

KENYA'S SUSTAINABLE POWER FORECASTING



Data-Driven Solutions for a
Reliable and Green Energy Future

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PROBLEM STATEMENT

Kenya's growing energy demand and variable renewable supply are straining the grid, leading to outages, underused renewables, and costly thermal backups.

Smart forecasting and data-driven planning are essential to ensure a stable, affordable, and resilient energy future.

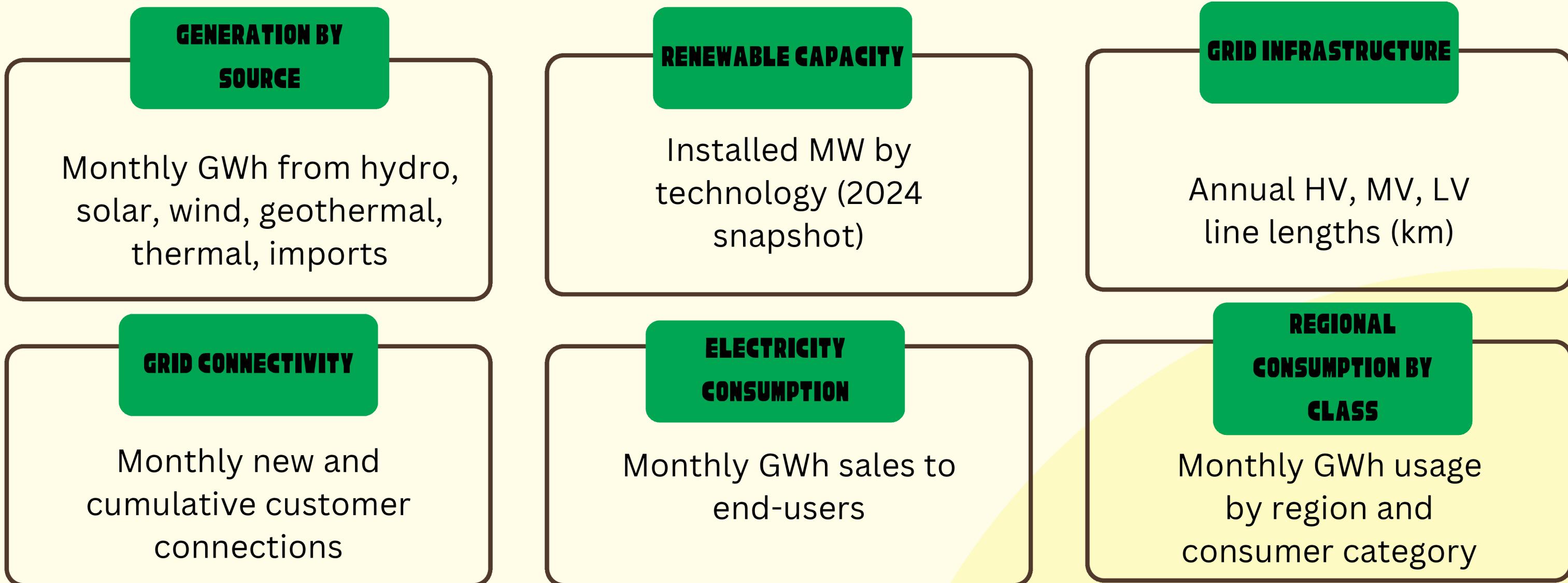


OBJECTIVES

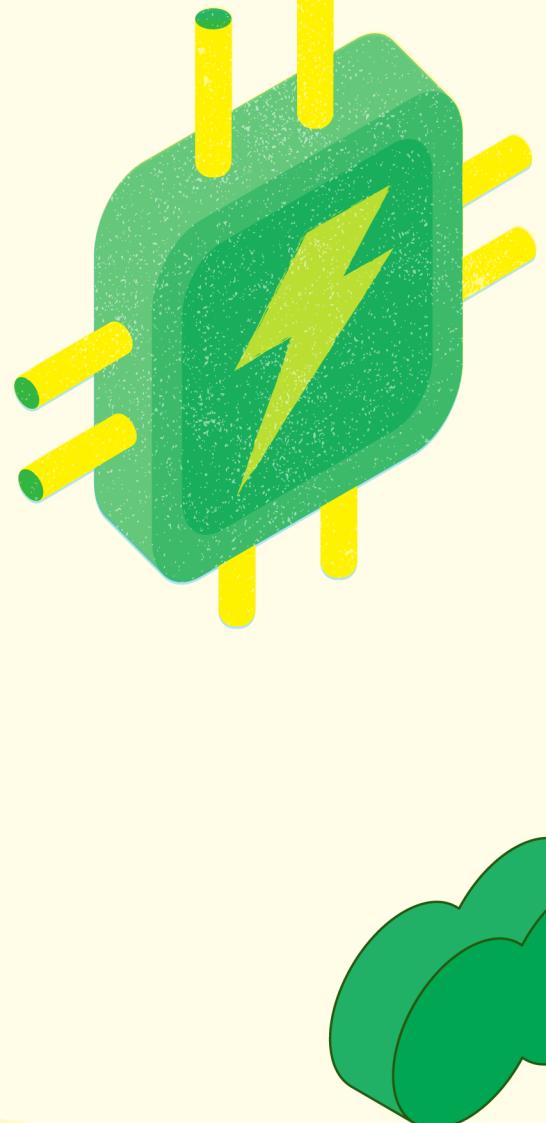
- How have electricity consumption and grid connectivity changed over time?
- How has the energy mix evolved between renewables and non-renewables?
- How can we visualize Kenya's energy landscape to reveal key insights?
- What patterns can inform energy planning and strengthen grid resilience?

Dataset Overview

Source: EPRA – Kenya's National Energy Regulator



Imported Excel files → Indexed by month → Standardized energy units (GWh, MW) → Handled missing values (interpolation, forward fill) → Merged datasets → Exported CSV



