

The background image shows an aerial perspective of a large industrial or commercial building's roof. The roof is covered with numerous dark blue solar panels. In the foreground, there are some grey metal vents and a small chimney. The sky above is a warm, golden-yellow color, suggesting either sunrise or sunset. In the far distance, a line of trees and a few small buildings are visible on the horizon.

**SunOptimize
Technologies**

**Rooftop Solar Potential
Optimization for Sustainable
Energy in Nairobi**

MEET THE TEAM!



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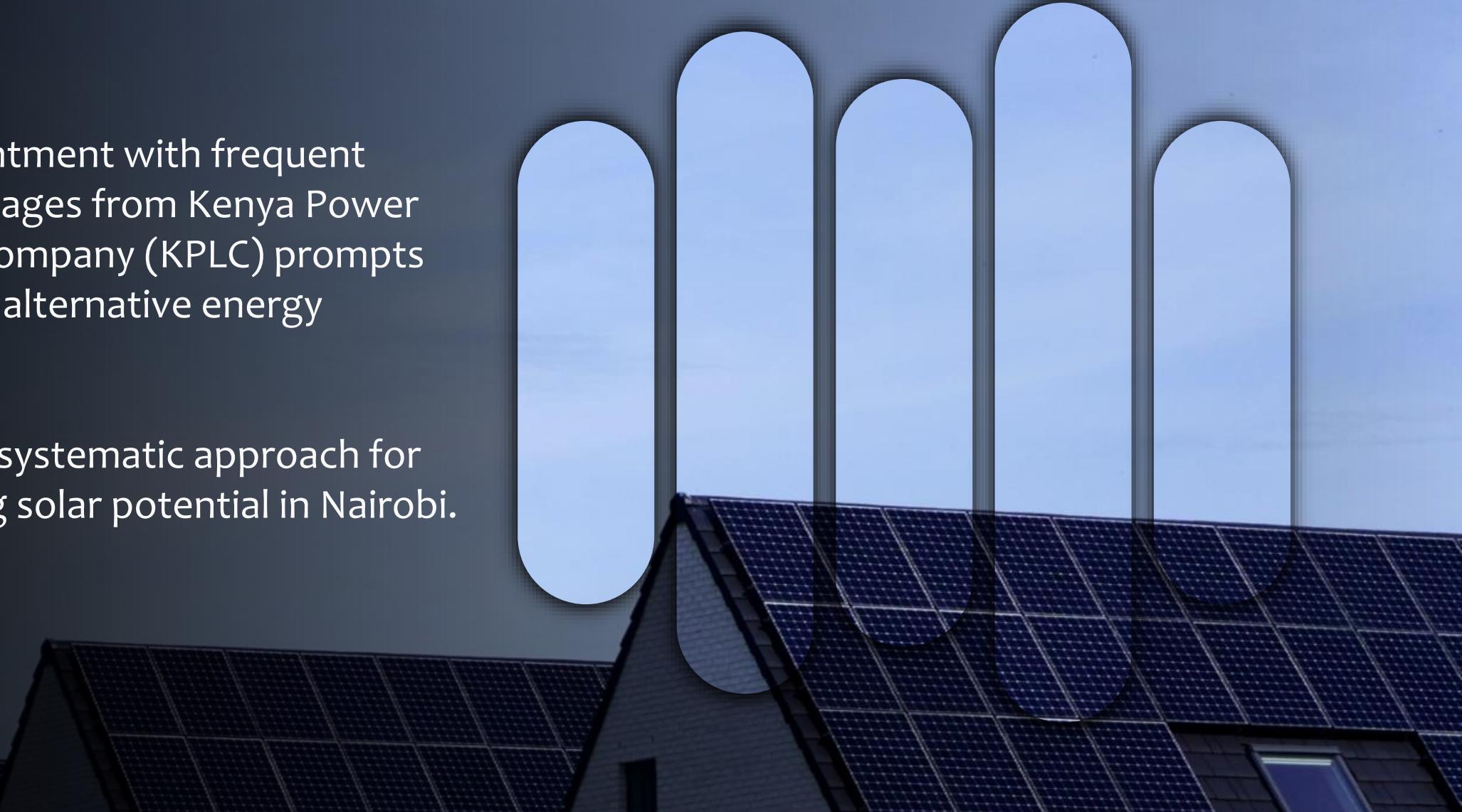
Timothy Lenku
Data Analyst

