

1. Introduction :

1.1 Project Overview: In today's data-driven world, electricity consumption analysis plays a vital role in energy planning and policy-making. Government agencies and electricity boards collect vast amounts of consumption data, but without proper visualization tools, extracting meaningful insights becomes difficult.

The project titled "Plugging into the Future – Electricity Consumption Analysis Using Tableau" focuses on analyzing electricity usage across states, regions, months, quarters, and years (2019 & 2020).

Using Tableau, raw electricity datasets are transformed into interactive dashboards that help answer key questions:

- Which states consume the most electricity?
- How did lockdown impact electricity demand?
- What are the seasonal and regional trends?
- Which regions dominate overall power usage?

The dashboard enables interactive filtering and drill-down, providing a complete analytical view for energy stakeholders.

1.2 Purpose: The purpose of this project is to support data-driven energy planning by visualizing electricity consumption patterns across:

- State-wise usage
- Region-wise comparison
- Monthly and quarterly trends
- Lockdown impact analysis
- Top and Bottom consuming states

The solution simplifies complex datasets into intuitive dashboards that allow policymakers and energy officials to make faster, evidence-based decisions.

2. IDEATION PHASE :

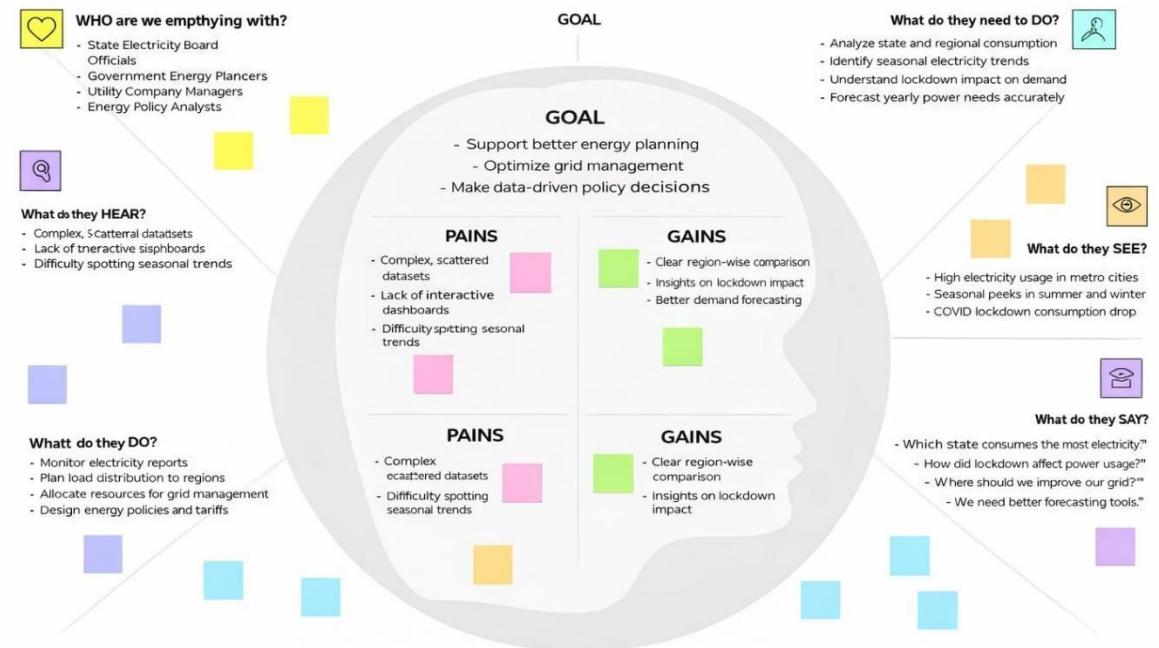
2.1 Problem Statement: Electricity boards struggle to analyze large state-wise and time-based datasets using static spreadsheets.

Challenges include:

- Difficulty identifying peak demand periods
- Lack of regional comparison tools
- No interactive filtering capability
- Limited visibility of lockdown impact

There is a need for an interactive visualization solution that connects stakeholders directly to their data.