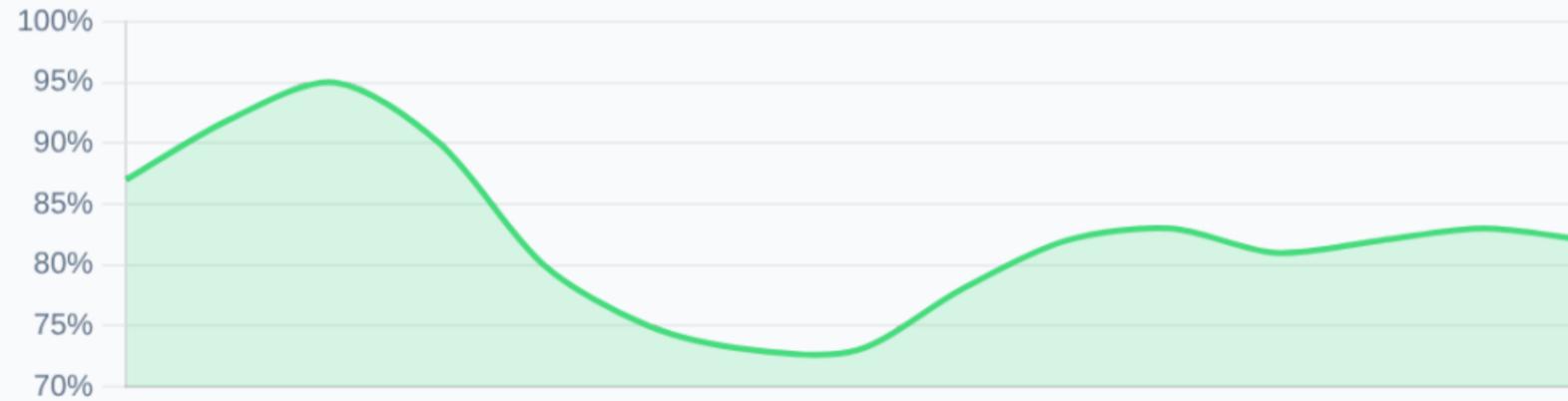
KEY METRIC ANALYSIS



Tracking the Trends: Data That Defines the Grid's Evolution



Renewable Share



89%

2019 Average

82%

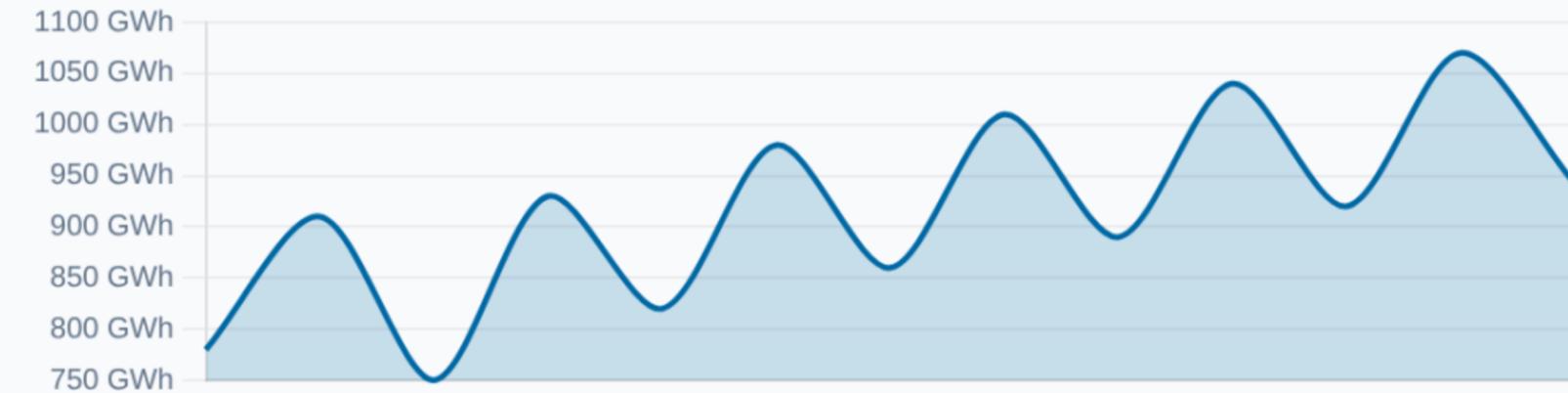
2025 Average

95%

Peak
(Apr 2020)



Consumption Trends



1,237

Peak GWh
(Mar 2025)

647

Lowest GWh
(Apr 2020)

3.2%

CAGR Growth



9.98M

Customer Base

↑ 12.3% since 2019



329,366 km

Transmission Network

↑ 35.4% since 2019

- Electricity consumption has been growing steadily, with a compound annual growth rate of 3.2%.
- Renewable energy continues to dominate the energy generation, now making up 82% of total generation – a strong indicator of Kenya's commitment to clean energy.

