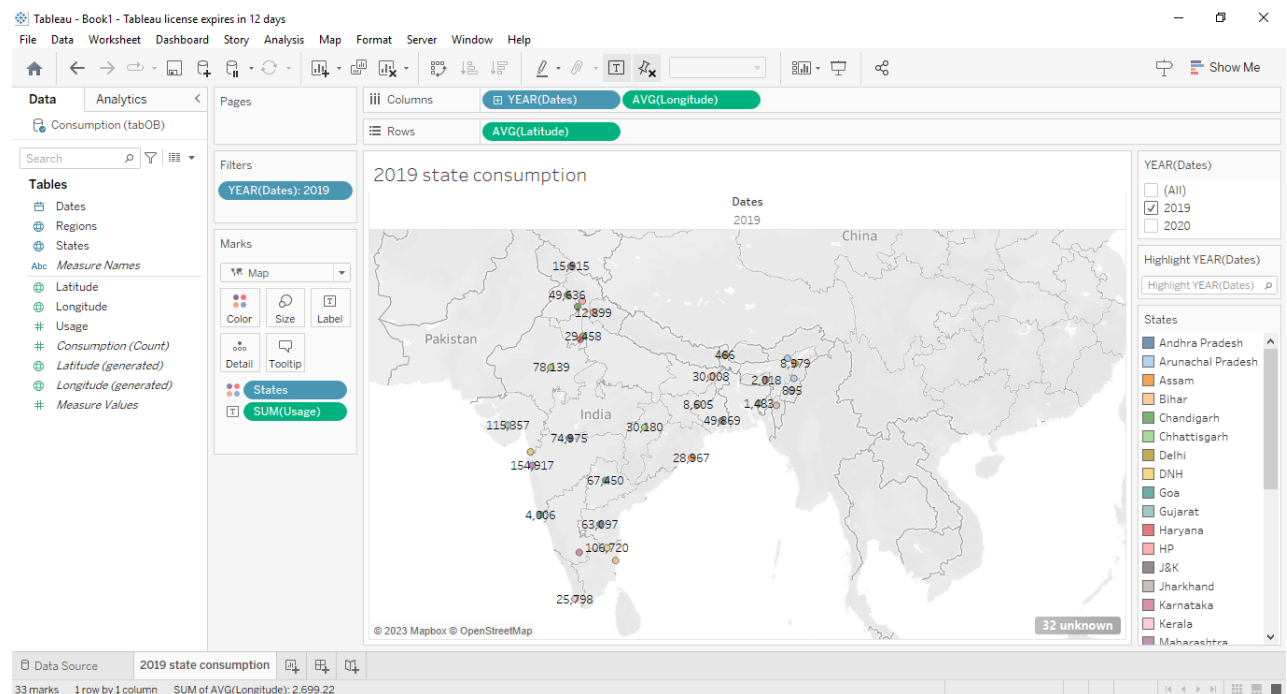
Activity 1: No of Unique Visualizations

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

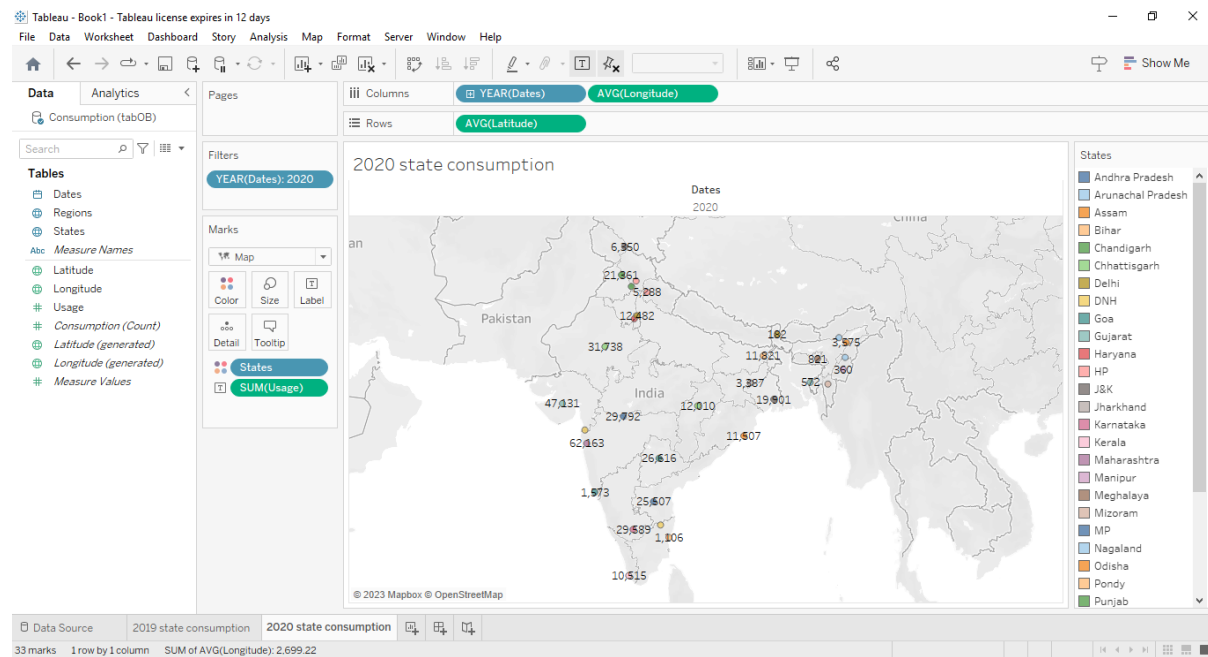
to compare performance, track changes over time, show distribution, and relationships between variables, breakdown of revenue and customer demographics, workload, resource allocation and location of hotels.

Activity 1.1: To Understand-2019 and 2020 Consumption, Total Consumption, Usage by Region, Top N and Bottom N States

