

FINAL REPORT

Team ID: LTVIP2026TMIDS35958

Title: Plugging into the Future: An Exploration of Electricity Consumption Patterns Using Tableau

1.INTRODUCTION:

1.1 Project Overview

The Electricity Consumption Analysis project focuses on analyzing and visualizing electricity usage data across different states and regions using Tableau. The project aims to transform raw electricity consumption data into meaningful insights through interactive dashboards and visual analytics. By analyzing year-wise, month-wise, and region-wise consumption patterns, the system helps in identifying trends, high and low consumption areas, and seasonal variations. The dashboard enables users to make informed decisions through dynamic filters and comparative visualizations.

1.2 Purpose

The primary purpose of this project is to provide a structured and interactive analytical platform for understanding electricity consumption patterns. It aims to simplify complex raw data into clear visual representations that support decision-making for energy analysts, planners, and policy makers. The project enhances data-driven planning, improves resource allocation strategies, and assists in identifying consumption trends for better energy management.

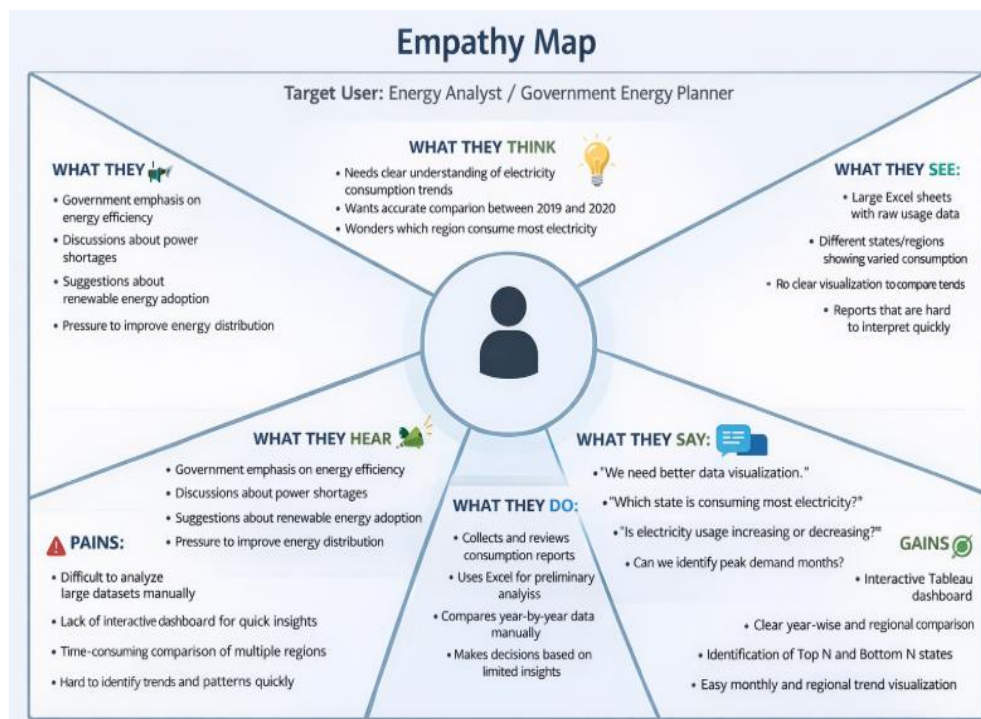
2. IDEATION PHASE

2.1 Problem Statement

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS – 1	An energy analyst	Understand electricity consumption trends across states and regions	The data is available only in raw Excel format	There are no proper visualization or dashboards to interpret patterns	Confused and unable to make quick data-driven decisions
PS – 2	A government energy planner	Identify high and low electricity consuming states	I cannot easily compare year-wise and month-wise consumption	The data lacks interactive filtering and comparative tools	Uncertain about resource allocation and planning

PS – 3	A regional electricity distribution manager	Monitor regional electricity usage performance	It is difficult to track trends over time	There is no centralized visual analytics system	Concerned about inefficiencies in energy distribution
PS - 4	A policy maker	Analyze seasonal electricity demand variations	Monthly data is complex and hard to interpret	There is no clear trend analysis visualization	Insecure about making strategic energy policies

2.2 Empathy Map Canvas



2.3 Brainstorming

S. No	Ideas Generated	Category
1	Visualize electricity consumption across different Indian states	Regional Analysis
2	Analyze consumption trends by sectors (residential, commercial, industrial)	Sectoral Insights
3	Identify peak usage hours and visualize as heatmaps	Time-based Patterns
4	Compare consumption trends across years/months (seasonal patterns)	Seasonal Variations
5	Use Tableau filters to enable dynamic interaction	Visualization Enhancements
6	Include policy implications and energy-saving tips based on findings	Impact & Recommendations

7	Forecast future consumption using historical data trends	Predictive Analysis
8	Highlight states with highest and lowest per capita electricity usage	Benchmarking
9	Show changes in urban vs rural electricity consumption	Demographic Comparison
10	Integrate external datasets like population or weather for deeper insights	Data Enrichment

3. REQUIREMENT ANALYSIS

3.1 Customer Journey map

Customer Journey Stages:

Stage 1: Problem Awareness

User Realization:

- Electricity demand fluctuates unpredictably.
- Seasonal peaks cause overload.
- Lockdown impacted consumption patterns. Pain Points:
- Raw CSV data difficult to interpret.
- No centralized dashboard.
- Hard to compare region-wise usage.

