

Project Report

1. INTRODUCTION

1.1 Project Overview:

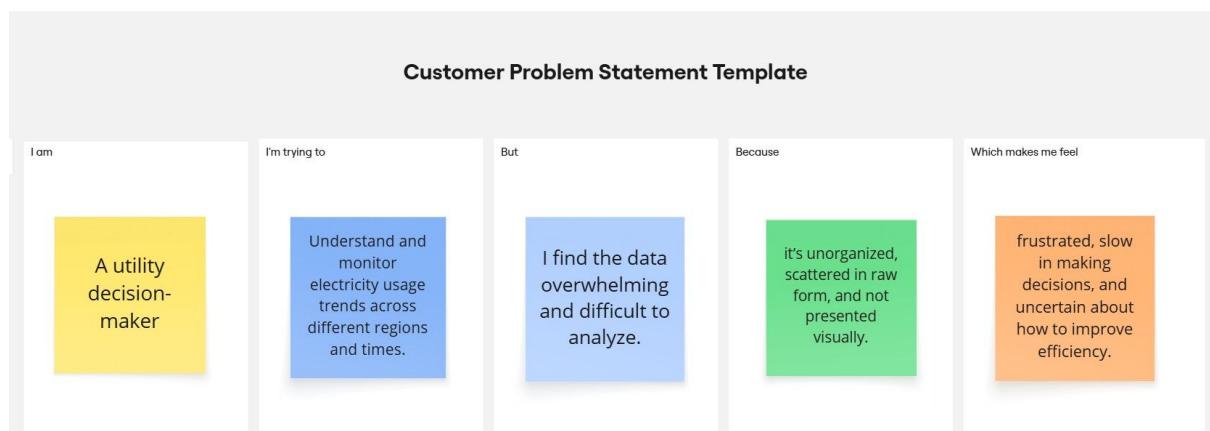
This project analyzes India's electricity consumption patterns across states and regions using Tableau. By leveraging data visualization, it aims to simplify complex usage data and promote better decision-making by utilities and policymakers.

1.2 Purpose:

To visualize electricity consumption patterns and empower smarter, data-driven energy decisions for a sustainable future.

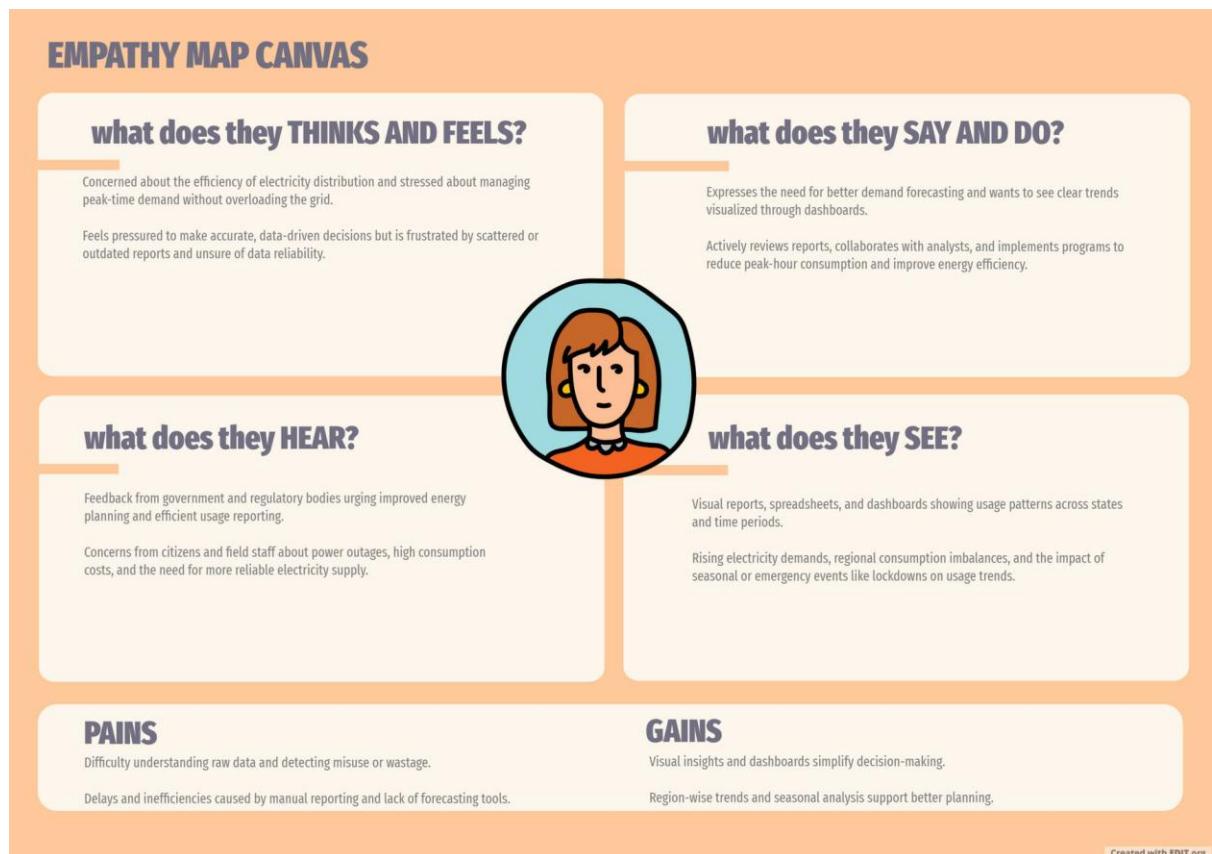
2. IDEATION PHASE

2.1 Problem Statement



Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	I am a utility company decision-maker	I'm trying to optimize electricity distribution based on demand	But the existing data is hard to interpret and scattered	Because it is presented in raw tables without visual insights	Which makes me feel frustrated and unable to make timely decisions
PS-2	I am a data analyst working in the energy sector	I'm trying to identify trends and patterns in electricity usage	But I spend too much time cleaning and preparing the data	Because the datasets are not dashboard-ready or well-structured	Which makes me feel inefficient and under pressure to deliver faster insights