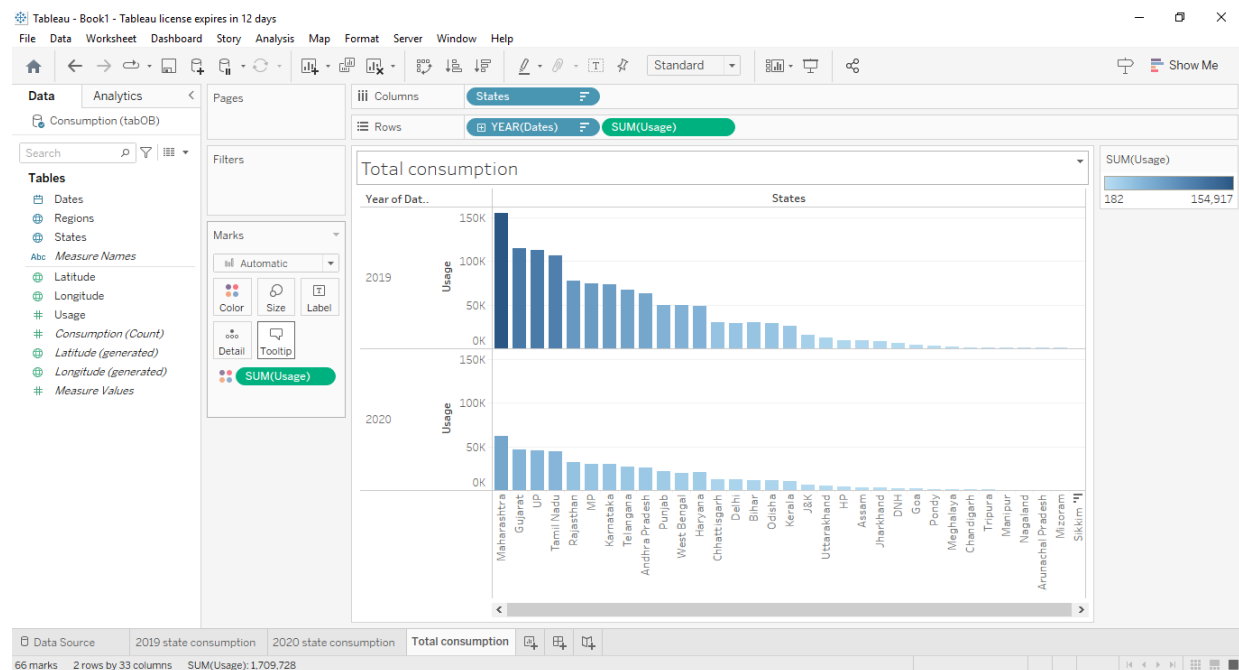
2019 state consumption



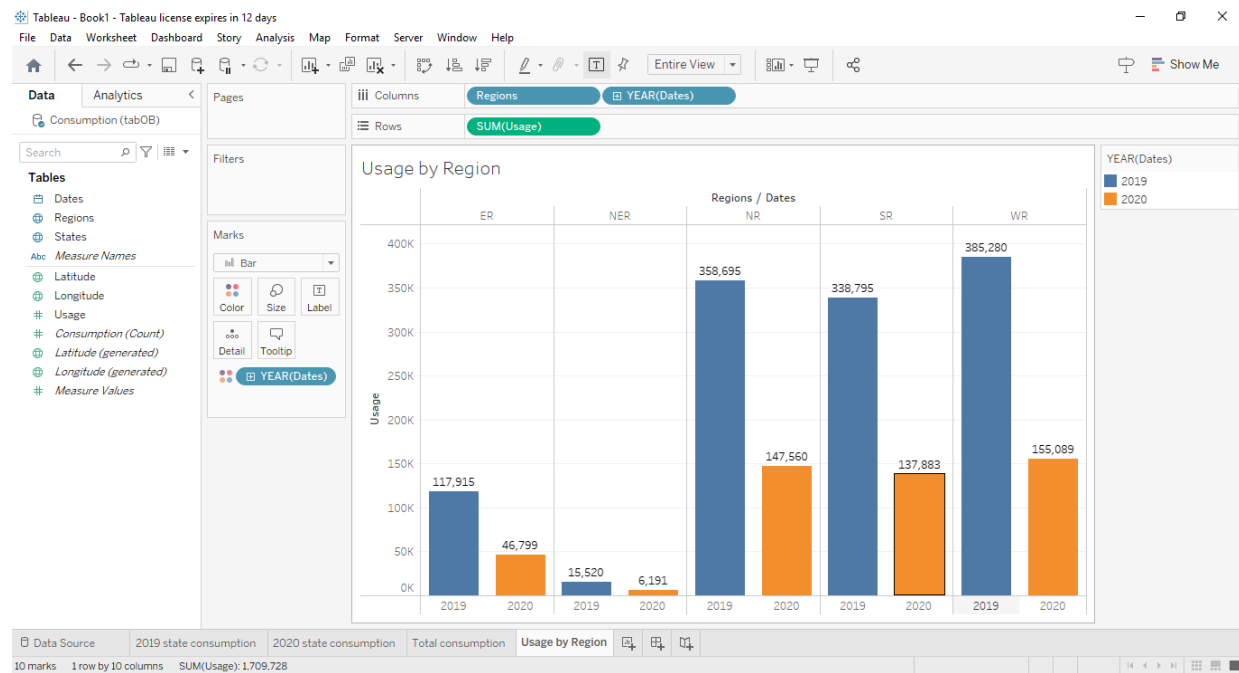
2020 state consumption



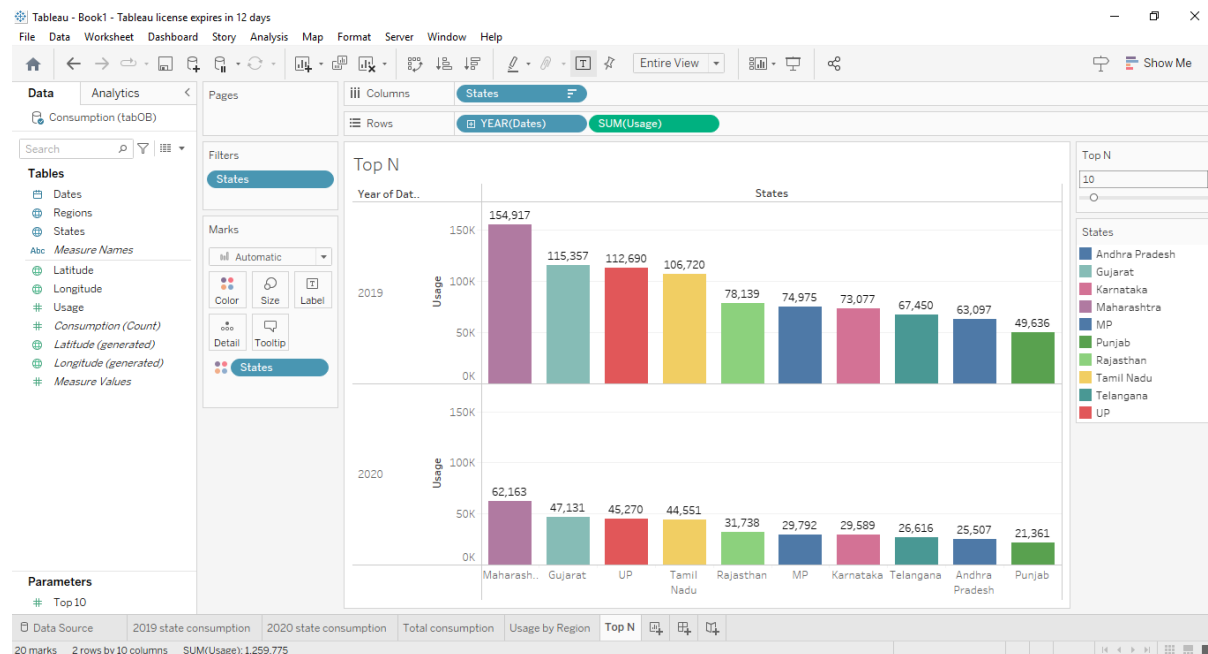
Total consumption



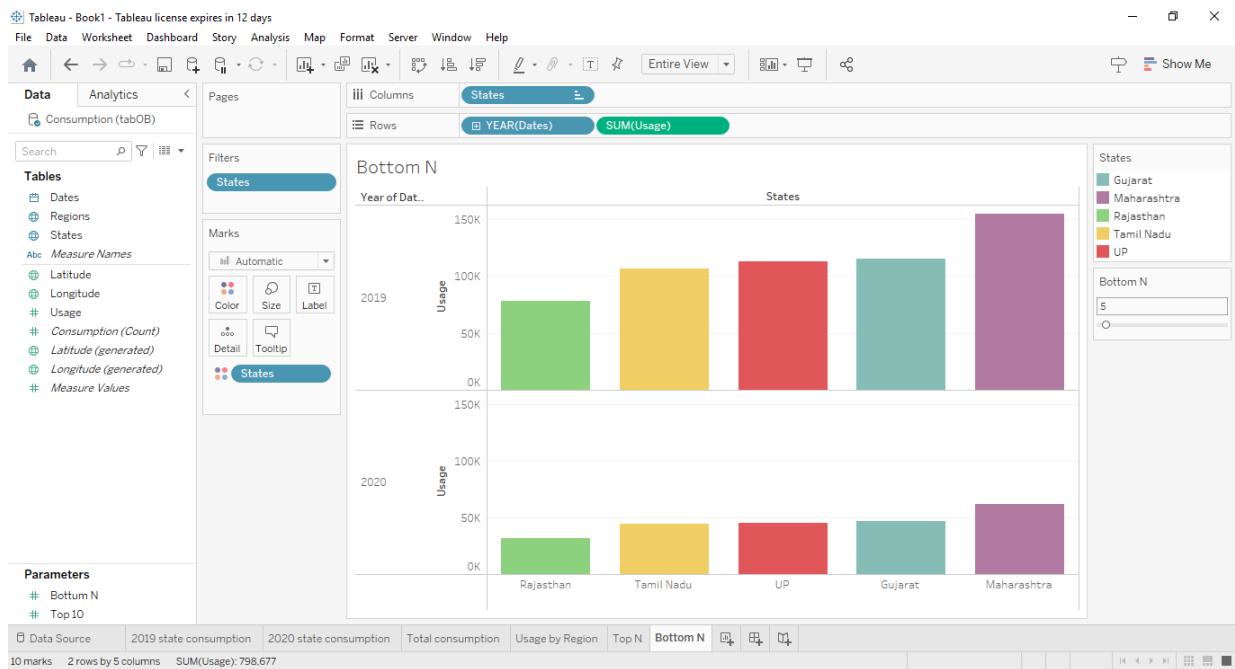
Usage by Region



Top N States

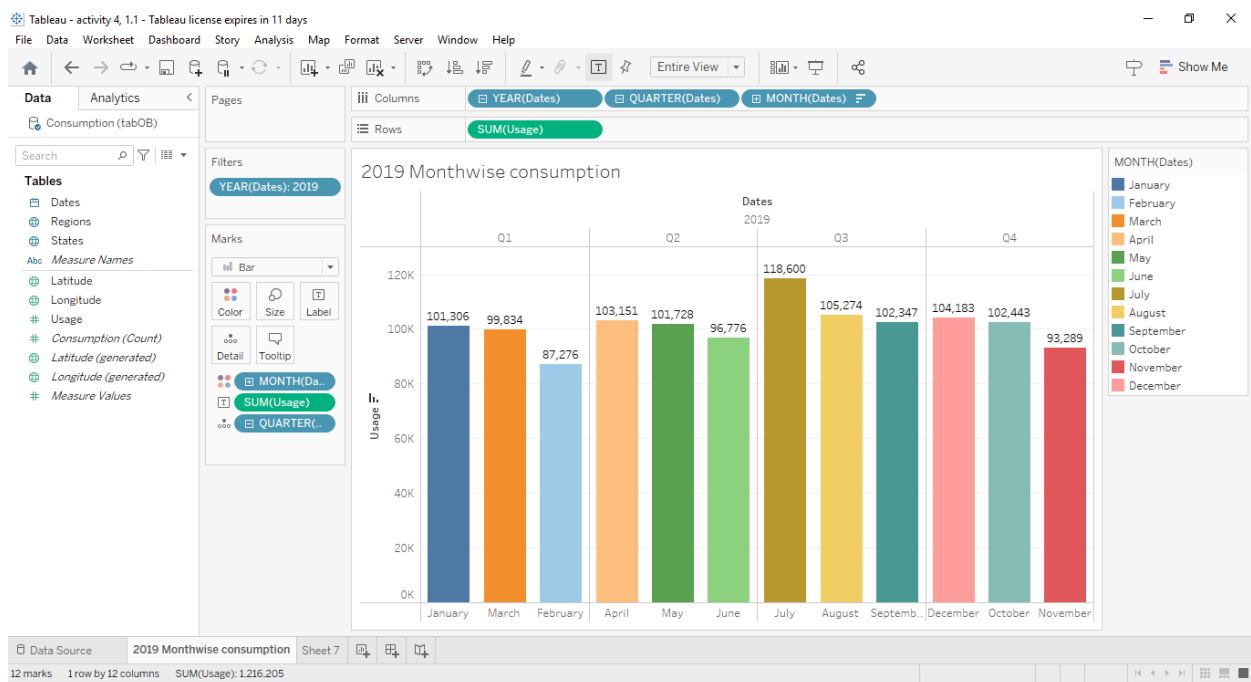


Bottom N States

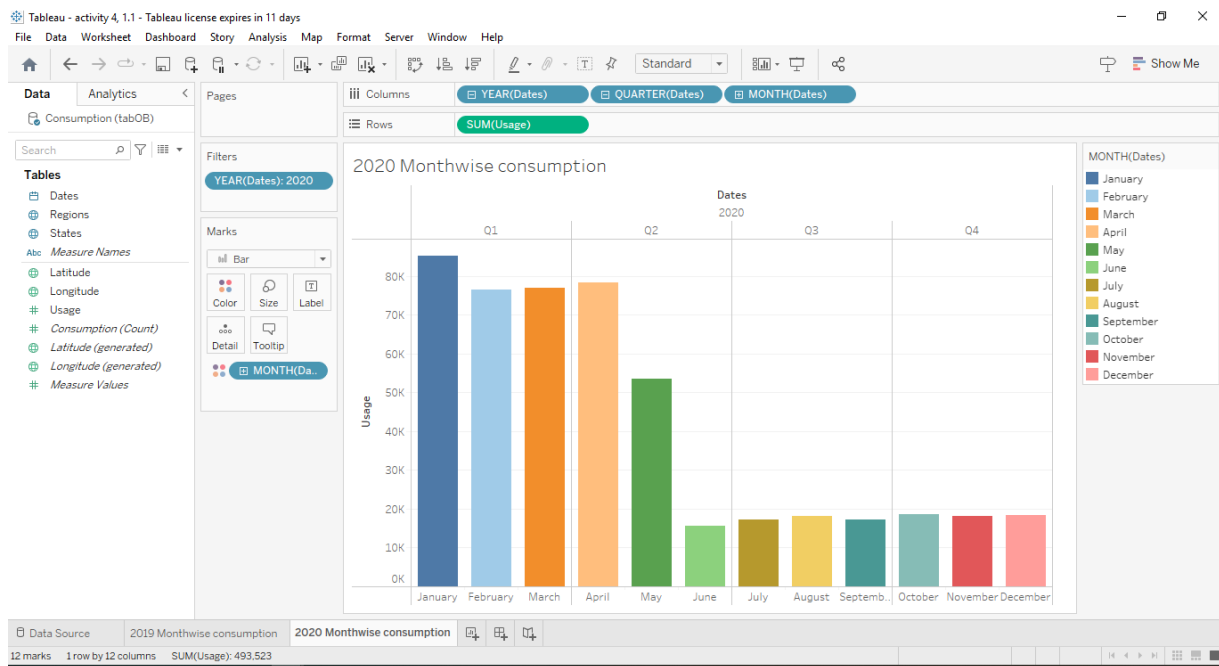


Activity 1.2: To Understand-2019 and 2020 Month wise Consumption, Total Consumption by region, Usage Before and After Lockdown