Stage 2: Data Exploration

User Actions:

- Access Tableau dashboard
- Select Year (2019 / 2020)
- Filter by Region
- Compare States

System Response:

- Displays time-series graphs
- Shows Top N / Bottom N states
- Provides regional comparison map

Stage 3: Insight Discovery

User Discovers:

- Southern region consumes highest power.
- 2020 lockdown reduced industrial consumption.
- Summer months show peak demand.
- Certain states show consistent growth trend.

Stage 4: Decision Making

User Decisions:

- Allocate more supply during peak months.
- Promote off-peak usage incentives.
- Improve grid infrastructure in high-demand regions.
- Plan renewable energy investment.

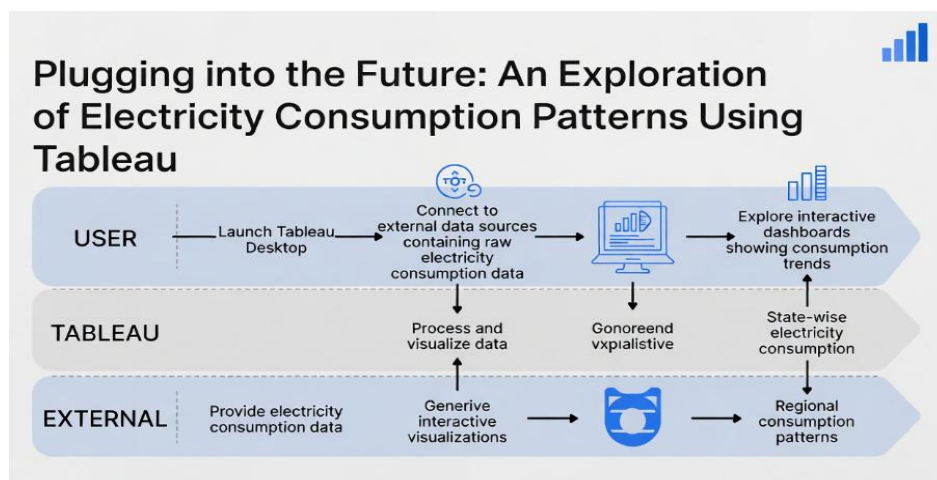
3.2 Solution Requirement

Functional Requirements:

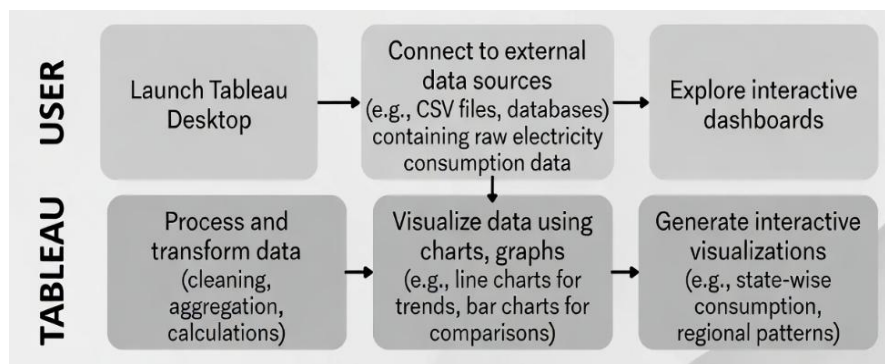
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Data Collection & Import	Import electricity consumption dataset into Tableau Support CSV/Excel data format Clean and prepare dataset for visualization
FR-2	Data Processing	Perform data cleaning (remove null values, formatting) Create calculated fields for year, region and monthly usage Categorize states into regions (WR, NR, SR, ER, NER)
FR-3	Visualization Creation	Create yearly electricity consumption trend chart Create region-wise consumption pie chart Create Top N and Bottom N states bar charts Create month-wise consumption charts Create India state consumption maps
NFR-4	Dashboard Development	Build interactive dashboards combining multiple visualizations Enable filtering by year and region Add titles, legends and labels for clarity Provide comparative view of 2019 vs 2020 data

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Dashboard should be easy to understand and interactive for non-technical users. Visualizations must be clear and self-explanatory.
NFR-2	Security	Dataset used must be public/non-confidential and protected from unauthorized modification.
NFR-3	Reliability	Dashboard should display accurate and consistent results based on the dataset.
NFR-4	Performance	Dashboard should load and respond to filters quickly without lag.
NFR-5	Availability	Dashboard should be accessible anytime through Tableau Public.
NFR-6	Scalability	Solution should allow addition of future years and more states without redesigning the dashboard.