2.2 Empathy Map Canvas



2.3 Brainstorming

Idea	Idea Description	Group/Category
1	Analyze electricity usage by time of day	Time Patterns
2	Compare state-wise usage in 2019 and 2020	Yearly Comparison
3	Identify regions with highest and lowest consumption	Regional Insights
4	Study the effect of COVID-19 lockdown on power consumption	Event Impact (COVID)
5	Use heat maps to show high and low usage zones	Visualization Techniques
6	Embed interactive dashboard on a web app using Flask	Deployment / Web Integration
7	Create a data story using Tableau storytelling features	Narrative & Communication
8	Use filters for region, year, and quarter in dashboard	Dashboard Interactivity
9	Create visualizations for quarterly trends	Seasonal Analysis
10	Add calculated fields for monthly and annual usage	Data Processing / KPIs
11	Forecast future usage using historical data trends	Predictive Analysis
12	Display total and average usage across years	KPI Overview / Trends

3. REQUIREMENT ANALYSIS

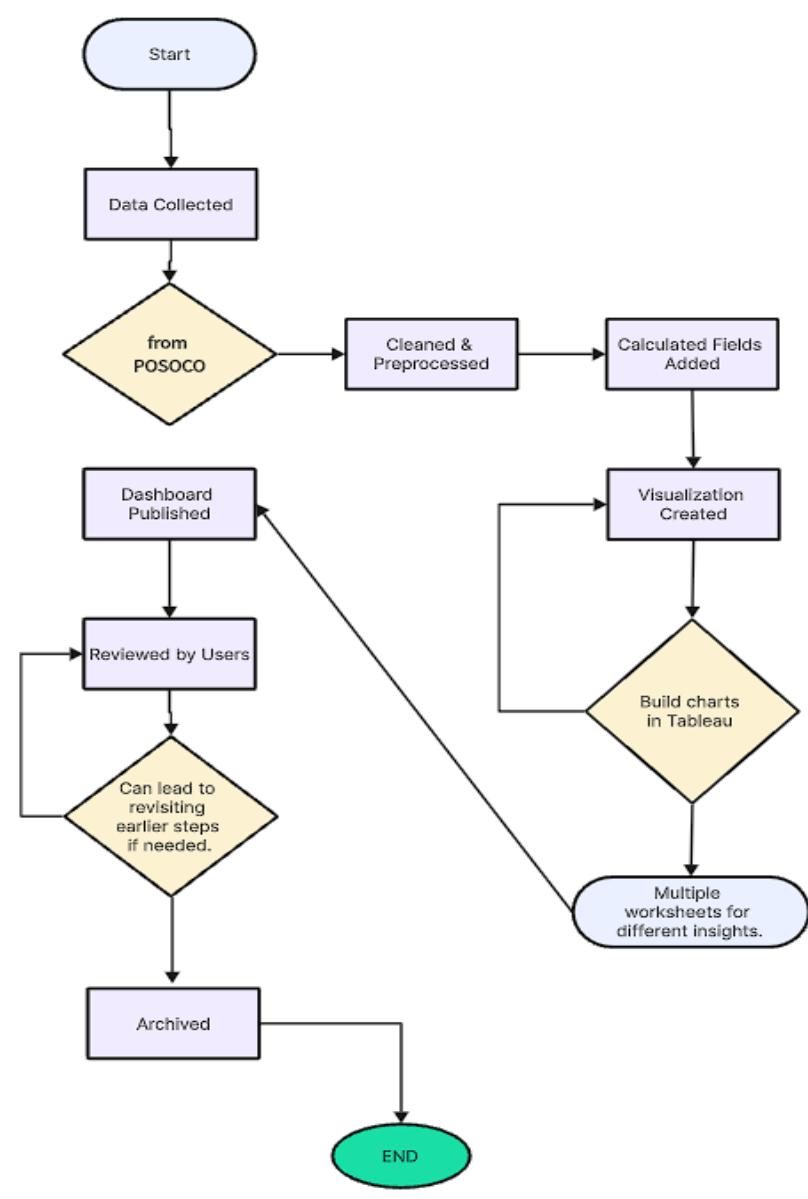
3.1 Customer Journey map

Triggering into the Feature: An Executive electricity consumption monitoring Tool	Steps	Interactions	Things (Touchpoints/Object)	Places	People	Positive Moments	Negative Moments	Areas of Opportunity	Goals & Motivations
Initial	Initial login into the system.	Click on email link to insert credentials.	Initial, welcome page, shared dashboard.	Office, home, mobile.	Executive, analyst, supervisor.	Curious about data trends.	Not many what the clear board offers.	Add a clear title and purposeful description.	Help me see useful data quickly.
Search	Find specific data points or reports.	Search, filters, click through reports.	Office desk, phone screen.	Home, office, mobile.	Analyst, supervisor.	Quintessential role representation.	Overwhelmed by too many filters at once.	Allow filters to be applied per report.	Help me look where to look first.
Usage	Review usage patterns and generate reports.	Print, download, generate reports.	Office desk.	Office, home, mobile.	Analyst, supervisor, executive.	Integrating data from multiple sources.	Slow loading of dashboard.	Quick, responsive interface.	Help me find insights quickly.
Exit	Leave the system.	Log out, click on log out button.	Office/mobile computer.	Home directly.	Analyst, supervisor.	Easy export of charts.	Unknown how to save dashboard.	Save dashboard prior to logout.	Help me save dashboard work.
External	Share insights with external stakeholders.	Share analysis, dashboard.	Anywhere with internet.	Supervisor, project lead.	Analyst, supervisor.	Sharing multiple insights and areas.	A user has to leave dashboard.	Enable high-level sharing of dashboard.	Bridge some gap between dashboards.