2.2 Empathy Map Canvas :



2.3 Brainstorming :

2.3.1. Team Collaboration and Approach: Our team began the project with a brainstorming session to analyze the electricity consumption dataset and identify key variables such as State, Region, Year, Quarter, and Usage.

We discussed suitable visualizations like maps, bar charts, and line charts to effectively present insights. Responsibilities were divided among data cleaning, calculated field creation, dashboard design, and story development.

We followed an Agile approach with regular reviews to ensure clear visuals, proper interactivity, and timely project completion.

2.3.2. Ideas Generated and Grouped by Category:

3. Key Ideas Generated:

Idea	Category
State-wise comparison map	Geographic Analysis
Quarter-wise usage trend	Seasonal Analysis
Lockdown impact comparison	Event Impact Analysis
Top N & Bottom N states	Ranking Analysis

Region-wise pie chart	Regional Distribution	
Interactive filters	User Interactivity	
Tableau Story feature	Presentation	
2.3.3. Prioritization:		
Priority	Idea	Reason
High	Bar Chart for Product Position vs Sales	Core to solving the project's main problem
High	Donut Chart for Promotion Impact	Simple and clear to stakeholders
Priority	Idea	Reason
High	Highlight Table for Demographics	Helps target customer segments more precisely
High	Filters for Category, Traffic, and Promotion	Essential for interactivity
Medium	Funnel and Waterfall Charts	Adds depth to financial and behavioral insight
Low	Word Cloud and Storyboard	Adds polish and storytelling but not critical to logic

4. REQUIREMENT ANALYSIS :

4.1 Customer Journey map : The Customer Journey Map helps visualize the enduser's experience from problem identification to solution adoption. For this project, our primary users are retail managers, marketing analysts, and store planners who want to improve sales using data-driven product placement.

Customer Journey Map

Stage	User Action	Pain Point	Dashboard Solution
Awareness	Notices inconsistent power demand	Static reports	Interactive dashboard

Analysis	Tries manual Excel analysis	Time-consuming	Filters & charts
Insight	Identifies peak demand	Hard to compare data	Quarter & Month charts
Stage	User Action	Pain Point	Dashboard Solution
Action	Plans resource allocation	Needs presentation support	Tableau Story & Export

3.2 Solution Requirement:

Functional Requirements

- Upload electricity dataset
- Clean and preprocess data
- Create state map and charts
- Add filters (Year, Region, Quarter, State)
- Build Top N & Lockdown analysis
- Enable export functionality

Non-Functional Requirements

- Usability – Easy to navigate
- Performance – Load within 5 seconds
- Reliability – Accurate filter results
- Scalability – Support future years
- Availability – Accessible via Tableau Public

3.3 Data Flow Diagram: A Data Flow Diagram (DFD) shows how data moves through your system — from input to final output — across different components. This project processes a CSV dataset through Tableau to produce interactive dashboards for business decision-making.

Level 1 DFD – Detailed Process Flow:

	Process Component	Description
1	Data Input	User uploads Product Positioning.csv to Tableau

2	Data Cleaning & Formatting	Missing value check, column type conversion, column renaming
3	Calculated Fields	Fields like Price Gap, Sales Category, % Difference
4	Visualization Engine	Tableau sheets and dashboards created using multiple chart types
	Process Component	Description
5	Filters	Applied on Promotion, Traffic, Demographics, Product Category
6	Dashboard Assembly	All sheets combined into one interactive dashboard
7	Storytelling Mode	Tableau story created to walk stakeholders through key insights
8	Output	Users view or export dashboard results (PDF, image, or shareable link)

3.4 Technology Stack: This section outlines the tools, technologies, and components used to build and deploy the solution. It includes both the architecture layers and the technology choices for your project.

