College of Design, Construction and Planning

Predicting High-Load Energy Intervals Using Residential AMI Data and Machine Learning

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BACKGROUND

Utilities collect high-resolution AMI data every 15 minutes, yet most conservation workflows still rely on monthly billing histories and simple visual inspection. This leaves the predictive potential of interval-level data largely unused.

This project explores whether machine learning can turn raw AMI data into a practical tool that automatically identifies high-load events and supports more data-driven residential energy conservation.

METHODS

Dataset & Cleaning

One month of residential AMI data (≈2,880 intervals).

Cleaned by removing metadata, fixing timestamps, and standardizing 15-minute spacing.

Features

Interval kWh

1-hour and 4-hour rolling averages

Hour-of-day, day-of-week

High-load intervals labeled as the top 25 percent

Models

Logistic Regression baseline

Random Forest for nonlinear patterns

80/20 train–test split with accuracy, precision, recall, F1 metrics

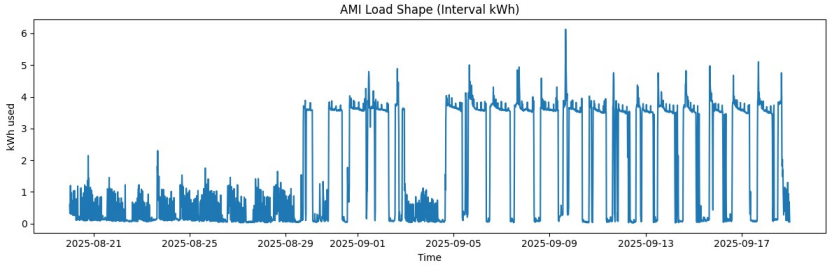
RESULTS

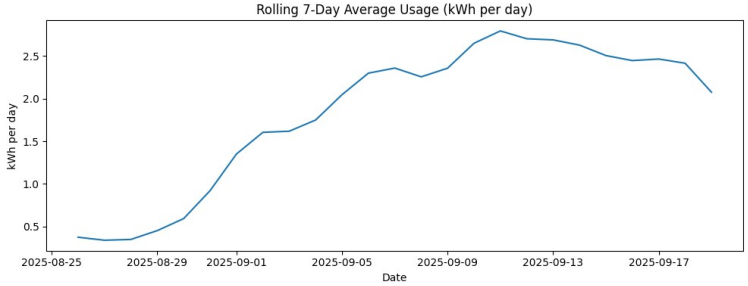
Logistic Regression: **94 percent accuracy**, F1-score **0.87**.

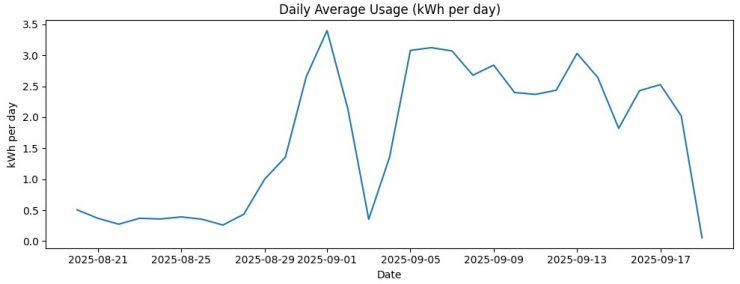
Random Forest: **100 percent accuracy**.

Most important features: interval kWh, 1-hour rolling average, 4-hour rolling average.

Time-based features contributed minimally in this







CONCLUSIONS

AMI interval data contains strong, actionable signals for detecting short-term usage spikes. With simple engineered features, machine-learning models can reliably identify high-load events and reveal patterns that monthly bills cannot capture. This demonstrates significant potential for integrating AMI-driven analytics into utility conservation programs, enabling faster screening, better targeting, and more efficient audit preparation.

TAKEAWAYS

- AMI data alone provides strong predictive signals for identifying high-load intervals.
- Rolling averages are crucial for detecting meaningful spikes in residential usage.
- Machine-learning tools can support energy auditors by highlighting irregular patterns before site visits.
- * Perfect accuracy indicate[illegible] but also the [illegible] testing across multiple households

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