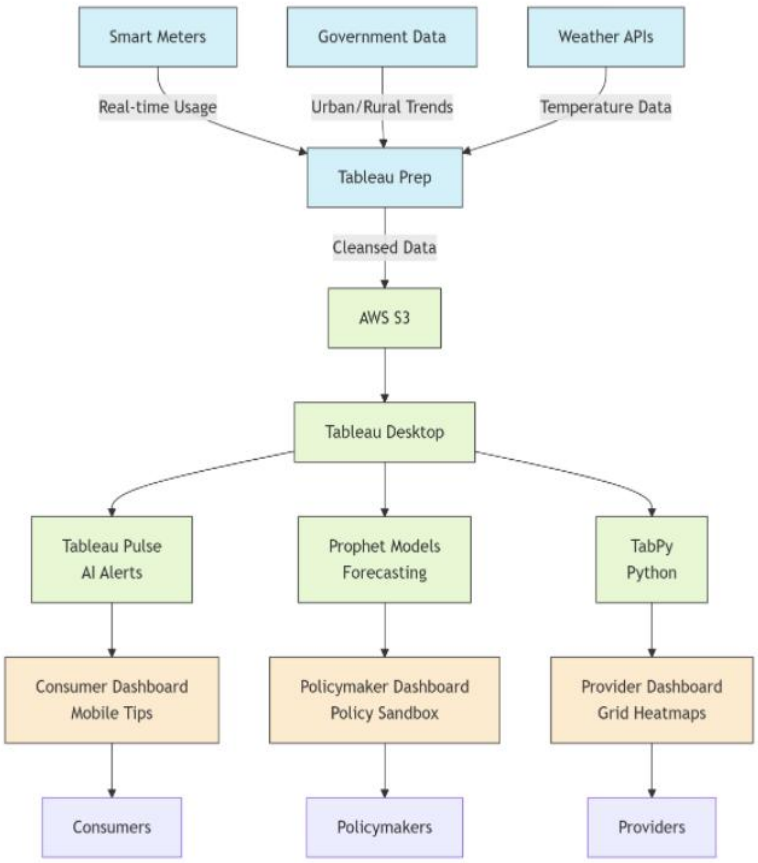
Project Design Phase
Solution Architecture

Date	25 June 2025
Team ID	LTVIP2025TMID50075
Project Name	Plugging into the Future : An Exploration of Electricity Consumption Patterns Using Tableau
Maximum Marks	4 Marks

Solution Architecture:

Architecture diagram :



Energy Data Analytics Platform Architecture Overview

EnergyInsight Platform

Dashboard Analytics Documentation About Login

Energy Data Analytics Platform Architecture

Transforming raw electricity data into actionable insights for consumers, policymakers, and providers through a scalable, multi-stakeholder platform.

Architecture Goals

Bridge the Gap: Transform raw electricity data into actionable insights for consumers, policymakers, and providers.

Multi-Stakeholder Alignment: Deliver customized Tableau dashboards for each user type.

Scalability: Design for pilot (city-level) → national → global rollout.

Data Layer

Sources:

- Smart meters (real-time usage)
- Government open data (urban/rural trends)
- Weather APIs (correlate demand with temperature)

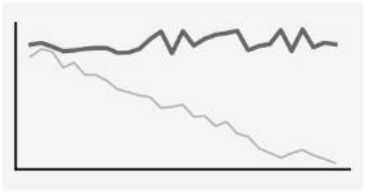
Processing:

- Tableau Prep: Cleanse data (remove outliers, fill missing values)
- Python Integration: Clustering for anomaly detection

Analytics Layer

Core Features:

- Tableau Pulse: AI-driven alerts for consumers
- Scenario Engine: Policy impact simulations
- Forecasting: Prophet models for demand prediction (via TabPy)



Presentation Layer

Dashboards:

- **Consumer:** Mobile-friendly view with savings tips and leaderboards
- **Policymaker:** Map-based comparisons + sliders for policy testing
- **Provider:** Real-time grid heatmaps with overload risk scores