A. Technical Architecture (3-Tier Design)

Layer	Component Description
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Presentation Layer	The final Tableau Dashboard UI, visible to users. Includes interactive filters and visuals
Application Layer	Tableau Engine responsible for creating calculations, visual logic, and rendering visuals
Data Layer	Raw dataset: Product Positioning.csv stored locally or on Google Drive

B. Components & Technologies Used

S. No	Component	Description	Technology Used
1		Tableau Dashboard with visual and filter components	Tableau Public / User Interface Desktop
2		Data cleaning, type conversion, and calculated fields	Tableau, Optional: Data Processing Python/Pandas
3		Dataset stored and imported into Tableau	Local File System / File Storage Google Drive
4	Visualization		Tableau Visualization Chart rendering and interactivity
	Engine		Engine
5	Story	Tableau Story feature for	Tableau
	Presentation	sequential insights	
6	Export & Sharing	Export reports in PDF/Image formats; public dashboard access	Tableau Public / PDF Export

C. Application Characteristics

Feature	Description	Technology Used
Open Source Frameworks	Tableau Public is freely accessible, optional use of Python (Pandas)	Tableau Public, Pandas
Security	Controlled data sharing via Tableau Public permissions and Google Drive	Tableau Share Settings
Scalability	Can support more data rows, product lines, or new categories easily	Tableau Extract Engine
Feature Availability	Description Hosted via Tableau Public or downloadable as a file for 24/7 access	Technology Used Tableau Public

Performance	Fast loading for up to 1000+ rows with live filters and dashboard response	Tableau (Live / Extract)
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4. PROJECT DESIGN:

4.1 Problem Solution Fit:

The Problem

Our product is an interactive Tableau dashboard that analyzes electricity consumption across states and regions for 2019 and 2020.

It provides insights into monthly trends, quarterly usage, lockdown impact, and Top/Bottom consuming states using dynamic filters and visual storytelling for better energy planning decisions.

The Solution

This project proposes a fully interactive Tableau dashboard that transforms raw, static electricity consumption data into dynamic and meaningful visual insights. The dashboard allows users to:

- View and compare state-wise electricity consumption for 2019 and 2020
- Analyze regional distribution and identify high-demand areas
- Examine monthly and quarterly trends, including lockdown impact
- Identify Top and Bottom consuming states
- Explore metro city usage and seasonal variations

By integrating filters, calculated fields, drill-down features, and multiple chart types, this solution enables energy officials and policymakers to understand consumption patterns clearly and make faster, data-driven planning decisions.

Challenge

Static, unfilterable
spreadsheets

No correlation between
multiple variables

Manual analysis is timeconsuming

How the Solution Solves It

Tableau dashboard allows dynamic filtering and exploration

Users can interactively combine factors like traffic + promo + demographics

Visuals offer instant insights, reducing dependency on Excel

Dashboard shows which placements drive the

Poor placement decisions

Difficulty sharing insights

most sales **Why This Solution Fits the Problem with**

teams

4.2 Proposed Solution: To address the challenges faced by electricity boards and policymakers in analyzing complex consumption datasets, we propose a Tableau-based interactive dashboard solution that enables deep exploration of electricity usage patterns across states and regions. The proposed solution transforms flat, tabular electricity consumption data into a dynamic visual analytics environment where users can interact with the data, apply filters, and gain real-time insights into how state distribution, regional trends, seasonal variations, quarterly changes, and lockdown impact influence overall electricity demand.

Key Features of the Proposed Solution

Feature	Description
State-wise Map	Visualize electricity consumption across different states for 2019 and 2020

Bar Charts	Compare electricity usage across states, regions, and Top/Bottom N rankings
Line Charts	Analyze yearly and monthly consumption trends
Quarter Charts	Study seasonal variations and lockdown impact (Q2 2020)
Pie Charts	Show region-wise contribution to total electricity usage
KPI Cards	Display total consumption and key summary metrics
Drill-Down Feature	Enable Region → State level detailed analysis
Interactive Filters Feature	Slice data by Year, Region, State, and Quarter
Calculated Fields	Description Add Growth %, Lockdown Impact classification, and ranking logic
Dashboard Story	Present insights step-by-step for policymakers and stakeholders
Export Options	Allow dashboards to be exported as PDF or image for reporting

How the Solution Will Be Implemented

1. **Data Upload & Preparation:** Import the electricity consumption dataset (CSV) into Tableau o Clean and format data fields (State, Region, Year, Month, Quarter, Usage) o Remove null or duplicate entries o Create calculated fields such as Growth % and Lockdown Impact classification

