Smart Internz

Plugging into the Future:

An Exploration of

Electricity Consumption Patterns

(Project Based Experiential Learning Program)

Smart Internz

1 INTRODUCTION

1.1 Overview

A brief description about your project

1.2 Purpose

The use of this project. What can be achieved using this?

2 Problem Definition & Design Thinking

2.1 Empathy Map

Paste the empathy map screenshot

2.2 Ideation & Brainstorming Map

Paste the Ideation & brainstorming map screenshot

3 RESULT

Final findings (Output) of the project along with screenshots.

4 ADVANTAGES & DISADVANTAGES

List of advantages and disadvantages of the proposed solution

5 APPLICATIONS

The areas where this solution can be applied

6 CONCLUSION

Conclusion summarizing the entire work and findings.

7 FUTURE SCOPE

Enhancements that can be made in the future.

8 APPENDIX

A. Source Code

Attach the code for the solution built.

1. INTRODUCTION

1.1 Overview

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. Analyzing 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.

1.2 Purpose

The purpose of this project is to analyse the data of electrical consumption in India from Jan 2019 till 5th December 2020 and to find the larger and smaller electricity consumption state in India and related causes, observed the consumption pattern sequences respectively.

2. PROBLEM DEFINITION & DESIGN THINKING

2.1 Paste the empathy map screenshot

With the help of empathy map, the helps to investigate into the mind of users. The empathy map quadrants such as what user says, thinks, feels and does. In this context, based on chosen projects we created the empathy map showcase in **figure 1**. And, thanks to MURAL to providing us the map template.

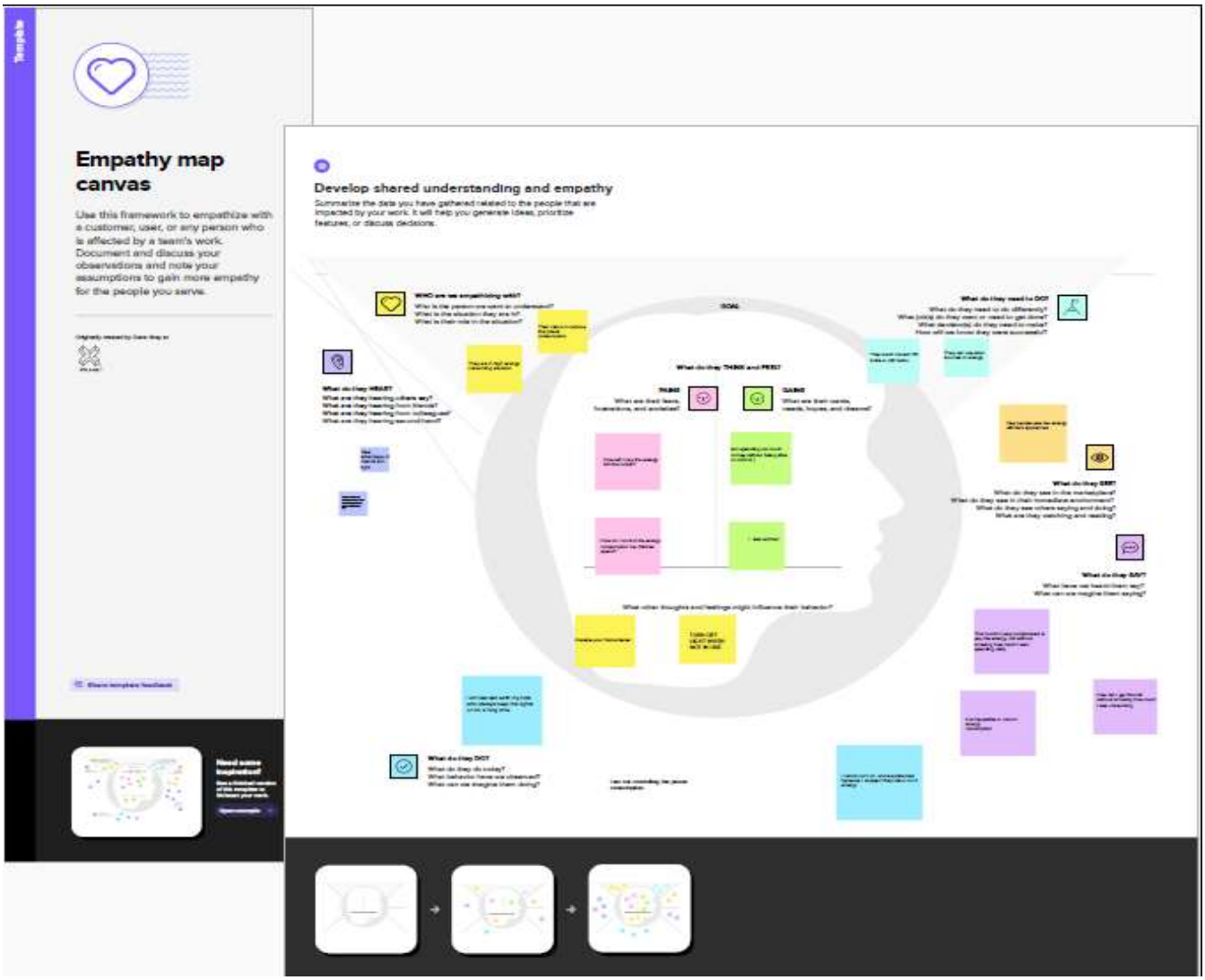


Figure 1. Screenshot about Empathy Map as user minds

2.2. Ideation & Brainstorming Map

The ideation and brainstorming map defined as the closely related to the practice of brainstorming. In this context, based on chosen projects team members given the individual pursuit and further team members making the brainstorming (group) ideas to the respective project using the mural (brainstorming map template) and is shown in **figure 2**.

