

CASE STUDY: FORENSIC ENERGY ANALYSIS REVEALS HIDDEN ECM FAILURE BEHIND A 50-POINT ENERGY STAR® SCORE COLLAPSE

Focus Measure: Multi-Family Energy Efficiency Package (Smart Thermostats, 100% LED Lighting, Envelope Air-Sealing, & High-Efficiency Ceiling Fans)

Measurement & Verification (M&V) Platform: Verify™

Measurement & Verification (M&V) Approach: IPMVP Option C / UMP Chapter 8 Forecasted Model

Consultant Role: Independent 3rd-Party Forensic M&V Specialist

Acknowledgments: Rachel Hartley, PMVA/CMVP

Executive Summary

In mid-2026, the sustainability team of a global investment manager faced an urgent challenge: one of their managed property's ENERGY STAR® score had plummeted from 90 in 2024 to the 40s in 2025, increasing consumption by more than 1,147,000 kWh compared to the baseline period (*Figure 1*). Ownership questioned whether unseasonable weather or fluctuations in tenant occupancy were driving the massive spike in consumption.

Power TakeOff was engaged as an independent third-party M&V consultant to investigate the cause. The International Performance Measurement and Verification Protocol (IPMVP) Option C was used in this investigation. This modeling approach uses total facility-level energy consumption to determine energy savings. Option C uses a linear regression model to relate energy consumption to independent variables that drive usage (most notably, weather and operating schedules). Using Verify™ — Power TakeOff's IPMVP-compliant M&V software platform — the team executed a weather-adjusted forecast model to evaluate actual consumption against expected baseline performance.

The forensic analysis definitively proved that neither weather nor occupancy caused the increase, pointing to an unmonitored failure of the asset's Energy Conservation Measures (ECMs). This case study highlights the limitations of relying on lagging monthly utility bills and demonstrates how third-party M&V paired with real-time AMI submetering transforms M&V from a delayed post-mortem into an active operational guardrail.

