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Identifying Source of Supply for Smart Meters

What This Is About? Understanding the Importance of Source of Supply Mapping

For a utility as expansive as a large electricity distribution company in Middle East, accurate mapping of the source of supply and establishing connectivity between consumer meters with distribution transformer is a foundational requirement. This critical task ensures that the GIS database accurately reflects real-world network configurations. Errors in this mapping can lead to inefficiencies in grid operations, challenges in outage management, and inaccuracies in energy balancing. Recognizing the strategic importance of this effort, the company embarked on a project to enhance GIS mapping using advanced analytics and data from smart meters.

The goal of this project was to validate and correct existing meter-to-transformer relationships while identifying unlinked or incorrectly mapped connections. By incorporating voltage, current, harmonics profile data into the analysis, the company aimed to establish a highly accurate, data-driven approach for source-of-supply mapping.

How Was It Done? From Data to Insights: The Implementation Journey

In a groundbreaking collaboration with the company, we harnessed the power of smart meter data and advanced AI analytics within the Impresa Insights ecosystem to redefine source-of-supply mapping.

The journey began with seamless data integration, uniting voltage-current profiles from HES systems, harmonics insights, and GIS master datasets into a unified data framework. This rich tapestry of information became the bedrock for our cutting-edge AI/ML models, engineered to decode the complex electrical relationships in the company's distribution network.

Our proprietary algorithms went beyond traditional analysis by decoding complex electrical relationships through voltage dips, current imbalances, and harmonic distortions. But what truly set the solution apart was the integration of geospatial intelligence. By layering geospatial analysis atop connectivity insights, we created a comprehensive view of the company's distribution network, pinpointing mismatched connections, validating correct mappings, and identifying unlinked meters with unprecedented precision.

This dual-layered approach—combining geospatial insights with AI/ML analytics—transformed static data into dynamic intelligence. Iterative validation, in collaboration with the company's operations team, ensured the accuracy of results, aligning them with real-world configurations and fine-tuning the models for even greater precision.

The outcome is actionable insights, presented in structured, geospatially aware reports, enabling the company's GIS team to seamlessly update mapping databases and make confident, data-backed decisions.

Impresa Solutions:

- Impresa Insights Data Platform

- Revenue Assurance Insights
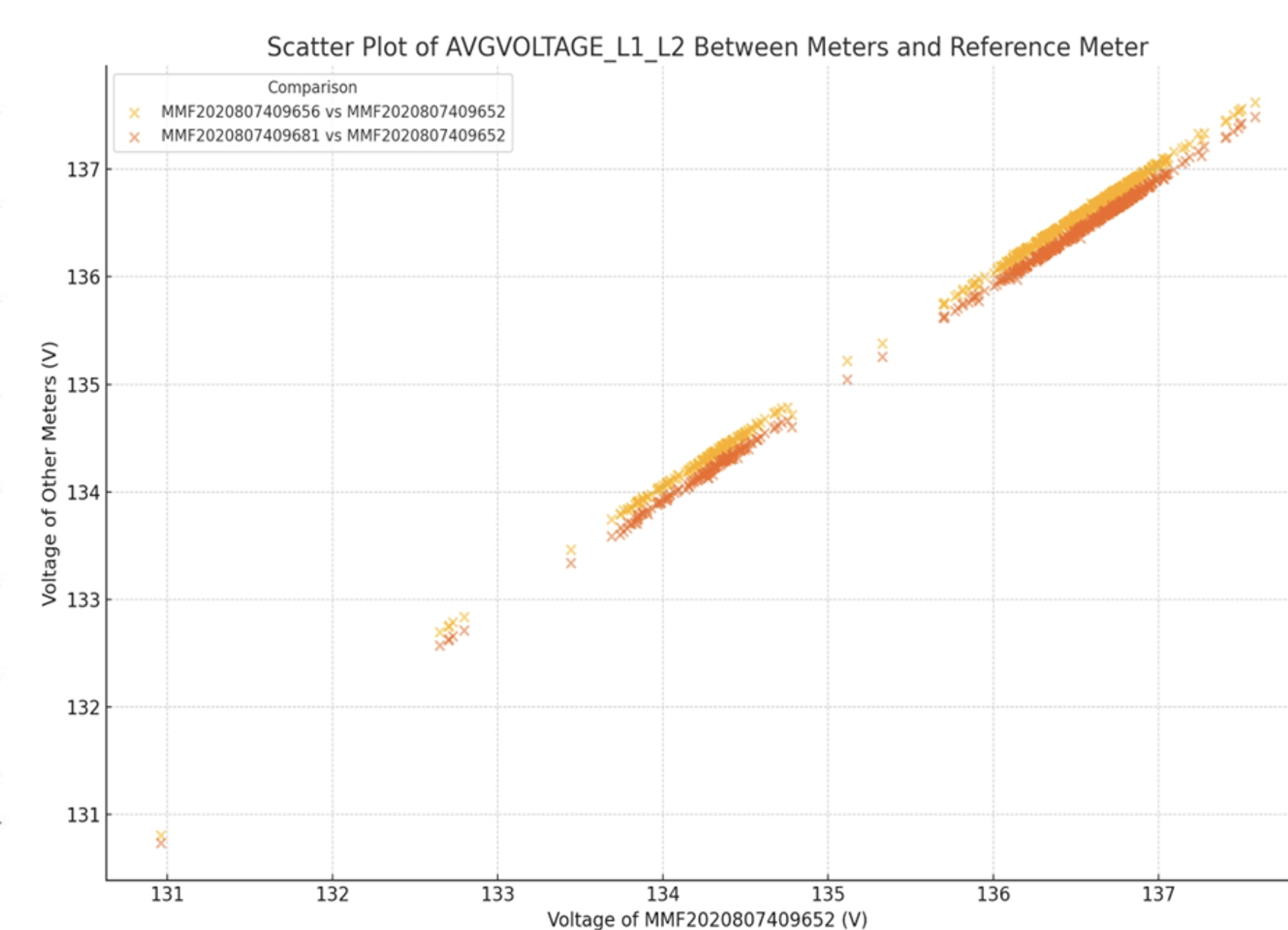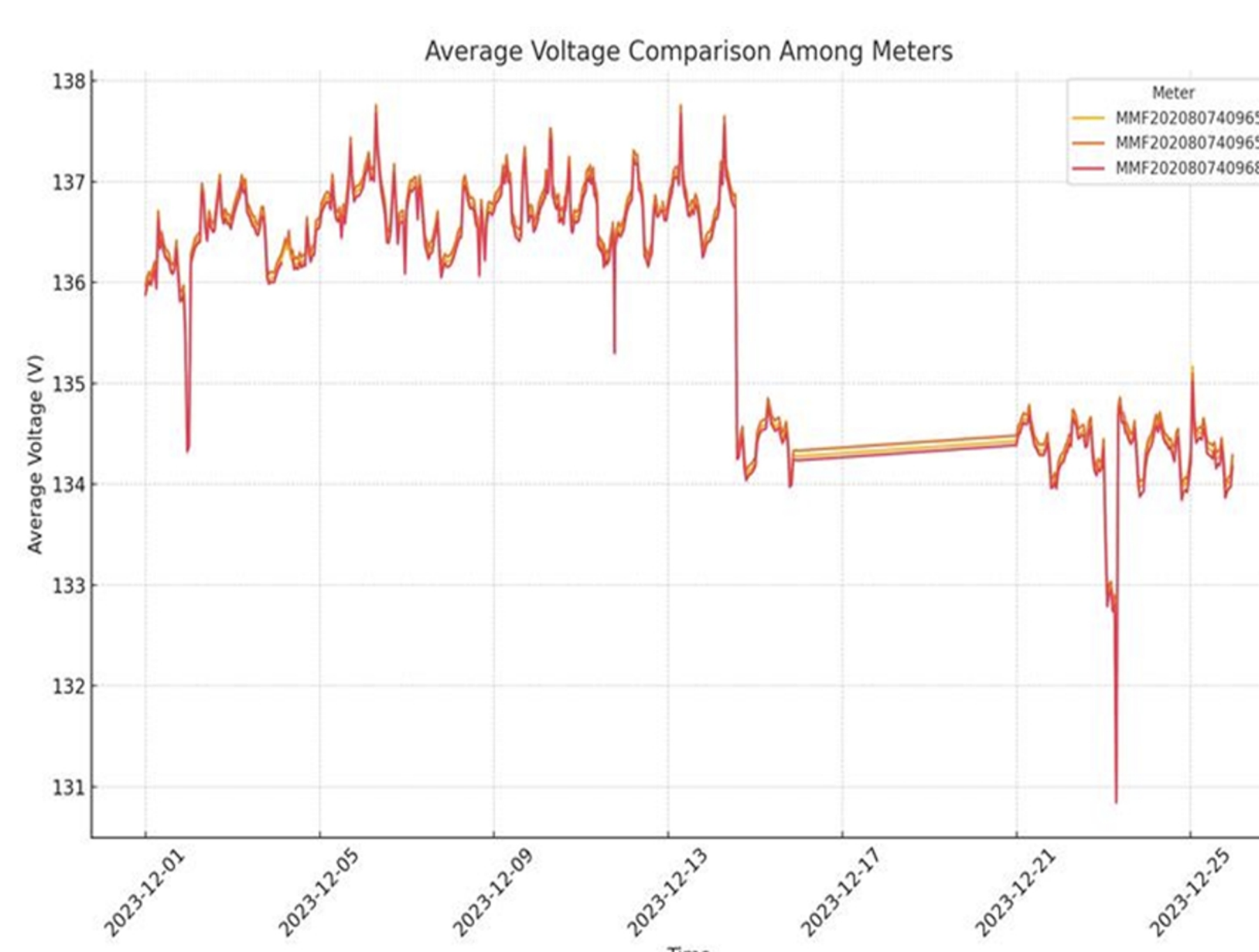
Voltage trends and scatter plot comparisons between meters reveal strong correlations, providing confidence in accurate transformer-meter mappings.
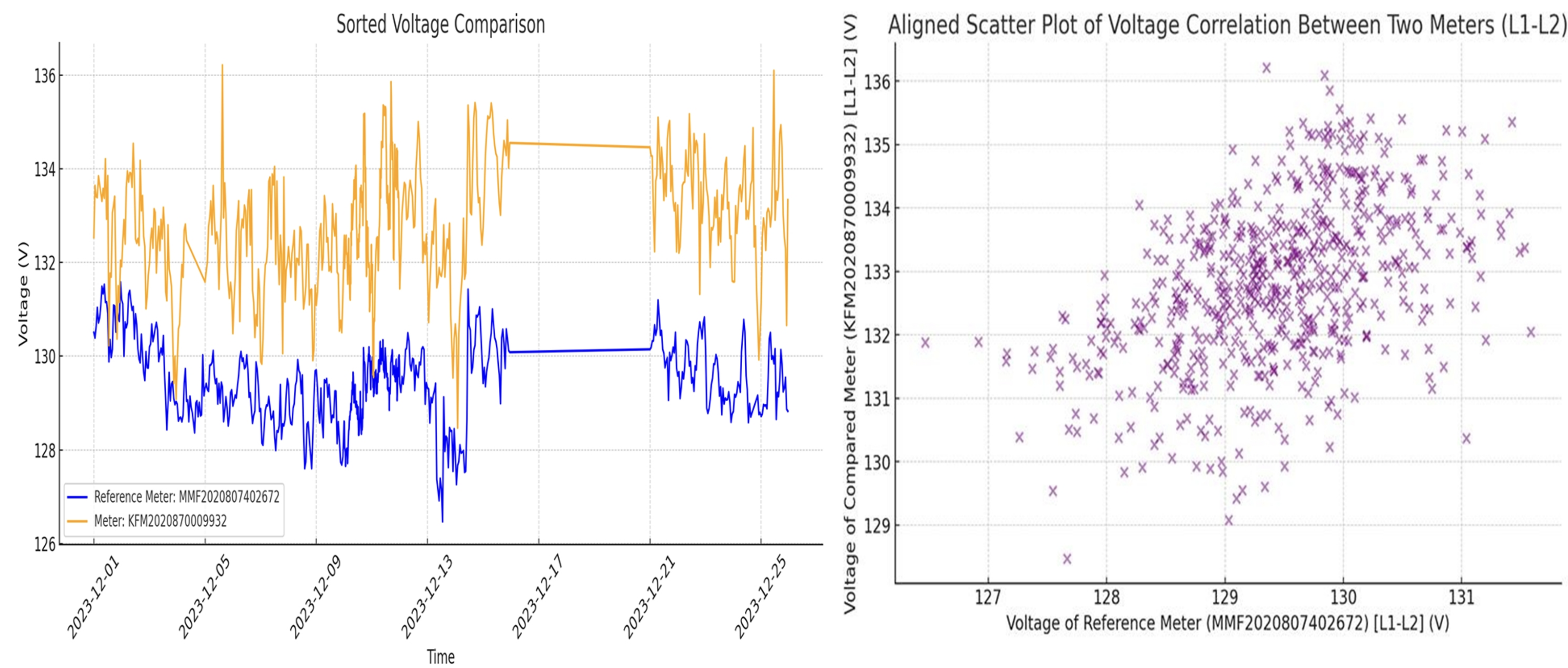
As depicted here, diverging voltage trends and non-correlated scatter points indicate an absence of expected connectivity. These anomalies were flagged by the AI/ML model for further validation and correction, showcasing its ability to identify and address inconsistencies within the distribution network.

