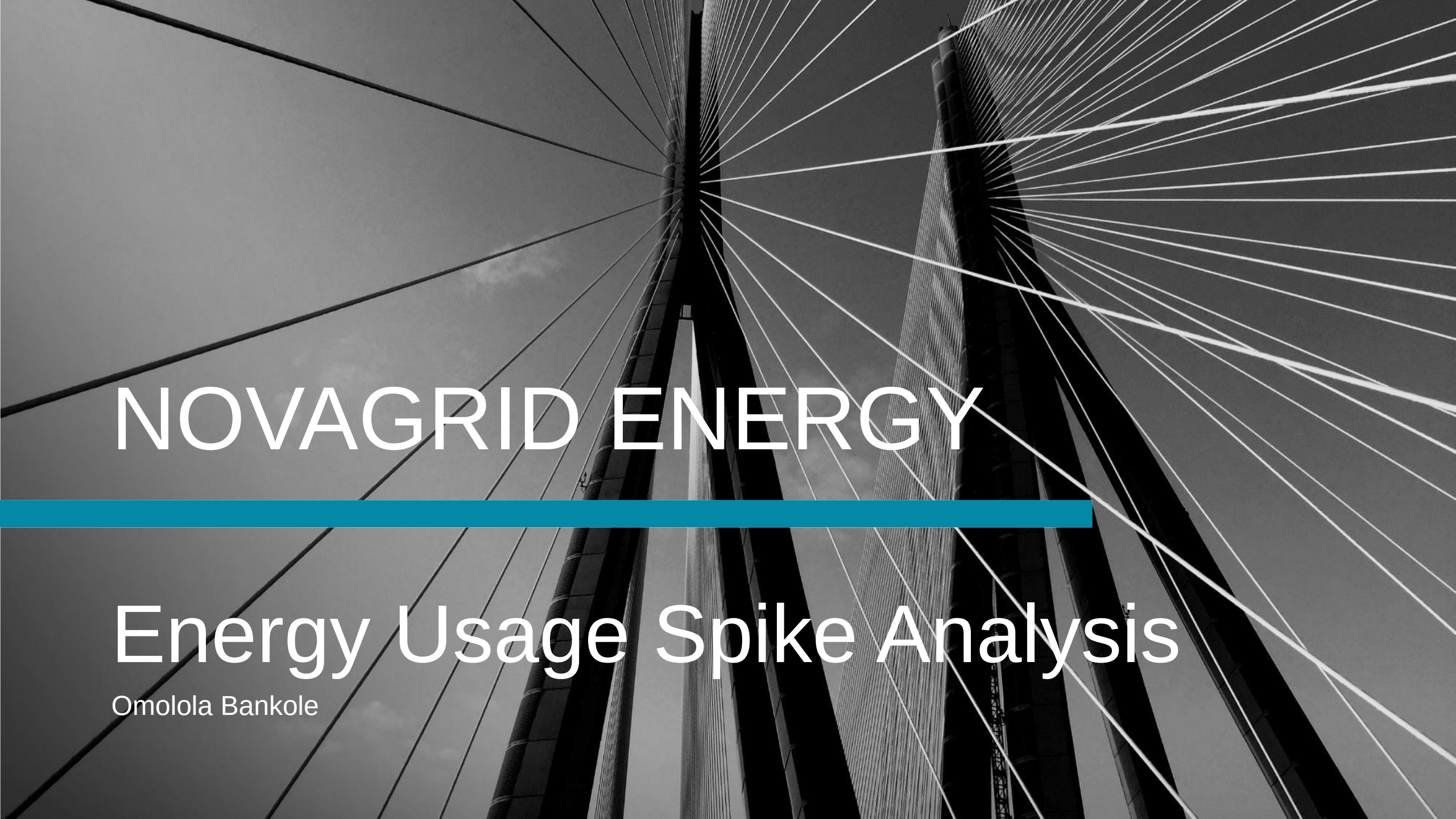

NOVAGRID ENERGY

Energy Usage Spike Analysis

Omolola Bankole

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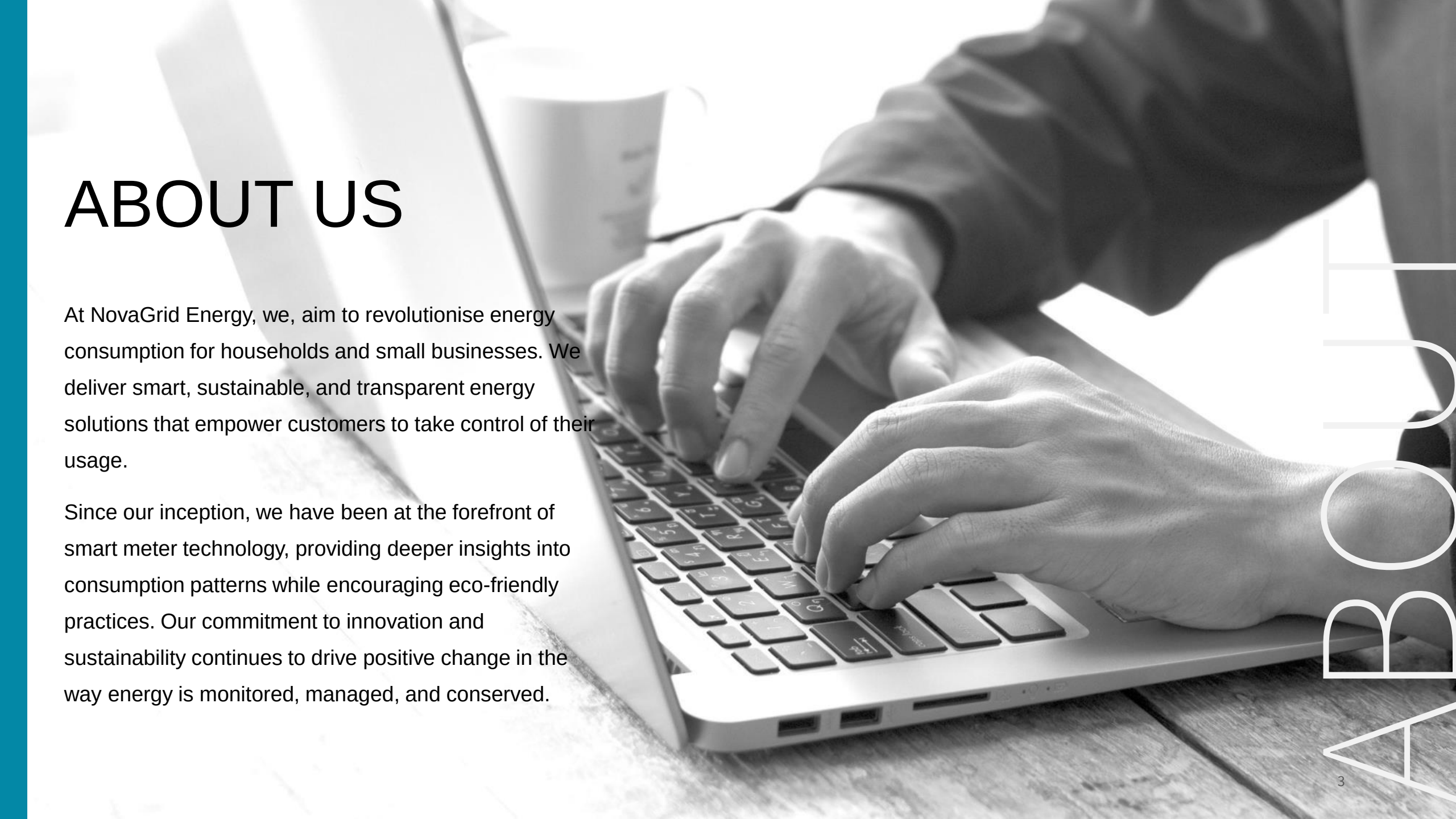
ABOUT US

At NovaGrid Energy, we, aim to revolutionise energy consumption for households and small businesses. We deliver smart, sustainable, and transparent energy solutions that empower customers to take control of their usage.