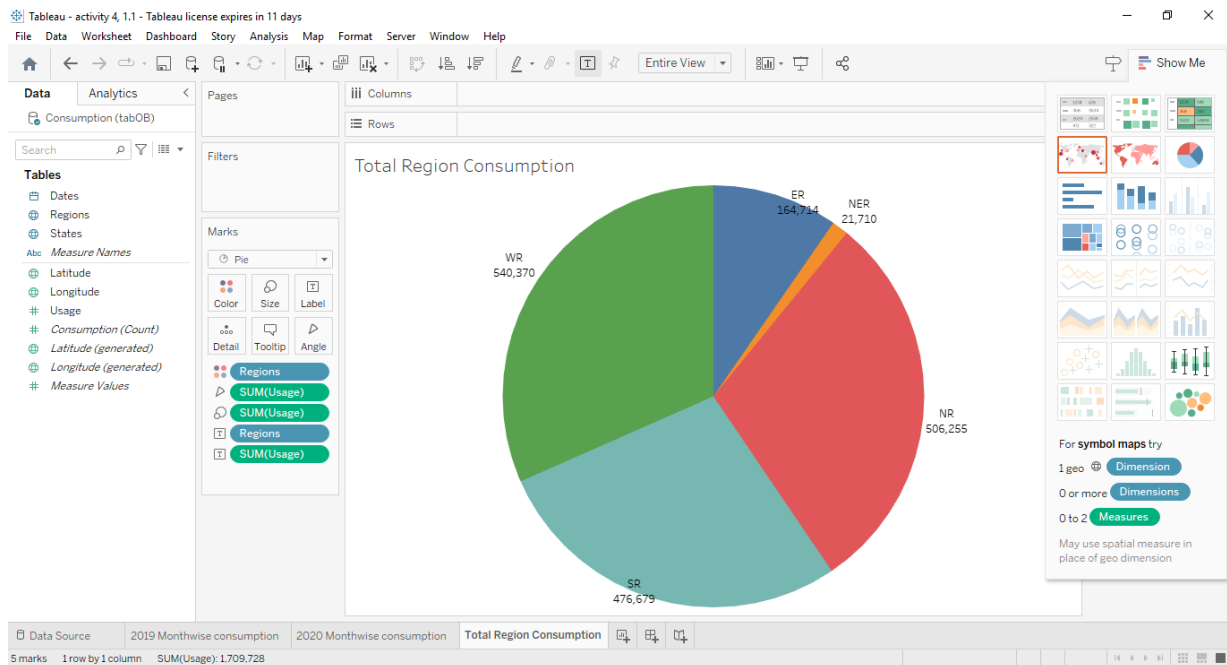
2019 Monthwise Consumption



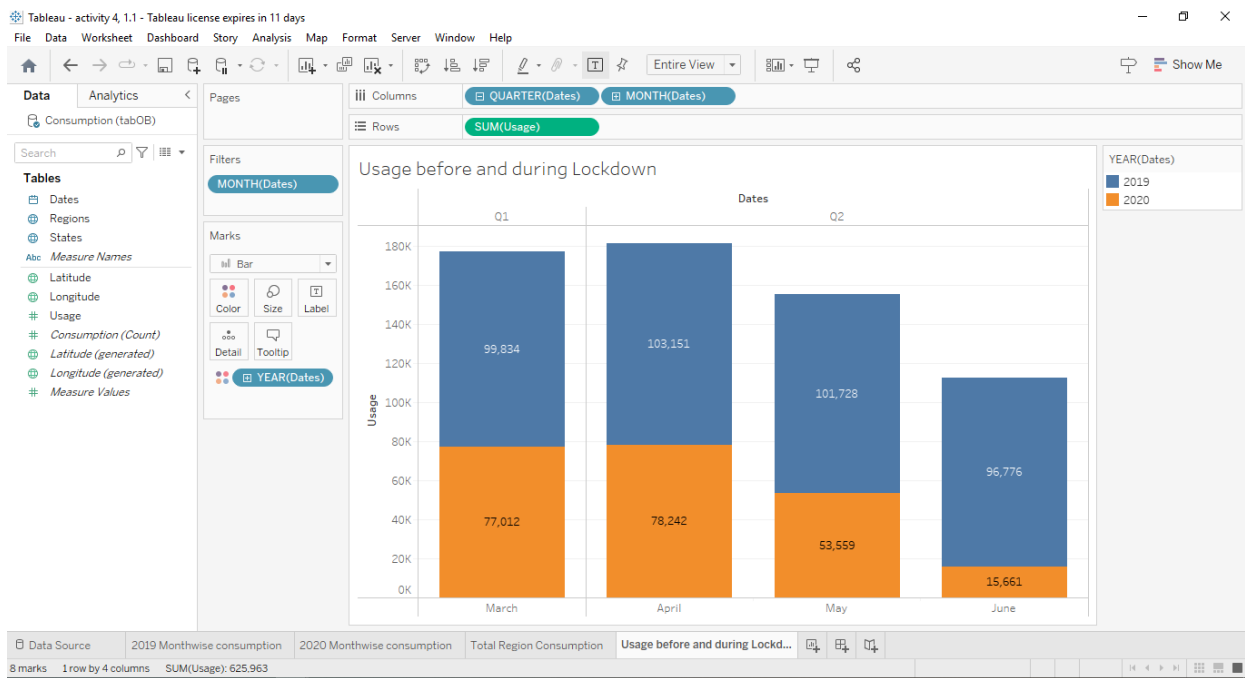
2020 Monthwise Consumption



Total Region Consumption

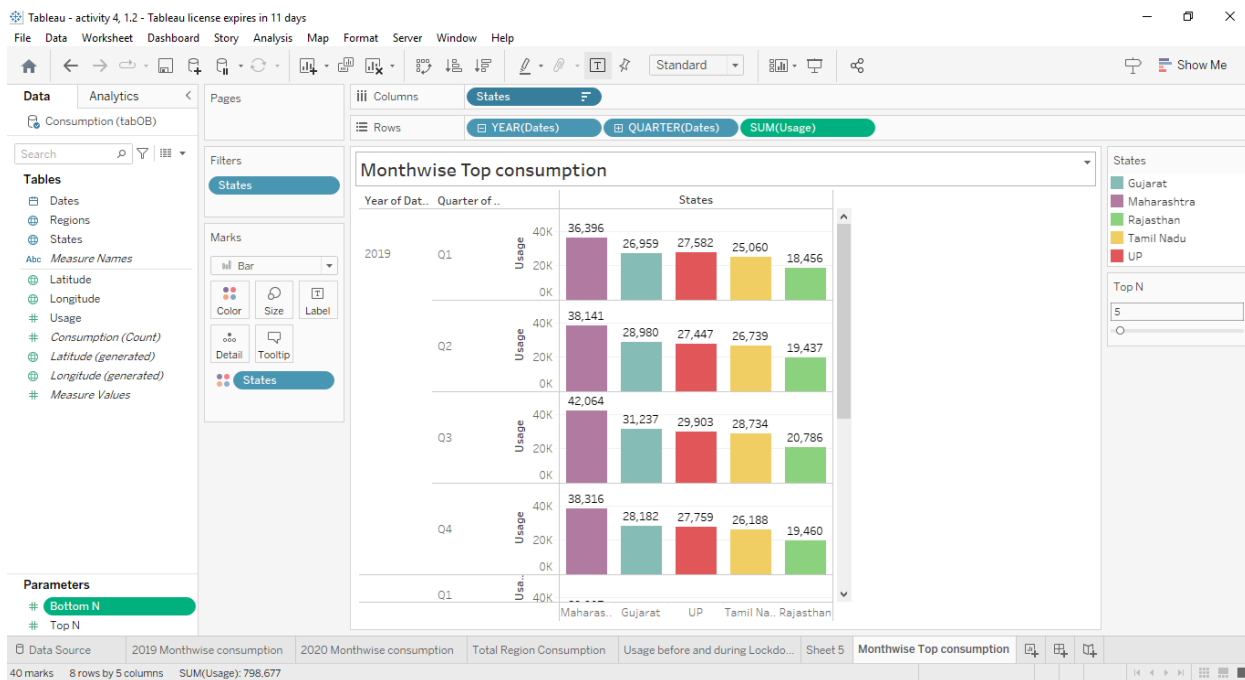


Usage Before and After Lockdown

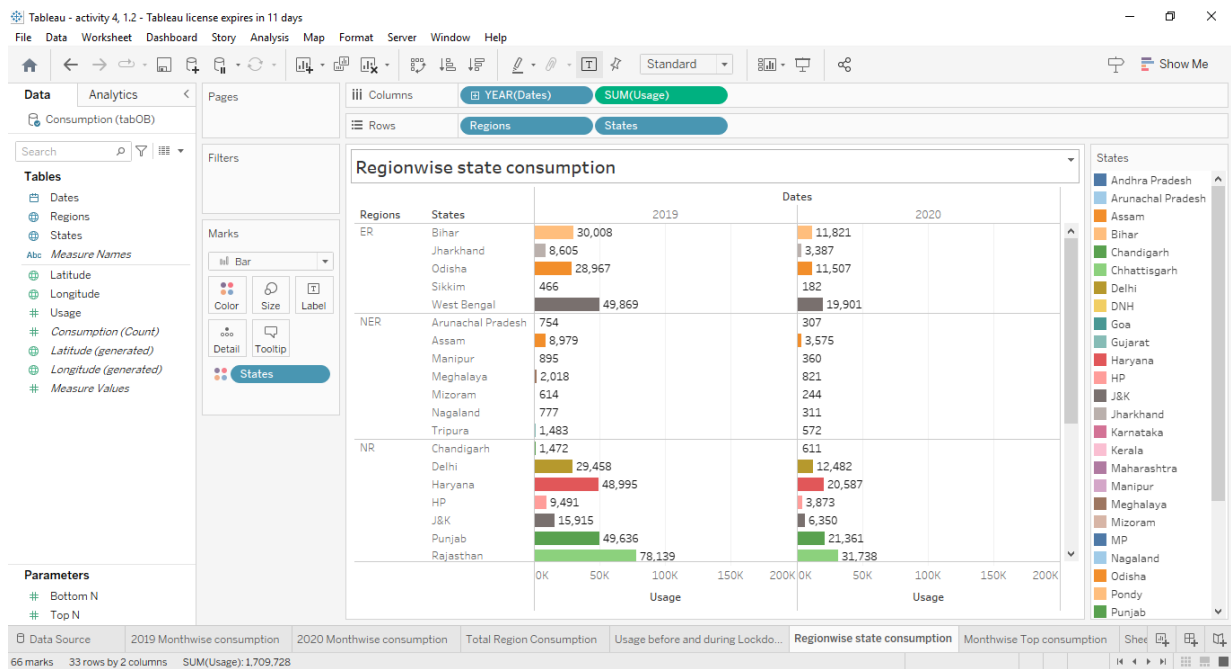


Activity 1.3: To understand Region wise State Usage Quarter Usage and Usage by Year