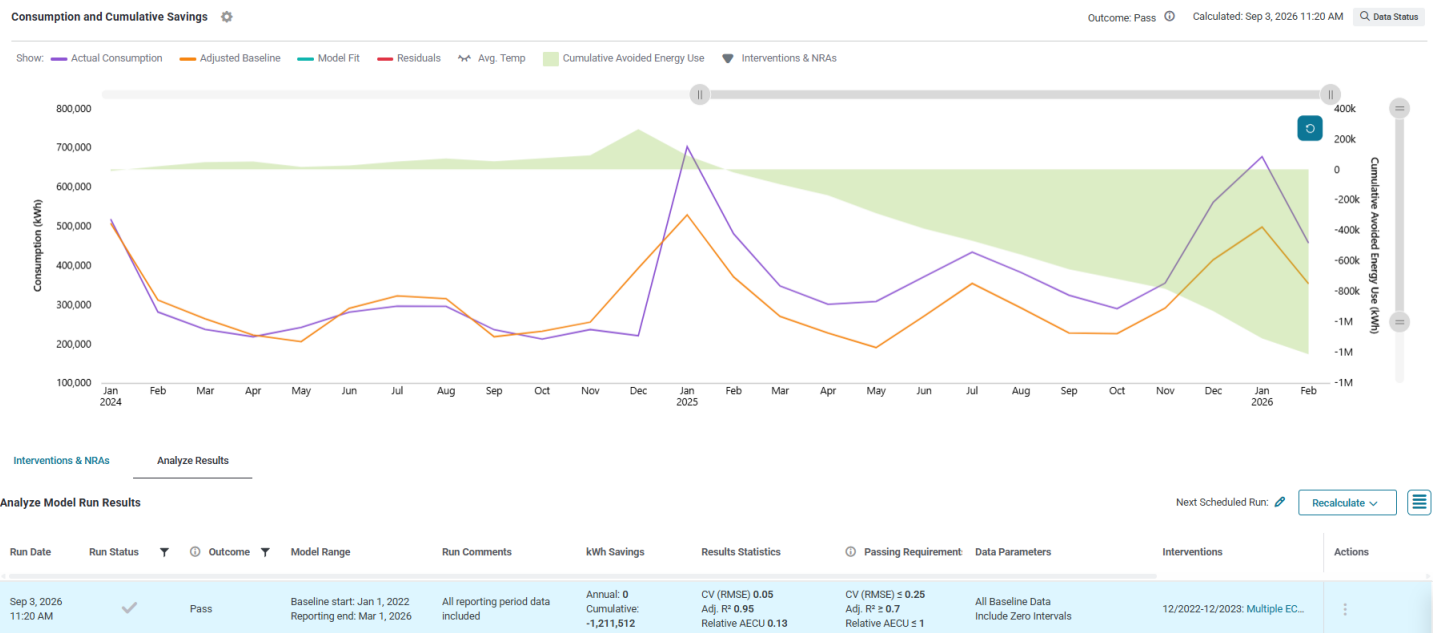


Figure 1

The Investigation: Ruling Out Weather and Occupancy

The baseline period for this project was January 2022 - December 2022. Between 2022 and 2023, the asset underwent a comprehensive efficiency retrofit, including smart thermostats, 100% LED lighting, ceiling fans, and envelope insulation repairs. In 2024, the property performed as designed, saving 275,160 kWh/year (~7.8% whole-building energy reduction) and earning an ENERGY STAR® score of 90 (Figure 2). However, in 2025, annual energy consumption surged by 1,580,900 kWh (+48.3%) over 2024 levels (Figure 4).

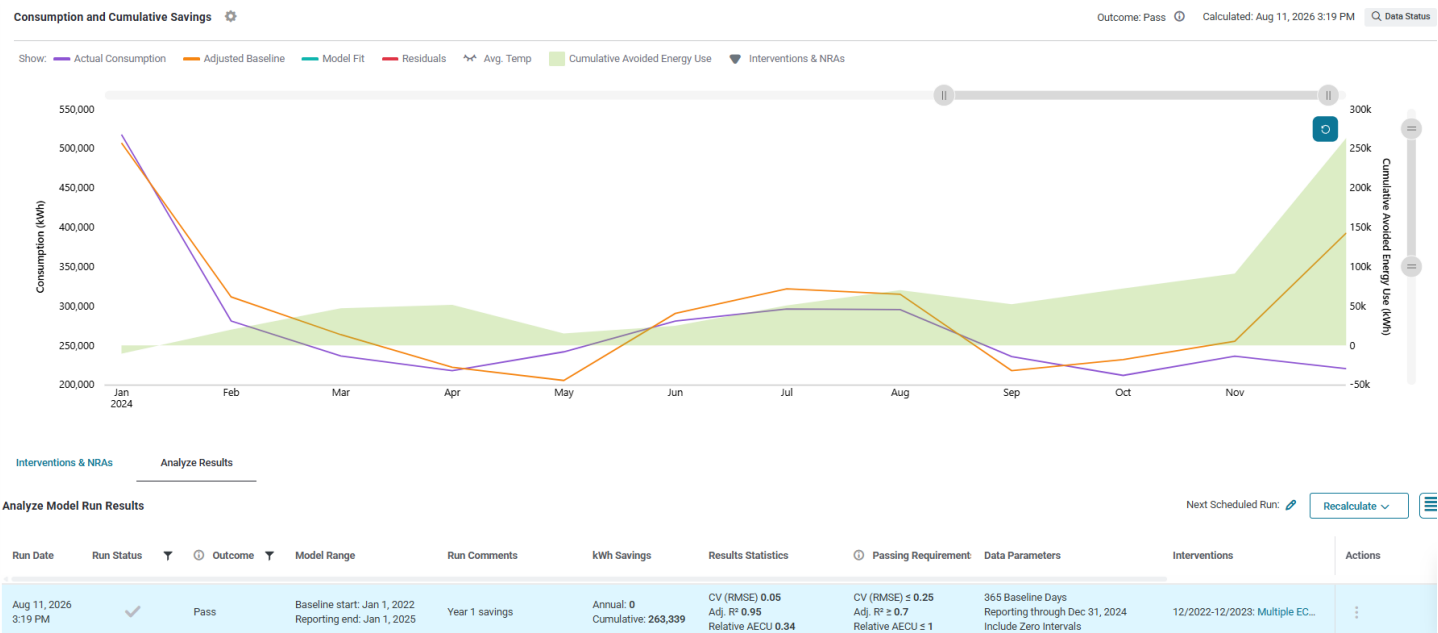


Figure 2

Forensic Findings in Verify

By isolating each variable in Verify, our team tested ownership's primary hypotheses:

- 1. Was it Occupancy?** Historical monthly occupancy remained virtually flat across the entire evaluation window (averaging 92.8% in 2024 and 94.1% in 2025). Removing occupancy as a model variable yielded a statistically robust weather-only regression ($R^2 = 0.974$, $CV(RMSE) = 3.49\%$), indicating that occupancy changes had a negligible impact.
- 2. Was it Weather?** Verify projected the calibrated baseline against the exact outdoor temperatures in 2025. The model predicted the facility should have consumed 3,705,207 kWh under 2025 weather conditions. Actual usage was 4,851,742 kWh, an unexplainable excess of 1,146,535 kWh. In *Figure 3*, you can see that there was only a 1 degree Fahrenheit difference between 2022 (previous year) and 2025 (current year).