Since our inception, we have been at the forefront of smart meter technology, providing deeper insights into consumption patterns while encouraging eco-friendly practices. Our commitment to innovation and sustainability continues to drive positive change in the way energy is monitored, managed, and conserved.



KEY OBJECTIVES

- Detect abnormal energy spikes in real-time or near-real-time for each household.
- Classify anomalies to identify whether they are appliance-related, behavioural, or infrastructure-driven.
- Send proactive alerts and usage tips to customers via dashboards and email notifications.
- Measure and report reductions in abnormal usage across monitored customers.
- Enhance Tableau dashboards for operations and support teams, enabling monitoring, drill-down, and rapid response.

PROBLEM STATEMENT

CUSTOMER DISSATISFACTION

Rise in customer complaints due to billing disputes

REPUTATIONAL DAMAGE

The organization has lost her credibility from the inconsistent billing

INCREASED OPERATIONAL COSTS

High in flow to call center due to unsatisfied customer

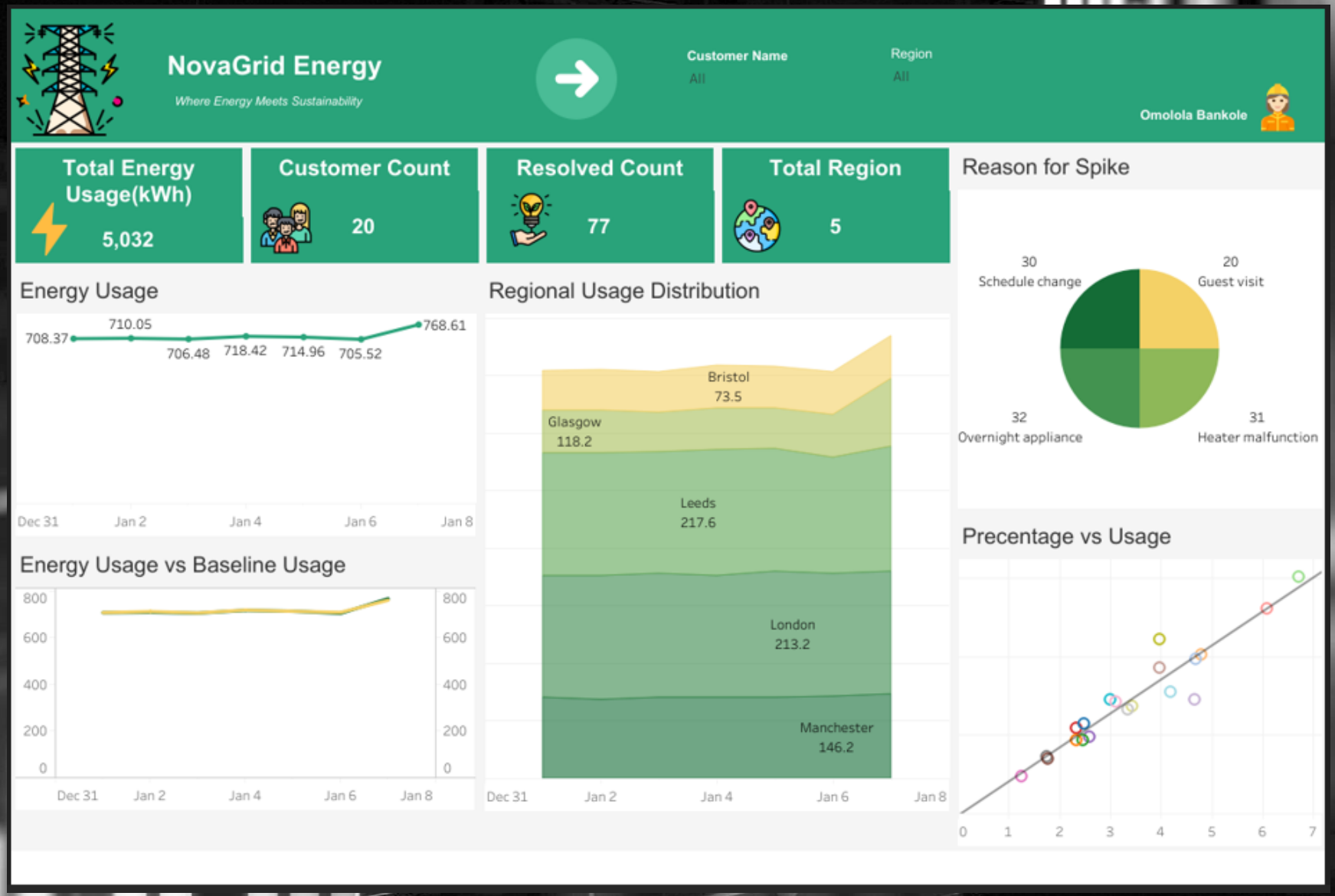
ENERGY WASTE

A divergence from the company’s goal of providing sustainability energy

PROBLEM

KPI DASHBOARD OVERVIEW

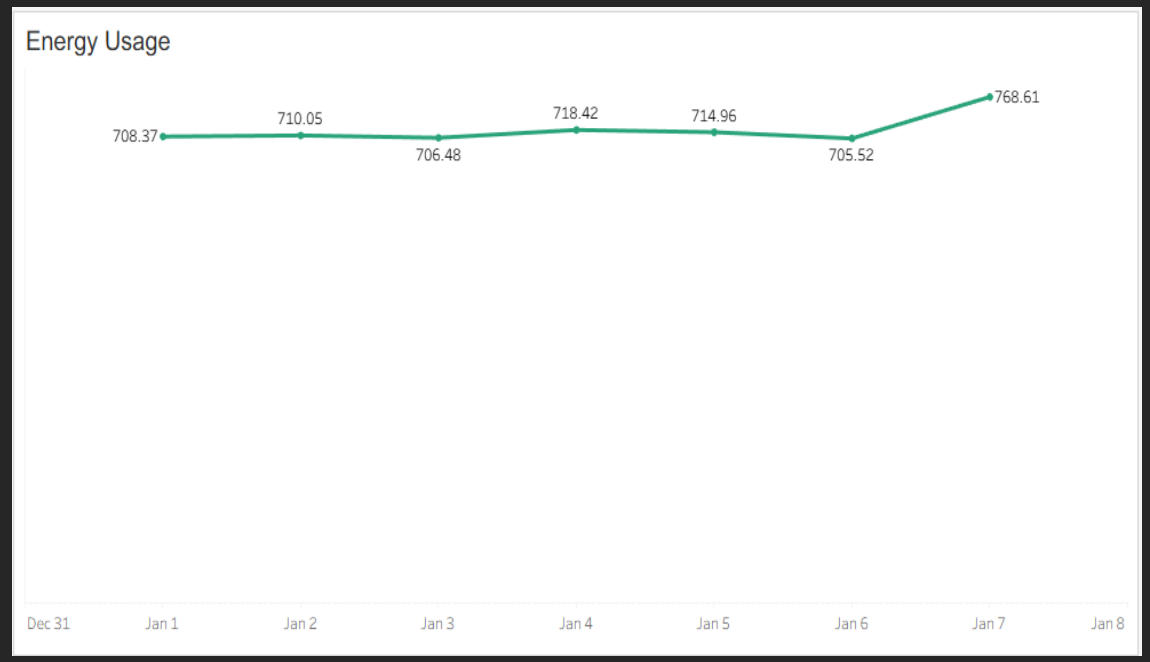
- Total Energy Usage - 5032
- Customer Count - 20
- Resolved Count - 77
- Total Region – 5

