# WattsNext

Forecast tomorrow’s energy demand today: enabling sustainable, carbon-aware buildings

* **Solution Approach**

Energy consumption contributes to nearly one third of global energy use.

Accurate forecasting is the key to managing this increasing demand and reducing waste.

Our solution is WattsNext. It focuses on forecasting short term energy demand for all the Indian states. The work flow includes:

* + 1. *Data Exploration and Cleaning*: Using historical load data from 2013 to 2023, we remove duplicates, handle missing values, and remove outliers.
    2. *Stationarity Checks:* Applying Augmented Dickey-Fuller (ADF) test to confirm stationarity.
    3. *Modelling:* Experimentation using ARIMA to model temporal trends and spikes in daily energy consumption. Using ACF/PACF plots for parameter tuning. Due to weak autocorrelation in the chosen data set we were unable to find accurate forecasts.
    4. *Validation*: Rolling forecasts and error metrics (MAE and RMSE) were used to evaluate accuracy.
    5. *Visualization*: Creating comparative plots between actual and predicted loads to understand model behaviour.
* **Tools, Libraries and Dataset**
  + 1. *Dataset*: <https://www.kaggle.com/datasets/krishnadaskv/daily-power-generation-in-india-2013-2023>
    2. *Tools and Libraries*
       - 1. Python: Primary development language
         2. Pandas and NumPy: Data preprocessing and cleaning
         3. Matplotlib: Visualization of the data set
         4. Stats model: ARIMA, ADF test, ACF and PACF plots
         5. Scikit-learn: Error metric evaluation.
         6. Jupyter Notebook: For exploratory data analysis and experimentation.
* **Expected Outcome**
  + 1. A working forecasting pipeline using time series foundation that predicts short term load for India states from historical data.
    2. Insights into trade offs between classical models and modern foundation models for energy forecasting.

iii)A foundation that scales into real world application, supports:

* + - * 1. Policy makers and building managers in planning demand.
        2. Grid operators in aligning consumption with renewable energy availability.
        3. Integration of anomaly detection for proactive energy management.
* **Future Extensions**
  + 1. Deploying TSFMs for improved learning across building types.
    2. Building real time anomaly detection modules.
    3. Designing dashboards for smart city energy tracking.