3.3 Data Flow Diagram



3.4 Technology Stack



4. PROJECT DESIGN

4.1 Problem Solution Fit

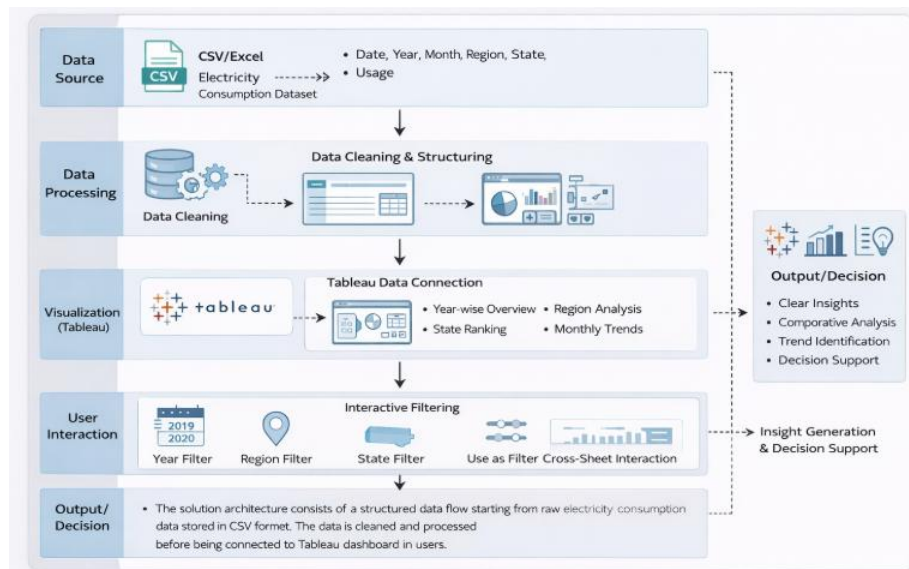
1. CUSTOMER SEGMENT(S) C5 Energy analysts and government planners analyzing electricity consumption data	6. CUSTOMER CONSTRAINTS CC Electricity consumption data is stored in large, raw Excel sheets making interpretation very difficult. Manually comparing year-by-year, state-by-state, and region-by-region consumption data is time analysis.	5. AVAILABLE SOLUTIONS A5 Currently, the data is in large Excel sheets and difficult to compare. Simple charts in Excel are static, and provide interactive features required for deep analysis.
3. JOBS-TO-BE-DONE / PROBLEMS J&P 1. Interpreting raw Excel data is challenging. 2. Comparing electricity consumption year-wise and region-wise is difficult. 3. Identifying Top N and Bottom N consuming states is hard. 4. Manual analysis is time-consuming and inefficient.	6. PROBLEM ROOT CAUSE RC Data is stored in large, unprocessed Excel sheets and lack of proper visualization tools.	7. BEHAVIOUR BE They manually sift through Excel sheets to compare yearly, regional, and state consumption data. Inefficient, and time-consuming decision-making.
3. TRIGGERS TR • When tasked to analyze electricity data, energy analysts manually analyze Excel sheets and compare states' consumption data.	1. YOUR SOLUTION SL Developed interactive Tableau dashboard for clear and meaningful insights with: • Year-wise bar charts comparing 2019 & 2020 • Region-wise distribution pie chart • Dynamic state-ranking (Top N & Bottom N) using parameters • Monthly trend analysis using line charts • Interactive filters (Year, Region, State) & "Use as Filter" feature.	6. BEHAVIOUR BE • They manually sift through Excel sheets to compare yearly, regional, and state consumption data. Inefficient, and time-consuming decision-making.
4. EMOTIONS: BEFORE / AFTER EM Before: Difficult, time-consuming, indecisive. After: Clear, fast, and confident decision-making.	9. YOUR SOLUTION SL • Developed interactive Tableau dashboard for clear and meaningful insights with: • Year-wise bar charts comparing 2019 & 2020 • Dynamic state-ranking tool for easy viewing	7. YOUR SOLUTION SL • Business & Marketing channel (ie. late on interest) • Analyst collaboration platform member interest.
5. EMOTIONS: BEFORE / AFTER EM Before: Difficult, time-consuming, indecisive. After: Clear, fast, and confident decision-making.		8. OUTCOME O 1. Solution effectively addresses the problems identified. 2. Enhanced efficiency and decision-making speed with interactive visual analysis.

4.2 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Electricity consumption data is stored in large Excel sheets, making it difficult to interpret, compare year-wise and region-wise trends, and identify high and low consuming states. Manual analysis is time-consuming and inefficient for decision-making.
2.	Idea / Solution description	Develop an interactive Tableau dashboard that visualizes electricity consumption data using bar charts, line charts, and pie charts. The dashboard includes year-wise comparison, region-wise distribution, Top N & Bottom N state analysis, monthly trend visualization, and interactive filters (Year, Region, State).
3.	Novelty / Uniqueness	The solution integrates dynamic filtering, parameter-based Top N and Bottom N analysis, and cross-sheet interaction in a single dashboard. It transforms static Excel data into an interactive, user-friendly analytical system.
4.	Social Impact / Customer Satisfaction	The dashboard helps energy planners and analysts make faster and more accurate decisions. It improves transparency in electricity consumption patterns and supports better energy planning and resource allocation.

5.	Business Model (Revenue Model)	The solution can be adopted by government agencies, electricity boards, and energy companies. It can be implemented as a data analytics service or integrated into energy management systems for performance monitoring.
6.	Scalability of the Solution	The dashboard can be expanded to include additional years, renewable energy data, predictive analytics, and real-time data integration. It can also be adapted for other sectors such as water consumption or fuel usage analysis. predictive analytics, and real-time data integration. It can also be adapted for other sectors such as water consumption or fuel usage analysis.