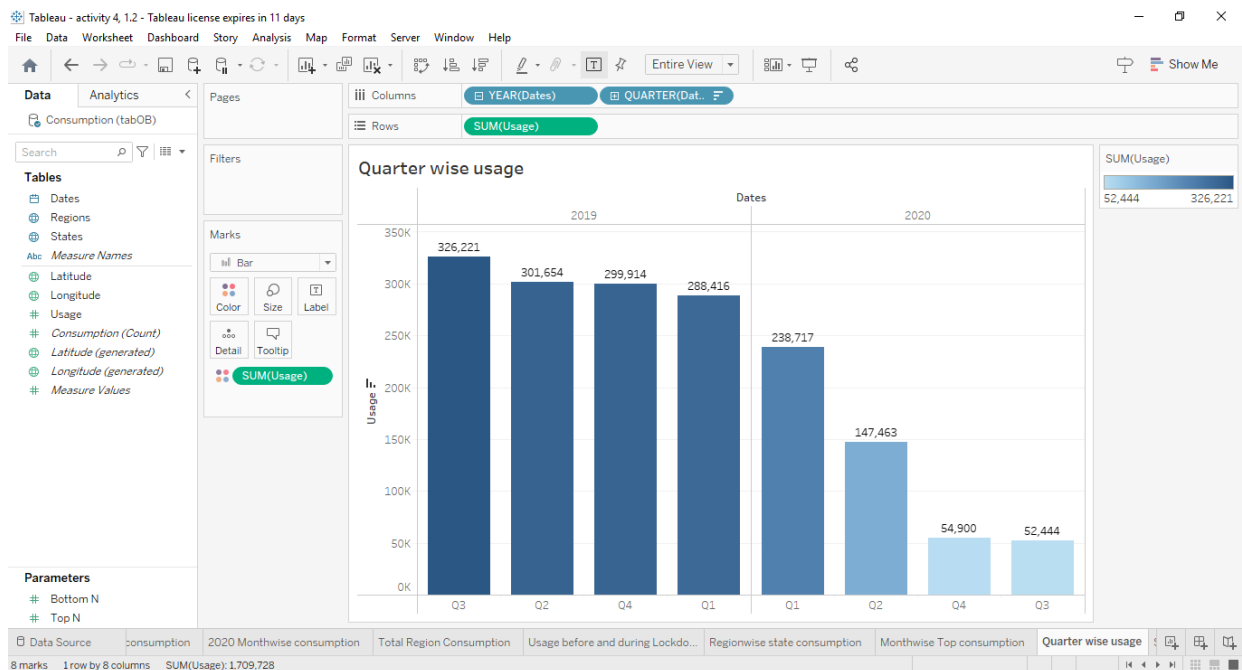
Monthwise Top Consumption



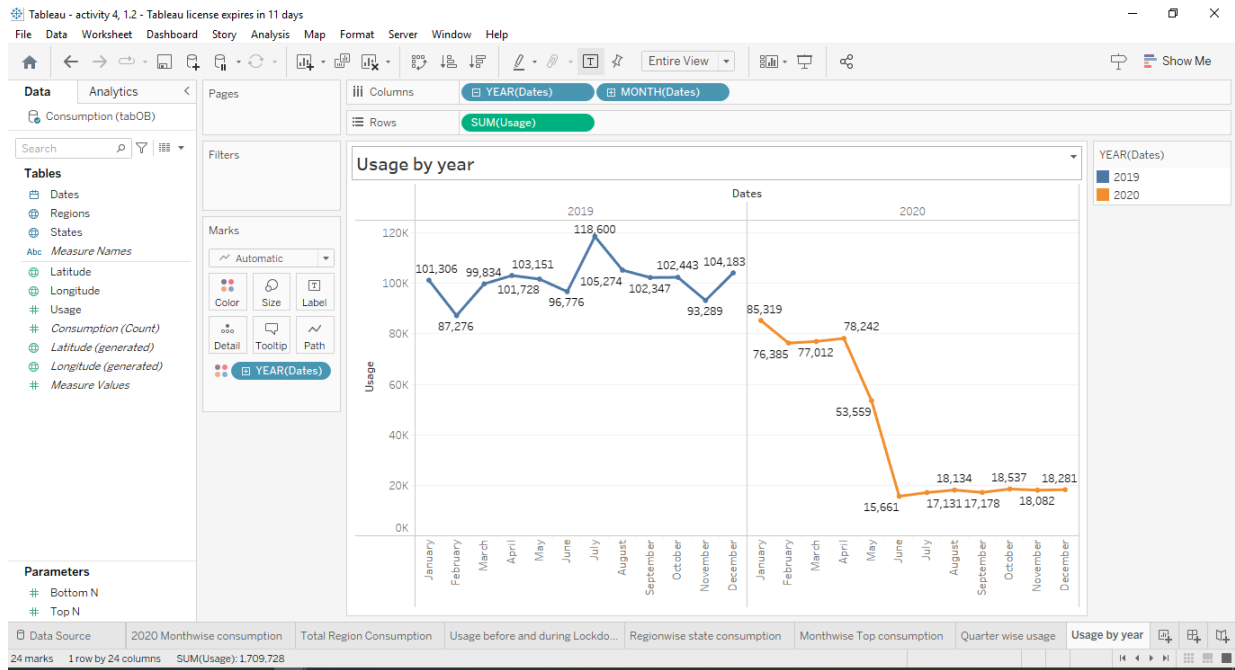
Regionwise State Consumption



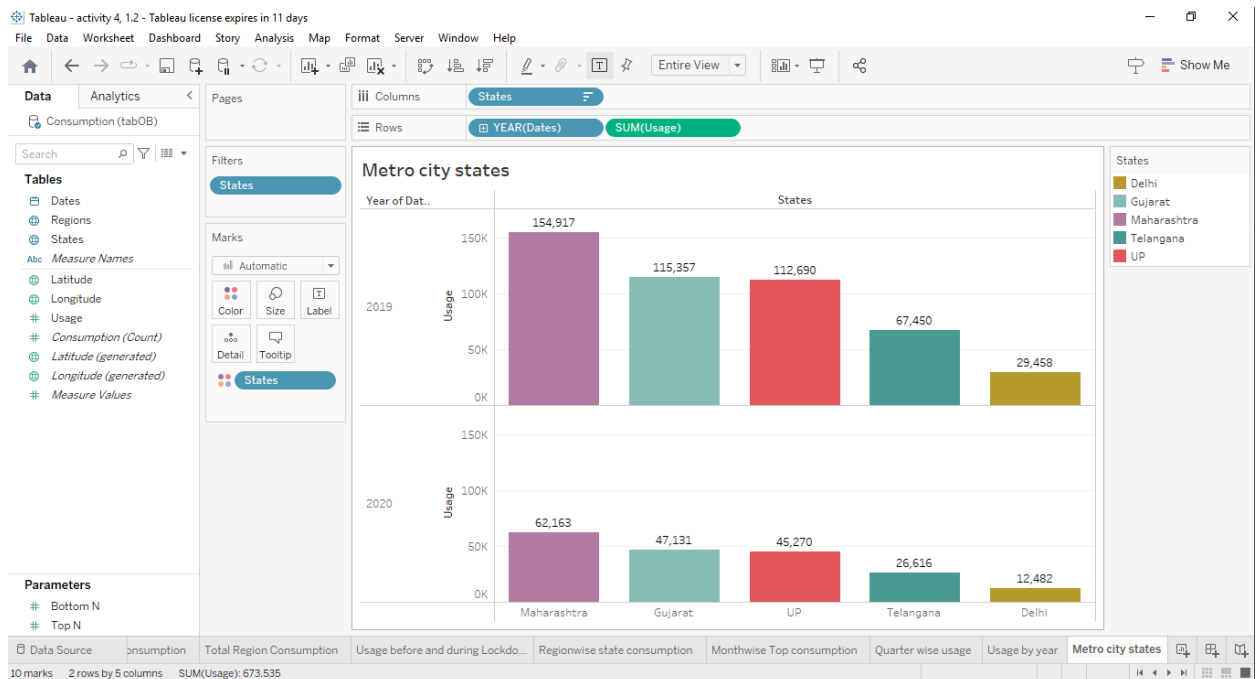
Quarter wise Usage



Usage By Year



Metro City States



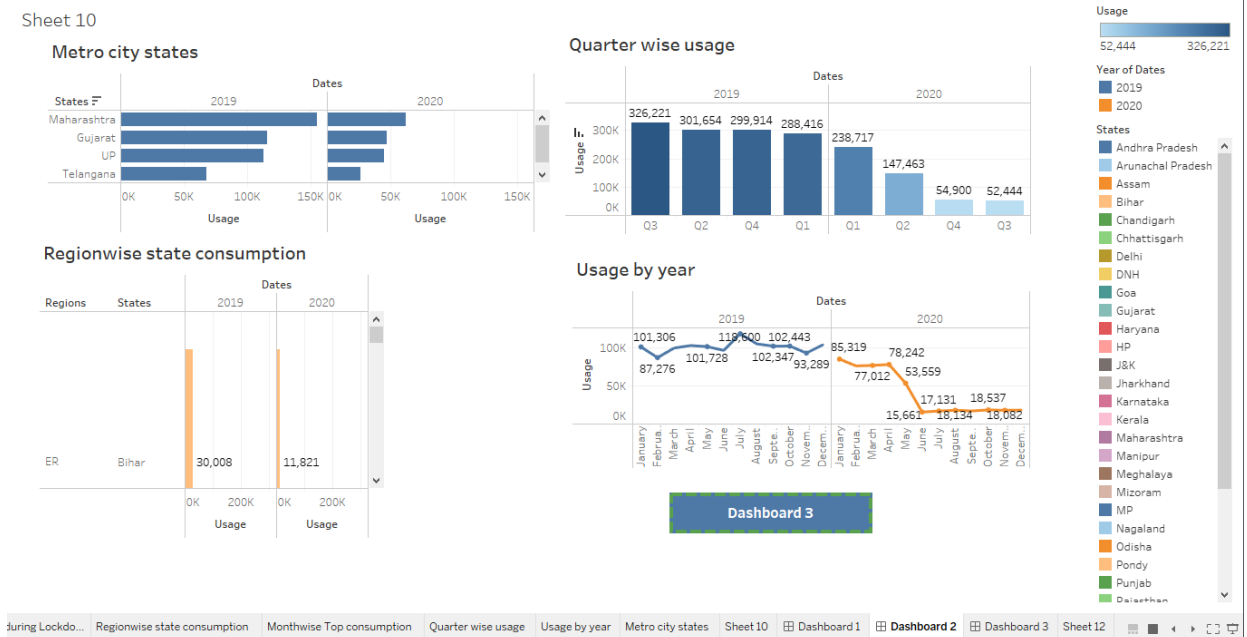
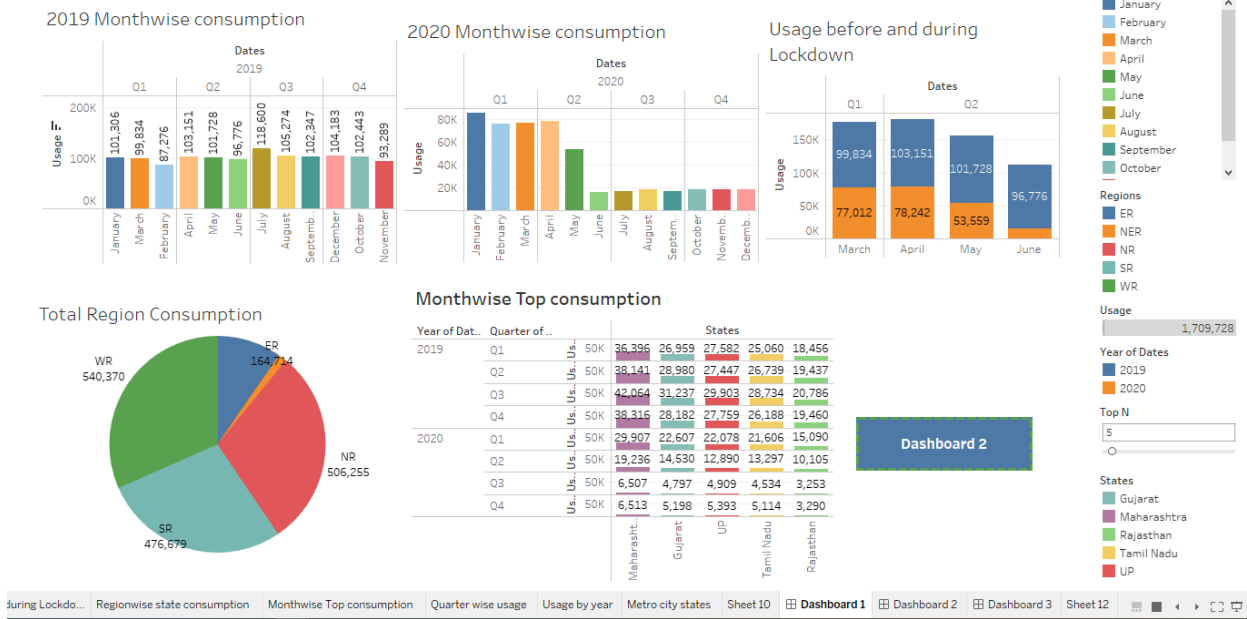
Milestone 5: Dashboard

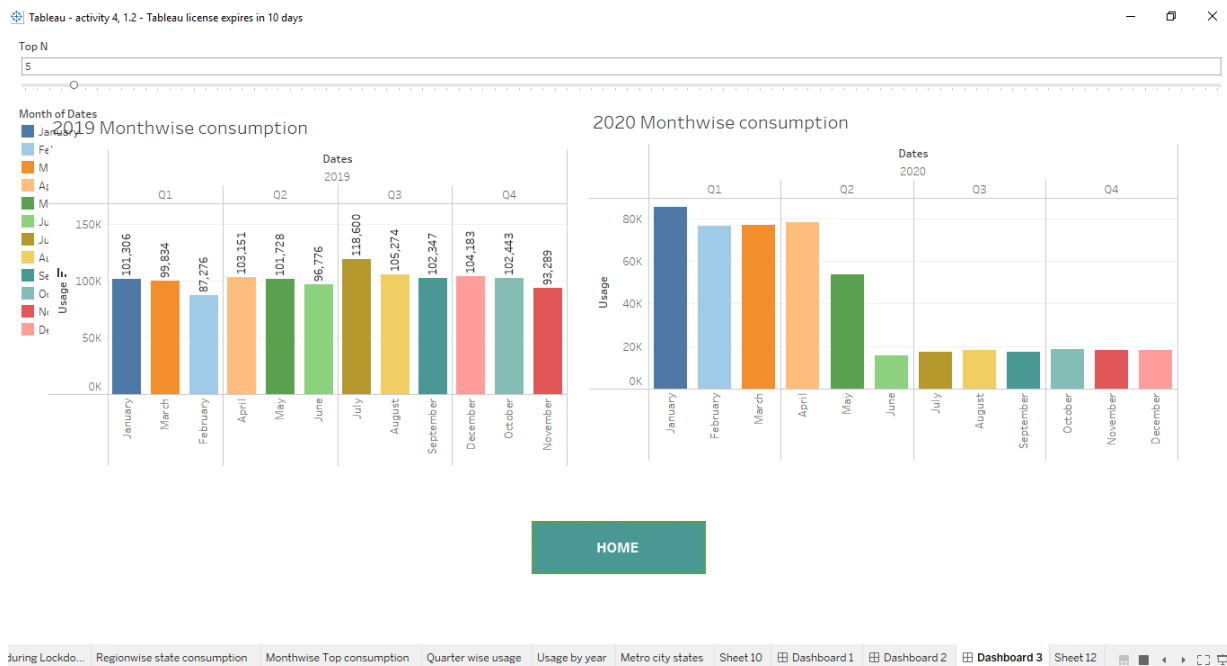
A dashboard is a graphical user interface (GUI) that displays information and data in an organized, easy-to-read format. Dashboards are often used to provide real-time monitoring and analysis of data, and are typically designed for a specific purpose or use case. Dashboards can be used in a variety of 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.

Activity :1- Responsive and Design of Dashboard

The responsiveness and design of a dashboard for analyzing the performance and efficiency of Radisson Hotels is crucial to ensure that the information is easily understandable and actionable. Key considerations for designing a responsive and effective dashboard include user-centered design, clear and concise information, interactivity, data-driven approach, accessibility, customization, and security. The goal is to create a dashboard that is user-friendly, interactive, and data-driven, providing actionable insights to improve the performance and efficiency of Radisson Hotels.

Once you have created views on different sheets in Tableau, you can pull them into a dashboard.





https://public.tableau.com/shared/DHZ57KRFB?:display_count=n&origin=viz_share_link

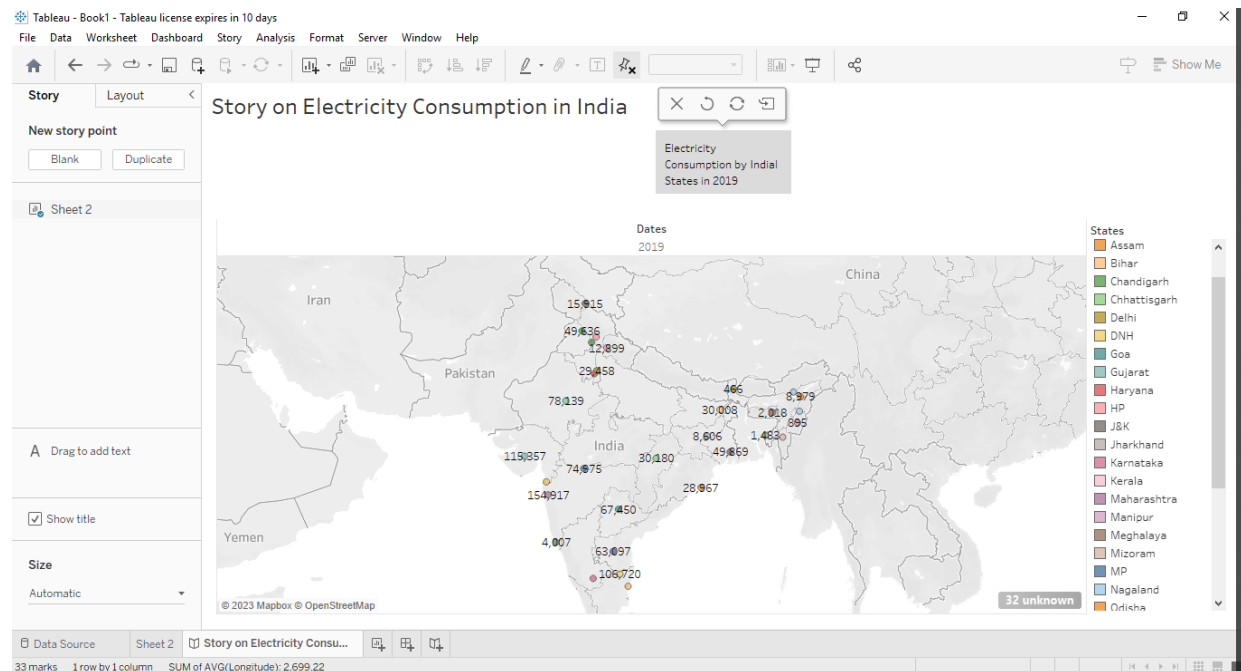
Milestone 6: Story

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.

Activity:1- No of Scenes of Story

The number of scenes in a storyboard for a data visualization analysis of the electricity consumption in india will depend on the complexity of the analysis and the specific insights that are trying to be conveyed. A storyboard is a visual

representation of the data analysis process and it breaks down the analysis into a series of steps or scenes.



<https://github.com/lokes20030915/Plugging-into-the-Future-An-Exploration-of-Electricity-Consumption-Patterns>

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.

SQLQuery1.sql - LENOVO\SQLLEXPRESS.tabOB (LENOVO\ELCOT (55)) - Microsoft SQL Server Management Studio

File Edit View Query Project Tools Window Help

tabOB

Object Explorer

Connect +

LENOVO\SQLLEXPRESS (SQL Server 1)

Databases

System Databases

Database Snapshots

tabOB

Database Diagrams

Tables

System Tables

FileTables

External Tables

Graph Tables

dbo.Consumption

Columns

States (nvarchar)

Regions (nvarchar)

latitude (float)

longitude (float)

Dates (date, n)

Usage (float, r)

Keys

Constraints

Triggers

Indexes

Statistics

Views

External Resources

Synonyms

Programmability

Query Store

SQLQuery1.sql - LENOVO\ELCOT (55)

Exec sp_help 'Consumption'

Results

Name	Owner	Type	Created_datetime
Consumption	dbo	user table	2023-04-22 22:38:06.477

Column_name	Type	Computed	Length	Prec	Scale	Nullable	TrimTrailingBlanks	FixedLenNullInSource	Collation
1 States	nvarchar	no	100			no	(n/a)	(n/a)	SQL_Latin1_General_CP1_CI_AS
2 Regions	nvarchar	no	100			no	(n/a)	(n/a)	SQL_Latin1_General_CP1_CI_AS
3 latitude	float	no	8	53		NULL	no	(n/a)	NULL
4 longitude	float	no	8	53		NULL	no	(n/a)	NULL
5 Dates	date	no	3	10	0	no	(n/a)	(n/a)	NULL
6 Usage	float	no	8	53		NULL	no	(n/a)	NULL

Identity	Seed	Increment	Not For Replication
1 No identity column defined.	NULL	NULL	NULL

RowGuidCol
1 No rowguidcol column defined.

Data_located_on_filegroup
1 PRIMARY

Query executed successfully.

LENOVO\SQLLEXPRESS (16.0 RTM) LENOVO\ELCOT (55) tabOB 00:00:04 10 rows

Ready Ln 1 Col 27 Ch 27 INS

SQLQuery1.sql - LENOVO\SQLLEXPRESS.tabOB (LENOVO\ELCOT (55)) - Microsoft SQL Server Management Studio

File Edit View Query Project Tools Window Help

tabOB

Object Explorer

Connect +

LENOVO\SQLLEXPRESS (SQL Server 1)

Databases

System Databases

Database Snapshots

tabOB

Database Diagrams

Tables

System Tables

FileTables

External Tables

Graph Tables

dbo.Consumption

Columns

States (nvarchar)

Regions (nvarchar)

latitude (float)

longitude (float)

Dates (date, n)

Usage (float, r)

Keys

Constraints

Triggers

Indexes

Statistics

Views

External Resources

Synonyms

Programmability

Query Store

SQLQuery1.sql - LENOVO\ELCOT (55)

Use TabOB select * from Information_Schema.columns

Results

TABLE_CATALOG	TABLE_SCHEMA	TABLE_NAME	COLUMN_NAME	ORDINAL_POSITION	COLUMN_DEFAULT	IS_NULLABLE	DATA_TYPE	CHARACTER_MAXIMUM_LENGTH	CHARACTER_MAXIMUM_LENGTH
tabOB	dbo	Consumption	States	1	NULL	NO	nvarchar	50	100
tabOB	dbo	Consumption	Regions	2	NULL	NO	nvarchar	50	100
tabOB	dbo	Consumption	latitude	3	NULL	NO	float	NULL	NULL
tabOB	dbo	Consumption	longitude	4	NULL	NO	float	NULL	NULL
tabOB	dbo	Consumption	Dates	5	NULL	NO	date	NULL	NULL
tabOB	dbo	Consumption	Usage	6	NULL	NO	float	NULL	NULL

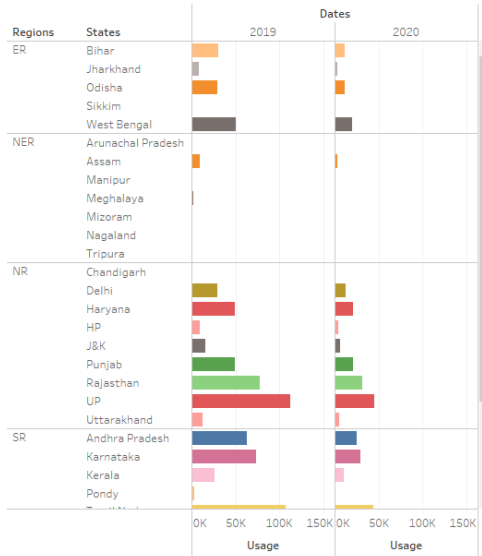
Query executed successfully.