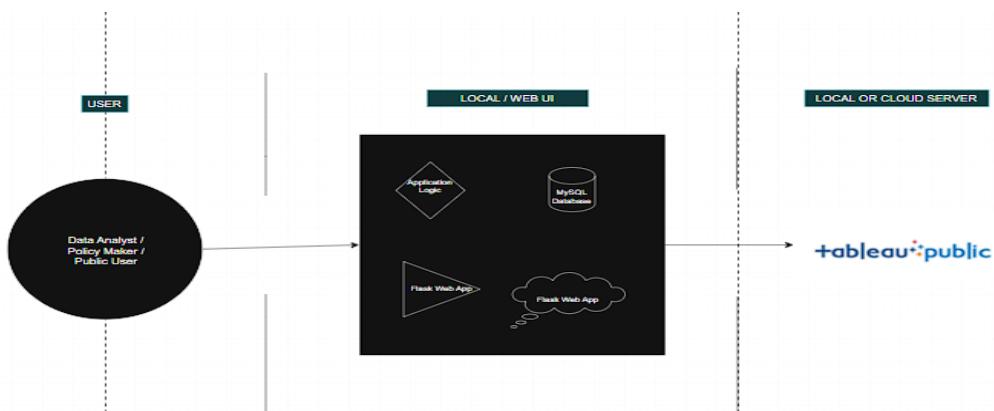
3.2 Solution Requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Data Upload & Storage	Upload CSV File Store into MySQL Database
FR-4	Data Visualization	Create visualizations in Tableau Integrate with dashboard Create time, region, and sector-based charts
FR-5	Dashboard Access	View interactive Tableau dashboard Use filters (Year, Region)
FR-6	Web Integration	Embed Tableau dashboard into Flask-based UI
FR-7	Insights & Reports	View data stories Access summary reports on usage patterns
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Interface should be intuitive and user-friendly for both technical and non-technical users
NFR-2	Security	Secure login with OTP/Email, protected data access
NFR-3	Reliability	System should consistently provide correct visualizations
NFR-4	Performance	Dashboards should load within 3–5 seconds even for larger datasets
NFR-5	Availability	The platform should be available 24/7 without major downtime
NFR-6	Scalability	Should support addition of new datasets and visualizations

