WillowWatt

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The Problem

Background:

- In the U.S., buildings consume about **40% of all energy** consumed annually
- NAU currently spends around **$15 million annually** on energy alone
- The need for **proactive instead of reactive** energy management
- Our sponsor, Willow, focuses on using data to generate **insights on energy** usage

Motivation:

- Leverage AI and Machine Learning to **create a proactive energy management tool**
- Help NAU **reduce energy costs** and **environmental impact** through predictive insights
- Demonstrate how AI forecasting can support **sustainable campus operations**

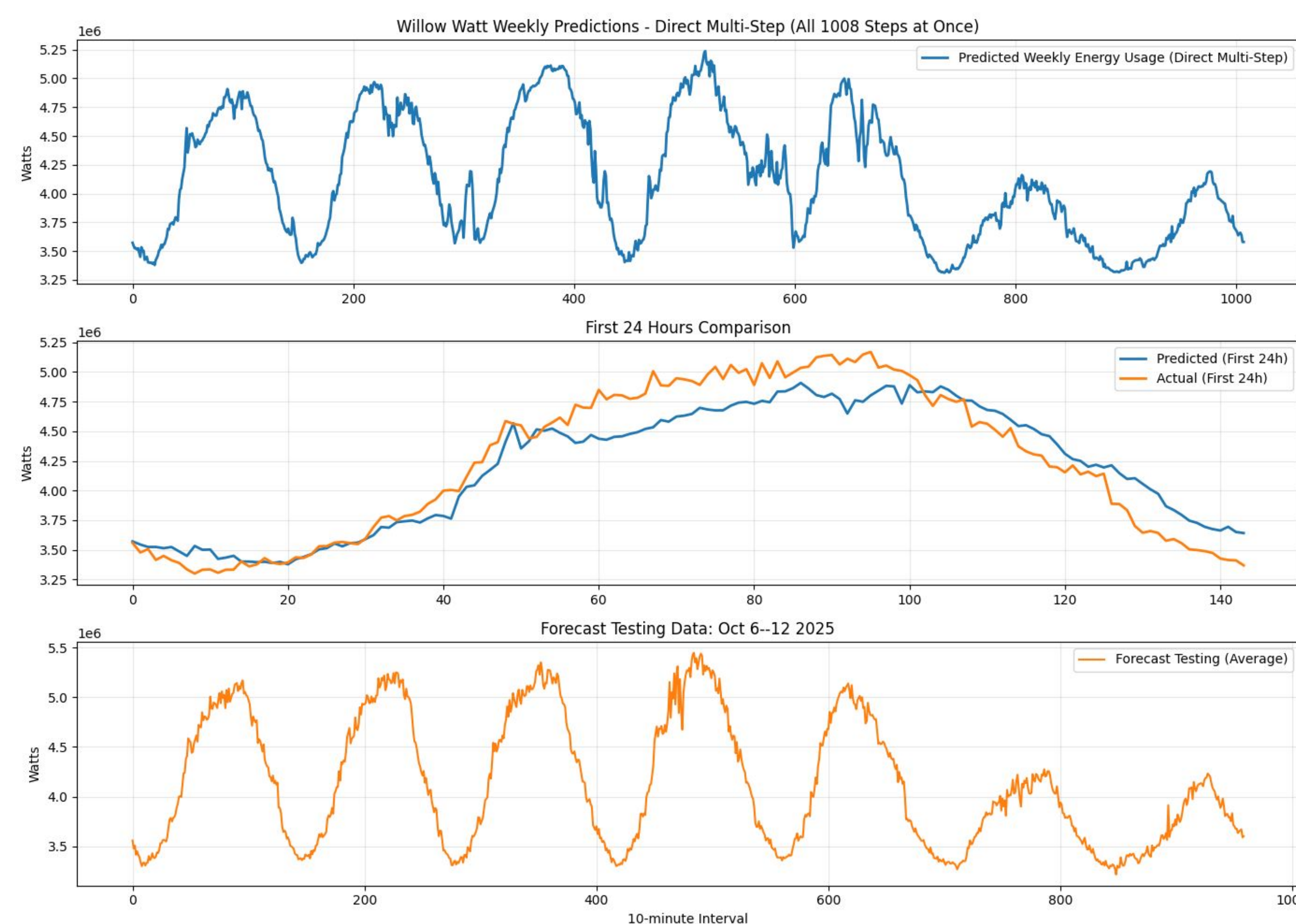## Key Features & Testing

Key Features:

- Accurate forecasting using **Random Forest Regression**
- Generates **weekly energy forecasts** for North Campus
- Provides graphical output for **easy trend visualization**
- **Predicts peak loads** and generates insights to **alert users**
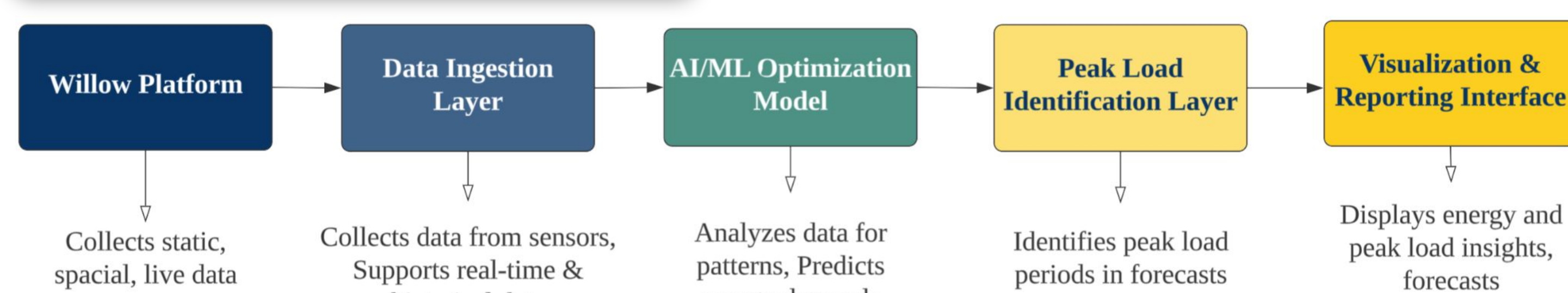
Testing & Validation:

- Trained and tested with historical NAU energy data
- Achieved **~95% accuracy** on test forecasts
- Validated results with Willow to ensure **consistent model behavior** both locally and within the Willow platform

Our Solution: WillowWatt

An AI/ML model that forecasts NAU's North Campus energy usage to support sustainable energy management.

System Workflow:

Willow Platform	Data Ingestion Layer	AI/ML Optimization Model	Peak Load Identification Layer	Visualization & Reporting Interface
Collects static, spacial, live data	Collects data from sensors, Supports real-time & historical data	Analyzes data for patterns, Predicts energy demands	Identifies peak load periods in forecasts	Displays energy and peak load insights, forecasts

Challenges & Solutions

1) Inconsistent and **incomplete datasets** → Cleaned and reformatted all data for model compatibility

2) Difficulty training a reliable model due to **limited data scope** → Tuned the Random Forest model to handle varying data resolutions

3) **Integration issues** with data formats between Willow's system and ours → Collaborated with Willow to ensure model integrates smoothly

Design & Technologies

System Overview:

1) **Train**/test model: Historical NAU data
2) **Log** predictions: Random Forest Regression
3) **Identify** peaks in billing period

Technologies Used:

- **Python**: primary programming language
- **Pandas**, **NumPy**, **Matplotlib**, **Scikit-Learn**: data processing, visualization, model building
- **ONNX**: used for packaging to seamlessly integrate with the Willow platform
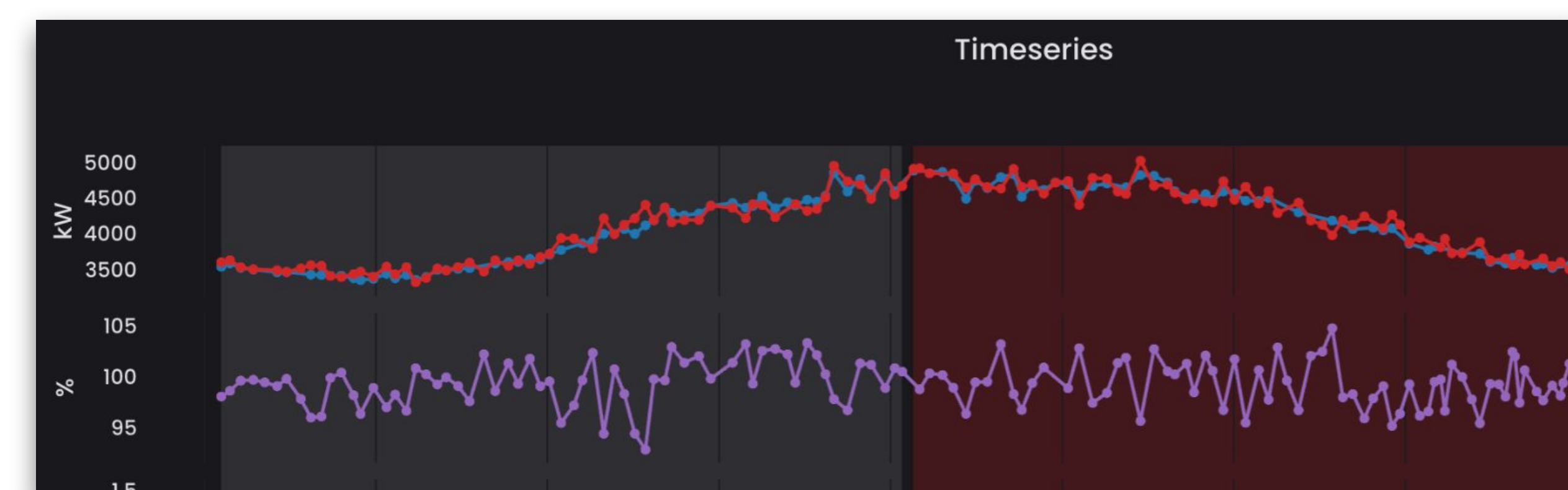
Outcomes & Future Work

Results:

- Random Forest model achieves **~95% accuracy**
- **Detects peak loads** to help reduce energy usage costs
- **Successfully tested** on North Campus energy data

Willow Environment:

◆ Current Load   ◆ WillowWatt   ◆ Model Accuracy

Future Development:

- Incorporate weather data for improved seasonal pattern recognition
- Automate recommendations for peak load management