LENOVO\SQLLEXPRESS (16.0 RTM) LENOVO\ELCOT (55) tabOB 00:00:00 6 rows

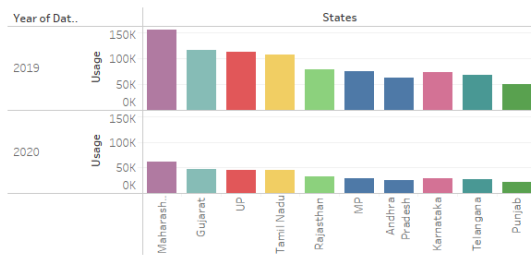
Ready Ln 1 Col 3

Activity 2: Utilization of Data Filters

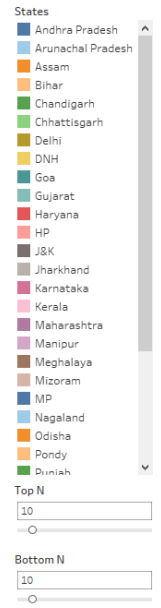
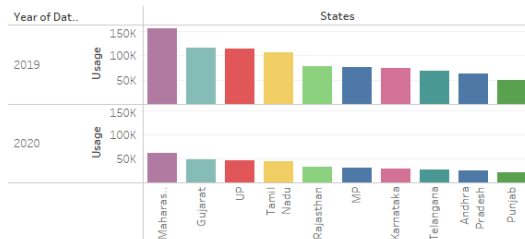
Regionwise State Consumption



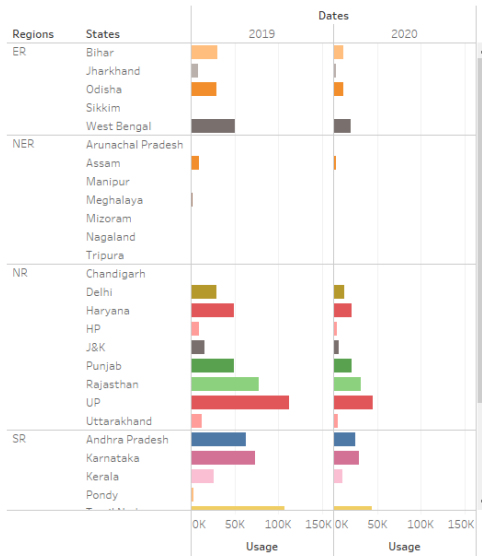
Top N



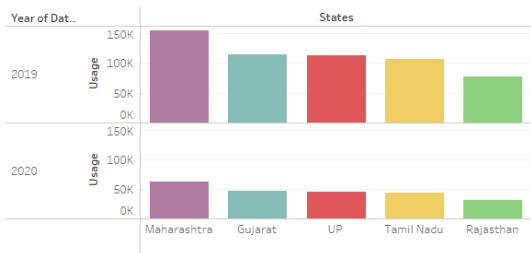
Bottom N



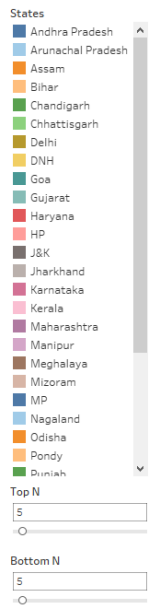
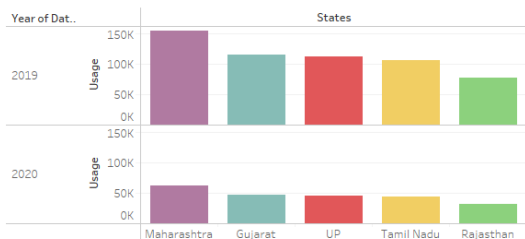
Regionwise State Consumption