4.3 Solution Architecture



5. PROJECT PLANNING & SCHEDULING 5.1 Project Planning

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection & Preparation	USN-1	As an analyst, I can import electricity consumption data into Tableau.	3	High	Peddapalem Revathi
Sprint-1	Data Cleaning	USN-2	As an analyst, I can clean and structure the dataset (Year, Month, Region, State, Usage).	3	High	Nagineni Chandana
Sprint-2	Dashboard Creation	USN-3	As a user, I can view year-wise electricity consumption using bar charts.	5	High	Peddapalem Revathi
Sprint-2	Trend Analysis	USN-4	As a user, I can analyze monthly trends using line charts.	3	Medium	Bagi Chandana
Sprint-3	Filter Integration	USN-5	As a user, I can filter data by Year, Region, and State.	3	High	Gudur Nazurulla
Sprint-3	Top/Bottom Analysis	USN-6	As a user, I can view Top N and Bottom N states based on usage.	3	Medium	Melupaku Nithin Krishna

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Story & Final Presentation	USN-7	As a user, I can view insights in story format for better understanding.	4	High	Peddapalem Revathi

Project Tracker, Velocity & Burndown Chart

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	6	6 Days	15 Jan 2026	20 Jan 2026	6	20 Jan 2026
Sprint-2	8	6 Days	21 Jan 2026	28 Jan 2026	8	28 Jan 2026
Sprint-3	6	6 Days	29 Jan 2026	3 Feb 2026	6	3 Feb 2026
Sprint-4	4	6 Days	4 Feb 2026	7 Feb 2026	4	7 Feb 2026

6. FUNCTIONAL AND PERFORMANCE TESTING

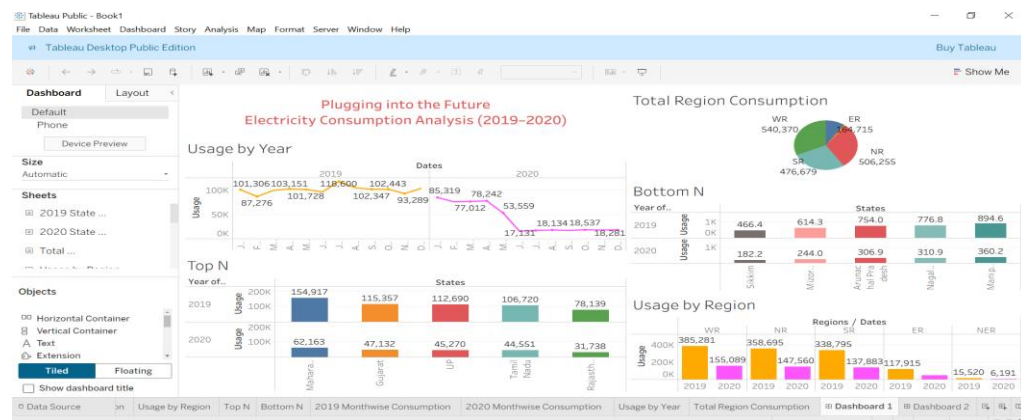
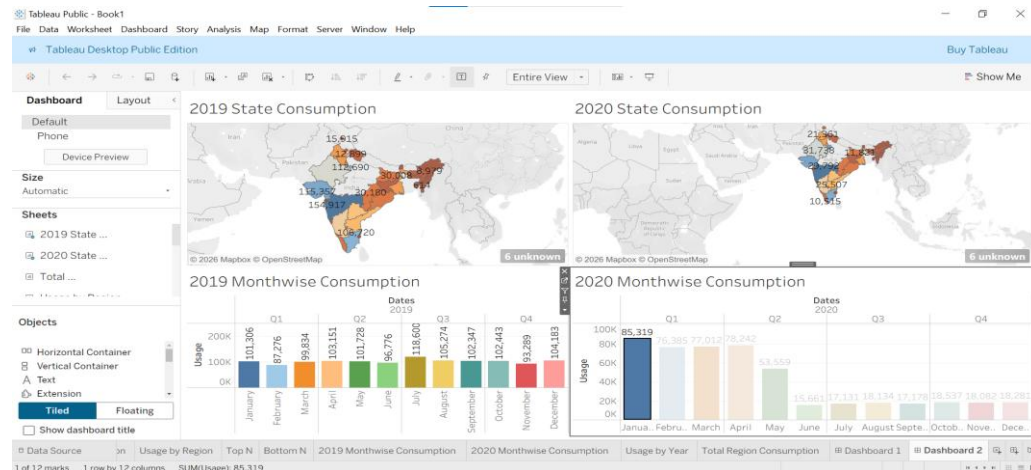
6.1 Performance Testing

S.No.	Parameter	Screenshot / Values
1.	Data Rendered	The dashboard successfully renders electricity consumption data without delay. The dataset includes Year, Month, Region, State, and Usage fields. All visualizations load within acceptable response time.
2.	Data Preprocessing	Data was cleaned before visualization. Date fields were structured into Year and Month hierarchy. Usage values were converted into numeric format. Null values were verified and handled appropriately.
3.	Utilization of Filters	Interactive filters such as Year, Region, and State were implemented. "Use as Filter" functionality enables cross-sheet interaction. Dashboard updates dynamically when filters are applied.
4.	Calculation fields Used	Calculated fields such as Total Usage (SUM), Top N / Bottom N using parameters, and Year-wise Growth were implemented to enhance analysis.
5.	Dashboard design	Number of Visualizations / Graphs – 6 (Bar Chart, Pie Chart, Line Chart, Top N Analysis, Bottom N Analysis, KPI Summary). Layout is structured and responsive.
6	Story Design	Number of Visualizations / Graphs – 6. Story points are arranged logically to explain trends, comparisons, and insights step by step.

