**Ideation Phase**

**Defining the Problem Statements**

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| **Project Name** | **Electricity Price Prediction** |

**Electricity Price Predictions using Data Science**

**Problem Definition and Design Thinking**

**Introduction**

The electricity price prediction project using data science is an essential initiative aimed at harnessing the power of data and advanced analytical techniques to forecast electricity prices accurately. Accurate price prediction is crucial for both consumers and producers in this sector to make informed decisions and optimize their operations.

In this document, we will outline the problem statement, the steps involved in solving it, and the design thinking approach that will guide our project.

**Problem Statement:**

Objective: Develop a model that can predict electricity prices with a higher level of accuracy.

Data: We have a dataset containing various features such as previous household electricity billing price details. With this datasets we train our model to provide better prediction.

**Key Challenges:**

1. Data Quality and Availability: Obtaining accurate and comprehensive historical and real-time data on electricity supply, conditions, and market variables can be challenging. Data may be incomplete, noisy, or subject to errors, which can significantly impact the accuracy of predictions.

2. Non-Linearity and Seasonality: Electricity prices exhibit non-linear patterns and strong seasonality. Various factors such as weather can influence prices. Developing models that can capture these complex relationships is a significant challenge.

3. Market Dynamics and Regulations: Electricity markets are subject to regulatory changes and market dynamics that can affect price behaviour. Understanding and incorporating these factors into prediction models can be difficult, as they often involve legal and political considerations.

4. Integration of Multiple Data Sources: Effective price prediction often requires integrating data from diverse sources, such as grid operations, weather forecasts, fuel prices, and economic indicators. Ensuring seamless data integration and synchronization is a technical challenge.

5. Model Complexity and Interpretability: Developing accurate prediction models, such as machine learning algorithms, may involve high complexity. Balancing model complexity with interpretability is crucial, especially in industries where decision-makers need to understand the factors influencing predictions.

**Design Thinking Approach**

**Empathize:**

Before diving into solving the problem of electricity price prediction, it's crucial to empathize with the users and understand their needs. In this case, our primary users are consumers, businesses, and utility companies who need accurate predictions of electricity prices to make informed decisions. We need to gather insights into what factors are most important to them when considering electricity prices and how accurate predictions can benefit them.

**Actions:**

Conduct surveys or interviews with consumers, businesses, and utility company representatives to gather their perspectives on the importance of electricity price predictions.

Analyse historical electricity market data to identify critical pricing factors such as supply and demand trends regulatory changes.

Seek feedback from experts in the energy industry to gain insights into the key variables affecting electricity prices.

**Define:**

Based on our understanding of the problem and the users' needs, we will define clear objectives and success criteria for our electricity price prediction project.

**Objectives:**

Develop a machine learning model that achieves a Mean Absolute Error (MAE) of less than $X on the test data for electricity price prediction.

Create a user-friendly web application or API for users to input relevant data and receive accurate electricity price predictions.

**Ideate:**

Brainstorm potential solutions and approaches to address the problem of electricity price prediction. This phase involves thinking creatively and considering various algorithms and techniques for price forecasting.

**Actions:**

Explore different machine learning algorithms suitable for time-series forecasting, such as ARIMA, LSTM, or Prophet.

Experiment with feature engineering techniques to include factors like historical price data, weather patterns, and market trends.

Consider incorporating real-time data sources like weather APIs and market indices for improving prediction accuracy.

**Prototype:**

Create a prototype of the machine learning model and the user interface for electricity price prediction.

**Actions:**

Develop a Jupyter Notebook or Python script for data pre-processing, model training, and evaluation.

Create a simple web interface or API using tools like Flask or Django to allow users to input relevant data for price prediction.

Test the prototype with historical electricity market data to ensure it meets performance objectives.

**Test:**

Evaluate the model's performance using appropriate metrics and gather feedback from users.

**Actions:**

Split the dataset into training and testing sets, ensuring that the test set includes recent data for validation.

Train the model on the training set and evaluate it on the testing set.

**Implement:**

Once the prototype meets the defined objectives and receives positive feedback, proceed with full implementation.

**Actions:**

Train the final machine learning model on a larger dataset that includes historical electricity price data.

Deploy the model as part of a production-ready web application or API.

Conduct thorough testing to ensure the application is robust and user-friendly.

**Iterate**

Continuous improvement is essential. Gather user feedback and iterate on the model and interface to enhance accuracy and usability.

**Actions:**

Monitor the model's performance and retrain it periodically with updated electricity market data. Address user feedback and make necessary improvements to the web interface or API.

Stay informed about advancements in time-series forecasting and energy market data for potential enhancements to the prediction model.

**Conclusion:**

In conclusion, applying the Design Thinking Approach to create an electricity price prediction model using data science involves understanding user needs, defining objectives, ideating solutions, prototyping, testing, implementing, and iterating for continuous improvement. By prioritizing accuracy and user-friendliness, this approach ensures a valuable tool for consumers, businesses, and utility companies to make informed decisions in the dynamic energy market.