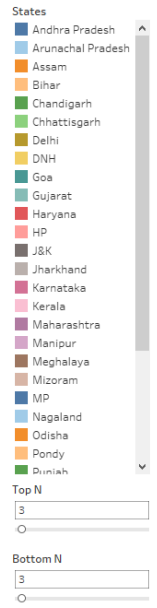


Top N

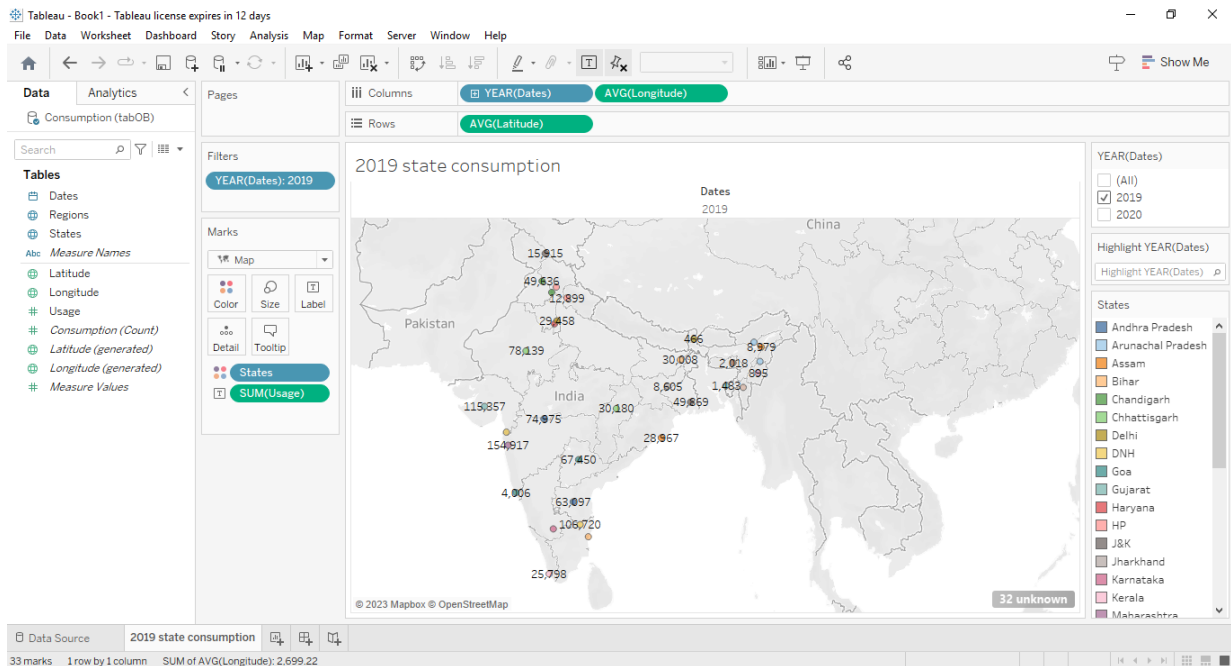


Bottom N

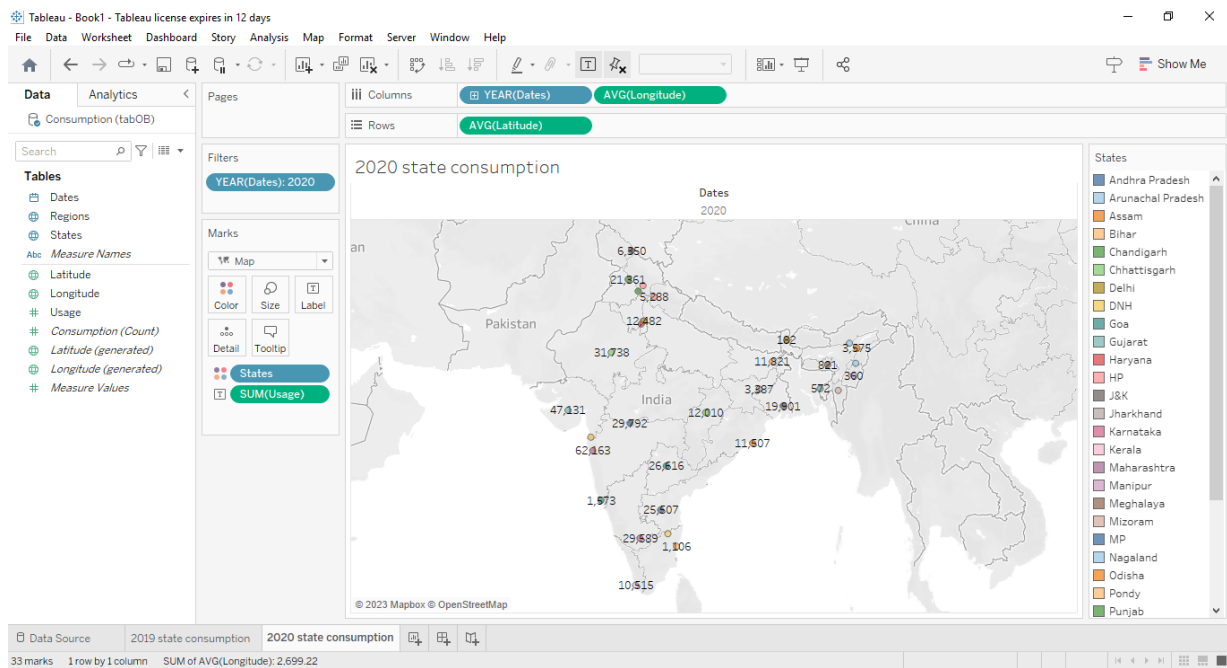




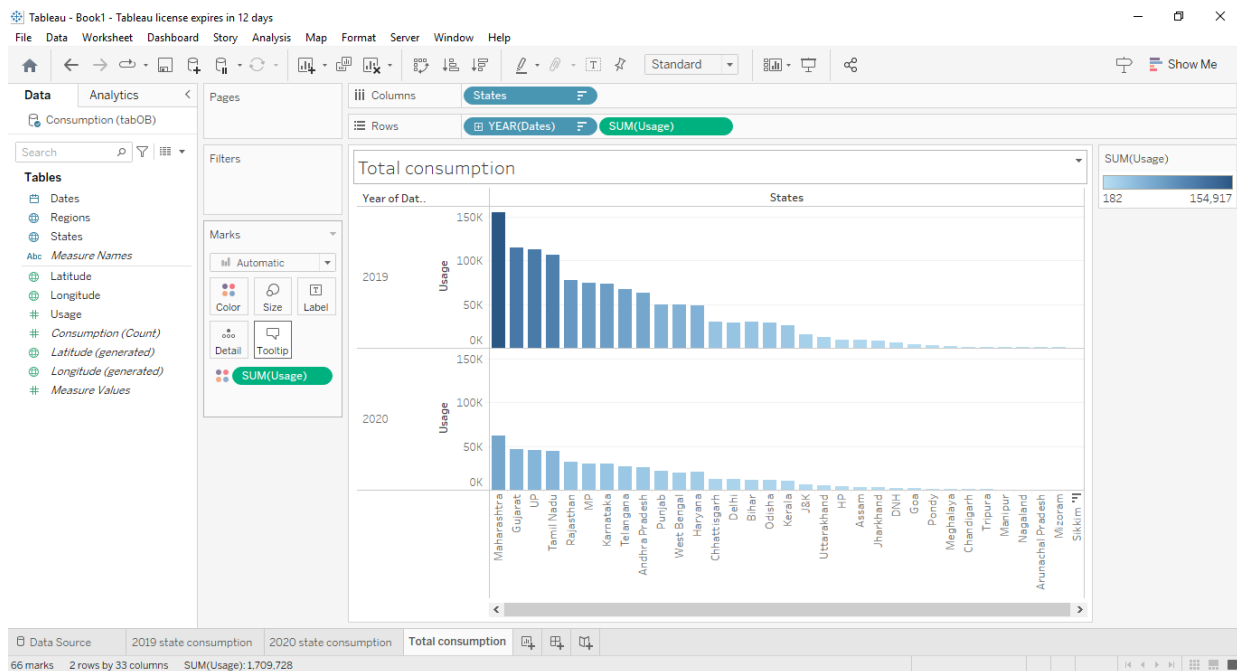
1) 2019 State Consumption



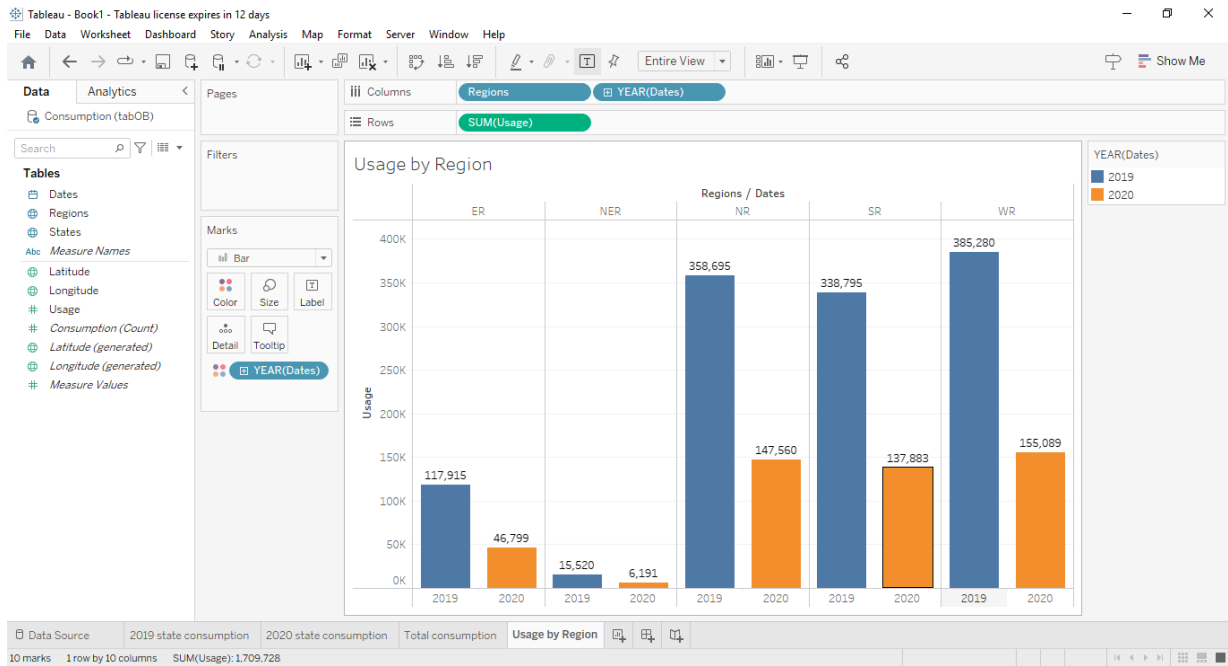
2) 2020 State Consumption



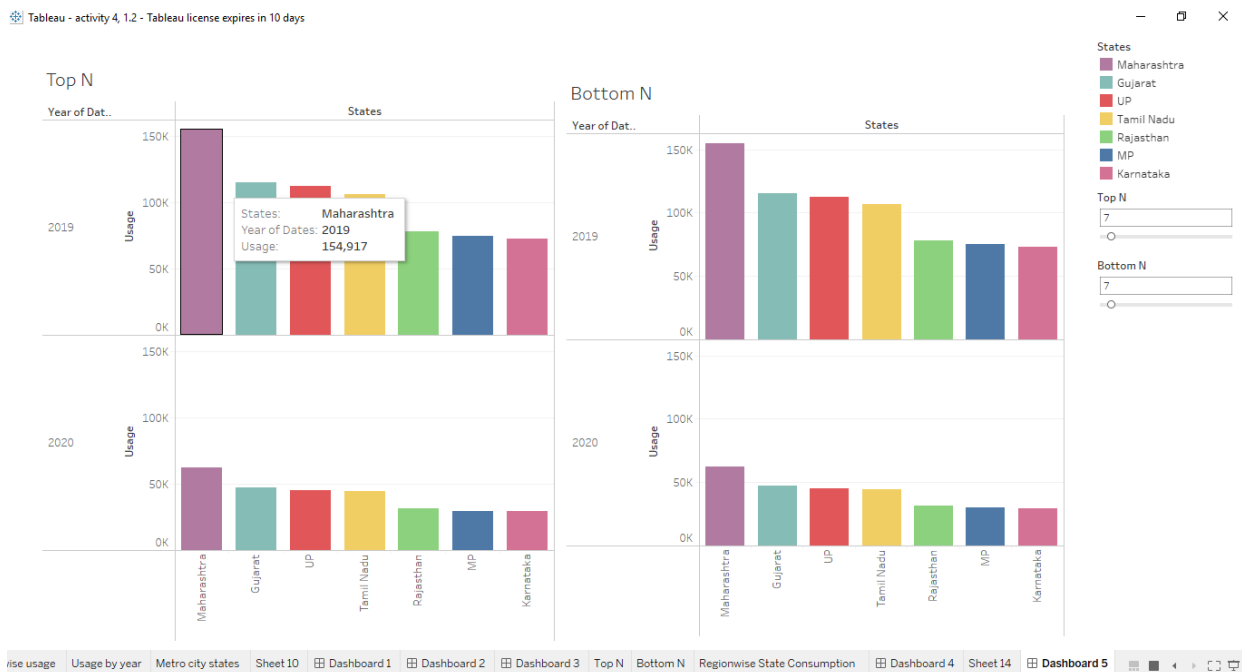
3) Total Consumption



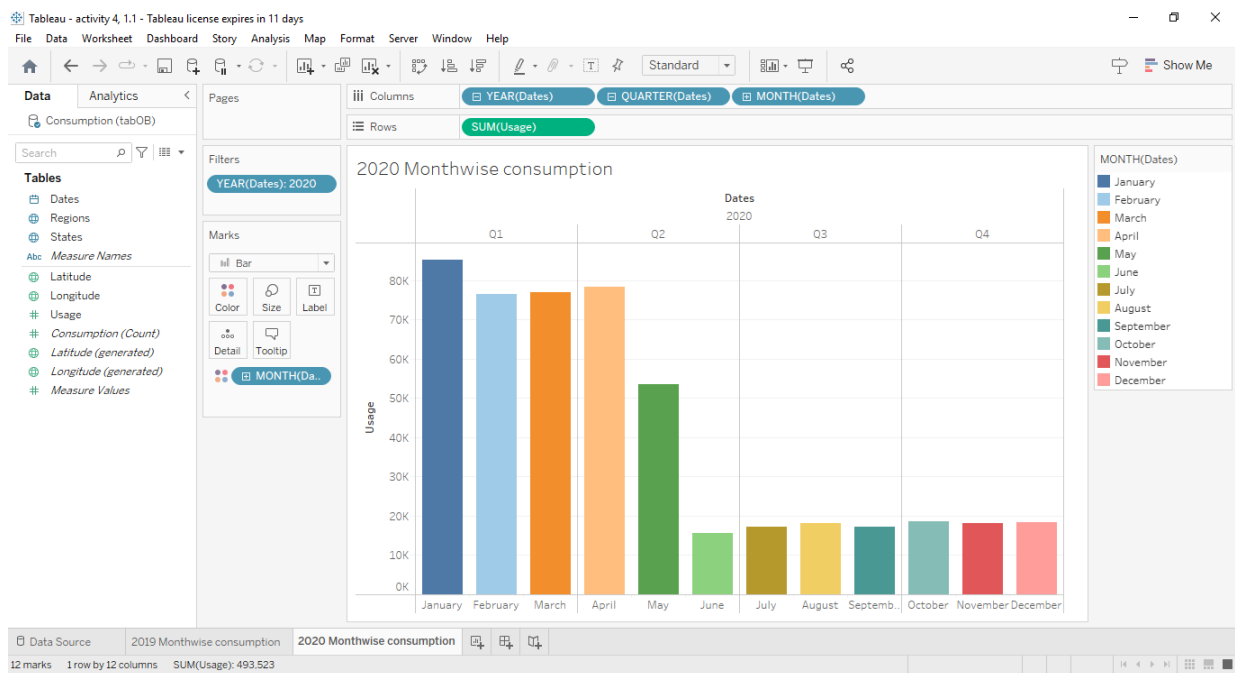
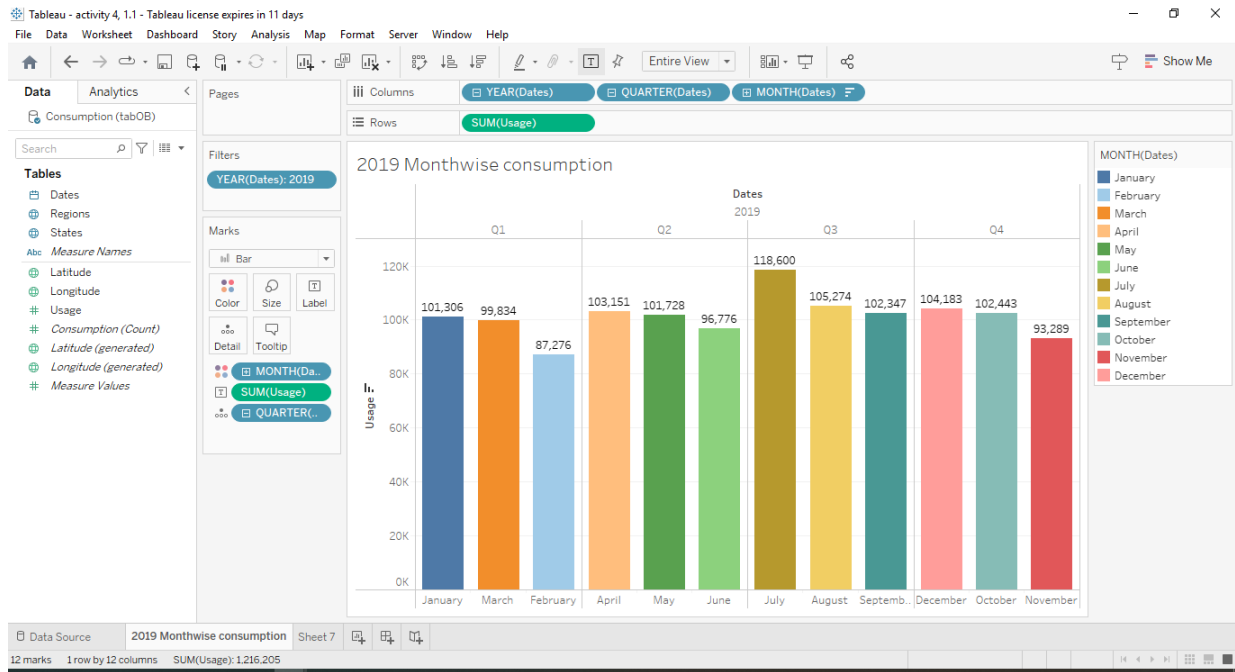
4) Usage By Region



