# ⚡ Local Weather → Electricity Usage Predictor

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Project: Predicting household electricity consumption based on local weather and time features.  
Tools: Python, Pandas, Scikit-learn, Seaborn, Matplotlib

## 📌 Project Overview

This project uses local weather data (temperature, humidity, wind speed, pressure) and time features (hour, day of week, month, weekend) to predict electricity usage (kWh) for a household or building.  
  
It demonstrates a full data science pipeline:  
- Data cleaning and exploration  
- Correlation analysis  
- Regression modeling (Linear Regression)  
- Model evaluation and visualization

## 🗂️ Dataset

Source: Weather + household electricity data (CSV)  
Size: ~26,300 hourly records  
Key columns:  
- temp\_dry: Dry bulb temperature (°C)  
- humidity: Relative humidity (%)  
- wind\_speed: Wind speed (m/s)  
- pressure: Atmospheric pressure (hPa)  
- hour, day\_of\_week, month, is\_weekend: Time features  
- kWh: Target variable — energy usage in kWh

## ⚙️ How It Works

1. Load & clean data — Removed missing rows, selected numeric features only.  
2. Explore relationships — Plotted correlation heatmap and scatter plots.  
3. Train baseline model — Linear Regression using scikit-learn.  
4. Evaluate performance — R² score, MAE, plots of real vs. predicted, and residuals.

## ✅ Results

Model: Linear Regression  
Features used: temp\_dry, humidity, wind\_speed, pressure, hour, day\_of\_week, month, is\_weekend  
Metrics:  
- R² score: 0.130  
- MAE: 0.1215 kWh  
  
Insight: The simple linear regression explains about 13% of the variance. Time factors like hour and is\_weekend have stronger effects than weather alone. There is room for improvement with non-linear models.

## 🚀 Next Steps

- Try advanced models like Random Forest or XGBoost.  
- Experiment with feature engineering (e.g., add lag features, weather trends).  
- Hyperparameter tuning and cross-validation.  
- Deploy as a simple web app using Streamlit.

## 📦 How to Run

1. Clone this repository:  
 git clone https://github.com/YOUR\_USERNAME/weather-energy-predictor.git  
2. Install Python 3.x and required libraries:  
 pip install pandas numpy scikit-learn seaborn matplotlib  
3. Run the script:  
 python Code.py  
 Or open the notebook version if you prefer Jupyter.

## ✨ Author Notes

This project was built as part of my high school data science portfolio. It demonstrates practical use of Python and machine learning to solve a real-world problem.

## 📬 Contact

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⭐ If you like this project, feel free to ⭐ the repo or fork it!