MODEL DEVELOPMENT

MODELS USED

TIME SERIES MODELS

SARIMAX

PROPHET

LSTM

REGRESSION MODELS

LINEAR REGRESSION

RANDOM FOREST

GRADIENT BOOSTING

SVR

KEY STEPS:-

Feature Engineering

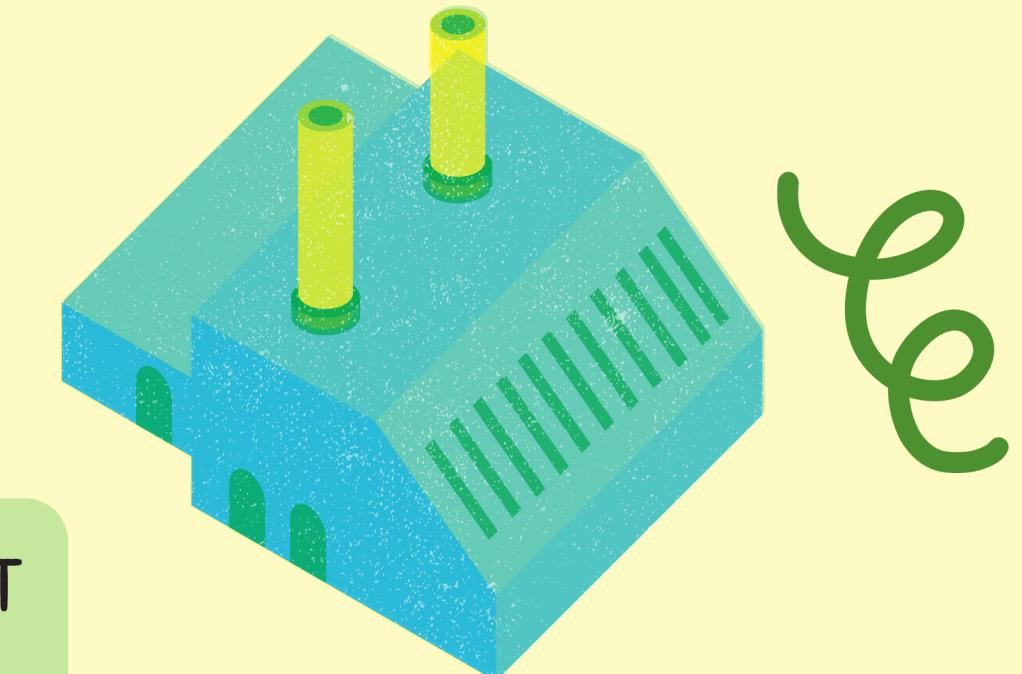
- Time-based: month, quarter
- Metrics: renewable share %, demand growth