BUSINESS OVERVIEW

- **SunOptimize Technologies:** A pioneering company dedicated to revolutionizing the energy landscape through solar innovation.
- **Commitment to sustainability and efficiency** by empowering individuals, businesses, and communities to embrace solar energy solutions.
- **Stakeholders:** Property owners and managers, solar installation companies, Energy Regulatory Authorities.
- **Challenges:** Absence of precise insights and leveraging vector dataset hinder informed decision-making and implementation of solar power

PROBLEM STATEMENT

- Disappointment with frequent power outages from Kenya Power Lighting Company (KPLC) prompts interest in alternative energy sources.
- Lack of a systematic approach for harnessing solar potential in Nairobi.



OBJECTIVES

- Main Objective: Predict Rooftop Solar Potential using machine learning.
- Specific Objectives: Implement optimization strategies, develop a user-friendly interface, and assess economic viability.



DATA UNDERSTANDING & PREPARATION

THE DATA

The data is from NEO which is a leading company in the Earth Observation (EO) business based in the Netherlands.

This dataset contains (272721 Rows x 9columns)

Types of data: numerical and categorical variables

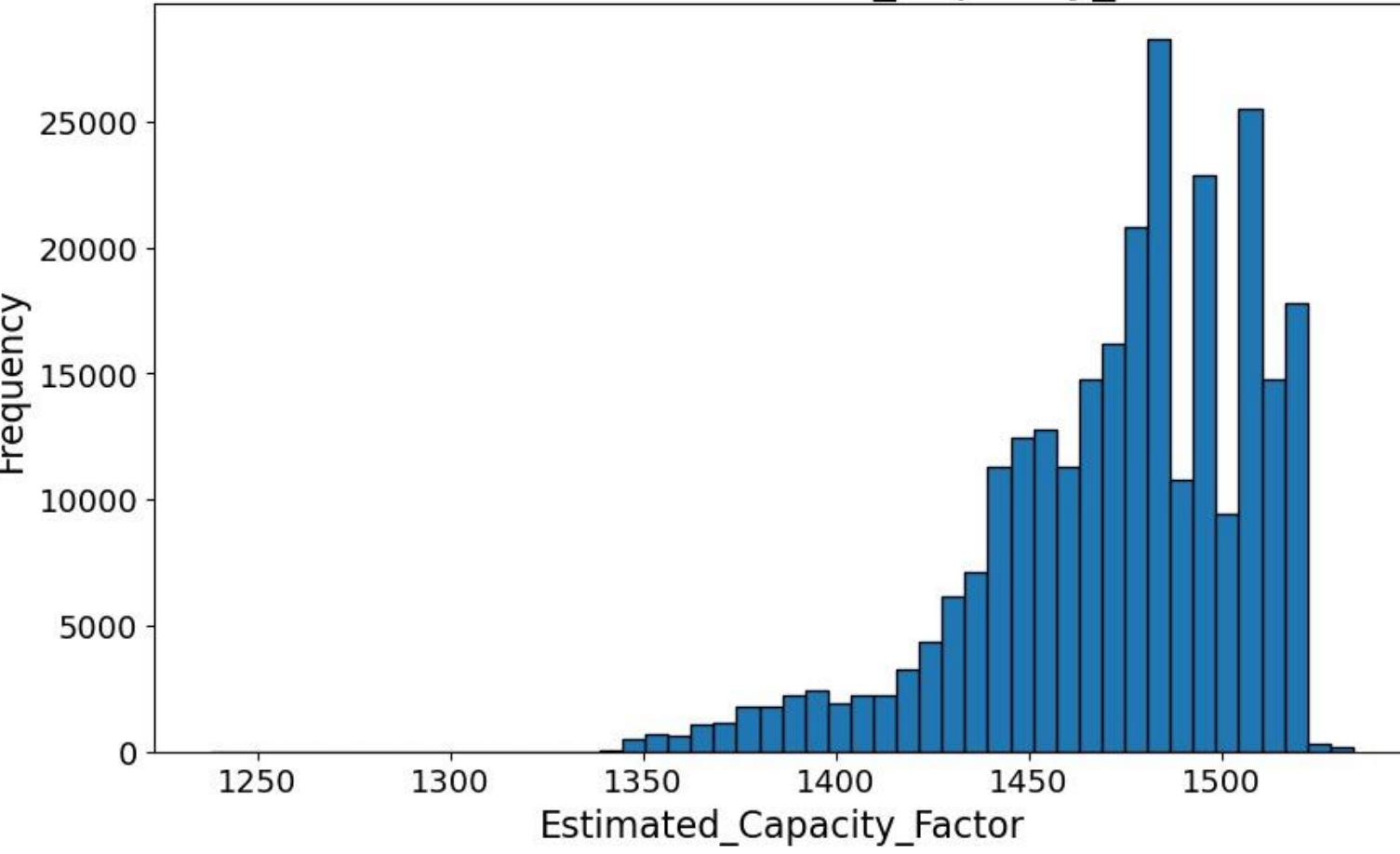
Data cleaning involved removing unnecessary columns, handling missing values, and outliers.