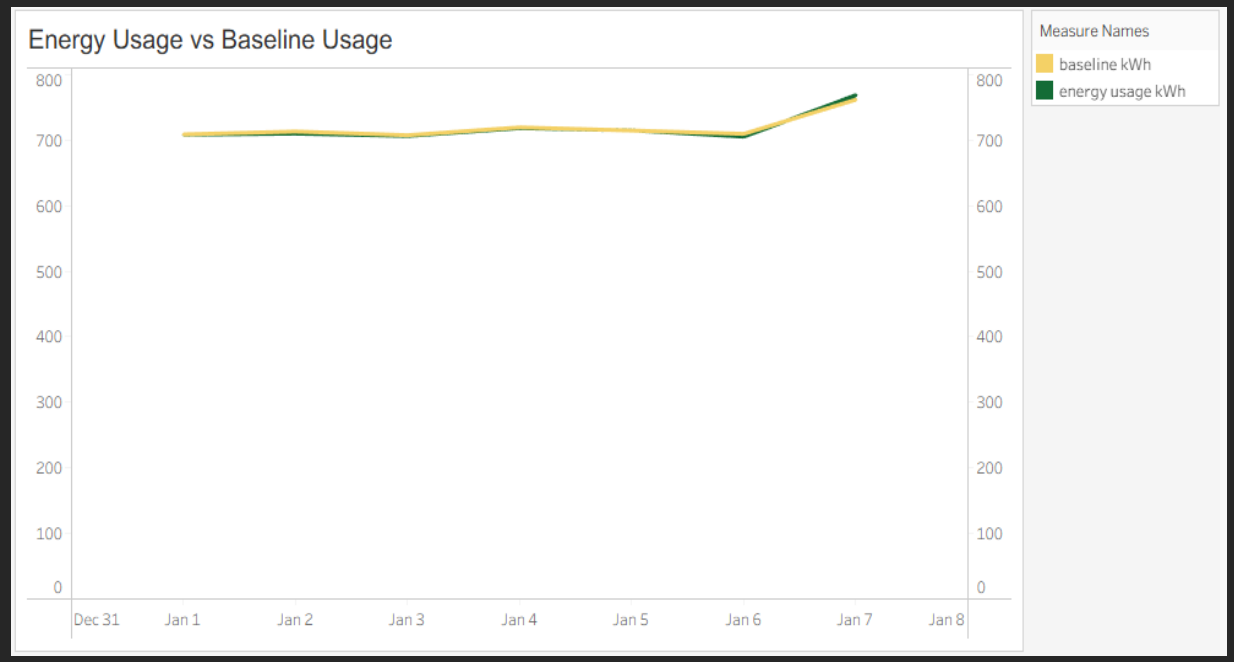


KPI DASHBOARD OVERVIEW

- Spike Counter – 114
- Spike Threshold – 40%
- Avg Spike Detected % - 51.3
- Alert Counter - 111