Model Selection

- SARIMAX chosen for accuracy

TRAIN - TEST SPLIT

80:20



Training & Evaluation

- Trained on historical consumption
- Evaluated using MAE, RMSE, MAPE



Deployment

- Streamlit app for real-time forecasting
- Interactive dashboard





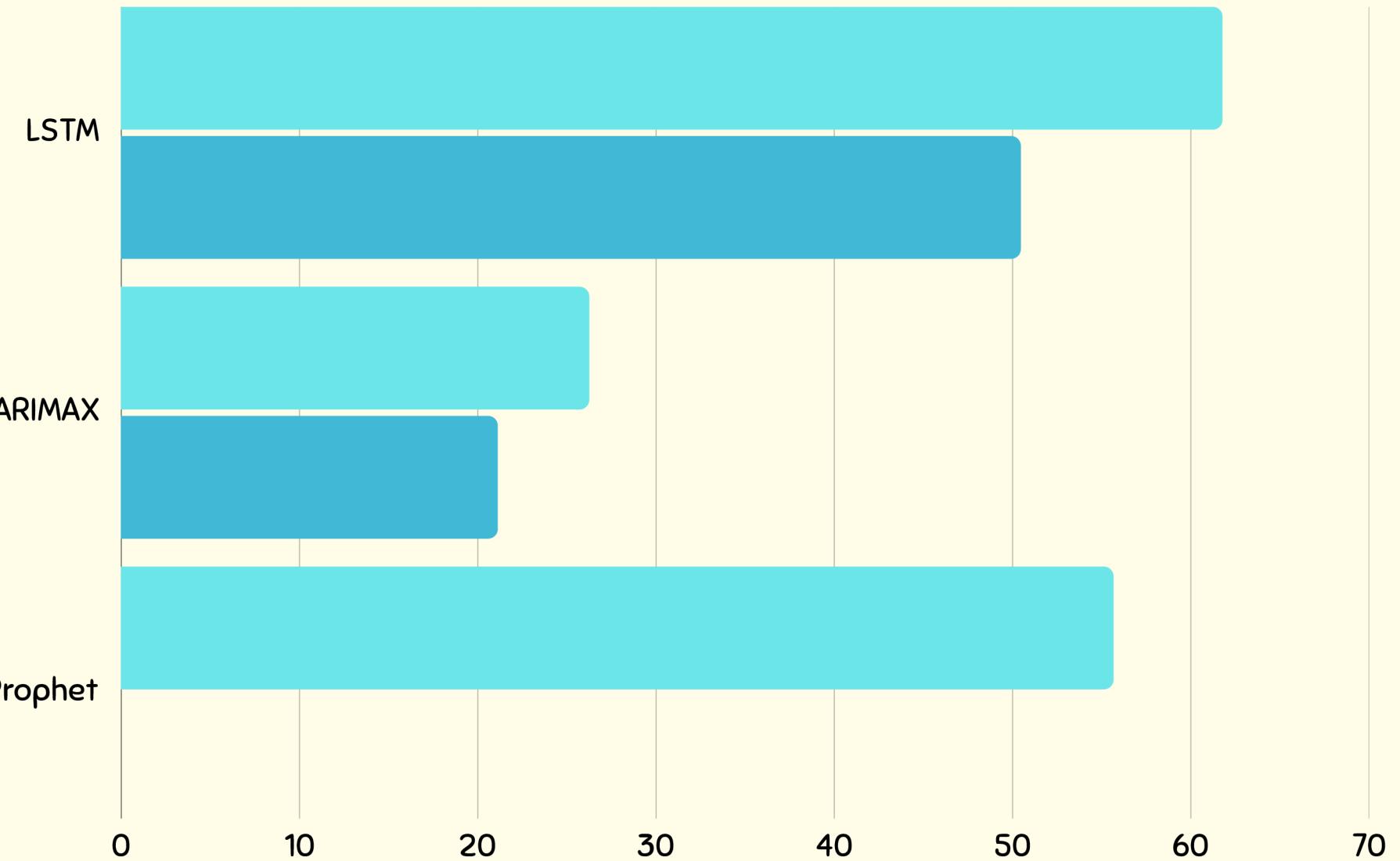
RESULTS AND EVALUATION



Time Series Forecasting Performance

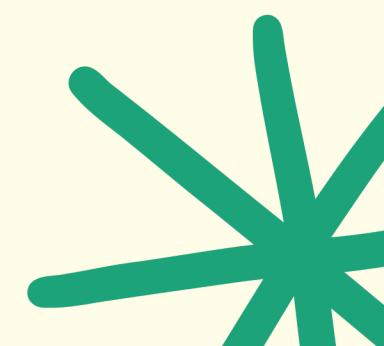
● RMSE ● MAE

Model	MAE	RMSE	MAPE (%)
LSTM	50.46	61.77	-
SARIMAX	21.12	26.25	2.26
Prophet	-	55.66	-



