Wireless Power Transforms Asset Tracking for Global Logistics

In the early 2020s, one leading global enterprise faced a critical challenge: its supply chain lacked real-time visibility. Despite massive scale, the retailer's inventory data was often fragmented. Shipments of goods, from electronics to perishable groceries, could vanish between distribution centers and store shelves. These visibility gaps carried expensive consequences.

Industry context (third-party sources): Analysts estimated that inventory distortion (from out-of-stocks and overstocks) was costing retailers $1.77 trillion worldwide in 2023 (foodinstitute.com). Cargo theft incidents spiked nearly 40% in 2024, contributing to losses of up to $35 billion annually across U.S. supply chains (talkbusiness.net).

For this enterprise, the inability to track assets continuously meant more frequent out-of-stock losses (lost sales when products weren't where they needed to be) and overstocks (excess goods ending up discounted or spoiled). In some cases, shipments were diverted or lost in transit. Each undetected theft or delay not only hurt the bottom line but also eroded customer trust with empty shelves and unmet orders.

Compounding the issue, the retailer's existing sensor infrastructure was both limited and expensive to maintain. Trials with RFID tagging and battery-powered trackers to improve supply chain data brought their own headaches. Passive RFID tags (the kind used to track pallets or crates) only worked when an RFID reader was nearby. This meant visibility only at certain checkpoints, like a warehouse doorway or store receiving bay, and nothing in between. Valuable goods could leave a depot and then "go dark" until someone scanned them at the next stop – by which time any theft or mishandling was discovered far too late.

Active tracking devices (with GPS or cellular capabilities) existed, but each required batteries and networking subscriptions, making them prohibitively expensive to put on every shipment. The few trackers in use demanded constant battery changes and attention from staff. In short, the retailer was stuck with partial visibility and a high-maintenance sensor network that couldn't scale to its needs.

Rising Action: RFID Limitations, Asset Loss, and Battery Burdens

As the retailer's operations expanded, the limitations of the status quo became more pronounced.

- **Limited Range of Legacy RFID:** Traditional RFID-based tracking only provided data at fixed reader points. Anything outside a reader's range went unmonitored. As one industry executive noted, existing solutions were "limited to locations where reader infrastructure is available" (rfidjournal.com). If a pallet bypassed a gate or a trailer sat in a lot without a scanner nearby, the system saw nothing. These blind spots meant items

could be stolen or misrouted without immediate detection. The "find it when it's missing" approach was no match for operations handling millions of moving pieces.

- **Risk of Asset Diversion and Loss:** With partial visibility, the enterprise experienced instances of asset diversion – shipments that were lost, stolen, or delayed en route. This was not unique to them; retail supply chains everywhere faced similar risks. Cargo theft alone cost U.S. supply chains up to $35 billion annually (talkbusiness.net). Without real-time tracking, problems were often detected only after a truck failed to arrive or inventory counts came up short. The delays in detection led to higher losses and longer recovery times.

- **High Battery Maintenance Costs:** Meanwhile, IoT sensor trials were running into the cost and labor burden of battery dependency. Each active sensor tag (used to log temperature, location, or shock for high-value loads) ran on a finite battery. With thousands of sensors distributed across warehouses and trucks, maintaining them was a logistical challenge. Batteries died every few years (if not sooner), and staff had to locate and replace each one. Analysts estimate that battery replacements can account for up to 30% of an IoT device's total cost of ownership (connectedsensors.com). For 10,000 IoT devices, two battery swaps over five years at ~$300 per replacement represented about $6 million in potential maintenance costs (qoitech.com). Drained batteries also created blind spots whenever a sensor went offline unexpectedly.

- **Scaling Constraints:** Because of these RFID and battery issues, the retailer tracked only a fraction of assets – typically the most valuable pallets or time-sensitive perishables. Many areas of warehouses and stores lacked coverage simply because wiring or changing batteries there wasn't practical. The vision of an "instrumented" supply chain, where every product's journey could be monitored in real time, remained out of reach.

The pressure to solve these problems was mounting. Operational leaders knew that better supply chain visibility could unlock significant savings and efficiencies. Real-time insights could enable proactive rerouting, reduced safety stock, and faster responses to theft or delays. At the same time, new regulations like the FDA's FSMA 204 traceability rules, coming into force in 2026, would require grocery companies to prove traceability of foods through every step (rfidjournal.com). The message was clear: the current approach would not suffice. The retailer needed a scalable, low-maintenance solution to track assets continuously, without relying on millions of disposable batteries or line-of-sight infrastructure.

Finding a Scalable, Battery-Free Solution

By 2023, the enterprise decided to pursue a bold new approach to achieve the real-time visibility it needed. The search led them to Energous, a pioneer in over-the-air wireless power networks (WPNs). Energous had been developing a system that could deliver power at a distance, wirelessly, to IoT sensors, and enable those sensors to send back data without the constraints of wiring or manual battery changes. Intrigued by this technology, the retailer

partnered with Energous to pilot a next-generation asset tracking solution in a portion of its supply chain.