3.3 Data Flow Diagram



3.4 Technology Stack

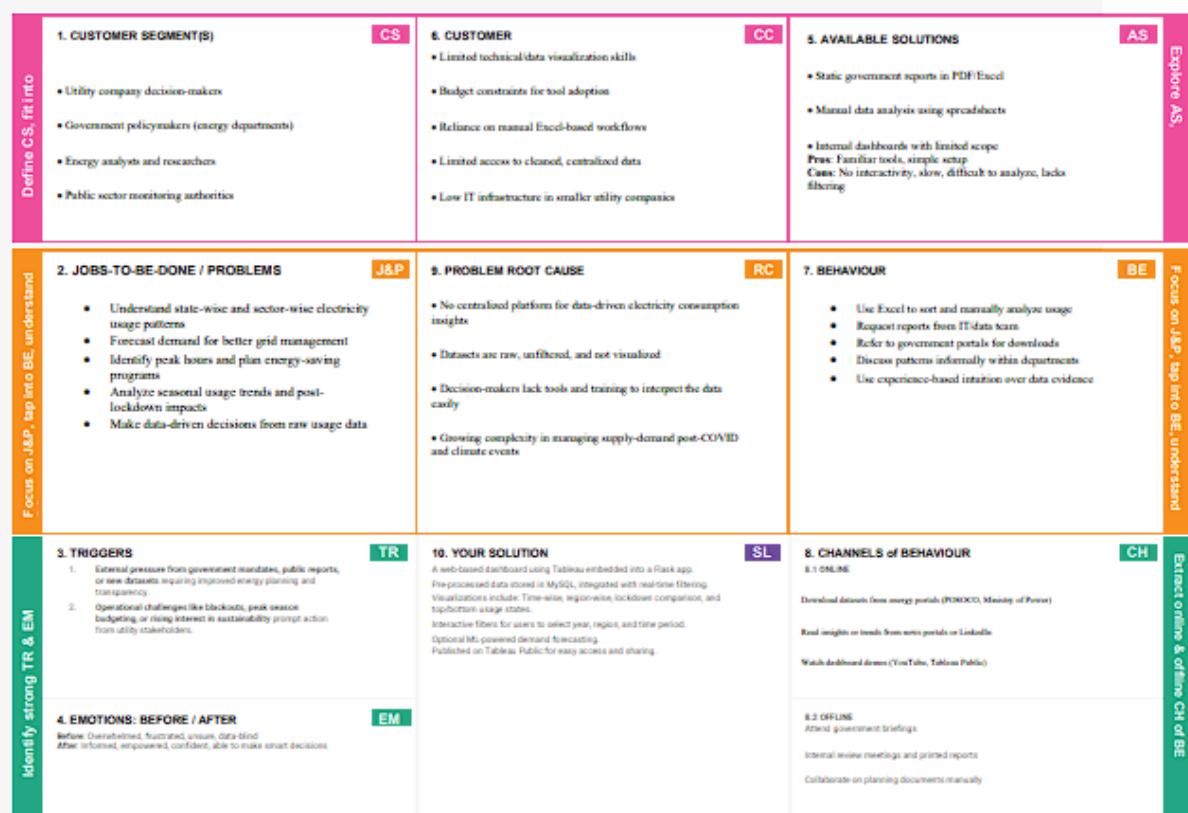


4 .PROJECT DESIGN

4.1 Problem Solution Fit

Problem-Solution fit canvas 2.0

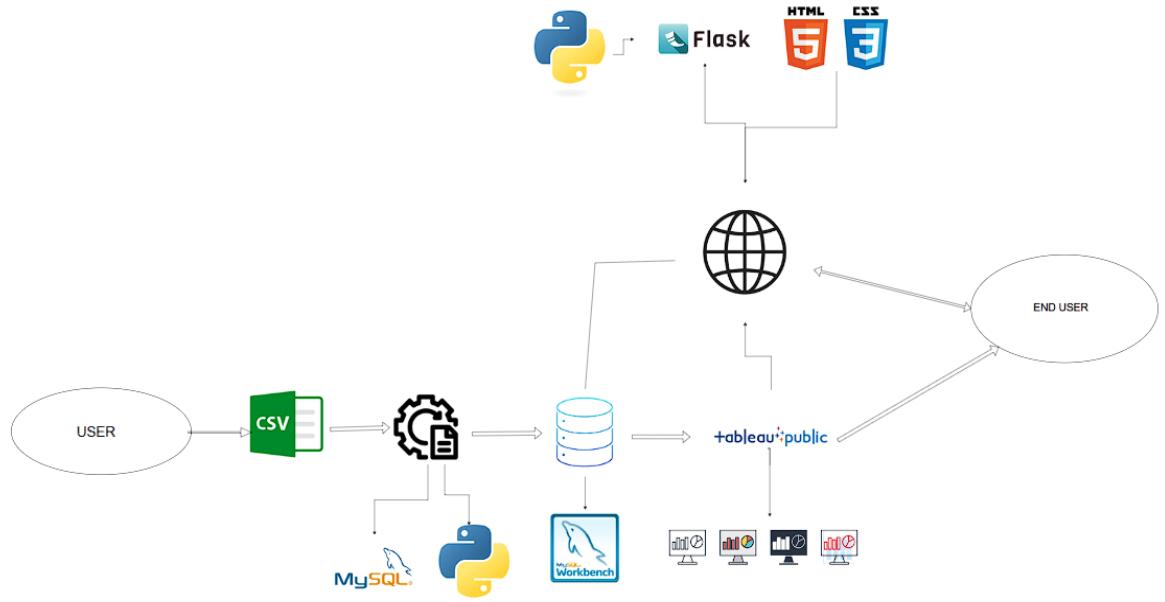
Purpose / Vision: To visualize electricity consumption patterns and empower smarter, data-driven energy decisions for a sustainable future.



4.2 Proposed Solution

S.No.	Parameter	Description
1	Problem Statement	Electricity usage data in India is often raw and scattered, making it hard for utility providers and policymakers to analyze trends and make informed decisions.
2	Idea / Solution Description	Our solution transforms raw electricity consumption data into interactive dashboards using Tableau. Data is cleaned, stored in MySQL, and visualized through a web app built with Flask.
3	Novelty / Uniqueness	Unlike static reports, our system provides real-time, interactive insights. It's flexible, extendable, and integrates forecasting using optional ML tools.
4	Social Impact / Customer Satisfaction	Helps improve energy planning, reduce wastage, and supports better decision-making by energy companies and government bodies.
5	Business Model (Revenue Model)	Can be offered as a SaaS tool to utility firms and government bodies. Advanced features like forecasting or data export can be monetized.
6	Scalability of the Solution	Built on a modular and cloud-friendly architecture, it can be expanded to cover more regions, sectors, or even other utilities like water or gas.

4.3 Solution Architecture



5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

Sprint	Epic	User Story No.	User Story / Task	Points	Priority	Assigned To
Sprint-1	Registration	USN-1	As a user, I can register with my name and email	2	High	S.Aneeqa Thamreen
Sprint-1	Upload CSV	USN-2	As a user, I can upload electricity data in CSV format	3	High	A.Gowtham
Sprint-1	Data Cleaning	USN-3	As a developer, I can clean and preprocess uploaded data using Python	4	High	J.Takeshwar
Sprint-1	Database Storage	USN-4	As a developer, I can store cleaned data into MySQL	2	Low	K.Veena Madhuri
Sprint-2	Tableau Dashboard	USN-5	As a user, I can view dashboards generated using Tableau	5	High	Aneeqa Thamreen
Sprint-2	Web Integration	USN-6	As a user, I can access the dashboard via Flask UI	3	High	J.Takeshwar
Sprint-2	Add Filters	USN-7	As a user, I can filter the data by region, year, and quarter	2	Medium	Gowtham
Sprint-3	Data Story	USN-8	As a user, I can view a Tableau Story with key electricity usage insights	2	Low	K.Veena Madhuri
Sprint-3	Forecasting	USN-9	As a developer, I can forecast usage using Prophet	3	Low	Gowtham
Sprint-3	Documentation	USN-10	As a team, we can prepare final project documentation	2	Medium	J.Takeshwar
Sprint-4	Deployment	USN-11	As a developer, I can deploy the Flask app and publish the Tableau dashboard online	3	High	K.Veena Madhuri
Sprint-4	Demo Prep	USN-12	As a team, we can prepare a live demo walkthrough for stakeholders	2	Medium	Madhuri
Sprint-4	Bug Fixing	USN-13	As a developer, I can test and fix UI/visual bugs from user feedback	2	Medium	S.Aneeqa Thamreen