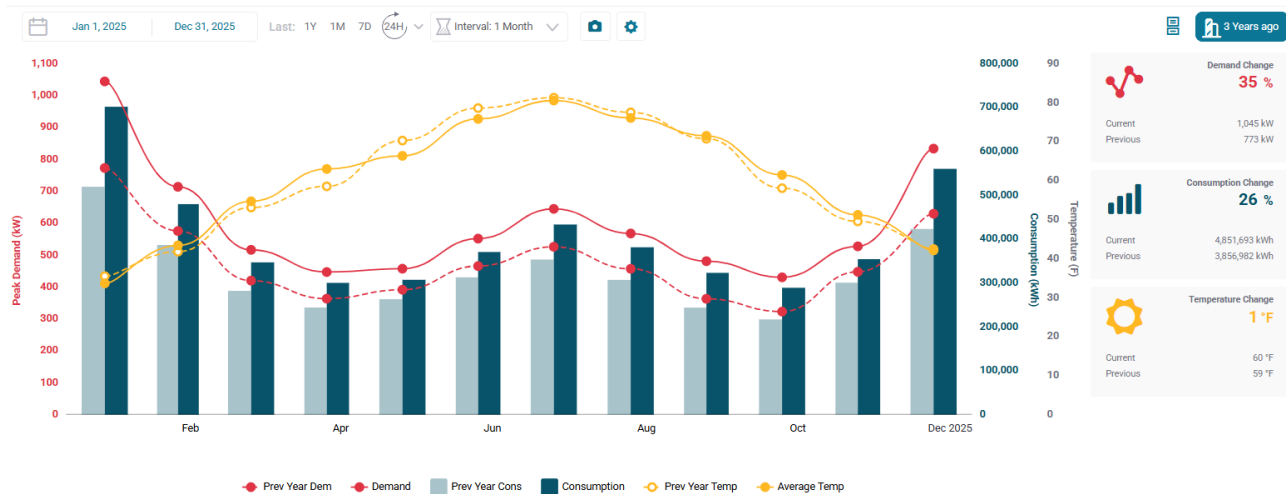


Figure 3

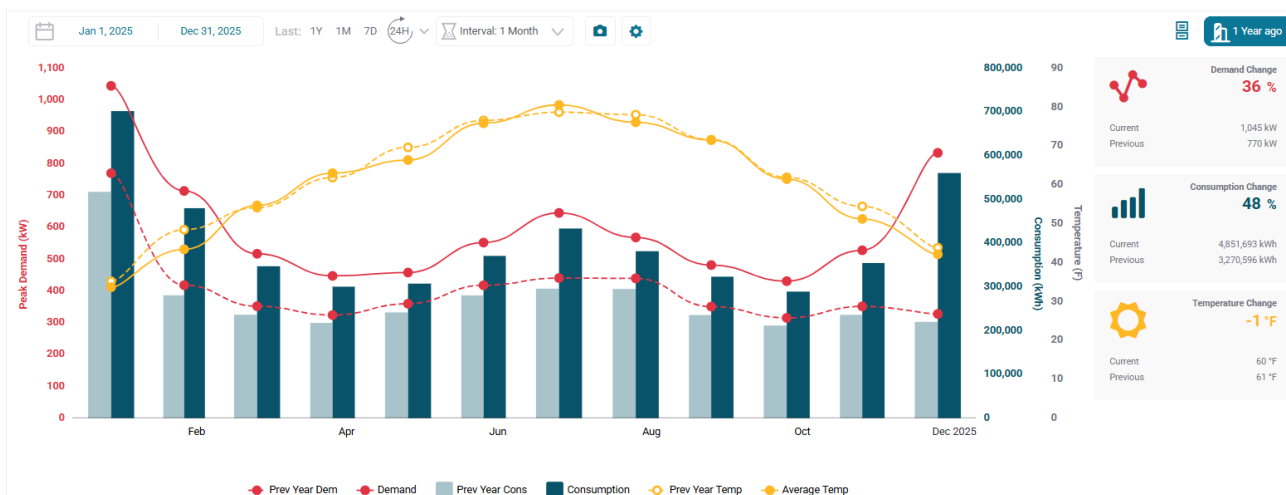


Figure 4

- 3. The Verdict:** Because weather and occupancy were mathematically ruled out, the team deduced that there was an ECM/control failure at the site (*Figure 5*). Specifically, the smart thermostat gateway may have lost automated control loops, triggering 24/7 setpoint overrides and causing heat pump auxiliary electric resistance strips to lock on continuously during the winter months (driving January 2025 usage to 701,982 kWh, up from 220,436 kWh in December 2024).

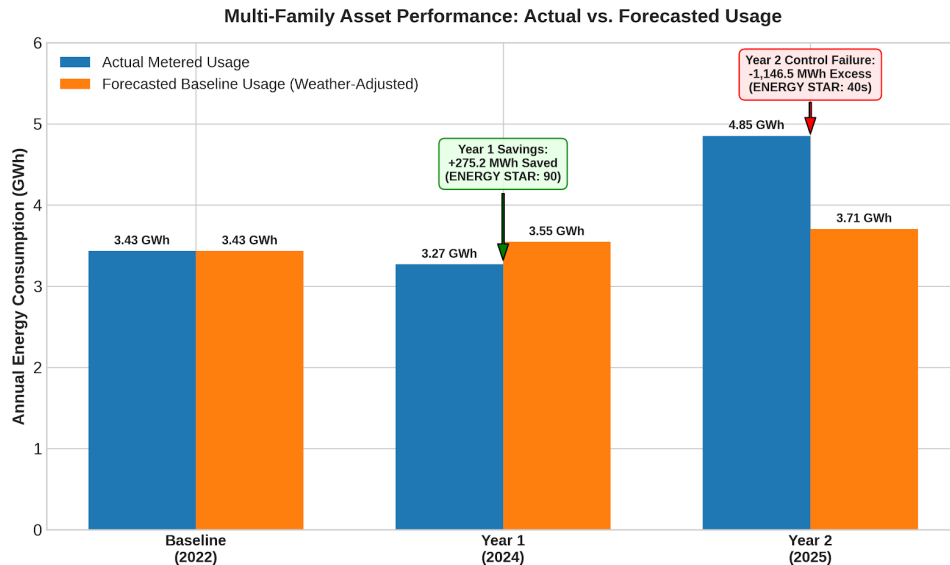


Figure 5

The Vulnerability of Monthly Bills as Lagging Indicators

This site's performance collapse illustrates the fundamental risk of relying on standard monthly utility bills or annual benchmarking reports for sustainability management:

- Monthly Bills Are Lagging Indicators:** Utility bills arrive 30 to 60 days after energy is consumed and are aggregated into a single monthly number. They lack the interval resolution needed to distinguish between a cold snap, a tenant billing shift, or a stuck heating valve.
- Delayed Benchmark Scores:** ENERGY STAR® Portfolio Manager® scores update annually on a lag. By the time this site's score dropped from 90 to 40 in mid-2026, the property had already sustained 18 months of unbudgeted utility costs and over 1.4 million kWh of wasted energy.
- No Granularity for Diagnosis:** A monthly bill shows *that* consumption increased, but it cannot explain *why*. Without a calibrated M&V engine like Verify™, asset managers are forced to guess whether tenant behavior, weather, or equipment failure caused the issue.

Key Takeaways for Sustainability Teams

- Require Independent 3rd-Party M&V on All Major Retrofits:** Third-party evaluation powered by IPMVP-compliant software such as Verify protects capital investments by ensuring that post-install savings are mathematically verified rather than assumed.
- Utilize Interval Data:** Investing in real-time equipment monitoring (i.e., CT kits) on all buildings to ensure you have access to interval data. If your utility already provides this, ensure you can share this data with a third-party M&V implementer for modeling.
- Retrofits are Phase One; Persistence is the Strategy:** Physical measures (LEDs, insulation) perform reliably, but active control measures (smart thermostats, BAS systems) require continuous, impartial oversight to prevent override drift and gateway disconnections.
- Transform M&V from Passive to Active:** When embedded into monthly asset operations via Verify, continuous, forecasted 3rd-party M&V serves as an operational guardrail that protects net operating income, carbon reduction targets, and ESG asset valuations.