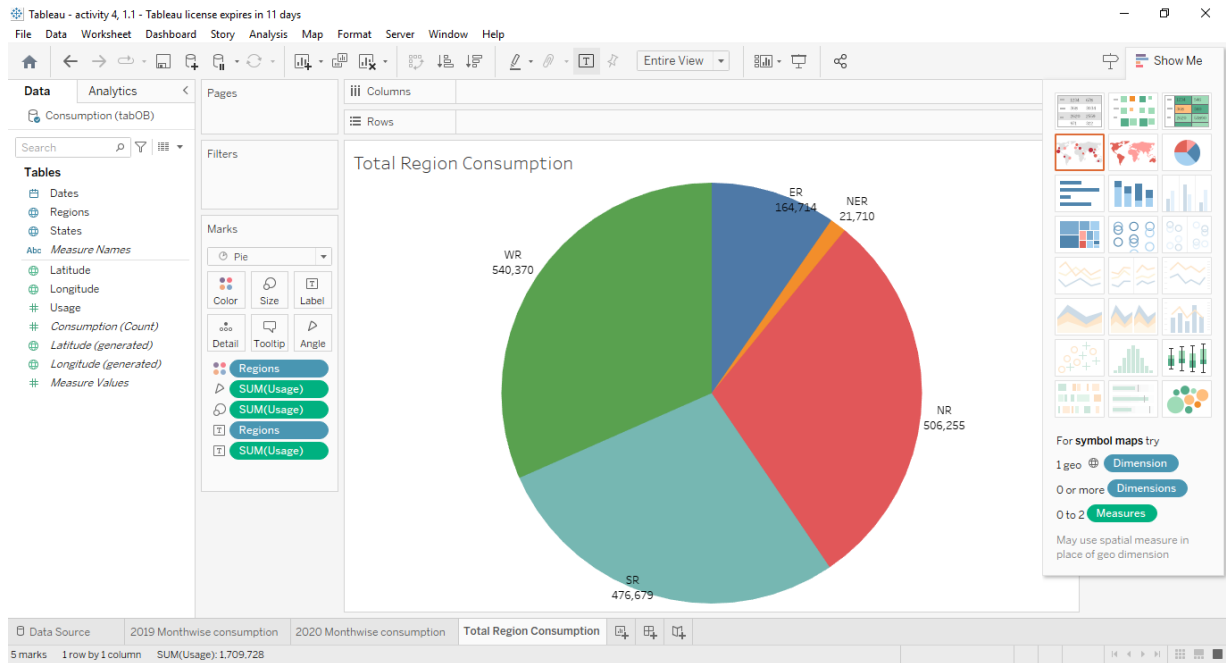
5) Top N and Bottom N



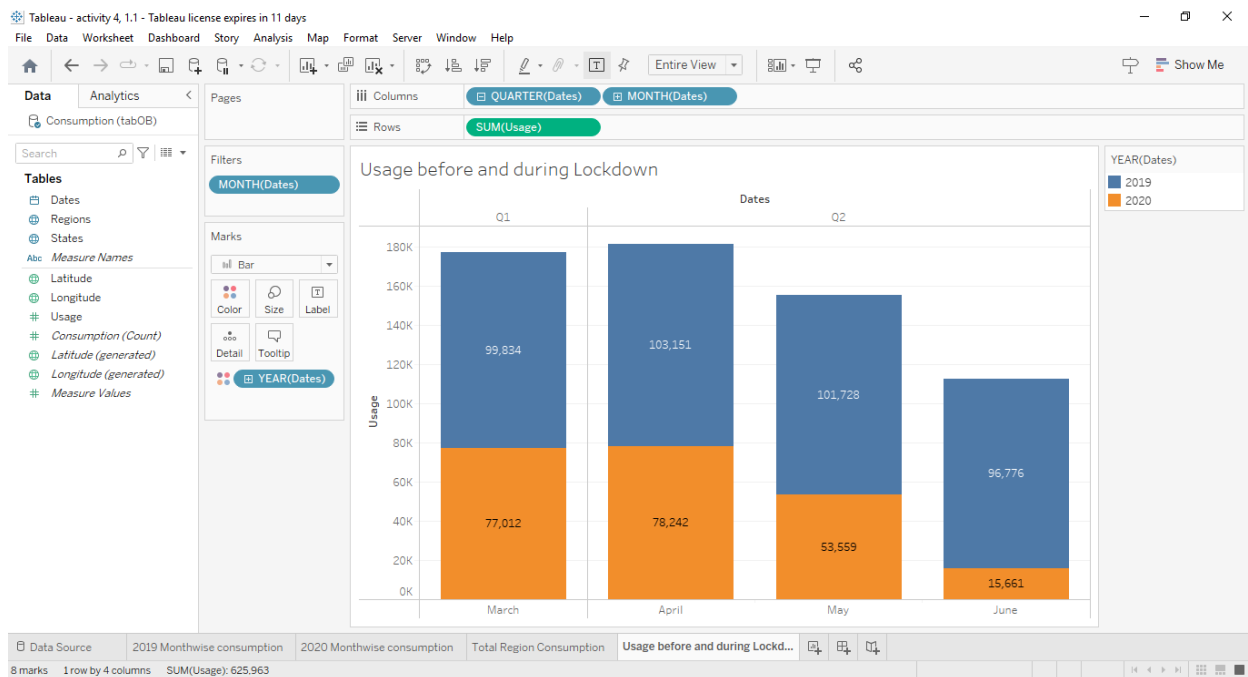
6) 2019 and 2020 Monthwise Consumption



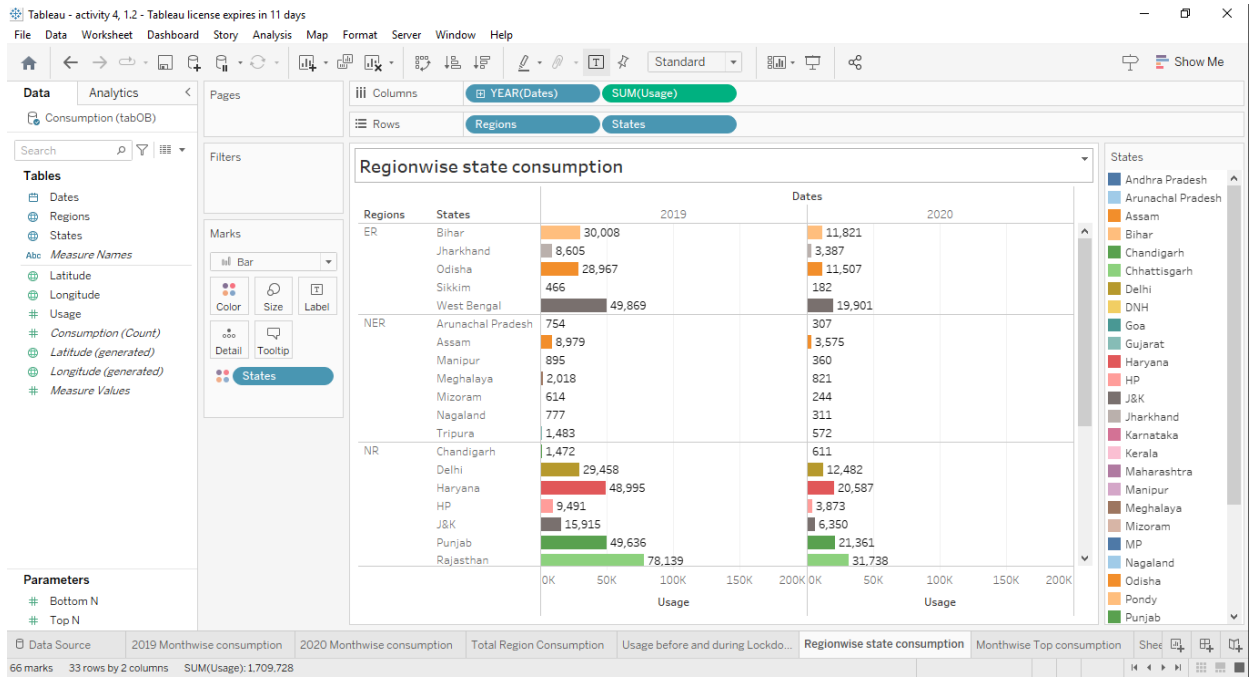
7) Total Consumption Region Wise



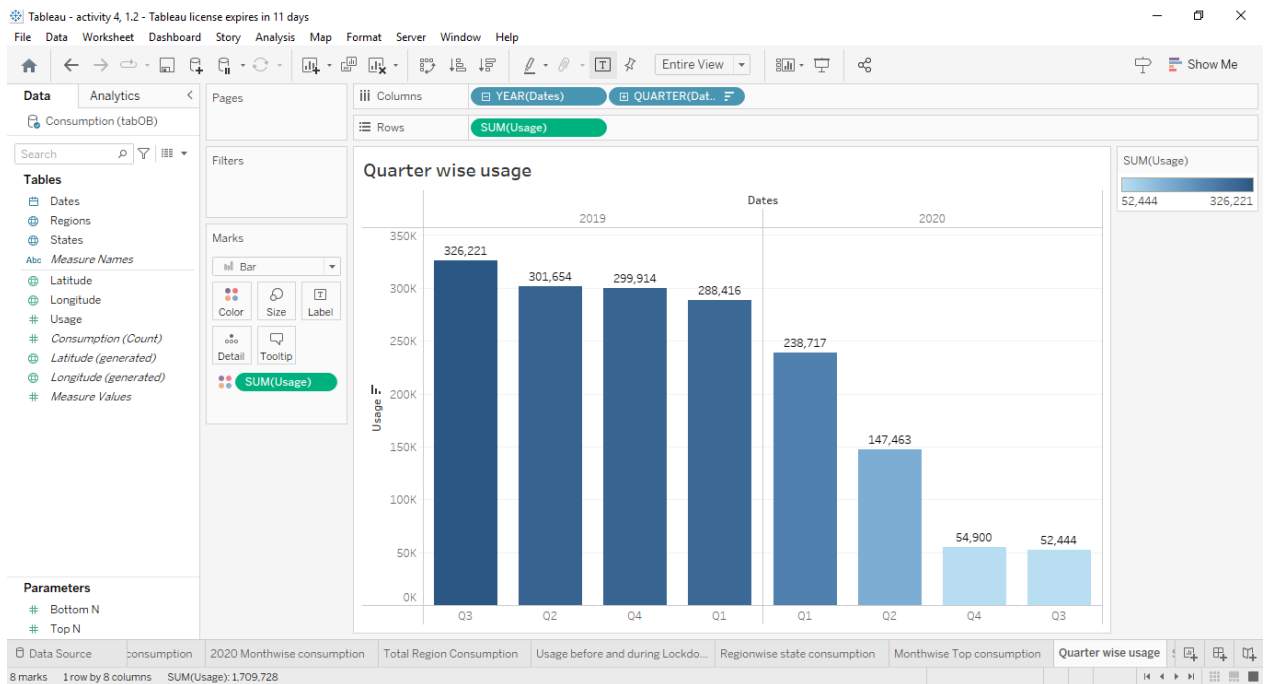
8) Usage Before and After Lockdown



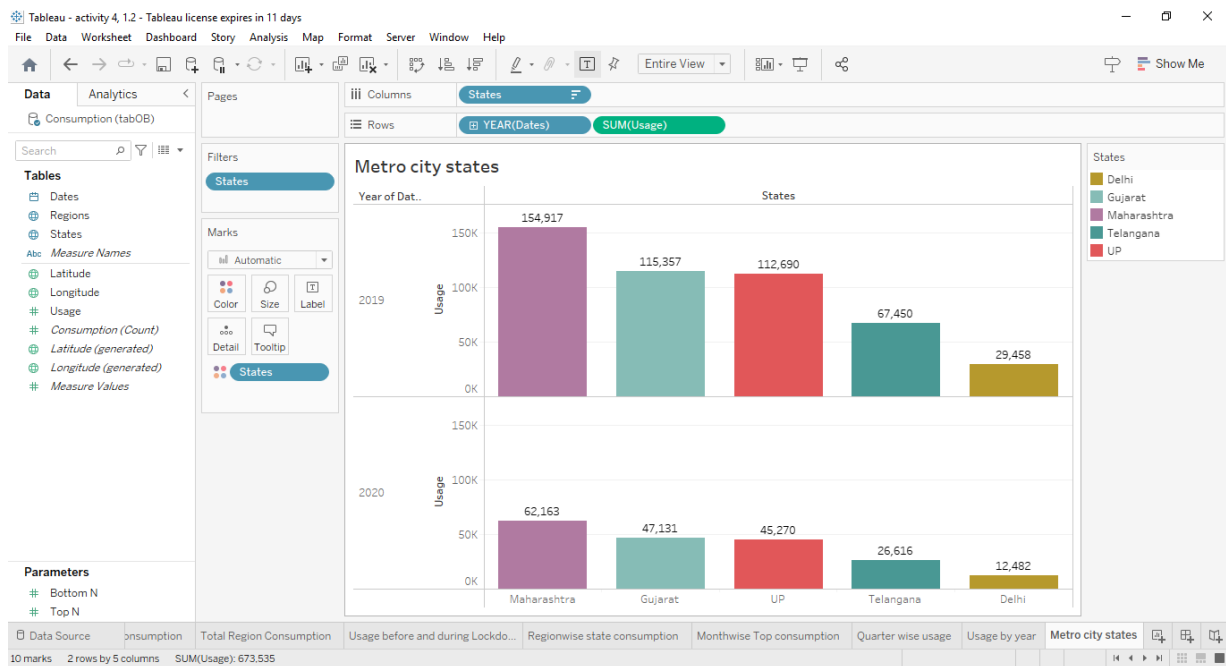
9) Region wise State Usage



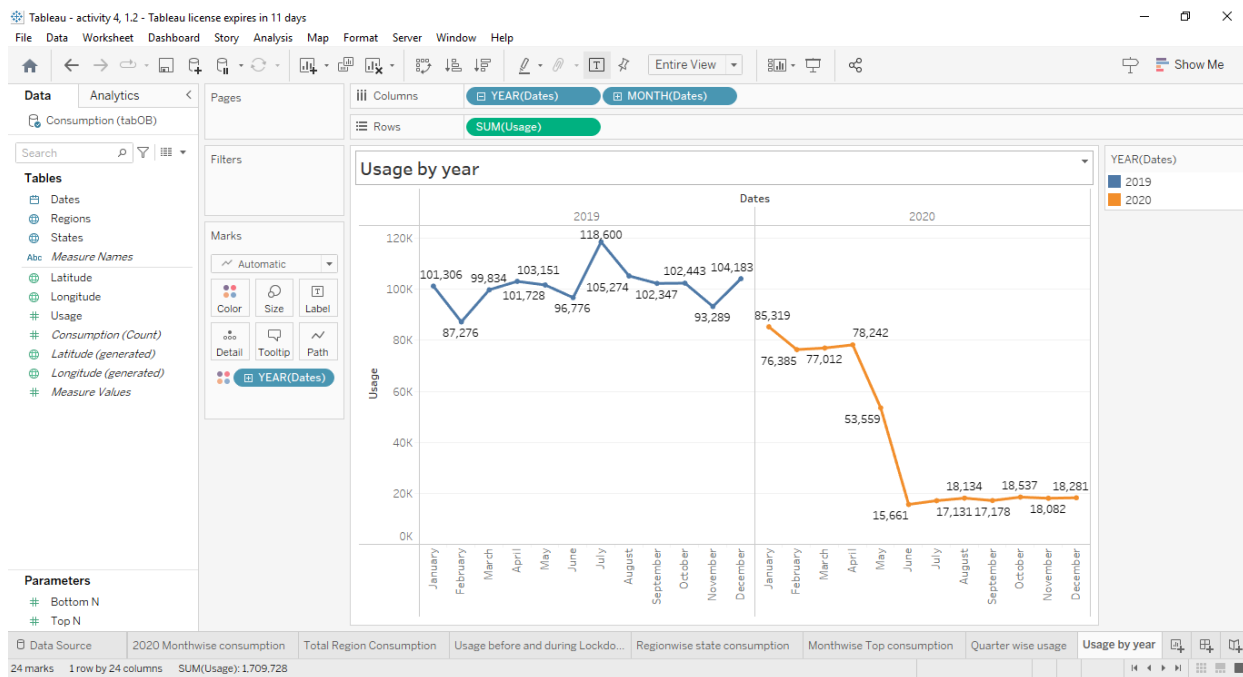
10) Quarter Usage



11) Metro city State usage



12) Usage by year

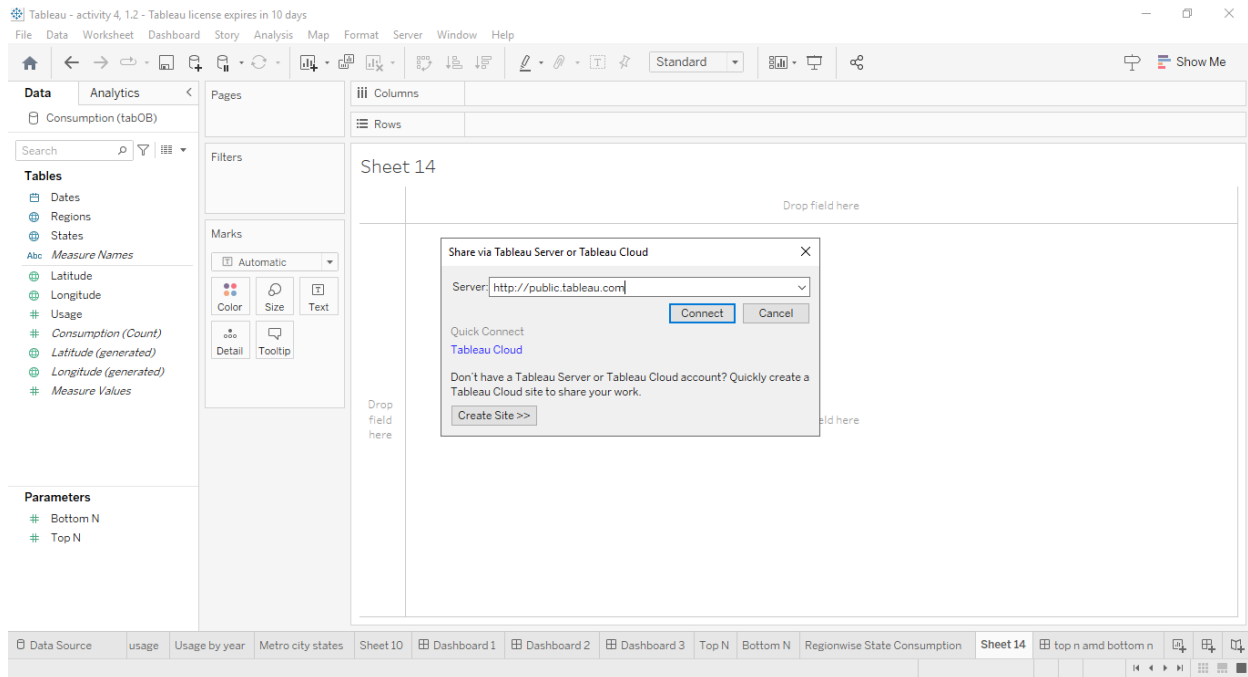


Milestone 8: Web integration

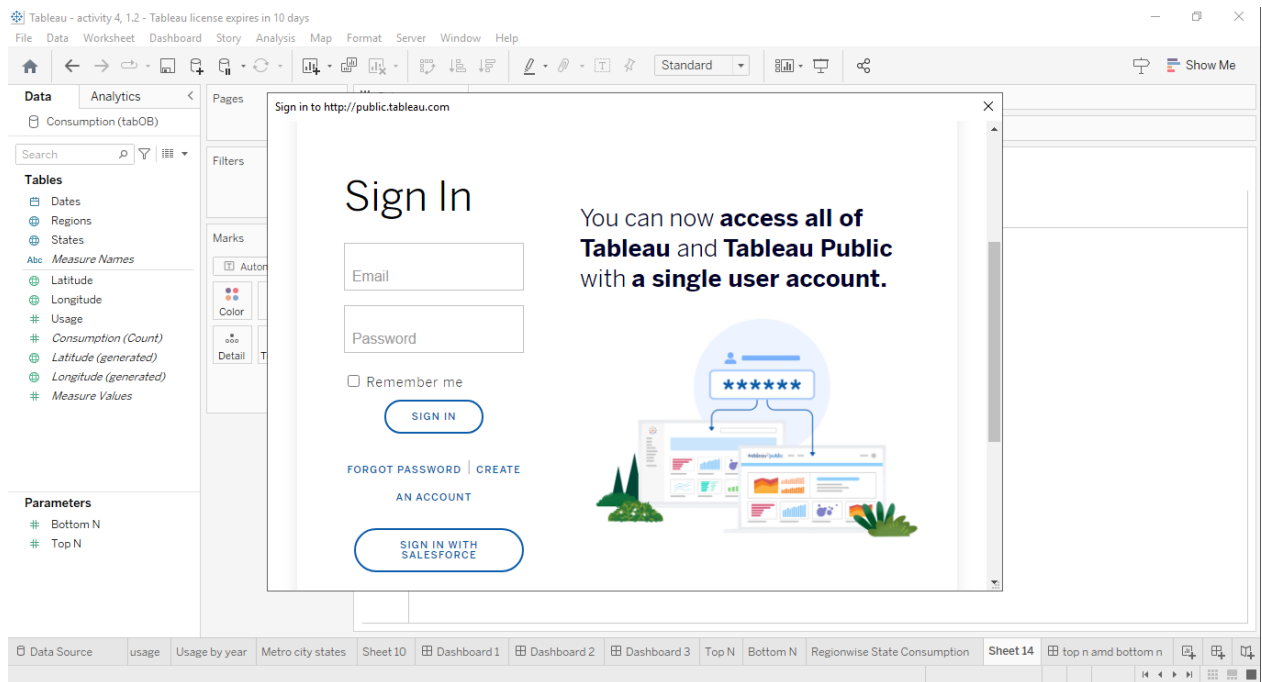
Publishing helps us to track and monitor key performance metrics, to communicate results and progress. help a publisher stay informed, make better decisions, and communicate their performance to others.

Publishing dashboard and reports to tableau public