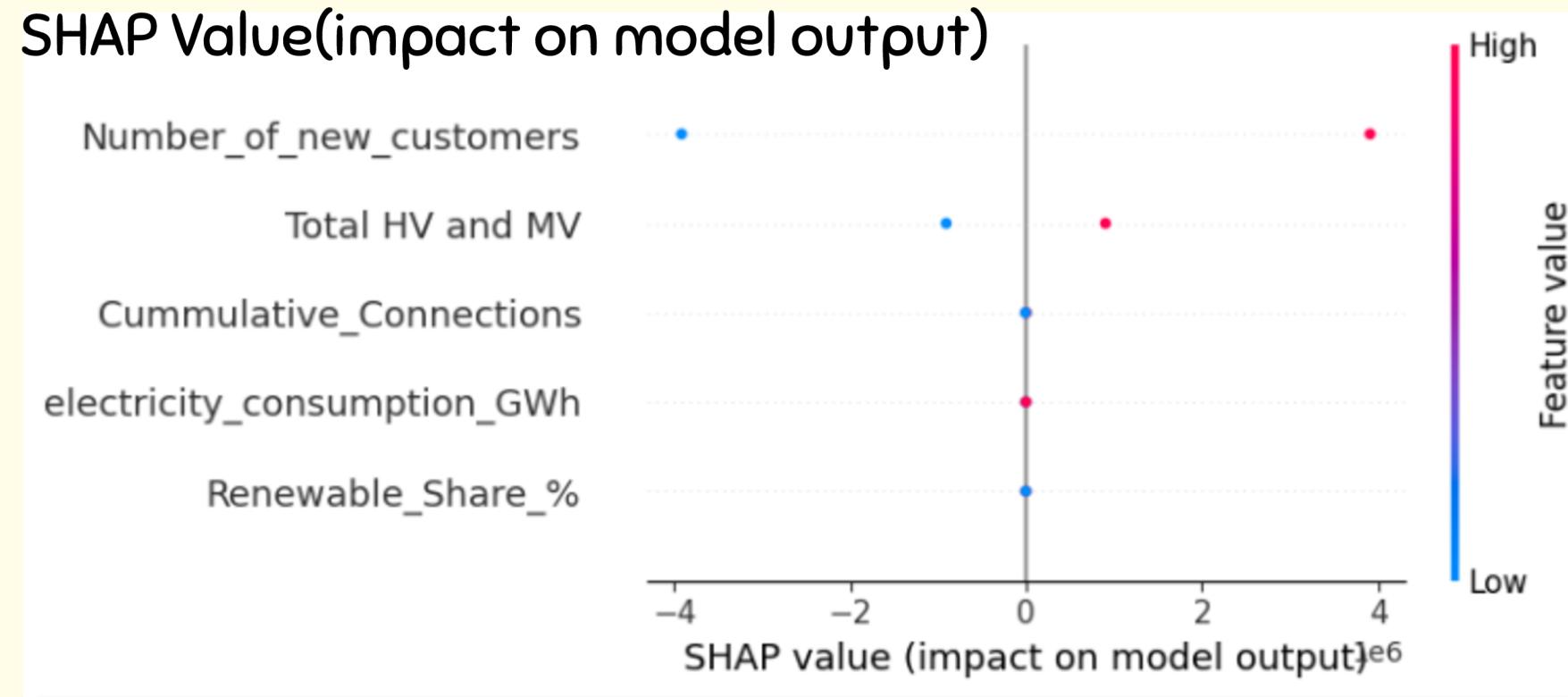
Key Insights

- SARIMAX chosen for accuracy, interpretability, and exogenous input support. LSTM and Prophet underperformed.



RESULTS AND EVALUATIONS

SHAP Value(impact on model output)



Findings

- ↑ Strong Positive Impact:
 - Number of New Customers
 - Cumulative Connections
- ↓ Minimal Impact:
 - Electricity Consumption (GWh)
 - Renewable Share (%)