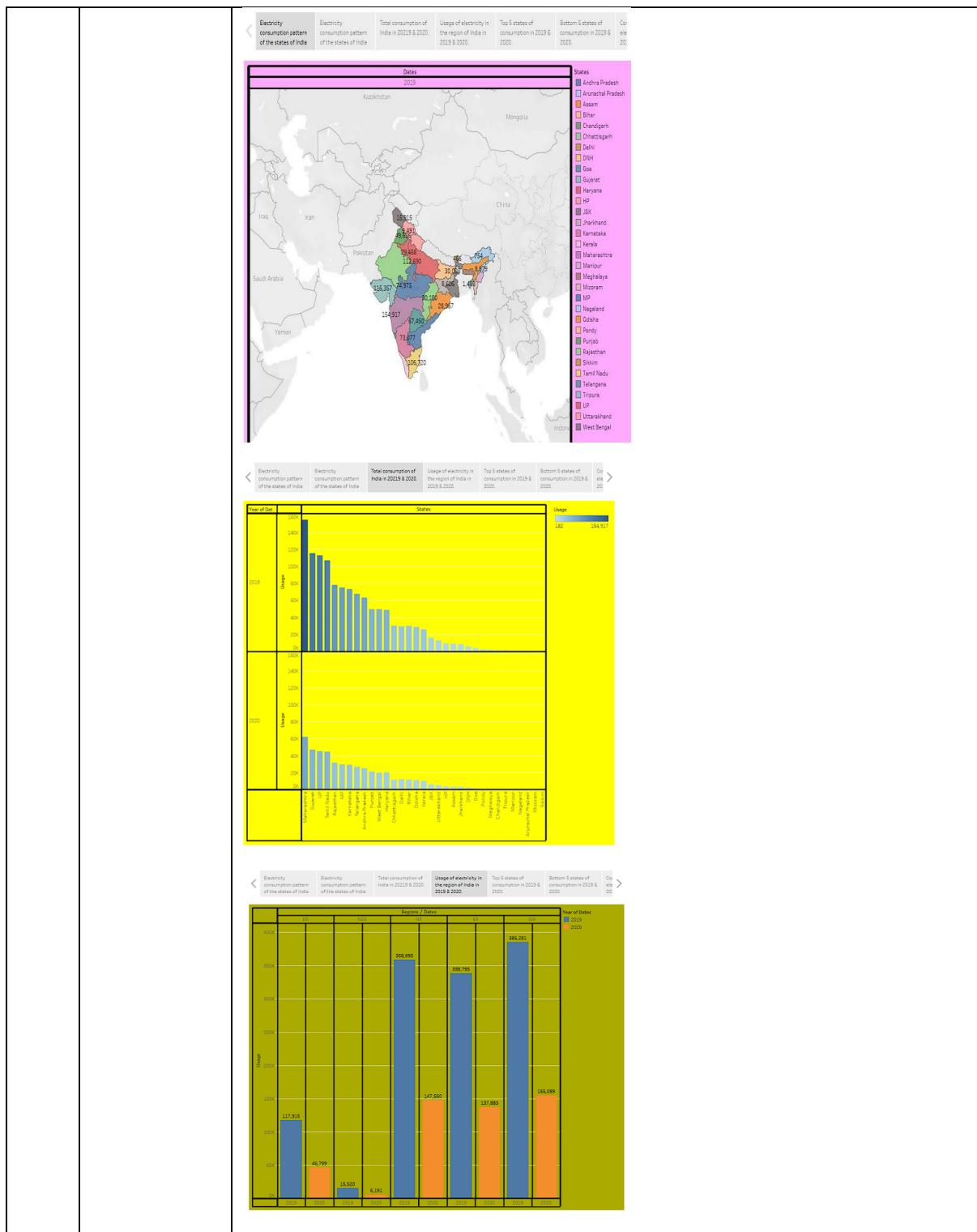
6. FUNCTIONAL AND PERFORMANCE TESTING

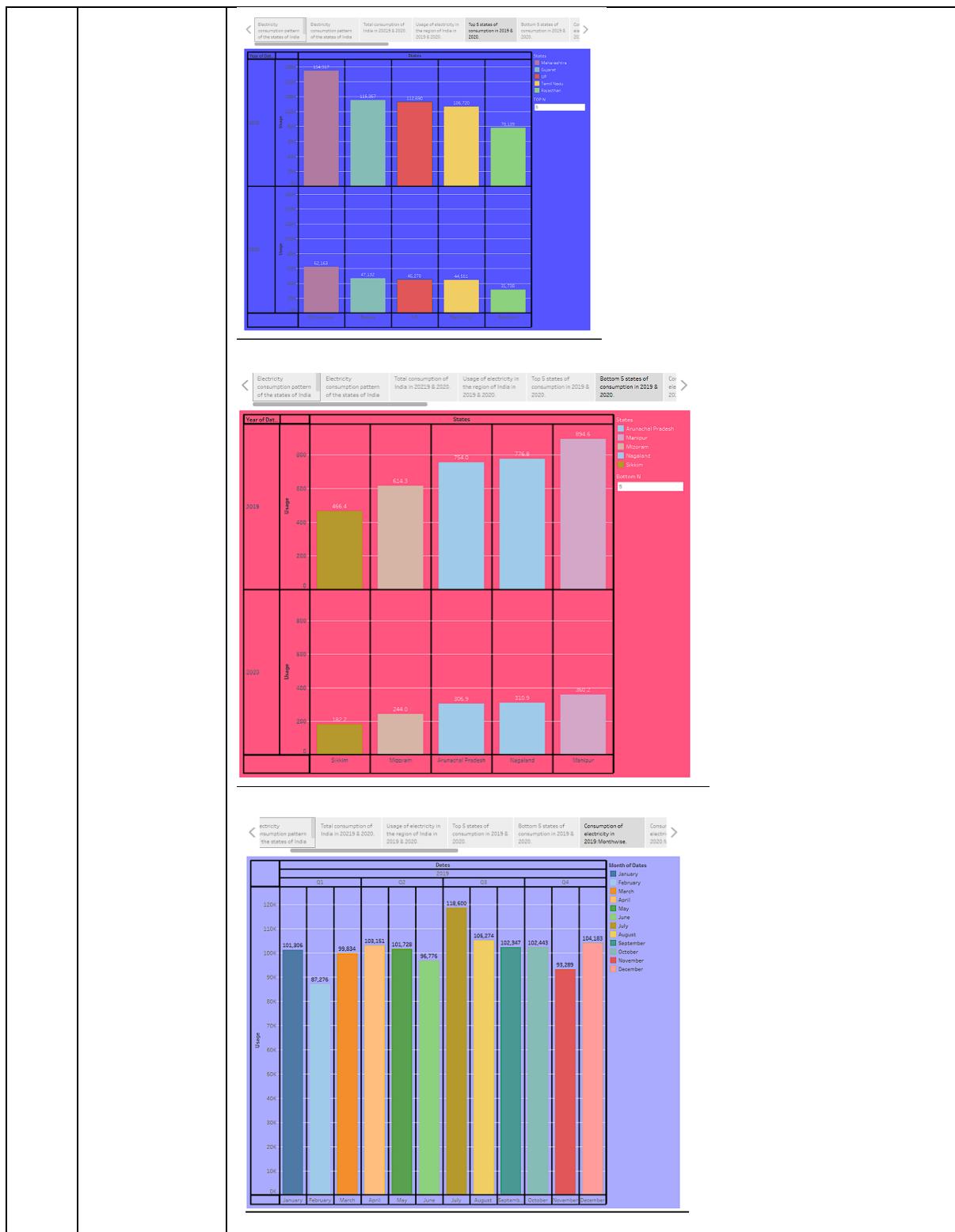
6.1 Performance Testing

S.No	Parameter	Screenshot / Values
1.	Data Rendered	Electricity consumption data from states and regions of India from 2019–2020 in .csv. Columns used include Region, State, Date, MU, Month, Quarter, and Lockdown.
2.	Data Preprocessing	Null values handled, new fields derived (Quarter, Month, Lockdown), filtered for required years. This was done using Python (Pandas) and stored in MySQL before importing into Tableau.
3.	Utilization of Filters	<p>Filters applied in dashboard:</p> <ul style="list-style-type: none"> • Region • State • Year • Quarter • Lockdown (Yes/No) Used across all dashboards to enhance interactivity. 4 Calculated Fields Used Created fields in Tableau: <ul style="list-style-type: none"> • Year(Date) • Month(Date) • Quarter(Date) • Lockdown Label for categorizing data before and after lockdown. • Top N States (for usage comparison). 5 Dashboard Design Number of Visualizations: 3 Dashboards Each dashboard includes: <ul style="list-style-type: none"> • Line Chart (Monthly trends) • Bar Chart (State-wise comparison) • Map / Tree Map (Region-wise consumption) • KPI indicators (Total and Average Usage) Refer: <i>Screenshots of Dashboard.pdf</i> 6 Story Design Number of Slides/Graphs in Story: 15 Covers: <ul style="list-style-type: none"> • Intro & Problem • State-wise Usage • Lockdown Comparison

