Research Proposal

Title: Electricity Demand Forecasting Using Time Series Analysis and Machine Learning Models

Team Name: Snipers

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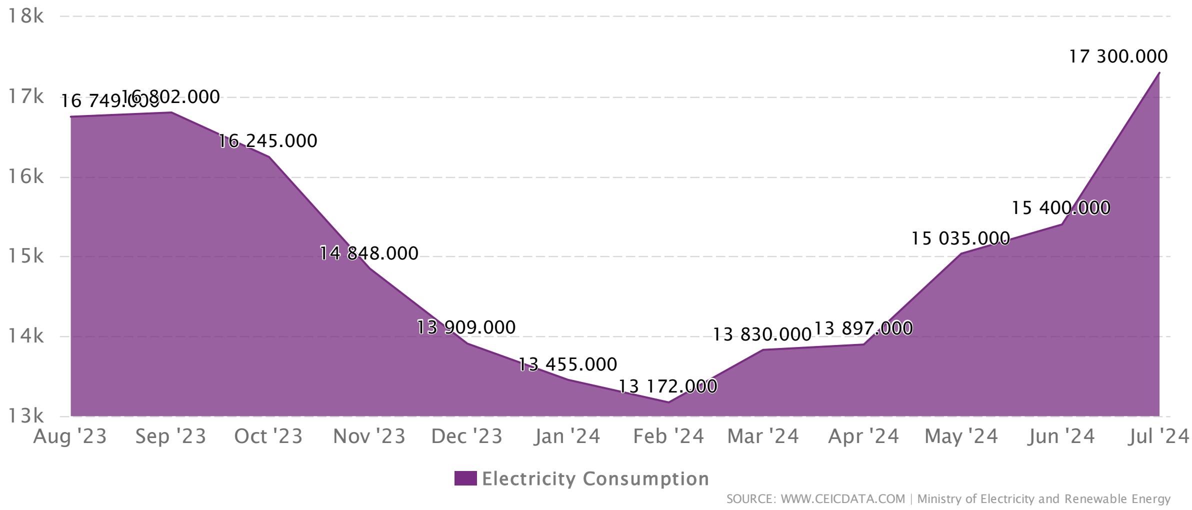
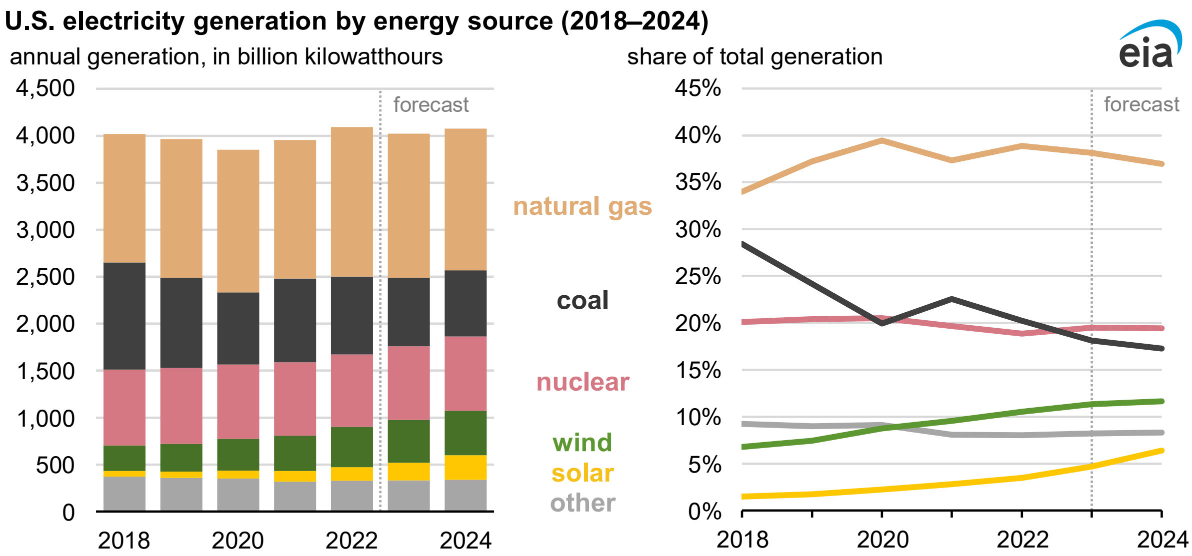
Problem Definition:

Electricity demand is governed by intricate patterns influenced by daily cycles (e.g., morning and evening peaks), seasonal variations (e.g., higher demand in summer or winter due to cooling or heating requirements), and external environmental factors such as temperature, humidity, and wind speed. These fluctuations present a significant challenge for utility providers, as they must accurately predict demand to maintain grid stability, minimize energy wastage, and optimize resource allocation.



The rapid growth in the adoption of renewable energy sources, such as solar and wind, adds an additional layer of complexity. Unlike conventional energy sources, renewable energy production is intermittent and weather-dependent, introducing variability in supply. This variability necessitates precise demand forecasting to align supply with demand and prevent power shortages or overproduction.

Inaccurate forecasts can lead to grid imbalances, increased operational costs, and reliance on backup systems, such as costly and less environmentally friendly fossil fuel plants. Additionally, extreme weather events and temperature anomalies further exacerbate forecasting challenges, making it crucial to understand and model the dynamic relationships between weather factors and electricity usage.



This research aims to address these challenges by developing an advanced forecasting model that integrates traditional time series analysis techniques (e.g., ARIMA) with cutting-edge machine learning models (e.g., Long Short-Term Memory Networks, or LSTMs). By leveraging historical electricity demand data, weather information, and modern statistical methods, the research seeks to deliver accurate, scalable, and reliable forecasts that support the transition to a sustainable and efficient energy grid.