By overlaying predicted transformer locations onto a geographic map, the SOS framework integrates geospatial intelligence with electrical data analysis.

How It Benefitted the company? Strengthening GIS Accuracy and Utility Operations

The enhanced source-of-supply mapping initiative brought significant value to the company's operations by addressing a critical gap in the GIS database. Accurate connectivity mapping between meters and transformers reduced operational inefficiencies, leading to improved grid reliability and energy balancing. This accuracy also translated into better outage management, as precise location data will allow field teams to respond quickly and effectively to disruptions.

Furthermore, the project provided a foundation for advanced analytics use cases. The validated data enabled the company to enhance loss detection and improve transformer load monitoring, creating a ripple effect across other operational domains. By integrating harmonics and profile data into the analysis, the company achieved a level of precision that minimized errors and strengthened decision-making processes.

Overall, the initiative not only improved the company's operational efficiency but also reinforced its commitment to building a smarter, data-driven energy ecosystem.

Conclusion: Paving the Way for Smarter Utility Operations

The enhanced GIS mapping initiative stands as a cornerstone in the company's journey toward a more data-driven and efficient utility network. By validating and refining meter-to-transformer connectivity, this project addressed a foundational challenge, ensuring that the GIS database accurately mirrors the physical distribution grid. This accuracy not only improved operational efficiency but also provided a robust foundation for advanced analytics and decision-making processes.

Through the innovative use of voltage, current, harmonics, and profile data, the company has demonstrated its commitment to leveraging modern technologies for smarter grid management. The results of this initiative extend beyond GIS accuracy, empowering other critical operations like outage management, loss detection, and transformer load optimization. As the company continues to modernize its energy infrastructure, this project exemplifies the transformative potential of integrating AI/ML solutions with utility operations, creating a smarter, more reliable energy ecosystem for the Kingdom.