2. **Dashboard Design:** Develop individual visualizations
(State Map, Bar Charts, Line Charts, Quarter Charts, KPI Cards)
 - o Implement Top N and Bottom N analysis
 - o Apply global filters (Year, Region, State, Quarter) across all dashboards
 - o Use consistent color coding and labels for better readability

3. **Storytelling and Output:** Use Tableau Story feature to present insights step-by-step
 - o Highlight key findings such as regional dominance and lockdown impact
 - o Export dashboards as PDF or images for reporting and presentations

4.3 Solution Architecture

A. Technology Stack:

Component	Technology Used
Data Storage	Local CSV File (Electricity Consumption Dataset) / Google Drive
Data Processing	Tableau Desktop / Tableau Public
Visualization Engine	Tableau Visualization Engine
Calculated Logic	Tableau Calculated Fields (Growth %, Lockdown Impact)
Storytelling & Output	Tableau Story Feature
Sharing & Export	Tableau Public, PDF/Image Export
Optional Enhancements	Python + Pandas (for advanced data cleaning and future forecasting)

4.

B. Key Functional Features Enabled by Architecture:

- Calculated Fields like:
 - o **Growth %** = $(2020 \text{ Usage} - 2019 \text{ Usage}) / 2019 \text{ Usage}$
 - o **Lockdown Impact Classification** = IF Year = 2020 AND Quarter = "Q2" THEN "Post-Lockdown" ELSE "Normal Period"
 - o **Region Ranking** to identify highest and lowest electricity-consuming regions
 - o **Top N / Bottom N Logic** to dynamically rank states based on total electricity usage
- **Dashboard Filters for:**
 - o Year (2019 / 2020)
 - o Region (NR, SR, ER, WR, NER)

- o State o Quarter
(Q1–Q4)

- **Charts & Visuals:**
 - o Filled Map for state-wise electricity consumption
 - o Bar Chart for Top N & Bottom N states
 - o Line Chart for yearly and monthly trend analysis
 - o Quarter Chart for lockdown impact analysis
 - o Pie Chart for region-wise contribution
 - o KPI Card for total electricity consumption summary

5 PROJECT PLANNING & SCHEDULING:

- a **Project Planning:** Project planning was essential to ensure the systematic development of the electricity consumption dashboard. Our approach followed the Agile methodology with three focused sprints, each targeting core functional elements of the solution — from data preparation and visualization design to story creation and final presentation.
- This structured approach helped ensure timely completion, clear task distribution, and continuous improvement throughout the dashboard development process.

PERFORMANCE TESTING :



Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Setup & Cleaning	USN-1	As an analyst, I want to upload and clean the electricity dataset so it is ready for visualization	2	High	You
Sprint-1	Basic Visualization Design	USN-2	As a user, I want to create state maps and bar charts to compare electricity consumption	3	High	You
Sprint-1	Dashboard Filtering	USN-3	As a user, I want to add filters (Year, Region, State, Quarter) to interact with dashboards	2	Medium	You
Sprint-2	Advanced Visualizations	USN-4	As a user, I want to build Top N, Bottom N, and Quarter analysis charts	4	High	You
Sprint-2	Lockdown & Growth Analysis	USN-5	As a user, I want calculated fields (Growth %, Lockdown Impact) to analyze trends	3	Medium	You
Sprint-3	Story Building	USN-6	As a presenter, I want to create a Tableau Story to communicate insights step-by-step	2	Medium	You
Sprint-3	Export & Presentation	USN-7	As a user, I want to export visuals and present the final dashboard to stakeholders	2	High	You



Project Tracker, Velocity & Burndown Chart (4 Marks)

Sprint	Total Story Points	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed	Sprint Release Date (Actual)
Sprint-1	7	7 *	6 Days	01 Feb 2026	06 Feb 2026	7	06 Feb 2026
Sprint-2	7	7 *	6 Days	07 Feb 2026	12 Feb 2026	7	12 Feb 2026
Sprint-3	4	4 *	6 Days	13 Feb 2026	18 Feb 2026	4	18 Feb 2026