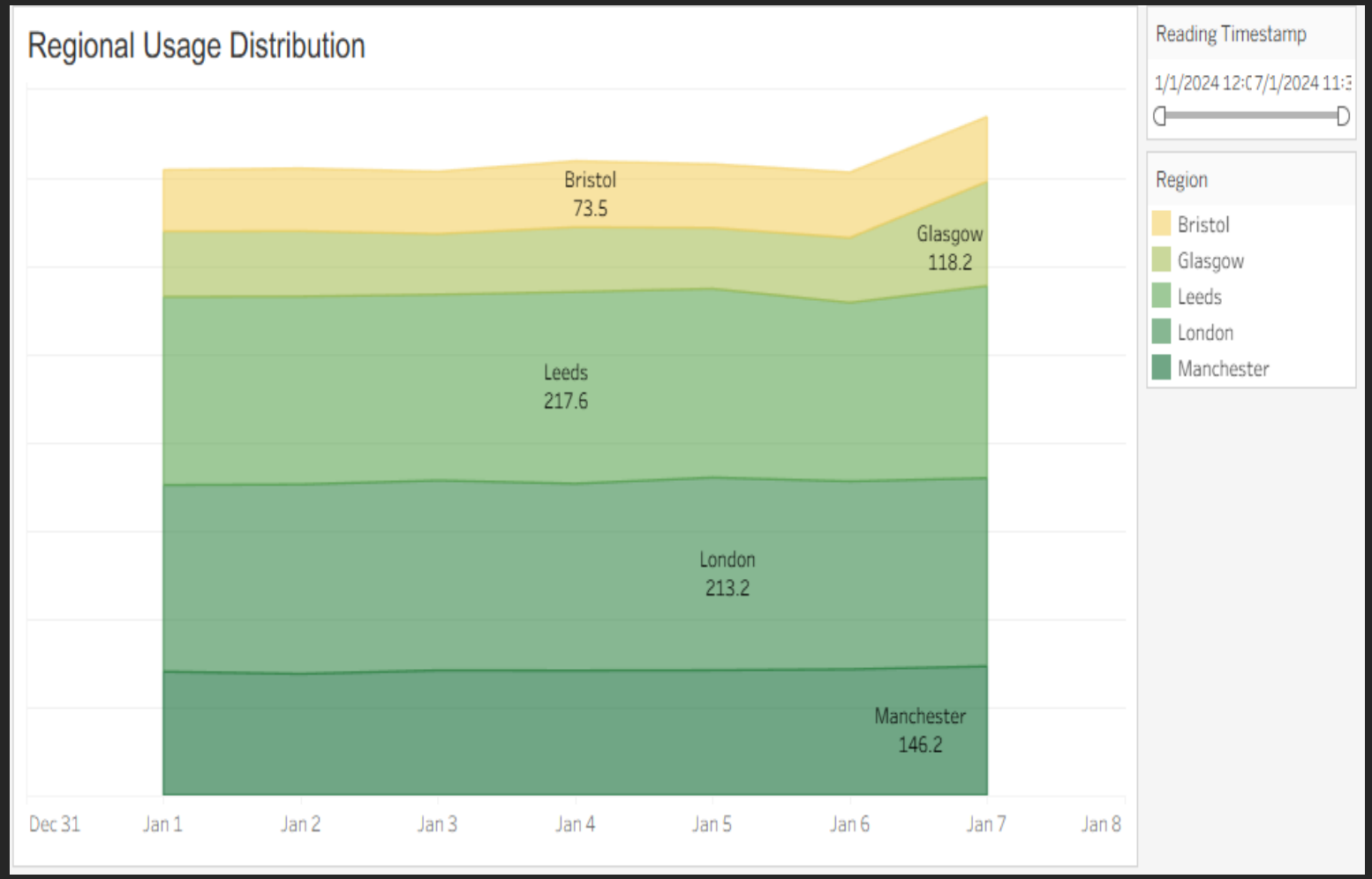
OPERATIONAL INSIGHTS





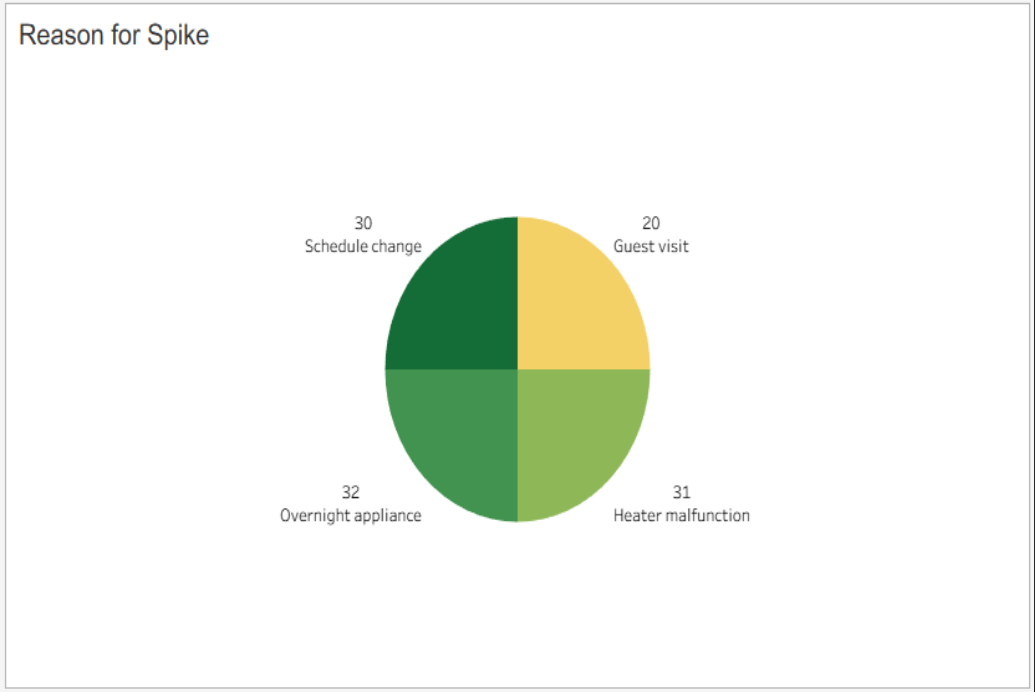
- Energy usage remains broadly stable but shows a late-period increase. This likely reflects seasonal behavior shifts, increased appliance usage, or short-term lifestyle changes (e.g. colder weather or extended home occupancy), which commonly drive gradual consumption increases rather than sudden volatility.
- A small number of regions (notably Leeds and London) account for the highest energy consumption. Densely populated urban areas typically have higher household energy demand due to larger customer bases, multi-occupancy housing, and higher appliance saturation.

OPERATIONAL INSIGHTS



- Actual energy usage closely follows the baseline with occasional upward deviations. This suggests baseline models are well calibrated, and most spikes are event-driven rather than structural inefficiencies, such as temporary behavioral changes or short-lived appliance faults.
- Energy spikes are evenly distributed across behavioral and appliance-related causes Household energy inefficiency is rarely driven by a single factor; instead, it reflects a combination of lifestyle events (guest visits, schedule changes) and unnoticed appliance issues.

OPERATIONAL INSIGHTS



- Higher energy usage is strongly associated with higher spike percentages. High-consumption households tend to have more appliances and longer usage durations, increasing the likelihood of abnormal usage patterns and compounding inefficiencies.
- Customer-level filtering reveals significant variation in spike behavior within the same region. Individual household behavior, appliance age, and occupancy patterns often outweigh regional averages, reinforcing the need for customer-specific monitoring.
- Regional patterns shift noticeably when individual customers are isolated. This indicates that regional spikes are frequently driven by a small subset of high-impact customers rather than widespread regional inefficiency.
- Spike causes and intensity change dynamically when customer or region filters are applied. Energy usage patterns are context-dependent, meaning static alerts are less effective than adaptive, personalized interventions based on real-time behavior.

OPERATIONAL INSIGHTS

- Spike intensity fluctuates over time rather than following a steady upward trend. This suggests spikes are driven by short-term events (e.g. appliance usage, behavioral changes) rather than long-term structural inefficiency. When the Region filter is applied, some regions show sharper peaks, indicating that volatility is more concentrated in specific locations rather than system-wide.
- Weekday spikes significantly exceed weekend spikes. Higher weekday activity aligns with working-from-home patterns, regular schedules, and increased appliance usage. Filtering by Region reveals that this weekday dominance is strongest in urban regions, while some regions show a narrower weekday–weekend gap, likely due to different lifestyle or occupancy patterns. Detached homes experience the highest weekday spike intensity across housing types.
- Detached properties typically have larger floor areas, more heating demand, and a higher number of appliances, increasing exposure to abnormal usage. When filtered by Region, this effect is amplified in regions with colder climates or older housing stock.
- Flats show moderate but more consistent weekday spike behavior. Flats tend to have smaller spaces and shared infrastructure, which limits extreme spikes but still allows behavioral-driven increases. Regional filtering shows that flats in high-density cities contribute more consistently to weekday spikes than those in smaller regions.

OPERATIONAL INSIGHTS

- Semi-detached properties exhibit the lowest spike intensity overall. This housing type often balances space and efficiency, reducing the likelihood of extreme energy fluctuations. Across regions, this pattern remains relatively stable, suggesting housing type is a stronger driver here than geography.
- Spike distribution varies significantly by region and housing type combination. Certain regions show high spike counts concentrated in specific housing types (e.g. detached homes in major cities), while others are more evenly distributed. This indicates that regional infrastructure, housing mix, and resident behavior interact to shape spike risk.
- Daily average energy usage mirrors spike patterns by housing type. Housing types with higher daily average usage also show higher spike intensity, reinforcing the link between overall consumption levels and abnormal usage risk. Applying the Region filter shows that this relationship is stronger in regions with higher baseline consumption.
- No single region consistently dominates all spike categories. Different regions emerge as spike hotspots depending on time, housing type, and weekday/weekend context. This confirms that energy inefficiency is not uniform and cannot be addressed with a single regional strategy.

RECOMMENDATIONS

- Introduce seasonal and lifecycle-based monitoring during late-period increases by deploying proactive alerts and advisory messages during colder months or high-occupancy periods (e.g. winter, school holidays).
- Prioritize high-consumption regions (e.g. Leeds and London) for targeted intervention, I recommend allocating regional energy-efficiency campaigns, appliance checks, and tailored messaging to top-consuming regions first.
- Maintain existing baselines but strengthen spike detection and response: Keep baseline models unchanged while enhancing real-time spike alerts and anomaly explanations.
- Deploy cause-specific alerts rather than generic energy warnings: Classify spikes into behavioral vs appliance-related categories and send tailored advice (e.g. “possible heater malfunction” vs “schedule change detected”).
- Create a “high-usage customer” risk tier for proactive monitoring: Flag high-consumption households for enhanced monitoring, frequent alerts, and personalized energy-saving recommendations.

RECOMMENDATIONS

- Shift from region-level to customer-level intervention strategies: Use customer-specific dashboards to support personalized alerts, targeted advice, and proactive outreach for high-risk households.
- Focus investigations on a small set of high-impact customers within spike-heavy regions: Identify and prioritize customers driving regional spikes instead of assuming region-wide inefficiency.
- Implement adaptive, context-aware alerting instead of static thresholds: Adjust alert sensitivity dynamically based on region, housing type, weekday/weekend patterns, and recent behavior.
- Use time-based targeting to address short-term spike volatility: Trigger alerts and tips during known high-risk periods (weekday mornings, evenings, cold
- Design weekday-focused energy optimization programmes: Promote weekday-specific recommendations such as off-peak appliance use, heating schedules, and work-from-home energy tips.
- Target detached homes with appliance and heating efficiency initiatives: Offer heating audits, smart thermostat recommendations, and appliance health checks to detached households.
- Use flats as a testbed for behavioral nudges rather than hardware interventions: Focus on usage tips, scheduling guidance, and behavioral messaging rather than costly infrastructure upgrades.
- Maintain lighter-touch monitoring for semi-detached homes: Apply standard alerts and monitoring without aggressive intervention.

THANK YOU

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