The Proof-of-Concept: Cold Chain and In-Transit Coverage

The initial proof-of-concept focused on one of the retailer's toughest scenarios: the cold chain for perishable foods. They equipped refrigerated grocery shipments with new battery-free sensor tags that enabled environmental monitoring and asset tracking. In the pilot distribution center, a set of test stores, and in selected trailers, Energous installed its PowerBridge transmitters to create a radio frequency (RF) "power zone" across critical areas.

These transmitters used RF power designed to comply with FCC regulations. Tags harvested this energy to remain powered continuously. Whenever a tagged pallet or container came within range — arriving at the warehouse, stored in a backroom, or traveling in a trailer with auxiliary transmitters — the tags transmitted their data via Bluetooth Low Energy (BLE) back to the PowerBridge. The PowerBridge then relayed the data to the cloud, creating automated "check-ins" without the need for manual scanning. Even while goods were in storage, tags could continue to send environmental data, since wireless power kept them operating.

Pilot Outcomes

The results were immediate. For the first time, the retailer gained continuous, real-time insight into tagged products' journeys across the covered areas. In the pilot environment, Energous' wireless power solution maintained greater than 95% visibility of tracked assets — essentially every pallet equipped with a tag was accounted for, representing a dramatic improvement over checkpoint-based RFID.

Dashboards displayed tagged shipments moving from the distribution center to trucks to stores, with frequent updates. Environmental data such as temperatures was consistently available, enabling proactive intervention. For instance, if a refrigerated truck's cooling unit failed, the system would flag rising temperatures in a pallet of dairy products. Logistics managers would be alerted and reroute the truck to the nearest facility for service, preventing what could have been a spoilage incident.

The success of the pilot also demonstrated scalability. The Energous transmitters provided robust coverage and supported high device density, making it cost-effective to blanket large facilities. Importantly for the retailer, the trial showed that sensors could operate battery-free in these environments. Removing the need for ongoing battery swaps addressed the biggest maintenance bottleneck and pointed toward a future where thousands of sensors could be deployed at scale without incremental maintenance burden.

Early Deployments and Phased Rollout

Encouraged by the results of the pilot, the enterprise authorized additional deployments. In late 2024, Energous and the customer began a phased rollout plan.

The first wave outfitted key regional distribution centers and a few hundred stores as initial hubs. Nearly two thousand PowerBridge transmitters were shipped to support this stage, with installation progressing through 2025. At each facility, PowerBridge Pro transmitters were mounted strategically to cover loading docks, sorting areas, storage zones, and store backrooms. In some deployments, transmitters were placed in delivery trucks and trailers, enabling tagged goods to provide periodic updates during transit.

With infrastructure in place, the retailer increased the density of sensor deployments. Where once only a handful of trackers were used in a warehouse, hundreds of pallets and roll-cages could now be tagged and monitored daily. On selected routes, trucks leaving a distribution center carried tags on each pallet or container, ensuring a near-continuous chain of updates as shipments passed through covered areas.

This broader deployment was structured in phases. Future expansions remain subject to the customer's internal plans, site readiness, and approvals.

Benefits Observed at Instrumented Sites

Real-time visibility: Tagged assets reported frequent status updates within covered areas, significantly reducing blind spots compared to checkpoint-based methods.

Faster exception handling: When deviations from planned routes or temperature excursions occurred, the system generated alerts in near real time, allowing managers to respond before issues escalated.

Labor and cost savings: Battery maintenance was dramatically reduced. Staff no longer had to replace or recharge thousands of device batteries, freeing labor hours for higher-value tasks.

Sensor density: Freed from battery limitations, the enterprise deployed more sensors than in earlier trials, increasing data points while reducing maintenance effort.

Inventory accuracy: Internal analyses showed measurable improvements in pilot categories, enabling better shelf replenishment and reducing emergency ordering.

Sustainability gains: Eliminating disposable batteries reduced electronic waste and labor-related truck runs, aligning with corporate environmental goals.

Looking Ahead

Energous' wireless power infrastructure has become a backbone for digital transformation, enabling continuous telemetry and supporting advanced analytics. Management is evaluating

ways to use the data stream for predictive models, routing optimization, and preventive maintenance.

This enterprise's journey illustrates how Energous can help global organizations move from limited, battery-dependent tracking to scalable, battery-free visibility. While results vary by site and configuration, the pilot demonstrated clear improvements in visibility, efficiency, and sustainability.

Disclaimer

Illustrative scenarios: Examples are illustrative and not a statement of performance at all customer sites.

Pilot results: Visibility figures reflect pilot environments; actual performance varies by site, layout, and configuration.

Forward-looking statements: Certain statements relate to potential future deployments or benefits and are subject to risks and uncertainties.

Regulatory: Energous products are designed to comply with applicable regulations (e.g., FCC). Regulatory compliance remains the customer's responsibility.

Results vary: Performance depends on site conditions, configuration, and operational practices.

No endorsement: Customer references, if any, reflect permissioned, publicly disclosed information only.