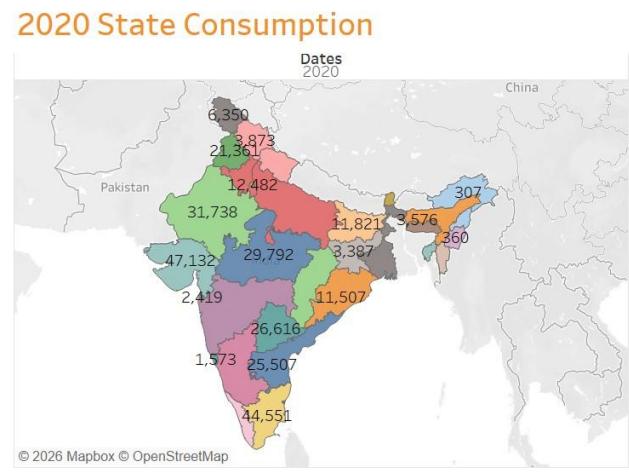
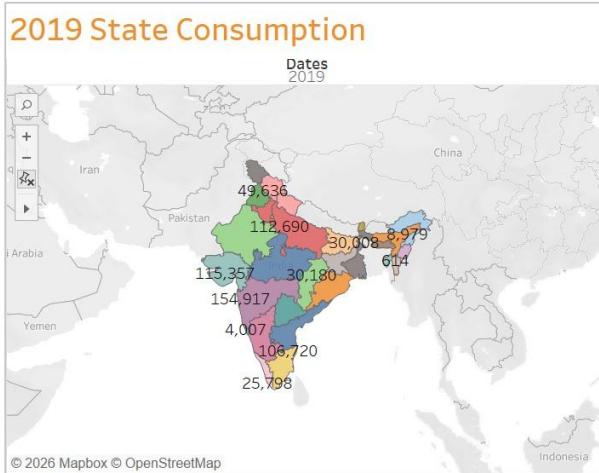
Velocity Calculation = 18 Number of Sprints = 3 ✓ Velocity ✓ 6 story points per sprint

Model Performance Testing

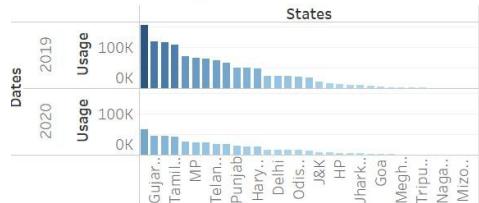
S.No.	Parameter	Screenshot / Values
1.	Data Rendered	<p>The dataset used contains 1000 entries related to product placement, pricing, traffic, demographics, promotions, and sales volume. Key fields include:</p> <ul style="list-style-type: none"> • Product_Position • Traffic • Foot Traffic • Promotion (Yes/No) • Customer Demographics • Sales Volume
2.	Data Preprocessing	<ul style="list-style-type: none"> • Cleaning and computed column types • Removed missing/null entries (none in this dataset) • Data preprocessed for easy visualization in
3.	Utilization of Filters	<p>Global filters used in the dashboard:</p> <ul style="list-style-type: none"> • Promotion (Yes/No) • Demographics (Segment/Age) • Foot Traffic (Low/Medium/High) • Seasonal (Q1–Q4) <p>All filters applied across all visualizations to enable dashboard interactivity:</p>
4.	Calculation fields Used	<ul style="list-style-type: none"> • Price Gap = (Price) – (Competitor's Price) • Promotion Impact = IF Promotion = "Yes" THEN Sales Volume • % Price Difference = [[Price] – (Competitor's Price)] / (Competitor's
5.	Dashboard design	<ul style="list-style-type: none"> • Bar Chart – Avg Sales by Product Category • Donut Chart – Promotion-wise Sales • Funnel Chart – Traffic Drop-off Zones • Quarter Chart – Traffic vs. Sales Post-Lockdown Impact
6.	Story Design	<ul style="list-style-type: none"> • Bar Chart – Avg Sales by Product Category • Key Findings. <ul style="list-style-type: none"> • Regional Traffic Impact • Promotion Effectiveness • Sales Optimization Insights <p>Story figures:</p> <ul style="list-style-type: none"> • Key Findings • Regional Traffic • Sales Optimiz Insights

6 RESULTS :

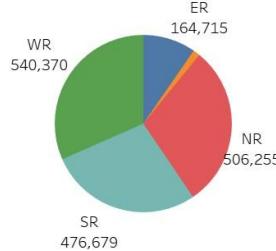
a Output Screenshots:



Total Consumption



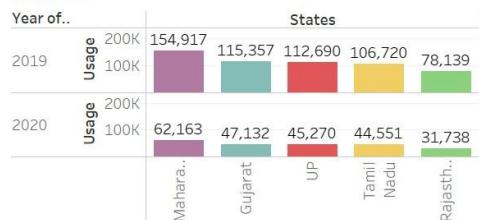
Total Consumption Region Wise



Usage Of Region



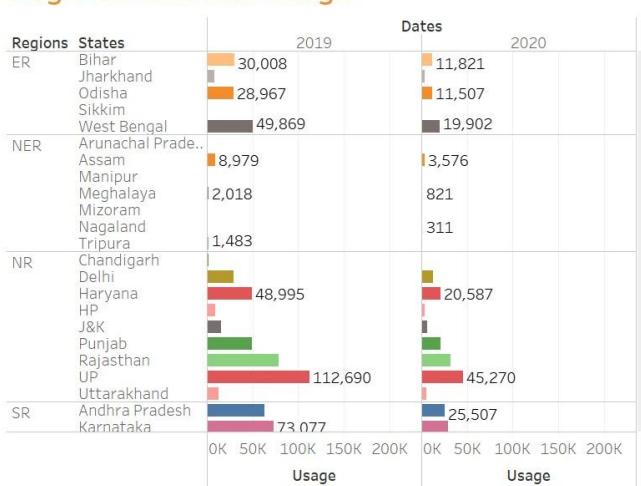
Top N



Regionwise Top N Consumption



Regionwise State Usage



2019 Monthwise Consumption



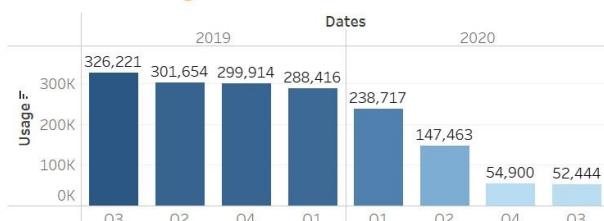
2020 Monthwise Consumption

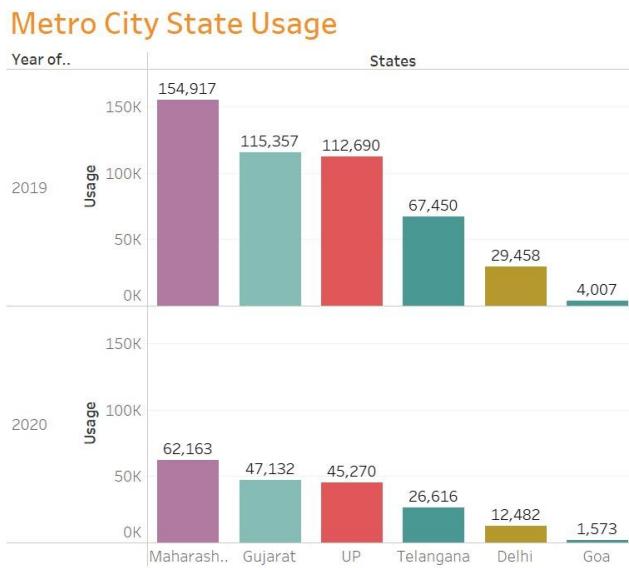
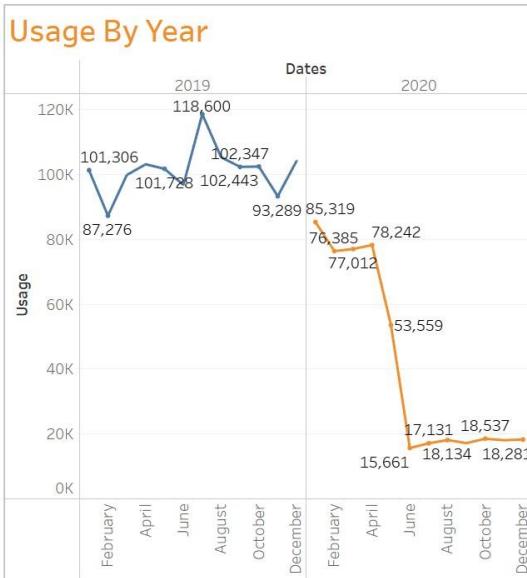


Usage Before And After Lockdown



Quarter Usage





Disadvantage

1. Static Data Source

Description

Since the dataset is CSV-based, it lacks real-time data updates. Manual uploads are required for each update cycle.