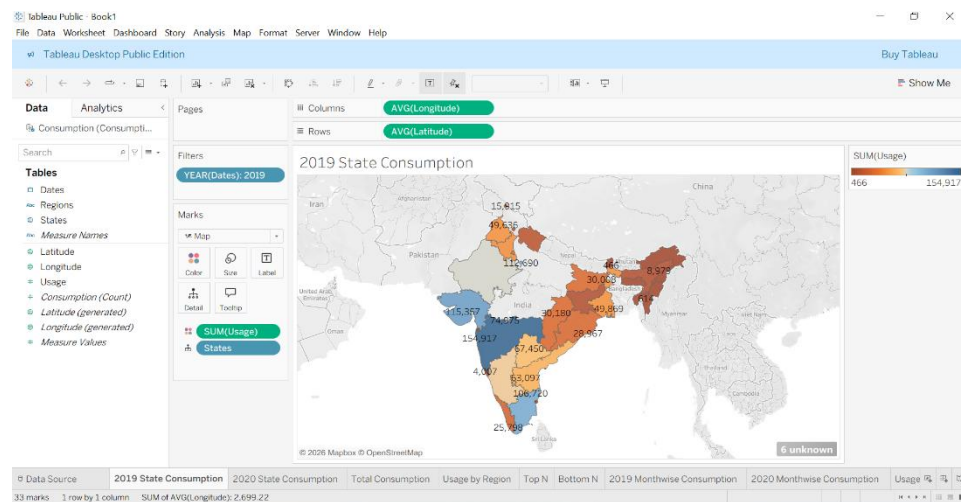
7. RESULTS

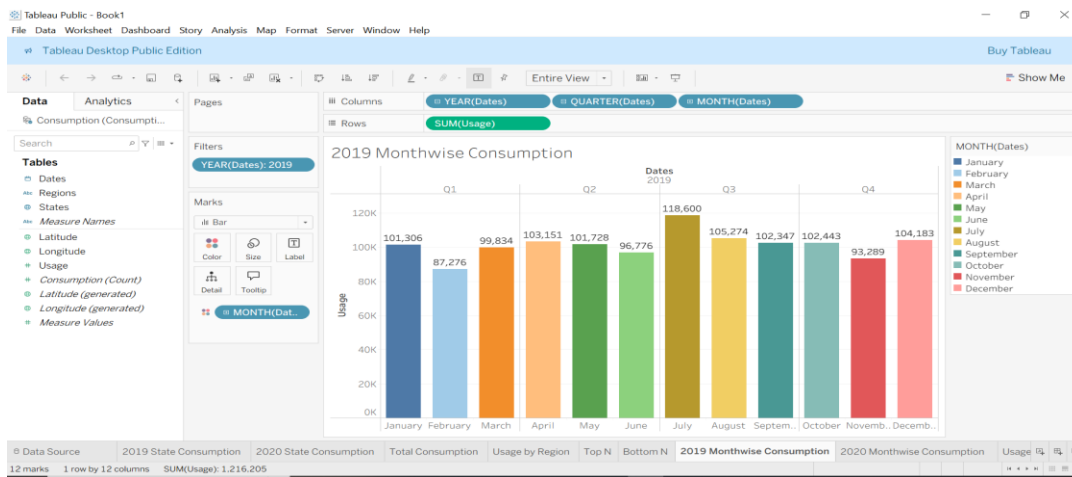
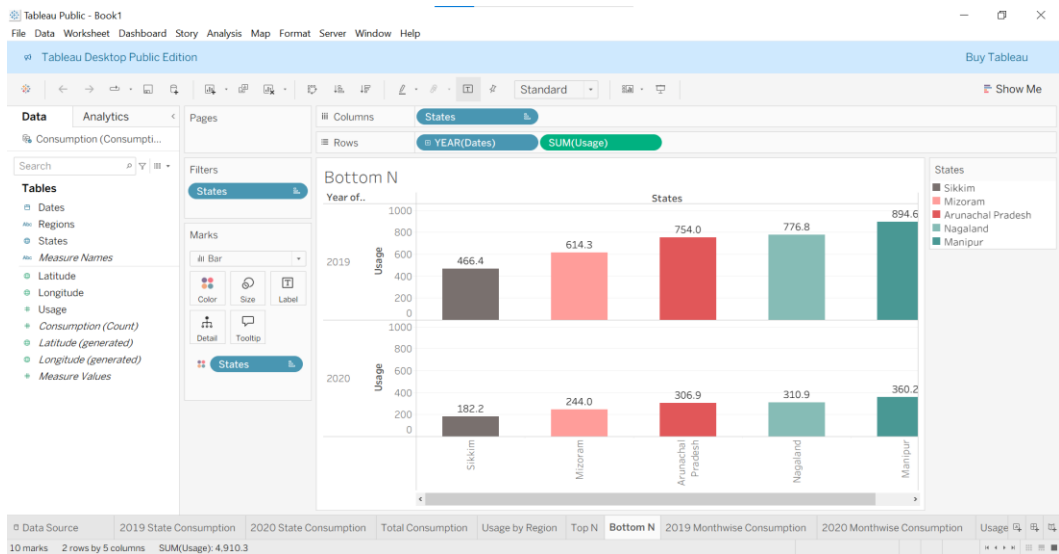
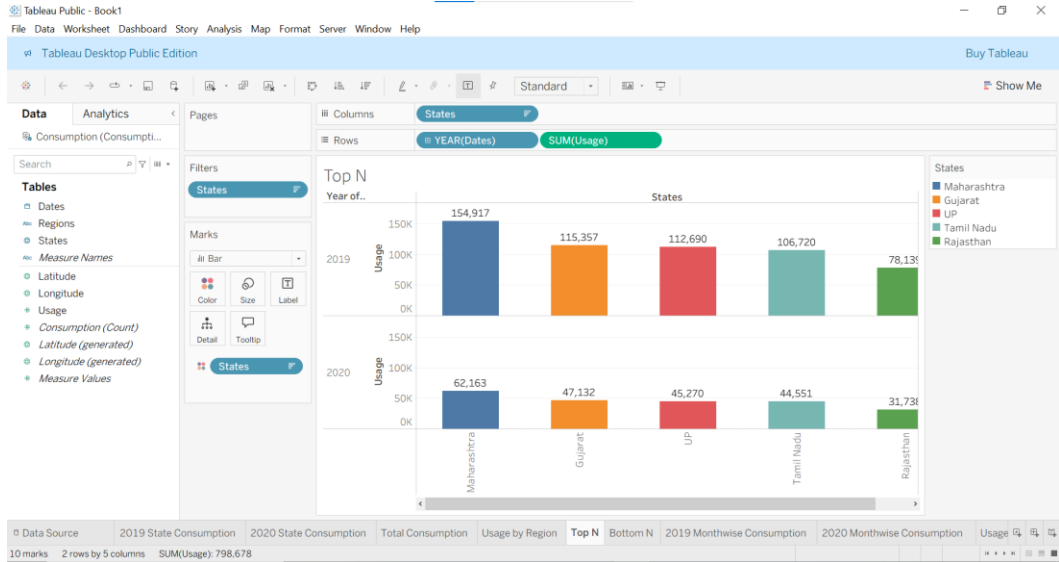
7.1 Output Screenshots