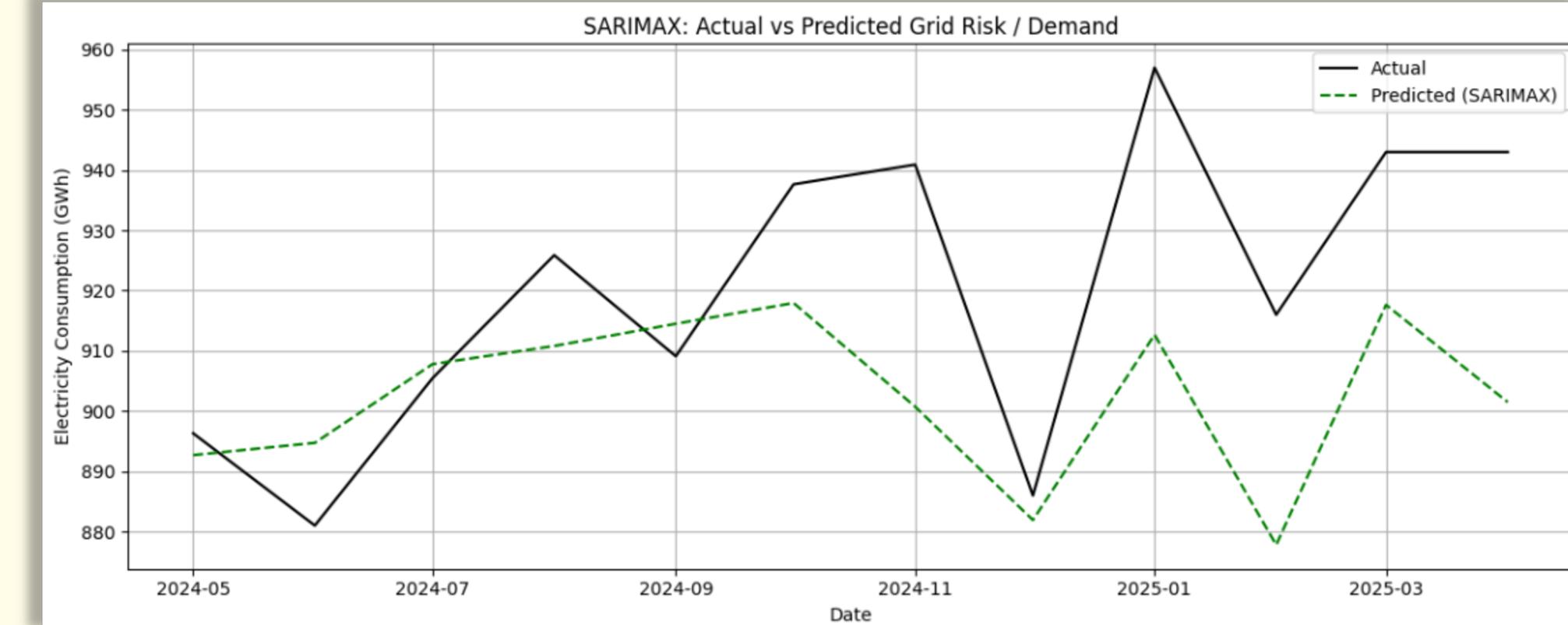
Observations

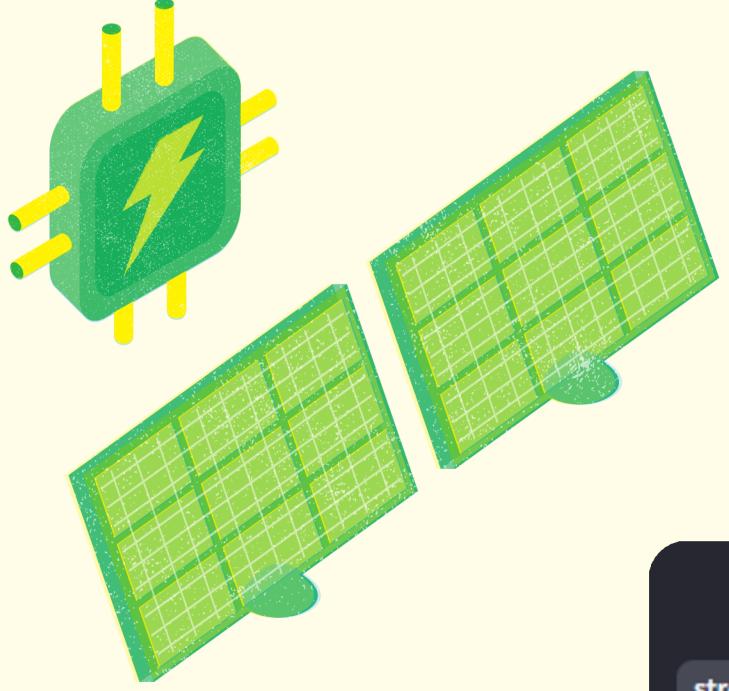
Overall upward trend in electricity demand

Peaks around late 2024 and early 2025 (seasonal effects)