2. No Predictive Capabilities

The current solution is descriptive, not predictive. It identifies patterns but doesn't forecast future trends.

3. Limited Automation

Without integration to live data sources (e.g., APIs, databases), it cannot support automated, continuous data refresh.

4. Requires Tableau Familiarity for Editing

While the dashboard is easy to use, editing charts or building new visuals requires knowledge of Tableau.

5. No Backend Storage for Historical Dashboards

Tableau Public does not support complex versioning or change-tracking unless hosted in Tableau Cloud/Server.

CONCLUSION:

This project, “**Plugging into the Future – Electricity Consumption Analysis Using Tableau**,” successfully demonstrates how electricity consumption data — when visualized effectively — can uncover meaningful insights that directly support energy planning and policy decisions. By transforming a static electricity consumption dataset into a fully interactive and filterable Tableau dashboard, the project empowers energy stakeholders to:

- Identify which states and regions have the highest electricity demand.
- Understand the impact of seasonal variations and lockdown periods on power consumption.
- Compare yearly and quarterly trends to detect growth patterns and demand shifts.
- Highlight hidden insights that were previously difficult to interpret using traditional spreadsheets or static reports.

The dashboard offers a user-friendly and visually intuitive interface that supports real-time filtering, multiple chart types (e.g., maps, bar charts, line charts, pie charts), and a structured story presentation to communicate findings clearly. It serves as a valuable decision-support tool for:

- Energy department officials planning infrastructure development
- Policymakers designing efficient power distribution strategies

- Analysts monitoring consumption patterns and regional demand

Through structured project planning, sprint-based execution, and iterative dashboard design, the solution achieved its key objectives:

- Enhanced data visibility
- Faster and evidence-based decision-making
- Reduced dependence on manual analysis

Although there are limitations — such as reliance on historical data and absence of predictive forecasting — the project establishes a strong and scalable foundation for future enhancements, including real-time integration and advanced analytics.

In conclusion, this project validates that visual data storytelling using Tableau is a powerful tool for improving transparency, efficiency, and strategic decision-making in electricity consumption management.

FUTURE SCOPE:

1. Real-Time Data Integration

Integrate live electricity consumption feeds from smart meters, energy grids, or government databases.

- Use Tableau live data connections or APIs to automatically update dashboards without manual uploads.

2. Predictive Analytics and Machine Learning

Incorporate machine learning models (using Python or R) to:

o Forecast future electricity demand based on historical trends.

o Predict peak load periods and seasonal demand spikes.

- Apply clustering techniques to group regions with similar consumption patterns for optimized distribution planning.

2. Cloud Deployment for Collaboration

Deploy the dashboard on Tableau Cloud or Tableau Server for centralized access.

- Enable energy departments, policymakers, and analysts to collaborate using a unified data source.

3. Deeper Segmentation and Personalization

- Extend analysis to sector-wise consumption (Residential, Commercial, Industrial).

- Add deeper time-based filters such as weekday vs. weekend or hourly demand patterns.

5. Historical Data Versioning

Implement year-over-year and quarter-over-quarter comparison features.

Add toggle options to compare pre-lockdown, lockdown, and post-lockdown electricity usage.

6. Dashboard-as-a-Service Model

Offer the dashboard as an analytics solution for electricity boards or smart city projects. Provide customizable versions for different states or energy departments with integrated realtime data.

APPENDIX:

Dataset Link - https://drive.google.com/file/d/1XDxHSKwHBM-VNf-6sz_406Y0e7MJRrAd/view?usp=drivesdk

GitHub - <https://github.com/Aditya17112/Electricity-Consumption>

Project Demo Link-

https://drive.google.com/file/d/1N7IOkm_RljOG1cDrDgdEclCPF6UXRcT5/view?usp=drivesdk