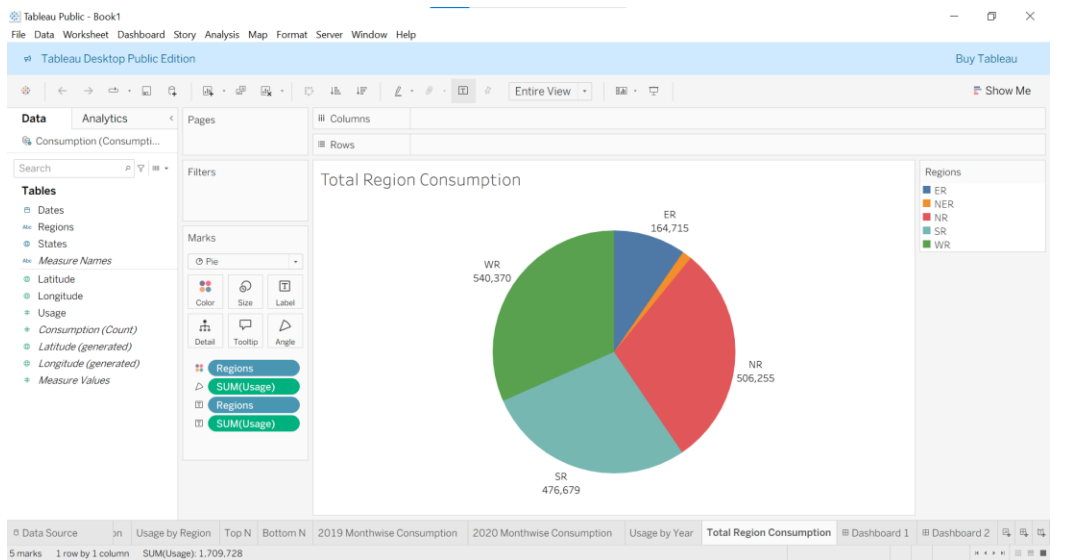
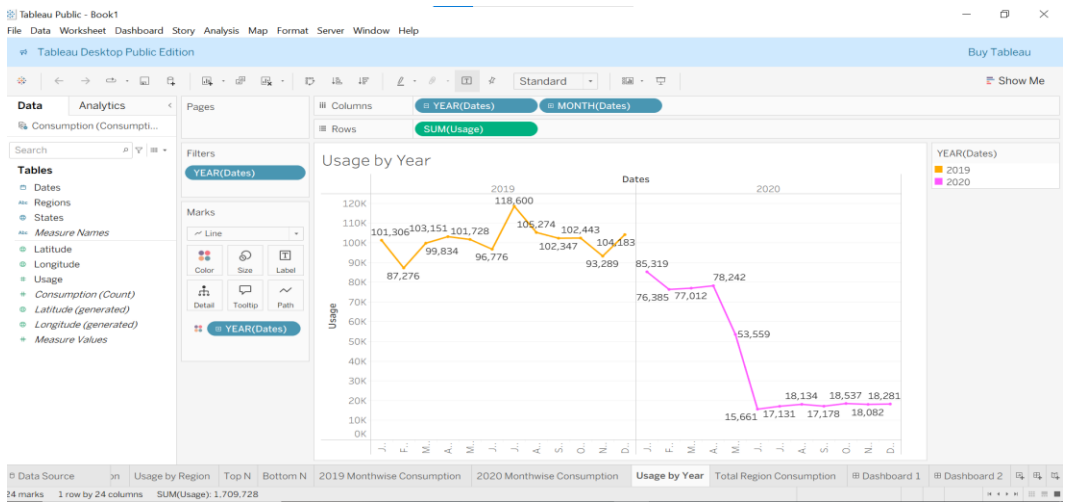
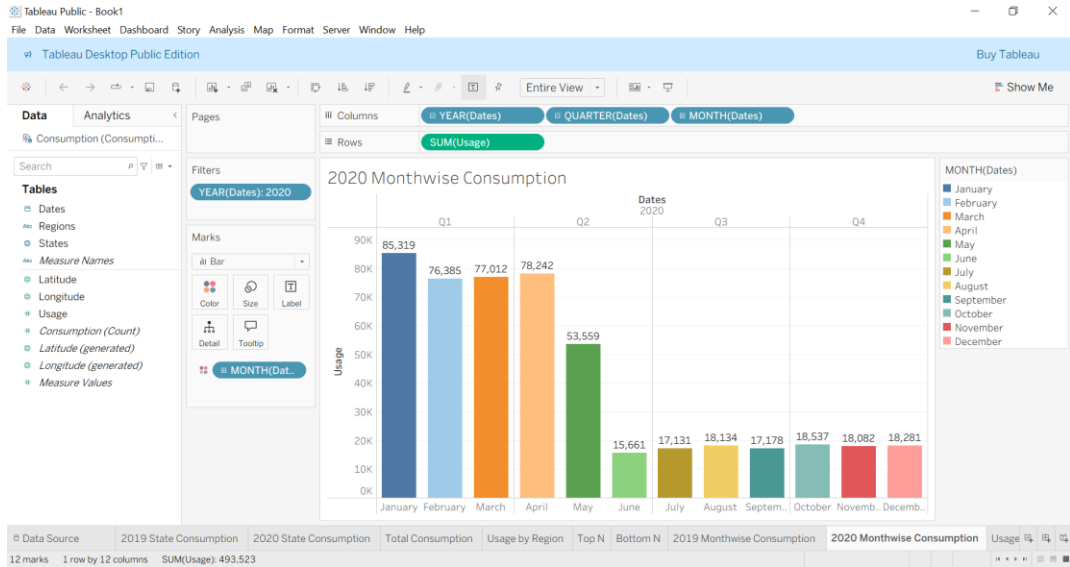
Dashboard Screenshots:



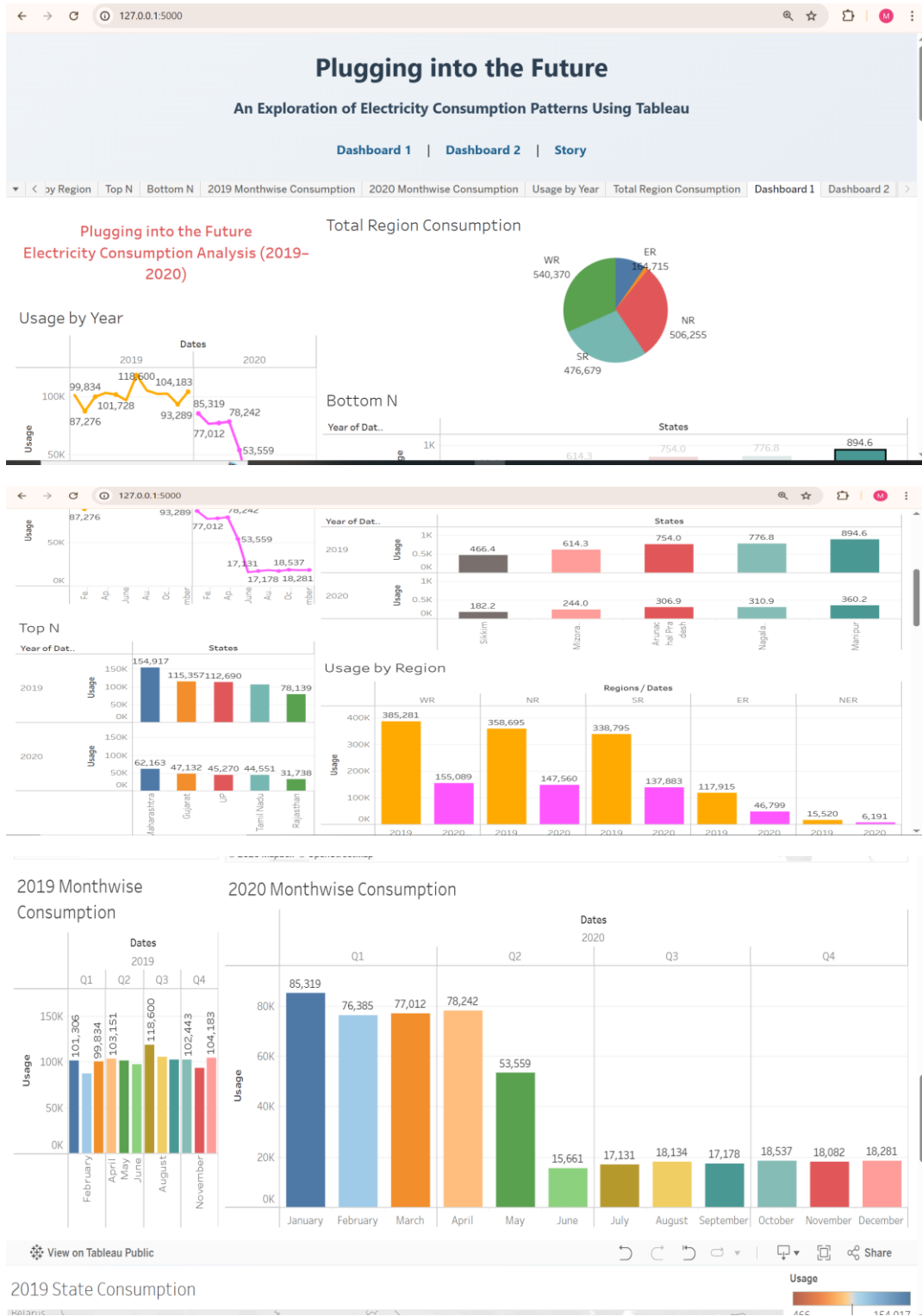
Story

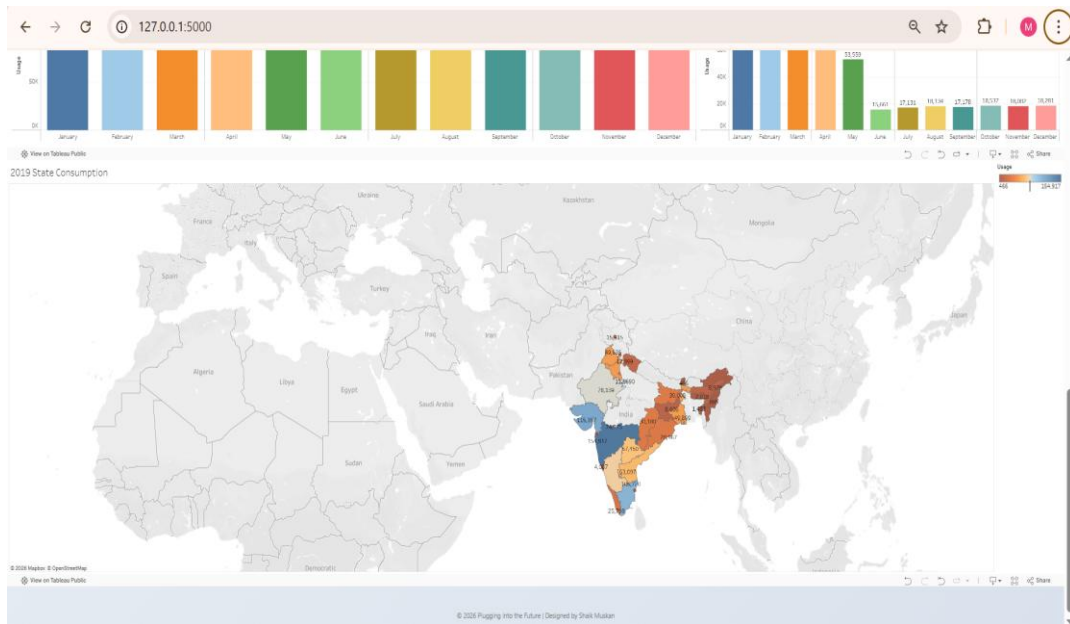






Web Integration Screenshots:





8. ADVANTAGES & DISADVANTAGES

Advantages

1. **Interactive Visualization**
The dashboard provides interactive charts and filters that allow users to explore electricity consumption data dynamically.
2. **Improved Decision Making**
Year-wise and region-wise analysis helps stakeholders make informed and data-driven decisions.
3. **Easy Trend Identification**
Monthly and seasonal trends can be easily identified through line charts and comparative analysis.
4. **Time Saving**
Instead of manually analyzing raw Excel data, the dashboard presents insights instantly.
5. **User-Friendly Interface**
The system is simple to use and does not require advanced technical knowledge.
6. **Better Resource Planning**
Helps energy planners identify high and low consumption regions for efficient energy distribution.

Disadvantages

- **Dependent on Data Quality**
If the input data contains errors or missing values, the analysis may not be accurate.
- **Limited to Available Data**
The dashboard can only analyze the data provided and cannot predict future consumption without advanced modeling.

- **Requires Tableau Software**

Users need access to Tableau to interact with the dashboard.

- **Initial Setup Time**

Data cleaning and dashboard development require initial time and effort.

9. CONCLUSION