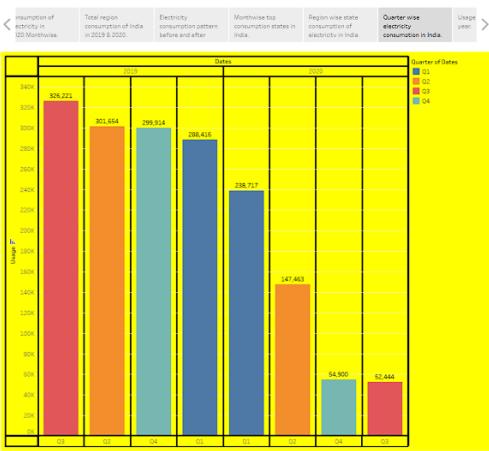
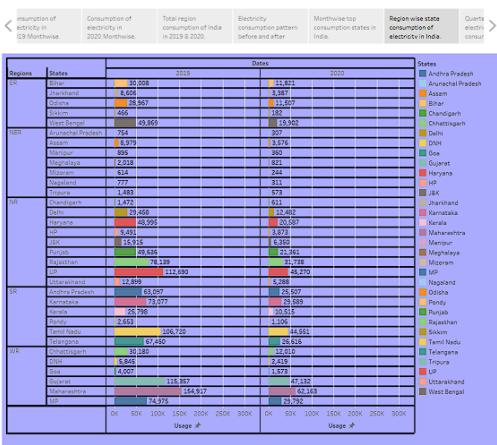
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5.	Dashboard design	<p>No of Visualizations / Graphs - 3 Dashboards , 8 Visualizations / Graphs.</p> <p>Dashboard 1 :</p> <p>2019 Monthwise Consumption</p> <table border="1"> <thead> <tr> <th>Month</th><th>Usage</th> </tr> </thead> <tbody> <tr><td>January</td><td>216,223</td></tr> <tr><td>February</td><td>181,954</td></tr> <tr><td>March</td><td>204,618</td></tr> <tr><td>April</td><td>209,717</td></tr> <tr><td>May</td><td>147,463</td></tr> <tr><td>June</td><td>148,301</td></tr> <tr><td>July</td><td>32,441</td></tr> </tbody> </table> <p>2020 Monthwise consumption</p> <table border="1"> <thead> <tr> <th>Month</th><th>Usage</th> </tr> </thead> <tbody> <tr><td>January</td><td>216,223</td></tr> <tr><td>February</td><td>181,954</td></tr> <tr><td>March</td><td>204,618</td></tr> <tr><td>April</td><td>209,717</td></tr> <tr><td>May</td><td>147,463</td></tr> <tr><td>June</td><td>148,301</td></tr> <tr><td>July</td><td>32,441</td></tr> <tr><td>August</td><td>18,134</td></tr> <tr><td>September</td><td>20,557</td></tr> <tr><td>October</td><td>17,379</td></tr> <tr><td>November</td><td>18,062</td></tr> <tr><td>December</td><td>18,062</td></tr> </tbody> </table> <p>Usage by year</p> <table border="1"> <thead> <tr> <th>Year</th><th>Usage</th> </tr> </thead> <tbody> <tr><td>2019</td><td>216,223</td></tr> <tr><td>2020</td><td>181,954</td></tr> <tr><td>2019</td><td>181,954</td></tr> <tr><td>2020</td><td>204,618</td></tr> <tr><td>2019</td><td>204,618</td></tr> <tr><td>2020</td><td>209,717</td></tr> <tr><td>2019</td><td>209,717</td></tr> <tr><td>2020</td><td>147,463</td></tr> <tr><td>2019</td><td>147,463</td></tr> <tr><td>2020</td><td>148,301</td></tr> <tr><td>2019</td><td>148,301</td></tr> <tr><td>2020</td><td>32,441</td></tr> <tr><td>2019</td><td>32,441</td></tr> <tr><td>2020</td><td>18,134</td></tr> <tr><td>2019</td><td>18,134</td></tr> <tr><td>2020</td><td>20,557</td></tr> <tr><td>2019</td><td>20,557</td></tr> <tr><td>2020</td><td>17,379</td></tr> <tr><td>2019</td><td>17,379</td></tr> <tr><td>2020</td><td>18,062</td></tr> <tr><td>2019</td><td>18,062</td></tr> </tbody> </table> <p>Legend:</p> <ul style="list-style-type: none"> Quarter of Year: Q1, Q2, Q3, Q4 Year of Dates: 2019, 2020 Month of Dates: January, February, March, April, May, June, July, August, September, October, November, December 	Month	Usage	January	216,223	February	181,954	March	204,618	April	209,717	May	147,463	June	148,301	July	32,441	Month	Usage	January	216,223	February	181,954	March	204,618	April	209,717	May	147,463	June	148,301	July	32,441	August	18,134	September	20,557	October	17,379	November	18,062	December	18,062	Year	Usage	2019	216,223	2020	181,954	2019	181,954	2020	204,618	2019	204,618	2020	209,717	2019	209,717	2020	147,463	2019	147,463	2020	148,301	2019	148,301	2020	32,441	2019	32,441	2020	18,134	2019	18,134	2020	20,557	2019	20,557	2020	17,379	2019	17,379	2020	18,062	2019	18,062
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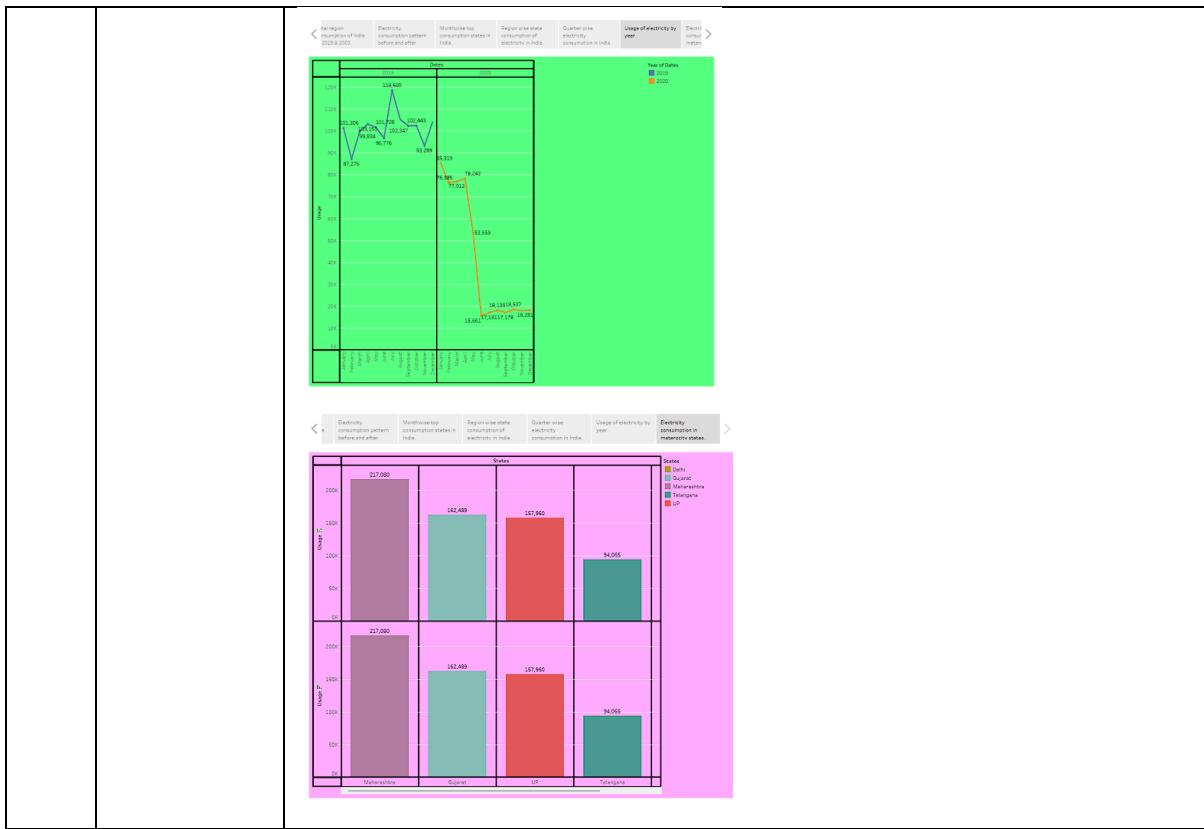
		<p>Dashboard 2 :</p>
		<p>Dashboard 3 :</p>
6	Story Design	No of Visualizations / Graphs -15 slides. <p>Report or Story:</p>