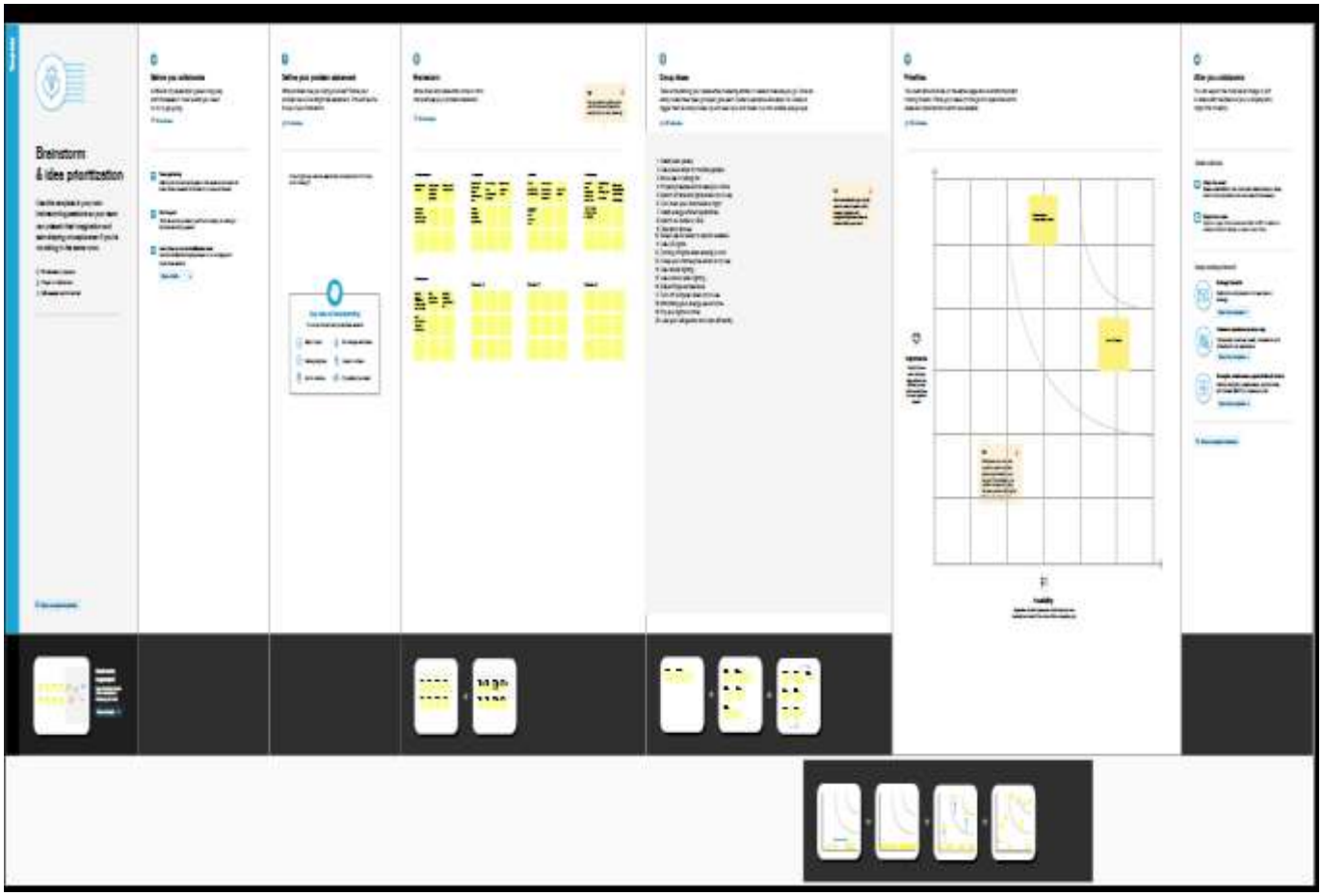


Figure 3. Screenshot about ideation and Brainstorming ideas

3. RESULTS

3.1 Project Based Experiential Learning Course video content

Initially, as a physics students in the naan mudhalvan scheme, we chosen the project entitled "**Plugging into the Future: An Exploration of Electricity Consumption Patterns**". We (team members) watched the course video content and learned the basics about data analytics with advanced tool (Tableau Desktop). We attend MCQs as based on the course video content. The following is the screen shot of course content percentage (**Figure 3**),

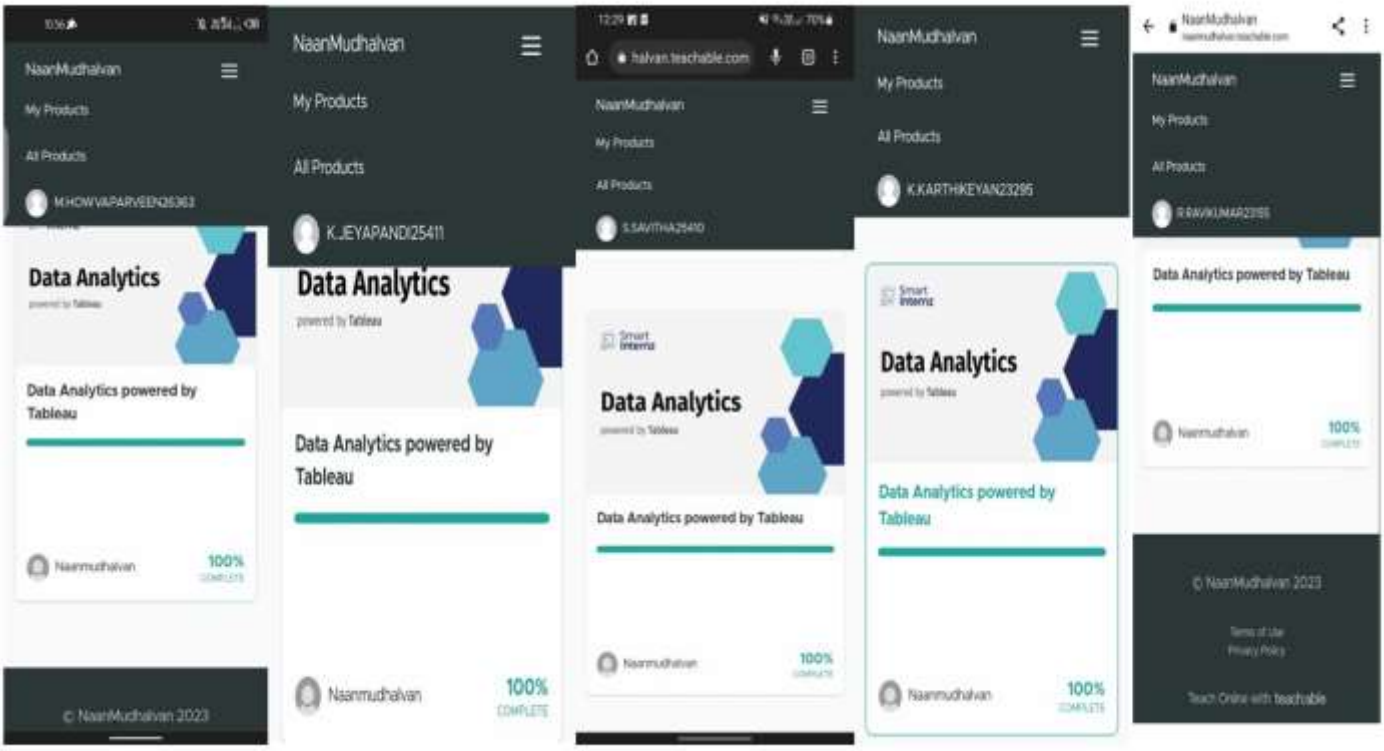
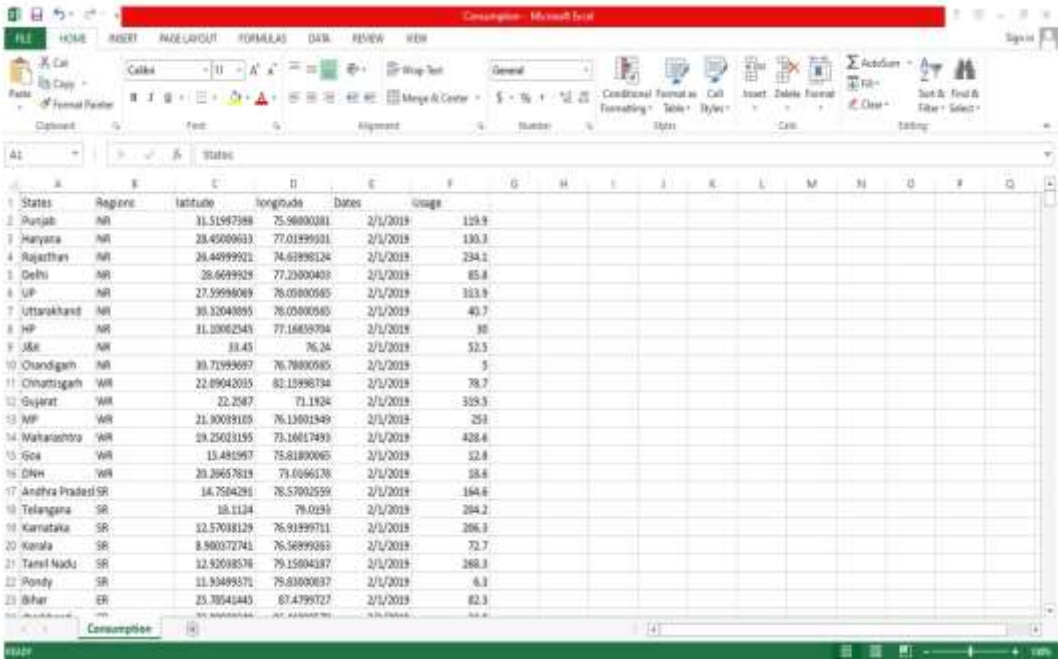