Technical Specifications

Component	Tools/Technologies	Purpose
Data Ingestion	Tableau Prep, AWS S3	Collect and store raw data from diverse sources
Analysis	Tableau Desktop, TabPy (Python)	Run predictive models (e.g., ARIMA for demand forecasting)
Visualization	Tableau Public (pilot) → Tableau Server (scale)	Interactive dashboards with role-based access
Integration	REST APIs (for weather/policy data)	Enrich datasets with external factors

Phased Development

Phase 1: Pilot

Timeline: 3 months

Deliverable: City-level dashboard (Tableau Public)

Success Metric: 1,000+ active users

Phase 2: Scale

Timeline: 6 months

Deliverable: National integration (government data APIs)

Success Metric: 15% peak-demand reduction in pilot city

Phase 3: Global

Timeline: 12 months

Deliverable: Multi-language support + IoT integrations

Success Metric: Partnerships with 3+ utility providers

Innovation Highlights

Behavioral Nudges
Color-coded alerts (red = urgent action) based on psychology

Policy Sandbox
Policymakers adjust sliders (e.g., tax rates) → see real-time grid impact

Edge AI
Lightweight models on smart meters flag anomalies before cloud processing

Policymaker Dashboard Preview

Stakeholder Benefits

Stakeholder	Technical Benefit	Business Impact
Consumers	Real-time mobile alerts via Tableau Mobile	20% higher engagement in energy-saving actions
Policymakers	Drag-and-drop scenario testing	50% faster policy drafting
Providers	Automated peak forecasts (Tableau + ML)	30% reduction in grid stabilization costs

Compliance & Security

Data Privacy
Role-based access (Tableau Server permissions) ensures data is only accessible to authorized users.

Audit Trails
Log all policy simulations for transparency and accountability in decision-making.

Encryption
End-to-end encryption for all data transfers and storage to protect sensitive information.

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HOW THE SOLUTION WORKS :

1. Architecture Goals
Bridge the Gap: Transform raw electricity data into actionable insights for consumers, policymakers, and providers.
Multi-Stakeholder Alignment: Deliver customized Tableau dashboards for each user type.
Scalability: Design for pilot (city-level) → national → global rollout.

2.Key Components :

A. **Data Layer**

Sources:

Smart meters (real-time usage).

Government open data (urban/rural trends).

Weather APIs (correlate demand with temperature).

Processing:

Tableau Prep: Cleanse data (remove outliers, fill missing values).

Python Integration: Clustering for anomaly detection.

B. **Analytics Layer**

Core Features:

Tableau Pulse: AI-driven alerts for consumers (e.g., "Unusual 7 PM spike").

Scenario Engine: Policy impact simulations (e.g., solar adoption effects).

Forecasting: Prophet models for demand prediction (via TabPy).

C. **Presentation Layer**

Dashboards :

Consumer: Mobile-friendly view with savings tips and leaderboards.

Policymaker: Map-based comparisons + sliders for policy testing.

Provider: Real-time grid heatmaps with overload risk scores.

4. Technical Specifications

Component	**Tools/Technologies**	**Purpose**
Data Ingestion	Tableau Prep, AWS S3	Collect and store raw data from diverse sources.
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Visualization	Tableau Public (pilot) → Tableau Server (scale)	Interactive dashboards with role-based access.
Integration	REST APIs (for weather/policy data)	Enrich datasets with external factors.

5. Phased Development

Phase	Timeline	Deliverable	Success Metric
1. Pilot	3 months	City-level dashboard (Tableau Public)	1,000+ active users.
2. Scale	6 months	National integration (government data APIs)	15% peak-demand reduction in pilot city.
3. Global	12 months	Multi-language support + IoT integrations	Partnerships with 3+ utility providers.

6. Innovation Highlights

Behavioral Nudges: Color-coded alerts (red = urgent action) based on psychology.

Policy Sandbox: Policymakers adjust sliders (e.g., tax rates) → see real-time grid impact.

Edge AI: Lightweight models on smart meters flag anomalies before cloud processing.

7. Stakeholder Benefits

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8. Compliance & Security

Data Privacy: Role-based access (Tableau Server permissions).

Audit Trails: Log all policy simulations for transparency.

Visual Tip: Include a high-level architecture diagram (like above) and a screenshot of the policymaker dashboard with sliders. convert this into that kind of diagram or else tell me AI tools which can do.