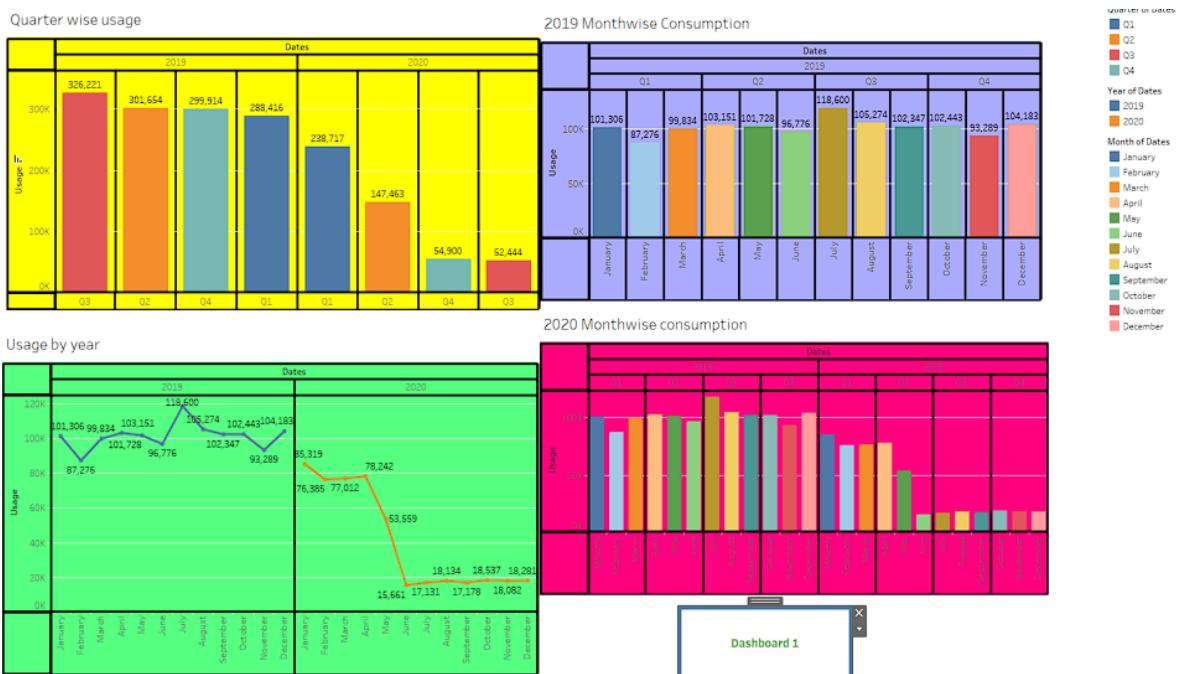


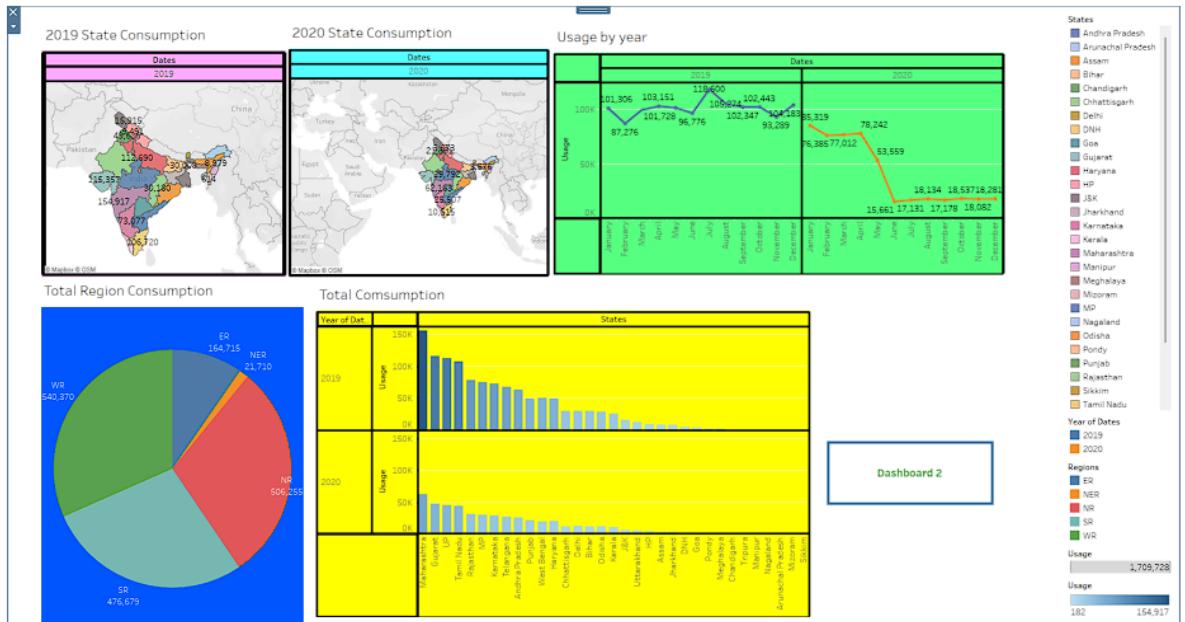




7. RESULTS

7.1 Output Screenshots





Dashboard:

https://public.tableau.com/authoring/Pluggingintothefuture_Anexplorationofelectricityconsumptionpatterns__/Dashboard3#1

https://public.tableau.com/authoring/Pluggingintothefuture_Anexplorationofelectricityconsumptionpatterns__/Dashboard1#1

https://public.tableau.com/authoring/Pluggingintothefuture_Anexplorationofelectricityconsumptionpatterns__/Dashboard2#1

Story:

https://public.tableau.com/authoring/Pluggingintothefuture_Anexplorationofelectricityconsumptionpatterns__/Story1#1

8. ADVANTAGES & DISADVANTAGES

Advantages	Disadvantages
Free, open-source technology stack	Depends on Tableau Public hosting
Visually rich dashboards with no coding	Manual data upload (not automated)
Easy to scale and reuse with other datasets	Limited customization in Tableau Public
Interactive filters and storytelling	Requires stable internet for live dashboards

9. CONCLUSION

The project successfully demonstrated how data visualization can transform electricity usage data into actionable insights. Stakeholders can make informed energy decisions backed by real trends.

10. FUTURE SCOPE

- Automate data fetching from APIs
- Add predictive forecasting using ML
- Extend to water, gas, and renewable datasets
- Mobile responsive version

11. APPENDIX

Source Code : NIL

Dataset link :

https://drive.google.com/file/d/1JxIkHNwXxjFztKq7ad0_KtkukCqTckNy/view?usp=sharing

GitHub link: <https://github.com/Aneeqa-05/Plugging-into-the-Future-An-Exploration-of-Electricity-Consumption-Patterns-Using-Tableau.git>

Project Demo Link: