**PHASE 2: INNOVATION**

**MACHINE LEARNING MODELS FOR ENERGY CONSUMPTION:**

1.Time Series Forecasting Models:

•Autoregressive Integrated Moving Average (ARIMA): ARIMA models are well-suited for univariate time series data, making them useful for predicting energy consumption trends over time.

•Seasonal Decomposition of Time Series (STL): STL decomposition separates time series data into seasonal, trend, and remainder components, which can then be modeled separately.

•Prophet: Developed by Facebook, Prophet is designed for forecasting time series data with strong seasonal patterns and holiday effects.

2.Regression Models:

•Linear Regression: Simple linear regression or multiple linear regression can be used to model the relationship between energy consumption and various predictor variables (e.g., temperature, population, economic factors).

•Support Vector Regression (SVR): SVR is a regression technique that can capture non-linear relationships in the data.

•Random Forest Regression: Random forests can handle complex relationships and interactions among features, making them suitable for energy consumption prediction.

3.Neural Networks:

•Recurrent Neural Networks (RNNs): RNNs are effective for modeling sequential data, making them suitable for time series forecasting.

•Long Short-Term Memory (LSTM) Networks: LSTMs are a type of RNN that can capture long-range dependencies in time series data, making them well-suited for energy consumption prediction.

•Convolutional Neural Networks (CNNs): CNNs can be used for spatiotemporal forecasting, especially when considering energy consumption across geographical regions.

4.Ensemble Methods:

•Gradient Boosting Machines (GBM): GBM algorithms like XGBoost and LightGBM can be powerful for regression tasks, including energy consumption prediction.

•Stacking: Stacking involves combining the predictions of multiple models, which can lead to improved accuracy.

5.Clustering and Anomaly Detection:

•K-Means Clustering: Clustering can be used to group similar time periods or regions based on energy consumption patterns.

•Anomaly Detection Algorithms: Techniques like Isolation Forest or One-Class SVM can identify unusual energy consumption patterns, which can be valuable for detecting anomalies or inefficiencies.

6.Deep Learning Models:

•Transformer-based models: Transformers, known for their success in natural language processing, can also be adapted for time series forecasting tasks.

•Temporal Convolutional Networks (TCN): TCNs are deep learning models specifically designed for sequence modeling and forecasting.

7.Hybrid Models:

•Combining multiple models, such as ARIMA and LSTM, in an ensemble can often lead to more accurate predictions.

These are deep learning and mechine learning models to enhance the accuracy and robustness of energy consumption prediction systems.