The Electricity Consumption Analysis project successfully transformed raw electricity usage data into meaningful and interactive visual insights using Tableau. The developed dashboard enables year-wise, month-wise, and region-wise analysis, helping stakeholders identify consumption trends and high-demand areas. Through the use of filters, calculated fields, and comparative visualizations, the system improves decision-making and simplifies complex data interpretation. Overall, the project demonstrates how data visualization and analytics tools can enhance energy planning, resource allocation, and strategic decision-making. The solution provides a user-friendly and efficient platform for analyzing electricity consumption patterns effectively.

10. FUTURE SCOPE

In the future, this project can be enhanced by integrating real-time electricity data for live monitoring. Predictive analytics can be added to forecast future consumption trends. The system can also be expanded to include renewable energy analysis and deployed as a web-based platform for wider accessibility.

11. APPENDIX

Source Code (if any)

App.py:

```
from flask import Flask, render_template

app = Flask(__name__)

@app.route("/")

def home():

    return render_template("index.html")

if __name__ == "__main__":

    app.run(debug=True)
```

Dataset Link

https://drive.google.com/file/d/1JxIkHNwXxjFztKq7ad0_KtkukCqTckNy/view

GitHub & Project Demo Link

<https://github.com/Revathi1809-star/Plugging-into-the-Future-An-Exploration-of-Electricity-Consumption-Patterns-Using-Tableau>