Evaluation metrics: MAE, RMSE, and R-squared.

DATA ANALYSIS

UNIVARIATE ANALYSIS

Distribution of Estimated_Capacity_Factor



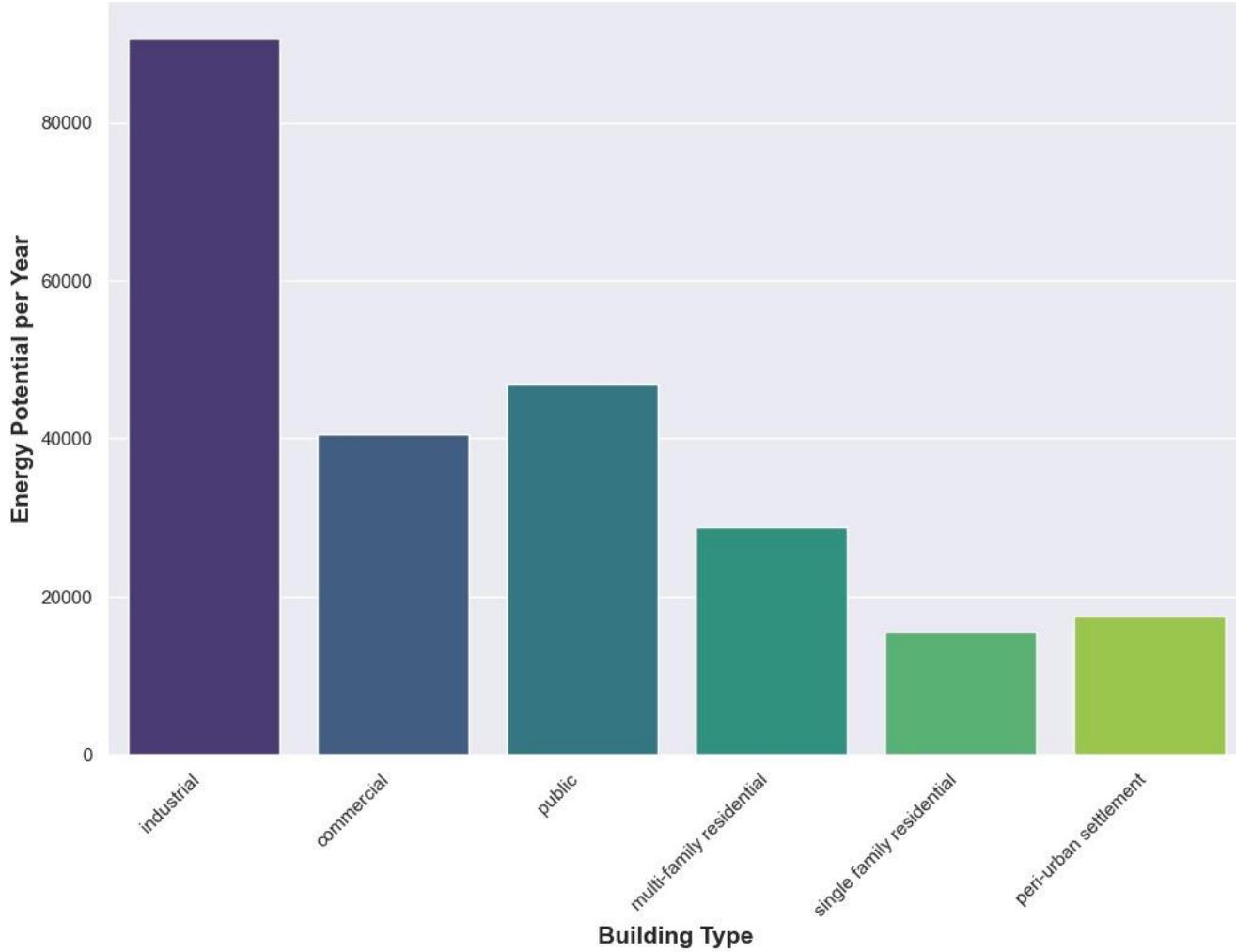
Given the distribution of the Estimated_Capacity_Factor column, it appears to be right-skewed.