Troughs in other months indicate lower demand

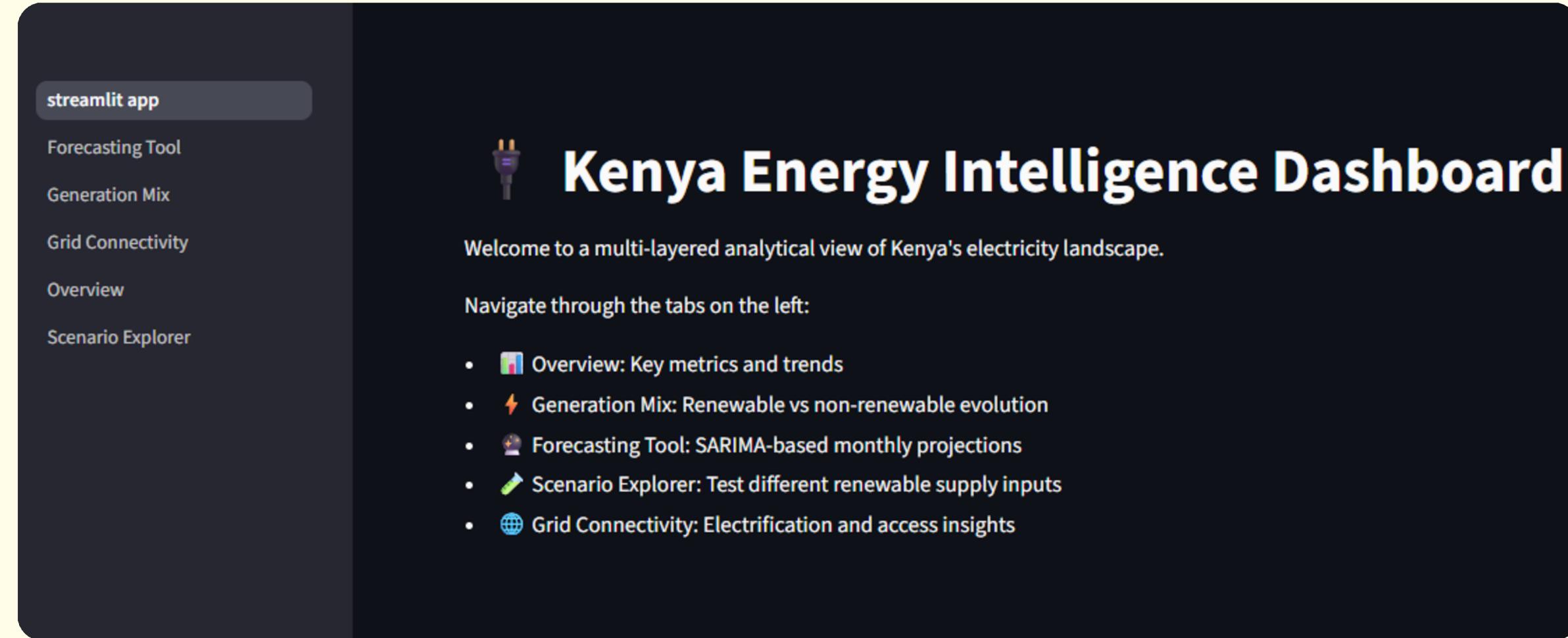
SARIMAX: Actual vs Predicted Grid Risk / Demand





APP DEPLOYMENT

Live App: energyconsumptionapp.streamlit.app



streamlit app

Forecasting Tool

Generation Mix

Grid Connectivity

Overview

Scenario Explorer

🔌 Kenya Energy Intelligence Dashboard

Welcome to a multi-layered analytical view of Kenya's electricity landscape.

Navigate through the tabs on the left:

- 📊 Overview: Key metrics and trends
- ⚡ Generation Mix: Renewable vs non-renewable evolution
- 🔮 Forecasting Tool: SARIMA-based monthly projections
- ✍️ Scenario Explorer: Test different renewable supply inputs
- 🌐 Grid Connectivity: Electrification and access insights

Key Features:

- Forecast national demand
- Visualize monthly trends
- Interactive & user-friendly dashboard

Built With:

Streamlit · SARIMAX

CONCLUSIONS

- ⌚ SARIMAX model deployed for accurate and explainable forecasting.
- ⌚ Electricity demand is rising, with clear seasonal trends.
- ⌚ Industrial and urban users drive most of the consumption.
- ⌚ Variable solar and hydro output shows need for better storage.
- ⌚ The dashboard supports real-time energy planning.



RECOMMENDATIONS

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- Integrate app into daily utility forecasting.
 - Use seasonal trends to optimize renewable energy use.
 - Plan grid upgrades based on forecasted demand.
 - Expand dashboard access to energy planners and policymakers.

NEXT STEPS

- Automate dashboard updates for real-time insights
- Continuously refine the SARIMAX model using new data
- Train utilities, planners, and regulators on tool usage
- Share insights to support data-driven energy policies



LET'S COMMIT TO CLEAN ENERGY FOR A SUSTAINABLE FUTURE!



Thank you.
Any Questions?