Figure 3. Screenshot about the course video content percentage

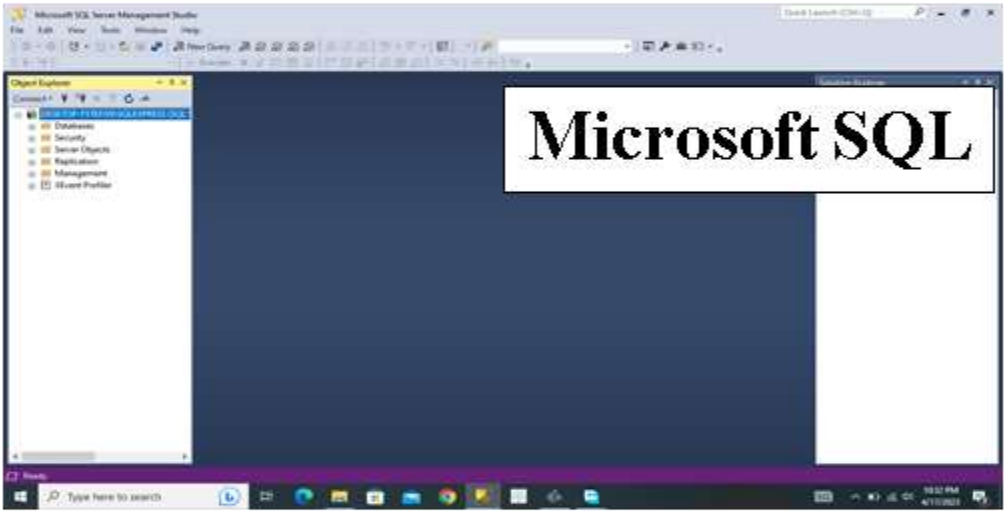
3.2 Data Collection & Connect Database with Tableau

Further, scheme providing the project based learning schedule through the TABLEAU DESKTOP and MICROSOFT SQL with power consumption dataset in all over India during the period of 1st January 2019 to 5th December 2020. We used the Microsoft SQL is acting as the database server in the Tableau desktop (DESKTOP-F5TKFG9/SQLEXPRESS). After that, the power consumption dataset (.csv file format – **figure 4**) to integrate the TABLEAU DESKTOP to learn the basic level of understanding (**Figure 5**). Then, preparing the data for visualization involves cleaning the data to remove irrelevant data, transforming the data into a format that can be easily visualized, exploring the data to identify patterns and trends 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.



States	Regions	latitude	longitude	Dates	Usage
Punjab	NR	31.51997388	75.98800281	2/1/2019	119.9
Haryana	NR	28.45009613	77.01999101	2/1/2019	130.3
Rajasthan	NR	26.44999921	74.61999124	2/1/2019	234.1
Delhi	NR	28.6699929	77.23000403	2/1/2019	85.8
UP	NR	27.59998069	78.05000565	2/1/2019	313.9
Uttarakhand	NR	30.32040895	78.05000565	2/1/2019	40.7
HP	NR	31.10082565	77.16659704	2/1/2019	30
J&K	NR	33.45	76.24	2/1/2019	52.5
Chandigarh	NR	30.71999697	76.76800565	2/1/2019	5
Chhattisgarh	WR	22.09042035	82.15998734	2/1/2019	78.7
Gujarat	WR	22.2587	71.1924	2/1/2019	319.5
MP	WR	21.30039105	76.13001349	2/1/2019	251
Maharashtra	WR	19.25023195	73.16017493	2/1/2019	428.6
Goa	WR	15.491997	73.81800065	2/1/2019	32.8
DNH	WR	20.26657819	73.0166178	2/1/2019	18.4
Andhra Pradesh	SR	14.7504291	78.57002559	2/1/2019	164.6
Telangana	SR	18.1124	79.0193	2/1/2019	284.2
Karnataka	SR	12.57038129	76.91999711	2/1/2019	286.3
Kerala	SR	8.900372741	76.56999063	2/1/2019	72.7
Tamil Nadu	SR	12.92038576	79.15004187	2/1/2019	268.3
Pondy	SR	11.93499371	79.83000037	2/1/2019	6.3
Bihar	ER	25.78541445	87.4799727	2/1/2019	82.3

Figure 4. Dataset (Excel sheet) screen shot



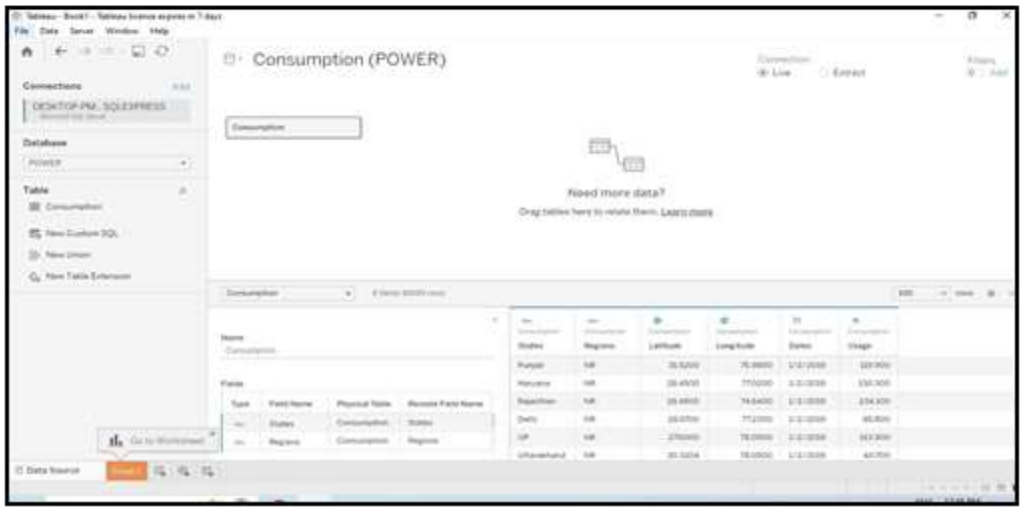


Figure 5. Screenshot about the TABLEAU Desktop, Microsoft SQL, Connect Database with Tableau

3.3 Data Visualization

Concomitantly, the number of unique visualizations has created using the given dataset. This type of data visualization is the process of generating graphical representations of data in order to help people understand and explore the prominent information. The goal of data visualization is to make complex data sets more accessible, and easier to interpret. Using visual elements like charts, graphs and maps, data visualizations can help people identify patterns, trends in the data.

3.3.1 Visualization 1

In order to understand the dataset, the 2019 and 2020 Consumption, Total Consumption, Top N usage states is shown in figure 6 (a, b, c& d).

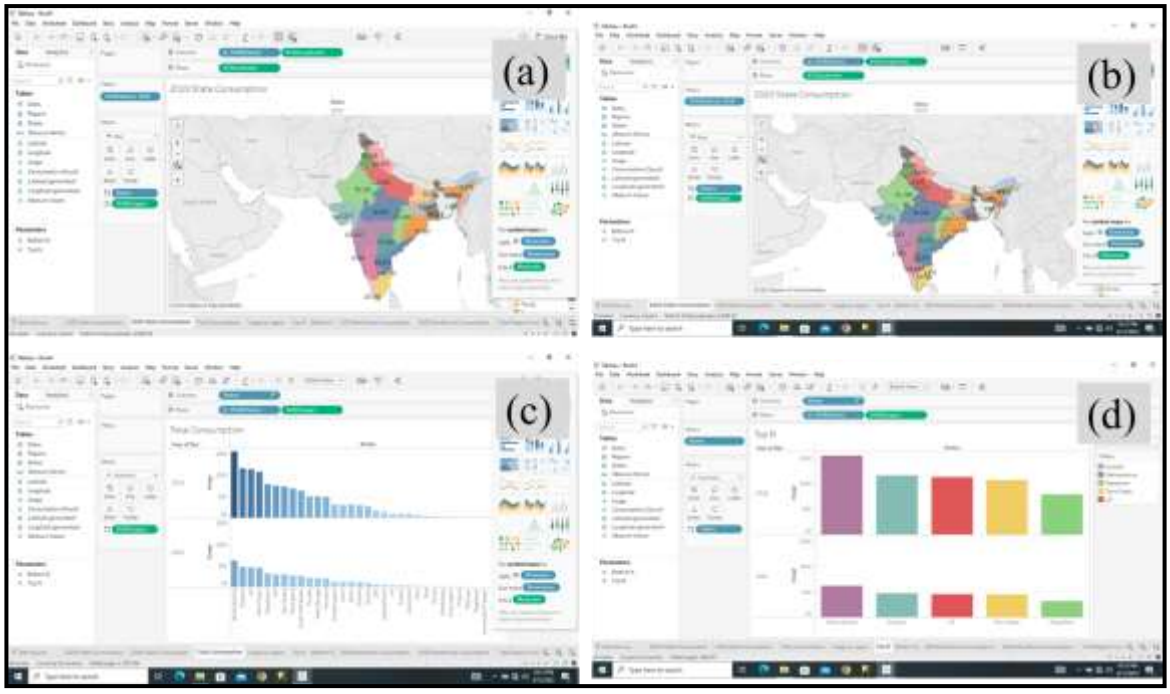


Figure 6. (a) Consumption in 2019 (Map) (b) Consumption in 2020 Map) (c) Total Consumption (d) Top N usage states

From the figure, we realized that longitude, latitude values of all over India as visualized and usage of total electricity consumption in India. During the 2019-2020, the top usage of power consumption such as Maharashtra, Gujarat, utter Pradesh (UP), tamilnadu, Rajasthan and also we observed the bottom N states such as Manipur, Nagaland, arunachal Pradesh, Mizoram, and sikkam as shown **figure 7**. Further, usage of power consumption region wise (East, west, north, north east and south regions) shown in **figure 8**.

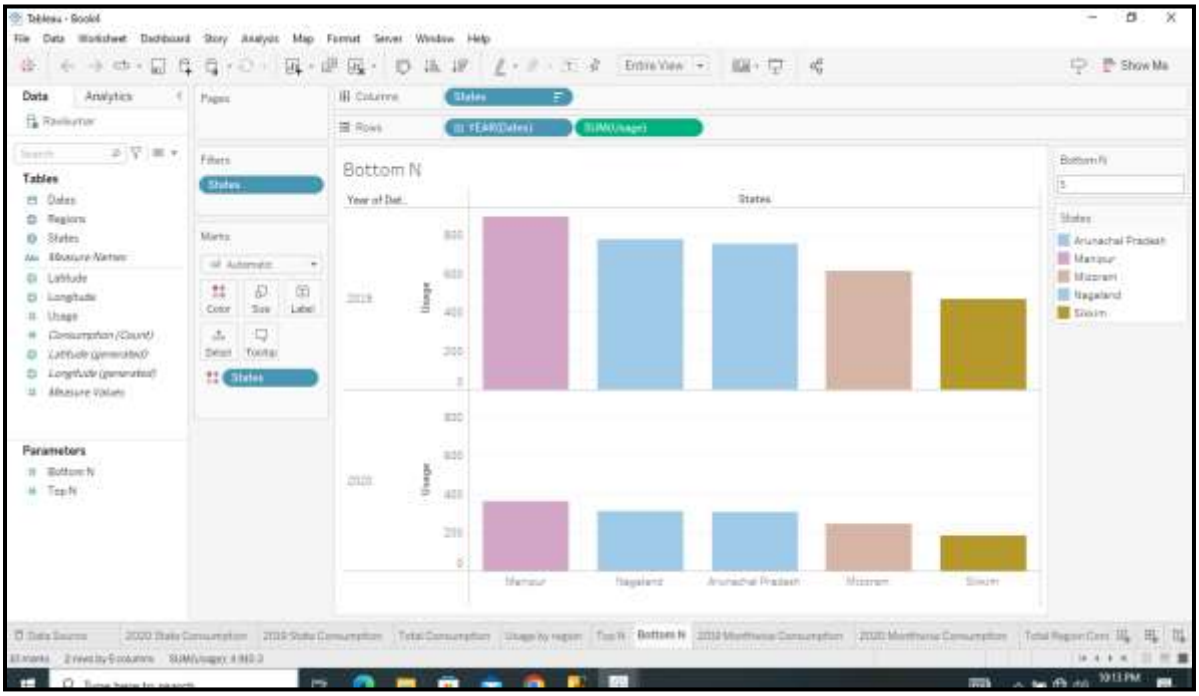


Figure 7. Bottom N Usage States

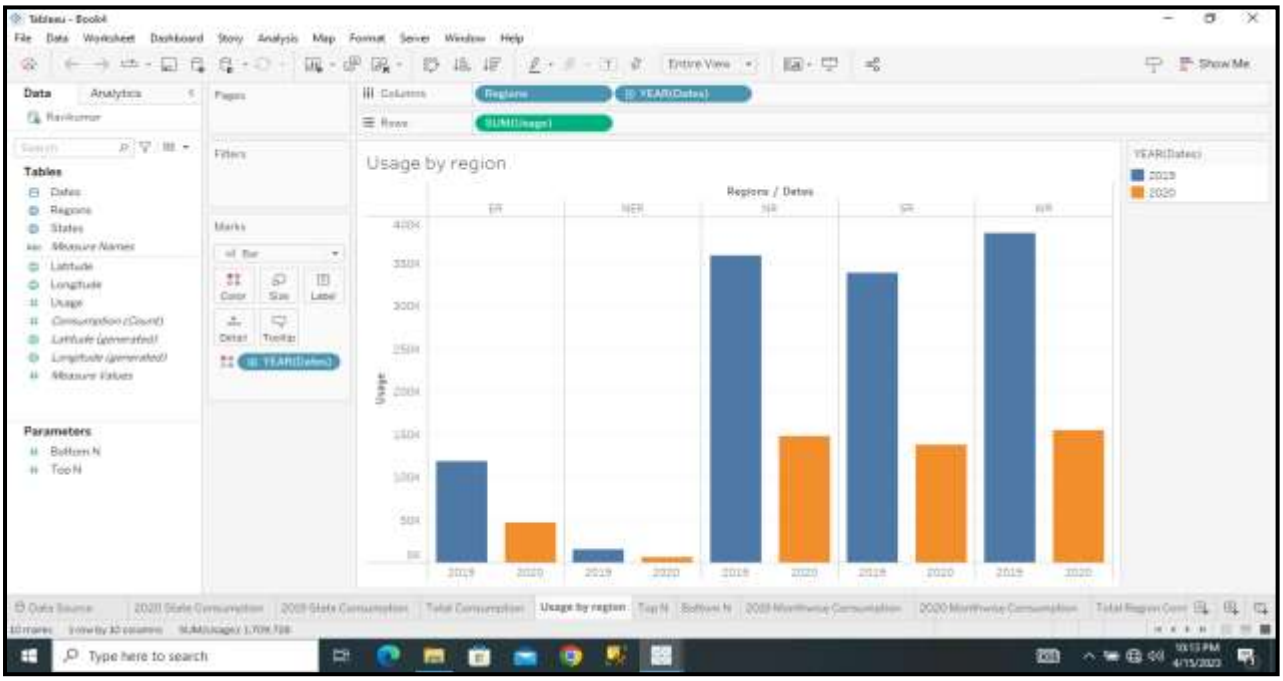


Figure 8. Region wise power consumption 2019-2020

3.3.2 Visualization 2

The 2019 and 2020 month wise power consumption is as shown in the **figure 9 (a, b)**. One can concluded that, 2019 month wise consumption is literally high usage because all over India every people stayed in home for pandemic period. In particular, the power consumption showcased the January to May month only high usage, while the rest of remaining month June to December 2020 is less usage due to the relaxation of lock down in all over India. When we look at the region wise power consumption in the order of top 3 regions such as west, north and south region and it is shown in **figure 9 (c).** The usage of before and during the lock down period is shown in **figure 9 (d).**

Figure 9. (a) Month wise Consumption in 2019 (b) Month wise Consumption in 2020 (c) Region wise power consumption (d) Usage before and during lock down

3.3.3 Visualization 3

In this context, the region wise state consumption is shown in **figure 10 (a)** by bar diagram. As previous discussion, we discussed only region wise only. From the **figure 10 (b)**, quarter wise consumption is created through bar diagram. But, 2019 itself the quarter wise power consumption is large quantity than the 2020 quarter consumption. Further, the year wise 2019 is the high power consumption. From the graph, it showing exponentially falling the 2020 power consumption peak (**Figure 10 (c)**). Further, the major metro cities in the Maharashtra state is high power consumption and shown in **figure 10 (d)**.

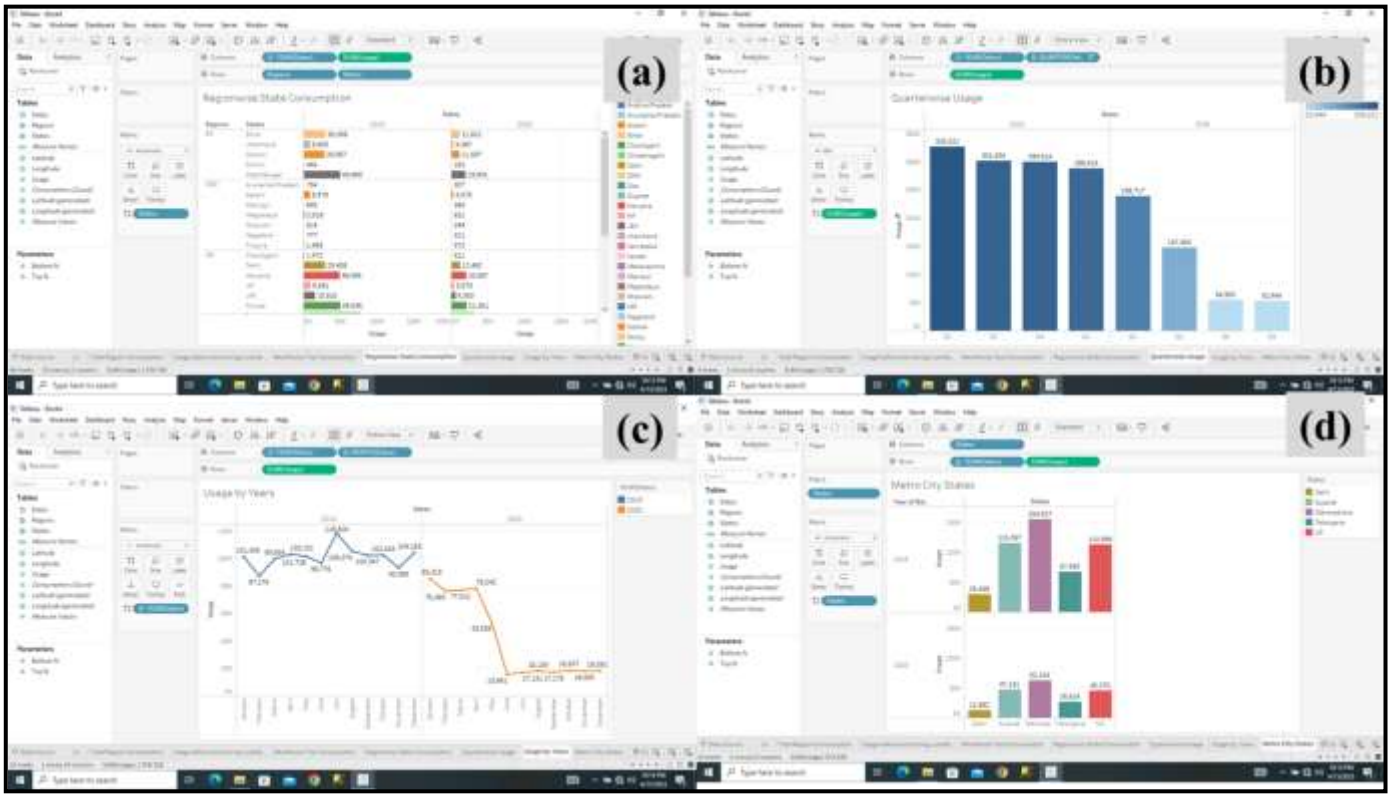


Figure 10. (a) Region wise state Consumption (b) Quarter wise Consumption in 2019 and 2020 (c) Usage by year wise power consumption (d) Metro city wise power consumption

3.4 DASHBOARD

A dashboard is a graphical user interface that showcased the information and data in an organized, easy and read format. Dashboards are mostly used to provide real-time monitoring and analysis of data and are designed for a specific purpose. The overall dashboard is shown in this context **Figure 11 (a, b, c)**.

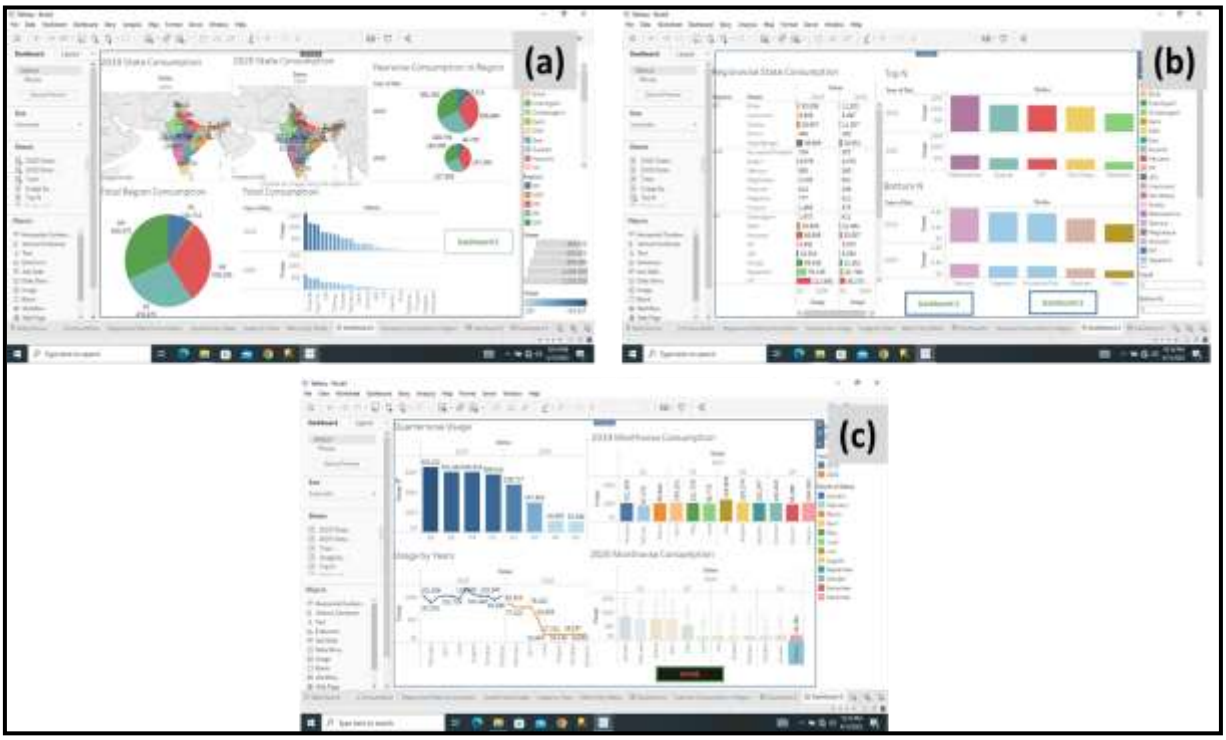


Figure 11. (a) Dashboard 1 (b) Dashboard 2 (c) Dashboard 3

3.5 STORY ON CONSUMPTION IN INDIA

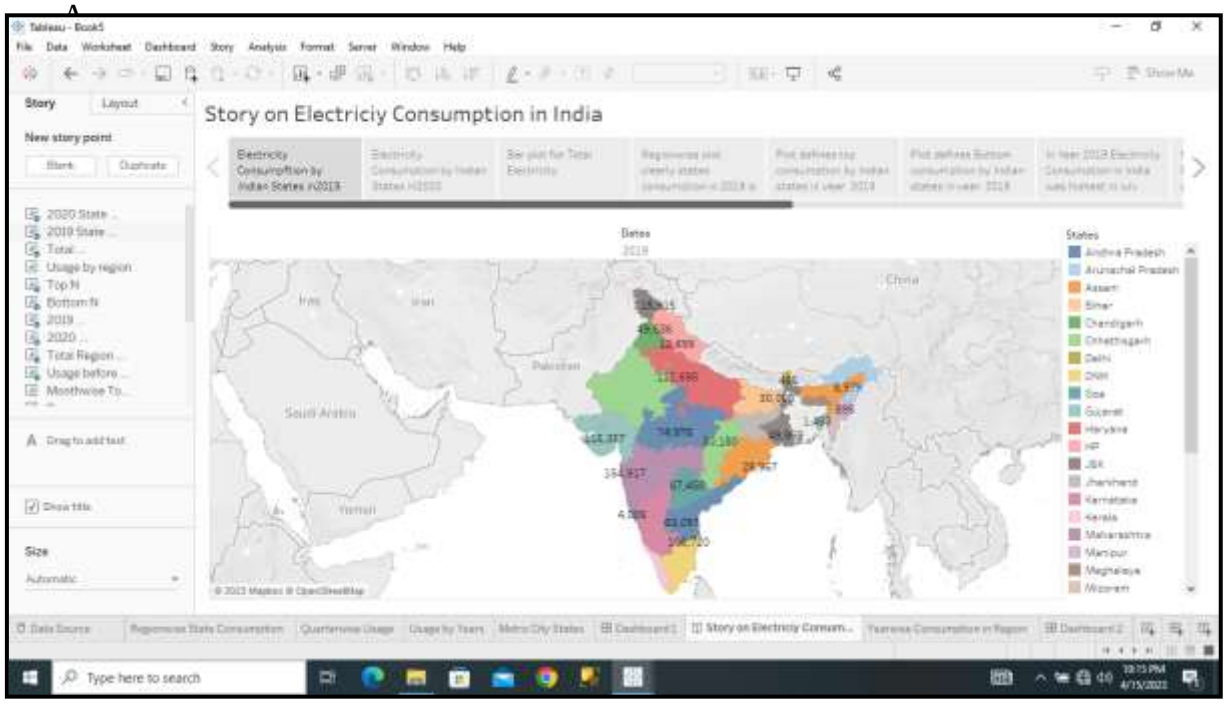


Figure 12. Story on consumption in India

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. Here, the combined form of dashboards and separate worksheets is shown in **figure 12**.

3.6 PERFORMANCE AND TESTING

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. In this scenario, the given dataset how much of space, rows and columns occupied and it is shown in **figure 13**.

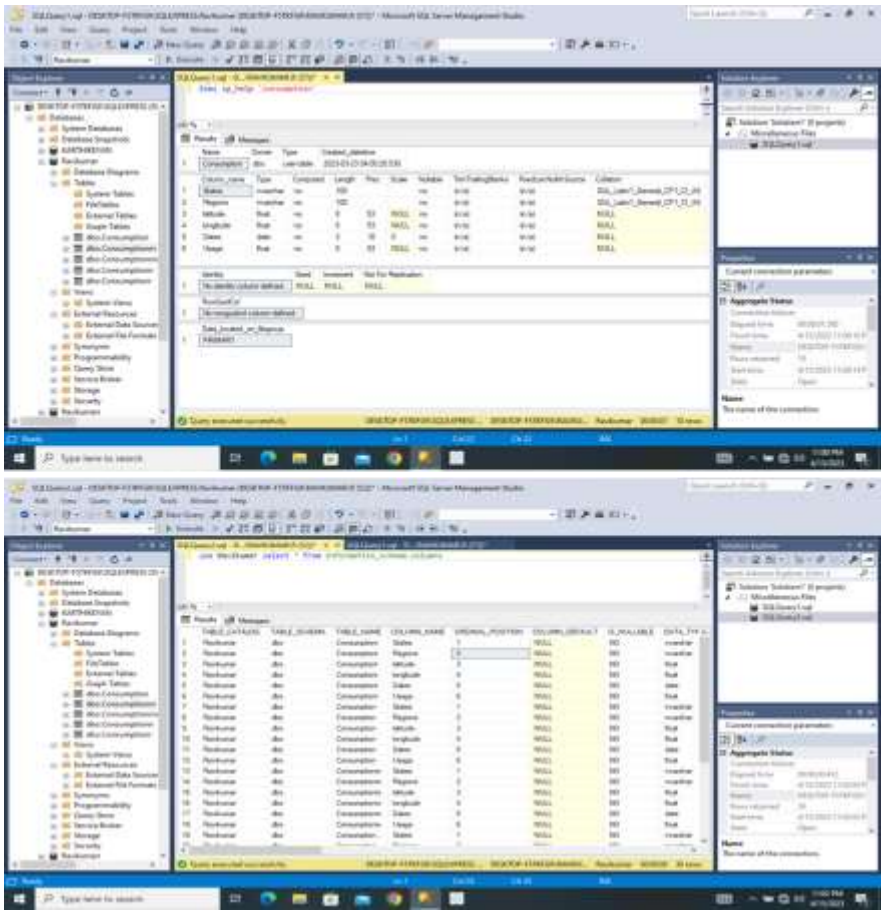


Figure 13. Dataset size and capacity rendered

3.7 WEB INTEGRATION

In this web integration part, with the help of creating the HTML and bootstrap integrated files, the project work dashboards and story to view the tableau public and further to track and monitor communicate results and progress. It is shown in **figure 14**.

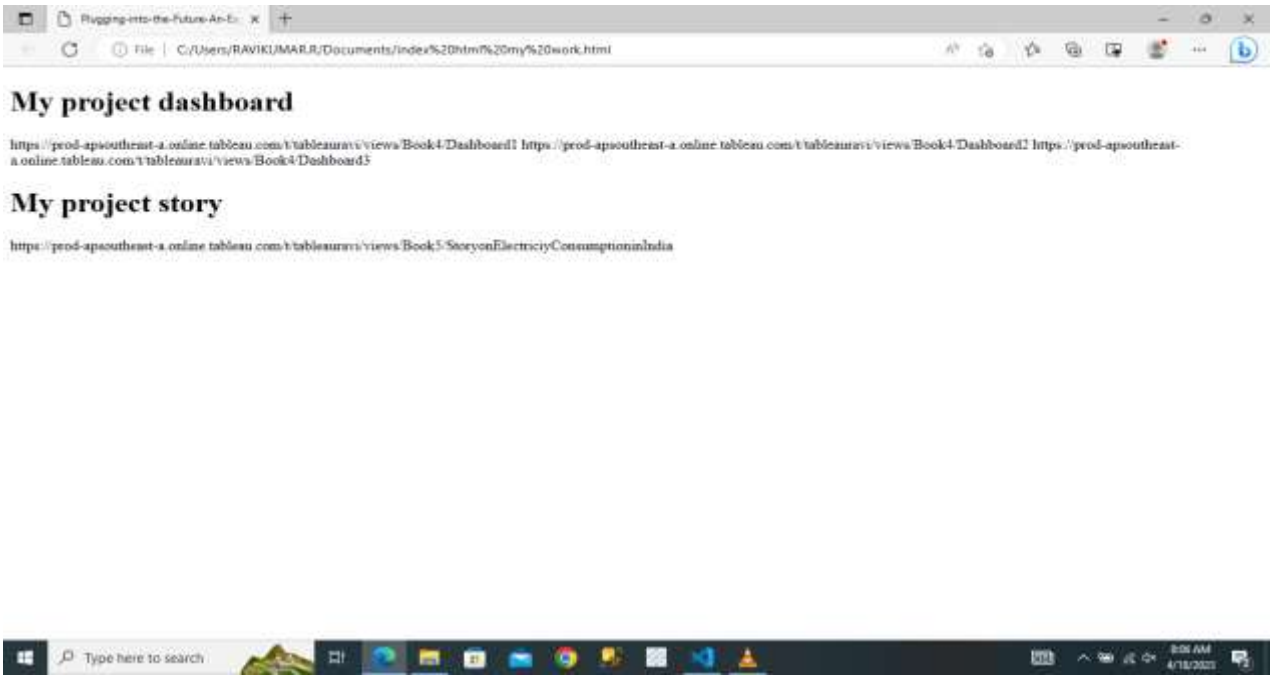


Figure 14. HTML page for Web integration

3.8 RECORD EXPLANATION VIDEO FOR PROJECT

The following link is the project explanation video link, through Google drive

https://drive.google.com/file/d/11MLhYDpYvAx-v3Wefob2fM1XGjO1YWF2/view?usp=share_link

4. ADVANTAGES AND DISADVANTAGES

Advantages:

- By using data analysis in electrical consumption the user will know how to analyse and optimize electrical consumption, understanding consumption patterns and predict future needs
- Project based learning for student support and user friendly

Disadvantages:

- Need a more manual support
- Relatively more complex
- Expensive – Software

5. APPLICATIONS

- It helps to design and optimize electrical systems, predict and prevent failures, and better understand and control electrical processes
- Cloud-based analysis of utility data can give real-time insight into electrical consumption

6. CONCLUSION

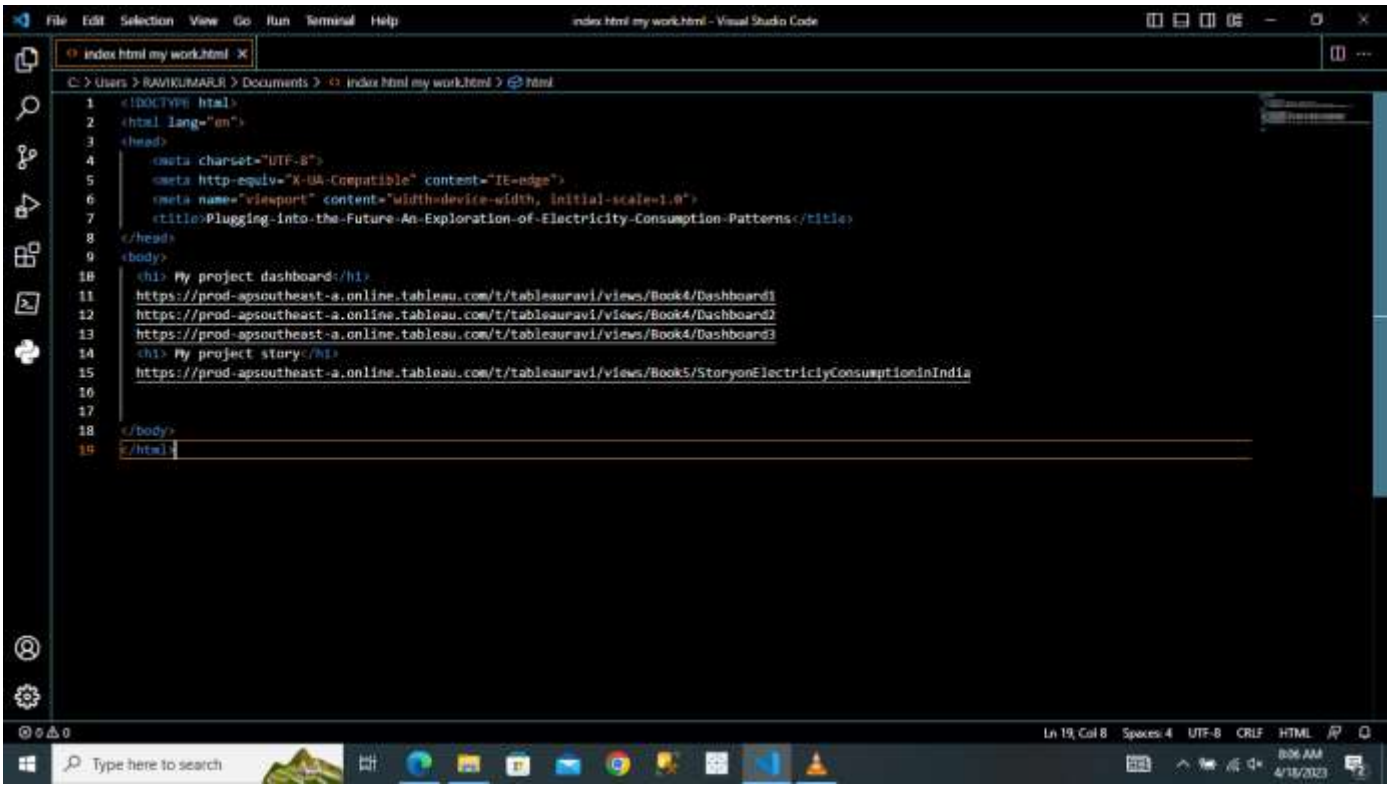
From this project, we observed and analyzed the all over India how much power is consumed during (January 1, 2019 to December 5, 2020) I.e., corona highly infected period. Based on this we realized the necessity of electricity.

7. FUTURE SCOPE

- In this context, we (team members) learnt about the one of the best business intelligence data analysis tool- TABLEAU.
- Further we will learn the Python program to integrate/associate with TABLEAU DESKTOP server software and to develop the more options in very clear way

8. APPENDIX

A. Source Code



```html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Plugging-into-the-Future-An-Exploration-of-Electricity-Consumption-Patterns</title>
</head>
<body>
  <h1> My project dashboard</h1>
  https://prod-apsoutheast-a.online.tableau.com/t/tableauravi/views/Book4/Dashboard1
  https://prod-apsoutheast-a.online.tableau.com/t/tableauravi/views/Book4/Dashboard2
  https://prod-apsoutheast-a.online.tableau.com/t/tableauravi/views/Book4/Dashboard3
  <h1> My project story</h1>
  https://prod-apsoutheast-a.online.tableau.com/t/tableauravi/views/Book5/StoryonElectricityConsumptioninIndia


</body>
</html>
```