In such cases, using the median for imputation is generally more appropriate.

This is because the median is less sensitive to outliers and skewed data, providing a more robust measure of central tendency.

BIVARIATE ANALYSIS

Relationship between Building Type and Energy Potential per Year



Industrial buildings showcase the highest energy potential, with close to 80,000 KWH per year, while peri-urban settlement structures exhibit the lowest energy potential.

COST BENEFIT ANALYSIS

Our rooftop solar project in Nairobi boasts a positive NPV of Ksh. 7,656,815.49 and an ROI of 2552.27% over a 20 year period.

In simple terms, this means our solar investment promises substantial returns, surpassing initial costs.

It's a clear win-win: harnessing clean energy while reaping significant financial gains.



MODELING

While the Tuned XGBoost Model demonstrates strong performance, the Neural Networks Model showcases superior accuracy and predictive capabilities on both the training and testing sets.

MSE
486,404.14

R-Squared Score
99.98%

Neural Network

MSE
5,028,871.68

R-Squared Score
97.26%

Tuned XGBoost Model

CONCLUSIONS



Growing Interest in Solar Energy

User-Friendly Interface



Cost-Benefit Analysis

Stakeholder Engagement



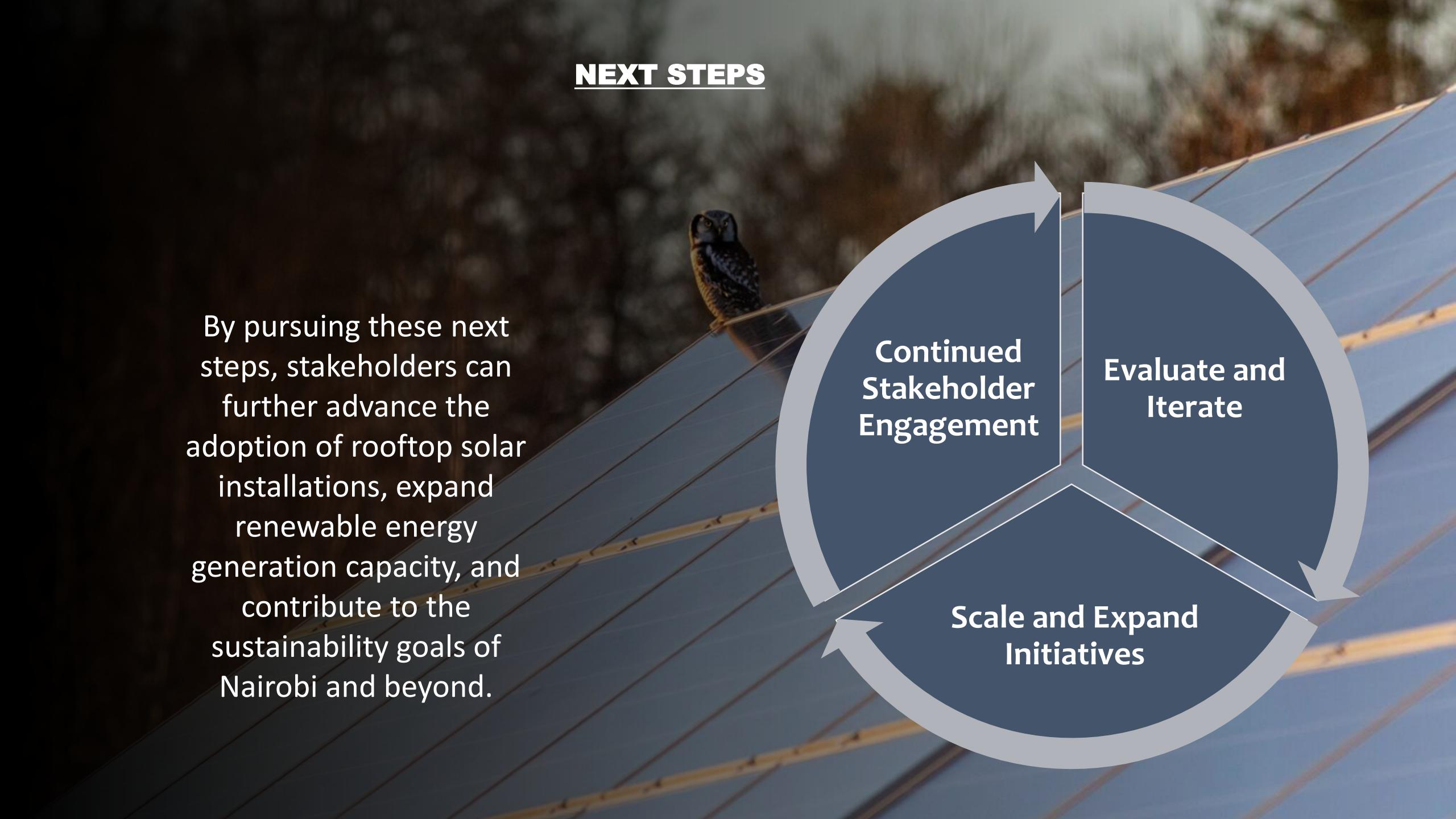
Lack of Systematic Approach

RECOMMENDATIONS

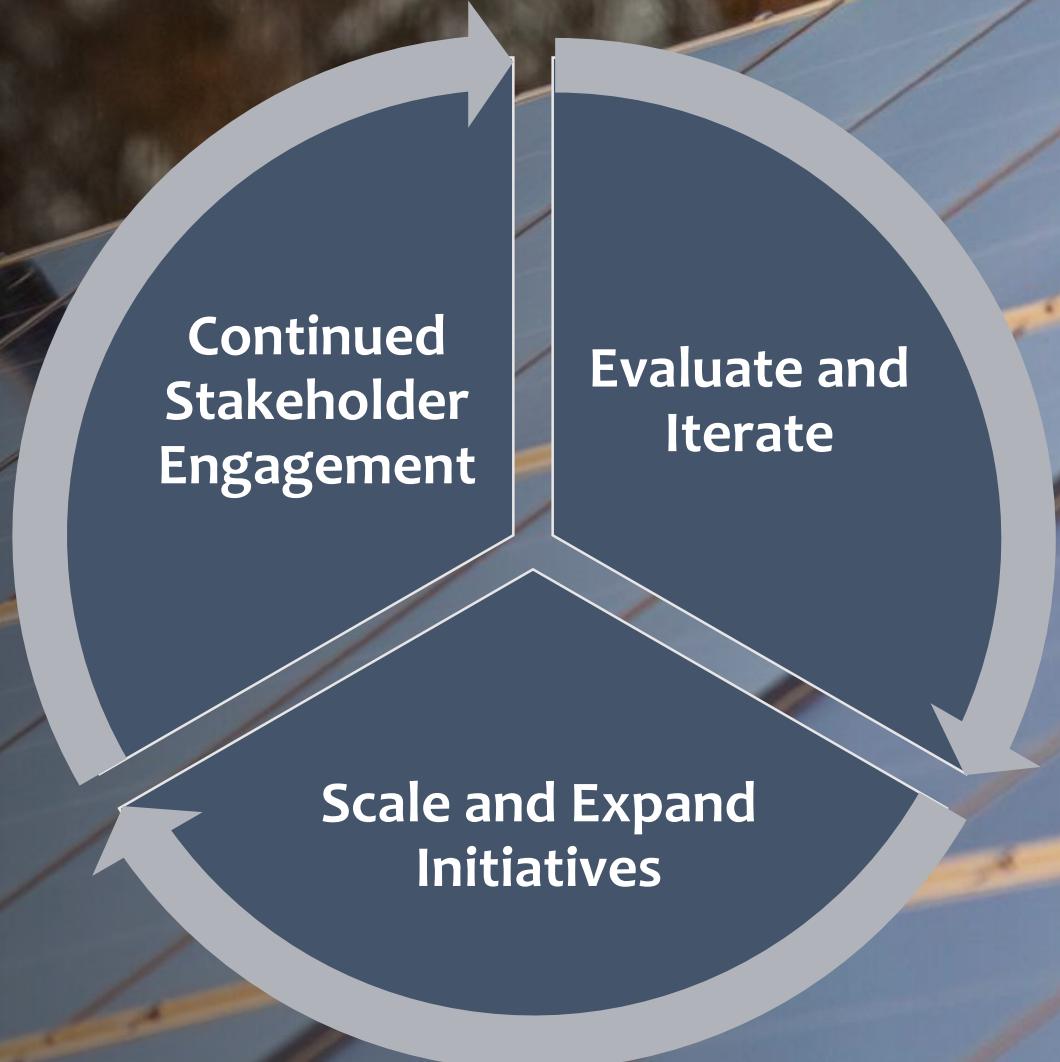
Recommendations for Rooftop Solar Potential Optimization:



NEXT STEPS



By pursuing these next steps, stakeholders can further advance the adoption of rooftop solar installations, expand renewable energy generation capacity, and contribute to the sustainability goals of Nairobi and beyond.



DEPLOYMENT

Deploying the Streamlit web application.

The screenshot shows a Streamlit web application interface. On the left, a sidebar titled "Navigation" contains links to "Potential Installable Area" and "Solar Energy Prediction". Below it, the "Input Parameters" section includes fields for "Surface Area" (50), "Potential Installable Area" (50), "Peak Installable Capacity" (50), "Estimated Tilt Angle" (45), "Estimated Building Height" (5), "Estimated Capacity Factor" (0.85), "Assumed Building Type" (single family residential), and "Current yearly energy consumption in units" (0.00). On the right, the main content area features a sunset background image of a building roof covered in solar panels. The title "SUNOPTIMIZE TECHNOLOGIES" is displayed in large bold letters. Below it, the text "Solar Energy Potential Prediction:" and "The predicted energy potential per year in KWh is: [2789331.]" is shown. A "Recommendation:" section states "Full adoption of solar is recommended."

Thank You!
Open Floor for Feedback and
Inquiries.