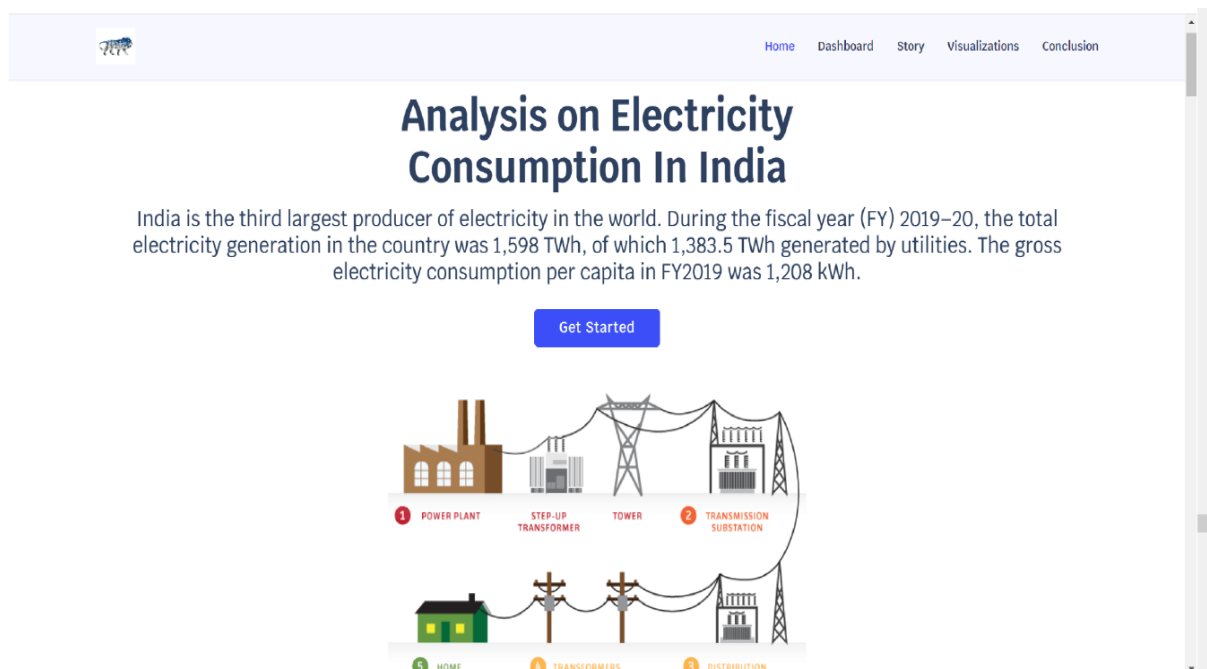
Step 1: Go to Dashboard/story, click on share button on the top ribbon

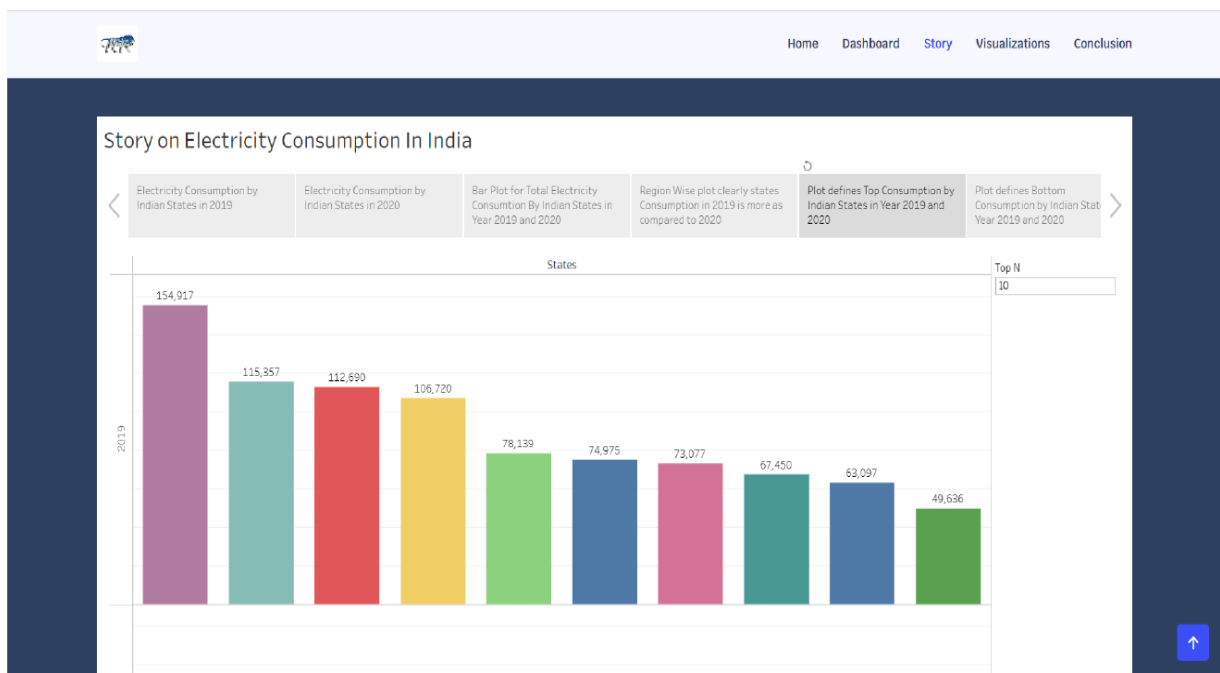
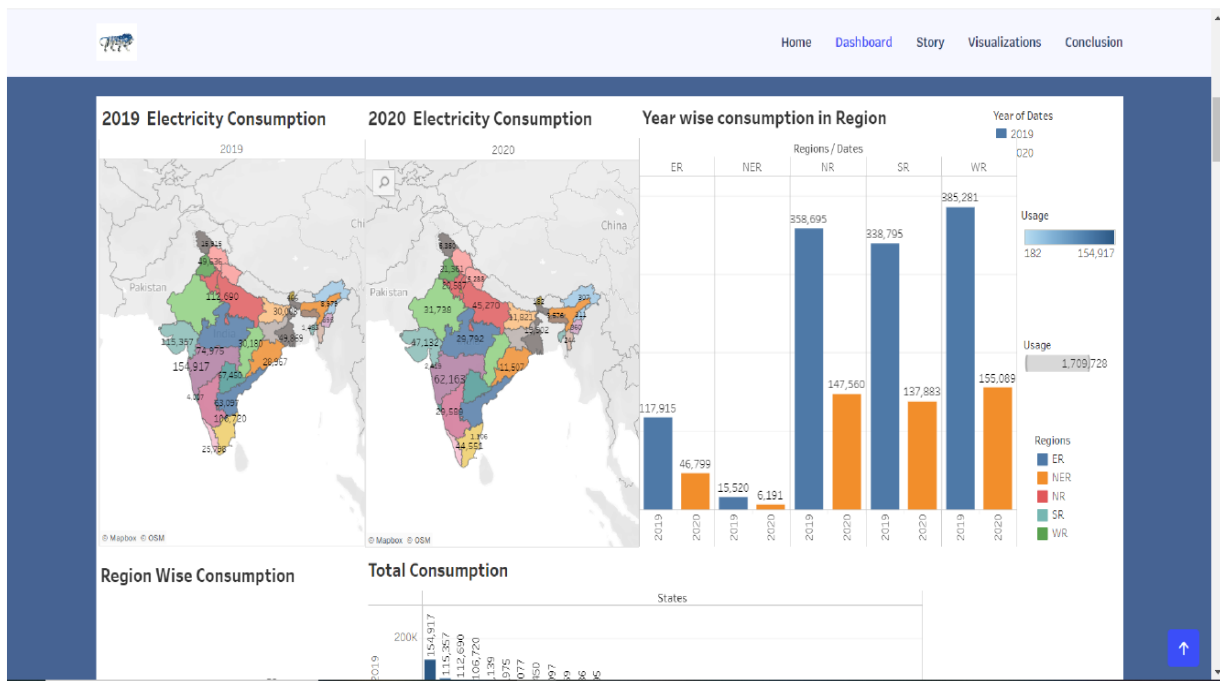


Step 2: Once you click on connect it will ask you for tableau public user name and password



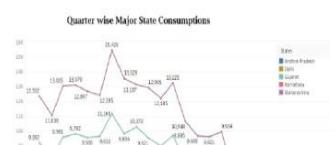
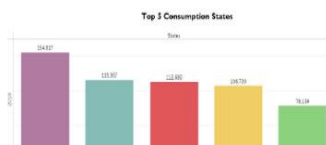
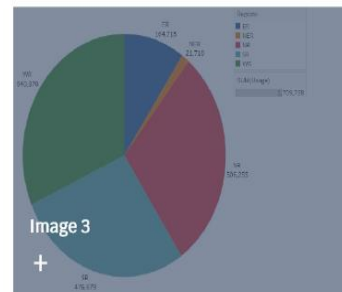
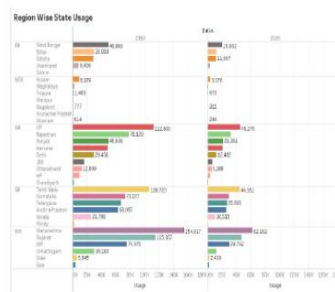
Activity 1: Dashboard and Story embed with UI With Flask







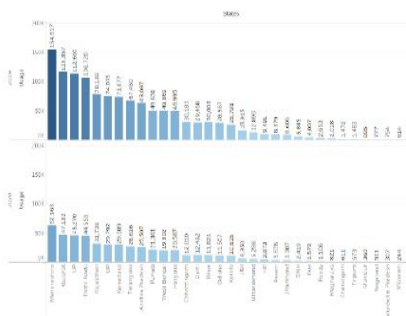
Visualizations

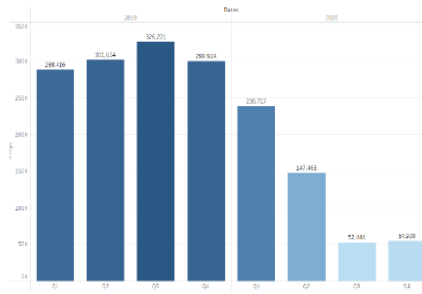


Conclusion

Electricity Consumption Stats.

- ✓ 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 in Quarters

- ✓ 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.

Electricity Consumption in Regions

- ✓ 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.

